BUILDING AN ALL-DRY SUPERHET— See page 18

A NEWNES PUBLICATION

Edited by F. J. CAMM

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EVERY MONTH

October, 1940.

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OUR ALL-DRY 4-VALVE SUPERHET

Practical and Wireless

* PRACTICAL TELEVISION *

EVERY MONTH.
Vol. XVII. No. 412. October, 1940.

EDITED BY
F. J. CAMM

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COMMENTS OF THE MONTH

Broadcast Propaganda

WE were impressed with the remarks of Captain Plugge who intervened in the debate on the war situation in the House of Commons a few weeks ago to deal with broadcast propaganda. He analysed the situation very accurately and pulverised the methods of previous Ministers who were responsible for our weak propaganda programmes. Look at the facts.

In September, 1939, this country had 16 broadcasting stations of which only two were high powered, above 100 kilowatts or more. These were operated on 12 wavelengths, of which 2 were clear channels, and not shared by any other country. Of these 12 wavelengths only one was long-wave (we are referring, of course, to the long- and medium-wave stations only). These stations and wavelengths compare with Germany's 40 stations, two of which were high-powered, and her 31 wavelengths, of which 17 were clear channels, including one long wavelength.

Our Jettisoned Wavelengths

WHAT happened when war was declared? Great Britain jettisoned 10 of our 12 wavelengths, and so at the opening of the war we had 16 stations operating on two waveengths with one programme only, as against Germany's 40 stations on 31 wavelengths. After Germany conquered Poland Germany's broadcasting stations increased in number to 50, of which 11 were high-powered, operating on 40 wavelengths, 21 of which were clear channels and two long-wave. It will be remembered that no country has been granted more than one long-wave at international conferences with the exception of Russia, whilst several countries, such as Italy and Switzerland, have never succeeded in obtaining even one. Germany proceeded to conquer Norway and Denmark, and then enlarged her broadcasting strength to 68 stations, 11 of which were high-powered, operating 52 channels, 26 of which were clear, and four were long-wave. There followed the conquest of Holland, Belgium and Luxembourg, and Germany enriched her number of stations which were increased to 84, 13 of which were high-powered, operating 62 wavelengths, with 29 clear channels, and six long-wave channels. By that time we re-opened three of our scuttled wavelengths and were thus operating five.

Germany then occupied a large part of France, and she increased her ether power at the expense of the Allies' channels. After the capture of Paris and the surrender of France she had command of 112 stations, of which 24 were high-powered, operating on 82 wavelengths, of which 37 were clear channels, and seven were long-wave. Italy then entered the war and a further 50 stations on some 20 wavelengths joined the anti-British Brigade.

As Captain Plugge says, this is the position in which we find ourselves to-day. "How is it possible," he asks, "however good may be our propaganda, for us to compete with Germany? It is the same thing as trying to carry on business with 16 cargo boats when your enemy possesses 162, most of which are faster, larger, have a bigger cruising range, and cover ten times more routes than your own. We simply do not possess the cargo space to transport our propaganda, however good it may be."

England's Geographical Disadvantage

GEOGRAPHICALLY, England is at a natural disadvantage from the point of view of radio transmission. We are situated at the end of a continent, and therefore 180 degrees of the radiations from our stations fall into the Atlantic. Germany is situated in the middle of Europe, and all the 360 degrees of her radiations fall on fertile soil in all directions. Captain Plugge stated that the inhabitants of all countries have formed the habit of judging the power, importance and efficiency of a country by the manner in which they receive that country's broadcast programmes. That is why we are possessed with a very bad area in the Mediterranean, for there it is almost impossible to receive clearly or with ease any of the British medium-wave channels. Short waves are received, but there are few instruments in Europe that receive short waves. It is estimated that in France about one in every 100,000 sets is capable of receiving short waves.

This is a radio war, but our Government has quite failed to appreciate the value of the word spoken with conviction to the peoples of the vanquished countries and of the enemy. It is one of the basic principles of good advertising that a slogan or a message should be oft repeated. The Germans are repeating their hymn of hate through their vast numbers of wireless stations day after day, night after night. The fact that 99 per cent. of it is untrue does not matter, for a lie told sufficiently often is believed. Let us open out fresh channels, and make use of all those allotted to us.

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

Negative Feedback

A New System Utilising the Cathode Dropper

IT is known, for the purpose of linearising an amplifier, to introduce a current feedback by removing the by-pass capacity which is usually provided in shunt with the cathode resistance. Another known arrangement, making use of voltage feedback, is to feed back A.C. voltage on the anode of a valve over a voltage divider, part of the voltage divider remote from the anode serving as cathode resistance for the preceding valve.

It is found that feedback requirements generally call for a cathode resistance of different magnitude from that required for generating negative grid bias. Usually the correct value for the feedback is too small to generate the required grid bias, so that it is necessary to connect a further resistance in series with the feedback resistance in the cathode lead, which further resistance is, however, capacitatively bridged for the working frequencies. It would be desirable to be able to cut out the additional resistance with its condenser, or at least the condenser. The present notes indicate an arrangement enabling this to be done. The general idea is that the cathode resistance is made of suitable value for the required counter coupling, and an additional current is fed through the cathode resistance via another resistance, the additional current being of such magnitude that the D.C. voltage drop at the cathode resistance is equal to the grid bias required for the particular valve. If the feedback resistance is too small to provide the required grid bias, the additional current is derived from a positive pole of the source of potential. It is desirable for this purpose to make use of a potential divider already available, say, the screen-grid potential divider.

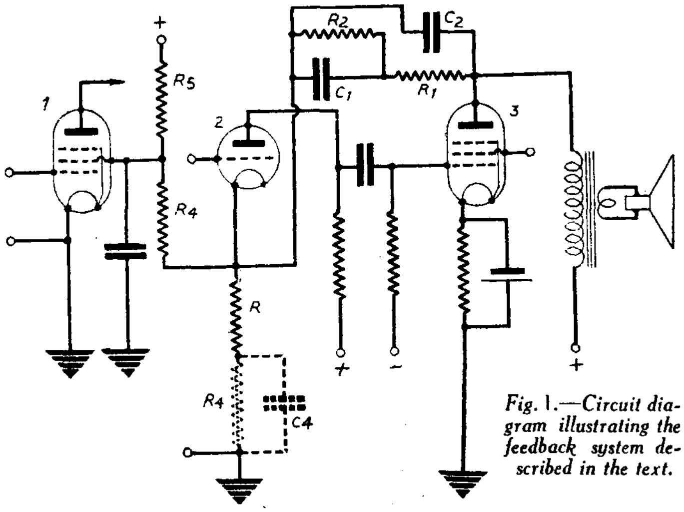


Fig. 1.—Circuit diagram illustrating the feedback system described in the text.

Increasing L.F. Amplification

Fig. 1 illustrates the arrangement suggested. Here the anode A.C. potential of the final valve 3 is divided by the potential divider consisting of the elements R_1, R_2, C_1, C_2, R. The fraction of the anode potential developed across R is applied in phase opposition to the input of the valve 2, which may be resistance coupled to the valve 3. The condenser C_1 serves to diminish the counter coupling at the low frequencies, a continuous reduction occurring down to a particular value of low frequency determined by the resistance R_2. In this way the amplification for the lower frequencies is increased. The condenser C_2 is found to increase the feedback for the higher frequencies.

In receivers and amplifiers of known types use is made of an additional resistance R_4 with condenser C_4 in order to obtain the correct grid bias voltage for the valve 2. The present proposal is to conduct through the resistance R, for example, through the resistances R_4, R_5, an additional current, so that the direct current flowing through the resistance R has a greater total value and, therefore, generates a greater grid bias voltage across it. The resistances R_4, R_5 serve at the same time for carrying the screen-grid voltage of a valve 1 or a number of valves of the receiver or amplifier.

It might be objected that the desired grid-bias voltage could be adjusted by suitably choosing the resistance R and then giving the resistance R_1 and the other circuit elements such values as to produce the correct feedback, but the disadvantage then arises that the current feedback mentioned at the commencement, generated by the anode current of the valve 2 by means of the resistance R, is too large. The amplification then falls markedly, without appreciable reduction of distortion, for the valve 2 would then have greater feedback than the valve 3, which is undesirable, since feedback is not required at all for the valve 2, which operates on small amplitudes.

Diode Detector

It may also happen that the resistance R has to be small for another reason, for example, in a receiver where the diode for detecting reception is built into the envelope of the next following low-frequency amplifier valve and shares a cathode in common with that valve, as shown in Fig. 2. In that arrangement the high-frequency or intermediate frequency is led to the diode D via the band filter B, and the low frequency obtained by rectification is tapped from the potentiometer P. This serves at the same time for carrying the grid-bias voltage generated at the resistance R so that the lower end of the potentiometer must be at the lower end of the resistance R. In the minimum volume setting, however, the volume is not completely reduced to zero, since a part of the low-frequency voltage generated by the rectification appears on the resistance R, because the series circuit of D and R is across the load resistance W of the diode. For this reason also it is desirable to have a small resistance R, as well as for the reason already given above.

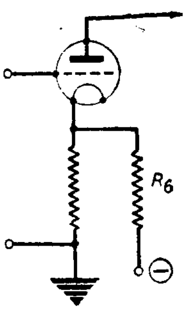


Fig. 3.—Current back-coupling by means of a cathode resistance.

It may be noted that in the two circuits illustrated a weak direct current flows in the resistances R_1, R_2 also, but this is not in general sufficient to achieve the desired effect. The resistances R_1 and R_2 would have to be made very small, so that the counter coupling would then be too great, because the part of the anode A.C. voltage of the valve 3 appearing across R then becomes too great. It is common practice to block off this direct current flowing from the anode by means of a blocking condenser, and this may be done with the present arrangement also.

Another case in which the proposed arrangement could be used is that in which, for example, only the above-mentioned current back-coupling by means of a cathode resistance is used, and the negative feedback voltage is too small. For example, the cathode resistance may be made large so that the feedback voltage has the correct value, and the resulting excessive value of negative grid-bias reduced by an auxiliary current. This current must be opposed to the anode current flowing through the cathode resistance and the valve, and must therefore be led up from a point negative with respect to earth via a resistance such as that indicated by R_6 in Fig. 3.

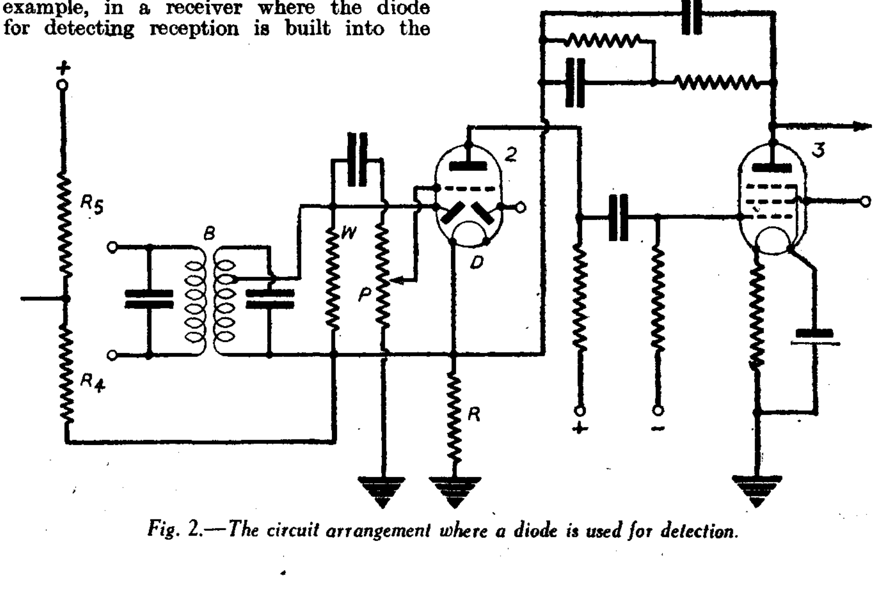


Fig. 2.—The circuit arrangement where a diode is used for detection.

Reading a Circuit Diagram

This Article Will Help You to Get a Clear Understanding of the "Shorthand" of Wireless

WHEN you look at a circuit diagram, such as the one in Fig. 1 on this page, does it convey anything to you, or is it so much Greek? Do you know that every line in it refers to some particular part of a wireless set?

It is for those readers who are hazy on the point that we have had the two diagrams shown here specially prepared. As you see, Fig. 1 is a conventional circuit diagram with certain letters and numbers added. Fig. 2, on the other hand, is a perspective drawing, showing how a receiver following the circuit of Fig. 1 would be made up. The letters and numbers appearing on the circuit diagram are repeated on the receiver, and show clearly to what component each symbol refers.

Why an Actual Set was Used as an Explanatory Model

You may ask, "Why show a drawing of a particular receiver? Why not explain the various symbols by means of a kind of glossary?" Well, the answer is that a glossary does not go far enough. It does not show you the relation of each part. It merely tells you that such and such a sign stands for a condenser, or that another represents a tuning coil, and so on, with the result that you are left with a whole lot of *isolated* facts. These facts in themselves are usually quite uninteresting, and are often forgotten as soon as they are learned. We suggest that what the reader wants to know when he sees a particular circuit is what it all means in terms of an actual set; not only what component each symbol represents, but also how it is placed and what it looks like in relation to other parts of the set.

A Three-valve Circuit

No doubt the ideal method would be to have the completed receiver in front of you, together with the circuit diagram, and get someone to carefully explain the relation between the two. This is, of course, impossible in all but exceptional cases. We therefore suggest the use of a perspective drawing of a typical receiver as providing the next best thing. This idea was worked out fully with the results shown in Figs. 1 and 2. The circuit used is the popular three-valve arrangement, consisting of a screen-grid valve, a detector valve and a pentode-amplifier valve, while the layout is conventional in every respect. Of course, we realise that there are other circuits than this, and also there are a number of components to be met with in modern receivers which are not represented here. This is unavoidable, but we think you will find that at least one type (in some cases there are more than one) of each of the more important components is included, and that practically all the symbols used in radio are to be found in the circuit diagram. There is one sign, however, which you may come across, but which is not shown here. It is the symbol for a battery. This is very similar to that used for a fixed condenser (of which several are shown), but instead of consisting of two thick lines of equal size like the condenser sign, it is made up of one long thin one and one short thick one. The long one represents the positive pole of the battery, and the short one the negative. For a series of cells the sign is usually repeated thus: long, short, long, short, etc., or one long and short stroke may be used at each end, and the intermediate cells represented by a series of dots. . . .

What the Diagrams Show

Before you study them in detail it should be understood what the two diagrams are intended to show. We also point out the things you must *not* expect from them. First and foremost they show you what each symbol on the circuit diagram represents in the actual set. Secondly, by means of numbers, every connecting line on the circuit can be identified with its equivalent wire, where there is one, on the perspective drawing. Lastly, by showing *every* wire and *every* component there is no part of the set left to your imagination apart from the accessories. The connections to these, however, are clearly indicated.

What we cannot profess to show you with the aid of these diagrams is the function of the various values. These are rather outside our present scope, and if we attempted to include them it would only tend to confuse matters. If, however, you particularly wish to know the value of some part or other, you can always refer to any similar circuit shown in the pages of PRACTICAL WIRELESS, or you can send the coupon on the Queries and Enquiries page and send it to the Editor.

Valves Removed for Clarity

When you look inside a modern wireless receiver, probably the first things that strike your eye are the valves, with their shining glass or white metal-coated bulbs, and also the screens covering the tuning coils, which look somewhat like aluminium cocoa-tins. In the set illustrated here, however, is has been found necessary for the sake of clarity to show it with the valves and coil covers removed. This is mentioned because it may give the set a somewhat unconventional appearance in the eye of those unaccustomed to seeing the "insides" of a wireless receiver, and also because in the absence of the valves the indicating letters "F," "M" and "S" are shown against the valve *holders*.

How to Use the Diagrams

Now suppose we wish to follow the circuit diagram right through and identify each part. Where shall we start? Well, as the signals enter a set via the aerial, that is where we ought to begin our investigations.

Look at the top left-hand corner of the circuit diagram (Fig. 1). There you will see a sign like a crow's foot. This is the universally accepted symbol for the aerial. The aerial is joined to the aerial terminal or binding screw on the bottom right-hand corner of the set, as shown in Fig. 2.

From the crow's foot on Fig. 1 is a line marked (1), leading to a symbol consisting of two thick lines with an arrow through them marked (A). If you look for the same signs on Fig. 2, you will see that (1) refers to the wire from the aerial terminal to a little oblong affair with a knob on it, and that (A) refers to the oblong thing itself. If you don't immediately recognise this latter as what is known as a pre-set condenser, you will be able to find its name by referring to the key published with this article.

Returning to the circuit, you will see a line marked (4) following from the pre-set condenser to one of a group of three curly-looking gadgets like springs. These are marked (B). Now turn again to Fig. 2, and you will see that (4) is a wire from the pre-set condenser to one of the two tuning coils which we mentioned previously as being shown with their screens of "cans" removed, while (B) refers to the coil itself.

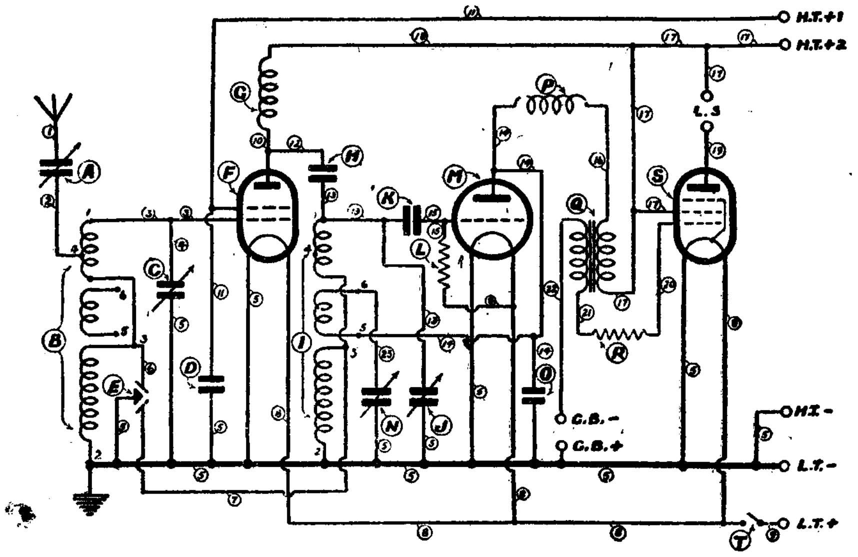


Fig. 1.—Theoretical circuit diagram of a three-valve receiver.

Circuit Diagram Tells How Many Windings in a Coil

Why this is shown in Fig. 1 as three separate "springs" is because it contains three separate windings. The top one tunes in to the medium waves, the middle one in this case is not used, and the bottom one when joined to the top one by means of the wave-change switch (E) tunes in to the long waves. Thus you can always see from the circuit diagram just how many

(Continued on next page.)

READING A CIRCUIT DIAGRAM

(Continued from previous page.)

separate windings there are in a tuning coil.

Perhaps we should explain that the small numbers 1, 2, 3, 4, 5, and 6 round the base of each tuning coil, and shown on Fig. 1 *not in circles*, are those used by the manufacturers to mark the terminals of the coils, and have no connection with our system of numbering the various connecting wires.

Lack of space prevents us going through each part of the circuit with you in detail, but you will see from what has been shown so far how to carry on. There is one point which may puzzle you, and that is that there are several wires marked (5). We will explain why this is.

Wires Connected to Earth

In the first place all these wires are what we call at earth potential, in other words they are all joined directly or indirectly to the earth terminal of the receiver. Now in the circuit diagram a connection from a particular component to earth is shown by a line connecting it to the thick line or "bus bar" lead, as it is sometimes called, which runs right across the diagram. This thick line itself is represented as being joined to earth at the extreme left-hand end by the triangular group of parallel lines at this point. Now this is purely diagrammatical, and it may not be practicable or convenient in building the set to literally connect a long thick wire to the earth terminal and then join each component that has to be "earthed" to it with a separate wire. For instance, where two components are situated close together it simplifies the wiring if they are both joined together with a short piece of wire and then a second wire is taken from one of them across to the earth terminal. Electrically it amounts to much the same thing, but the one is the theoretical arrangement and the other the practical. It is because these arrangements are not always identical that some lines on the circuit diagram have no wires exactly corresponding to them in the actual set. In order, therefore, that there should be no conflicting numbers we have numbered all the earthed wires the same, namely (5).

There are also one or two other numbers which occur more than once. In each case you will find that it is where a number of wires are all joined together or to the same point.

What an Arrow Stands for

In studying the circuit diagram you will notice in several cases an arrow drawn through the symbol for a condenser. This means that it is variable and the variation is usually carried out by means of a knob or some such device. Whenever you find this arrow sign on a circuit diagram it always means that the particular component has a variable control. It may, for instance, be shown across the symbol for a coil or a valve. In the case of variable condensers it is sometimes shown somewhat differently. Instead of putting an arrow through the two thick lines, one of the lines themselves is drawn curved with an arrow head at one end. This is an alternative method of representing the same thing.

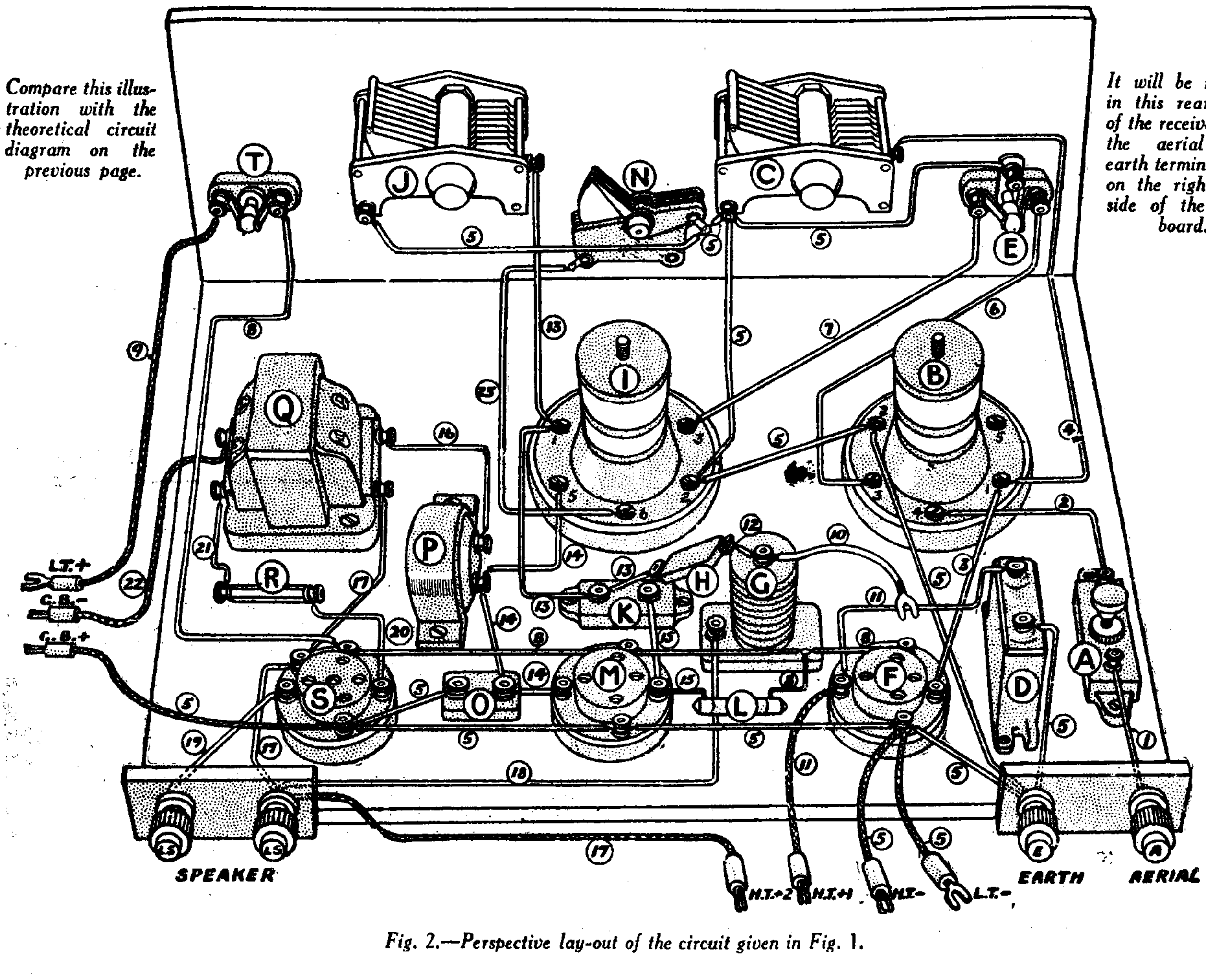
Keep the Diagrams for Reference

Finally, we hope that these diagrams and the accompanying explanation will be of use to you in enabling you to understand the "shorthand" of radio. We suggest you might care to cut out the diagrams and the key table for future reference.

