Stower -

RECEIVING NEWS ON THE SHORT WAVES— See page 108

A NEWNES PUBLICATION

Practical Wireless and PRACTICAL TELEVISION

6D. EVERY MONTH

Edited by F. J. CAMM

Vol. 17. No. 415. January, 1941.

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COMMENTS OF THE MONTH

By THE EDITOR

Frequency Modulation

THE American press has recently dealt with the new transmitting system which functions on the principle of frequency modulation. The claims made for it are wide, and it is said to be a great improvement on existing systems. Up to the present we have used amplitude modulation for broadcasting, and frequency modulation provides a different method of superimposing the programme on to the carrier wave. It is well known that with amplitude modulation the programme wave is combined with a carrier wave in such a manner as will give rise to change of power of the resultant wave.

In frequency modulation the programme wave does not vary the power of the carrier, but it makes it change its frequency, thus speeding up the carrier wave for part of the time and retarding it for another. The advantage this confers is that the programme is superimposed on the carrier without changing its power, which means that the broadcasting station operates at full power all the time.

It will be apparent that further advantages are that less valves are necessary, and hence less current and less operational cost, for the transmitter can be run full out all the time, dispensing with the services of an engineer, who with amplitude modulation must constantly watch the volume indicator so that he may increase the volume when the programme level is reduced, and reduce it when it rises. With amplitude modulation the transmitter must be constructed to handle four times the rated power of the station on volume peaks; thus what is known as the dynamic volume range must be compressed, so affecting the quality of reception. In frequency modulation there are no volume peaks, for all that variation in volume does is to swing the carrier frequency. The microphone amplifier is made to affect the oscillator.

General adoption of transmission by frequency modulation would obviously affect the design of receiving sets, for two more valve functions would be added to existing arrangements. One of these controls the strongest incoming signal at the wavelength or frequency to which the receiver is tuned, and it is known as a limiter.

The other valve is called a discriminator, and its function is to expunge any noise or signal other than the strongest incoming signal, and it eliminates any amplitude modulation station that might be broadcast on the same wavelength. Thus natural static is virtually eliminated as well as man-made static, and any kind of extraneous noise including carrier hiss and valve noises from the broadcasting station. Hum modulation is also wiped out. In fact, a frequency modulation receiver is absolutely silent until the programme starts. With amplitude modulation receivers it is always possible to hear the set whilst waiting for the programme to start. You know that the set is "alive." Not so with a frequency modulation receiver. It is obvious that the tone quality of such a system introduces an enormous improvement over the present system. The system has been tried out and adopted in certain parts of America.

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Radio Sets for the Army

FROM time to time we have received requests from soldiers who are stationed in huts or under canvas for old wireless receivers, and we have been able to appeal to our readers, and to supply a number of them.

The War Office has now taken the matter in hand, and in future it is only necessary for the troops concerned to place their request before their Commanding Officer.

It is necessary, when writing, to give details as to the kind of set best suited to the location, and whether a battery or mains set is required.

New Books

RECENT books issued from this office are "The Superhet Manual," 5s., by post 5s. 6d.; the "Radio Training Manual," 3s. 6d., by post 4s.; the "Radio Engineer's Vest Pocket Book," 3s. 6d., by post 3s. 9d.; "Gears and Gear Cutting," 5s., by post 5s. 6d.; "Watches: Adjustment and Repair," 6s., by post 6s. 6d.; "Diesel Vehicles: Operation, Maintenance and Care," 5s., by post 5s. 6d.; "Newnes' Engineers' Manual," 5s., by post 5s. 6d.; and "Motor-car Principles and Practice," 3s. 6d., by post 4s. A catalogue of reference books for engineers, motor mechanics, aero-engineers, electricians, radio mechanics, students, etc., is available free of charge, to those making application on a postcard to the Book Publisher, George Newnes, Ltd., Tower House, Southampton St., Strand, London, W.C.2.

RECEIVING THE NEWS ON SHORT WAVES

How to Make an Efficient Unit Which Can be Used as a Complete Receiver, as a Converter, or an Adapter. Constructional Details of a 25-50-metre Coil are Also Given

by The Experimenters

THE B.B.C. have frequently announced that, for reasons no doubt connected with the efficient air defence of this country, there may be occasions on which one or other of the programmes on the medium-wave band may be interrupted for a short time. To miss a part of a concert does not worry any of us in the special conditions under which we are now conducting our business in the certainty of bringing the Nazis to their knees. But we do like to know as soon as possible how many German 'planes have been brought down each day, and how successful our own R.A.F. has been over enemy territory. In other words, we do not like to miss "the news."

To make sure that we need not miss it, the B.B.C. have brought into use a number of alternative wavelengths, of which that on the S.W. band around 48 metres is found to be thoroughly reliable even if difficulty is experienced in tuning-in any of the M.W. transmissions. It appears to be the usual experience throughout the country that the 48-metre transmission can be received at any time. This may not always give perfect reproduction of music (S.W. working is never ideal for this), but it does allow the reproduction of speech which can be followed with ease.

Good 'Phone Reception

The problem of those listeners who do not possess a S.W. or all-wave receiver is, therefore, how reception of this transmission can most easily be effected. For 'phone reception, a single-valve receiver is quite sufficient, and the circuit shown in Fig. 1 is unusually good. It will be seen that it is fairly simple, although the use of an H.F. pentode involves the use of a few more components than would be necessary with a triode. The tuning coil is of the simplest type, but since it is for one S.W. range only (covering both the 41-odd-metre "Forces" and the 48-odd-metre "Home Service" (transmissions), it is perfectly satisfactory.

As every S.W. experimenter knows, good reaction control is the most important factor governing efficient operation with a single-valve receiver. Because of this, special care has been taken in planning the reaction circuit. In addition to the usual inductive-capacity coupling with condenser control, there is a potentiometer to feed the screening grid. This may be used as a final or "vernier" control, besides being useful in selecting the optimum S.G. voltage. It will also be seen from Fig. 1 that the 'phones are parallel-fed; this is an advantage, and is of help in minimising hand-capacity effects which reduce the ease of tuning. This is also an improvement if the receiver is to be used in conjunction with a receiver, which will be employed as an L.F. amplifier.

Making the Coil

The remainder of the circuit is on straightforward lines, and the only part which calls for comment is the tuning coil, for which we suggest that a home-made component be used. For covering the approximate wavelength range previously referred to, with a tuning condenser (a slow-motion drive is essential) of about .00016-mfd. capacity, the former may well consist of a 2in. diameter paxolin or shellacked cardboard tube. For the tuning winding about 15 turns of 22-gauge enamelled wire will be suitable, a tapping for the aerial connection being taken after the sixth turn, as illustrated in Fig. 2. This winding is best arranged with a slight gap between the turns; the spacing can well be the diameter of the wire, and can easily be arranged by winding along with the wire a length of thin string. After completion of the winding, the string is removed, leaving the wire in position. For this method of winding to be completely satisfactory it is necessary to maintain a steady tension on the wire, while it is an advantage to apply a coat of shellac varnish on completion to hold the turns in position. An alternative method is to apply a few spots of sealing wax to the turns; the wax can be run down the winding in two straight lines.

For reaction 12 turns should be sufficient if they are placed a short distance away from the tuning winding. For this coil the wire may be of finer gauge—say 26 s.w.g. enamelled—and the turns should be touching. The spacing between the adjacent ends of the two windings can be about ⅛in., and if both windings are put on in the same direction (as shown), the top of the grid winding should be taken to the grid condenser and the top of the reaction winding to the reaction condenser.

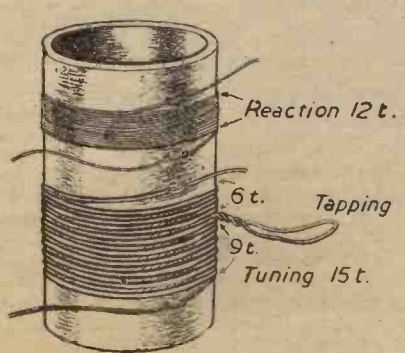

Fig. 2.—Details of the simple home-made coil.

As a Receiver

When using the unit as a simple one-valve receiver an H.T. voltage of 100 to 120 is most suitable, although the set will operate on a lower voltage. The method of operation is the same as that for a det.-L.F. type of receiver, but a little initial experiment should be carried out to find the best average setting of the potentiometer; in most cases this will be found to be about one-third of the way between the minimum (anti-clockwise) and maximum settings. After the most suitable position has been found for smooth reaction control, the reaction condenser is used in the normal manner. If necessary, a "fine" setting can be obtained by careful adjustment of the potentiometer. At this point it should be emphasised that the potentiometer should be a good component which is "silent" in action. In many respects one of the non-metallic kind is to be preferred, but many of the wire-wound components made by the leading manufacturers are perfectly satisfactory.

As a S.H. Converter

If the unit is to be employed as a superhet converter in conjunction with a "straight" H.F.-Det.-L.F. type of receiver, the anode connections must be slightly modified as shown in Fig. 3. It will be seen that a second H.F. choke is required, this being of the ordinary "reaction" or "H.F." pattern. It is wired in series with the standard S.W. reaction choke, and a lead is taken from the junction between the two to a fixed condenser, which is used to couple the converter to the aerial terminal

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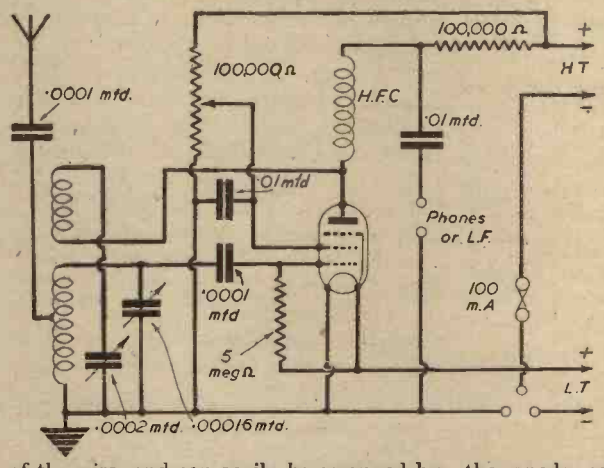


Fig. 1.—Circuit of the unit, suitable for use as a one-valve or in conjunction with an L.F. amplifier.

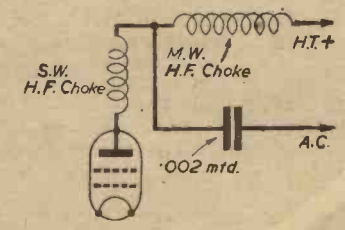


Fig. 3.—Modified anode connections when using the unit as a superhet converter.

RECEIVING THE NEWS ON SHORT WAVES

(*Continued from previous page*)

of the receiver. When that is done, the H.T. lead can be taken to a tapping on the H.T. battery—probably between 72 and 100 volts, while the L.T. connections can be made to the accumulator in the usual manner. If a three-point on-off switch is fitted in the broadcast receiver the L.T. connections can be made to the filament terminals of a valveholder. In that case the switch on the unit can be left in the on position, when that in the set will control both the set and the converter.

The method of using the unit as a converter is rather different from that of using it as a single-valve receiver. This is largely because the valve must be maintained in an oscillating condition. Thus, reaction coupling must initially be set rather "tight." The set should be adjusted to tune to the bottom of the long-wave range, after which all tuning is carried out on the tuning condenser in the unit. A little experiment should be made to find the positions of the reaction condenser and S.G. potentiometer which give greatest signal strength, but it will generally be found that there is no need to vary these settings once they have been found. Because of this, operation is unusually simple, and the only control which need be considered is the converter tuning condenser.

Three-point Switch

When using the unit as an adapter, the anode connections are slightly different again and should be as shown in Fig. 4. It will be seen that a valve plug adapter is fitted, this plugging into the detector valveholder, after removing the detector

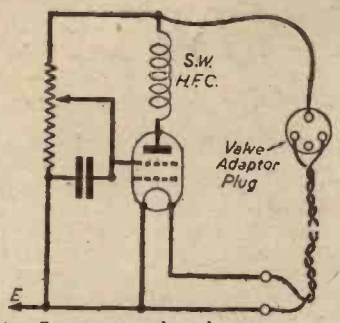


Fig. 4.—Connections when the unit is serving as an adapter.

valve. When using these connections it is essential that the on-off switch in the receiver is of the three-pole type, because it is necessary to disconnect the H.T. as well as the L.T. to avoid "drainage" of current through the potentiometer while

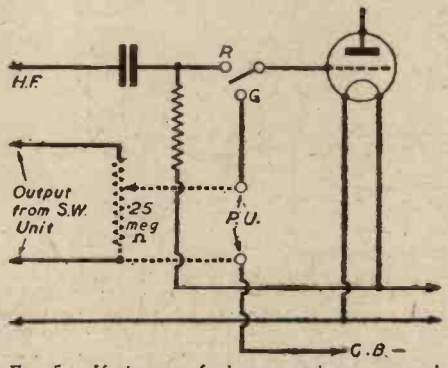


Fig. 5.—If the unit feeds into pick-up terminals a potentiometer is required as shown by broken lines.

the set is out of use. If a two-point switch is fitted it can be replaced by a three-point one, following the connections shown in Fig. 1.

Using as an Adapter

As an adapter, the unit is operated in precisely the same manner as a single-valve S.W. receiver, since only the L.F. portion of the broadcast receiver is being used.

In some instances it may be found more convenient to feed the output from the S.W. unit (the 'phone terminals, that is) into the pick-up terminals of the broadcast set. That can be done conveniently provided that a potentiometer volume control is used to complete the grid circuit of the detector valve, into which the pick-up terminals feed. If the potentiometer were omitted the valve would not be biased and would therefore either fail to operate or would be extremely inefficient. The method of connecting the potentiometer, which should have a valve of about one-quarter megohm, is indicated in Fig. 5. This diagram makes it clear how the G.B. supply is able to reach the detector grid through the potentiometer.

It is of interest to note that the unit can be used in this manner in conjunction with a mains-type broadcast receiver, and also in conjunction with a set of either the "straight" or superhet type. Where a superhet is concerned, this is, in fact, the only simple manner of providing for short-wave reception without the need for entirely modifying the receiver. For use in this way, the S.W. unit should have the exact circuit shown in Fig. 1, for it acts simply as a single-valve receiver feeding into an L.F. amplifier provided by the detector and following valves of the broadcast set.

A TRANSFORMER-COUPLED NEGATIVE FEED-BACK AMPLIFIER

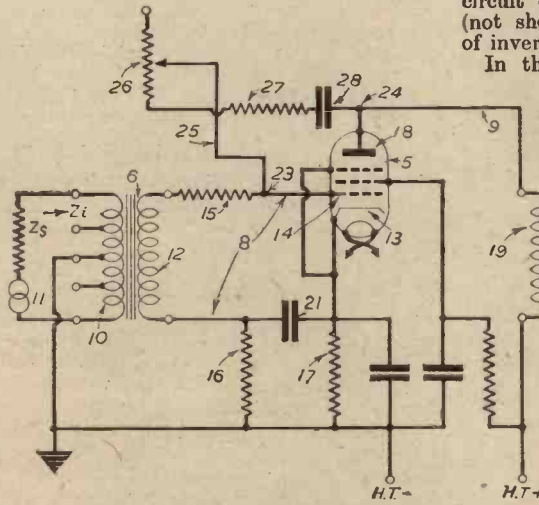
IT is well known that the input impedances of a valve amplifier may be greatly modified by either positive or negative feedback, and it is frequently desirable to overcome such effects in order to avoid changes in the operating conditions of amplifier stages preceding the stage to which feedback is applied.

A typical example of this kind of problem, and the way in which it can be solved, is shown in the attached diagram.

Referring to the diagram, 5 is an audio-frequency amplifier valve provided with transformer couplings 6 and 7 in the input and output circuits 8 and 9. The primary winding 10 of transformer 6 is connected to a signal source 11 having a source impedance Zs on which a pre-determined loading is desired. The transformer secondary 12 is connected between the cathode 13 and control grid 14 through the input circuit 8, which includes an additional series impedance 15. The control grid is suitably biased through a filter resistance connection 16 with a self-bias resistance 17 in the cathode circuit, which is decoupled by a condenser of small reactance to audio-frequencies. The output anode 18 of the pentode valve 5 is connected through the output circuit 9 with the primary 19 of the output transformer. The latter is provided with a suitable output secondary 20 for connection to a load.

By including the resistor 15 between the feedback connection 23 at the grid and the transformer secondary 12, the input impedance across the transformer secondary may be maintained substantially constant for all conditions of feedback.

For example, in the system illustrated, with the transformer secondary loaded to a value of 100,000 ohms in order to provide an input impedance of 500 ohms in a given



A method of overcoming modification of the operating conditions.

amplifier, the feedback connection would provide an input impedance considerably below that value without the use of the divider circuit comprising the resistors 27, 26 and 15. By choosing the resistor 15 of a proper value, such as 56,000 ohms, the input impedance may be restored, for example, to 500 ohms.

Potential Divider Circuit

The amount of feedback is determined by the potential divider circuit comprising the resistors 27, 26 and 15, and is adjusted to a fixed value by the resistor 26. Thus, by adjusting the resistor 26 a predetermined load may be maintained on the signal source 11 which may represent the output circuit of a preceding amplifier or filter (not shown), while obtaining advantages of inverse feedback in the amplifier stage.

In the circuit shown, the output impedance of the valve 5 is also reduced by the inverse feedback action which, as is well known, tends to reduce the effective output impedance of an amplifier to which it is applied. With a pentode amplifier stage as shown having a relatively high output impedance, the latter may be reduced to substantially equal the load impedance by a proper amount of inverse feedback, and the input impedance may then be corrected for this amount of feedback to a proper value by including the impedance 15 or its equivalent in the secondary circuit.

This system was developed in the laboratories of the Radio Corporation of America.

"Reversed" Valves

Several Unusual Methods of Using Valves for Experimental Purposes

QUITE a number of valves can be used in positions for which they were originally not intended. This is useful to the experimenter, because with a given set of valves many more circuits and layouts may be attempted.

Perhaps the classic example of this is in the use of an ordinary three-electrode valve as a diode. This is accomplished by strapping the grid and anode together and using this combined electrode as the plate of the diode. No H.T. is used with the valve when it is employed in this way. The alteration is shown in Fig. 1.

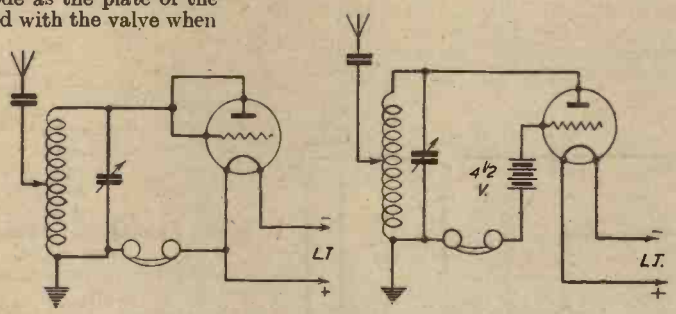


Fig. 1 (Left).—Method of using a three-electrode valve as a diode.

Fig. 2 (Right).—Modified method of using a triode valve as a diode.

Modified Diode

Using the same valve, we can obtain a modified form of diode which uses a nominal amount of H.T.—usually from about 4 to 9 volts. In this the anode of the valve is used as the plate of the diode, and the grid is given a slight positive potential to disperse the space-charge. This form is a little more efficient than the plain diode, and the layout is shown in Fig. 2.

For a more ambitious form of "high-tensionless" valve, however, we really need a four-electrode valve. In the Osram range there is a four-electrode valve which detects and amplifies on a very low value of H.T., but the same result can be achieved with an ordinary pentode (L.F.) valve. We transfer the control grid to the auxiliary grid which normally goes to the maximum H.T. point. The original control grid is given a positive potential, usually of 6 to 9 volts, and the anode receives a potential of from 9 to 24 volts through the usual coupling devices—which may be headphones, transformer, loudspeaker, etc. The scheme is illustrated in Fig. 3. It is worth mentioning that when using an L.F. pentode in this manner, a pentode should be chosen which has the normal control grid connected internally to the outermost grid; in some valves this latter is connected to the filament, and these are not so efficient when used in this way.

Some double-diode valves have their diode plates close to the filament, from which they derive their supply of electrons directly. Others have the plates placed on either side of the anode of the valve, which latter is of open grid construction. The Mazda L2 DD may be cited as an example of the latter class. Now, this form of construction is identical with the conventional form of screened-grid valve. That is, we have the filament, two grids, and beyond these two small plates which serve as the anode. From this it follows that we can use the double-diode valve as a screened-grid valve.

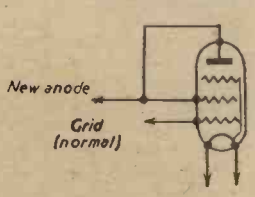


Fig. 5.—Altered connections to a pentode valve for converting it to a normal power valve.

Makeshift S.G. Valve

The control grid comes out at the top of the valve, so that there is no likelihood of interaction within the valve setting up uncontrollable oscillation. When using this as a screened-grid valve the two halves of the diode should be strapped together, and this implies that the centre pin, and one of the side pins, should be joined. Fig. 4 shows the course to take when converting the double-diode valve to function as a screened-grid valve.

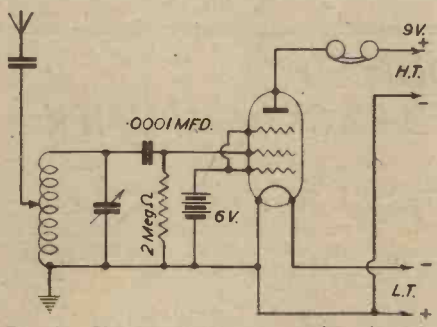


Fig. 3.—Using a pentode as a four-electrode valve.

If you have a conventional pentode valve which sounds harsh and screechy, it may be softened down, but only at the expense of the pentode characteristics. This may be done by regarding the auxiliary grid as the anode, the auxiliary grid being, of course, the one to which a positive potential of 120 to 150 volts is applied. This grid, and the anode, may be strapped together if desired. The valve then becomes a normal power valve or super-power valve, according to the rating of the pentode, and its amplification factor is, of course, altered. The necessary few alterations are shown in Fig. 5.

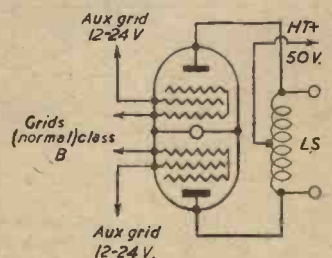


Fig. 6.—A novel modification of a Q.P.P. valve.

One form of "reversed" valve with which you may be familiar is the Class-B valve, in which one section functions as a detector while the other operates as a straight amplifier. You may not be familiar, however, with an ingenious modification of the double-pentode or Q.P.P. valve, shown in Fig. 6.

Modified Q.P.P. Valve

It is arranged to operate on a much reduced H.T. voltage, of the order of 30 to 50 volts. As will be seen from Fig. 6, the valve operates without any grid-bias, the H.T. voltage being such that only a small standing anode current is passed. The grids are driven into the positive region by a Class-B driver transformer, and the system partakes of the Class-B type of reproduction rather than the Q.P.P., though a double Q.P.P. valve is used. This system makes good loudspeaker reproduction possible on a house lighting plant of 50 volts, the output being in the neighbourhood of 500 milliwatts. Normal precautions are necessary as to the matching of the centre-tapped output transformer, or choke, with the loudspeaker.

Finally, for the benefit of those to whom economical running costs are a consideration, I give the circuit shown in Fig. 7.

Double-diode-triode Modification

The two halves of the diode operate as a full-wave detector, but instead of developing the voltage in a resistance, the load takes the form of the primary of a transformer. The secondary of the transformer goes to the grid of the triode section of the valve in the normal way. By this means there is a useful step-up from the diodes to the triode section, and within a reasonable distance of a transmitter the valve will provide quiet loudspeaker signals.

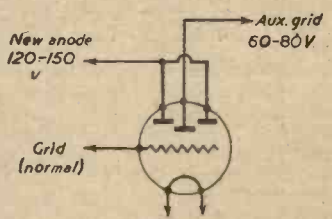


Fig. 4.—Method of utilising a double-diode valve to operate as a screened-grid valve.

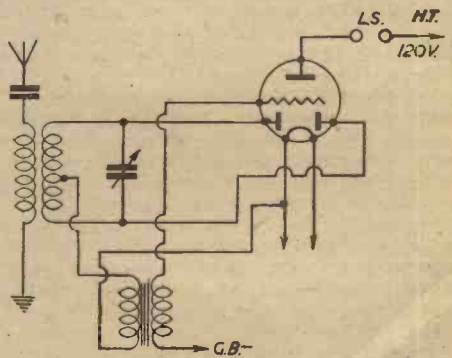


Fig. 7.—Method of modifying a double-diode-triode valve.

Problems of Amateur Receiver Design—5

The Method of Determining the Correct Values of Resistor for the Two Arms of a Fixed Potentiometer. Details are Also Given Concerning the Choice of Grid Leaks and Other Resistors.

By FRANK PRESTON

LAST month we dealt with the "easy" resistors in the typical circuit represented by Fig. 1. The choice of the resistors marked R.3, R.7, R.8 and R.10 was explained in simple terms, but we ignored the two marked R.1 and R.2, which together form a fixed potentiometer for supplying the screening grid of the H.F. pentode. It would appear at first glance that the choice of values for these is a very simple matter, but the little calculation involved often proves difficult to the average constructor.

To simplify the matter to a certain extent the skeleton circuit of this potentiometer is shown separately in Fig. 2. Arrows are added to show that there are, in fact, two separate current paths: one straight through the two resistors in series between H.T.+ and H.T.−; and one through the upper arm of the potentiometer and that

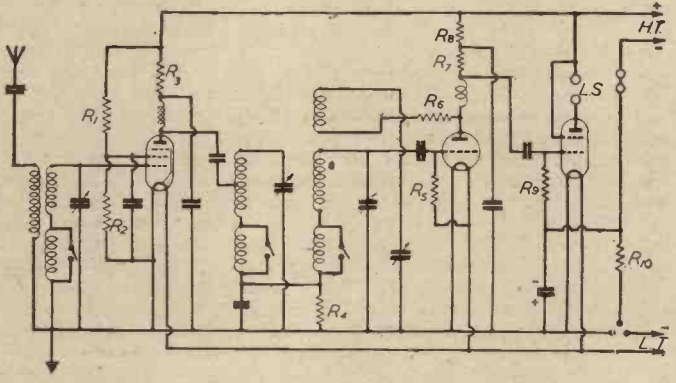


Fig. 1.—The simple circuit diagram referred to last month is again used in dealing with the choice of the resistors not previously considered.

portion of the valve which is virtually in parallel with R.2. At this point it should be explained that the arrows are not necessarily drawn to show the *direction* of current flow (I am not going to be drawn into an argument about that at this juncture), but merely to show the path along which current does flow.

Potential Dividing

If there were no current passed between the screening grid of the valve and earth (or if this current were extremely small in relation to that passed through the potentiometer), the choice of resistance values would be very easy, for they would bear a simple relation to the ratio between the maximum H.T. voltage and the voltage to be applied between the screening grid and earth. Thus, if we were to suppose for the moment that there is no current taken from the tapping point between the resistors, this point supplying a *potential* only, such as might be used in the form of bias, the simple calculation would be as follows: Assume that the total H.T. voltage is 120 and that 80 volts is required between the tapping point and the earth line. This means that the required voltage is two-thirds of the maximum voltage or that, of the 120 volts, 40 must be "dropped" across R.1 and 80 across R.2. From this it is obvious that R.1 should have a value of just half that of R.2. Thus, if it were known that the total resistance should be 100,000 ohms, it would be clear that R.1 should have a value of approximately 33,000 ohms, and R.2 of approximately 66,000 ohms.

"Bleeder" Current

In practice, this simple method of working is completely "washed out" because of the higher current flowing through R.1 as compared with that through R.2. We must first know the maximum H.T. voltage, the S.G. voltage, and the current passed by the screening grid at that voltage. After that we must decide on what shall be the total value of R.1 and R.2. It is not possible to give any absolutely definite ruling with regard to the last-mentioned point and, theoretically, it does not matter in the least what the resistance value is. It is a reasonably good rule, however, to take as the total resistance a figure such that the current passed through the resistors (without taking the S.G. current into account), is not less than twice the average S.G. current required. For example, if the S.G. current were known to be 1 mA, the "bleed" current, as it is called, should be not less than 2 mA. If the total H.T. voltage were 200 the combined value of the resistors could therefore be in the region of 100,000 ohms. As a simple rule-of-thumb arrangement it is reasonable to allow for a total value of 100,000 ohms for a battery set and 50,000 ohms for a mains set, in each case assuming that the potentiometer will feed only one valve. If it were to feed two valves, these valves could be halved, although it will be appreciated that the resistance should be kept as high as practicable with a battery set, in the interest of H.T.-current economy.

Working It Out

Now we can revert to our example, taking it that the total value of the two resistors should be 100,000 ohms, that the S.G. current taken is 1 mA at, say, 80 volts, which is the voltage required by the screening grid of the valve to be used. We will also work on the assumption that the maximum H.T. voltage is 200.

It will be seen that the current flowing through R.1 in working conditions will be 3 mA, although only 2 mA will pass through R.2. Therefore, we have to find the value of resistor which will drop 120 volts (200 minus 80) when passing 3 mA. From Ohm's Law this can be found to be 40,000 ohms. By subtracting this figure from 100,000 ohms, we see that the correct value of R.2 would be 60,000 ohms (see Fig. 3). It is interesting to compare these figures with those which would apply if no current were drawn from the potentiometer; in that case R.1 would be 60,000 ohms and R.2 40,000 ohms—just the reverse of the correct "working" figures which we have obtained!

In many instances the figures would not prove to be as convenient as those which we have just used, but the values of R.1 and R.2 are not often critical and therefore it is in order to use the nearest convenient component values. This is often simplified by disregarding the precise total resistance and choosing values such that the total is somewhat greater or less than that originally taken as a guide.

H.F. Anode Resistor

It was mentioned, in passing, last month that the value of R.3 would be modified if the top of R.1 were connected to the lower instead of the upper end of R.3. This is simply because the total current would, in the example taken above, be increased by as much as 3 mA. Consequently, the voltage drop would be appreciably greater per 1,000 ohms than if the value were estimated when taking into account only the anode current of the first valve.

By-pass Resistor

When we come to R.4 we are dealing with an entirely different type of resistor.

(*Continued on next page*)

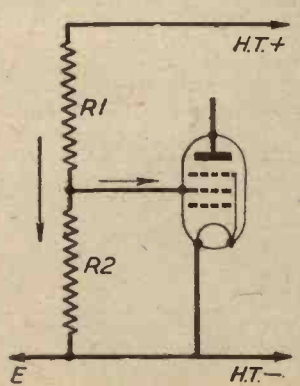
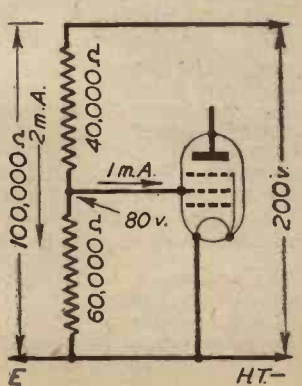


Fig. 2 (Left).—This simplified skeleton diagram shows more clearly the fixed potentiometer included in Fig. 1.

Fig. 3 (Right).—The various values shown in this diagram (which is otherwise similar to that in Fig. 1) are those taken in the example given in the text.



PROBLEMS OF AMATEUR RECEIVER DESIGN

(*Continued from previous page*)

To all intents and purposes it does not pass any current, and it is included in the circuit primarily as a means of earthing the lower ends of the two coils comprising the band-pass filter. In fact, the resistor could be removed from the circuit illustrated without greatly affecting the behaviour of the set. The position would be quite different, however, if the band-pass circuit were placed immediately before an H.F. valve, as is perhaps more usual. In that case the resistor would be the means of supplying the necessary bias voltage (even if it were only that provided by making the grid return to the earth line) and if it were omitted the receiver would show a marked loss of efficiency. In practice, a value of 1,000 ohms is generally suitable, but it may be found that no appreciable difference can be observed if the resistance is doubled or even quadrupled. It should not generally have a value below 500 ohms, however, or it may affect the behaviour of the "bottom-capacity" condenser in the band-pass filter.

The Detector Grid Leak

I am afraid that it will be necessary to take the grid leak, marked R.5, very much for granted, since to appreciate its precise function it is necessary to study in some detail the complete action of a leaky-grid detector. And even when that has been done the calculations involved in obtaining a theoretically correct value are rather involved. What is more, it is most unlikely that any constructor would notice the slightest difference in an ordinary broadcast set if the value used were reduced to one-quarter or increased to four times its calculated value. For present purposes, then, we can take it that the average value of 2 megohms, in conjunction with a fixed condenser of .0002 mfd., is good enough for all ordinary purposes.

With a short-wave receiver, especially if a high-impedance detector valve is used, it is often found better to use a value of 3 to 5 megohms in conjunction with a .0001-mfd. condenser. The chief advantage derived from the higher resistance value is that reaction control is smoothed out to a certain extent.

Improving Reaction Control

The resistor included in series with the reaction circuit (R.6) is not generally used, but it is often beneficial when reaction control is otherwise inclined to be "plonky"

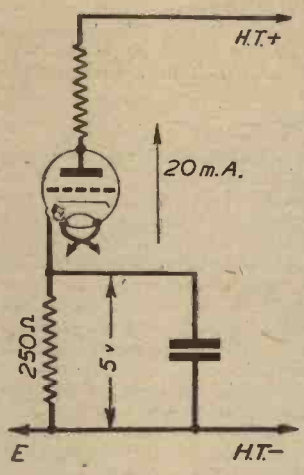


Fig. 4. — In this diagram figures are given to show the method of obtaining the value of a bias resistor wired in the cathode lead of an indirectly-heated valve.

or when there is a tendency towards parasitic oscillation; the latter is indicated by distortion, and sometimes by a form of very-high-pitched whistle not unlike that heard when a receiver is forced into self-oscillation and reaction pressed to the limit.

The reactance of the reaction winding increases with increase in frequency, and vice versa. But when the resistor is in series (the resistance value of this remaining unchanged regardless of frequency) the overall impedance of the reaction circuit is kept within narrower limits, and this tends to obviate the form of trouble outlined above. It is in nearly every case necessary to find the most suitable value of R.6 by experiment, although it is worth remembering that the figure will, in almost every instance, lie between 100 and 500 ohms. Very occasionally a value up to 1,000 ohms is better, but if such a high resistance is called for it is often a sign that the reaction circuit could, to advantage, be improved in design.

The determination of the most suitable value for R.9, which is the grid leak for the resistance-capacity-fed output valve, is similar in all important respects to that in connection with R.5. It is, of course, possible to calculate the theoretically-correct value, but in practice it is generally sufficient to make it about ten times as high as the anode coupling resistance which precedes it. The most generally-used value, which is perfectly satisfactory in almost every case, is .25 megohms, although double this value may be better in conjunction with a comparatively high-impedance L.F. valve—as opposed to a small-power or other output valve.

A.C.-Set Bias Resistors

Now that we have dealt in general terms with all of the resistors used in a simple battery receiver we may consider the most important of those used in, say, an A.C. mains set. First of these is the bias resistor shown in Fig. 4. It is in series with the cathode lead, and can be considered in the same light as R.10, shown in Fig. 1. The only difference is that it passes only the anode current of one valve; its value is calculated from Ohm's Law.

When variable bias is obtained by using a variable resistor in the cathode lead the maximum value can be determined from a knowledge of the maximum bias voltage required by the particular valve in use and the combined anode and S.G. current passed by that valve at that G.B. voltage. Thus, if the voltage were 15 and the current 2 mA the value would be 7,500 ohms. It is of practical importance that a good "graded" component be used for this position so that smooth control can be obtained round the setting which gives the normal G.B.—probably about 3 volts.

When a potentiometer of this kind is used to apply the variable bias to two similar valves, the maximum resistance mentioned above would be halved, due to the current passing through the component being doubled.

Books Received

RADIO-FREQUENCY MEASUREMENTS. BY BRIDGE AND RESONANCE METHODS. By L. Hartshorn, D.Sc., A.R.C.S., D.I.C. Published by Chapman and Hall. 266 pages. Price 21s. net.

THE progress made in the realm of electrical engineering during the twentieth century has been amazing, and during the last few years the allied sciences of high-frequency and electrical communications technique have moved forward with such gigantic strides that it is not very surprising that the electrical engineer whose college days are some years behind him finds it absolutely essential to devote a considerable amount of time to reading to keep his knowledge abreast of modern developments. Unfortunately, however, the comprehensive and voluminous literature covering the revolutionary advances which have been made, is so scattered that the student or engineer had to waste, so to speak, much valuable time on intensive literary research. So far as radio-frequency measurements are concerned, this unsatisfactory procedure no longer applies, as the author of this most comprehensive work has succeeded to the full in presenting, not an encyclopædic account of everything that has been written on the subject, but a systematic account of the basic principles and general working ideas that form the tools of the practising technician. To give an idea of the scope of the book it may be mentioned that included amongst the subjects covered in its twelve chapters are Impedance and Related Quantities; General Principles of Screening and the Radio Frequency Bridge; Generators; Standards of Capacitance; Standard Inductors; Resistance, Power Factor, Decrement by Resonance Methods; and Bridge Methods. This useful book, which is illustrated with numerous diagrams, also includes a full index.

INTRODUCING RADIO RECEIVER SERVICING. By E. M. Squire. 100 pp. Sir Isaac Pitman and Sons, Ltd., London, 6s.

THIS new book is intended to cover the ground between elementary radio theory and the practice of radio engineering. Thus, the scope is wide, and the difficulty of treating it adequately must be admitted. The author has started by giving a general outline of the operation of a wireless receiver and of the simpler aspects of the underlying theory. Later, he deals briefly with servicing equipment and concludes with a chapter entitled "Tackling the First Service Job."

There are 106 line illustrations.

ON YOUR WAVELENGTH

By Thermion

The New Year

I AM necessarily writing this, the first copy to be issued in 1941, some time before the abbreviated Christmas holiday, but I wish every reader the happiest possible New Year, and I hope that superlative degree of happiness will be consummated during the year by peace. As I write there seems to be a crack in the Axis, which lacks a little *grease*, if you will excuse the pun. Further evidence of this crack is evinced in the broadcasts from Germany and Italy. The swashbuckling blacksmith ceases to work himself into a frenzy or to obtrude his diabolical physiognomy. The speeches by the little house-painter have lost their self-complacence. It seems, indeed, that with the collapse of Italy there may not be a focal point upon which the Axis may revolve.

You have only to listen to Haw-Haw's broadcast, and then compare it with the German version intended for home consumption, to detect the weakness. What a tragedy it is that the ether should be used for the propagation of lies.

However, we can still hope that there will be a Wireless Exhibition in 1941. It does not seem possible at the moment, but in this quaintest of all wars anything is possible.

When peace *is* declared we shall revert to weekly publication, but naturally this may take a little time, because the paper-producing industries will not immediately get back to their pre-war stride.

On Active Service

MANY hundreds of our readers are on active service, but they are able to find the time to write interesting letters to me. I have received a large number of entries for the "How War Has Affected My Radio Hobby" competition, and it is noteworthy that many of them are from readers on active service whose names have already appeared in our Roll of Merit. A point which emerges is that they maintain a keen interest in radio and that this journal is sent to them each month. Some of them plan circuits in their spare time, and send them for criticism. Most of them pay tribute to our library of technical books which has helped them to obtain promotion. I shall publish a selection of the winning entries next month.

New Designs

ALTHOUGH the war has necessarily stifled enterprise and design, I know that there are many ingenious new components, valves, and circuits in cold storage awaiting production when peace returns. One of the greatest developments which will take place is in connection with television. When the last war finished, wireless telephony suddenly descended on the world to cheer, mystify, and interest us. It provided the antidote to the war, and caused memories of it rapidly to recede into the background. It is my view that television will do the same when this war finishes. I am privileged to know something of the development and experiments which have taken place, and which are being pursued. Radio has lapsed into the order of accepted things, like the aeroplane, the telephone, and the gramophone. Television has yet to be born, but it is inevitable. In a few years we shall wonder how it was we were able to *listen* to a wireless programme without being able to see those providing the entertainment. No one to-day wishes to see a silent film, and no one a few years hence will tolerate a blind broadcast programme.

It is also my view that the large cathode-ray tube, costly to make, difficult and slow to produce, will vanish, and in its place will be a small tube no larger than a wireless valve. One such television receiver, of course, has already been marketed, but I think that system will be general. The replacement of a cathode-ray tube, which has a comparatively short life, is too expensive at present, and there is always the danger of an implosion.

It is one of the tragedies of the war that television fell, an early casualty. It was getting into its stride and high definition was showing us the way. It was still, however, imperfect. I always felt that the Cossor velocity modulation system was a better proposition. I well remember witnessing some experiments late at night at the Cossor factory when Bedford and Puckle demonstrated the velocity modulation system. It was as near perfect as the cinematograph is to-day. The Television Advisory Committee, however, recommended that the Baird system should be used, and finally abandoned this in favour of the E.M.I. iconoscope system. It seemed to me that the Cossor system, on which so much had been spent, was never given a fair trial. Perhaps when this war is over it will be, and the public left to judge.

Whether television will ever be possible as a hobby for constructors is a matter which cannot, at present, be considered. Before the war started there were a few experimenters, and the editor of this journal founded *Practical Television* which, however, suspended publication because it was found that the market was too small. Those were the days of mirror screws and mirror drums and synchronising gears, and I early formed the opinion that they were too crude and unmechanical to achieve the object in view. The Baird 30-line system had been made as perfect as its crudeness permitted, but it had not progressed very far beyond the experiments of Nipkow towards the end of the last century. I also formed the opinion that many of those toying with television (and I use the word advisedly) had not sufficient knowledge or training to enable them to understand what they were doing, and that is why so much of it had the appearance of being built by schoolboys from a well-known constructional outfit. Take one example—the 30-line disc machine. The disc was driven by a toy motor which suffered from sporadic changes of speed. Rather than design a motor which had a constant speed (a fairly simple matter), complicated synchronising gear was attached, but even this failed to keep the motor steady. Some experimenters found that they could control the speed better by holding their finger against the periphery of the disc. The mirror screw does not *look* right, and neither does the mirror drum. The cathode-ray tube, however, solved the problems. Much has to be done at the transmitting end, for there was little depth of focus in the transmissions, also there were far too many knobs on the receiver. Still, we have some interesting times to anticipate when scientific brains can be diverted from the production of war material.

Our Roll of Merit

Our Readers on Active Service—Tenth List.

N. L. Foster (Gnr., R.A.), Ireland.

R. Burns (Ordnance Artificer), Hayling Island.

J. E. A Reed (Cpl., Royal Signals), Home Forces.

J. Keenan (Driver, R.A.S.C.), Duffield, Yorks.

E. Woodcock (A/C.1, R.A.F.), Gloucester.

— Ludbrook (Signalman, A.F. Signals), Ongar, Essex.

A DOUBLE DEMAND

"CUMBAT" and "Respit"
Get our Thermion's goat.
And with much indignation
He asks us to note
A subject at which
He's determined to hammer,
The horrible state
Of the B.B.C. grammar.
Now, we know, as a rule,
That our Thermion is right,
And rarely, if ever,
Is prompted by spite.
But may we point out,
With the greatest respect,
That more than good grammar
We really expect?
Bad grammar's annoying,
We freely admit,
Bad programmes are worse
And our language unfit
For polite conversation
When both are combined.
So in kindly indulgence,
P'r'aps our Thermion won't mind
If we press a demand
That both be improved;
Or "them wot's responsible"
Firmly removed.

"TORCH."

Comment, Chat and Criticism

Outline of Musical History–15

Continuing the Life and Work of Wagner, by Our Music Critic, MAURICE REEVE

WAGNER spent the years immediately following the revolution in prose writing, chief of which was a remarkable treatise, "The Art Work of the Future." The defeat of the revolution had not shaken his belief in the desire that had given rise to it. In fact, his belief only strengthened that music, like government and all other things, needed thoroughly re-casting and placing on an entirely new economic basis. One of his strongest prejudices strongly savours of modern German thought: he was a most violent anti-Semite. Every evil that Germany then suffered from he attributed to the gentlemen with the wrong-shaped nose. He had the firmest faith in the "folk"—the German folk legends. Again like modern Germany, he believed that the Germans were like the Greeks with their wonderful mythology—"a nation of high-souled dreamers and deep-brained thinkers." His study and research into German mythology have certainly enriched the world with a cycle of the most stupendous music dramas that it is ever likely to see.