Key

(A) "Pre-set" or Semi-fixed Condenser.
(B) Dual range tuning coil, used as aerial coil.
(C) Aerial Tuning Condenser.
(D) Fixed Condenser.
(E) Three-point Wave-change Switch.
(F) Screen-grid Valve.
(G) H.F. Choke.
(H) Fixed Condenser.
(I) Dual Range Tuning Coil, used as Intervalve Coil.
(J) Tuning Condenser for Anode-grid Circuit.
(K) Fixed Condenser.
(L) A Resistance, in this case the Grid-leak.
(M) Detector Valve.
(N) Reaction Condenser.
(O) Fixed Condenser.
(P) H.F. Choke.
(Q) L.F. Transformer.
(R) A Resistance.
(S) Pentode Power Valve.
(T) "On-off" Filament Switch.

Compare this illustration with the theoretical circuit diagram on the previous page.

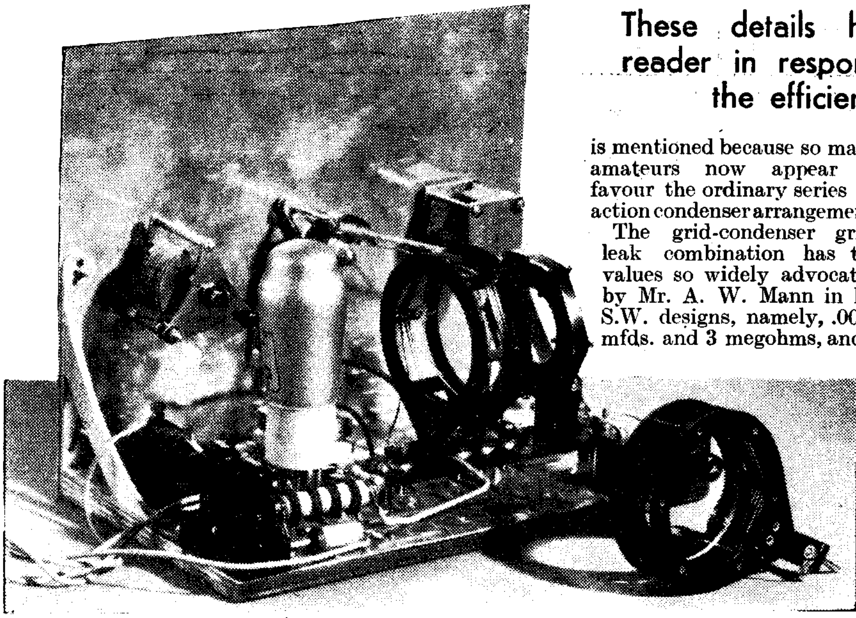


It will be noticed in this rear view of the receiver that the aerial and earth terminals are on the right-hand side of the base-board.

Fig. 2.—Perspective lay-out of the circuit given in Fig. 1.

A SHORT-WAVE ONE-VALVER

These details have been submitted by a reader in response to the controversy about the efficiency of simple one-valvers



A rear view of the actual receiver described in this article, showing the location of components and the formation of the coil unit and coils.

I HAVE followed with great interest the controversy which has brought forth many interesting letters in your columns concerning the possibilities of the simple one-valve receiver. Up to the present I have refrained from making any comments but, as I take sides with those who have already proved what one valve can do, so far as the reception of S.W. stations is concerned, I am venturing to put forward the details of a set which has provided me with very many hours of remarkably good D.X. entertainment, with the hope that such information will help to strengthen the case of the one-valvers, and enable others to carry out actual tests to prove for themselves the claims or opinions of both parties.

Much has been said about "hotted-up" circuits, but so far no one has yet given a clear definition of what is meant by that term when applied to radio. Personally, I think the expression is used simply to cover up the little experiments and adjustments which any keen constructor always makes before feeling satisfied with his labours. Many would, no doubt, like to create the impression that some specialised skill is necessary to undertake this alleged "hotting-up" process, and that it is beyond the capabilities of the average amateur.

To avoid any misunderstanding about the set to be described, it should be noted that no claim is made that the results which have been obtained are due to any secret "hotting-up" business, in fact, nothing more has been done to it than that which, as mentioned before, would be undertaken by any S.W. enthusiast.

The Circuit

In view of the above remarks, it is hoped that fellow readers will not be disappointed when they see that the theoretical circuit, which is shown in Fig. 1, is nothing more than the usual leaky-grid triode detector arrangement. It is as orthodox in all respects as the majority of such circuits *with two exceptions*, and they are, firstly, the type of coils utilised and, secondly, the use of throttle controlled reaction. The latter is, of course, nothing unusual, but it is mentioned because so many amateurs now appear to favour the ordinary series reaction condenser arrangement.

The grid-condenser grid-leak combination has the values so widely advocated by Mr. A. W. Mann in his S.W. designs, namely, .0001 mfds. and 3 megohms, and I found that no improvement, bearing all things in mind, could be obtained by incorporating other values. The valve used is one of the Hivac S.W. types but, if any difficulty is experienced in obtaining this, then any of the recognised makes of triode H.F. valve will prove quite satisfactory. If several valves are to hand, then it is always well worth while giving each a thorough test in the receiver, noting, in particular, its sensitivity, and the smoothness of reaction. It would seem that the sole reason why so many amateurs fail with an o-v-o is due to lack of attention to these items.

Two S.W. H.F. chokes are used in the anode circuit, the first being between the 'phones and the anode, and the second between the positive H.T. supply and the other side of the 'phones. On test it was found advisable to incorporate the second component as it prevented the possibility of any high-frequency currents from reaching the 'phones and H.T. battery, and likewise eliminated all traces of head-capacity or body-capacity effects. When selecting the chokes, care was taken to see that they were of different types or characteristics to prevent any resonating at certain frequencies.

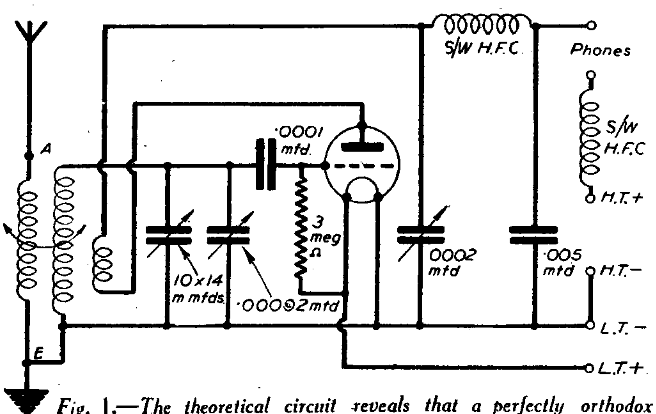


Fig. 1.—The theoretical circuit reveals that a perfectly orthodox arrangement is used, and gives all component values.

The Coil Unit

It will be obvious from the component list that the set is made up from parts which happened to be on hand, and it is this fact which accounts for the American-produced coil unit being embodied in the circuit. It so happened that the unit was secured several years ago, when they were readily obtainable in this country, but whether they are still available I cannot say. The unit is known as The Air King S.W. coil assembly, and, by virtue of the method of construction adopted, the coils are, to all intents and purposes, self supporting, i.e., they are not wound around a solid former. The writer has always a strong belief in large diameter coils of this type for S.W. work, and from the results obtained, feels that his views are justified, but that, of course, is just one of those personal opinions to which we are all entitled.

The illustrations show that the aerial is coupled to the grid coil by means of a swinging coil, thus dispensing with the more usual aerial series variable condenser, and allowing

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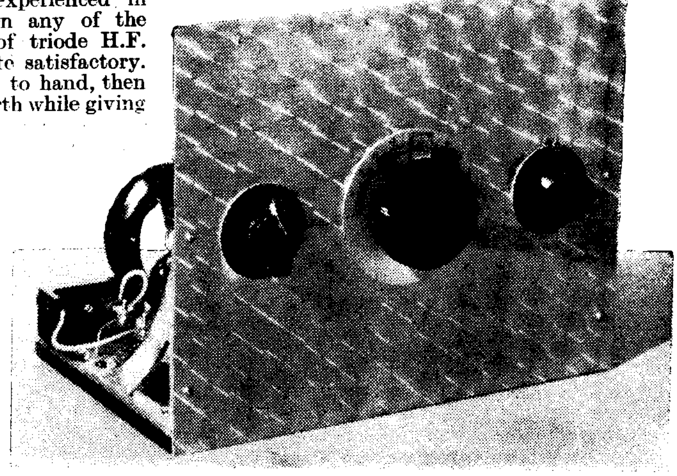


The clean panel layout is emphasised in this illustration, the centre control being that of the band-spreader, the tank being on the left and the reaction control on the right.

A SHORT-WAVE ONE-VALVER

(Continued from previous page)

perfect adjustment of the aerial load on the grid coil. In actual practice, the variation is sufficient for the total waveband covered by the three coils. The reaction winding is wound inside the grid coil, at one end, and is absolutely self-supporting, it being fixed in position by means of small locating slots and adhesive. The swinging coil forms a definite part of coil holder platform into which the grid coils are inserted by means of the four pins which form the connections for the grid and reaction coils.

The unit could be home-made by those constructors who have patience and reasonable experience of coil construction, but for those not so inclined or gifted, the nearest commercial coils appear to be the Bulgin types S.W, 35-38 which would require very little modification to enable them to fulfil the specification of the originals.

Various experiments were tried with the actual detector stage and the reaction circuit, and although some interesting results were obtained, it was found that the arrangement, as shown in Fig. 1, proved most consistently satisfactory, especially the throttle controlled reaction, which allows the sensitivity to be built up in a most smooth manner right to the point of oscillation. Backlash and tuning drift were as absent as one could desire, and by adjustment of the aerial coupling coil, satisfactory reaction is obtainable right down to the minimum wavelength of each coil.

Construction

A 5-ply baseboard, covered with aluminium, is used to carry the two terminal strips, valve-holder and panel, the latter being of aluminium, and held firmly in position by two metal brackets.

Particular care has been taken to see that all points at earth potential have low resistance connections to the actual earth terminal, the point being very important. The three controls, namely, the tank condenser, the band-spreader and the reaction condenser, are mounted in line on the panel, the last two components having slow-motion drives. The tank or band-setter condenser is the original Eddystone model having ten settings each of 14 m.mfd. capacity, thus providing a total of .00014 mfds., while the band-spreader has a capacity of 20 m.mfds. This combination gives very simple tuning with easy means of recording the setting for any given frequency.

It will be noted that no L.T. on-off switch is shown in the assembly, and in case it is thought that this is an oversight I will say that its omission is perfectly intentional. In the majority of S.W. sets I have used, the very action of such a switch invariably causes a very disturbing noise in the *headphones*, when it is fitted to the panel, therefore, as the set in question is used in conjunction with other apparatus, a switch is fitted on the table within easy reach of the operator. This could be termed a personal fad, so if others wish to fit a switch to the panel there is nothing to stop them.

Operation and Results

There is very little to say concerning the actual operation of the set as it in no way differs from normal procedure, although, of course, as most S.W. enthusiasts will have already found, a certain time is required to get the touch of the set before peak results are obtained. With the valve in use, 90 volts positive H.T. is found to be most satisfactory. The aerial I am using is a simple Inverted-L type, the effective height being 25 feet, and the overall length 50ft. Its location is such that it is very free from any sort of screening and its direction is approximately E. to W.

Space prevents me from giving a detailed log, but I can assure my fellow enthusiasts that the little set has been able to pull many D.X. transmissions which friends of mine, using more powerful receivers have, so far, failed to contact. Naturally, I like to think that this is due to the receiver, but, perhaps, it is more rightly due to the combination of my location, aerial and patience.

Components

It will be obvious to many that the parts used for the actual construction are those which happened to be on hand, therefore it is not possible to give a hard and fast specification. For example, the grid condenser, which has a value of .0001 mfd., is of the air-spaced type and was produced by Messrs. B.T.S. A similar component can also be obtained from Messrs. Bulgin. The associated grid leak is by Dubilier and it has a rating of ½ watt. A 1-watt resistor can, of course, be used, but personally I think these tend to look awkward in positions where circuit conditions do not call for such a rating. The H.F.C. directly in the anode circuit is one of the B.T.S. products, whilst the second, between the H.T. and one side of the 'phones, is the Bulgin H.F.3.

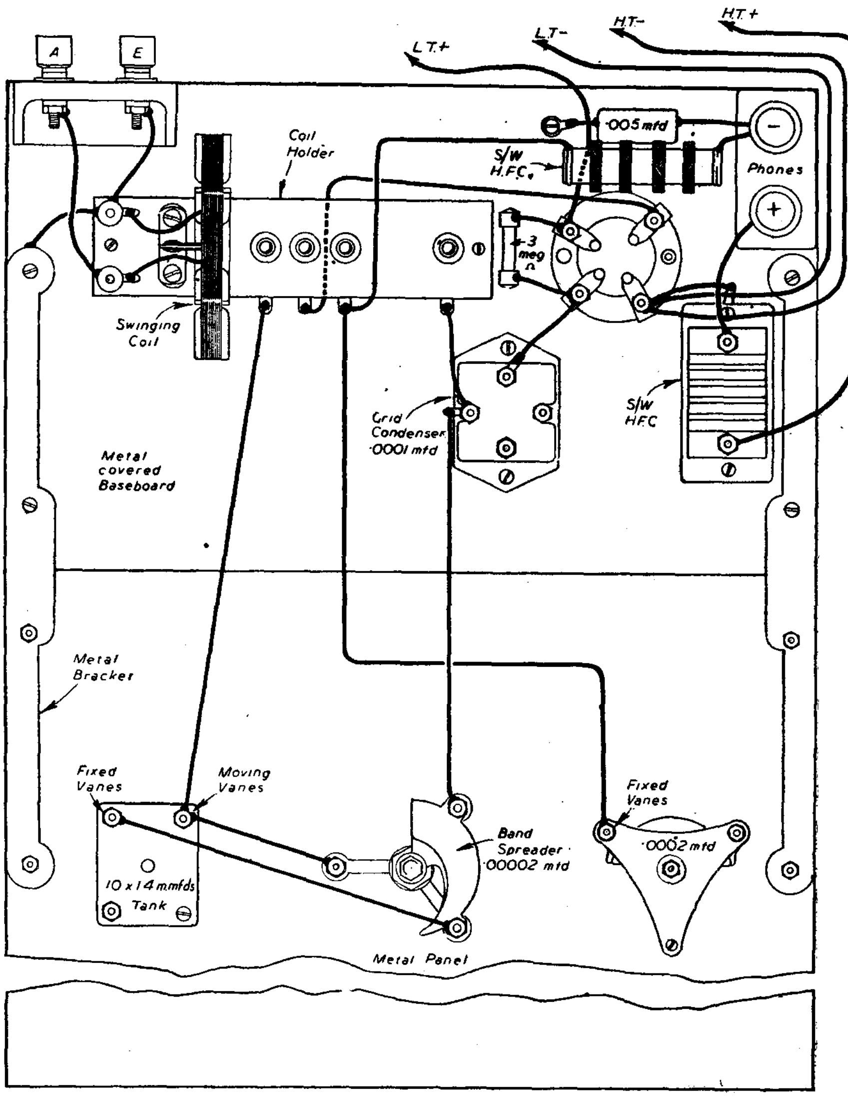
The tank-tuning condenser is part of the Eddystone bandspread tuning outfit. It has a total capacity of 10 x 14 m.mfd., and as it is fitted with stops at each of the ten sections, it forms an ideal component. Its type number is No. 1,042. The band-spreader is also of the same make but it has a capacity of 20 m.mfd.

The anode by-pass condenser is a small tubular type of Dubilier make, whilst the two terminal blocks happen to be two odd ones that were to hand and can be replaced with any suitable terminal mounts of socket strips.

As there may now be some difficulty in obtaining aluminium for the panel or for covering the baseboard, use can be made of perforated zinc of close mesh, to cover the back of the panel and the top of the baseboard. Care must be taken, however, to see that good earthing connections are made.

S.P.

Fig. 2—WIRING DIAGRAM OF THE S.-W. ONE-VALVER



ON YOUR WAVELENGTH

By Thermion

A Much Needed Invention

CHATTING with an Air Ministry official the other day, on the question of technical instruction, the subject of the morse code cropped up. Although wireless telephony is used on aircraft, the morse transmitter still predominates because it has a far greater effective range, and also it is possible to transmit in code, whereas the spoken word does not lend itself so easily to such coding unless someone invents a new language, like Esperanto, but which is known only to the operators. This is not feasible.

Technical developments have been entirely confined to the improvement of the transmitting apparatus, but no one has yet improved on the method of transmitting morse. The speed of the average operator varies between 18 and 30 words a minute, and it takes from five to six months to attain this speed. Moreover, the operator must be kept in constant practice. Thus, the efficiency of the apparatus depends upon the skill of the operator. In these mass-production days such a system is wrong. I do not know whether it is possible to simplify the morse code which has always struck me as being a cumbrous and cranky business. It should, however, be possible to produce a transmitting apparatus on the lines of a typewriter so that even an unskilled operator could soon be trained to work a keyboard, and transmit messages in code. Thus, by depressing the, say, A key, the transmitter would radiate whatever code letter was assigned to A. Girls could quickly be trained to transmit at a rapid rate. I know that the process has been speeded up by automatic morse, but I am referring particularly to transmissions from ship or from aircraft. Here is a chance (if it has not already been patented) for one of those people who frequently write to me asking for a list of things to invent!

Propaganda Broadcasting

CAPTAIN PLUGGE in the House of Commons recently had a good deal to say on the question of broadcast propaganda which, he said, embodies the fundamental British spirit, since it consists in trying to induce people to do the right thing, merely by talking to them and persuading them to do it, instead of by the other method which is to apply force, and inflict bodily injury, to make people fall in with your ways. As one newspaper correspondent facetiously put it, the plethora of regulations introduced since the war would lead a foreigner to believe that the British Government is at war with the British public! However, Captain Plugge went on to say that broadcasting is a new weapon with which we were not faced in the last war, and that very few Members of Parliament realise how weak we are in this respect. Before the war started Great Britain had sixteen broadcasting stations of which two were high-powered. These operated on twelve wavelengths on which seven were clear channels, and these included one long-wave. He was referring, of course, to the medium- and long-wave stations. Before the war, however, Germany had forty stations, ten of which were high-powered operating on 31 wavelengths, of which seventeen were clear channels and included one long wavelength. A clear channel is, of course, one allotted to a country and is unshared by any other. When war broke out Germany maintained all her wavelengths and stations, whereas we scuttled ten of our twelve wavelengths, and at the beginning of the war had sixteen stations operating on two wavelengths with one programme only, as against Germany's forty stations on 31 wavelengths.

I am afraid that this country has never become propaganda-conscious. Propaganda can be as powerful as high-explosives. It needs, of course, to be of different quality to the guttersnipe vapourings of British gamin who have sold themselves to Germany, and are broadcasting in English.

Our Roll of Merit

Our Readers on Active Service—Seventh List.

T. Bingham
(Pte., R.A.O.C.),
Okehampton.

W. T. Black
(Gnr., R.A.),
Canterbury.

D. Pasfield
(Pte., R.A.O.C.),
Sutton.

J. H. Ramsbotham
(Sigmn.),
S.W.3.

J. A. T. Stephenson
(Pte., R.A.M.C.),
Doncaster.

L. M. Trimmer
(Sapper, R.E.),
Great Dunmow.

A. Hart
(Sapper, R.E.),
Ilkeston, Derbyshire.

M. East
(L.A.C., R.A.F.),
London, N.W.1.

J. Downing
(Private, 2nd Herts Regt.),
Stoke-on-Trent.

R. H. Kilpin
(Private, R.A.S.C.),
Kingsthorpe, Northampton.

An Idea

IN connection with the question of British propaganda, I have an idea to put forward. It is frequently announced in the newspapers that the German stations such as Hamburg and Bremen are silent as a result of the presence of British aircraft. I suggest, therefore, that we send flocks of aeroplanes over there to silence them each night, and then transmit on the Bremen and Hamburg, etc., wavelengths a British propaganda programme in German!

The sooner that the Government refrains from treating the British public as if they are a gang of imbeciles instead of intelligent individuals the better. Very many listeners are annoyed with that supercilious, ingratiating, smug, complacent, I-know-more-than-you-poor-people attitude of the bone-headed Philip Snowdens (with their "sitooations"), Ramsay MacDonalds with their "wurrrrlds"), Simple Simons (with their "I *know* taxes are unpleasant), childish Chamberlains ("Do you trust Hitler?" "Yes, he promised *me* this time."), Hore-Belishas ("*I* will democratise the Army"), little Leslie Burgins ("*I* propose to give all unused machine tools return tourist tickets"), and others who talk to us over the air as if we were a collection of pimps, unable to think for ourselves. There needs to be some life and bite about our propaganda. At present it is too anæmic, too old-school-tie, too full of we-can't-hit-a-plane-when-it-is-down-come-up-and-fight nonsense to carry any weight abroad. We are engaged in a total war, and we must adopt total methods. It is of no use using a boxing glove with a man attacking you with a dagger.

Radio Export Drive

RADIO manufacturers have been grumbling because while all other industries have been encouraged to export as much as possible they have not received much assistance from the Government in the matter of release of steel and aluminium. Representations have been made, and by this time the sympathetic treatment promised to manufacturers has no doubt been implemented by the release of raw material. It was necessary to conserve this for the manufacture of armaments, and only to grant permits for radio apparatus required for the Army, Navy, and Air Force.

The radio trade is expected to make an enormous export drive to capture some of the markets opened to them as a result of the war.

Television

ALTHOUGH the television service has closed down for the duration of the war, technical developments have been going on. When the war is over I expect television will provide a boom similar to that which was created when wireless telephony (developed during the last war) surprised the public.

Audibility *versus* Quality

Obtaining the Best from Loudspeakers in Factory Radio Installations.

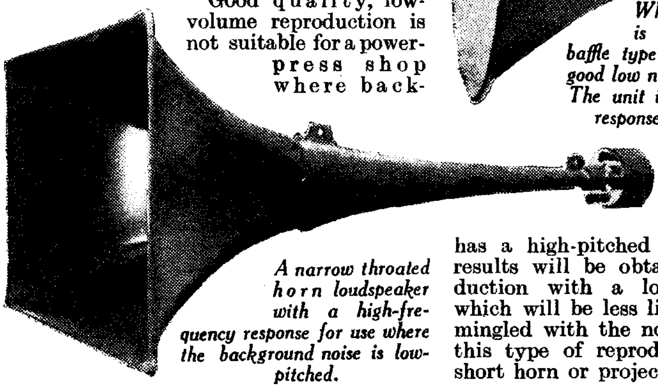
THE popularity of musical installations in factories engaged on full-time war production, and the "Music While You Work" periods radiated by the B.B.C. are rapidly encouraging more and more works managers to install equipment in their own factories. The results in most cases are very satisfactory, but in several instances which have been brought to the writer's knowledge, disappointment has been experienced due to the slavish adherence to quality of reproduction rather than audibility.