Music Dramas

This cycle, which ultimately comprised the four operas, "The Rheingold," "The Valkyrie," "Siegfried," and "The Twilight of the Gods"—known collectively as "The Nibelung's Ring"—had long been turning round in his brain, and when Liszt commissioned him to write an opera on the young Siegfried for 1,500 marks, the whole plan further matured.

The whole gigantic plan always depended on an adequate presentation. No existing theatre or opera house came anywhere near Wagner's requirements, with their huge symphony orchestra and enormous settings. The full story of the construction of the world-famous Wagner Festival Theatre at Bayreuth cannot be told here. But even to-day, it alone presents the only perfect production of the immortal operas.

A Great Conductor

During these years of exile he established his reputation as a great conductor, and appeared all over Europe, including England. He gave memorable performances of the classic orchestral works, as well as special concert arrangements of excerpts from his own operas. He lived in Zurich as an honoured exile, fêted and banqueted. He had never known such prosperity. Three special concerts were given for his benefit, and at last, in spite of very indifferent health, and a mind roaming over all sorts of problems, he reached that mental state which allowed him to plunge into the completion of the Ring.

His energy at this time appeared to be inexhaustible, and he completed the scores and libretti of these monumental works at incredible speed. He may have been inspired by a remarkable woman he met, Mathilde Wessendonck, whose husband had financed the Zurich festival just mentioned. A typical Wagnerian affair where the harassed musician borrowed money from the husband whilst he made love to the wife with acumen and aplomb.

A larger flat, a de luxe publication of his operas at his own expense, and other extravagances, made him jump at an offer of the London Philharmonic Society to conduct a series of their concerts. But Mendelssohn was the rage in England then, and poor Wagner was practically reviled. A chance here for some slashing attacks on the Jews, which was seized with both hands. Hopes that Covent Garden would mount his operas were also frustrated, the management then being slaves to the Italian vogue.

Return to Zurich

He returned to Zurich and experienced a bad attack of his old complaint, erysipelas. However, a birthday present of 1,000 francs from Liszt enabled him to take a cure, and a complete rest at Mornex. The great work that had been engaging him must have been a colossal strain, but by complete rest and a rigid diet he returned to Zurich cured.

Wagner's second wife was the eldest daughter of Liszt, Cosima, the wife of Hans von Bulow. Few more remarkable affairs than this one are to be found, even in the annals of great people. Not only was Bulow—a great pianist and musician—the intimate friend of Wagner by virtue of the master employing him to transcribe his orchestral scores into piano arrangements, but his worship of Wagner and o Wagner's art was of such a quality that he accepted the loss of his beloved wife with a stoicism and a fortitude which one reads of rarely and never sees.

Bulow's Sacrifice

The nobility of Bulow's sacrifice in putting aside all personal feelings for what he considered were the imperious needs of one of the world's master minds, is a classic example of calm resignation and devotion to the highest ideals. On the other hand we see the great musician, himself the servant of his art, who would stop at nothing where a stimulant to his creative genius was concerned.

I am unable, owing to the exigencies of military service, to detail the entrancing story of the foundation and construction of the world-renowned Wagner Festival Theatre at Bayreuth, and of the master's amazing relations with the young, and later insane, King Ludwig of Bavaria. Here again the tyrant and egoist had his way. No existing theatre or opera house was in any way competent to stage the mammoth works which Wagner was either planning, or which were in actual composition—the mighty "Ring of the Nibelungs" (four works which he demanded performance for on four consecutive nights), "Tristan and Isolde," "The Mastersingers of Nuremberg," "Parsifal," etc. Not only were the stages inadequate to the theatrical side of the works, but the most important point was the necessity for the provision of an orchestral pit capable of seating seventy or eighty musicians forming the Wagnerian orchestra, at the same time blending acoustically, and artistically, with the stage presentation. The Bayreuth Theatre, built at Ludwig's personal expense, fulfilled every requirement.

Return from Exile

When Wagner returned from his exile, it was to a "young" Germany flushed with the Bismarckian victories that culminated at Sedan in 1871. He was, in fact, witnessing the birth of that Germany which, during the present century, has been the scourge of mankind. It is not surprising that his music should, almost at all times, have a nationalistic flavour stronger than in any other of the great masters. Triumphant young Germany breathes in every note. It is not German in the sense that Beethoven or Bach are—by culture, temperament and historical development—but it is German deliberately, as it were, because he gloried in Germany and in being a German. Wagner's music breathes the spirit of the dominating, militant Germany of his and our own day, just as so much of Shakespeare glorifies England, whether right or wrong. But the music would not be what it is if there was no more in it than that, any more than our own illustrious Swan of Avon would be where he is if he were solely judged on Henry V's speech at Agincourt, or his scandalous decrying of Joan of Arc, just because she was French.

Wagner at the Proms.

For this reason it may not be so strange as it would otherwise seem that war with Germany and a righteous hatred of all things Teutonic make no difference whatever to the public's demand for Wagner's music. Monday's Wagner night was as firmly established in the last series of Promenade Concerts as it was in the last war. I say "Wagner's music" as apart from "Wagner's operas" purposely. I have no doubt whatever that any attempt to mount any of the operas at the present moment would meet with organised resistance. The compulsory witnessing of stage action and the listening to the spoken word—especially in its native tongue—would completely destroy any illusion which we may be under when engrossed in the abstract and uncontaminated language of music

Wagner's death in 1886 marks the end of 200 years of domination of music by German masters. Brahms lived a few more years, and only Richard Strauss, among subsequent writers, can be classed in the top flight. Unique among the musicians of all time, his legacy to the world is indeed great, judged from any angle. His poetry, libretti, works on music, literature and other subjects, and his voluminous correspondence, together with his amazing, if dishonest autobiography, are an ordinary man's lifetime in themselves.

Tuning-up Your S.W. Receiver

Apart from Experimental Considerations, it is Essential in the Interests of Economy to Secure the Maximum Efficiency from the Minimum Number of Valves and Components

By L. O. SPARKS

CONSIDERABLE interest has been shown, in the last two or three issues of PRACTICAL WIRELESS, in what has been described as "hotted-up" one-valvers. Numerous opinions have been expressed by readers, concerning what constitutes the processes embraced by the rather ambiguous term "hotted-up," and it would seem that the majority of them miss the essential considerations. Quite a number of those who had been carrying out experiments, appear to have concentrated solely on the reaction circuit; others have devoted all

Fig. 1.—One form of well-known low-loss insulator. It has great strength and a very long leakage path.

their skill on the tuned circuit; whilst another group apparently thought that the values of the grid-condenser and its associated leak held the solution to all their problems. Whilst each experimenter is tackling an item which would directly effect the performance of a receiver, they miss the main issue by taking too much for granted, so far as the *whole* installation is concerned, and allowing their own particular theories to govern their activities.

Let us examine the subject under the term "tuning-up" rather than "hotting-up," as this puts a different aspect on the whole matter and suggests more suitable lines of approach. We speak of tuning or tuning-up musical instruments; the term is also used with relation to high-efficiency engines, accurate timepieces and many other items where so much depends on the final adjustments. In no one of these instances does the term suggest the adoption of some drastic expedient to obtain a temporary increase in efficiency at the sacrifice of some other vital factor. Rather does it convey the impression of the application of great skill, unlimited patience and fine craftsmanship, and it is in these very important details that the term differs from "hotted-up."

The Aerial

This vital part of the average installation is sadly neglected. Too many listeners *and constructors* choose to starve the input to the receiver, rather than go to the trouble of erecting a simple but efficient aerial. They are encouraged in this lax practice by the high gain obtainable from a modern receiver. It is, perhaps, understandable in the case of the ordinary listener, but it hardly seems credible that a genuine constructor would wish to put forward that plea as an excuse for (a) an inefficient outdoor aerial, or (b) an equally inefficient but more unsightly external aerial system. PRACTICAL WIRELESS has already stressed the value of a good aerial, and it is apparent in some districts that endeavours are being made to make outside aerials businesslike and neat, but, in spite of what has already appeared in these pages, there are still far too many who appear to be content with hideous contraptions waving about in the air, which can neither be efficient nor safe and can, therefore, only form a permanent eyesore to their neighbours and a source of poor results to the owner. It seems obvious that any attempt to tune-up an installation must start at the input, or otherwise the aerial. If constructors will try and appreciate that the high-frequency currents developed in the aerial circuit prefer travelling *on the surface* of and *not in or through* a conductor, and that it is *practically impossible* to imagine the *minute value* of such currents, then they will be taking a step in the right direction, provided that they allow such appreciations to govern their treatment of the aerial.

Losses

Losses can be incurred through any part of a receiver, including the actual construction and wiring. It is of vital importance that such detrimental factors are eliminated or reduced, and this applies in particular to those parts of the circuit carrying high-frequency currents. It must be realised that the higher the frequency of an alternating current the more difficult it becomes to provide satisfactory insulation. For example, when erecting an aerial, especially if it is intended for use on the short-waves, careful consideration should be given to the insulation at the points of suspension. It is far better to use, say, three small insulators in series at each point than one large one, as the latter tends to offer a much shorter path for leakage when effected by moisture or deposits from the atmosphere. Insulators are cheap enough, and practical tests have proved that a remarkable increase in efficiency can be produced by their intelligent use. There are certain proprietary types specifically designed to provide a very long leakage path (Fig. 1) and constructed from material less effected by atmospheric conditions than the original porcelain models. Although they are slightly more expensive, the extra cost is well worth while.

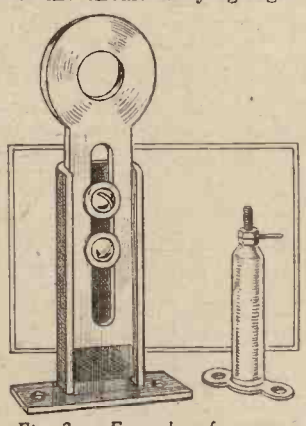


Fig. 3.—Examples of a commercially produced adjustable bracket and an insulating pillar. Both very useful for S.W. work.

Aerial Wire

Bearing in mind the characteristics of H.F. currents, the diameter of the aerial wire is also important. For normal work, 7/22 S.W.G. wire is quite satisfactory, but, with many S.W. aerial systems it is better to use a single wire having a gauge of, say, 12 to 14 S.W.G., the material being copper.

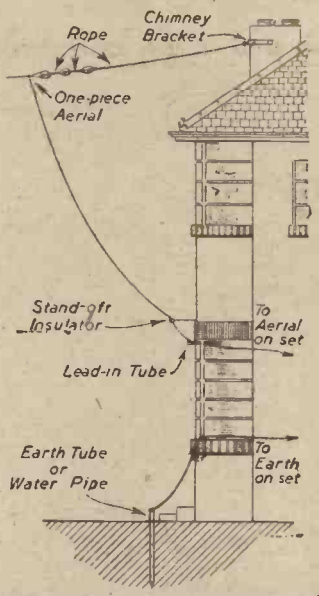


Fig. 2.—A neat and efficient inverted "L" type of aerial. Note the three insulators, continuous length of wire and good earth connection.

When designing and erecting the aerial, endeavour should be made to use a continuous length of wire for the *horizontal* portion and the *down-lead* (Fig. 2). If circumtances prevent this, then the junction formed between the down-lead and the aerial should be well and securely *soldered* and finally bound with insulating tape. On no account should a simple twisted joint be made; the wires are bound to become coated with a film of oxidisation, and a high resistance and intermittent contact will result. Many weird noises can be traced to such joints, and they are a recognised source of loss of efficiency. If it is possible to bring the down-lead straight into the room through an insulating tube, so much the better, but if a lead-in tube fitted with terminals is used, do see that the contact between wire and terminals is good and that the metal parts are bound with insulating tape or other suitable material to protect them from the atmosphere. Lightning switches are another possible source of loss; they also should be covered to prevent any moisture or deposits reaching them, the contacts frequently examined and cleaned and a periodical examination carried out to make sure that the associated wires are not fractured or corroded. The earth system is *equally* important. No trouble should be spared in securing the best possible earth connection. The earth wire should be kept as short as possible. It is preferable to use insulated wire of reasonable gauge, say 7/20's or 7/22's and, if it is not feasible

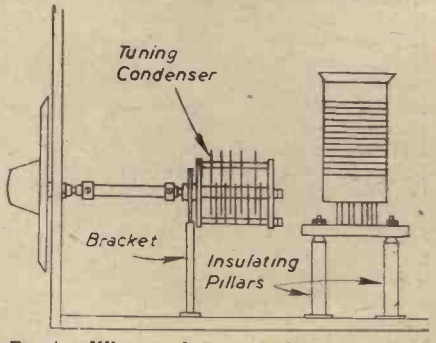


Fig. 4.—When good use is made of brackets and pillars, wiring can be simplified and efficiency increased.

owing to local conditions, to use an earth tube or plate buried in moist ground, then the next best thing is a connection to the rising main water pipe. For this purpose, use should be made of the special clips or bands which are adjustable to suit various diameter pipes.

Tuned Circuits

Careless planning of the layout, use of unsatisfactory connecting wire and the selection of components without due regard to their low-loss properties, all contribute to the overall loss of efficiency. The location of the coil-holder, variable condenser and associated valve-holder—with relation to each other—forms an essential consideration. A tuning condenser mounted on a panel several inches from the coil and valve-holders, can introduce sufficient unwanted wiring to cause H.F. losses, additional capacity to earth and across the tuned circuit, and pick-up or break-through of signals at frequencies other than that to which the circuit is tuned. It is not possible to illustrate all flaws in a layout, but Fig. 5 shows a good and a bad arrangement of the components just mentioned. It will be seen that one layout necessitates long inter-connecting wires, one of the things to avoid. The other diagram shows how the components have been re-arranged to reduce length of wiring to a minimum. The use of brackets (Fig. 4) for holding variable condensers, raising the coil holder by means of insulating pillars, until its terminals are on the same level as those of the condenser, are but two items which will do a great deal towards reducing losses. All tinned-copper wire used for connecting components on the H.F. side of the detector should have a gauge of, say, 18 S.W.G., as such diameter wire not only tends to reduce H.F. losses but it also makes rigid wiring which, in itself, is an important item.

It is not usually necessary, unless one is concerned with the reception of the 56 mc/s band, to raise the valve-holder, as the length of the grid-condenser invariably permits a straight-line connection to be made between the coil and the valve-holder when they are arranged as shown in the diagram. The band-spread condenser should always be mounted close to its "tank," similarly, H.F. chokes and anode by-pass condensers should always be so located so that the wiring to the anode terminal is as short as possible.

Reaction Components

When capacity-controlled reaction circuits are used, don't assume that any type of variable condenser will do. Remember that it is carrying H.F. currents, and choose one of the air dielectric type of good make and, preferably, fitted with a slow-motion drive. Quite a good deal of erractic reaction can be traced to a poor condenser; always make sure that the fixed vanes are connected to the H.F. side of the circuit, i.e., anode, and that the condenser is placed so that the connection between anode and plates is kept short. As it is desirable to keep the complete reaction circuit as compact as possible, without, of course, bringing the actual controlling condenser so close to the grid or aerial winding as to introduce a degree of permanent reaction, it is well to devote some little time in the placing of the associated parts and, in this direction, it is often found that a chassis construction lends itself to an easier solution of the problem than when the parts are mounted on a baseboard. As with tuning and tank variable condensers, don't be afraid of using extension rods for control purposes, not solely from the point of view of reducing hand-capacity effects but to allow the most satisfactory placing of the components as suggested above.

Wiring

It is not sufficient to keep all wiring as short as possible. Each constructor must acquire, by experience, the knowledge about which components can be brought close together, just how close they can be and how much wiring can be shortened *without* introducing an undesirable form of interaction. A few experiments with a simple S.W. receiver will soon show many interesting snags which are likely to arise if the "all wiring as short as possible" statement is taken too literally.

As stressed before, use wire having a diameter which will form rigid self-supporting wiring and cut down H.F. losses. Thin wiring, straggling all over the assembly, can introduce serious losses, instability and inconsistent performance. The same applies to poorly-made connections, presence of soldering flux on components and faulty earth returns. Wherever possible, solder all connections and see that a perfect joint is formed. Earth every part which has to be connected to the common negative-earth line with stout wire, taking all such connections direct to the earth terminal by the shortest way. The earthing of the frame and the moving vanes of a variable condenser, when such is called for, is usually a point so often treated with scant consideration. Don't assume that any individual part is earthed because it is making a mechanical contact with another part which is. Connect all such parts together electrically by 18 S.W.G. or, in certain cases, it is better to use the metallised sleeving used for screening conductors, pressed flat and well soldered to the part concerned.

Layout

While a pleasing layout is usually desirable, especially so far as the panel is concerned, it must not be made an overruling consideration. It is far more important to study component location in the light of associated wiring than appearances. With a little thought and skill, it is often possible to arrange matters so that a satisfactory compromise is secured but, to achieve this, one must be prepared to devote a good amount of time experimenting with the layout on a dummy baseboard or chassis, bearing in mind all the time the necessary interconnecting wiring

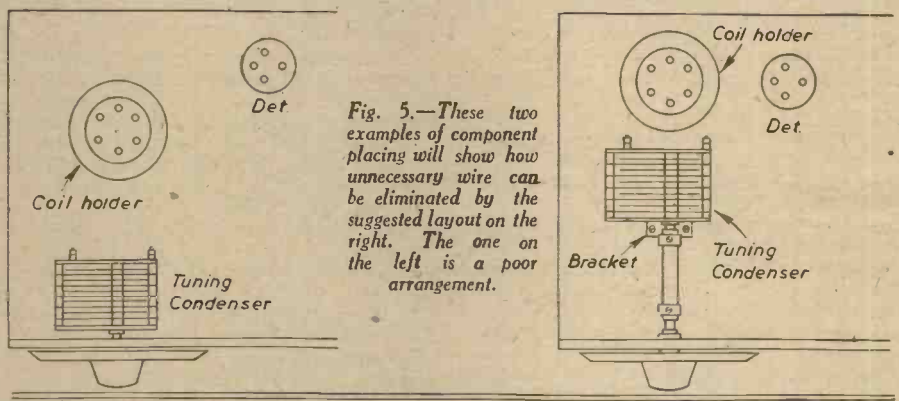


Fig. 5.—These two examples of component placing will show how unnecessary wire can be eliminated by the suggested layout on the right. The one on the left is a poor arrangement.

NOTES AND NEWS

"Personal" Parcels to Prisoners of War

WE are informed by the G.P.O. that the arrangements for the despatch of "Personal" parcels to prisoners of war interned in enemy territory which were suspended last July have now been restored. Under these arrangements the next of kin of a prisoner will be allowed to despatch a parcel once every three months. Each parcel must bear a special label which will be issued by the British Red Cross Society and Order of St. John of Jerusalem, 14, Finsbury Circus, London, E.C.2, otherwise it will not be accepted for transmission at a Post Office.

Full particulars of the arrangements are given in a Post Office leaflet, number P.2280E, which contains the general regulations for communication with prisoners of war interned abroad. Copies of this leaflet may be obtained at any Head Post Office. Copies will also be sent by the British Red Cross Society to the next of kin.

It should be noted that the British Red Cross Society is preparing complete lists of prisoners of war and their next of kin, and special labels for use on "Personal" parcels will be issued to all concerned as soon as possible. As these will have to be issued in rotation some time may elapse before all the labels are issued. In the meantime next of kin are asked to refrain from applying for the labels, but if they have recently changed their addresses they should notify particulars of the change to the British Red Cross Society at the address given above.

G.E.C. Radio Sets in the Wars

DURING the past few weeks several letters have been received by The General Electric Co., Ltd., bearing news of radio sets that have stood up to the Luftwaffe with what might be called typical British fortitude.

One visitation by Goering's staff which Londoners will remember occurring near a railway station caused the roof of a Salvation Army canteen to be lifted several inches, most of the goods on the shelves inside consequently being thrown to the ground. A G.E.C. B.C. 4040 was among the casualties. All "injuries," however, were of "superficial" nature. The Adjutant reported that after making a couple of connections which came away in the fall, the set now performs as well as it did when new.

Another note from a Midland branch of this company tells a similar tale of a battery set which successfully survived the damage caused in a private house by an aerial torpedo. "Apart from a few scratches," the correspondent says, "and a broken high-tension lead, no serious damage seems to have been done, and the set is now working again in good order."

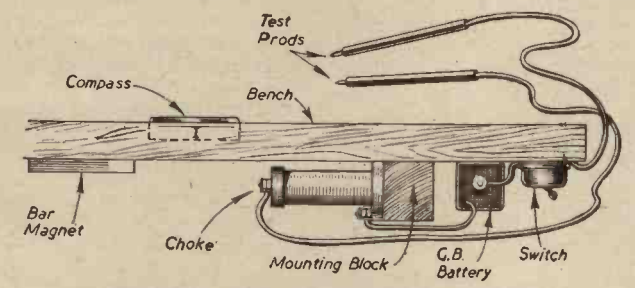
Practical Hints

Simple Continuity Tester

IN constructing a bench with aerial, earth, amplifier, etc., I devised a dodge which may be of interest to other readers. It is a simple continuity tester on the following lines.

A small pocket compass was countersunk into the bench, leaving the glass level with its surface. An old H.F. choke was then mounted with its axis at right angles to the field of the compass. Through the choke may be passed a current, the strength of which will depend on the choke resistance and the thickness of the wood. In my case 1½ volts sufficed. The choke was wired up in series with a switch and a pair of test prods. After a little use the device gave a rough idea of resistance values, etc., and acted quite well as a continuity kick meter.

The compass response can be improved, and its position "off" reading standardised by putting a bar-magnet in a position roughly at right angles to the choke and at a distance best found by experiment. The inclusion of the bar magnet below the desk serves to balance the compass, and if



Details of a simple continuity testing apparatus.

well placed, gives it a surprising sensitivity. —R. KEARNEY (Belfast).