For example, in a large installation amplifiers may supply loudspeakers in an assembly bay, a power-press shop, and a wrapping department. Now it is essential that the loudspeakers in these various places should be individually controlled with regard to their volume in order that they may be adjusted so that their reproduction is just sufficient to overcome the various *levels* of background noise. The latter, however, not only differs in magnitude, but also in characteristics from the heavy, low-frequency rumbling of the press shop, the clatter of the assembly bay, and the comparative quietude of the wrapping department.

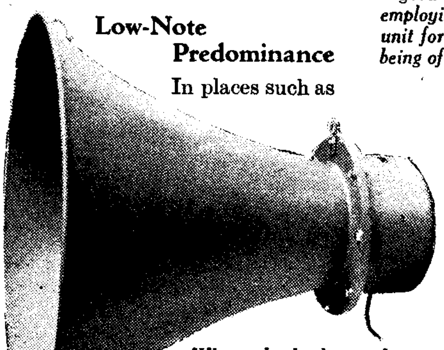
Different Tonal Values

The reproduction of music in these three examples, therefore, should be of different tonal values.

Good quality, low-volume reproduction is not suitable for a power-press shop where background noise is high, due to the heavy trundling and reverberation of the presses. The output from the loudspeakers must not only be sufficient to be heard above the background noise, but the tone of reproduction should be high, almost strident, because any tendency for the output to be "mellow" will make it unintelligible, as it will be hopelessly submerged in the low-frequency characteristics of the prevailing noise. Reproduction, therefore, in such places should be clear and brilliant, and this may be obtained by using narrow-throated horn-type projector loudspeakers.



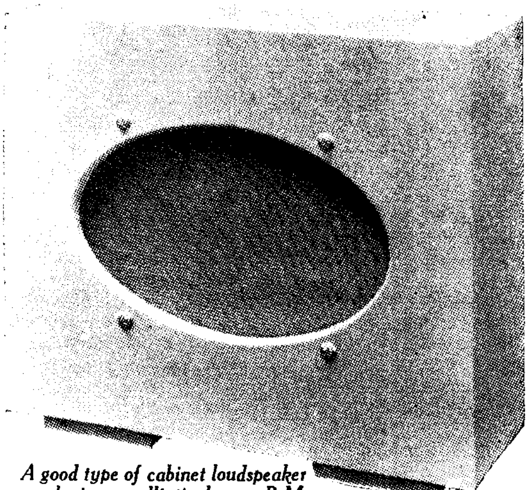
A narrow throated horn loudspeaker with a high-frequency response for use where the background noise is low-pitched.



Where the background noise is high-pitched a directional baffle type of loudspeaker having a good low note output should be used. The unit illustrated has a frequency response going down to 80 c.p.s.

Low-Note Predominance

In places such as sawmills, grinding-shops, etc., where the background noise level has a high-pitched characteristic, better results will be obtained by using reproduction with a low-note predominance which will be less liable to become intermingled with the noise of the shop. For this type of reproduction wide-mouthed, short horn or projector-baffle loudspeakers may be employed using several units to cover the shop, and directing the speakers towards the normal position taken up by the operatives when attending their machines.



A good type of cabinet loudspeaker employing an elliptical core P.M. unit for wide-angled diffusion for general use. The cabinet being of plain wood can be painted or sprayed to harmonise with its surroundings.

In offices, small-parts assembly bays, and rooms in which quiet work is being carried on, moving-coil cabinet loudspeakers give good results, and may be easily and inconspicuously installed at convenient points.

Small Output Amplifiers

The use of a number of amplifiers each with a small power output is often advantageous in factory installations with the above conditions, and is to be preferred to one large amplifier. The small amplifiers may all be fed from the same source—microphone, radio or records—but they may each have their bass and treble tone controls adjusted to give the best audibility of reproduction, and each can serve one particular shop or bay in which the most suitable type of loudspeakers have been installed.

In this way the music provided for the employees will be most readily appreciated by them at their work and, after all, it is for them that the entertainment is being provided. Audibility is more important to them than quality reproduction.

NEWS AND NOTES

Standardisation Troubles

WITH the promise of a renewed effort on the part of America to lend aid to the Allies by the supply of equipment and materials, many will conjecture as to the reaction this will have on the development of non-essential industries in that country. At the moment television can be classed in this category, but it would appear from all accounts that the biggest drawback to progress in this science is the lack of co-ordination resulting in an absence of standardisation, in as far as the picture definition is concerned, ratio of synchronising to video signal, type of modulation, etc. A marked controversy arose because of the Federal Communications Commission bringing about a suspension of its original concession to companies for limited commercial operation. Recently the President of the U.S.A., Mr. Roosevelt, stated that he advocated a free competitive industry for television, based on lines similar to that operating for radio in that country. The main difficulty hinged on an acceptance of a common picture standard, for each company interested in the industry seemed to have different views as to public requirements. The American R.M.A. advocated a 441-line standard, but the Du Mont company obtained a licence recently for a transmission of 625 lines. It is hoped for all concerned that unanimity of ideas will be forthcoming soon, otherwise progress will be held up to the detriment of all concerned.

Selenium Cell Developments

THE relatively sluggish reaction of selenium cells to the action of light variations limited the application of the device very considerably. After being proved unsuitable for television purposes, developments of the cell slowed down considerably, although several inventors endeavoured to increase the rapidity of action by mechanically presenting fresh surfaces to the light, but without achieving the measure of success necessary for successful application. The need for various forms of light-sensitive devices to perform a wide variety of functions in the commercial world where sluggishness was no serious bar, revived the fortunes of the cell. One of the latest developments is to increase the cell's sensitivity to both the red and infra-red end of the light spectrum. This has been achieved by mixing with the selenium itself 20 per cent. of iodine and adding small traces of both lead and cadmium. In practice these elements are vaporised together, and finally precipitated as a layer of the requisite thickness on a glass face whose surface has been roughened. As an alternative to this process the expedient of cathodic sputtering may be used.

Modern Factory Production Methods—1

A Description of the Various Processes Through Which a Receiver Passes Before Being Placed on the Market. By "SERVICE"

A KNOWLEDGE of modern factory production methods is of importance not only to engineers engaged in some part of a large radio manufacturing organisation, but also to the service engineer in the field, whether he be working on his own or for a dealer. It is also of value to candidates for the many technical posts in the Forces, especially those jobs which concern the inspection of supplies from manufacturers engaged in fulfilling Government contracts.

The object of this series of articles is to review the many processes through which a receiver travels, from its inception to its finality. In this way the points of view of the various engineering departments concerned will be better appreciated, and the reasons why they cannot do some of the things service engineers, and salesmen, would like them to do will be more readily tolerated.

Origin of a New Receiver

The origin of a receiver may be a sales demand or a designs recommendation. The sales department may press for a certain type of receiver to meet competition either in price, performance, or appearance. Perhaps a competitor has brought out a new system of tuning which has caught the public's fancy, and sets that do not have this feature will not sell. A receiver must, therefore, be designed that not only incorporates the new attraction, but is also better in some respect.

On the other hand, the designs department may put up to the sales people a new feature, style of receiver, or method of reproduction that they think may create a demand for the firm's products above all others.

There is generally a sub-division or group within the designs department, often termed the development section, whose job is to bring out new features and investigate those of other manufacturers.

Popular Features

The ideas developed in this department are not always original ones. Quite a great deal of time and money is often spent in trying to get round an attractive feature or circuit arrangement patented by a competitor. For example, most modern radio users demand that their receivers be fitted with A.V.C., push - button tuning, etc. The patents covering these features may be owned by one person, company, or syndicate, but as they have become universally acknowledged as being essential to modern radio, manufacturers have to pay the owners of the patent for the use of the ideas. Thousands of pounds are spent in this way, and if a designer can produce the same or similar results in a way not covered by the patents he will save his company very large sums of money every year.

The progress of a Government receiver follows similar lines. In this case the sales department is replaced by one of the Services, who demand a type of receiver to fulfil certain requirements. Alternatively, a firm may put before the Government representatives a new invention, or a receiver having possibilities in certain directions, and obtain an order for the construction of sufficient quantities to warrant mass production.

A production line at maximum output. Many months of preparation are essential before the first operative starts the chassis on its journey down the line.

TYPICAL SCHEMATIC CHART OF MAJOR PROCESSES IN FACTORY PRODUCTION

Origin of Receiver (Sales or Design Dept.)

- Cabinet design. → Samples of cabinets for sales approval. → Selected design to cabinet factory for drawings and timber orders.
- Chassis design. → Technical meeting to consider chassis layout. → First complete hand-made model for sales approval.

Then:

- Test gear for assembly checking.
- Production planning. → Production of trial batch. → Final approval meeting by designs and service. / Soak tests. / Despatch of models to various districts for test under domestic conditions. → Full production. → Release of model.
- Tools or component supplies.
- Blueprints and lists of parts. Service manual preliminary data for internal use. → Final Service manual. / Sales Literature. → Training of service personnel on new model. → Repair and inspection of new models which break down.
- Packing requirements. → Transit tests.

Schedule of Production Stages

In the accompanying chart the various stages of receiver production are outlined. Factory managements have slightly different ideas of planning, but in the main the chart is representative of the average schedule drawn up by the production planning engineers.

The schedule, which is based on the various functions shown in the chart, gives dates by which each operation is to be completed. The period will probably extend over six months, so that with the preliminary stages during which ideas are tried out and developed in a general way with no particular receiver in mind, a total time of twelve months may elapse before a certain feature of design is available to the public.

Once it had been decided to bring out a new receiver incorporating special features a conference between the sales and designs departments, attended by representatives from Service, Factory, and Inspection sections, will probably be held to decide the backbone of the receiver—5- or 6-valve superhet, the price market which it is proposed to attack, the output power, wave ranges, etc.

Question of Cost

With the cost ever before him, the designer allocated to father the receiver

(Continued on next page.)

MODERN FACTORY PRODUCTION METHODS

(Continued from previous page.)

then sets about making up the first hand-made model. Naturally, as all receivers are but an assembly of components he must know intimately the specification of each item. If he cannot find a standard part that will meet his needs, he must get one specially designed to his requirements.

In the sphere of radio designers there are men who are specialists in just one thing—condensers, coils, loudspeakers, etc. Large manufacturers retain a group of such experts; smaller firms call in consulting engineers having the required qualifications, or put their problems before component manufacturers.

Components

The next stage for the receiver designer, therefore, is to advise the component experts of the parts he intends to use, how he means to use them (applied voltages, desired length of life, etc.) and to receive their report on each one.

Some manufacturers of radio receivers prefer to buy their components from firms who have specialised in the making of the parts required, as this has in many ways a definite advantage over making the components in the factory. As they will have been designed by experts in collaboration with the receiver manufacturer's designers, any faulty component can be sent back for free replacement, or credit, should trouble appear in the components after they have been accepted by the receiver manufacturer. The component manufacturer obviously wishes to retain the goodwill of his client, and will readily meet any reasonable demands.

On the other hand, the making of components by large radio receiver manufacturers can be made financially advantageous, as most of the machinery, such as punches and presses, are quickly adaptable from one type of operation to another, so that by a change of tools the machines may be made to turn out the various parts needed to make up the particular components required at the time.

Factory Making Own Components

The disadvantage of a factory making its own components is that if a mistake is made, and faults develop, these will often not be found until all the components have been manufactured, which means that the components must be modified or even new ones made at the expense of the factory, so that no profit or even a loss is effected in the making of the components.

For the purpose of these articles, however, it will be assumed that all, or some, of the component parts for the radio receiver under consideration are made in the one factory. Any meeting or conference between receiver designers, component designers and production engineers will take place in other concerns just the same, but the components manufacturers would send along their own technical representative to be present at the various discussions.

However, as stated, we have arrived at the stage in the receiver's progress where the designer commences to make contact with departments outside his own. It is also the stage at which theory and ideas must be translated into practical work, and the early processes of mass production planning.

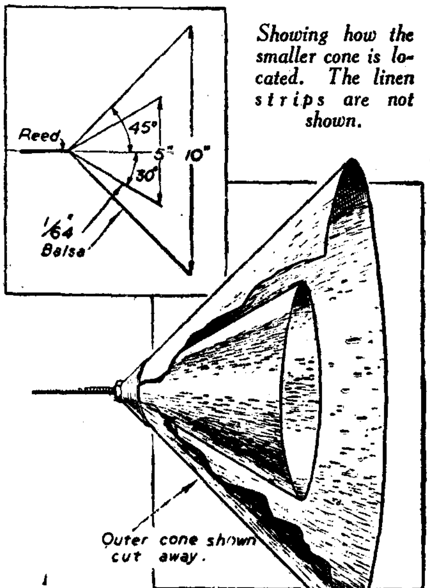
The next article will describe these processes, and will show how the service engineer of even the humblest status plays an important part in the designer's deliberations.

B.L.D.L.C. The British Long-Distance Listeners' Club

NOW that this page will be appearing monthly, it is hoped that sufficient constructional information will be received from members to enable us to make it of greater interest to the practical man. From the tone of the numerous letters received, it would seem that many members are carrying out quite interesting experiments, and constructing some rather original pieces of apparatus, but owing to their modesty they are inclined to get the impression that their efforts would not be of general interest and do not, therefore, give us any constructional details. It is rather a pity that this happens, as it is quite possible that the very item they have made, or the results they have obtained from a certain experiment, is just what many other members require. When writing to us, remember the *other fellow*, and let us have all the essential details, as we can then tell whether it is worthy of inclusion in this page. In any case, you will be showing a genuine desire to take an active part in the movement.

It has been left to Member 6,713, of Sparkhill, Birmingham, to start the ball rolling, and we thank him for his letter, and the suggestion which we give below. "This is the first letter I have written to you since becoming a member of the B.L.D.L.C., because I think that most of my experiments would not interest other readers (Why ?—*Sec.*). However, there is one thing that might be of general interest, and that is a rather novel idea concerning cones for ordinary moving-iron speaker units. I purchased a large sheet of balsa, 1/64in. thick, and cut from it a piece suitable to form a cone for the spare unit I had on hand. When I tested it in conjunction with a small set, I was amazed at the wonderful frequency response, due, no doubt, to the rigidity of the cone, and its extreme lightness. I have tried various angles and cone sizes, but I have found that for the moving-iron speaker, a cone 10in. in diameter, with an angle of 45 degrees, used in conjunction with another cone of 5in. in diameter, at 30 degrees, produces the best over-all response.

To reduce strain on the reed, the cones



Showing how the smaller cone is located. The linen strips are not shown.

are supported by a thin linen strip, fastened to their edges with a smear of adhesive.

The small diagram has been reproduced to indicate the general ideas outlined by the member, and we would refer those interested to an article dealing with cone formation which appears in our issue of June 8th, page 255.

Smile a While

WE are indebted to Member 6,679, of N.22, for this very snappy little story from across the Atlantic. When listening on the 20-metre band at 01.29 B.S.T. last week he heard the following being told by W1ON, who was in contact with W4EWY. He quotes the conversation from W1ON, "Three U.S.A. hams who were very interested in 2.5 metre work, decided to take their portable TX's out into a high part of Boston, Mass., and experiment. They drove their cars to the spot concerned and separated about 50 yards apart, and after contacting each other moved further apart to see how long they could keep in touch. When they had got about two miles between each station, one of them was calling in the usual manner, i.e., W1JFS . . . W . . One . . . Japan . . . France . . . Spain, when a couple of elderly people came along and seemed very interested in what was going on. To cut a long story short, they wrote down the car registration numbers and reported them to the local police, who came along and stopped the experimenters' activities. About half an hour later, the State Police came along on motor-bikes, and told the hams that they had been reported as Fifth Columnists, who had been transmitting to Japan, France and Spain.

After quite a lot of explanation, and on production of their Ham Tickets, they were allowed to continue, but were advised to say Joan . . . Fred . . . Stan, instead of Japan . . . France . . . Spain."

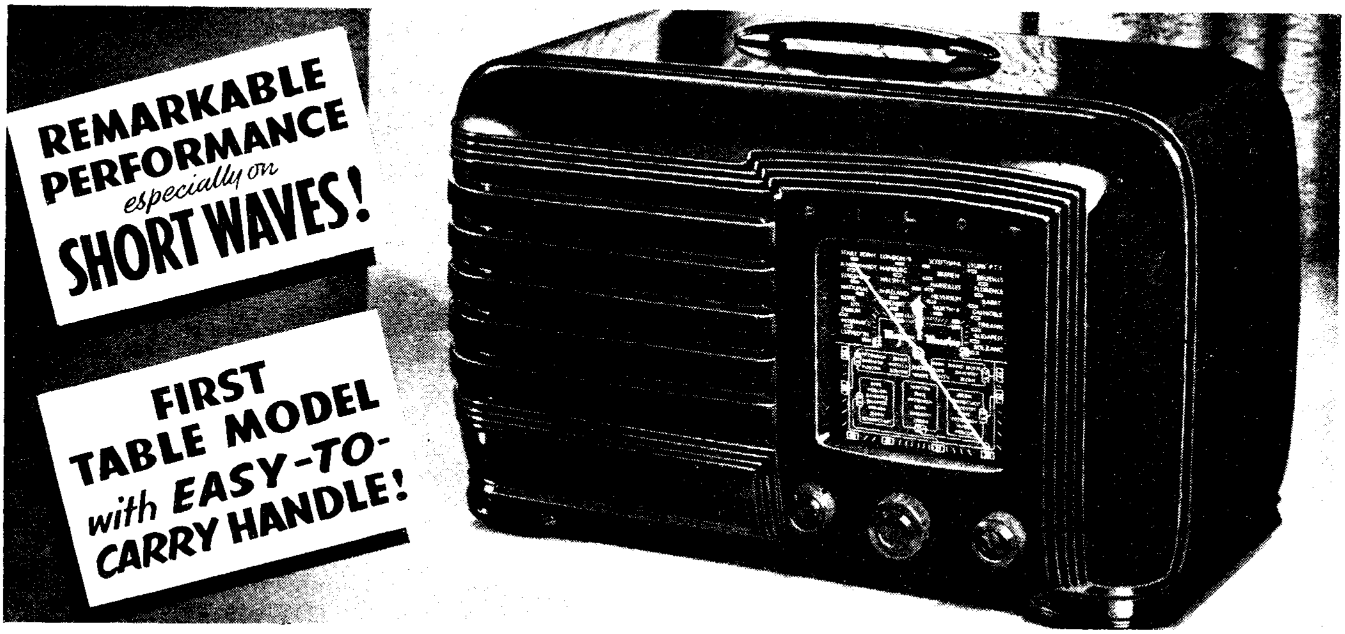
As all S.W.L.'s and ex-Tx'ers will readily appreciate, the words Japan, France and Spain are used to identify the call letters JFS.

Before concluding his letter, Member 6,679 adds, "It may be of interest to fellow members to state that I receive WJSV (U.S.A.), on approximately 245 metres at 05.00 G.M.T., and have received an official verification by letter from this station, which is owned by the C.B.S., whose station is at Washington D.C."

Change of Address

Member 6430 wishes to notify all correspondents that his address is no longer 2, Jenkinsville, Penarth, but now "Grosvenor," Lower Westbourne Road, Penarth, Glamorgan.

TO-DAY'S SET FOR WORLD LISTENING!



Features : Suitable for operation on 200/250 volts. 100/115 volt models available. Smart Bakelite Cabinet (walnut shade). Size : 9in. high, 15in. wide, 6¾in. deep. Illuminated dial scale in glass, in colours. Fast and slow motion tuning. Large mains energised speaker. Medium and Short Waves, covering 200-570 metres ; 16.5-54 metres.

Go places with Pilot's Major Maestro ! Up-to-the-minute news from Europe . . . Continental orchestras and dance bands . . . the great programmes of America—the Major Maestro gets them all with the power and performance of a set twice the size and price. There's been nothing like it before. A real Table model with a neat carrying handle ! Just plug it in—and it plays. A.C. or D.C. mains. No earth required and 20ft. of aerial wire is self-contained. A timely all-British set at a real economy price !

7½ GNS

(Prices do not apply in Eire)

Pilot Major Maestro

5 VALVE AC/DC SUPERHET *Short & Medium Waves*

Free TRANSATLANTIC WAVE-LENGTH CHART!

FREE ! TRANSATLANTIC WAVE-LENGTH CHART.

Please send me full details of Major Maestro and all Pilot quality receivers. Also Free Wave-length chart. A wonderful aid to Short Wave listening.

Name...

Address..

.... P.W.1.

Post in unsealed envelope, ½d. stamp, to Pilot Radio, Ltd., 31-37, Park Royal Road, N.W.10.

PILOT RADIO, LTD., 31-37, PARK ROYAL ROAD, LONDON, N.W.10. *Tel. : WILlesden 7353-7*

New Cossor Programme

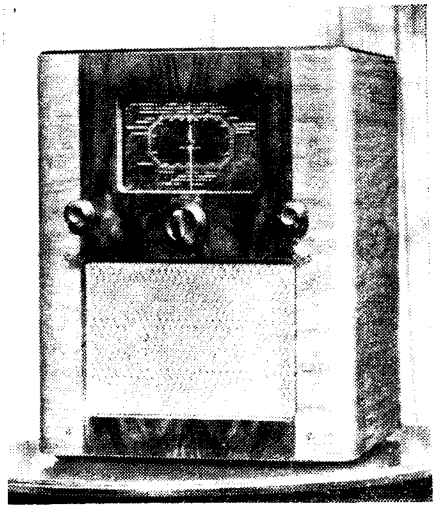
DETAILS have just been received of some of the latest Cossor releases, some of which are illustrated on this page. The complete programme provides most interesting reading, but owing to the fact that space prevents us from giving extensive details of each model, it is hoped that the brief general surveys will be sufficient to convince our readers that the features which have always distinguished the Cossor receivers, namely, remarkable range, clear cut and vivid reproduction, absolute reliability and, above all, value for money, are still maintained in the highest degree in the new addition to the already familiar range of Cossor products.

Battery Melody Maker

Commencing at the bottom of the price scale, there is Model No. 39 which is a three-valve battery-operated "Melody Maker," and retails at the very reasonable price of £7 19s. 6d. This figure does not, of course, include batteries. The circuit is of the variable-mu H.F. stage type feeding into an H.F. pentode as the detector, which in turn is coupled to an economy output tetrode. The current consumption is extremely economical, a vital factor these days, and ample accommodation is provided inside the modern design well-finished walnut cabinet for the batteries. The latest type of P.M. moving-coil speaker is fitted, and provision is also made for an extension speaker and gramophone pick-up.

A.C. Mains Receiver

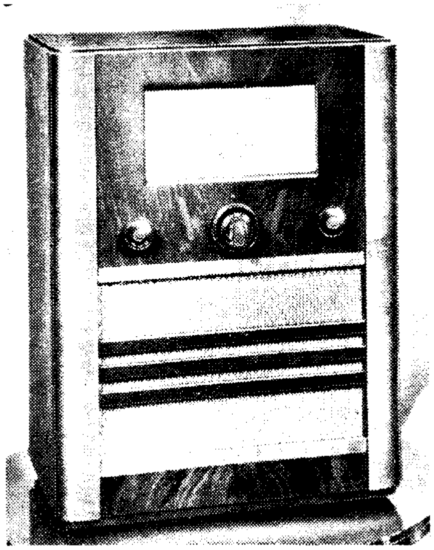
For those requiring an A.C. operated receiver Messrs. Cossor's have catered for them by providing a four-valve receiver of reasonable price with their Model No. 49. This is actually a three-valve receiver, the fourth being, of course, the rectifier having a similar circuit arrangement to Model No. 39, with the exception that the output valve is of the triode power class. The special coils employed give increased performance and high degree of selectivity, while the 8in. energised moving-coil speaker maintains the Cossor reputation for brilliant reproduction. The chassis and speaker are housed in a two-tone modern cabinet finished in polished walnut, and the illuminated wavelengths scale carries a full calibration of stations. Provision is made for an extension speaker and gramophone pick-up, and the price of this attractive receiver is only nine guineas.