THAT DODGE OF YOURS!

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

SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page 136.

A Slow-motion Dial

HERE are details of an illuminated S.W. dial I made recently and which gives me very satisfactory service. The actual dial is composed of a celluloid protractor, the other half being a semi-circle of stiff cardboard the same size as the protractor. At the junction of the marked angles on the protractor is a small semicircle. This is cut out with a razor blade. Treat the cardboard likewise. The two semicircles are then, by means of another piece of cardboard and eyelets, made into one complete disc with a central hole for the spindle. This central hole is occupied by a brass bush with a $\frac{1}{16}$in. hole drilled through it. The condenser spindle also has a $\frac{1}{16}$in. hole drilled through it. Put the dial on the bush, leaving the nut slack. Then put the bush on the spindle of the condenser and insert a split-pin in the $\frac{1}{16}$in. hole. Turn the condenser to maximum, turn the dial round on the bush until it reads 180°, then tighten the nut holding the dial on the bush. The pin prevents the dial turning on the spindle, and the dial is now set to show the correct values.

The rest is fairly simple. A brass bush is fixed in the panel so that the top of the rod turning in it is level with the bottom of the dial. A washer carrying a spring is slipped over the driving spindle, the end of it resting over the panel bush. Between this washer and an adjustable brass collar the dial is held securely. The magnifying glass is 1in. in diameter and is taken from an old torch. This is mounted over a hole $\frac{1}{8}$in. in diameter cut in the plywood panel. It is held in position by a square of plywood having a central hole of $\frac{1}{8}$in. diameter cut in it, and screwed to the panel. Washers may have to be interposed between the panel and the holder to prevent undue pressure on the glass.

For best effects the back of the protractor should be painted over with white enamel. This does not affect the markings which are black and sunk in grooves. A vertical wire should be placed behind the magnifying glass, but a hair dipped in adhesive and stuck to it will suffice.—JOHN BRIDGES (Gateshead).

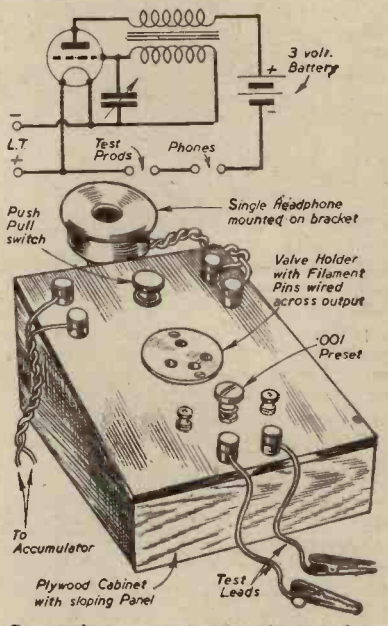
A Valve Oscillator Unit

THOUGH the neon oscillator is very popular as a circuit tester, morse practice oscillator, etc., I have always preferred a simple valve oscillator, as no high voltage D.C. is required, and the necessary parts are usually to be found at hand.

After much experimenting I finally made up the unit, as shown in the sketch, and which has since proved indispensable.

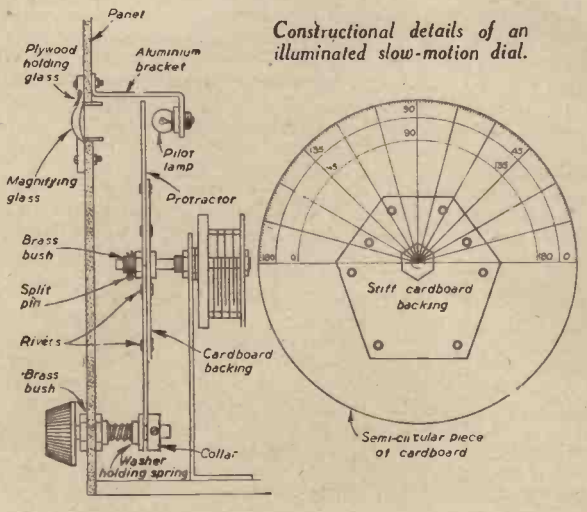
Though the basic circuit is not original, one or two of the details are. A single headphone is permanently mounted on the unit. For morse practice and testing of high-resistances this may be removed and 'phones used. The 3-volt H.T. battery is mounted inside the box. Note that the negative lead goes to L.T.+, so connecting both batteries in series.

A pre-set condenser is mounted on the panel, by means of its terminals, to vary the tone, and a valve-holder is mounted on the panel with the filament terminals across the output, for testing filaments for continuity.



Circuit diagram and pictorial view of an easily-made oscillator unit.

I sometimes use this oscillator for feeding a resistance-capacity bridge, in which case the headphone is shorted out. This is also done when testing transformers, the 'phones being connected to the second winding, thus testing both windings at once.—R. BUCKERIDGE (Radford).



Constructional details of an illuminated slow-motion dial.

Modern Factory Production Methods—4

Details of Assembly Work, and Wiring Operations

By "SERVICE"

WHILE the test engineers are designing their test equipment which was dealt with in the last article, the production planning engineers will be working out details associated with the actual assembly of the components on to the chassis, and the wiring-up of them into the receiver circuit.

Methods of Assembly

There are two main methods of assembly, one being the continuous belt system which, however, is generally only worth while in very large establishments, and the second system in which each operator as she finishes her particular job on the chassis passes the chassis along to the next girl on the line. As this is the more general method among most manufacturing concerns we will describe its functioning more fully.

The accompanying chart conveys the general idea underlying the average assembly line.

The first eight stages along the line are shown, but it will be appreciated that the amount of work done at each stage will depend upon the production per hour required. As stated above, each operator passes the chassis to the next operator when she has completed her job, but this passing along has to be carried out by all operators at the same time. Therefore, the first consideration of the production planning engineer is to arrange that each operator will take the same amount of time to do her own particular job as all the other operators.

For example, let us assume that he works to a period of three minutes for an operation, he will have decided that this period is the shortest time in which any single operation can be done. In the accompanying chart the first operation on the actual assembly line is to fit a mains transformer to the chassis. This will entail putting the transformer bolts through the chassis, fixing the required washers and nuts, and tightening these up with an electrically driven tool.

Second Operation

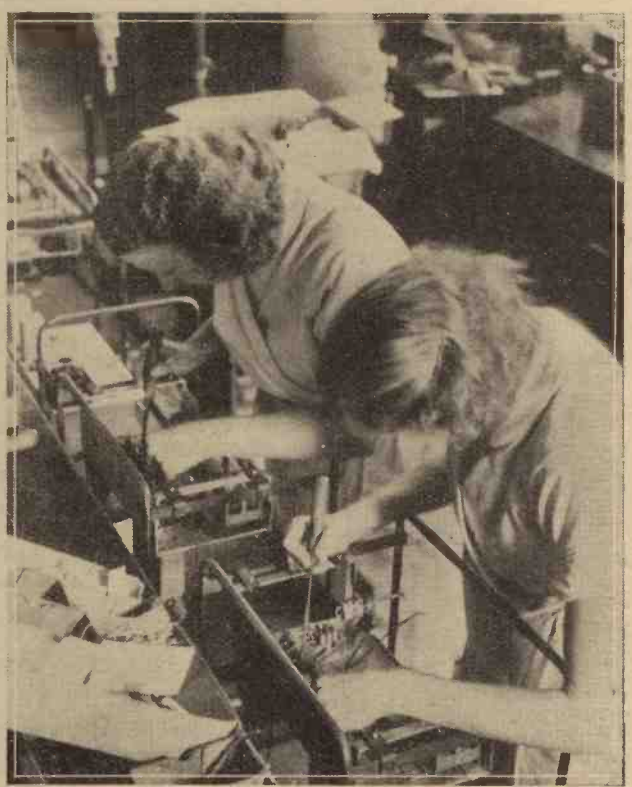
The second operation is the fitting of the smoothing condenser, but as this may only comprise driving a couple of P.K. screws through a flange of a condenser block or, in the case of tubular condensers, fixing a clamping ring to the chassis by means of one nut and bolt, the operator will obviously have time to spare. The production planning engineer will, therefore, arrange for some other work to be carried out at this stage, such as the fitting and connecting up of certain lengths of wiring to the condenser or transformer so that the total time of three minutes is expended in working on the chassis.

The third stage, as will be seen from the chart, is the fitting of the wavechange switch and variable condenser.

It will be appreciated, therefore, that the chassis will be coming off the end of the line at the rate of one every three minutes, and if the production planning engineer wishes to double the output from the line he can do so by halving the amount of work done by each girl and doubling the number of girls. Thus, each one completes her operation in one and a half minutes. This cutting-down of the time may necessitate the increasing of the amount of work done by groups of girls working on sub-assemblies The question of sub-assemblies, however, will be dealt with later.

Timing

Reverting back to the timing of the various operations, the moment at which the chassis is being passed from one operator to the next is often indicated by a bell, or klaxon, operating in conjunction with a large clock fitted with a single hand. The hand travels round the circular scale with zero at the twelve o'clock position, and the klaxon or bell is arranged to sound as the hand of the clock reaches the zero mark.



The start of an assembly line. Note how the chassis are safeguarded by the protecting steel cradles.

It is obvious that as the girls become more expert at their individual jobs they will be able to carry out their operations more quickly. This will be evident to the observant engineer in charge of the floor, because the girls will be waiting for the bell or klaxon to sound so that they can pass the chassis along. When all the girls have become so efficient that they are all finishing their jobs before time, the production engineer will often arrange that the clock runs more quickly, and he may cut off a quarter minute so that the signal is given every 2¾ minutes instead of every three minutes, as previously, and he may be able to do this again when the girls have got used to the new conditions.

So that they will not be penalised by the increase of efficiency with its proportionate increase in output they are often paid a bonus based on the production from their line which, naturally, encourages them to maintain as much output as possible.

Protecting Cradles

The passing of the chassis along the line when the signal is given is rather a rough process for a radio receiver, and they are generally fitted with protecting steel cradles which are shaped so as to hold the chassis in a position that will not allow any harm to come to it, no matter how roughly the chassis cradle is handled. These cradles may be seen fitted to the chassis in the accompanying photograph, and it will be noted that not only do they protect the chassis, but they also form runners like those on a sledge by means of which the chassis is easily slid along the bench from one operator to another.

With regard to the actual passage of the receiver down the line, for illustration purposes in the accompanying chart the operators are shown seated next to each other, but where a large output is required a correspondingly larger number of girls is needed. Where the facilities for long assembly shops are not available, the passage of the receiver chassis down the line may be arranged as shown in the insets at A and B on the assembly line chart.

Awkwardly Placed Components

One of the chief considerations which the production planning engineer has to keep in mind is that the work on the chassis must progress so that the awkwardly placed component or wiring are assembled first. Components and leads which lie close to the chassis must be put into position before complicated arrangements such as wavechange switches and multiple condenser blocks are fitted to the chassis. If this point is not looked after time will be wasted in trying to make soldered joints in practically inaccessible places, and there will also be the danger that such joints will be bad ones and adjacent wiring or components damaged by the hot soldering irons.

This problem is one that really should be taken care of by the chassis layout engineer as he generally compiles the sequence of operations, but it may be that, due to an oversight on his part, or to modifications effected on the chassis at the

last minute, that the production planning engineer has to rearrange the sequence of operations when he finds that some of the operators experience difficulty in carrying out their jobs efficiently. Therefore, although for explanatory purposes the accompanying assembly line chart shows the major operations carried out and completed in one sequence, it may well be that in actual practice some of the fixed condensers or resistances referred to in a later stage may be wired into the circuit in earlier stages along the line.

Sub-assemblies

A glance at the assembly line chart will show that there are other operations being carried out simultaneously with those performed by the girls on the line. These sub-operations, as they are termed, are for purposes of making up sub-assemblies which are being constantly fed to the girl whose job is to fit them to the receiver chassis.

For example, the production line cannot be expected to remain stationary for the length of time needed by operators to cut wires to the right lengths, fit them with systoflex, and bend them into position before finally soldering them into the circuit. One of the girls at a bench near the assembly line will be given this job. It will not be skilled labour and, therefore, the cost will be reduced in addition to the general speeding up of production.

Another reason for sub-assembly operations would be the fitting of wiring to the bottom tags of the tuning coils, because of the fact that when the tuning coils are in position on the chassis such wiring would be difficult to carry out.

Dealing with Long Wires

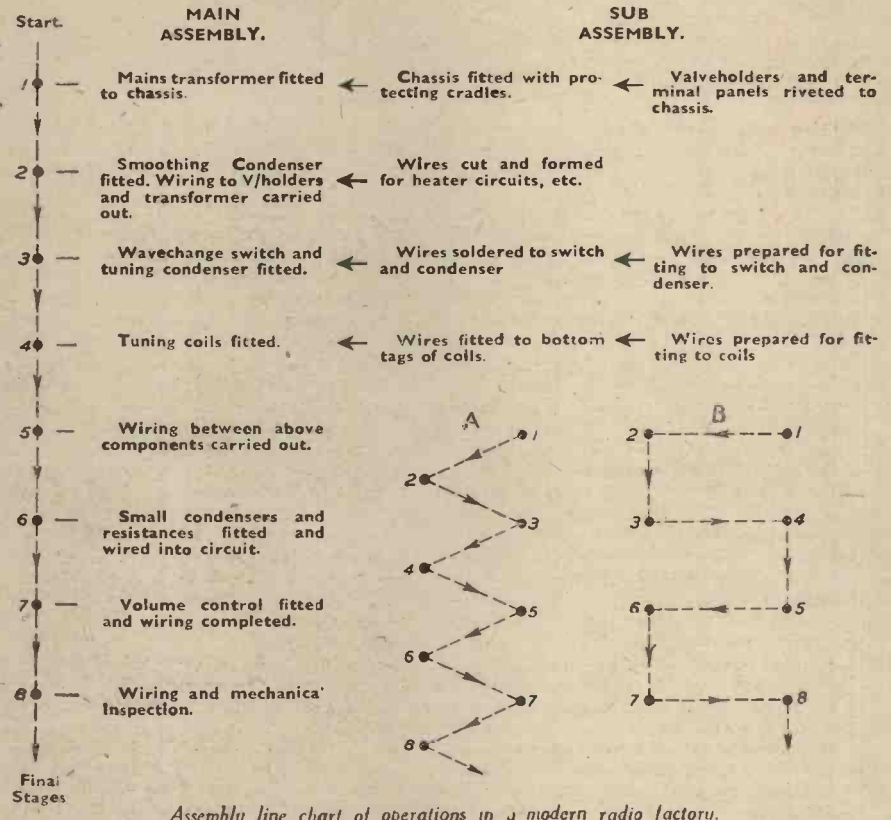
In large receivers several long wires will take the same path when they are finally assembled in the chassis, and the layout engineer will, wherever possible, have these wires made up as a sub-assembly.

After they have been cut to length, properly shaped on a jig comprising a length of wood with wood or steel pegs driven into it, and bound together to make what is called a cable form, they will be supplied to the operator on the assembly line, who merely places the cable form in position and solders the ends of the wires to the various terminal tags, which should automatically be adjacent to them.

In the accompanying photograph supplies of cut and prepared wire may be seen in the cardboard boxes in front of the first girl.

When the whole of the assembly line planning has been completed a small quantity of chassis will be ordered, say about fifty, and on the production of these the girls will be taught and shown what to do. Any difficulties experienced by the operators can be rectified, and a general idea of the job can be obtained by the engineer in charge of the assembly floor.

This early trial production is very important, and in the next article the tests carried out on the chassis, and the information gleaned from this early work, will be discussed.



Assembly line chart of operations in a modern radio factory.

American Radio Artists' First Appearances

MANY of the American radio artists heard over the air from station WLW (Cincinnati) were clever when they were children. Presumably, that's why they're performers to-day. For instance, Arthur Chandler, Jr., veteran organist for WLW, made his entertainment debut at the age of seven, playing the piano in a dramatic skit. The conversation exchanged was notable. Arthur's mother said, "Arthur, will you play that charming piano selection you have been practising?" And Arthur, acting just as if he hadn't expected the request, cavalierly replied, "With the greatest of pleasure, mother!" To-day, Chandler is embarrassed when he remembers those elegant words.

Piano Recital at Five

Anita, the new WLW song stylist, also started her career at the piano, giving a recital at the age of five. John Cornell, announcer, played the triangle in a kindergarten rhythm band at the same age.

Younger still was Jim Day—just turned three, when he discovered he could walk, which was also the age he found he liked to jig-dance in front of an audience.

Billie deVore, of the sweet-singing trio on "Moon River," made her blushing debut in the first grade—in a school dance, dressed as a rose and dancing to the strains of "To a Wild Rose." Paul Arnold, baritone, was no chicken, comparatively speaking, when he brought his talents to the public. He got going in high school when he wrote, directed and took part in a modern version of "Don Quixote." Shortly afterwards he gave a unique delivery of Marc Anthony's address—with laryngitis.

Burt Farber, orchestra leader and nimble-fingered pianist, was coy. Not until graduating from high school did he emerge from the obscurity of small-boydom by playing a piano solo. He has been doing the same thing since, but better and better. Roy Fields also entered the entertainment ranks with a piano solo, albeit nowadays he plays the accordion.

A Singer at Four

At the age of four Drummer Tom Richley, of the WLW orchestral staff, sang—not for his supper, but for his first drum. It was a Christmas prize, and Richley must have liked it, for he made his career amid the tympani. Jimmy James, the WLW maestro, danced in a neighbourhood show at the age of four. This performance had no discernible influence on his later rise in the world.

Charlie Wayne, M.C. of the "Time to Shine" programme, was a cute kid at five. The Elks thought so when he appeared in a minstrel show at that age. Tom Fouts—"Stubby," of the Buccaneers—likewise was five, and likewise sang. It was at a farm gathering, and for his effort he got all the hot dogs and pop he wanted.

Saxophone Player at Twelve

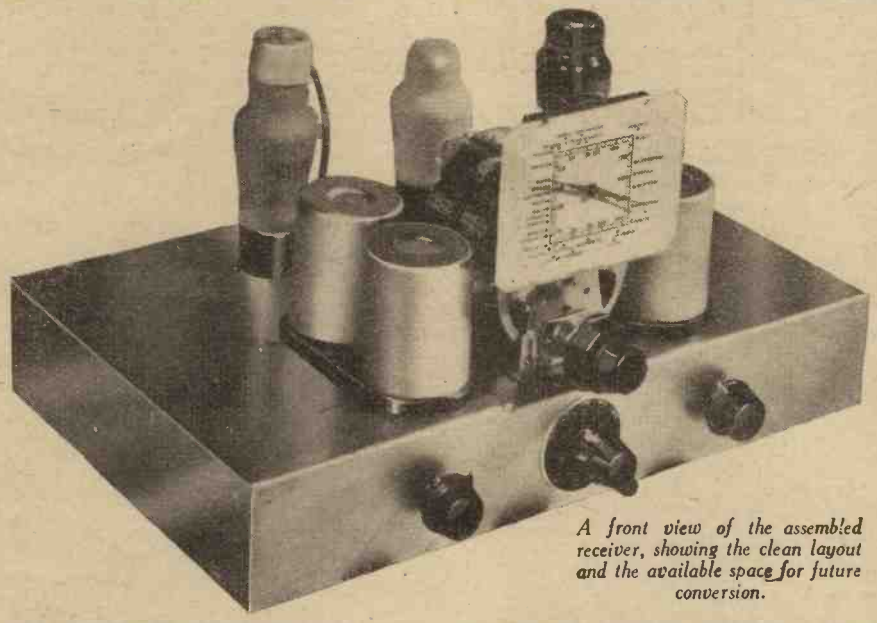
Joe Lugar, the orchestra leader, turned pro. at the outset, though he had to wait until he was 12 to show the public what he could do—which was to play saxophone, to player piano accompaniment, in a demonstration of the latter in a home-town music store. For this he received one dollar.

THE A.C. FOU

The Constructional and W Unavoidably Held Over Fully Explained

THE general circuit details have already been published, and as those interested in this receiver will be anxious to get on with its construction, we will not waste time by elaborating on the theoretical considerations.

The metal chassis, obtainable from Premier Radio, has the following dimensions: 15in. by 9in. by 2½in., and it will be seen when the plan drawings are examined, that there is some space to spare. This is intentional; we mentioned in our November issue that the design lends itself to conversion to a superhet circuit, therefore full use will be made of the space left available. If it is desired to keep the receiver as a three-valver, it would be permissible to reduce the length of the chassis by, say, 3in. and its width by 1in.



A front view of the assembled receiver, showing the clean layout and the available space for future conversion.

The specified coils, one type 52 and one type 56 (Bulgin) are mounted on separate moulded bases of insulating material, the long connecting tags projecting downwards through the bases. To avoid any misunderstanding, each coil unit has two cylindrical screening cans, and this may create the impression, on looking at the layout plan, that four coils are required, which is not the case so far as individual components are concerned. Ten holes, each having a diameter of 5/16in., have to be drilled through the chassis for each coil unit, plus two 6BA clearance holes for fixing. The 5/16in. holes are for the connecting tags, and we have purposely made them on the large size to allow ample clearance. For the sake of safety, we would advise slipping a short length of insulating systoflex over each tag to prevent the possibility of short-circuits. Each piece of systoflex should be approximately ¼in. in length, thus leaving the end of the tag clear for soldering purposes.

For the valveholders, two 1¼in. diameter and one 1in. diameter holes are required. The two larger ones for the H.F. and output pentodes and the smaller for the 5-pin detector valve. On the front runner of the chassis, three holes have to be drilled for the mounting of the volume control on the left, the wave-change switch in the centre and the reaction condenser on the right. A word of warning is essential about the mounting of the latter. The spindle of the specified reaction condenser is common with the moving vanes, and while this is quite useful in many circuits, it so happens in this design that the condenser comes between the anode of the detector and the reaction winding, thus making it *vital* for the spindle (fixing nut, etc.) to be insulated from the chassis which is connected with earth. This is not a difficult matter, as it only calls for the use of two insulating washers (Bulgin or Premier), or, as an alternative, the mounting of the condenser on a small strip of insulating material, ebonite or fibre, and bolting that to the runner after making sure that the hole is sufficiently large to prevent any contact being made between chassis and condenser fixing.