Another Cossor receiver in the new range. Model 49 4-valve A.C. mains "Melody-Maker."

Superhet

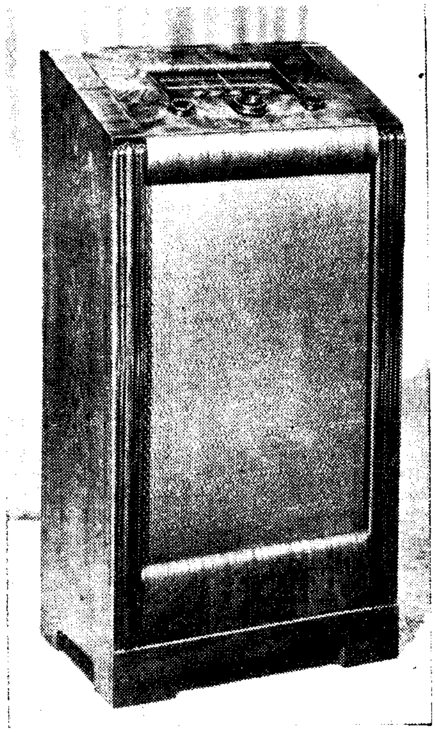
There is always a vast number of listeners who prefer a superhet receiver, and this section of the public has not been over-



Model 35.—4-valve All-wave Cossor battery superhet.

looked in the new programme. Model No. 35 is a four-valve battery-operated receiver incorporating economy high slope output stage, high efficiency A.V.C. system, full vision calibrated dial, automatic grid bias, and a wide response 8in. moving coil speaker. Unlike the two previous models, the No. 35 is designed for all-wave reception, the wave-bands covered being 16.35 to 51.3 metres, 190-590 metres, and 835-2,150 metres. High "Q" Coils are used together with permeability-tuned iron cored I.F. transformers, and iron cored pre-selector coils on medium and long waves. The price of this model is £10 without batteries.

A receiver above average in performance, reliability and performance is the Model No. 63, which is a five-valve all-wave superhet console which is priced at £14 7s. 6d. With this receiver clear-cut reception from an unusually large number of stations on all free wavebands is made possible by a brilliantly designed highly efficient superhet circuit. An exceptionally high degree of selectivity permits stations working on adjacent wavelengths to be received freely and without interference. The handsome polished walnut cabinet has been successfully designed on correct acoustic principles to do full justice to the rich, natural beauty of tone of the wide response 8in. moving-coil speaker. Full A.V.C. large edge-lit tuning dial calibrated in wavelengths and station names adds to the distinctive appearance of this model.



The new model 63.—5-valve All-wave Cossor A.C. mains console.

New American Pick-up

IT is reported in the American journal *Communications*, that engineers of the Philco Corporation of America have designed a gramophone pick-up utilising a photo-electric cell.

The operation of this interesting device is quite simple. A small mirror is mounted on a rotating axis which swings as the needle (a jewel point) follows the sound impressions on the record groove. A beam of light is directed on to the mirror at an angle which causes it to be reflected on the photo-electric cell.

As the needle vibrates in the record groove, the mirror swings from side to side on its axis, and flashes the reflected beam of light on and off the sensitive area of the photo-electric cell. In this way the current generated by the cell is made to vary according to the impressions on the groove of the record, and is subsequently amplified in the usual way.

To minimise the amount of energy required for the needle to swing the mirror, an exceedingly thin mirror is employed of the type used in reflecting galvanometers. This is "silvered" with vaporised aluminium, and mounted on a minute block swinging on an axis carried on two flexible bearings.

Another problem involved the design of a bulb to supply the light beam, and to meet technical requirements as to size and weight a special small gas-filled bulb was designed. It was found that if the light was produced by a 60 c/s current flowing through the filament, the flicker, although not visible to the eye, modulated the final output. Consequently the lamp supply current had to be obtained from a high-frequency source, which was actually an oscillator generating at 1,800 kc/s.

Planning a Power Pack

Some General Practical Notes on the Most Important Points to be Observed

IT is fairly obvious that the design of the power-supply unit or the power pack of a mains receiver is closely linked with the design of the receiver itself. But it is customary to decide on the circuit and general details of the set before completing the details of the power supply. At the same time, it should be remembered that, even when considering the receiver, some thought should be given to the limitations of the power supply section, as far as the economic output is concerned. For example, if it were found that by using a P.M. speaker an H.T. voltage of 250 would be ample, whereas when using an energised speaker it would be necessary to have a voltage of between 300 and 350, it might be possible to effect a good saving in the cost of components by employing the P.M. unit.

For the purposes of the present article it will be best to confine our attention to A.C. mains receivers, since various additional points arise when dealing with power packs for battery receivers. And again, the power-supply system for a D.C. or universal set calls for rather special consideration. It will probably be possible to deal with the questions arising in connection with the two latter cases at a later date.

H.T. Required

Although it might appear obvious to many, it is not always realised that in working out a design for the power pack it is essential that a start should be made by considering the exact requirements of the receiver. First comes the matter of H.T. voltage. The majority of output tetrodes and pentodes have a maximum anode voltage of 250; and it is worth while to work fairly near to that voltage if maximum efficiency and output is desired. Because this is the anode voltage, however, it does not follow that it is the maximum required H.T. voltage. From the latter must be subtracted the voltage drop across the bias resistor—probably about 15 volts—and also across the smoothing choke and primary winding of the speaker transformer. If the choke had a resistance of 200 ohms and the total current consumption of the set were 50 mA, the drop across this component would be 10 ohms. If we assume that the drop across the transformer primary is similar, we find that the total voltage "lost" amounts to 35. That would seldom be considered serious unless the full output of the output valve was considered necessary. But if a choke with a resistance of 500 ohms were used and if the bias voltage were 20 the voltage actually applied to the anode of the last valve would be under 200. This would entail an appreciable loss of volume.

Effect of Current

There are some possible counteracting influences which are worth remembering, however. For example, it was assumed above that the total current consumption was 50 mA; if the rectifier in use had an output of, say, 75 mA at 250 volts (with the particular transformer to be used), the actual voltage supplied when the load was only 50 mA would probably be over 300 and therefore the output valve would receive its maximum anode voltage when operated under the conditions set out above.

It is seldom that the receiver requires the exact voltage and current which constitute the maximum output of the particular rectifier to be used, and it is consequently important to determine the voltage developed at the normal operating current. This can be found from the makers' output curves for both valve and metal rectifiers, and should any doubt exist after studying the curves, the makers will always be glad to advise.

Should it be found that the voltage will be higher than that required, it will often be possible to insert a fixed resistor in series with the smoothing choke, to replace the

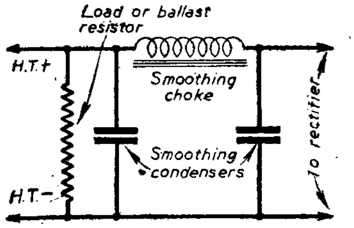


Fig. 1.—To keep down the rectifier output to that which is normal at full current load it may be desirable to use a "ballast" resistor, as shown here.

choke by one of higher resistance or by the field winding of an energised speaker, or to use a mains transformer having a secondary winding giving a lower voltage than that normally specified for the rectifier.

Another method is to connect a "load" resistor across the output from the smoothing choke, as shown in Fig. 1; this will act as a "ballast" and prevent undue voltage surges. In that capacity it represents a safety measure and gives protection to the smoothing condensers. The resistor must, of course, be chosen so that it just "absorbs" the excess voltage, or—to express it differently—just brings the current consumption up to the rated value of the rectifier. This value should never be exceeded in an attempt to cut down the voltage, for if it is the rectifier is almost sure to suffer.

Methods of Rectification

There are three general forms of rectification: full-wave, half-wave and voltage-doubler. Each has its own uses, but half-wave is seldom employed if one of the other forms can conveniently be adopted. Full-wave is almost universally employed with valve rectifiers, whilst the voltage-doubler system is generally to be preferred with metal rectifiers. This statement is not intended as a strict rule, since it is often found very convenient to use a metal rectifier in a half-wave circuit in order to obtain the required output when using a transformer which may be readily available. To make this point quite clear it may be mentioned that the Westinghouse H.T.14 metal rectifier (the smallest in the range) has an output of 20 mA. at 140 volts, and that the input required when used as a voltage-doubler is 80 volts, 60 mA; as a half-wave valve the required input is 135 volts, 30 mA.

The different rectifier connections are shown in Fig 2, where it will be seen that the two condensers in series are required for smoothing the output of a voltage-doubler.

Type of Rectifier

In deciding whether to use a valve or metal rectifier there are so many points to consider that it would be impossible to detail all of them here. In general, it may be found that the first cost of the metal rectifier is rather higher than that of the valve, but against this must be set the fact that the metal rectifier is practically everlasting, whilst the valve must be replaced after a few years of use. The valve is usually less bulky and might therefore be chosen where space is at a premium; on the other hand it is inclined to heat up to a somewhat greater extent if easy air circulation is not provided.

There is another advantage to be placed to the account of the valve, which is that it can be obtained with an indirectly-heated cathode, if desired. This is an advantage when the valves in the receiver are of the indirectly-heated type, since it does not produce its full output until the receiver valves are in a condition to "absorb" it. This means that there is no voltage surge when the set is first switched on, and that the smoothing condensers can have a lower working voltage.

In many cases, however, the type of

(Continued on next page.)

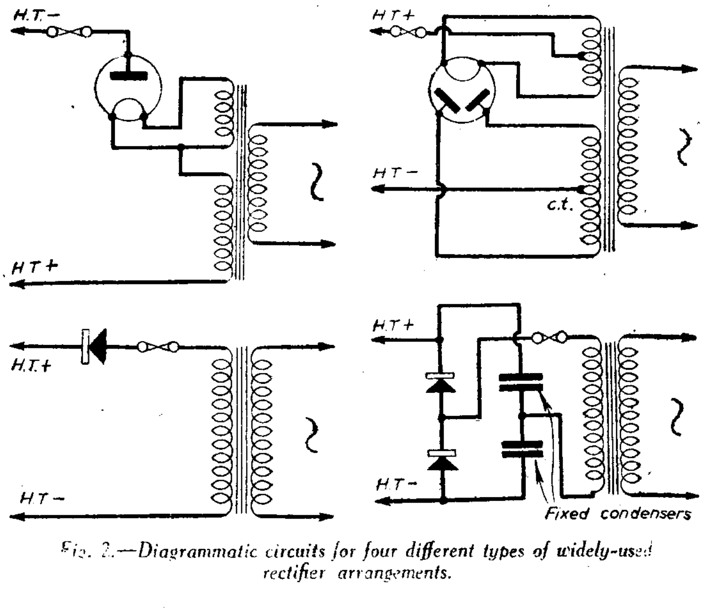


Fig. 2.—Diagrammatic circuits for four different types of widely-used rectifier arrangements.

PLANNING A POWER PACK

(Continued from previous page.)

rectifier will be governed by the output required, since the output ratings of metal rectifiers are different from those of valves. It is, of course, an easy matter to vary the output of either by using a different transformer, but there is always an advantage in adopting transformers of standardised types.

Mains Transformer

It will have become clear from the above that the choice of mains transformer depends primarily upon the rectifier to be used. After settling the question of the H.T. current, the L.T. winding or windings arises. If all the valves in the receiver require the same L.T. voltage, and all are of the indirectly-heated type a single L.T. winding will suffice, but when a directly-heated output valve is used in conjunction with indirectly-heated valves for the preceding stages it is better to have a separate winding for it. If a valve rectifier is to be used an additional L.T. winding will be required for its filament or cathode.

Many constructors entertain some doubts about the current rating of the L.T. winding. For example, if the winding is rated at 4 volts, 5 amp. (or 2-0-2 volts, 5 amp., as some makers describe it to indicate that the winding is centre tapped) the question arises as to whether or not the voltage will rise excessively if the consumption is only, say, 3 or 4 amp. In almost every case the answer is in the negative, since the ampere figure is the maximum for the transformer. Provided that the transformer has good "regulation"—which really means that it is a reliable, well-made component—the voltage will vary only within very small and negligible limits if the consumption is less than the maximum rated output. It is, however, essential that a good transformer be used; a poor-quality component will almost certainly give rise to trouble of one sort or another.

Smoothing Components

After the transformer we have to consider the important smoothing equipment, which comprises the choke and the necessary condensers. The importance of choke D.C. resistance has already been dealt with, and need not be considered further. There is also the question of inductance; in general, if this is between 20 and 30 henries *when passing the full H.T. current required by the set*, it will be adequate to prevent mains hum. It is important to bear in mind that an inductance rating at less than the maximum current is practically meaningless and should not be considered.

Smoothing condensers are generally of 4 mfd., and the electrolytic type is generally preferred, if only because of their more compact construction. Remember, however, that capacities of 6 mfd. and 8 mfd. are sometimes specified by the maker of the rectifier and should then be used, since quite apart from their effect on smoothing they govern the voltage output to some extent.

The important rating is the working voltage, and this should be about twice the output voltage of the rectifier at full current loading, so that there is an ample margin for the higher voltage developed at lower outputs. This rule can be disregarded when using an indirectly-heated rectifying valve or if a thermal-delay switch is incorporated in the output lead. In no case should the rated working voltage be as low as the rectifier output voltage at the working current load, for if it is there will sometimes be a danger of breakdown—although it should be remembered that the so-called working voltage is usually only about one-third of the "test" or "breakdown" voltage.

TEST REPORT OF THE
PILOT MAJOR MAESTRO

Brief Specification

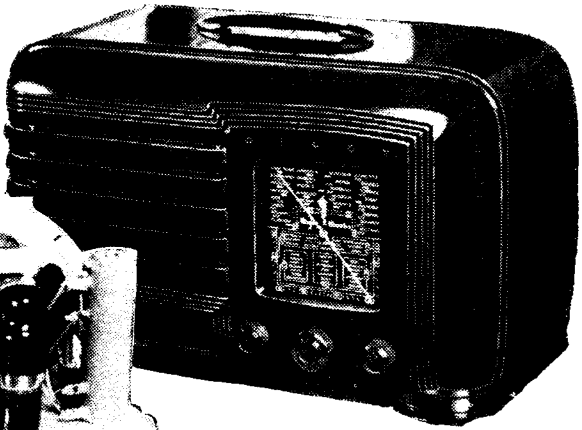
FIVE valve A.C./D.C. superheterodyne receiver suitable for operation on 200-250 volt supplies. (It is possible to obtain models suitable for 100-115 volts at an extra charge of 5s.) Bakelite cabinet, 9in. high, by 15in. wide, by 6¾in. deep, incorporating a carrying handle. Medium and short waves covering 200-570 metres, and 16.5 to 54 metres. Illuminated dial scale calibrated with station names and wavelengths. Fast and slow-motion tuning, mains energised speaker, 3-watts undistorted output, and full automatic volume control. Self-contained aerial of the throw-out type.

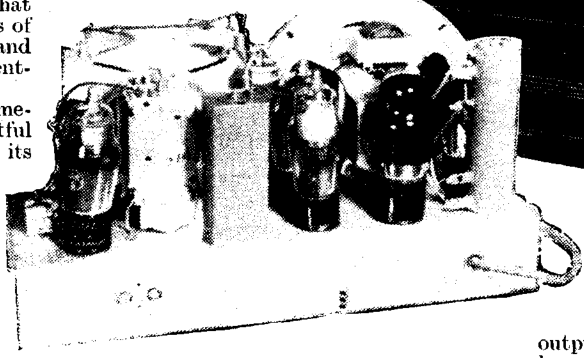
Price, 7½ guineas.

During the course of the year we have the opportunity of examining quite a number of commercial receivers, and although each individual model usually reveals some distinctive feature, we must admit that the Major Maestro stands in a class of its own, and should fill a great demand for a compact receiver to meet present-day requirements.

On opening the carton one is immediately impressed with the delightful finish of the bakelite cabinet and its pleasing design. The large station-marked illuminated dial gives clear vision on all the wave-bands covered by the receiver, and this is a very important feature when one is concerned with the reception of those stations on the higher frequencies. Bearing in mind the low price of the receiver, the overall specification is really remarkable and, unlike many of the lower-priced models, it incorporates a very efficient fast- and slow-motion tuning drive which eliminates the difficulty so often experienced of obtaining perfect adjustment on the short-wave settings.

The loudspeaker fret is certainly distinctive; its design is such that although a free passage is provided for sound radiation, and complete protection is provided for the cone, no awkward ornamentations are embodied to form dust traps. In the back of the receiver a small compartment is provided for housing the 20ft. of throw-out aerial which can be wound on a neat former and inserted in the compartment during transit. Quite good results can be obtained with the aerial in this position, but when it is unwound, and stretched out to its maximum length, a considerable increase in sensitivity is naturally obtained. This applies, in particular, to the short-wave transmissions. As is usual with most A.C./D.C. receivers of this type no earth connection is required, so it is quite an easy matter to bring the receiver into use in any room fitted with a source of electricity, and in this direction it is also worth noting that the weight of the set allows even a child to carry it with ease. The moulded bakelite carrying handle does not upset the lines of the cabinet as the makers have taken the trouble to arrange its fixing so that it sinks back on to the top of the cabinet when not in use.





The pleasing lines of the cabinet are revealed in the above illustration, while that on the left shows the sound engineering practice adopted for the chassis.

Test Report

The makers claim of full rich tone equal to receivers of twice the price was amply substantiated during our tests, as we were very impressed with the overall response which has been adjusted to give the most pleasing results on the speech and music. It is only fair to say that the set was put through its paces in a steel-framed building. Therefore, we know from past experience that we did not attain the results which the average user would, but even so, the performance was most satisfactory on medium and short waves: as a matter of fact, the stations coming within the latter, came in with remarkable strength and very consistent volume, as selectivity proved adequate on all frequencies and the output was far in excess of that which would be required for normal domestic purposes.

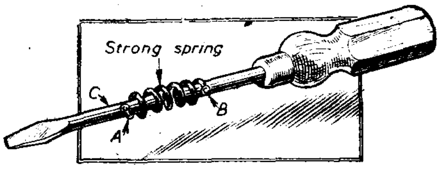
General Remarks

The Pilot Major Maestro can be recommended with confidence to those who require a compact and efficient receiver of the A.C./D.C. portable type. Needless to say, it is covered by the usual 12-months guarantee, which applies to all Pilot Radio models, and can be obtained on very convenient hire-purchase terms. The makers are Pilot Radio, Ltd., 31-33, Park Royal Road, London, N.W.10.

Practical Hints

A Screwdriver for Awkward Places

THE accompanying sketch shows a screwdriver that I have found very useful for dealing with screws in inaccessible corners. The shaft is cut in two and a hole drilled at points A and B an inch or so from each respective cut end. A piece of strong spring is then taken (this spring



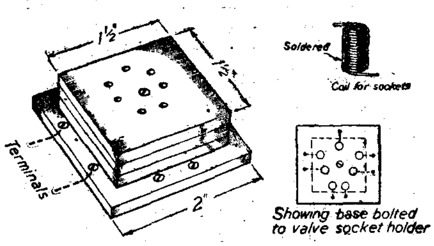
A novel screwdriver for use in awkward places.

should fit closely over shaft) and the temper at the two ends is drawn by heating and allowing to cool slowly; but before cooling, hammer the ends flat, and then drill holes corresponding with those in the screwdriver shaft. Through the shaft and each hole in the spring a short piece of iron rod metal (red hot) is pressed and riveted over.

A collar of metal could be passed over the cut shaft at C, if desired, but I did not find it necessary.—J. R. WOOD (Stonehaven).

Simple Home-made Valveholders

FOR those living in remote country districts, the following method of making seven-pin valveholders should prove useful. Cut three pieces of ebonite about 1½in. square, and one piece 2in. square. Drill a hole through the centre of each piece, countersinking one side of one 1½in. piece, and one side of the 2in. piece. Bolt the three smaller pieces together, and mark the valve-pin positions in the usual way with a dab of white paint. Make the pin sockets by forming a coil of wire into which the pin will fit fairly



A method of making improvised valve holders.

tightly, leaving one end for connecting, and coat it with solder to make it rigid. Drill out holes for these sockets where marked by the paint, and slip them in, leaving the ends protruding for connecting. Now remove nut from the fixing bolt, and slip on the 2in. piece for the base. Bolt all firmly together. Terminals can be fitted to base piece if required, or the wire ends left for soldering. For chassis mounting, small holes drilled in the base and corresponding with the pin sockets to allow the wire ends to pass through can be used. Holders for all pin-base valves could be made in this manner.—ALAN ALDWORTH (Bridport, Dorset).

Automatic Morse Sending Device

I RECENTLY started to teach myself the morse code, and soon became quite efficient at sending in morse. I was, however, unable to get on very well with the "receiving" of morse as I had nobody who could practise with me. I therefore made up the automatic key illustrated and which I found worked very well.

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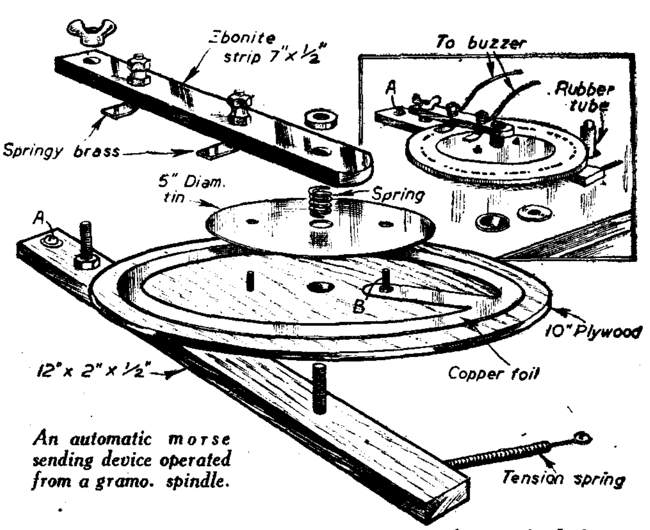
> **SPECIAL NOTICE**
>
> **All hints must be accompanied by the coupon cut from page iii of cover.**

The chief feature of the automatic key is that any number of paper discs can be made, each with different groups of signals.

The component parts consist of a strip of wood 12in. long, 2in. wide, and ½in.



An automatic morse sending device operated from a gramo. spindle.

thick; an ebonite strip 7in. long by ½in. wide; two springy strips of brass; a tension spring; and a plywood disc 10in. diameter. On to this disc is glued a strip of copper foil ½in. wide, at about ½in. from the edge of the plywood disc. From this circular contact path a strip of copper foil is taken to one terminal screw, as shown. A central contact disc of tin 5in. diameter is fitted as indicated. The inset illustration shows how the whole may be fixed to a portable gramophone by screw A. The tension spring keeps the plywood disc tight against the gramo. spindle, over which a piece of rubber tubing has been slipped to prevent any tendency of the disc from slipping.

The paper records or discs are cut from brown paper, and are 10in. in diameter. On these paper discs a circle 8½in. in diameter is drawn as a guiding line on which to punch the dot and dashes. In my case I used a 3/16in. leather punch for the purpose. Punch one hole for a "dot" and three holes overlapping each other for a "dash," the space between each "dot" or "dash" being the width of one hole, and the space between each word or group of letters being the width of five holes.

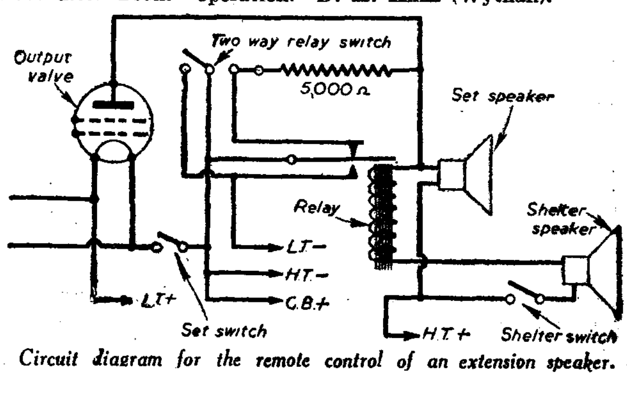
The paper disc is placed on the plywood disc, the metal disc is then placed on top of the paper disc, so keeping it in place, and also making contact through screw B with the copper foil. The ebonite strip is then placed over the two bolts so that the springy brass strips make contact, one with the metal disc, the other resting on the trail of the "dots and dashes." Two leads are taken from the terminals on the ebonite strip to the buzzer or oscillator.

When the gramo. motor is started, and the disc revolves, the outside brass contact strip will make and break contact with the copper foil path as it passes over the dots and dashes punched in the paper disc.—D. J. MORRIS (Pentre, Rhondda).

A Remote Control Device

MANY people during prolonged air raids have wished for a wireless set. In many cases people have an extension speaker in the shelter, but owing to a hurried exit from the house are unable to switch on the set; and even if the set can be switched on the home service closes down just after midnight, thus a method for switching off is required. The method I have adopted is simple, foolproof, and works very well. It requires no extra wires from the set to shelter; all that is required is two toggle or other type switches, a sensitive relay about 5 ma. and a resistance about 5,000 ohms.

It will be noticed that the two-way relay switch is shown in the "on" position. In the other position it is ready for set operation.—D. H. HALL (Wythall).



Circuit diagram for the remote control of an extension speaker.

ALL-DRY 4-VALVE

Constructional Details of c
the Latest Type of N

THE development of modern radio equipment has followed interesting lines, and for some years now the majority of improvements which have been introduced have been in the direction of operating mechanisms or modified components. The valve has remained more or less stationary, and the various attempts which have been made to cater for the battery-user, by reducing the cost of maintenance or giving improved performance comparable with mains equipment have failed, or met with little success. Some time ago news was received from America that a successful valve had been produced which dispensed with the accumulator, and although this meant that the portable type of receiver was brought into the really portable category, there were other advantages to be obtained from such a type of valve. It was not long before these valves were brought on to the English market and now they are available to the home-constructor, and in accordance with our policy of introducing all modern improvements to the home-constructor as soon as they are generally available, we now have pleasure in putting before our readers the first amateur-built receiver using these new valves.

For the benefit of new readers or those not familiar with the latest type of valve it may be mentioned that they are commonly referred to as "all-dry" valves, on account of the fact that the filaments are so designed that they may be fed from a small dry cell, having a voltage of 1.5. The essential detail of valves of this type must be a very low current consumption, and in the valves used in this receiver the current is just half of that taken by ordinary battery valves. These are generally rated at .1 amps., and thus the valves in the new class are rated at .05, although in some cases a higher current has to be taken in order to obtain certain characteristics.

Essential Details

The provision of a supply source for the filaments was originally met by using small separate dry cells, but it is obvious that if a single battery could be used to supply both H.T. and L.T. it would enable a more compact receiver to be made up and at the same time would simplify the question of replacements by needing the purchase of only a single battery unit. The question of the current, however, rather tended at the beginning to complicate matters as the cells in normal H.T. batteries would not stand up to the total filament current drain of a multi-wave receiver and thus the L.T. section would become discharged before the H.T. section. Thus, in the modern batteries a number of standard cells are wired in parallel to provide the L.T. supply, and therefore, by taking a standard high-voltage H.T. unit, and using a number of cells in this way, there is still 90 volts or so available for H.T. with an L.T. section which will last as long as the H.T. portion and thus the desired end is obtained. The maximum H.T. rating for the anodes of the valves in question is, in fact, 90 volts. The use of automatic grid bias in the usual manner removes the necessity for a grid bias battery and thus a single battery unit becomes practicable for a receiver even of the 5- or 6-valve type.

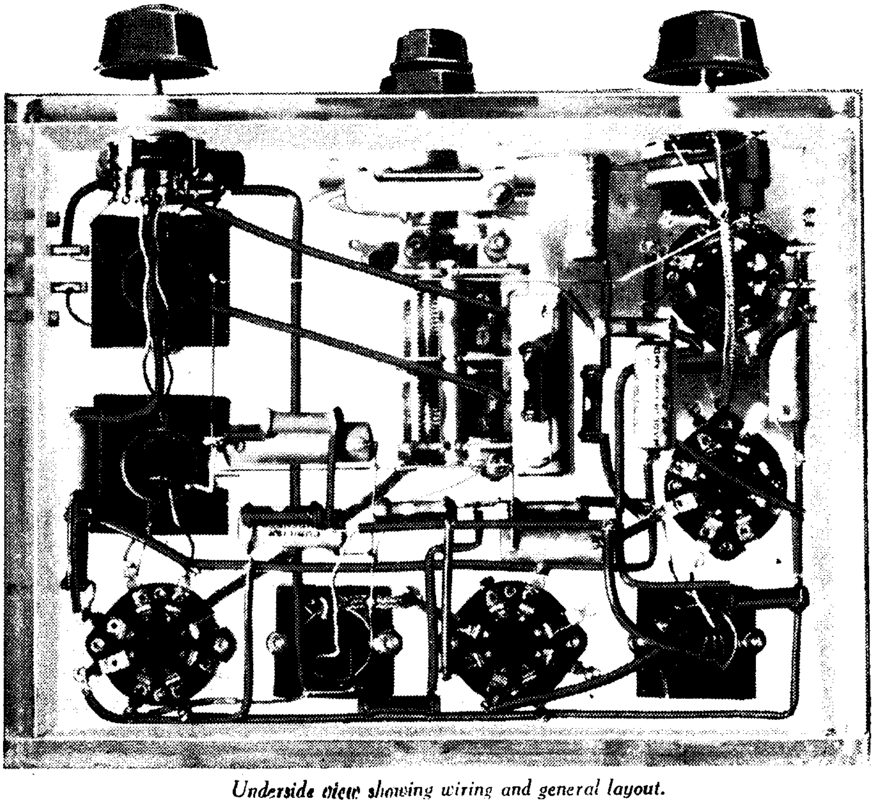
Superhet or Straight?

The valves which have so far been introduced have been designed for use in the superhet type of receiver, this providing maximum efficiency with a minimum number of valves, and the inclusion of a single-diode-triode enables the overall number of valves to be kept at a minimum whilst still permitting all modern superhet refinements, such as A.V.C. for instance, to be introduced. In the design now to be described we have used a frequency changer without initial H.F. amplification, an intermediate frequency stage, both of which are of the variable-mu type and controlled by the A.V.C. section. Next comes the single-diode-triode providing rectification, A.V.C. and the first L.F. stage, the usual volume control being included in the feed to the L.F. section in the customary manner. The output stage is of the pentode type, and the intervalve coupling is of the resistance-capacity type. The auto-bias arrangement is standard, with a large-capacity electrolytic by-pass condenser.

The aerial and oscillator coils are of the dual-range type, as it was decided not to make this particular model an "all-wave" design for various reasons. The switching is simplified in a standard dual-range model, and the coils used (Bulgin square-can types) require a three-point unit for each coil, and it is thus possible to use a very neat rotary-action switch of the multi-contact type to obtain the desired switching action. The I.F. transformers are also of Bulgin make and provided in similar square cans, and these have the customary preset trimming condensers incorporated. The trimming of an oscillator coil is one of the things which usually debars the home-constructor from making superhet receivers, and the problems of adding tracking or padding condensers are not easily solved. However, Messrs. Bulgin have overcome this difficulty for the constructor by including the necessary condensers inside the coil can in the same manner as with the I.F. transformers, and thus the wiring is simplified and the trimming is easily carried out.

Constructional Details

The receiver was built in its original form on a transparent chassis, but ordinary



Underside view showing wiring and general layout.

LIST OF C

- One Bulgin coil, type 72.
- One Bulgin coil, type 70.
- Two Bulgin I.F. transformers, type 73.
- One 2-gang tuning condenser, bar-type J.B., .0005 mfd.
- One tuning dial, J.B. square Airplane type.
- One wavechange switch, Bulgin type, S.204.
- Four octal valveholders (Clix).
- One each A.E. and L.S. socket strips (Clix).
- *Fixed condensers* (Dubilier): Two .1 mfd., type No. 4603/S.; three .04 mfd., type 4601/S; two .0001 mfd. type 4601/S;

SUPERHET

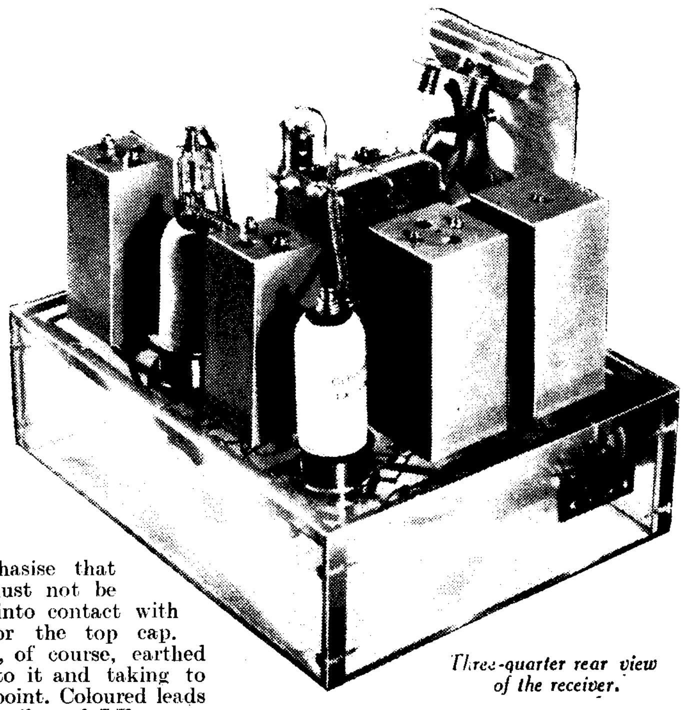
. Battery Receiver Utilising on-accumulator Valves

plywood may be used, or a metal chassis should one be available. Metal offers many advantages, but under present conditions it is not easily obtained. In this connection one important point must be stressed at this stage. The coils specified are provided with a special fixing lug in the form of a spring grip designed for insertion in a slot in 18 S.W.G. metal. Accordingly the coils cannot be fixed direct to wood or thinner metal as the holding edges of the fixing lug will not grip tightly, and although the coil would be held in position it would be insecurely held and would be likely to move or even come adrift entirely. Therefore, if wood or thin metal is employed a separate holding strip must be made from 18 S.W.G. metal, and this need only be wide enough to form a base for the coil and sufficiently long to permit screws to be driven into the ends to hold it to the top of the chassis. Most constructors will be able to find a suitable spare piece of metal in their spares box, but failing this, we understand that Messrs. Bulgin have agreed to supply builders of this receiver with suitable strips with the coils if they order them direct. A nominal charge will be made for them. The only other point concerns the valve-holders, and these are of the type intended for mounting underneath a thin chassis, with a clearance hole for the base of the valve. With a wooden chassis care must be taken to make the clearance hole sufficiently large to permit the valve base to sink into the wood and thereby provide good contact between the valve pins and the valve-holder contacts. The diameter of the hole required is $1\frac{3}{16}$in. To permit the specified dial to be mounted without cutting away the front of the chassis, the variable condenser is raised above the top of the chassis, the desired effect being obtained in our case by using long bolts and the insulated ends of Clix plugs as spacing or distance pieces. These are $\frac{5}{8}$in. long and three are needed.

The remainder of the construction is straightforward and the positions of the parts, as well as the wiring, may be gathered from the accompanying illustrations and circuit diagram, although we shall publish a standard wiring diagram in our next issue in the usual way. It should be noted that the leads to the top caps of the first three valves are screened and the usual screened sleeving may be slipped over insulated sleeving with standard wiring through it, or flex with the screened outer braiding may be obtained and cut to suit. The small top-cap connectors are, of course, soldered to the ends of the internal lead and again we must emphasise that the outer covering must not be permitted to come into contact with the internal lead or the top cap. The outer braiding is, of course, earthed by soldering a lead to it and taking to the nearest earthed point. Coloured leads are provided on the coils and I.F. transformers and the key to these is given in the theoretical diagram on this page.

Battery Connections

The special combined H.T.-L.T. batteries which are manufactured for receivers of this type are provided with various types of connector, to avoid flexible leads, and at the same time to prevent damage which might arise due to the insertion of the plugs in the wrong sockets on the combined battery. The particular model specified has a four-pin socket mounted on it, and therefore the battery leads are joined to a four-pin plug having the standard four-pin valve spacing. The type number of this battery is H.1157, and the sockets are clearly marked to assist in the correct wiring of the valve plug. The latter may, of course, be a discarded valve base or one of the special small plugs such as are supplied by Messrs. Clix or Bulgin. The flex leads should be the standard material, and in view of the low current load there is no need for heavy gauge material.



Three-quarter rear view of the receiver.

No cabinet has been specified for the receiver as this is left to individual taste. It should be remembered, however, that in view of the absence of an accumulator and the small overall dimensions of battery and receiver (the total area being approximately 11in. by 8in. by 11in.), a portable or semi-portable receiver could easily be built. In this case, of course, the aerial would have to be of the throw-out type, that is, a coil of ordinary flex attached to the aerial terminal and either wound round a small strip of cardboard and thrown out as required, or wrapped round the back of the cabinet. By placing the battery behind the receiver the overall height could be reduced and a deeper cabinet could then be used. The loudspeaker could be included in a separate cabinet, or placed to one side, again the exact arrangement depending upon the type of cabinet which is required.

The receiver is quite simple to adjust and operate, and full details for this will be given in our next issue, together with a wiring diagram and other relative data.

COMPONENTS

one .005 mfd., type 4601/S ; one 12 mfd., type 3016.

Resistances (Erie), ½-watt type :

Two 1 megohm ; two 50,000 ohms ; one 100,000 ohms ; one 8,000 ohms ; two .25 megohms ; one 2 megohms ; one 1,000 ohms ; one potentiometer with 3-point switch, one megohm.

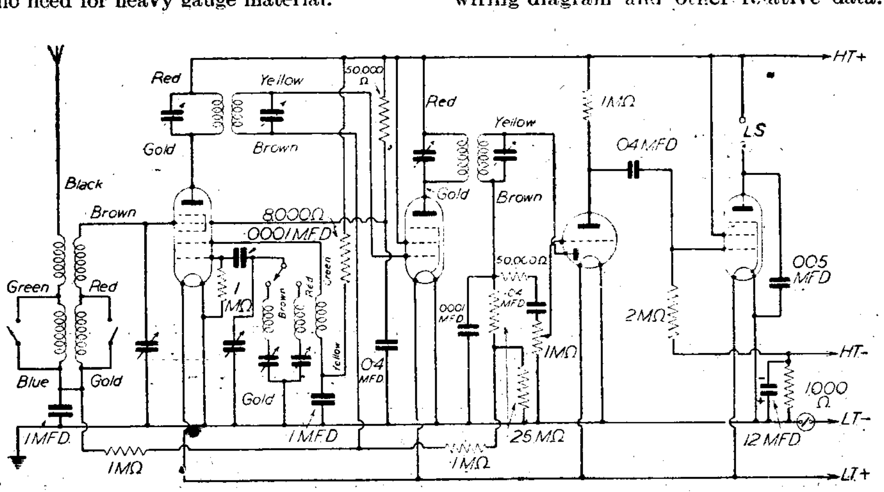
Three top cap connectors, Bulgin, type P.96.

Four Cossor valves, Types 1.A.7.V.G., 1.N.5.V.G., I.H.5.G., I.C.5.G.

One wooden chassis, 10in. by 8in. with 2¾in. runners.

One H.T. and L.T. dry battery, type H. 1157 (Exide).

One W.B. speaker.



Theoretical circuit of the receiver, with colour-coded references for the coils.

ROUND THE WORLD OF WIRELESS

American Television Slows Up

IT is announced from America that the expected F.C.C. approval for commercial operation of television has failed to materialise. A number of experimental licences have, however, been granted and this has been designed to keep any one interest from creating a monopoly. It is thought in the industry that there will be a speed-up with the coming of the new year, following the Christmas trade.

Wavelength Changes

SHORT-WAVE listeners should make a note of the following wavelength changes announced by All-India Radio. Morning transmissions from the Bombay, Calcutta, Delhi and Madras stations have been transferred from the 31 to the 41 metre band. This has been carried out primarily for the benefit of listeners within a 300-mile radius.

B.B.C. Monitoring Service

AT a recent luncheon members and guests of the Radio Industries Club were addressed by E. A. Harding, lately chief editor of the B.B.C. Monitoring service. This service employs a staff of upwards of a hundred to listen to broadcasts and announcements from all parts of the world. The programmes are recorded, translated and made use of in various ways. It is stated that about half a million words a day are dealt with in this department.

Plug-in Components

VARIOUS suggestions have been made for simplifying construction, and certain components in this country are now available with a form of spring grip which enables them to be inserted into a hole and held rigidly without the use of nuts or other additional parts. It is announced from America that certain plug-in parts, such, for instance, as electrolytic condensers, are also now available to home constructors. They are fitted with a special locating pin on the base similar to octal valveholders.

Enemy-controlled Radio

LISTENERS to Continental stations should bear in mind that many French stations are now in the hands of the enemy and a number of them have been closed down. Of the latter the most popular were Grenoble, Toulouse, Limoges, Lyons P.T.T., Nice, Radio-Montpelier and Radio-Méditerranée. Popular stations which are now in German-occupied territory include Eiffel Tower, Paris P.T.T., Radio-Paris, Lille P.T.T., L'Ile de France, Bordeaux Sud-Ouest, Strasbourg, Radio-Cité and Poste Parisien.

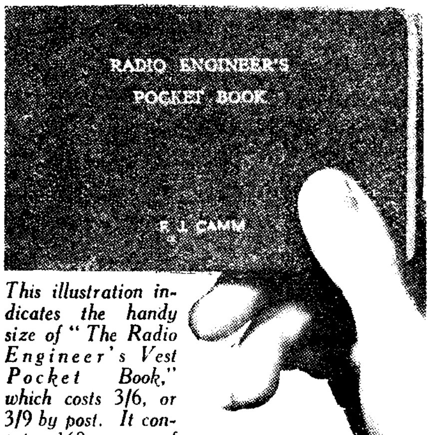
This Radio War

EVEN after a bomber pilot has got his wings and an air gunner his coveted A.G. badge, their training is by no means over. They must practise the bombing of targets from various altitudes, the imaginary bombing of moving targets on roads and railways (success being checked by a camera), diving on a fixed target and machine-gunning it, formation flying, avoiding searchlights and anti-aircraft fire, and exercises with fighters to become familiar with the various methods of attack and counter-attack.

Not until pilot, observer, gunner and wireless operator know the part that each must play in the team have the men become airmen.

Frequency-modulation

FULL speed ahead is the watchword now in the U.S.A. regarding frequency-modulation. Television stations have been



This illustration indicates the handy size of "The Radio Engineer's Vest Pocket Book," which costs 3/6, or 3/9 by post. It contains 160 pages of facts, figures and formulæ, and easily slips into the waistcoat or uniform pocket. Send postal orders to The Publisher, Book Department, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

authorised to use this system and complete rules have been drawn up for F.M. operation and new application forms have been printed for station applicants. It is anticipated that several hundred applications will shortly be made and that the total may reach 1,000 F.M. broadcasters. All new receivers will probably be adapted to cover the full F.M. band, and early receivers will be rebuilt to take advantage of the newly-awarded facilities which come into force on January 1st next.

Mr. J. M. G. Rees, whose new appointment is announced below.

Mr. J. M. G. Rees

MR. J. M. G. REES, Director of Oliver Pell Control, Ltd., and Tok Switches, Ltd., has been elected to the Board of Directors of Varley Dry Accumulators, Ltd. To executives in the radio world the announcement will matter little, as for years the names of Varley and Rees have been synonymous.

Mr. W. A. T. Horler

WE hear that Mr. W. A. T. Horler, who, prior to being called up as a naval reservist on August 27th, 1939, was employed as Exide and Drydex Battery storekeeper at the Chloride Co.'s Bristol Depot, was mentioned in despatches (*London Gazette*, July 9th, 1940) for meritorious conduct in the manner in which he dealt with injured survivors picked up by one of H.M. destroyers on which he was serving. Mr. Horler was in charge of the sick bay on the destroyer.

Williams Paley Award

THE A.R.R.L. announce that no award was justified in 1939 and the scope of the requirements will in future be broadened so that past achievements may be taken into account. This award is given annually to the amateur who has the best record for research and proficiency during the year.

Weather Reports

THE Swiss are stated now to be using the balloons in conjunction with automatic transmitters for collecting data regarding weather conditions in the stratosphere. As most readers know, small balloons are fitted with a special automatic short-wave transmitter which sends out special signals at regular intervals as the balloon rises, and when it reaches a certain limit the balloon bursts and the radio equipment is brought to ground by means of an automatic parachute.

Station VUD4

A NEW station is now working regularly on the All-India chain. This is Delhi, VUD4 on the 25-metre band, with a rated power of 10 kW.

The Teleprinter

VITAL messages pass daily and nightly between H.Q. and stations of the R.A.F. via the teleprinter. Similar in appearance to a typewriter, this transmits messages now via land lines, and it is claimed that it cannot be tapped. It was originally intended that it should be operated by radio operators, but now special operators are being trained for the work, and women from 18 to 43 are wanted for this branch. Pay is 2s. 2d. a day when trained, and applications should be made to the nearest W.A.A.F. Area Headquarters, addresses of which may be obtained from the nearest post office or Employment Exchange.

Loudspeaker Nuisance

REPEATED requests are being made by the B.B.C., as a result of letters received from listeners, to operate loudspeakers at a low level. Many workers are being deprived of much-needed rest owing to the thoughtlessness of listeners who operate their receivers at a volume which results in the sound being audible in adjacent houses. We hope that readers will co-operate in keeping this trouble down, and it does not take a moment to go outside the house in order to make certain of the volume which you are using. Police Regulations may be enforced if the trouble reaches any higher proportions.

Change of Address

WE are informed that the address of the Publicity Department, E. K. Cole, Ltd. (Ekco Radio, Ekco Lamps, Thermovent Heaters). is, until further notice: Green Park Hotel, Aston Clinton, Bucks. Telephone: Aston Clinton 3126.

Problems of Amateur Receiver Design—2

Drawing Up the Component List and "Pruning" It : Laying Out the Parts on a Baseboard or Chassis : How to Determine the Most Suitable Positions for the Components

By FRANK PRESTON

THE initial steps to be taken when planning a new receiver were outlined last month. In that article, however, the subject was viewed from the very elementary angle of a simple three-valve "straight" circuit. We could now either go into further details concerning the practical aspects of construction as applied to a set of that type, or proceed to examine the possibilities in the way of designing a more ambitious type of receiver.

It will be better to take the former line, since much of the information to be given can quite well be applied to more complicated circuits. Having produced a final circuit which is to be followed, and satisfied oneself that it will meet all requirements, it is an excellent plan to make a detailed list of the components that will be needed. First assume that a complete set of new parts will be bought if necessary—although we know very well that such a course is not likely to be followed in these times!