The Switch

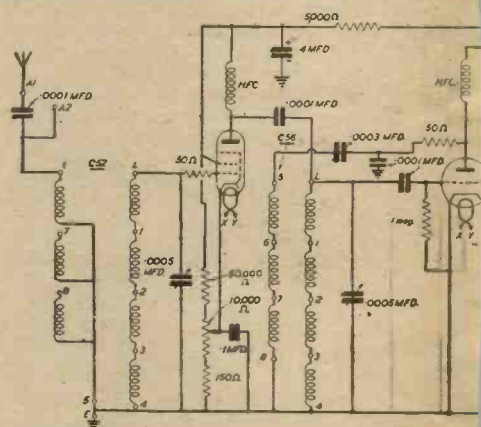
Because of the four wavebands, we have had to use a multi-contact type of switch, and although at first glance its associated wiring might appear to be complicated, we can assure you that such is not the case. The complete switch assembly consists of two separate units, each having twenty contacts and two rotating contacting arms, insulated from each other. The units are nothing more than double-pole switches of the five-way type, but owing to their design they lend themselves to various arrangements according to the system of wiring adopted.

The necessary rotating action is obtained via a ¼in. square bar which gangs the two units together and forms an integral part of the positive locating assembly which is fastened to the front runner of the chassis by the usual single-hole fixing method. It will be noted on examination of this part that it is provided with a small projecting lug to prevent the front unit from rotating during operation. A small hole must be drilled, in line with the fixing hole, to take the lug. The rear switch unit is provided with a bracket which bolts to the underside of the chassis, thus making the complete assembly thoroughly rigid. The small drawing inset on the layout plan should make all connections quite clear, and it is only necessary for us to remind constructors of the great need to make *good soldered* connections to the tags indicated. For ordering purposes, the type numbers of the various sections which go to make the complete switch are: One S.154, one S.153 and one S.150. All being Bulgin products.

Condensers

The J.B. (Jackson Bros.) two-gang variable condenser is mounted in the centre of the front of the chassis. It is set back sufficiently from the front edge to allow the mounting of the slow-motion drive specified. To bring the condenser to the height required by the S/M drive, it is necessary to raise it off the chassis by suitable distance pieces, these being made from metal or ebonite tubing or the insulating parts taken from spade connectors. Bolts must, of course, be used to anchor down the condenser at its three fixing points. It is advisable to spend a little time locating the drive and the variable condenser, otherwise one or both of the components will be subjected to strain due to malalignment.

The Dubilier block condenser, type number 307, which consists of four



Theoretical circuit diagram of the A.C. Four-wave omitted to avoid complications when

LIST OF CO

Mains transformer, type W33 (Heayberd).

Rectifier, type H.T.16 (Westinghouse).

Fixed condensers: three .0001 mfd. (4601/S); two .05 mfd. (4602/S); one .1 mfd. (4603/S); three 4 mfd. (307C); two separate 4 mfd. (B.E.355); one 50 mfd. (3004) (Dubilier).

Resistances: One 1 watt 5,000 ohm; three 1 watt 50,000 ohm; one 1 watt 300 ohm; one 1 watt 150 ohm; one ½ watt 1 megohm; one ½ watt 50,000 ohm; one ½ watt 500,000 ohm; one ½ watt 10,000 ohm; two ½ watt 50 ohm; one potentiometer, 10,000 ohm with switch (Erie).

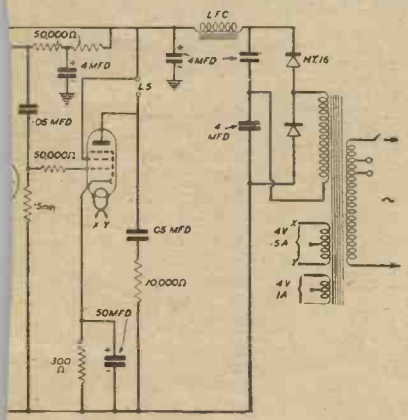
Variable condenser, one bar-type 2-gang .0005 mfd. (J. B.).

R-WAVE THREE

Wiring Details, which were from the Last Issue, are in This Article

electrolytic condensers of 4 mfd. each, is held in position by a simple metal strip, 5in. by ¾in., bent to the shape shown in the plan and bolted to the chassis. While it is necessary for the clamping strip thus formed to hold the condenser securely, care should be taken to see that the metal does not cut into the cardboard container which houses the condenser units.

The black lead is the common negative for the three 4 mfd. sections, and as such, it must make good contact with the chassis, i.e., earth. Owing to the flexible nature of the red leads, it is necessary to see that the connections made with them are insulated after the soldering has been done, so that there is no possibility of them short-circuiting to the chassis, etc. For this reason, it is as well to use stiff tinned copper connecting wire for wiring associated components—thus making the wiring as rigid as possible—and make the connec-



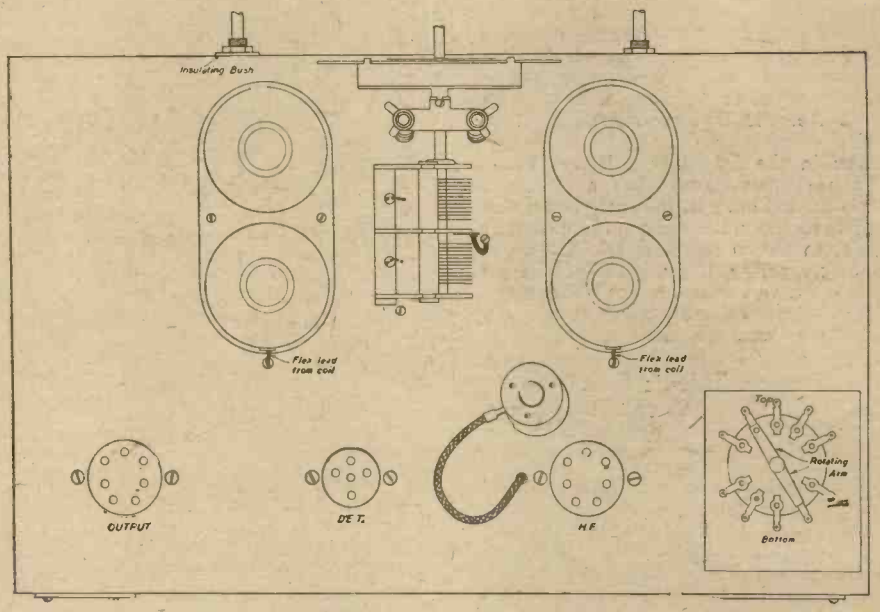
Three. Switching arrangements have been studying the circuit details.

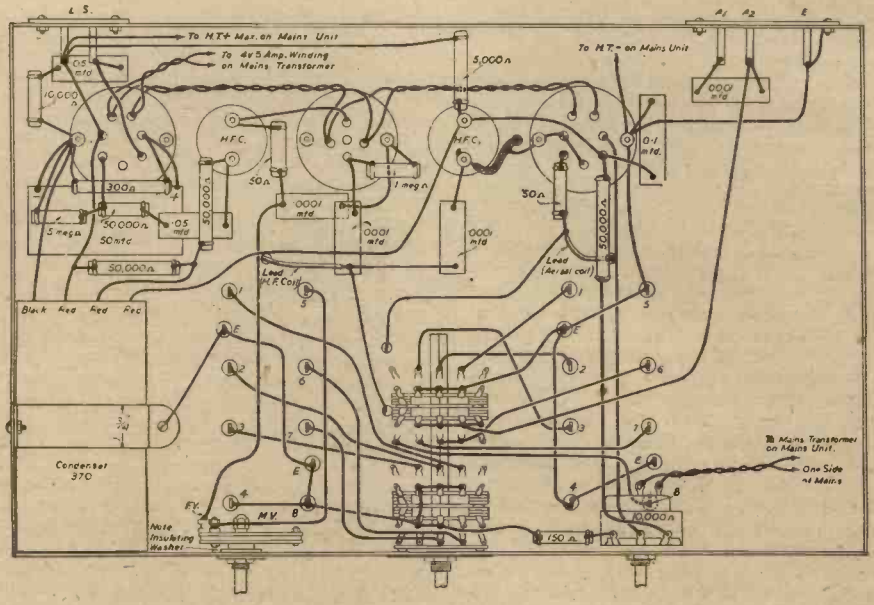
tions close to the condenser, cutting off the flexible leads to the desired length.

While speaking about wiring, there is one little but important point we would like to make clear. We always ask for wiring to be carried out according to the wiring plan given, *but* it is hoped that constructors will appreciate that circumstances do arise when, for the *sake of clearness*, a wire may be shown with one, two or even three bends in it and not taking the most direct path to its connecting point. When wiring the receiver, a constructor with a little experience will take the wire by the most direct route and likewise make a neater and cleaner-looking job. This is quite permissible in the majority of cases, but what we do ask is constructors *not to add length* to connecting wires and not take them by longer and more circuitous paths.

This has already been described in detail (see previous issue), therefore, it now only remains for us to consider the connections between the unit and the receiver. It is desirable that the connecting wires be kept as short as possible consistent with satisfactory location of the unit with respect to the set. An ideal arrangement would be to house the mains equipment underneath or at the side of the chassis. With the former, no holes need be drilled in the rear runner to allow the connecting wires to pass through. They could be taken straight down to the unit. The two wires for the heater circuit should be *heavy gauge* workshop flex, to reduce resistance, but the two for the H.T. supply can be ordinary good-quality lighting flex. One side of the mains will go direct to the mains transformer, whilst the other side will pass through the switch—on the volume control—before terminating at the appropriate tapping on the primary of the mains transformer.

Wiring Diagram of the A.C. Four-wave Three





COMPONENTS

Variable condenser, one Dilecon, .0003 (J. B.).
Tuning dial, Square Airplane (J. B.).
L.F. choke, type 60/400 (Premier).
H.F. choke, two, type H.F.15 (Bulgin).
Coils, one type 52, one type 56 (Bulgin).
Switch, type (Bulgin).
Valve-holders, one 5-pin, two 7-pin (Clix).
Socket strips one A1, A2, and E, one L.S. (Clix).
Chassis, metal (Premier).
Valves, V.M.P.4.G.; M.H.4; M.K.T.4. (Osram).

ROUND THE WORLD OF WIRELESS

H.M.V. Factory Concerts

IT is interesting to note that, following its practice during 1914-18, the Gramophone Company, of Hayes, Middlesex, is arranging a series of lunch-hour concerts in the canteen for its factory staff.

Swiss S.W. Transmissions

THE broadcasting authorities in Switzerland recently announced that its new short-wave broadcasting station at Schwarzenburg, which has been operating experimentally, is now heard regularly from noon to 1.30 p.m., and from 10.0 to 10.30 p.m. (B.S.T.).

B.B.C. Adapted

ROYAL AIR FORCE pilots have discovered several ways of adapting the B.B.C. announcers' preamble—"Here is the one o'clock news, and this is So-and-so reading it to you." One heavy bomber squadron which has amusing emblems drawn by the Padre on most of its aircraft, displays one showing a wireless announcer with the caption: "Here is a bomb, and this is No. 842 Squadron handing it to you."

Even in the Intelligence Room, where crews are interrogated after a raid, the joke is carried on. In the early hours of a morning recently, the captain of an aircraft back from Berlin marched brightly up to the interrogating officer's table followed by his crew, and announced in an imposing voice: "Here is the 3 a.m. line, and this is Flying Officer Jones shooting it."

Tax on "Magic Eyes"

THE British Radio Valve Manufacturers' Association has approached H.M. Customs with a view to securing an official ruling regarding the position of the "magic eye" cathode-ray tuning indicators in relation to the purchase tax. The ruling has now been given by H.M. Customs to the effect that such "magic eye" indicators are to be regarded as valves for the purposes of taxation.

University Course in Television

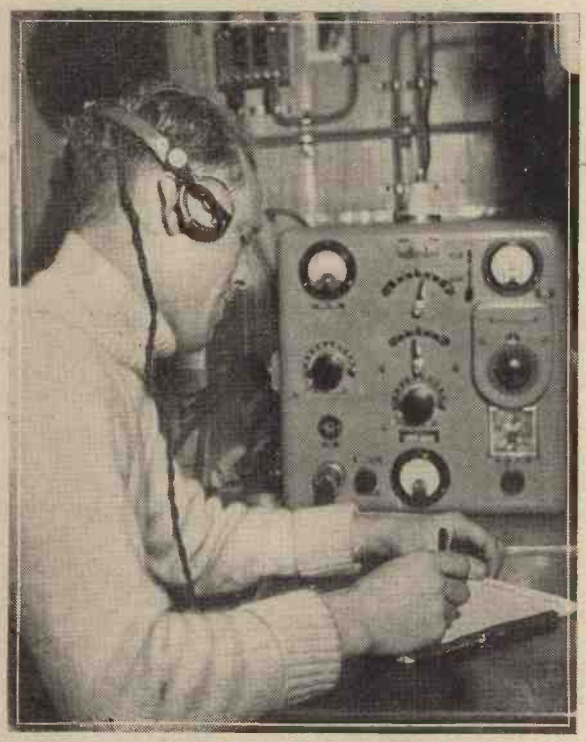
ACCORDING to news from America, New York University is to launch a television programme course during the winter months, under the direction of Thomas H. Hutchinson, manager of the N.B.C. television programme department. The lectures will be offered in the school's famous Radio Workshop which offers a full course to students desiring to make good in radio. Television is already a classroom subject at other American universities and colleges.

Australian Licences Soaring

AUSTRALIAN wireless licences for the month of July, 1940, reached remarkably high figures, particularly compared with July of the previous year. New licences issued throughout the Commonwealth last July totalled 29,992, as compared with 15,601 in July, 1939. The new monthly total of sets in use in the Commonwealth reaches 1,257,125, and the population ratio is now 17.63 licences per 100 of the population, as compared with 16.36 in July, 1939.

India Imports More Sets

REPORTS from India provide evidence of the growing interest in broadcasting in that country. According to the Indian Customs returns, for four months ended July, 1940, the yield from the imports of wireless apparatus and instruments registered an increase of nearly 29 per cent. as compared with the figure for the same period during the previous year.



The telegraphist in one of the Navy's fast motor torpedo-boats works in a wireless room no larger than a cupboard. Details of his set are secret. In these quarters at night, orders and warnings are flashed out and received to guide the little ship on her dangerous business.

Training Girls for Service Work

SPEAKING at the annual general meeting of the Scottish Radio Retailers' Association, held at Glasgow recently, the president, A. Redpath, referred to the difficulties now being faced by the trade owing to the shortage of skilled men, and suggested that dealers should consider the possibility of training girls to undertake service work. It was also suggested that the education authorities should be approached with a view to starting classes for girls.

New Television Station for Manhattan

THE Federal Communications Commission of America has granted a construction permit to the Bamberger Broadcasting Service for a new television station in New York City to use a frequency of 96,000-102,000 kilocycles with a power of 1 kW.

Radio in Shelters

WE understand that the installation of wireless receiving sets in public air-raid shelters is being considered by the Government.

Miss Ellen Wilkinson, Parliamentary Secretary to the Ministry of Home Security, who has been touring London shelters for several nights, is of the opinion that portable sets are not suitable for big shelters, as only the people near them can hear. She is therefore considering the installation of relay sets with loudspeakers.

Baird Television

IN the Companies Court, London, recently, a scheme was sanctioned providing for the merger of Baird Television with Cinema Television, to preserve its goodwill and retain the technical staff until television transmissions are resumed in this country. Subject to the sanction of the Board of Trade, it is proposed to retain the name of Baird.

Radio Industry Wages in U.S.A.

RECENT statistics show that the American broadcasting industry maintained its position during 1939 as the best-paying industry. The average weekly wage of its 19,873 full-time employees, including executives, was $45.96.

Blind Workers in Radio Industry

AN appeal to the radio industry was recently made by Captain Sir Ian Fraser, C.B.E., chairman of St. Dunstan's, to afford his committee the opportunity of visiting their works to study the production methods with a view to obtaining openings for those who had lost their sight, but whose senses of touch and hearing were often much above the average.

Morse Speed Tests

A SERIES of Morse speed tests is being conducted by the American Radio Relay League, to bring the receiving speed of American amateurs to 20 w.p.m. or more. Readers desirous of improving their speeds may be interested to learn that practice speeds are transmitted by the A.R.R.L. headquarters station W1AW every day, except Saturday, at 4.15 a.m., B.S.T., simultaneously on 1,761, 3,825, 7,280, 14,254 and 28,510 kc/s. These transmissions should prove most valuable to the keen amateur, as they provide an opportunity for Dx listening combined with Morse practice under true reception conditions, the only snag in the scheme being the hour at which the broadcast takes place.

The British Long-Distance Listeners' Club

This Month we are Devoting These Columns to Correspondence from Those Members who Have Opinions, and Items of Interest to Discuss

A Word from the Hon. Sec.

BEFORE handing over this page to those members who have been good enough to send in letters and details of general interest, I would like to take this opportunity to express my keen appreciation to all those members who are still able to find sufficient enthusiasm, even during these days of war-time activities, to give active support to the Club and to carry on with their experimental and general radio work. The numerous letters I receive are most encouraging; they are but another striking proof of the determination of all of us to "get on with our jobs" and enjoy, as much as our spare time permits, the hobbies and pastimes so closely associated with our normal lives. Much experimental work can still be done, and all that is done now will help to make for greater and quicker progress in the science of radio when we return to days of peace.

Members' Opinions and Activities

YOU will remember what we said last month about the world-wide membership of the Club. Well, we open these extracts from members' correspondence with a few remarks from Member 6,520, who resides in Swellendam, C.P., S. Africa. "Apart from listening, I have been trying very hard to build a loudspeaker. I have tried to re-assemble a broken-up balanced armature unit, but it was not within my ability. I then tried to fix a cone to an earphone diaphragm. With this I had little success, so I then tried to improve the device by fitting a strong permanent magnet to it, but the additional magnet caused a 'sucking' (attraction) effect, which prevented a free movement of the diaphragm. After this I made another cone and experimented with fitting to it a small 'speech coil' in conjunction with a strongly magnetised piece of iron, but when connected to the radio output, results were not too satisfactory." After mentioning other experiments, No. 6,520 goes on to say: "You might smile at my attempts, but all these failures of mine have shown me that the making of loudspeakers is a very finely developed science. . . . Allow me to congratulate the Editor on the continuation of PRACTICAL WIRELESS's publication. Even though I shall now receive it at longer intervals and at an increased price, this does not, in the least, worry me. I believe I can offer some support to Britain's war effort by buying PRACTICAL WIRELESS, and as long as Britain has a Navy, I shall receive and enjoy my copy regularly." That's the spirit, 6,520, keep at it.

To Member 6,732 we offer a word of thanks and praise for his last two letters. They both contain very fine logs, and what impressed us was the detailed report on each station, covering, for example, time of reception—using the 24-hour system, which so many amateurs still fail to appreciate—strength of signal, state of interference and weather conditions. Good work, 6,732. In his letter he says: "I was very interested in the super one-valver in the November issue of PRACTICAL WIRELESS in the Club columns. I have often wondered, when readers sent in their excellent D.X. logs heard on one-valvers, say, for example, such transmissions as VK's, how they hear them, i.e., how loud and clear are the signals. I note that one one-valver correspondent says that to hear many of the countries logged, he had to pin his ears to the 'phones, and be very patient. Still, it appears that he had done much experimenting to attain such results. . . . The new column entitled 'Items of Interest' is very useful. It makes up to a certain extent, for the absence of 'Leaves from a S.W. Log.' I noticed that in the issue giving details of the S.W. Three-valver (September) you gave a list of the principal stations that the set would receive. Were the two following station details wrong? WPIT, 16.87 metres, and WGEO, 48.47 metres? . . . Would you please insert for me a request for correspondents? I would like to hear from any members interested in S.W. logging and general S.W. work. I would like to exchange letters with such members regularly, and if any reader who has built the W.M.391 A.C. Four-valve Short-waver would write to me regarding the performance of the set, I would be very grateful."

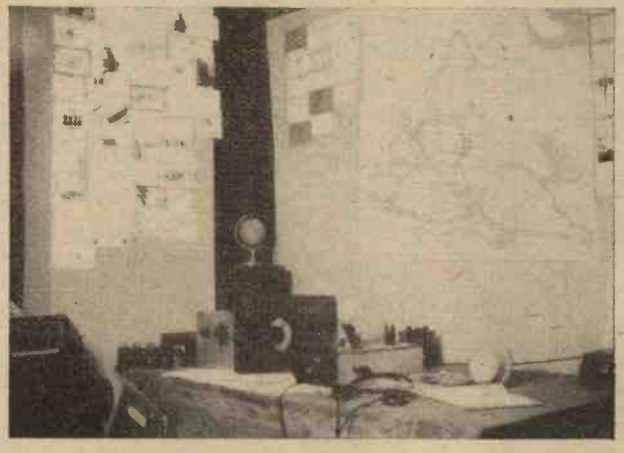
Well, regarding WPIT, No. 6,732, our records show that this station operates on 13.39 metres, 16.87 metres, 19.72 metres, 25.26 metres, and 48.86 metres. WGEO operates on 13.39 metres, 31.48 metres and 48.47 metres, so this time we don't think we are at fault. What did you think was wrong?

A.C. or Battery

MEMBER 5,698, of Sunnyside, Mount Road, Prestwich, Lancs., makes some very useful suggestions when he says: "More space should be devoted to A.C. operated receivers. This is also the opinion of several of my friends. That reports of readers' sets should be given in far greater detail, and not just 1-V-1 or 0-V-0, etc., and that in exceptional cases, a circuit diagram should also be published. More complete details are also very essential when members are describing their aerial arrangements, such as height above sea level, direction, type and points about the general construction. If readers send in logs which include transmissions from the more distant countries, they should give full data concerning time, frequency, weather and condition of moon, etc., as this information would prove invaluable to other readers trying to emulate their performances. Finally, I should like to ask any other members in my district, about my own age (17 years), to get in touch with me at my QRA." What do the rest of you think about A.C. gear? We try to meet all requirements but, as we have mentioned before, we cannot know what you want *unless you write to us. Re* aerial data; we stressed that in the last issue, and as regards circuit details, well, that is up to those who do write to make their letters as descriptive as possible, *without*, of course, sending in several pages of closely written copy.