Alternative Components

At this stage the component list can be "pruned" after searching out from the junk box as many parts as possible which are to exact specification. It will, of course, be found that many of the specified components are not available. But in many cases, others can be substituted without seriously impairing efficiency. For example, the aerial series condenser will probably have been given a value of .0001 mfd., although any component with a rating between .0001 mfd. and .0003 mfd. will serve very well. Should it later be found that tuning is not quite sharp enough with the aerial in use the condenser can be changed or another can be placed in series. Thus, two .0003-mfd. condensers in series will have an effective capacity of .00015 mfd.

The screening-grid by-pass condenser will, no doubt, have been assigned a value of .1 mfd. A condenser up to ten times this capacity (1 mfd.) can well be used if more convenient, provided that it is of the non-inductive type—this generally means that it is tubular or has a mica dielectric. The same remark applies to the condensers used between the bottom of the aerial coil and earth, and between the anode winding of the inter-valve H.F. transformer and earth.

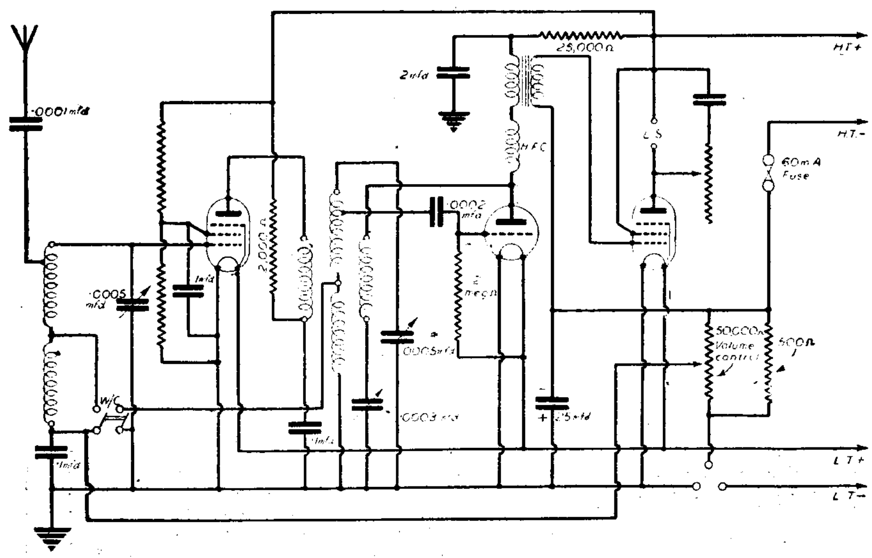


Fig. 1.—The circuit taken as an example in the first article of this series published last month. The use of this or a similar circuit is assumed in the layout shown in Figs. 2 and 3.

Resistor Variations

In the case of the fixed resistors there is generally a fair amount of latitude. Thus, the decoupling resistor for the H.F. valve may have a value up to 5,000 ohms by comparison with the 2,000 ohms originally assigned to it; the detector decoupler may have a value between about 20,000 and 50,000 ohms. It should be remembered in connection with these resistors that the higher their values are made, the lower will be the voltages applied to the anode of the valves fed by them. If an H.T. supply of 150 volts is to be used the voltage will be ample when using the higher values mentioned, but if a voltage of no more than 100 is available it is wise to keep the resistance values down to the approximate figures shown on the circuit reproduced last month and repeated here in Fig. 1—with a slight modification of the wave-change switches! I wonder how many readers noticed that, with a three-point switch, the auto bias resistor is short-circuited when the switch is set to the medium-wave section.

In connection with resistors do not overlook the fact that when two or more are wired in series the overall value is equal to the sum of the separate components, and also that if two similar resistors are wired in parallel the effective value is equal to half that of one of the components used alone. It is possible to calculate the value of any number of resistors of varying values wired in parallel, but I doubt whether readers who are following this series of elementary articles would be greatly interested in that aspect of the question.

Planning the Layout

Having gathered together all of the components which are available, and sub-

(Continued on next page.)

Component References

Carefully check the list against the circuit and, if you consider it worth while—it generally is—give reference letters and numbers to components such as condensers and resistors. Start with the condenser in series with the aerial lead and mark it C.1; then go to the aerial tuning condenser and mark it C.2. Proceed in this way throughout the circuit, doing the same for resistors. Here a start might be made with the upper arm of the fixed potentiometer used to feed the screening grid of the H.F. valve. Call it R.1, mark the lower one R.2, and so on.

This procedure might appear to be totally unnecessary when the circuit is to be used by one person only, but for the less-experienced constructor the marking will serve as a useful guide when wiring. If the idea is adopted remember to add the references to the list of parts, so that this will correspond exactly with the theoretical circuit.

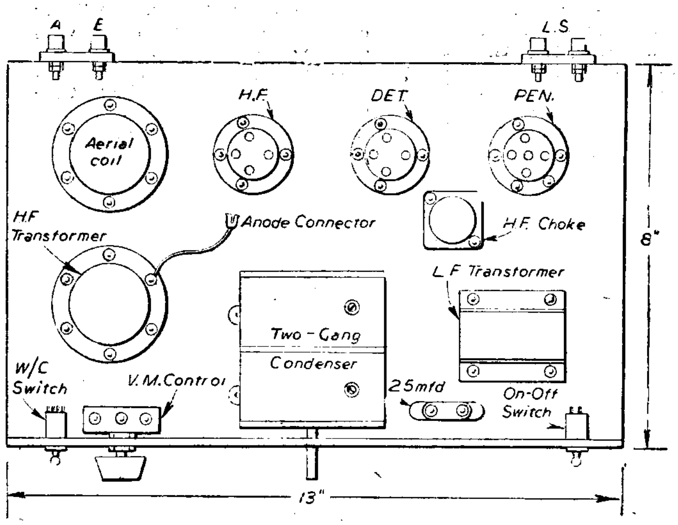


Fig. 2.—A suitable general layout for a set incorporating a circuit of the type shown in Fig. 1. It will be seen that reasonable compactness is aimed at, without making access to component terminals difficult. The chassis layout shown in Fig. 3 is usually to be preferred.

PROBLEMS OF AMATEUR RECEIVER DESIGN

(Continued from previous page.)

stituted where possible it can easily be determined what new parts, if any, have to be bought. Obtain these before going very much further. That done, the practical details of construction can be worked out. This part of the work can be very fascinating and is very important. The careful constructor will make a very rough assembly of the baseboard or chassis to be used—in either waste wood or stout cardboard—and then place the components in position. This sounds very easy and straightforward, but it should be remembered that literally dozens of different arrangements are possible and that some will prove better than others; probably one will be best of all.

Short Leads

In playing this game of "chess" there are a few simple rules to be observed. The first is that all leads in grid and anode circuits should be as short and direct as possible. Symmetry of layout helps to give a more "professional" appearance, and often leads to the best design, but do not be afraid to move a coil or valveholder slightly out of symmetry to ensure more direct wiring. Try the effect of turning the coil base round so that as many terminals as possible are almost adjacent to the terminals of components to which they will be wired. This also applies to valveholders, although in this case it is often an advantage to place all holders with the lines through their filament pins parallel to each other; this permits the use of straight runs of wire between the pins.

Put the H.F. choke very close to the anode pin of the detector valveholder and mount all by-pass condensers as near as possible to the resistors with which they are associated. By doing this many unwanted instability effects can be obviated. At the same time as the parts are being positioned on the chassis keep in mind the positions of the controls on the panel or on their mounting brackets. It would be silly to arrange the coils so that their grid leads are short if long wires had to be taken to the wave-change switch; especially is this the case when a single switch is used for both coils, as shown in Fig. 1. If it is found necessary to have these leads more than about 6in. in length it is wise to cover the connecting wires with screening braid.

Baseboard and Chassis Layouts

Fig. 2 shows a suitable layout when using a baseboard and panel for a circuit of the type illustrated in Fig. 1. It will be seen that the arrangement is compact and that short wires can be used throughout. It should not be assumed, however, that the layout shown is "correct," for it might be only partly satisfactory with some components. Nevertheless, it does represent a good starting-point for the "game of chess" mentioned previously.

In Fig. 3 the corresponding layout for chassis-form construction is shown. It will be seen that this layout is more compact due to the fact that the L.F. transformer, H.F. choke and other of the small components are mounted below the baseboard. The on-off switch and wave-change switch are also mounted below the baseboard level on the front of the chassis. Small components such as fixed resistors and condensers are omitted in both cases, since these would be suspended (rigidly) in the wiring where not supported entirely by their own wire end connections.

A metal or metallised chassis or a metallised baseboard is always to be preferred, partly because it simplifies the making of earth-return connections, and partly because the metal provides a measure of screening. Incidentally, it has been assumed in preparing the diagrams for both Figs. 2 and 3 that screened coils and H.F. choke would be used. Should these components be unscreened the coils should be mounted at right angles on a baseboard (one coil being attached to a bracket which holds it parallel to the baseboard). When using a chassis it would probably be possible to place one coil underneath and to attach it to the chassis side. The inter-valve coil would probably be placed in this position and the choke could be set at right angles to it by mounting on another side member.

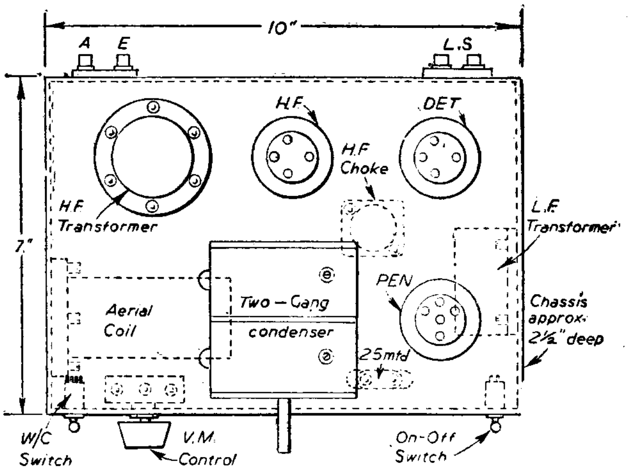


Fig. 3.—The more compact form of construction made possible by using a metal or metallised chassis. As in Fig. 2, dimensions are approximate only and components are not of any particular make or type.

Once the layout has been finally decided lines can be drawn round the principal components, after which screw holes may be drilled and the parts securely attached one at a time. In most instances this should be completed before starting the wiring, but if it is noticed that some terminals will be difficult of access after the parts have been mounted, lengths of connecting wire can be attached to them first; they will be cut to length later when the wiring is being done.

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

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Latest Patent Applications.

11889.—Bate and Co., Ltd., J., and Fisher, S. N.—Telescopic tubular members such as wireless aerials, etc. July 19th.

12749.—Marconi's Wireless Telegraph Co., Ltd., and Jefferson, H.—Volume compresser and volume expander systems for radio, etc., systems. August 8th.

13001.—Mullard Radio Valve Co., Ltd., and Eaglesfield, C. C.—Tuning arrangements of radio receivers. August 14th.

Specifications Published.

523611.—Edwards, B. J., and Pye, Ltd.—Television systems or the like.

523508.—Yardeny, M.—Devices for tuning radio-receivers.

523697.—Marconi's Wireless Telegraph Co., Ltd., and Keall, O. E.—Radio and like receivers.

523742.—Standard Telephones and Cables, Ltd.—Radio broadcast receiving-sets.

524094.—Philco Radio and Television Corporation.—Push-button volume-control device for radio receiving sets.

524193.—Philips Lamps, Ltd.—Radio receivers comprising means for suppressing aperiodic disturbances.

524226.—Kolster-Brandes, Ltd., and Shannon, D. S. B.—Supply circuits for cathode-ray tubes.

524245.—Cole, Ltd., E. K., and Martin, A. W.—Tuning arrangements for radio-receivers.

524373.—Philips Lamps, Ltd.—Radio receivers with pre-set tuning.

524443.—Valensi, G.—Television systems. (Cognate Applications, 1425/39 and 1426/39.)

524450.—Plessey Co., Ltd., and Gillard, F. G.—Mountings for coil formers, more especially in wireless apparatus.

524410.—Yardeny, M.—Device for tuning radio sets.

524499.—Radioakt.-Ges. D. S. Loewe.—Tunable coupling system for wide-band amplifiers for short and ultra-short waves. (Cognate Application 30835/38.)

524537.—Cole, Ltd., E. K., Shackell, A., and Kennedy, F. W. O.—Motor-operated press-button tuned radio-receivers.

524672.—Kolster-Brandes, Ltd., and Beatty, W. A.—Electric signalling systems.

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

Remote Control Systems

New Methods of Operating Radio Receivers Without the Use of Wires or Cables

MANY people like to add one or more extension loudspeakers to their radio receiver so that the broadcast programmes can be received in two or more rooms, and a logical development is remote control mechanism for the receiver so that the set can be controlled from any room containing a loudspeaker.

A common arrangement is to couple suitable control mechanism at the receiver and at a remote point together by means of a greater or lesser number of electric wires or cables according to the nature of the control system employed. In many arrangements of this kind the remote control installation can be both elaborate and costly.

The object of this article is to present two schemes whereby the tuning, volume, wave change or other functions of a receiver can be controlled from a remote point without the use of wiring.

In the arrangement shown in Figs. 1, 2 and 3, the remote control comprises in effect a miniature modulated carrier-wave radio transmitter, shown diagrammatically in Fig. 2, which is battery-operated and thus completely self-contained, and it can be placed at any convenient remote point, and a receiver, shown in Fig. 1, which picks up signals from the transmitter and causes the controls of the receiver, shown at the top of Fig. 1, to be operated in accordance with the nature of the signals from the remote point.

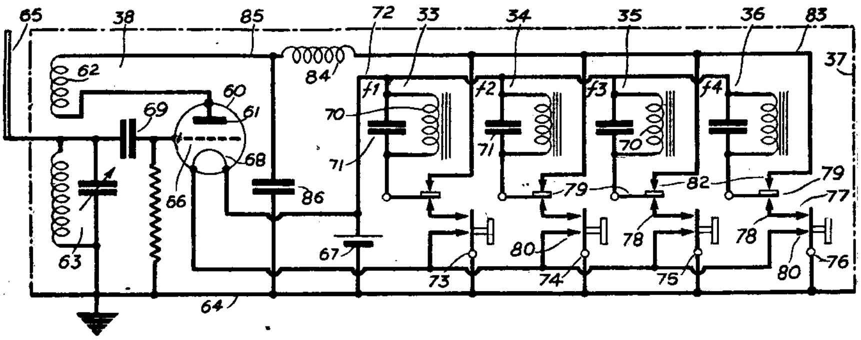

Fig. 2.—Circuit of the transmitting portion of the remote control.

Motor-driven Controls

Referring to Fig 1, for the continuous control of tuning and volume in a radio receiver 5, the tuning control shaft 6 and the volume control shaft 7 are connected to reversible electric motors 8 and 9, respectively energised through connections 10 from the radio receiver, and controllable in direction of operation through a reversing circuit comprising a ground connection 11 and circuit leads 12 and 13.

The system is adapted for controlling the motors through circuits 12 and 13 by energising suitable relays 14, 15, 16 and 17. The latter are provided with contacts 18 for connecting the control leads 12 and 13 to earth, thereby causing operation of the motors 8 and 9 in either direction as the relays 14 and 15, and the relays 16 and 17 are selectively energised by suitable means.

The relays 14-17 are preferably sensitive to rectified signal currents, and are each connected with a tuned rectifier circuit from which signal currents for operating it are derived through rectifiers. The number of tuned circuits correspond to the number of relays and functions to be controlled which, in the present example, are four, requiring four tuned circuits indicated at 20, 21, 22 and 23 for the relays 14, 15, 16 and 17, respectively. One side of each tuned circuit, and each of the relay coils are connected to earth at one terminal, while the opposite terminals are connected through suitable rectifiers, indicated at 25, 26, 27 and 28.

The circuits 20-23, inclusive, each include an audio or modulation frequency inductance 30 provided with an adjustable shunt tuning condenser 31, whereby the circuits are tuned to different modulation or audio frequencies which are to be utilised as the control frequencies for the system. In the present example, these control frequencies, which may be referred

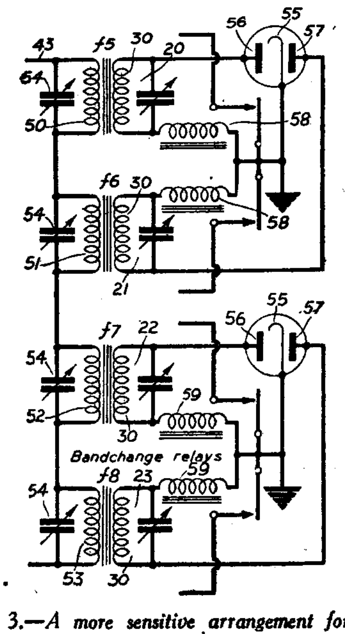

Fig. 3.—A more sensitive arrangement for the receiver.

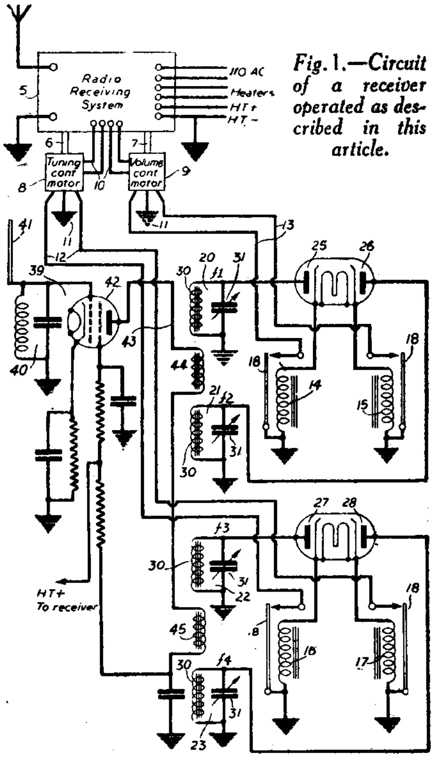

Fig. 1.—Circuit of a receiver operated as described in this article.

to as f1, f2, f3, f4, may be considered to be below 1,000 cycles and to be spaced substantially 100 cycles apart.

Signals at the desired control frequencies of the present example are supplied by vibrators 33, 34, 35 and 36 (Fig. 2) located in a portable remote control unit 37 and are conveyed to the receiving system and to the respective tuned rectifier circuits 20-23 on a carrier-wave generated by an oscillator 38 in the remote control unit, and demodulated at the receiver by a demodulator 39.

Demodulator

The demodulator comprises a circuit 40 tuned to the carrier-wave and coupled to an antenna 41 for supplying the carrier-wave, modulated at any one of the control frequencies, to a detector 42. The latter serves to demodulate the received signal and is provided with an output circuit 43 which is broadly responsive to all of the differing control frequencies.

In the present example, a valve detector is utilised for greater sensitivity, and the output circuit 43 is an output anode circuit including two coupling coils 44 and 45 in series, to which the control frequency circuits 20-23 are coupled in pairs, one pair for each function to be controlled. As shown, the output circuit of the demodulator 42 is coupled through the winding 44 to the circuits 20 and 21 for the rectifiers 25 and 26 by placing the winding 44, and the windings 30 for the circuits referred to, on a common core, or otherwise inductively coupling them to provide a coupling transformer having two secondary windings and a common primary winding.

The modulator output circuit is a simple untuned circuit involving a single coupling coil for each pair of control frequencies, and the transformer arrangement is greatly simplified, since the tuned circuits for each rectifier are inductively coupled or mounted on the same core with a common coupling coil.

The coil 45 is similarly coupled to the circuits 22 and 23 for the rectifiers 27 and 28. Thus, the function of volume control

(Continued on next page)

REMOTE CONTROL SYSTEMS

(Continued from previous page)

is responsive to signals received through the circuits 20 and 21 from the winding 44, and the function of tuning control is responsive to signals received through the circuits 22 and 23 from the winding 45.

These circuits may be coupled to the output circuit of the modulator in any other suitable manner, or additional circuits may be coupled to the demodulator output circuit 43, as shown, for example, in Fig. 3, wherein the windings 30 for the tuned circuits 20-23 are each individually coupled to separate primary windings 50-53 respectively. This provides an arrangement whereby the circuits may be made more sensitive to the control frequencies, since each of the primary windings may be tuned to the same frequency as the secondary winding to which it is coupled, by means of a shunt condenser 54.

Relay Control

Furthermore, as shown in Fig. 3, the rectifier for each pair of circuits, such as the circuits 20 and 21 and the circuits 22 and 23, may be provided with a common cathode 55 and separate anodes 56 and 57 for each of the associated circuits, to control relays 58 and 59 for the same or different functions, as in Fig. 1. For example, the relays 58 may control the power supply for the receiving system, whereby it is turned on and off from a remote point, as indicated, while the relay 59 may control the waveband change for two differing wave bands, as indicated.

Either rectifier circuit and transformer arrangement, as shown in Figs. 1 and 3, or a combination of both types, may be utilised in certain control systems, the circuit of Fig. 3 having the advantage, in addition to that hereinbefore noted, that it is slightly more sensitive, that the use of a single rectifier of the double anode type simplifies the circuit and permits a rectifier, for example, of the copper oxide type, to be used, thus obviating the necessity for connection with the receiving system for supplying cathode heating current.

The carrier frequency utilised is such that it does not interfere with radio reception and, therefore, may be of an order such that it falls outside the audio frequency, radio frequency and intermediate frequency ranges normally employed in receiving systems. For example, it may be of the order of 20 kc. However, preferably it may include ultra-high frequency waves of the order of 300 mc/s, or 1 metre, or even higher in frequency, in order that the carrier wave may not penetrate to any distance, and may be about the same in this respect as acoustic waves, thereby permitting operation of this type of remote control system to be practical for ordinary houses, or apartments, where interference must be maintained at a minimum. The use of the higher frequency carrier has the further advantage that the aerial 41 may be small, and may consist of a short rod, and all of the receiving and transmitting circuits may include inductances which require very little space. Furthermore, the valves used, such as the valve 42, and any transmitting valves in the remote control unit 37, may be of the so-called "acorn" type, although the consideration of size is not of such great importance in the receiver.

Oscillator Details

Referring more particularly to Fig. 2, the oscillator 38 comprises an oscillator valve 60, which may be of the "acorn" type having an anode 61 coupled through a coil 62 with a tuned high frequency circuit 63, which is connected between ground or chassis 64 and an aerial 65. The circuit 63 is also coupled to the control grid 66, and through the earth connections 64, and a battery 67 is connected to the cathode 68. The oscillator is provided with the usual grid condenser, and grid leak 69.

Each of the vibrators 33-36 is provided with a tunable electro-magnet, or operating winding 70, across which is connected a shunt condenser 71 for tuning this winding to a pre-determined audio frequency, the various vibrator tuned circuits differing one from the other in frequency. For example, the vibrators shown may be tuned for response at 500, 600, 700 and 800 cycles.

The windings are energised from the battery 67, one lead 72 being connected to the battery and to the coils 70 in parallel, while the remainder of the battery circuit for each coil is completed through ground 64 and a push-button switch to the vibrator contact. In the present example, one switch is provided for each vibrator as indicated at 73, 74, 75 and 76 having contacts 77 connected with the vibrator contacts 78. The vibrator armatures are indicated at 79 and are connected with their respective coils.

The switches are also provided with an additional contact 80, through which the filament 68 is energised to cause simultaneous operation of the oscillator with a selected vibrator.