A Neat Den

WE reproduce on this page a copy of a photograph sent in by one of our London members, No. 6,472, and apart from the fact that it shows a corner of his shack, it also shows that members in this area are still carrying on with the good work, in spite of war-time conditions. We read in the member's letter: "In the centre can be seen the 0-V-2 Rx, the line up of which is Cossor H.F.210, transformer coupled to an L.F.210, which is again transformer coupled to a P215 output valve. On the left of the RX is the one-valve TRF pre-amplifier, which I have found invaluable on frequencies below 10 mc/s. Also visible are the 'phones, log-book, power-pack, QSLs, call-book and 6- and 4-pin plug-in coils, etc.



A corner of the den, situated 75 feet above street level, owned by Member 6,472, who has been securing some fine logs with the use of indoor aerial systems.

"The station here consists entirely of home-built gear and the aerials in use at present are: (1) 66 foot e/o; (2) 45ft. E. to W. e/o; and (3) 16ft. 'V' type beam directed on the U.S.A.

"The DX is 86 countries 'phone/C.W. and 43 States of the U.S.A. The main reason why results have been fairly good at times is probably due to the fact that the QRA is situated at the top of a hill, and the shack is about 75ft. above street level. I am particularly interested in aerial systems, although, at the time of writing, I have been unable to erect an outdoor arrangement. I will close by stating that I am always willing to co-operate with or aid any fellow member or short-wave enthusiast."

Many thanks, No. 6,472, for photo, letter and your offer of co-operation.

PROTECTING YOUR HEADPHONES

Failure to Observe Certain Essential Considerations can Cause Serious Damage to Headphones and Possible Harm to the User

PRESENT conditions are bringing headphones into more general use, and as few modern receivers (those of the communication type excepted) make provision for their use, satisfactory methods for doing so are given below.

The electro-magnetic circuit of headphones consists of one or two coils of very fine insulated wire wound on suitable bobbins, and in view of the restricted size of the bobbins it is necessary to use, for the normal 2,000 and 4,000 ohm types, wire of a very fine gauge. It is the cross-sectional area of a wire which governs the maximum current it can carry. The value of the current is greater for a single free length of wire than for a wire of the same gauge wound in a compact coil, and without free circulating air to keep it at a safe temperature. It is usual to employ wire as fine as 40 S.W.G. for the winding of the bobbins; so the current flowing in the circuit must be kept within the specified maximum. An average maximum current value, for a *good* make of 'phones, is 7 mA's. For this reason alone, although there are others, it is desirable either to prevent any direct current flowing in the windings or make *quite sure* that its value is well within the limits specified by the makers. As the first precautionary method is the better, details are given showing how to apply it to those sets in most general use.

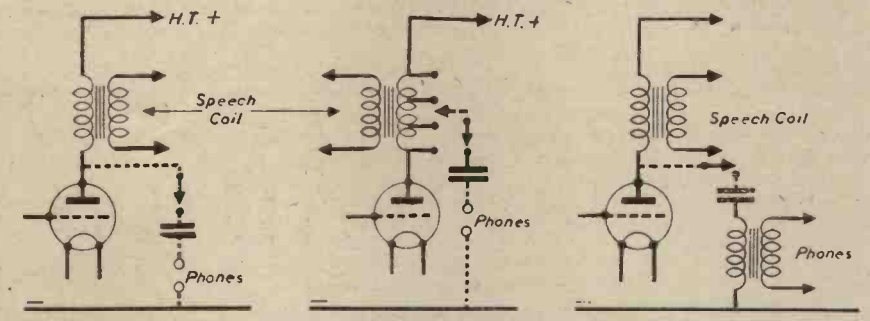


Fig. 1.—Three arrangements which enable headphones to be connected in the output circuit of a receiver. That on extreme right is the best for A.C./D.C. sets.

The Loudspeaker Terminals

Except in certain circumstances, 'phones should not be connected in the output stage of a receiver which is capable of giving loudspeaker volume. While the output can usually be reduced to something approaching headphone strength, provided that the circuit incorporates efficient L.F. and/or H.F. volume controls (preferably the latter), the quality of the reproduction might suffer due to the output valve not operating under the best conditions, or the 'phones being overloaded. One exception to the above statement is when a very weak signal is being received from a distant transmission. If the output is not sufficient to operate the speaker, then it would be reasonable to use 'phones but, on *no account* should they be connected directly in the anode circuit of the output valve.

If it is still desired to use 'phones in the loudspeaker circuit, then the arrangements shown in Fig. 1 should be adopted. That on the left of the diagram indicates how the primary of the output or speaker transformer is used, in conjunction with a 1 mfd. or 2 mfd. condenser, to form a simple choke-filter system. The condenser should have a voltage-rating in excess of the maximum H.T. being applied to the set. It will be seen that it prevents any *direct current* from flowing through the 'phone windings and gives, therefore, protection to both 'phones and user. The second circuit, Fig. 1, indicates how use can be made of the tapping points on an output transformer having a tapped-primary, whilst the third arrangement is, from an electrical point of view, the best as it completely isolates the 'phones from the receiver. For this reason it is to be recommended for mains-operated receivers, *especially* those of the *A.C./D.C.* type; in fact, it is the only safe method for using 'phones with a "universal" class of receiver. All the circuits shown are suitable for mains or battery-operated sets; it is essential, as mentioned before, to see that the receiver has a volume control capable of bringing the volume down to a level satisfactory for headphones.

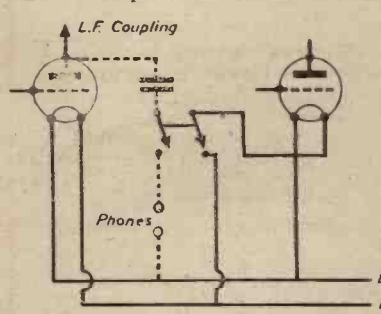


Fig. 3.—With battery sets it is often advisable to save L.T. current. The switching system shown cuts out the unwanted valve.

Intermediate Stages

The most pleasing method of introducing 'phones into the majority of receiver circuits, is to connect them across the output of the detector or one of the intermediate L.F. valves. The volume thus obtained is more in keeping with that required, and the quality of reproduction is likely to be better. With a superhet receiver, one would be concerned with the second-detector or subsequent valves, but as it is now usual to use a double-diode-triode in the detector position, it must be remembered that a stage of L.F. amplification is provided by the triode section of the valve, thus ensuring good 'phone strength. The inclusion of a volume control in the double-diode-triode circuit allows smooth control of the output to be obtained. The majority of the methods shown in the diagrams can be applied.

Fig. 2 shows the connections for 'phones to a detector or L.F. valve which uses an ordinary L.F. transformer in direct and parallel-feed methods of coupling. The quality of response with the first system will depend on the quality of the L.F. transformer. If it is of good make and the primary has a high inductance value, then results will be quite satisfactory. The second arrangement does not depend on the characteristics of the L.F. component, as it is parallel-fed, and really becomes a resistance-capacity coupling, so far as the 'phones are concerned.

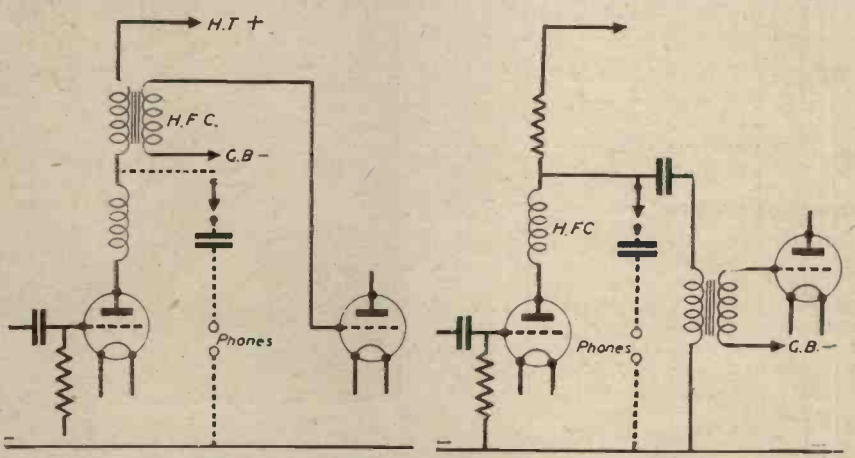


Fig. 2.—Showing how 'phones can be connected to intermediate stages. This procedure is better than connecting them in the output stage.

For the sake of clearness, switches have been shown which allow the headphones to be brought into circuit when desired. These should, for trouble-free operation, be replaced by suitable jacks of the single or double circuit types, according to the method used. Switches or jacks are not absolutely essential, but if it is desired to mute the speaker when 'phones are in use, then they will have to be used in one form or another.

With mains receivers, the question of cutting out unused valves on the score of economy does not come into the question; with battery-operated sets, however, 'phones are so often used for the dual purposes of saving accumulator and H.T. current, and individual listening, that it is usually advisable to use switches or jacks having a spare contact to break the L.T. supply to the valve or valves not being used, as shown in Fig. 3. If, as is often the case with an A.C. receiver, one wants the speaker out of action while the 'phones are in circuit, the two diagrams in Fig. 4 show alternative methods. The one on the left, by using a single-pole change-over switch or jack, allows the signal to go to the output—or previous L.F. valve—or to the 'phones, whilst the circuit on the right shows how the 'phones are tapped across the grid circuit, and the speaker muted by connecting the switching system in the *secondary* of the speaker transformer. With the first method, it is very important to remember to leave the grid of the valve *connected*, as shown in the diagram (Fig. 4), to the common-negative line in the case of mains valves, or the source of grid-bias with battery types, by means of the usual grid-leak. Failure to observe this will result in harm to the valve, and in the case of mains valves, on no account must one attempt to silence the loudspeaker by breaking the anode circuit of the output valve.

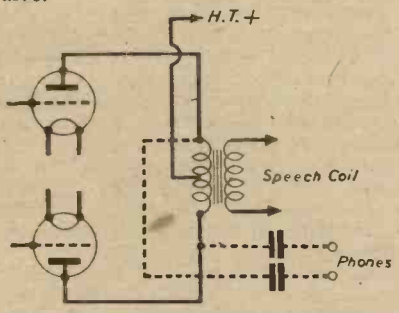


Fig. 5.—A simple method suitable for use with Class A, Class B, or Q.P.P. push-pull circuits.

Push-pull Circuits

Where push-pull circuits are in use, and these cover ordinary Class A, Q.P.P. or Class B, and it is required to connect headphones or an extension speaker, quite reasonable results can be obtained by using the system shown in Fig. 5. The condensers should be of reliable make and, as stressed in the choke-filter arrangement, their operating voltage rating must be in excess of that applied to the anodes. The capacity of each should be the same, but the actual value used is not critical; in fact, it can vary between .05 mfd. and 1 mfd., and some interesting results so far as frequency response is concerned can be obtained by experimenting with various capacities.

A.C./D.C. Circuits

A final word of warning concerning these circuits. Always remember that one side of the circuit is common with one side of the mains, and rather than take any risks, use the choke-filter-transformer system shown in Fig. 1.

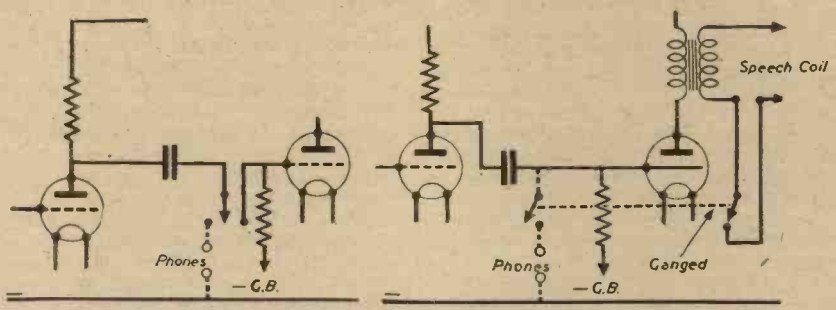


Fig. 4.—The loudspeaker becomes dead when the 'phones are brought into circuit when these forms of switching are used. The grid-leak must be returned to G.B.— or earth.

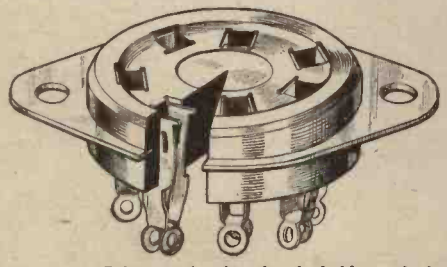
NOTES FROM THE TRADE

New All-dry Battery Portables

THE introduction of low-voltage battery-operated valves has made it possible for set designers to produce receivers which are no longer dependent on a two-volt accumulator for their filament current supply. The true significance of this progressive step in valve development is more important than it would appear at first sight. It creates new considerations for the accumulator and battery manufacturers; it has already been responsible for the production of several interesting battery-operated receivers, and it might well be the forerunner of revolutionary changes in the design and operation of receivers for those listeners who are unable to make use of electricity supplies.

One of the most obvious advantages, and one which we feel sure will be welcomed by the majority, secured by the use of the new valves, is the elimination of the accumulator in portable receivers. While admitting that this accessory has, and still does, receive more than its fair share of abuse, it cannot be denied that it is, to say the least of it, very annoying when, on switching on the portable to receive some particular transmission, one finds the L.T. supply defunct. The use of an all-dry battery supply does not, of course, eliminate this possibility entirely, but it does seem that one gets a little longer warning when the battery is approaching the end of its useful life, thus allowing a replacement to be obtained. Circuit details are worked out so that the L.T. section is capable of giving the same period of service as the H.T., so that when a new battery is purchased both sources of supply are renewed, and the question of having to replace the H.T. at some intermediate date does not crop up.

The Cossor All-dry battery Portable A.D.41 combines pleasing lines with high efficiency.



The new Celestion-Amphenol valveholder, which possesses many distinctive features.

One of the latest examples of an All-dry battery Portable, utilising to the full the advantages of the new valves, is the Cossor Model A.D.41, which is illustrated on this page, and reviewed below.

Model A.D.41. 4-Valve All-dry Portable Superhet

General Specification

SELF-CONTAINED aerial with provision for external aerial and earth. Permeability-tuned iron-cored I.F. transformers. Combined on-off and wave-change switch. Slow-motion tuning control. Manual volume control and A.V.C. Automatic grid-bias. High sensitivity P.M. Moving coil speaker. Dial calibrated in metres and station names. Size: 9¼in. high x 13¼in. wide x 6¾in. deep. Finish: Handsome black leatherette-covered cabinet fitted with carrying handle.

Price, complete with combined full-size all-dry 90 volt H.T. and L.T. battery—£8 5s. 0d.

The circuit follows the most satisfactory arrangement for a compact portable, the valve sequence being: Variable Mu pentagrid frequency changer (1A7VG), I.F. amplifier using an H.F. pentode having variable Mu characteristics (1N5VG), diode-triode as second detector, L.F. amplifier and A.V.C. (1H5G), and a pentode output using a 1C5G. The wavebands covered are medium waves 190-560 metres, and long waves 830-2,000 metres.

On actual performance, one is inclined to overlook the fact that a self-contained acrial is being used, excepting for directional properties, as the overall sensitivity is most satisfactory. Selectivity is good, tuning a pleasure, whilst the sensitive permanent-magnet moving coil speaker is fully capable of handling the generous output with a remarkable degree of fidelity.

General Remarks

THE A.D.41 represents a sound investment on the score of entertainment, news and views for everyday use, and owing to its compactness, and the fact that it is completely self-contained and independent of external sources of current supply, it is an equally valuable asset in times of emergency.

Amphenol Valveholders

A NEW method of valveholder construction is used in the design and production of the Celestion-Amphenol valveholders, claimed to be the strongest in the world. The part-sectional view of a standard 7-pin holder, shown on this page, gives a very good idea of how the exclusive Celestion-Amphenol method of moulded-in-plate construction ensures maximum strength, rigidity and a high degree of efficiency. The sturdy contact plates are so designed that they are actually keyed into the moulding, thus making it impossible for them to rattle loose. The plates are pressed from specially-treated phosphor-bronze and are shaped to ensure uniform contact on all prongs. Such vital factors become increasingly important, when one considers the modern multi-pin types of valve, especially those having octal-base fitting. In addition to the engineering side of these new products, considerable attention has been given to their electrical characteristics, and exceptional insulation is assured by the special properties of the moulding powder used for their construction.

The holders are available for all standard valve bases, British and American, and are intended for chassis mounting, the holding or fixing plate being so located that it can be secured to the underside of the chassis, thus allowing the neatly moulded top of the holder to come practically flush with the upper side. When mounted in this manner they add a neat and well-finished appearance to the chassis assembly.

Correcting Waveform

TO deflect the stream of electrons in a cathode-ray tube a time-base generator is employed which produces a rise and fall of voltage and current simulating in its characteristic a saw tooth formation. Unfortunately, all the simple circuits used for this purpose are non-linear in relation to time, except for very small values of time, and to obtain adequate deflection under these conditions the voltage used has to be of a high order. This may be dangerous or not commercially practicable for some installations, and breakdowns in the windings or condensers may occur unless due precautions are taken. Many expedients have been tried in order to achieve the required degree of linearity of deflection, and in some cases this has necessitated complicated circuits or expensive time-base generators. As an alternative to this, however, it has been found possible to use waveform correcting networks to eliminate the exponential curvature of the deflecting voltage. Accurate mathematical calculations are necessary to derive the values of resistances and condensers employed for this purpose, and another factor which must be taken into consideration is the phasing of the harmonics. This can be catered for by the use of a specially wound transformer which is adjustable in just the same way as other components of the correcting network. These networks also provide a possible solution to the provision of special forms of deflecting voltage characteristics, whether the cathode-ray tube is to be employed for oscillographic or television picture reconstitution.

Hugh Ferguson has now joined the board of A. C. Cossor, Ltd.

Sir Louis Sterling has accepted election as Vice-President of the British Institution of Radio Engineers.

The death has occurred of **Sydney E. Smith**, Chairman of Varley, following a short illness.

We regret to record the death, at the age of 58, of **Capt. R. L. Nicholson, D.S.O., R.N.**, which occurred on November 1st. Capt. Nicholson was appointed Fleet Wireless Telegraph Officer of the Grand Fleet, on the staff of Admiral Jellicoe, in September, 1914, and in 1917 he became Director of the Signals Division of the Naval Staff at the Admiralty.

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).

A Reader's Den

SIR,—I have never looked forward to PRACTICAL WIRELESS so eagerly before in all the years that I have had the pleasure of reading it. I enclose two photographs of my shack; it is the first attempt that I have ever made at inside photography, thanks to 2DTX, of Sheffield, for writing to tell me what to do. My Tx is in the safe hands of the G.P.O. (I hope), and my Rxs are a FAW2 and a S.W. converter, fed into a three-valve BC Rx. Since the war started I have increased my morse from 5 w.p.m. to 15 w.p.m.

In closing, if this letter is read by G5LP, I would like him to get into touch with me, as our correspondence was broken off so abruptly. Finally, I hope PRACTICAL WIRELESS will continue until such time that peace prevails once more.—J. Moss (Mytholmroyd, Yorks).

From a Reader in the Navy

SIR,—I have been a regular reader of your very fine paper for more than a year now, and have enjoyed every page. In that time of reading, I have witnessed many changes in the paper, but the change which I have enjoyed most among all was when the weekly issue was converted into a monthly. It gives us a better chance to digest its rich contents. It is a marvel to me how you can carry on under the conditions you have to work in, and I admire the pluck of many of the London readers, whom I have met with in the Service. I am in the Royal Navy as an ordnance artificer, but I still get PRACTICAL WIRELESS sent from my home in Scotland, and I certainly look forward to it.—R. BURNS (Hayling Island).

Heard on 20 Metres

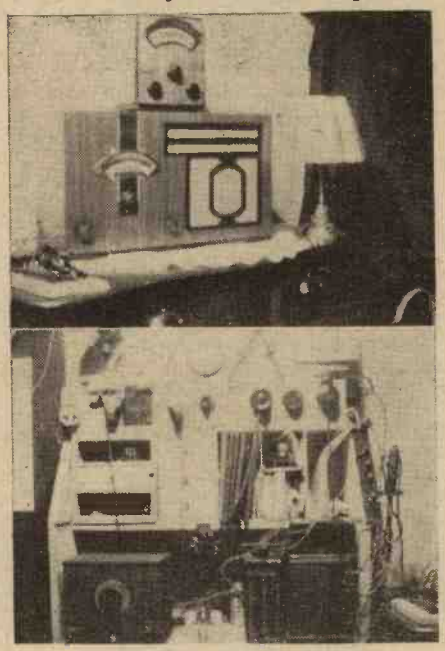
SIR,—I append a report of my log for the last two months. The stations received were as follow: W1, 25; W2, 46; W3, 20; W4, 22; W5, 5; W6, 4; W8, 18; W9, 23; K4, 3; HC4USA, K6NYB. PY1FN, VUD3, and TAP. All the W and HC4, K6, PY, K4 stations were heard on 20 m. I must thank you for carrying on the good work as a monthly, and hope you will continue to do so till the war is won, and then will be looking forward to having a weekly paper again. I would like to correspond with any reader living in Scotland or Wales with a view to comparing reception on amateur bands.—G. J. SMITH (Stanmore).

Portable Set for Air-raid Shelter

SIR,—The accompanying sketch might interest other readers who may be considering building a small set for the air-raid shelter. I have used this idea for some months now, and find it very useful.

The circuit is very much the same as the one given for your recent "Gas Mask Box Receiver"; the construction is very simple, being a two-valver. A single 'phone is connected direct to the plate, and fits into a circular hole cut into the plywood panel so that it lies flush with the condenser knobs, the panel being recessed about 1½in. below the hinged lid. The throw-out aerial is coiled up and rests on a piece of plywood 1½in. below the second hinged lid.

There is room in the battery compartment for six grid-bias batteries as H.T., or a 60-volt H.T. will do equally well. Two No. 800 cycle batteries coupled together are used for L.T. with a resistance to drop the volts down to two.



Two views of J. Moss's radio den.

With a 20-foot wire around the picture rail I have logged 23 stations at night. Seven or eight can be obtained in the daytime with the aerial thrown over a couple of chairs.

The set is the same size as the regulation gas-mask box, and the suitcase, which measures 15in. x 10½in. x 4½in. can be bought for 2s. 6d.—D. K. O'S. (Bournemouth).

On the 10-metre Band

SIR,—Recently, on a Sunday, it was a particularly good night for the 10-metre band. It was wet and boisterous.

About 30 stations were in evidence, some very loud and clear.

At 7 p.m. B.S.T. W1IYE, YoungEdward, was calling CQ10.

At 7.15 p.m. B.S.T., a lady, W2NSI, New York City, was also asking for CQ10. These two stations were the star performers, both coming through loud and clear on the loudspeaker, R7, and steady. Many were perfectly understandable in addition. The 13 and 16-metre bands were practically non-existent at the time. The set is an all-wave with plug-in coils, and an eliminator. The loudspeaker is a very early moving coil, about 1928, and the L.F. transformer is 12 years old. Some of the valves are seven years old, the detector being three years old. The aerial is an ordinary Post Office 100-feet type. The set does not howl and oscillates perfectly down to 9.5 metres. I often wonder how it would work with new valves.—W. H. LAWLEY (Penzance).

An Appreciation from Iceland

SIR,—Many thanks for the "Radio Training Manual" which undoubtedly will be very useful, and will pass many interesting hours away for me.

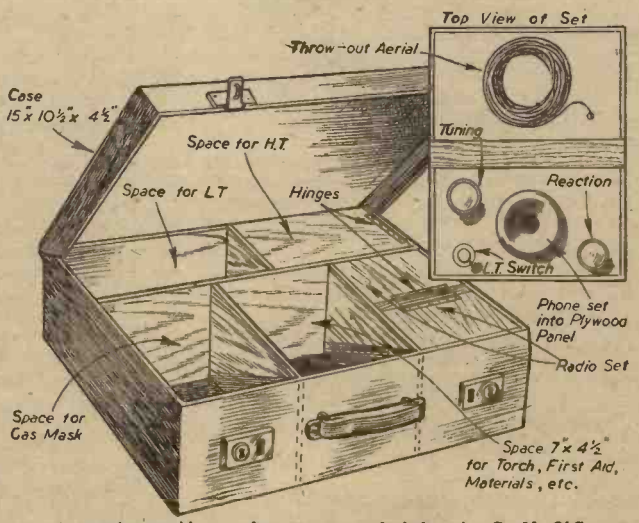
I still receive the monthly issue of PRACTICAL WIRELESS, out here in Iceland, as I did in France, and it gives me much pleasure to see it in the post bag. I shall endeavour to obtain more of your books, and I hope in the near future to send you a further order.

Thanking you again, and hoping that PRACTICAL WIRELESS will continue publication for the duration of the war.—W. L. FOSTER (Iceland).

On Active Service

SIR,—I am the reader who had his arm amputated after an army lorry crash. The officers kept their word and I am still in the Army on home service.

After my arm had healed up I went on sick leave. I came back and was stationed at ——— on an army W/T station. I afterwards got my stripe and went on a course. I returned here as a superviser in the signal office. I afterwards returned to the W/T section, where I am at the present time. I have still one or two of my old pals here. Les Dymond (G3HW) is still here and is also a lance-corporal. Bert Tupaman (G3ID) has been away some time. He is a cadet and should get his commission very soon. Bill Watson (G6JL) is still in the section, but is in another city. . . . We have another ham with us here, Dave Patton of Coventry; he is a sergeant. I think his call was G3YO. If any other readers want to join the Signals as wireless operators, get going on the S.W.'s and speed up the Morse. The keys get red hot here at times. I really believe after this little scrap is over there won't be so much R/T on the bands and not so much rotten keying.—J. E. BOWDEN (B.L.D.L.C. 6186, late 2AYQ), Salisbury.



A novel portable set for an air-raid shelter by D. K. O'S. (Bournemouth).

A Service Engineer's Log

A Further Selection of Simple Faults and Remedies Encountered in the Course of a Service Man's Routine Work

THE other week I was asked to carry out some tests on a mains superhet which was fairly new, and which had behaved extremely well until the beginning of autumn. Since then the owner had been troubled to a marked extent by intermittent crackling noises. The noises were sometimes so loud that they completely drowned reception, while at other times they were merely a "mushy" background. One thing which annoyed the owner of this set was that he had had it "serviced" recently by another firm, the set having been returned as in good condition.

I went along to see the receiver early one evening, taking the usual simple test gear which I carry with me on such occasions. It appeared that I was lucky, for the crackling was even worse than it had been before. The usual tests for continuity and checks of wiring did not reveal any fault. The noise was rather less pronounced when the aerial lead was removed, but still continued. After coming to the conclusion that there must be a fault in the mains leads, I replaced these, and made sure that the plug made good contact with the socket. But the trouble continued. A suggestion that the set should be taken away for test on another mains point did not meet with approval in view of the earlier experience, so I suggested that we might try switching off the various lights and other electric points in the house, one at a time. Fortunately, it did not then take long to find the cause of the trouble. As soon as the light in the room where the set was installed was switched off the noise ceased. After switching off the mains at the master switch, the room switch and lamp-holder were examined in turn; the switch was in order, but the lamp-holder was quite warm, and it was soon seen that the bulb had been making poor contact. This was due mainly to the fact that one of the springs behind a contact plunger had weakened due to over-heating—the over-heating no doubt resulting from previous imperfect contact. However, replacement of the holder set matters right, and also taught the set owner the foolishness of using cheap, unbranded holders.

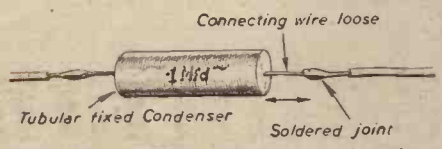


Fig. 1.—Intermittent crackling was traced to a loose wire connection on an S.G. by-pass condenser. The wire had been loosened by applying too much heat when making the soldered point.

Condenser Connections

The above brings to mind another case of crackling, where it was practically certain that the trouble originated in the set itself. Ordinary simple tests of wiring and components did not bring the exact cause of the fault to light, but a simple "mechanical" test soon revealed that a wire connector from the tubular condenser used as a by-pass from the S.G. of the H.F. pentode to earth was loose and could be moved a full ⅛in. toward and away from the end of the condenser. It had, no doubt, been loosened in the first place by the application of excessive heat to the lead when soldering a length of wiring to it. When doing this, it is important to use a hot iron and to keep it in contact with the solder and lead only just long enough to allow the solder to "run" neatly and make the joint (Fig. 1).

Choke Connections

A constructor was very disappointed to find that a three-valve H.F.-Det.-Pen. receiver which he had just made was very unsatisfactory. Reception was weak even on the "Home Service" transmission, whilst tuning seemed to be excessively sharp—probably due partly to the very low volume level. Since the receiver had just been built, however, it was considered best to check over the connections before carrying out any "instrument" tests. A start was made at the H.F. end, and the fault was soon discovered. It was due to the H.F. choke in the anode circuit of the H.F. pentode (tuned-grid coupling was used) being connected as shown in Fig. 2. It will be seen that the pigtail was correctly joined to the anode of the first valve, and one terminal to H.T.+; but the lead to the detector grid condenser was also taken from the same terminal instead of to the other one, marked X in Fig. 2.

With chokes of this type, the pigtail and one terminal are together joined to one end of the winding, the second terminal going to the other end. This is shown diagrammatically as an inset in Fig. 2.

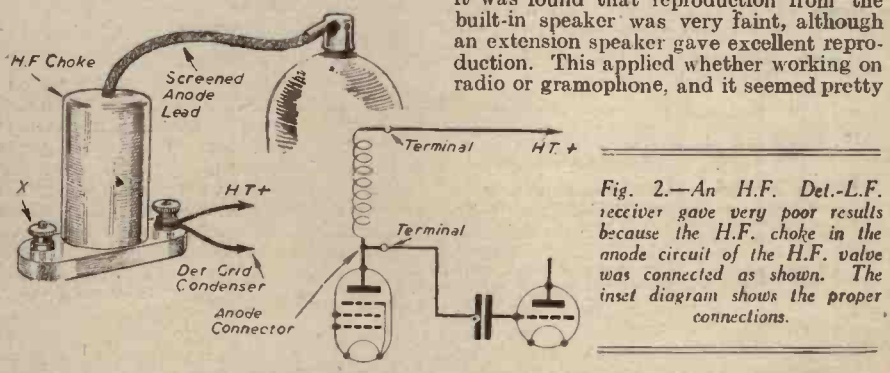


Fig. 2.—An H.F. Det.-L.F. receiver gave very poor results because the H.F. choke in the anode circuit of the H.F. valve was connected as shown. The inset diagram shows the proper connections.

Poor Reception with Battery Set

A fault which is not very unusual was recently found in a simple battery set of the "straight" type. Reception had become very faint—after having been normal—reaction control was practically impossible, and there was a feeling of "deadness" about the control of the set as a whole. The owner attributed the fault to a defective detector valve, which could easily have been responsible, but replacement of this did not have any effect. I was just going to take some voltage readings for H.T. and L.T. at the valve-holders, after finding that both batteries were well "up," when I had an idea to try a simpler preliminary test. The on-off switch terminals were short-circuited with a short length of wire. When that was done signal strength returned to normal and the receiver generally came to life. A bad contact had evidently developed within the switch, of the Q.M.B. type, and this had caused so much drop in L.T. voltage to the valves that they were being seriously underrun. A new switch was fitted, since it is seldom possible to repair a switch of this type. It should be mentioned in passing that the set had been out of use for some time, and had evidently been stored in a damp place; the dampness was probably responsible for the switch trouble.

No Reaction

A rather comparable case was recently encountered, although this time reproduction was not unduly weak and there was no suggestion of distortion, as in the example described above. The main trouble was that movement of the reaction control had scarcely any effect. Readers may remember that in these notes a short time ago I mentioned a similar fault, where it was found that the cause was a bad contact within the reaction H.F. choke or in the detector anode coupling component. This time the correct H.T. voltage of about 50 was reaching the valve.

After making a few other tests it was decided to try the effect of disconnecting the fixed condenser between the detector anode and earth; when that was done reaction behaved as it should. Obviously, the condenser was not open-circuited or disconnecting would not have any effect; equally obviously, it was not short-circuited or there would have been a short-circuit of the H.T. supply—and of the valve! When the condenser was tested on a capacity bridge later it was found to have a capacity of .003 mfd., instead of .0003 mfd., which was stamped on it. The excessively-high capacity had the effect of virtually short-circuiting the reaction circuit.

A Speaker Fault

In the case of a high-class mains receiver which had suddenly started to give trouble it was found that reproduction from the built-in speaker was very faint, although an extension speaker gave excellent reproduction. This applied whether working on radio or gramophone, and it seemed pretty clear that the built-in speaker was defective. The question was to find exactly what was wrong with it, and to put it right. It was unlikely that the cone was incorrectly centred or that there was some dirt between the moving coil and the pole piece because distortion was not noticeable, and there were no "scratching" sounds.

Careful examination showed that there was a "dry" soldered joint between the speech coil and the speaker transformer. This was at the point where the leads from the coil were brought out to two soldering "pips" on the cone. After re-soldering the speaker was as good as new. It will be appreciated that a few ohms of additional resistance in the speech-coil circuit can have a pronounced effect, since the total resistance of that circuit is seldom

more than five or six ohms, although it does vary with different speakers.

"Motor-boating" with Old A.C. Receiver

Pronounced motor-boating was noticeable with an old "straight" three-valve receiver of A.C. type. Normally, it occurred only when reaction was pressed above a certain setting of the reaction condenser. If the mains switch was turned off and then on again after the motor-boating had started, the trouble would cease until reaction was again altered. The fault was put down mainly to "senile decay" and poor original design, but the owner was anxious to overcome it in an inexpensive manner, and therefore without altering the design of the set. Additional detector-anode-circuit decoupling had little effect, and new valves did not set matters right. After a certain amount of experiment, however, it was found that if the S.G. valve was screened and a 250-ohm fixed resistor connected between the detector anode and the reaction winding the trouble was cured. It is not suggested that this was the correct method of stopping the objectionable noise, but it has often been found to work and was therefore considered to be good enough in the circumstances. The fault is sometimes due to the need for a new detector valve, and is often traced to the use of a poor earth connection, whilst extra decoupling is sometimes helpful although it should not be necessary. The extra decoupling may consist of connecting a resistor between 5,000 and 10,000 ohms in series with the original decoupling resistor and connecting a 1-mfd. fixed condenser between the junction of the two resistors and earth.

LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes price 2s. each.

NEW PATENTS

These particulars of New Patents of interest to readers have been selected from the Official Journal of Patents and are published by permission of the Controller of H.M. Stationery Office. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription, £2 10s.).

Latest Patent Applications

15457.—Lyons, W.—Control of wireless sets. October 19th.

Specifications Published

527292.—Rudkin, E. P.—Wireless receiving system.

527626.—Maguire, I. L.—Radio-amplifiers and the like.

527526.—Dierks, C. H.—Tuning devices for radio apparatus.

527967.—Poole, R. B.—Television apparatus.

527912.—Browne, C. O.—Systems for televising or producing a photographic record of a scene.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

An Automatic All-clear Detector

A Novel Device which Automatically Superimposes the Sound of the "All-clear" Siren on the Broadcast Programme

THIS device will prove invaluable to those who wish to use their radios during air-raids in dug-outs or shelters, but who dare not work them at their normal volume for fear that the sound of the all-clear siren will be swamped by the broadcast programme being received.

With the device described the sound of the siren is automatically superimposed on the programme by an electronic mixing system. This system, originally designed for P.A. work, uses a double-triode valve in place of one of the triode L.F. valves of the set. This valve gives perfect mixing with independent gain control and full amplification of two input channels, in this case the broadcast programme, and the sound of the siren picked up by a microphone.

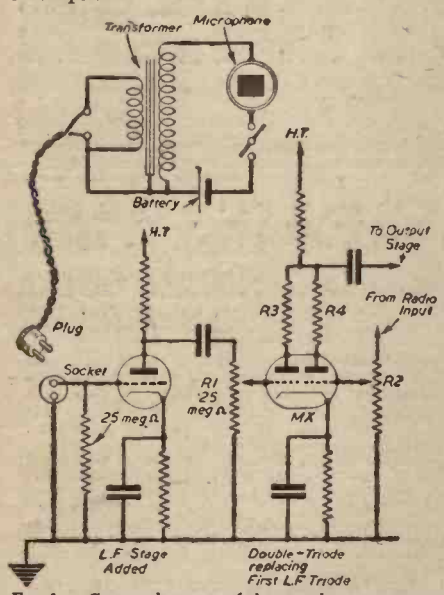


Fig. 1.—Circuit diagram of the complete apparatus. R3 and R4 are each twice the A.C. resistance of a single triode.

Circuit Arrangements

The circuit diagram is shown in Fig. 1. The microphone, energised by a small battery, is coupled by a microphone transformer to a triode L.F. stage. The output from this stage is fed through a volume control R1 to one grid of the double-triode mixer MX. The input of the broadcast programme, controlled by R2, is mixed with it and the combined output passes to the output stage of the set. The microphone is switched on and off by making or breaking its L.T. energising current.

Double-triode Mixing

The double-triode consists of two electrically separate triodes within one envelope. Double-triodes on the market are all American types, 6C8G, 6F8G and 6N7G having octal bases, and 6E6 and 6A6 American 7-pin bases.

The principle of working is the same for all.

The cathodes of the two triodes are tied externally, and input channels are fed into the separate grids through their own gain controls. The mixing takes place in the common anode circuit, and the mixed output is taken from the anode resistance and fed into the next stage.

Varying one input control cannot interfere with the volume or quality of the other channel, as occurs with mixing methods using only potentiometers. The two inputs are entirely independent.

The anodes of the two triodes must not be tied directly together externally. A load impedance on each triode of about twice its A.C. resistance is used. The characteristics supplied by the makers will give the details required.

If automatic bias for a double-triode is obtained by a resistance shunted by a large-capacity condenser in the cathode-earth lead, remember that the anode current passed is twice that for one triode, so that the biasing resistor has half the value of that for one triode alone. The makers usually give values for each triode.

Details of Construction

The microphone used need not be an expensive one. A carbon telephone instrument obtainable from any one of the radio stores advertising in this journal costs only a few shillings, and serves excellently. It is mounted on tough rubber bands or small tubing and is protected from the weather by a well-made wooden box. This is shown in Fig. 2. The measurements given may be modified slightly if necessary. The interior of the box is loosely packed with cotton wool except, of course, for the space immediately in front of the microphone.

From the front of the box protrudes a metal tube 2ins. diameter and 10ins. long. This is easily cut from tinplate, bent into a cylinder and riveted or soldered along the edges. The end of the cylinder is screwed to the inside of the box by small flanges. The object of this tube is to render the microphone more directional, so that it does not pick up unwanted noise. Here again the diameter is not critical, but it should not be less than 1¼ins. The tube should be painted to protect it from rusting.

The microphone housing is mounted as near to the shelter as practicable in an elevated position, not blocked by near obstacles. The directional tube must point accurately in the direction of the nearest siren. The aerial pole or the side of the house will do to support the housing, provided that the tube is not "blocked" by nearby obstructions.

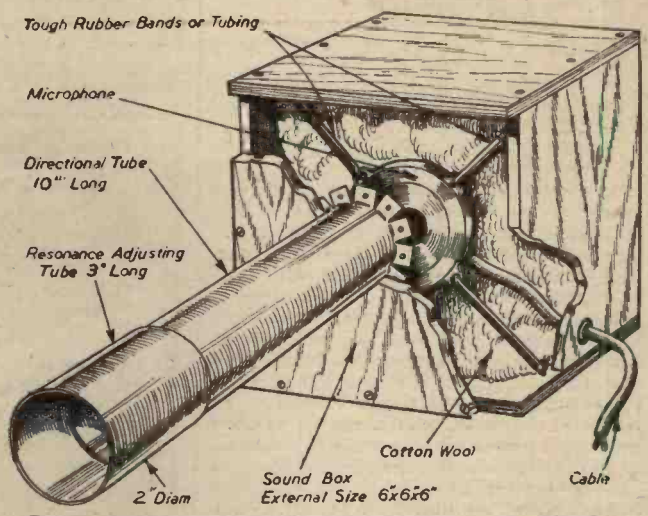


Fig. 2.—Part sectional view showing construction of sound box and directional resonator tube.

Wiring

The wiring from the microphone to the transformer must be made as short as possible. Tough flex will do, but it must be weatherproof. Screened wire will be needed if the wiring goes near any other electrical wires or apparatus. Microphone transformer, battery and the switch controlling the energising current are all mounted together near the set, so that the microphone current is easily controlled. L.T. and H.T. for the preamplifying L.F. stage are drawn from the main set.

It is suggested that this L.F. stage is built into the main set and a plug provided for its input. A pick-up can then be used with the set in place of the microphone. The mixing system works just as well with pick-ups as with microphones.

Resonance Improvement

We may improve the effectiveness of the device by using the directional tube on the microphone housing as a resonator to the frequency of the siren sounding the "All Clear." This is done as follows. First find what note the siren sounds, by means of a piano or other instrument.

Suppose the note is the D a ninth above middle C, that is, D an octave above the D immediately above middle C. This corresponds to a frequency of 576 cycles per second.

If our tube is of such a length that the natural frequency of oscillation of the air column it contains is 576 cycles, resonance will occur, the air in the tube will itself vibrate and the volume of sound picked up by the microphone will be greatly increased. Only sounds of 576 cycles or multiples of 576 cycles will have this effect.

The connection between the length of tube L, and the frequency n, is given by

(Continued on next page)

Valve.	Base.	Filament.		Anode.		Anode Resistance.	Load Resistance.	Grid Bias.
		Volts.	Amps.	Volts.	mA.			
6A6	7	6.3	.8	300	7.0	11,000	20,000	6
6N7G	Octal	6.3	.8	300	7.0	11,000	20,000	6
6C8G	Octal	6.3	.3	250	3.1	26,000	50,000	3
6F8G	Octal	6.3	.6	250	9.0	7,700	15,000	8
6E6	7	6.3	.6	200	11.5	4,300	10,000	20

Table of typical operating figures for double-triode type valves. Filament is common, otherwise values given are for each separate triode.

AN AUTOMATIC ALL-CLEAR DETECTOR

(Continued from previous page)

$$L = \frac{1100}{2n} \text{ (feet)}$$

Thus the length of tube required for resonance at 576 cycles is

$$\frac{1100}{2 \times 576} = .955\text{ft. or } 11\tfrac{1}{2}\text{in.}$$

The adjustment of the length of the tube is best made by having another 3in. of tube of slightly larger diameter to slide on the outside of the directional tube. A rough fit is sufficient, but excessive looseness must be avoided. When the position of resonance is reached a sudden increase of volume will be noticed. The sliding outer tube must then be firmly fastened with insulation tape.

The adjustment is made with the aid of the same instrument used to find the note of the siren.

Noise of Gunfire

The noise of gunfire and bombs is mainly of low frequency and is not picked up by more than a very small amount by any of the cheap microphones used by the author. The rubber suspension of the microphone and the cotton wool packing also help to make this amount even less.

If a better microphone is used it may be necessary to fit a low-frequency filter.

As long as gunfire can be heard in the shelter in spite of the radio the microphone is switched off to economise in energising current, since the "All Clear" is hardly likely to go then.

The microphone is switched on as soon as the gunfire ceases to be audible in the shelter, and the radio programme can then be enjoyed until the sound of the siren is automatically superimposed upon it.

Prize Problems

PROBLEM No. 415

THOMPSON had at last completed his de-luxe version of an A.C. operated receiver. During the initial tests, he was not quite satisfied with the background level, a very slight trace of hum still being present. He checked everything, and no apparent reason could be found, but to be on the safe side he decided to fit the quite common arrangement of two fixed condensers in series across the primary of the transformer feeding the rectifier, the junction of the two components being taken to the chassis. All was then well, and results were most satisfactory. Later on, however, he moved into a flat where he could not use an external aerial. Tests with short indoor types gave him all he required but, owing to appearance, he finally decided to try a "mains" aerial, so proceeded to connect the aerial terminal of the set, via a mica fixed condenser, to one side of the mains. The system was quite standard, but he could not get a trace of a signal. Thompson still wishes to know why! Can you tell him? Three books will be awarded for the first three correct solutions opened. Entries must 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. 415 in the top left-hand corner, and must be posted to reach this office not later than the first post Monday, December 16th, 1940.