Vibrators

The circuit is so arranged that the anode current for the oscillator is derived from the tuned circuits of the vibrators by the connection of the oscillator filament, and the low potential ends of the vibrator coils to earth through the battery 67, while the vibrator armatures are provided with contacts 82 connected in parallel with a supply circuit 83 for the oscillator anode, which is connected through a high frequency choke coil 84 with the oscillator anode circuit 85. The anode circuit is provided with a suitable by-pass condenser 82 to ground.

The contacts 82 are arranged to be engaged by the vibrator armature contacts when moved in the forward position under the impulse of the exciting current from the battery and serve to connect the coil circuit of the vibrator then in operation with the anode circuit, to apply the voltage across the circuit to the anode circuit, thus eliminating the necessity for providing a separate plate supply battery in the remote control unit, and permitting the said unit to be made relatively small in size.

With the new low filament voltage valves available, the battery 67 may comprise a single dry cell of small size, since the vibrator and oscillator are placed in operation only when tuning and the power requirements are low.

An Alternative System

It is also possible to devise a simple and less expensive wireless remote control system which needs no batteries, or other external source of power for its operation. Such an arrangement is shown in Figs. 4, 5 and 6, in which both the transmitter and receiver of the remote control are provided with tuned reeds that vibrate in strong magnetic fields.

Referring to Figs. 4, 5 and 6, a number of tuned vibratory reeds 5 and 6 are provided in a remote control unit 7, and a corresponding number of tuned vibratory reeds 8 and 9 are provided at the receiving portion of the system. The reeds 5 and 8 are tuned to vibrate at the same frequency f_1, while the reeds 6 and 9 are tuned to vibrate at a second frequency f_2. Any suitable number of pairs of reeds may be provided to operate at differing frequencies in the audio frequency range, as required to control a given number of functions of the receiver.

The reeds 5 and 6 are fixed at one end 10 to vibrate between the poles 11 of permanent magnets 12. The reeds are provided with pick-up coils 13 and 14 associated with the poles of the electromagnets, which receive a voltage when the reeds are caused to vibrate between the poles 11. The coils are connected in parallel across an output circuit 15 which terminates in a radiator or loop antennæ 16.

The reeds are caused to vibrate by being plucked at the free ends and this action may be arranged for push-button control, as shown in Fig. 5, wherein the end of the reed 5 is positioned to be engaged by a

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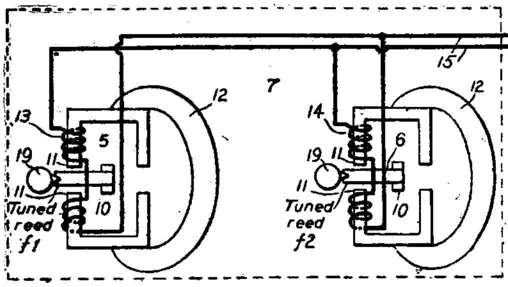


Fig. 4.—A tuned-reed remote control device.

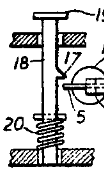


Fig. 5.—Details of a push-button reed-operating device.

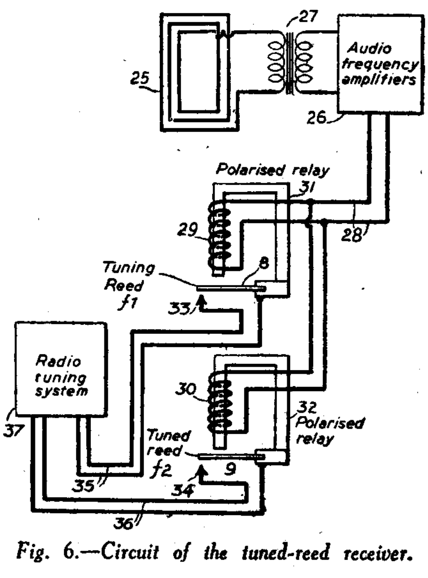


Fig. 6.—Circuit of the tuned-reed receiver.

finger 17 carried by a push-rod 18 connected with a push button 19. The push button 19 is depressed against the action of a spring 20 and causes the finger 17 to pluck or snap the end of the reed, causing it to vibrate at the predetermined frequency to which it is tuned. Voltage fluctuations at that frequency occur in the associated pick-up coil 13 or 14, and are applied to the radiator or loop 16.

The energy radiated from the loop 16 is picked up at the receiving point a short distance away, by a receiving loop 25 and is amplified through an amplifier 26 connected with the loop through a suitable coupling means such as a transformer 27. The output circuit 28 of the amplifier is connected with the operating coils 29 and 30 of relay devices indicated at 31 and 32, in which the vibratory reeds 8 and 9 are the armature elements. Suitable contact elements 33 and 34 are arranged to be closed with the reeds and actuated by control circuits 35 and 36 in any suitable radio tuning or other control system as indicated generally at 37.

Additional Reeds

While two tuned reeds are shown in the transmitting devices or remote control unit, and a corresponding number in the receiving portion of the system, as previously referred to, additional reeds may be provided at the transmitting and receiving portion of the system, one for each desired function to be controlled.

From the foregoing description, it will be seen that, when a button 19 is pressed at the remote control point, one of the reeds is forced from its position of equilibrium and, upon being released, vibrates at its natural frequency f_1 or f_2. The vibration of the reed induces a voltage in the pick-up coil 13 or 14 which causes a current to flow through the transmitting radiator or loop 16 at the frequency of the reed which has been actuated.

The signal f_1 or f_2 is picked up by the receiving loop 25, and is preferably amplified substantially 60 db, and being applied to the relay devices in parallel, the frequency responds thereto without the necessity for filter circuits or selector switch means. This causes a control circuit to be energised or de-energised, depending upon elements 33 and 34.

FLEXIBLE CHASSIS SUPPORTS

EVEN with modern valves, microphony is sometimes experienced due to feed-back from the speaker, or to vibration of the condenser vanes. For that reason it invariably pays to mount the receiver chassis on flexible bushes. One simple method is to make four fairly large holes in the chassis and fit rubber grommets in these. Long mounting screws are passed through the grommets, and then through short lengths of rubber tubes or pieces of sponge rubber, and into the base of the cabinet.

Another method is to fit a disc of sponge rubber on each side of the chassis and pass a screw through this; in that case the hole in the chassis must be big enough completely to clear the shank of the screw.

Prize Problems

PROBLEM No. 412

MAJOR had a battery receiver which gave splendid quality and he thought it would be a good idea to make some gramophone records of broadcasts picked up on the receiver. He therefore connected a standard gramophone pick-up to two terminals and fitted a two-pole change-over switch to change loudspeaker to pick-up and when he had found a good signal he made a test record by switching over to the pick-up, placing a new steel needle in it and placing an aluminium blank on the turntable. He made a tracking device to obtain the correct spiral trace on the blank. When he tried to replay the disc he found, however, that he could only hear an unintelligible noise, although the signals in the speaker were perfectly clear and undistorted. What was wrong? 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. 412 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, September 16th, 1940.

Solution to Problem No. 411

Although Jenkins appreciated the fact that the pentode had different working characteristics and accordingly changed the bias circuit, he overlooked the fact that the load required by a pentode differs from that of a triode and he thus omitted to modify his output circuit. Thus the mismatching of his speaker accounted for the distortion and poor output.

The following three readers successfully solved Problem No. 410 and books have accordingly been forwarded to them: V. Colwell, 1, Crown Cottage, Cannot, Coleford, Glos.; D. S. Price, 39, Nelson Road, Bournemouth; E. Irons, 82, Dunkeld Road, Dagenham, Essex.

Comment, Chat and Criticism

Outline of Musical History–12

Our Music Critic, Maurice Reeve, Reviews the Works of Brahms

BEFORE we arrive at the greatest of all, the geniuses of the nineteenth century, and the only one besides J. S. Bach who might, but doesn't, successfully challenge Beethoven's occupation of Mount Olympus, we must discuss that very challenging and arresting figure, Johannes Brahms, who was born at Hamburg in 1833.

Brahms is the one great "classicist" which this incurably romantic century threw up. He followed straight down the pathway opened up by Beethoven, and the saying that "Brahms began where Beethoven left off" is not inappropriate if we bear in mind that the great man of Bonn had blazed the trail and done most of the pioneer work required by a man of Brahms's temperament. Incidentally, this saying came from the amazing resemblance and similarity in character between the themes of the finales of Brahms's first and Beethoven's last—ninth—symphonies; a similarity too striking to afford it any chance of getting by unnoticed!

Brahms probably led the most "uneventful" life of any great artist. A biographer looks in vain for the excitements and the adventures which usually fill so many pages in a famous musician's story. Brahms's story is the simplest in the world to tell: hard work. Little else filled it, except the usual run of concert-giving, teaching and conducting various societies' orchestras and choirs.

Its chief landmark is probably an introduction he obtained to Joachim, the famous violinist, in 1853. Joachim gave the young master letters to Liszt and Schumann. On the strength of his Scherzo, Op. 4, Liszt adopted Brahms as an adherent of the, then, most advanced school of musical thought, whilst Schumann's admiration and prophecies for his future brought him in touch with the famous publisher Hartel. He also wrote a memorable article on him in his magazine, "Neue Zeitschrift für Musik"; an article which gave each new one of Brahms's compositions the fiercest publicity upon publication, and caused them to be discussed and sought as widely as any music then being produced.

The first piano concerto, in D minor, was received with a storm of abuse and opposition because of its uncompromising nature, and the absence of all those endearing features and qualities that go to make the concertos of Mozart and Beethoven so universally beloved. Brahms himself played it.

Associations with Vienna

He was attracted to Vienna by his ever-increasing interest in Hungarian folk music. His masterly employment of it, in his Hungarian Dances and other works, is only surpassed by Liszt. He lived in Vienna from 1861 until his death in 1897. He lies close to Beethoven and Schubert.

Not only is Brahms the last of the great German symphonists, but the last of that great dynasty of German composers which for over two hundred years reigned over music in undisputed sovereignty. With the exception of some masterpieces by Richard Strauss, the last of which appeared over twenty years ago, Germany has sunk to the lowest depths; such depths, in fact, that it is difficult to believe that any good music ever came out of the land. It shows no gradual eclipse or falling off as marked its rise: it just ended. The reasons for this phenomenon are obviously beyond the scope of this article. But the rise to power, this century, of those forces that we are now fighting must rank as one of the most potent.

Like Beethoven, whom he resembles at many points, Brahms took most of music's world for his field and exploitation: opera seems about the only one in which he was not interested. His whole output, however, was nothing like so huge as Beethoven's, and he was past middle age before he essayed on the first of his four symphonies; sixty years after Beethoven wrote his last. Seeing that those years may be said to have been among the most revolutionary in all music, embracing the "Symphonie Fantastique" and "Tristan und Isolde," Brahms's work shows little, if any, advance in thought or idea beyond that of his mighty prototype. That it was highly original, and stamped with its composer's personality, cannot be gainsaid. But it has often been repeated by those who are opposed to the school that wants to place Brahms at the head of all composers—and I think with justness and accuracy—that the almost total absence of new ideas in his works, and his willingness to walk down the tracks that others had beaten out, instead of opening up new ones for himself, must compel him to take a place rather below, than on top of, Mount Olympus.

But that he remains one of the world's foremost musical geniuses, and that he has contributed to music an imperishable store of rich and lovely work, is his title to everlasting fame.

Chamber Music

In spite of his magnificent symphonies, and such works as the Requiem and Song of Destiny—chorus with orchestra—it is in chamber music that Brahms has scored his greatest triumphs. Here he may be said to be Beethoven's equal, and in those examples which call in the co-operation of a piano, his superior—not forgetting the Archduke Trio. They achieve the perfection of balance and poise between the various instruments, and huge, almost orchestral, effects are obtained in their big moments which, however, never offend by going beyond the limits set by the type of music. Some of his loveliest melodies, too, are in these works; and here again he proves his genius for writing this type of music by imparting into them certain qualities—chamber qualities, if I may be permitted to coin a phrase—which cause one to believe that they have found their true destiny by coming to rest in these works, and that they would not have shown up to anything like the same advantage in any others.

Concertos

The second piano concerto, in B flat, is a marvellous work, and can easily claim to be the longest and most difficult of all concertos. Its four movements are packed with lovely melodies and rhythms of a folk nature, and the second—the only one not in the tonic key—was added afterwards as some relief was deemed necessary. Some critics, including the writer, consider it the best.

Both Brahms's two other concertos are also grand works, lofty in inspiration and brilliant in execution. One is for violin and the other for violin and 'cello—the only one of its kind. Had Beethoven not written his for the violin, then Brahms would have stood without a peer. But, magnificent and imperishable as it is, it is too much influenced by the shades of Bonn, as is so much of Brahms's work. Strikingly original as the content is of all Brahms's music, it bears too great a similarity in plan and design to its forerunners. Brahms reached his musical maturity at a very early age—witness the piano quintet in F minor—and consequently found very little left to say afterwards. It has been said, and not unjustly, that were the quintet to be labelled in the catalogue of Brahms's works as Op. 136 instead of Op. 36, no one could detect its chronological misplacement.

As a Song Writer

Brahms wrote wonderful songs, many of which are worthy to rank beside the best of Schumann and Schubert. The overtures, "Tragic" and "An Academic Festival," and such works as the Variations on a Theme by Haydn, are justly famous and universally played.

The piano works are a curious contribution to the literature of the instrument. They consist for the most part of collections of short pieces—Intermezzos, Capriccios, Ballades, etc.—which are chippings off the main granite slab. Although "some Brahms" is expected on most recital programmes, none of them come within the category of beloved pieces, like so much of Chopin and Schumann. He seldom "lets himself go" or lets his fancy wander. He could no more have written the "butterfly" study or the Berceuse than jump the moon.

The big-scale works are two early sonatas, two magnificent and gigantic sets of variations on themes by Paganini and Handel—the latter with a monumental fugue; and two sets of exquisite "Liebesleider Waltzes," in which the stern master waxes lyrical in as near the Chopin vein as he probably ever got.

Brahms's music is amongst the sternest and most formidable ever written; as difficult to perform as it is to listen to. It is extremely polyphonic and lacks the graces and ornaments of some other masters. The cross rhythm in which he frequently indulges, together with some rather unyielding harmonic and melodic characteristics, makes it puzzling and forbidding for many to whom "the fifth" is "a thing of beauty" and "a joy for ever."

Brahms Night at the Proms.

But that he is very high up in the hierarchy is recognized even by those whom he fails to sweep off their feet. And a Brahms Night at the Proms.—especially with the violin or the second piano concertos filling the bill—draws an enormous house. To the highbrow musician his name is sacred, and many do not hesitate to style him the greatest of all symphonists. But to those who look to music to tug at their heartstrings, then Mr. Brahms will seldom satisfy them.

Push-button Control

A Simplified Adjustment for Pre-tuned Push-button Receivers

AT least two adjustments are usually necessary to set any one push-button to a particular transmitter in the pre-tuned circuit type of receiver. The input and oscillator circuits of the mixer have to be tuned so that the former circuit is in resonance with the signal it is desired to receive, and the latter circuit adjusted to a frequency such that the I.F. signal will have the appropriate frequency, and separate trimmers are usually provided for making these adjustments.

It would obviously be convenient if the two adjustments could be ganged together so that only one adjustment is necessary, and in a design recently published by the Radio Corporation of America this has been done.

The tuning unit is shown in Figs. 1 and 2. It consists of the input circuit inductance 1 and the oscillator inductance 4 wound upon a common former 14, and tuned by means of the movable iron cores 3 and 14 respectively. These cores are adjusted by the same adjusting screw 11, which is secured to or moulded into the end of one of the cores and extends axially therefrom as shown and the other core is joined with the first core in axially spaced relation thereto, by an insulating body or core element 12, which is moulded between the main core elements. This insulating member may be constructed of moulded insulating material, and the core elements may be of moulded magnetite material, whereby both the cores and the insulating member may be moulded preferably in one cylindrical body, as shown, and all being substantially the same diameter to slide freely in the coil former 14.

Iron Cores

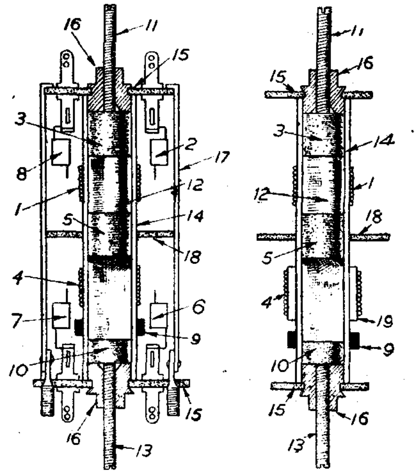
In the preferred embodiment shown, the two iron cores 3 and 5 are substantially $\frac{1}{2}$in. long, separated by the insulating member 12 which is substantially $\frac{1}{4}$in. long. The iron cores are shown in their extreme withdrawn position from coils 1 and 4, with which they are associated respectively. The coils may consist of 80 turns of No. 36 enamel-covered wire. This arrangement and design provides for tuning in the broadcast band with the maximum possible tuning variation range.

The inductances 1 and 4 are provided with fixed shunt capacities to determine their tuning ranges. The oscillator inductance 4 is shunted by the capacities 6 and 7 in series in order to avoid the necessity for tapping the inductance, the common point of the capacities being earthed and the ends of the inductance 4 being connected to the control grid and auxiliary anode of the mixer according to the well-known Colpitts circuit.

In order to gang the input and oscillator circuits, the latter is shunted by an adjustable inductance 9, which may conveniently be wound on the common former 14 at the end adjacent to the oscillator inductance 4, and provided with an iron core 10 adjustable by means of the adjusting screw 13.

Tracking Curve

Assuming a pre-determined frequency difference between the two circuits, such as 400 kc. for example, as a desired intermediate frequency, the windings are tuned initially to this frequency difference at 1,400 kc., for the oscillator and 1,000 kc. for the signal input circuit, as indicated in Fig. 3 at the points A and B respectively, on the curves C and D, which indicate the ideal tracking of the oscillator at C with the signal input circuit at D in tuning over the range of from 100 to 1,000 kc. These curves are plotted between frequency and relative inductance change. It will be noted that substantially a constant frequency difference of 400 kc. is maintained throughout the range.



Figs. 1 and 2.—Section of complete tuner unit and details of the iron cores.

The ideal tracking curve C for the oscillator is approximated in the response curve E, which indicates the result obtained when a shunt trimmer inductance 9 is employed in conjunction with the main oscillator winding 4 in the arrangement shown in Fig. 2.

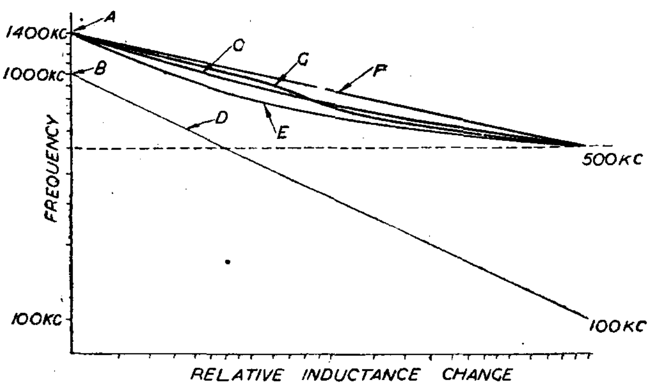


Fig. 3.—Tracking curves of the oscillator.

If the oscillator inductance 4 is spaced from its core, by reducing the core diameter or by winding the inductance 4 on a slightly greater diameter than the signal input winding 1, as indicated in the modification shown in Fig. 3, the rate of change of inductance of the oscillator will be less than that of the input circuit, and the response curve F of Fig. 4 will result. The curves E and F fall on opposite sides of the ideal curve C. The use of a greater diameter coil of the same length as the input inductance causes the oscillator tuning curve to be slightly too high between the two line-up points at the low and high frequency ends of the tuning range, while the use of the shunt coil tends to make the oscillator tuning curve too low between the two line-up points, although in either case the line-up may be kept within practical limits of satisfactory operation. The curves E and F are drawn with the departure from the ideal curve somewhat exaggerated in order to show the tendency of the change more clearly.

In providing the method for tracking as shown in the unit of Fig. 3, the oscillator inductance 4 is wound on a sleeve 19 placed between it and the coil former, and the tracking or shunt inductance 9 is also provided. The tracking curve for the oscillator assumes a form somewhat as shown at G in Fig. 4, and more closely approximates the ideal curve C by crossing this curve, so that the departure therefrom is only slightly higher over a certain portion of the tuning range, and only slightly lower over the remaining portion of the tuning range, than the desired frequency characteristic C.

Shunt-tracking Coil

The shunt-tracking coil 9 for the oscillator is made relatively high in inductance value with respect to the main oscillator tuning inductance, and the lowering of the overall inductance of the circuit is compensated by the shunt capacitance in each circuit.

The shunt inductance 9 may be of the multi-layer type, as indicated, and since it is connected in parallel with the inductance winding 4 it may be placed adjacent thereto. The casing 17 for the unit is of metal and is provided with a central shield ring 18 surrounding the coil former 14 between the windings 1 and 4 to prevent radiation of oscillations from the oscillator section of the tube through the signal input circuit to the aerial circuit.

The capacities 6, 7 and 8, and also if desired the oscillator grid capacity 2, may also be included in the tuning unit as indicated in Fig. 2, so that both the oscillator and input circuits are included substantially wholly within the shield casing.

The common tubular coil former 14 may be secured to insulating end plates 15 by end plugs 16 tapped axially to provide bearings for the adjusting screws 11 and 13.

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).

Charging Accumulators from D.C. Mains

SIR,—I regret to observe that it has become necessary for PRACTICAL WIRELESS to cease weekly publication, but shall continue to be a subscriber to the monthly edition.

As to the article in the July 27th issue descriptive of trickle charging from D.C. mains, I enclose a sketch which I have prepared from an article in last January's issue of the *T. & R. Bulletin*, which may interest other readers. The object of this arrangement is to enable accumulators to be charged in series with the ordinary house lighting system, and accordingly to obtain charging free of all expense.

If the consumption of all the lamps usually in use is in excess of the charging rate, then a three-pin socket must be inserted in such part of the lighting circuit as will pass the requisite current only.

As an ordinary 60-watt lamp at 240 volts will pass a current of a quarter amp., it will usually be necessary for the socket to be inserted in a portion of the lighting system which has two such lamps in general use.

The advantage of the three-pin plug is that it must always be inserted in the same way to maintain polarity, and a similar plug with its two pins shorted can be inserted to complete the lighting system when charging is not required.—J. H. COLLINS (Ystrad, Rhondda).

Appreciations of Our Monthly Issue

SIR,—With reference to your new monthly issue, I am very pleased to say that I enjoy it more than the weekly edition, as at the present moment work occupies too much of one's time to enable a proper digest of weekly issues. However, the reading can now be more conveniently spread over a month.

Although I am new to PRACTICAL WIRELESS I have never read a radio paper which gets you in its grip so much.—JOHN BRIDGES (Gateshead).

SIR,—As an amateur I sincerely hope that the paper will not cease. The first monthly issue is O.K., and means at least a continuance of that enjoyment gained in reading the weekly issues. Increase the price if you like, but do not diminish the grand contents of the magazine.—F. M. (Newport, Mon.).

Simplest S.W. One-valver

SIR,—I have been reading PRACTICAL WIRELESS for a year now, and would like to congratulate you on such an informative paper. I built my first receiver last March—your "Simplest S.W. One-valver" and have been operating it from that date.

I have made one addition to the set, however, and that is a .0001 mfd. aerial-series condenser. I found it essential for the 16, 19 and 25 metre bands, as my aerial, although free from interference, is too long for short-wave working.