Solution to Problem No. 414

Whitworth had made a mistake which is by no means uncommon. Although he paid every attention to the assembly of the receiver and, as he thought, the wiring, he made the simple but very detrimental mistake of not connecting the negative L.T. to the common negative earth line, thus breaking the anode current return circuit, i.e., anode through H.T. battery to filament.

No correct solution was received for Problem No. 413.

Practical Wireless

BLUEPRINT SERVICE

These Blueprints are drawn full size.
Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices *which are additional to the cost of the Blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Practical Wireless (issues dated prior to June 1st, 1940). 4d. Post Paid
" " (issues dated June 1st to July 27th, 1940. 5d. Post Paid
(Issues dated September, 1940 and after) 7d. Post Paid
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/4 " "

The index letters which precede the Blueprint Number indicate the periodical in which the description appears : Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS CRYSTAL SETS

	Date of Issue.	No. of Blueprint.
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)	27.8.38	PW93
Two-valve : Blueprint, 1s.		
The Signet Two (D & LF)	24.9.38	PW76
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	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)	21.3.36	PW62
The Centaur Three (SG, D, P)	—	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The " Colt " All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The " Rapide " Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 " Triband " All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's " Sprite " Three (HF Pen, D, Tet)	26.3.38	PW87
The " Hurricane " All-Wave Three (SG, D (Pen), Pen)	30.4.38	PW89
F. J. Camm's " Push-Button " Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
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)	26.9.36	PW67
" Acme " All-Wave 4 (HF, Pen, D (Pen), LF, Cl. B)	12.2.38	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)	5.6.37	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	16.1.37	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	23.12.39	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)	1.10.38	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	23.7.38	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
Lucerne Minor (D, Pen)	—	AW426
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
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
" W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	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, R.C, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen).	—	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340

Mains Operated.

Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home Lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
Mantovani A.C. Three (HF, Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM329
Harris' Jubilee Radiogram (HF, Pen D, LF, P)	*May* '35	WM386

SUPERHET.

Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four	*Oct.* '35	WM395
The Request All-Waver	*June* '36	WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. each.		
Heptode Super Three A.C.	*May* '34	WM359
" W.M." Radiogram Super A.C.	—	WM366

PORTABLES.

Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367

SHORT-WAVE SETS. Battery Operated

One-valve : Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
Roma Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SG, det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF, Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397

Mains Operated.

Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
" W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM391

MISCELLANEOUS.

S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	*Mar.* '36	WM403
New Style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

ITEMS OF INTEREST

Broadcasts to North America

NIGHT after night, while gunfire barks in the London streets and the London sky is full of the beams of searchlights and the drone of enemy aeroplanes, broadcasting goes on for six consecutive hours to North America. Listeners on the other side of the Atlantic hear the voice of Britain from the bombarded heart of the British Empire. Programmes of every type are now sent by the B.B.C. to the North American continent. "Britain Speaks" is a nightly feature given by such broadcasters as J. B. Priestley, Air-Marshal Sir Philip Joubert, Leslie Howard, the Hon. David Bowes-Lyon, and Philip Noel-Baker, as well as, from time to time, members of the British Cabinet. Nightly also comes the cream of vaudeville in the "Starlight" programmes, and later "To-night We Present . . ." does just what it says, bringing to the microphone music and personalities of stage, screen and radio. There are request programmes, a series on "The Music of Britain," as well as the series called, "Within the Fortress," and newsreels both in English and French.

While Britain is broadcasting to North America, the United States are also broadcasting to Great Britain. A new series of short-wave radio transmissions under the title "Friendship Bridge" has recently been inaugurated. Coming from Boston, U.S.A., the programmes may be heard nightly from Monday to Friday at 9 p.m., G.M.T., on the short-wave frequencies of 25.4 metres and 19.6 metres. Station WRUL, the source of these broadcasts, means to carry across its "Friendship Bridge" the admiration and comradeship of the United States as well as messages of encouragement and comfort to the British people from those of America.

The broadcasts are being presented in co-operation with the American-British Ambulance Corps, and the World-Wide Broadcasting Foundation.

Radio and Gramophone Industry and Export Trade

FROM the outbreak of war the radio and gramophone industry turned with marked success to munitions production, at the same time making a valuable contribution to the war effort with an intensive campaign to develop export trade. Some familiar overseas markets have naturally been lost, but others, from which Germany, Italy and enemy-occupied countries are cut off, are being opened up. British radio sets, gramophones and records are going in great quantities to Mediterranean, and even Central European countries. For other markets throughout Africa, India, the Far East, South America, British Dominions and Colonies, where results are proving most satisfactory, many radio receivers are specially designed to suit local climatic and other conditions. This export trade is fostered by the Radio Manufacturers' War Export Group, and the accompanying illustration shows great activity in progress at one factory in the Industry's group. Here the machines start with small parts and finish with complete wireless sets for export. Note the overhead trolley with completed sets *en route* to the packing department.

One of the shops where the machines start with small parts and finish up complete wireless sets for export. Each section is responsible for a particular section. Note the overhead trolley with completed wireless sets en route *to the packing department.*

Replies to Queries

S.W. Reaction

"I have a two-valve short-waver which, until recently, worked very well. Now, however, on switching on and turning the reaction condenser right in, the oscillation gets lower and lower until it finally disappears and I seem to get no reaction at all. I have tried different valves and, on test, the batteries show full voltage. Can you explain the trouble?"—G. F. (Woodhall Spa).

AS you did not enclose a theoretical diagram of the circuit we assume that you are using a conventional two-valve arrangement, having a triode detector and ordinary capacity controlled reaction. From your remarks, we are inclined to think that you are obtaining reaction, but the set itself might be a shade unstable or else you are pushing the reaction feed-back to such an extent as to produce oscillations above audible frequency. This would account for the effects produced and for the apparent absence of the more usual whistle. We would suggest that you try a small capacity, say, .0001 mfd., fixed condenser as a by-pass between detector anode and earth and, at the same time, make quite sure that no trace of instability, H.F. or L.F., is present when the reaction control is at its minimum setting.

Reducing Bass Response

"Having just completed an ordinary 'straight' type of A.C. operated receiver, I find that the bass response is a little too heavy. I do not think it is due to any error in the matching of the output valve and loudspeaker, as the makers of the latter supplied the correct transformer for the valve I am using. Could I fit a simple tone corrector to enable me to eliminate some of the bass?"—S. B. T. (Woking).

IT is a pity you did not enclose a theoretical diagram of the receiver, to enable us to see what L.F. couplings you are employing and what values you have selected for the associated components. If you are using resistance-capacity couplings, some of the trouble might be due to high capacity of the fixed condenser or, in the detector stage, to the use of an anode by-pass condenser of a high value. It would be advisable to carry out experiments round these items, but, if you wish to fit a tone corrector, for the reduction of the bass, then the following arrangement is quite simple and reasonably efficient. Connect a variable resistance — a potentiometer will do—across a good fixed condenser having a value of, say, .25mfd. The resistance should be in the neighbourhood of 20,000 ohms-25,000 ohms. The combination should then be connected in *series* with the L.F. coupling going to one of the L.F. valves. The purpose of the resistance is to by-pass the condenser, i.e., with the resistance at its minimum value, the signal will flow through it and not the condenser. When set at maximum, the reverse will be the effect, the current will pass through the condenser, and by so doing the lower frequencies will be choked back or cut-out, owing to the fact that the reactance of a condenser is higher at low frequencies. In other words, the condenser will offer greater resistance to the low notes. By virtue of the variable resistance, it will be appreciated that the total effect of the arrangement can be varied to suit individual requirements.

Conductance or Slope?

"I am trying to secure a better understanding of valve characteristics, but when reading various valve-makers' specifications I come across the terms 'Mutual Conductance' and 'Slope.' So far as I can trace, they appear to be used in the same sense, but I am not too sure, and as the matter has caused a little argument between a fellow enthusiast and myself, I would welcome a ruling on the problem."—H. O. (Teddington).

BOTH terms are used to denote the same characteristic of a valve. Mutual conductance or slope is usually expressed in terms of ma/V which, written in full, means milliamps-per-volt. The expression tells one what change in anode current will be produced—with the anode voltage kept constant—when the *grid voltage* is varied by *one volt*. For example, a valve might have a mutual conductance of 4.3 ma/V. This would indicate that the anode current will vary by 4.3 milliamps when a grid-voltage change of one volt takes place. The term is used to create a mental picture of one of the main characteristic curves of a valve, i.e., the grid-volt anode current curve, and thus enables one to select the correct type of valve for some particular purpose.

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 queriists.

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 must be enclosed with every query.

Harmonics. First or Second?

"Would you be good enough to settle a debate on the question of whether it is correct to refer to the first multiple of a fundamental as its first or second harmonic? Two friends and myself differ on the matter, so we shall be pleased to receive your verdict."—M. T. (New Malden).

WELL, we don't know which of the three of you has expressed the opinion that the first multiple of the fundamental is the *second* harmonic, but we do know that he is correct. Any harmonic of a fundamental note or frequency is a multiple of the fundamental, therefore one never uses the term first harmonic to denote what they actually have in mind, namely, the second harmonic. If you consider the matter in the following manner, we do not think any future confusion will arise. Supposing we do say the first harmonic of 40 metres (frequency of 7.5 mc/s), which we will take as being the fundamental; well, that means nothing more than 7.5 mc/s x 1, which is still 7.5 mc/s or 40 metres, the original fundamental. The second harmonic, however, will be 7.5 mc/s x 2, which equals 15 mc/s or 20 metres; therefore, it is obviously incorrect to refer to the first harmonic when one really means the second.

A Short-wave Design

"I have been trying to design a short-wave four-valve receiver for battery operation, but after making several attempts, helped by articles and diagrams from 'Practical Wireless,' I still find myself unable to make up my mind about certain components and circuit arrangements. Would you, therefore, please help me by suggesting a design which has appeared in past issues and which has received good reports from those who have made it? I do not want a superhet, as I think I ought to get more general S.W. experience before handling anything too complicated."—P. T. (Glastonbury).

WE have given your requirements our careful consideration and, bearing in mind your remarks about superhets, we think you could not do better than construct the "Kestral" S.W. Four, which is fully described in our issues of August 12th and 19th, 1939. This receiver was so designed that it could be constructed as an 0-V-2 or as a 1-V-2. A simple switching arrangement was incorporated to allow the H.F. stage to be used as a tuned or untuned circuit. The numerous reports we received proved, beyond doubt, that the claims of high efficiency made by the designer were the result of practical proof. No blueprint has been issued, but the diagrams given in the articles are so clear that no trouble should be experienced.

Code Query

"I have recently started to take an interest in S.W. work, and already I have found it so interesting that I am sorry I did not take it up before. Being an absolute novice, so far as this section of wireless is concerned, I have not yet become familiar with the code expressions or abbreviations used by S.W. enthusiasts. Could you tell me the meaning of the following and where I could obtain a complete list?"—A. P. (Wembley).

THE writer (A. P.) gives the following for explanation. QRA, 73's, QRN, QSO, QSL, OM, Op. These abbreviations are internationally used by both commercial and amateur stations, but it is impossible for us to give the complete list here. The above mean: "What is the name (address) of your station?" "The name (address) of my station is. . . ." "Kind regards." "Are you troubled by atmospherics?" "I am troubled by atmospherics." "Can you communicate with . . . direct or through . . .?" "I can communicate with . . . direct or through. . . ." "Can you acknowledge receipt of my signals?" "I acknowledge receipt." "Old man." "Operator." It should be noted that most of the code abbreviations are used in the form of a question or answer, the correct interpretation being determined by the general message or conversation. The full list is given in "Wireless Transmission for Amateurs" and "Newnes Short-wave Manual," to mention but two of our publications.

The coupon on page 136 must be attached to every query

Building an A.C./D.C. Test Set

ANY reader who possesses a good moving-coil milliammeter will be interested in descriptive pamphlet No. 11 B, issued by Westinghouse Brake and Signal Co., Ltd. This pamphlet (which costs 3d. and may be obtained from the Publicity Department, Westinghouse Brake and Signal Co., Ltd., Pew Hill House, Chippenham, Wilts) not only deals with the construction of an A.C./D.C. test set, but goes very fully into all the technical details of A.C. measurements, including temperature, frequency and waveform errors, etc. A special chapter is also devoted to the use and construction of current and potential transformers, and the calculation of voltmeter resistances is fully dealt with.

Briefly, the addition of a suitable Westinghouse metal rectifier converts a moving-coil milliammeter into an A.C. milliammeter reading 11 per cent. higher full scale deflection due to the fact that the meter now reads the R.M.S. value, which is greater than the mean value of the current and bears a constant ratio to it of 1.11. A 1mA D.C. milliammeter will, therefore, read 1.11 mA R.M.S. A.C., a 5 mA D.C. instrument 5.55 mA R.M.S. A.C., and so on.

By adding suitable resistances, the A.C. milliammeter is easily converted into an A.C. voltmeter, and the meter scale may be calibrated to read A.C. volts, watts and decibels.

If it is required to read higher voltages of alternating current, a current transformer will be necessary, a simple shunt not being suitable as when reading D.C. current, because it accentuates the defects of bad scale shape and temperature errors.

Potential Transformers

When it is desired to make the instrument read lower than about 10 volts A.C., it is advisable to use a potential transformer to step up the voltage to a higher value. Otherwise, the forward resistance of the rectifier will become an appreciable fraction of the whole resistance of the meter and will cause the scale shape to be distorted. The design and construction of suitable current and potential transformers is dealt with in the pamphlet.

The addition of a rectifier allows a D.C. milliammeter to retain all its advantages of high sensitivity, good damping, etc., and enables a simple robust meter, capable of measuring alternating voltages in mains receivers as well as L.F. voltages in amplifiers, and at the output stage of receivers, with an accuracy of the order of about two per cent. The scale shape is linear, and is therefore easily read.

The rectifier arrangement is an addition to, and in no way interferes with, any D.C. resistances or shunts associated with the meter, so that, by suitable switching, or the use of separate terminals, it is quite an easy matter to make a multi-purpose set capable of all measurements likely to be met with in servicing receivers.

Letters for Prisoners of War Interned Abroad

THE Postmaster-General has issued the following information for the guidance of relatives when writing to prisoners of war in German or Italian hands.

(1) Letters should be clearly written or typed to facilitate censorship and should not exceed two sides of a sheet of notepaper.

(2) Letters should be posted in posting boxes in the ordinary way and should be addressed directly to the prisoner. They should not be sent to the British Red Cross Society, or any other organisation to be forwarded, as this course serves no purpose and causes delay and unnecessary work. In particular letters should not be sent under cover to the German Foreign Office or the German Red Cross.

(3) No postage is payable for conveyance by surface transport; but letters prepaid at the European air mail rate of 5d. for the first ounce and 3d. for each additional ounce, and bearing a blue air mail label in the top left-hand corner, will be forwarded by air to Lisbon and thence by surface transport.

(4) The top left-hand corner of the envelope should bear the words "Prisoners of War Post," with the equivalent word "Kriegsgefangenenpost" if the letter is addressed to Germany or the words "Service des prisonniers de Guerre" if addressed to Italy.

(5) The prisoner's service number and rank should be given but no mention should be made of the unit, battalion or regiment in which he was serving at the time of his capture. It is important that the camp address should be correctly quoted; for example, in the case of a letter to Germany it is not enough to direct it to "Stalag" which is the term used for any permanent camp for N.C.O.s and privates—the number of the Stalag must be given in addition.

(6) The name and address of the sender should be written on the back of the envelope, but if the sender is a member of H.M. Forces the address of a relative or friend who would forward any reply should be given instead.

Further particulars of the letter service, together with information as regards parcels, are given in a Post Office leaflet, numbered P.2280E, copies of which are available at head post offices.

NEW RADIO BUOY

THE United States Coast and Geodetic Survey have developed a combination sound-and-radio buoy which will enable ships at sea to accurately locate their distance from the point marked by the buoy.

The buoy will respond to signals transmitted from a distance of 100 miles. It has a sound pick-up device, a radio amplifier and a radio transmitter. Most of the mechanism is contained in a sealed 50-gallon steel drum. Suspended from the drum is a sound pick-up, which sends a small current to an amplifier filtered to accentuate low-pitch sounds. When the sound signal is received, the radio transmitter sends out a sharp signal.

In operation a ship explodes a small TNT bomb. The current that explodes the bomb makes a mark on a rapidly moving tape. The sound of the explosion is picked up by the distant buoy, which instantly sends out its signal. This is received by the ship and causes a second mark to be made on the moving tape. The distance between the two marks permits the distance between the ship and the buoy to be calculated.

Classified Advertisements

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All candidates must have good general education, be able to read drawings, understand specifications, use micrometers and other measuring instruments.

(a) Applicants for the General Engineering Branch must have had practical experience in an engineering works. An elementary knowledge of materials testing is desirable.

(b) Applicants for the Instrument Branch must have knowledge of physics and training in light engineering or instrument making. Candidates with knowledge of optical instruments are also required.

(c) Applicants for the Radio-Electrical Branch should have good knowledge and experience of Radio or Electrical Engineering.

Normal age limits at entry 23 to 60.

PAY AND CONDITIONS.

Accepted candidates will be given a period of special training in inspection not exceeding three calendar months. The training courses comprise lectures and demonstrations by specialist instructors followed by practical works instruction.

During training candidates will be paid £3/10/0 weekly, plus Civil Service War Bonus (present rate of bonus 5s. weekly) and in addition subsistence allowance of £1/5/0 weekly is payable to married men whose normal residence is not in the training area.

On successful completion of training candidates will be appointed as Examiners at a fixed salary of £270 per annum, with a reduction of £12 per annum for each year of age under 24 on joining (payable monthly in arrear).

In addition payment for overtime is made when 46½ hours (net) or more have been worked in any one week, payment being made for all hours worked in excess of 40½ hours net.

Examiners are eligible for promotion to higher grades.

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Applications must be made on Form 786, copies of which can be obtained on application, **by postcard only,** to: Ministry of Labour and National Service, Box No. 171, Head Post Office, Small Street, Bristol.

Candidates should indicate on their application forms the vacancy (a) (b) or (c) for which they wish to be considered.

CABINETS

A CABINET for every radio purpose. Surplus cabinets (undrilled) from noted makers. We have hundreds in stock (no catalogues). Send measurements of chassis, etc., and say what kind of cabinet required. Stamp for reply. Inspection invited.
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LITERATURE

AMATEUR Radio Handbook—Second Edition, now on sale, 328 pages, price 4s. 2d.—Radio Society of Great Britain, 16, Ashridge Gardens, London, N.13.

LOUDSPEAKER REPAIRS

LOUDSPEAKER repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

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PRACTICAL WIRELESS, January, 1941.

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Model N/A2½, Radio Home Charger. To charge 2 volts ½ amp, 12/6. N/A6½, Trickle Charger. To charge 6 volts ½ amp, 17/6. N/B6/1, Car Charger. To charge 6 volts 1 amp, 24/- N/B6/1½, 6 volts 1½ amps, 27/6. N/C6/2, 6 volts 2 amps, 37/-. N/D12/1, H.M. Car Charger. To charge 12 volts 1 amp, 38/-. N/D12/2 N.K., 12 volts 2 amps, 55/-. N/E2, Doubler. Meter Car Charger. To charge 6 volts and 12 volts, 2 amps, 65/-.

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3,000 Speakers, P.M. and energised 4in. to 14in. including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

RADIO CHASSIS

ARMSTRONG CO. regret owing to the great difficulty in obtaining materials and skilled labour they have reluctantly been compelled to cancel many orders for various Armstrong chassis. A small number of the latest EXP48 chassis as advertised in the November issue of PRACTICAL WIRELESS are still available. Particulars gladly sent on request.—Armstrong Co., Warlters Road, Holloway, London, N.7.

RADIO MAP AND GLOBE

WEBB'S Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6, post 6d. Limited supply on Linen, 10/6, post 6d. WEBB'S Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post Paid. 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

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SHORT-WAVE Sets, Components, Valves, etc., for sale, cheap. Send stamped envelope for particulars, stating requirements.—G. Isherwood, 3, Brook Road, Black Bull, near Pickering, Yorks.

ARMSTRONG AW38 Chassis and matched speaker, new, £7.—Haigh, 45, Furzefield Road, Welwyn Garden City, Herts.

RECEIVERS AND COMPONENTS

COULPHONE Radio, New Longton, Preston. Prompt personal Service. Tungsram Valves. Guaranteed American Valves. All types, including G.T., 5/9 to 7/6 each, tax paid. Cosmocord Crystal Pickups, 22/6. Rola G12 Energised 2 500 with transformer, 55/-. Plessey Aluminium Can, 8+8 mfd., 525 v., 3/3. Dubilier and Erie 1 watt resistors, 4/6 doz. B.I. 50 mfd., 50 v., 2/6. B.I. 8+8, 550 v., 4/3. Airmaster 8-valve, 8 watt, 4 waveband chassis, with matched speaker, £10/15/-. Latest Pilot, Ferguson, K.B., Decca. Tax free. Stamp for list.

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MAINS dropping resistors, .2 amp., tapped 200-215-230-245v., 4/- each.
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HIGH-VOLTAGE TRANSFORMERS, useful for all test work, or television. Input 200/240 volts, output 5,000 and 7,000 volts. 6/6 each, post 1/-.
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DYNAMOS, for charging or lighting, etc., all shunt wound and fully guaranteed. 100 volt 10 amp., 4-pole, 1,500 r.p.m., 90/- ; 50/75 volt 15 amp., 1,750 r.p.m., 4-pole, 90/- ; 25 volt 8 amp., 1,750 r.p.m., 2-pole, ball-bearing, 37/6 ; 50/75 volt 25 amp., 4-pole, 1,500 r.p.m., 110/-.
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A.C. ELECTRIC LIGHT Check Meters, suitable for subletting, workshop, garage or any purpose where a separate check is required, for A.C. mains only, 200/250 volt, 50 cycle, single phase, in good condition and electrically guaranteed ; 5 amp. type, 6/- ; 10 amp. type, 7/- ; carriage 1/- on any size.
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