I connected the receiver to the pick-up of a commercial 5v. superhet, via a 5 : 1 L.F. transformer. I also fitted the band-spread arrangement, and my log includes the following stations (excluding enemy stations): WNBI, WCBX, WRUL, WGEO, WGEA, SP19, SPT, SBP, SBO, RW96, JZK, TAP, TAQ, YUA, YUC, TPB7, TPC3, OIE, together with Moydrum (Eire) and Berne (on the 49 m. band ?). My working hours at the set are usually only about 1½ hours each evening—between 9.30 and 11.0. So far, I haven't received any stations on the 13 metre band but I hope to give more attention there in the near future.—N. W. BELLWOOD (Croydon).

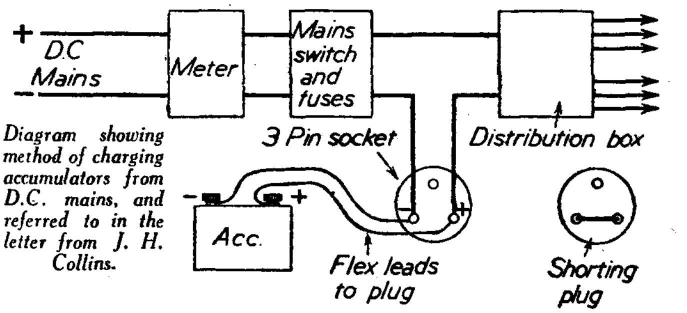


Diagram showing method of charging accumulators from D.C. mains, and referred to in the letter from J. H. Collins.

Wave-change and Auto Bias

SIR,—In the September issue of PRACTICAL WIRELESS there appeared an article by Mr. Frank Preston in which is shown the circuit of a three-valve battery set. The three-point wave-change switch, when closed, will short-circuit the auto-bias arrangement and, with the volume control at maximum bias, would leave the output pentode unbiased.

Some of your many readers may overlook this and be disappointed.

With best wishes for your continued success and an early return to the weekly PRACTICAL. A month is a long time to wait !—JOHN B. LEEMING.

[*How many other readers noticed the incorrect wave-change switch connections? This is just one of the many items which should be watched when modifying or adapting a standard circuit. The point is referred to in the second article of the series "Problems of Amateur Receiver Design" on another page in this issue.*—ED.]

Short-wave Work

SIR,—I wish to express my appreciation of your journal, especially now that you are publishing details of the more elaborate types of short-wave receiver. As with most other experimenters it is in this branch that I am most interested.

For the last two or three years I have experimented in short-wave work, and at first I used a 1v. adaptor. This was coupled into a home-built 0-v-2 broadcast receiver.

I notice that your contributor Thermion speaks about leaving out certain features so as to save space, and I think this is a very good idea.—W. J. MORGAN (Ealing).

"What is Impedance?"

SIR,—There is a misapprehension in an article on page 424 of your September issue, where it is implied (in middle column) that a condenser having an impedance of 5,000 ohms at the particular frequency considered, in series with a resistance of 10,000 ohms, will constitute a total impedance of 15,000 ohms. This is not so, as the ohmic values must be added vectorially, and the total impedance is a little over 11,000 ohms; the current in this circuit will lead the voltage by a phase angle between 26 and 27 degrees.—A. O. GRIFFITHS (Wrexham).

Air Defence Cadet Corps

SIR,—One of the most urgent needs to-day in the R.A.F. is for trained wireless operators. The Air Defence Corps organisation, sponsored by the Air League of the British Empire, is making every effort to help train cadets for signals work before joining the Services.

Already many squadrons have the benefit of prominent radio amateurs as instructors, but nearly all squadrons are in urgent need of morse keys, buzzers and head telephones.

The purpose of this letter is to ask whether any of your readers can assist us in the task of seeing that squadrons are supplied with morse equipment. The strength of the A.D.C.C. organisation may be judged from the fact that within 18 months of its formation in 1938 200 squadrons (representing 20,000 cadets) were enrolled.

Readers who have spare equipment to donate are invited to send it direct to Squadron Leader H. W. Woollett, London Area Controller, A.D.C.C., Kinnaird House, 1A, Pall Mall East, London, S.W.1, or to the writer at the address given below.—JOHN CLARRICOATS, Cadet F/Lt. (Signals Officer, A.D.C.C.), 16, Ashridge Gardens, Palmers Green, London, N.13.

Curing a Fault

SIR,—Referring to F. J. Grant's letter in the September issue, I should like to state that I have come across a similar occurrence. The set in question is a commercial radiogram about seven years old. It is of the S.G.-S.G.-Pen.-Rect. combination, employing three 8 mfd. "can" condensers for smoothing. Two of these were of the wet type, and one had been leaking. When this had been replaced, and the contacts cleaned, the set worked as well as could be expected of a set of that age.—L. LEES (Elton, Bury).

Correspondents Wanted

P. F. SALE, 29, Eastgate Street, Bury St. Edmunds, Suffolk, who is a beginner, is desirous of getting in touch with another reader interested in short-wave work.

E. E. Melhuish, 245, London Road, Mitcham, Surrey, would like to correspond with any young reader (16-21) residing in Canada, or the U.S.A.

RADIO CLUBS & SOCIETIES

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

ASHTON-UNDER-LYNE AND DISTRICT AMATEUR RADIO SOCIETY

Headquarters: 17a, Oldham Road, Ashton-under-Lyne.

Meetings: Wednesdays, 7.30 p.m. Sundays, 2.30 p.m.

Secretary: K. Gooding (G3PM), 7, Broadbent Avenue, Ashton-under-Lyne.

AT the annual general meeting held on July 31st the following officials were appointed: President, J. Partington (G5PX); Chairman, W. P. Green; Treasurer, J. Cropper (G3BY); Secretary, K. Gooding (G3PM); Asst. Secretary, W. Taylor; Librarian, H. Hattersley; Morse Instructors, J. Partington (G5PX), and C. Noke (G6DV). The secretary reported that since the society's inauguration two years ago 75 names had passed through the records, and that the present membership was 33. After considering the claims made by H.M. Forces, and other work of National importance, the position was considered very satisfactory. Twenty-five members and friends patronised the "social evening" held at the clubroom on August 7th, when an entertaining programme of demonstrations of gear was provided. 2BK made the journey from Royton to demonstrate his automatic "test-call" relay, and many varied opinions were expressed as to when we shall hear this particular exhibit on the air again! Suitable music was provided by members' records and an 8-record auto-radiogram loaned by Mr. W. Taylor. A "racing" record helped to swell the club funds later in the evening.

SLOUGH AND DISTRICT SHORT-WAVE CLUB

Hon. Sec.: K. A. Sly, 16, Buckland Avenue, Slough.

Meetings: Alternate Thursdays at 7.30 p.m.

AT the last meeting of the above club held on August 1st, 1940, the first matter for attention was the continuation of the hire of a meeting room; it was agreed that the financial position of the club did not warrant continuing the hire of a room, and it was decided that meetings should be held at members' houses for a time.

The meeting continued with a discussion and a demonstration of G3XH's portable receiver. The evening was completed by a session of Morse practice.

Members who are unable to attend on Thursdays are asked to communicate with G4MR, 16, Buckland Avenue, Slough, telling him which evening would be more suitable for them, and we will try to arrange meetings to suit the majority of our members.

FULHAM RADIO SOCIETY

Headquarters: Beaufort House School, Lillie Road, Fulham, S.W.6.

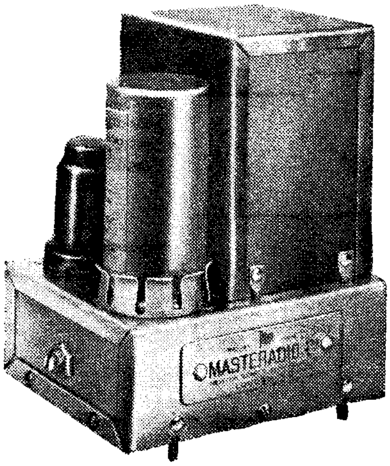
Hon. Sec.: F. H. Jones, 52, Oakbury Road, London, S.W.6.

THIS society has commenced its winter programme at the above address.

A special beginners' course has been arranged in wireless and Morse telegraphy; this may be of interest to those contemplating entering the Services. New members will be welcome and should pay us a visit, or the secretary will be pleased to forward particulars. Meetings are held on Monday and Wednesday, 7.30 p.m. to 9.30 p.m.

MASTERADIO MALLORY VIBRATORS

MOST constructors are now familiar with the various types of vibratory rectifiers and their general applications, but from the inquiries we receive it would appear that many readers have the impression that it is only possible to obtain a very restricted output. Those holding such opinions would do well to read the well-produced leaflets obtainable from Masteradio, Ltd., and, if possible, examine some of the exceptionally fine units manufactured by that firm. The name Mallory has too long been associated with vibrator equipment to need any introduction from us, but when it is combined with Masteradio, who actually produce in this country quite a wide range of units, excepting the vibrator component, it will be appreciated that the combined effort is one of some standing backed by a service of unquestionable efficiency.



One of the standard vibrapacks with valve rectifier.

It is not possible for us to give details of all available types in these columns, therefore we must confine our remarks to the more general and essential features. For example, Masteradio Mallory Vibrators are recognised for their superiority because of their proven performance and outstanding engineering designs. When it is realised that four out of five American motor-car radio receivers derive their H.T. power from Mallory-made vibrators, it becomes apparent that Mallory is and always has been the leader in the vibrator field.

An Aerial Coupling Unit

A Useful Device which may be Built from Spare Parts.
Designed and Described by W. J. DELANEY

MANY listeners are using simple types of receiver in which the aerial circuit is of the simplest design, and accordingly they are troubled with selectivity difficulties. The usual advice to such listeners is to use a wave-trap, but a suitably designed unit of this type may have other uses, giving it a much wider appeal, and providing a very interesting source for a series of experiments. In the ordinary way a wave-trap is merely a tuned circuit, that is, a coil and condenser, and this is included between the aerial and a receiver which is unselective. It may, however, also be

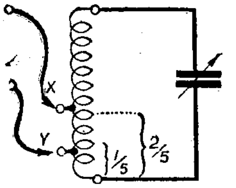


Fig. 1.—The fundamental circuit of the unit discussed on this page.

connected in parallel with the receiver in which case it acts in a slightly different manner. If, however, the coil, instead of being a simple winding, is provided with a series of tapping points (Fig. 1), it offers alternative methods of connection, and this then introduces the variations in performance which make it so useful. The unit illustrated on this page has been made up on these lines, and it will be found extremely effective with almost any type of receiver—including a superhet in which second-channel whistles may be experienced.

Components Needed

The unit (Fig. 5) consists of a standard .0005 mfd. tuning condenser; a standard 4-pin coil holder; a two-terminal or two-socket strip; a small panel carrying four sockets, and a baseboard and panel. Almost all of these items may be found in the spares box, and there is no need for any special reference to any but the socket strip. This was made in the original design from a strip of paxolin, and four standard Clix sockets. This arrangement is better than crocodile clips and tappings brought out on the coil, as it permits not only of quick changes in connection, but also gives a reliable and noise-free contact, not being subject to vibration as are ordinary clips. The wiring diagram is shown, from which it will be seen that the four terminals on the coil holder are joined to the four sockets, the tuning condenser being connected to two of the coil-holder terminals, and the two-terminal strip being provided with two lengths of flex to which plugs are fitted.

Using the Unit

The theoretical circuits (Fig. 2) show some of the many schemes which are possible with this unit, others no doubt occurring to the user after it has been put into use. In the simplest form the two plugs are inserted into the sockets corresponding with the ends of the coil, and if this is then of a standard medium-wave broadcast type the circuit will tune to the usual medium-wave stations. The aerial should then be removed from your receiver and connected to one of the input terminals on the coupling unit, and the other terminal should then be joined by means of a *short* flex lead to the aerial terminal of your receiver. Now tune to a station which you normally cannot hear very well owing to a background from another station. Ignore the interference for the time being. When properly tuned in, using reaction if it is necessary, carefully adjust the control knob of the coupling unit. This must be carried out slowly, and it will be found that a point is reached where the interfering station will suddenly disappear. A slight adjustment on either side of this point will also cause the wanted station to disappear, and therefore the adjustment has to be carried out very carefully. It is obvious that the coupling unit should tune very sharply, otherwise the same trouble will be experienced in a reverse direction, that is, the trapping effect will be so broad that not only the unwanted, but also the wanted station will be cut out, or at least seriously reduced in signal strength.

Rejector Circuit

To improve the sharpness of tuning, therefore, the simple connections just described are not always ideal, and therefore the coil in the unit should be wound with fairly thin wire and it should be tapped so that the aerial and also the receiver input lead may be connected to provide an auto-transformer effect. It is suggested that, to

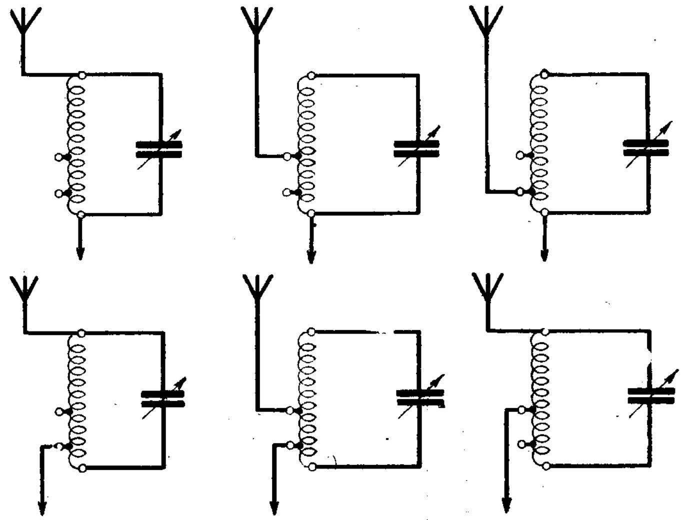


Fig. 2.—The circuits shown here indicate some of the various possible arrangements obtainable.

provide a fair number of alternative effects, the coil be tapped at one-fifth and two-fifths of the distance from one end. This will then provide a number of alternatives as indicated in the diagrams. An alternative method of connection is to add the unit in parallel with the receiver, that is, with the aerial and earth leads connected to the receiver in the usual way, but with duplicate

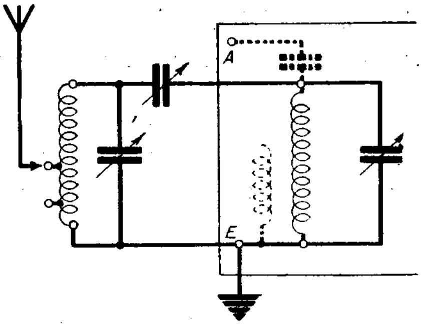


Fig. 4.—A suitable method of connecting the unit to a single tuned aerial circuit to provide band-pass tuning.

leads from aerial and earth terminals to the two input sockets on the unit. Then by modification of the position of the plugs the same alternative schemes as already described become possible, but the unit, instead of cutting out unwanted stations will cut out all stations except that to which the unit and receiver are both tuned. In practice this desirable effect may not be fully achieved. As the normal tuning circuit accepts a fairly wide band of frequencies (hence the interference), the coupling unit coil will also act in a similar manner, but the addition of a further tuned circuit will give added selectivity which will result in some improvement. Additional advantages may be gained, if the input circuit of the receiver is of the simple type, by cutting out any series aerial condenser which may be fitted, and then joining the coupling unit through a small pre-set condenser, thereby introducing a band-pass circuit with what is known as top-capacity coupling. Adjustment of the condenser will govern the

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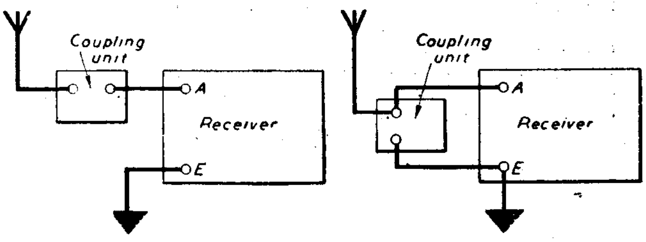


Fig. 3.—Acceptor and rejector wave-trap circuits are obtained by connecting the unit as shown here.

AN AERIAL COUPLING UNIT

(Continued from previous page.)

selectivity, and, of course, with this arrangement, the aerial is only joined to the coupling unit, and not to the aerial terminal on the receiver. This arrangement is indicated in Fig. 4.

Screening

There is one essential point which should be borne in mind when using a unit of this type, and that is the question of direct pick-up, either by the coil itself or by the lead between it and the receiver. Therefore, it should always be placed close up against the receiver, but in such a position

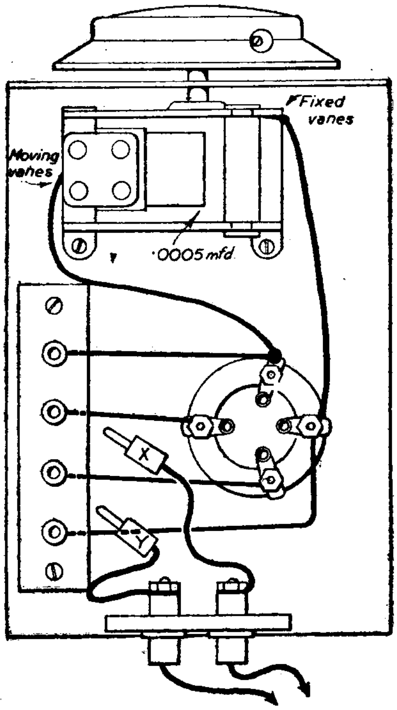


Fig. 5.—This plan view of the unit reveals the simplicity of construction and wiring.

that coupling does not exist between the coil and any coils in the receiver, and if possible it should be in a metal box, with the case earthed. The lead to the receiver should be as short as possible, and if any trouble is experienced due to pick up by the lead, it may be screened and the screening earthed. This will result in some loss in signal strength, and therefore should only be introduced when absolutely necessary, and in any case the lead should be as short as possible.

Replies to Queries

Crystal Amplifier

"I have purchased a crystal amplifier and wish to know more of its working principle and how to connect for operation. The unit has an adjustment over it and a small horn loudspeaker is fitted on the base. There are four terminals, two on each side. Two are marked positive and negative, 6 volt, and two marked L.E. 4,000. If it is possible a circuit diagram would simplify matters a great deal. I attach a rough sketch of the device."—D. H. (Moss Side, Manchester).

THERE were two or three devices of the type mentioned, all of which consisted of a mechanical method of amplifying the weak signals developed by a crystal receiver. In effect, they consisted of a reproducer, such as an ordinary earpiece, to which was attached a small microphone or other amplifying device, and this fed the speaker. One special type had, in place of the earpiece and microphone, a special reed movement arranged in a similar manner. The terminals marked positive and negative 6 volts are for connection of a dry-cell or accumulator to provide energising current for the microphone circuit. The other terminals indicate that the 'phone terminals of the crystal receiver should be connected at that point, the load provided being 4,000 ohms (similar to a normal pair of headphones).

Accumulator Problems

"I have a new accumulator with indicator which I understand is in perfect order. But upon filling with new acid the indicator goes to the full mark. Why is this if the battery is not charged? Should the acid contain distilled water; if so, in what quantity?"—J. C. (Manchester, 21).

THERE are two points raised in your query. Some types of accumulator are sent out in a "dry charged" condition, the addition of the correct acid strength bringing them more or less into a charged condition. This might account for your problem. On the other hand, accumulator acid consists of sulphuric acid which is diluted with distilled water to a certain specific gravity, the gravity reading generally being given on the label of the cell. If you have purchased ordinary acid (not diluted for accumulator use) and have poured this into the cell, it would account for the needle rising to a fully-charged position, as the needle is no doubt operated by a hydrometer device which indicates its position according to the gravity of the solution. If, however, you have purchased acid ready prepared for accumulators the gravity should be approximately correct and the first suggestion above would then answer your problem.

I.F. Transformer Connection

"I have an I.F. transformer for use in a superhet. I know how to connect it in general, but I am puzzled as to why the leads from each end of each coil are of different colours. From one coil the leads are red and red-yellow, and from the other brown and black. Can you tell me which colour should go to each connection, and also why it should make any difference which end of each coil goes to anode or grid, say? Provided one coil is in the anode and one in the following grid circuit I cannot see why it matters as to 'which way up' each coil goes in its proper circuit."—T. D. C. (Shiplake).

COLOUR-CODING is now adopted by many manufacturers, but there does not appear to be any standardisation in this country for I.F. transformers. It might be assumed in your case that red indicates H.T. positive and black H.T. negative (or G.B. or A.V.C., according to the circuit used). In that case, of course, red-yellow would be the anode connection and brown the grid connection. The first point, however, is to settle which is each separate coil. They must then be correctly connected, that is, in phase. The transformer consists, of course, of two coils, arranged a certain distance apart and they are wound in the same direction. Consequently, to provide maximum coupling they must be connected in the same "sense." That is, the high-potential ends of each winding must be correctly placed and you will find that this may be arrived at by test. Take the red lead as H.T. positive and then try the alternative positions of the brown and black leads. You will find that in one position signals will be weaker than in the other.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—
(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.
A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.
Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Short-circuit Protection

"I have had three or four difficulties with mains units in which I have had to replace a rectifying valve owing to the smoothing condenser breaking down. I have increased the voltage test of the condensers each time, but still this seems to happen and now the valve has gone again. On test I find the same trouble, an electrolytic which has developed a complete internal short-circuit. This seems an expensive arrangement and I wonder if there is not some way of overcoming it. What should the working voltage of these condensers be, compared with the rectifier output? Perhaps you can tell me how to get rid of this trouble."—R. J. (Hendon).

YOU may have considered only the D.C. output of the rectifier and chosen a condenser rated for working at that voltage. It is necessary, however, to consider the superimposed A.C. ripple on the D.C. supply, which may add a large percentage to the actual voltage. There is also the question of a surge when the set is switched on and off. Your condensers should therefore be chosen with a working voltage at least 50 per cent. greater than the D.C. output of the valve and as a further precaution we suggest you use two condensers in series. This means, of course, that double the usual capacity must be chosen for each condenser, and a special insulated fitting would have to be used for one of the condensers if the metal-case type is obtained. Then, if one condenser breaks down, the short-circuit will not damage the valve.

Signal Strength Meter

"Is there any advantage in the thermionic signal strength meter as compared with the ordinary 'R' meter? I wish to make one for my set but cannot decide on the best arrangement."—L. R. (Kingston).

THE term "R" meter actually covers all forms of signal strength indicator, although very often it is only applied to the ordinary current meter which is so placed as to give an indication of carrier strengths. The thermionic meter would, of course, be a more reliable arrangement if placed so that it measured the incoming H.F. currents, but it must be remembered that most signal strength meters are not capable of differentiating between the carrier and a rectified signal. Consequently, when receiving amateur transmissions the percentage modulation will in some cases give a false "strength" indication. Much depends, however, on the system which is adopted, as there are so many different ways of including such a meter in the circuit.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

A. D. (Shrewsbury). A layout was given in our issue dated May 11th. The wiring is, of course, standard in this circuit.

R. L. H. (Menston-in-Wharfedale). We have no blueprint or similar data, but think you would find difficulty in obtaining a satisfactory circuit, with speaker, in the space mentioned. All-dry valves would be of assistance, but we may publish details of a similar set at a later date.

E. H. (Walthamstow). The usual cause of such a trouble is a broken-down condenser, usually the one on the mains side of the smoothing choke. Check all by-pass condensers.

E. M. (Rotherham). We cannot give any of the data you require as you do not mention any of the current ratings. H.T. current must be known to work out the voltage drop, and the heater current must be known to work out the heater series resistors.

A. M. (Tenterden). We regret that the reference number is not sufficient to enable the component to be identified.

D. S. P. (Bournemouth). It is not possible for us to say for certain what the type is, and therefore it would be desirable to write direct to the makers, Messrs. Westinghouse, giving them full details of the rectifier. They may be able then to identify it. You should remember that there are a number of these items on the market which have been dismantled from commercial apparatus and which have been specially designed and are not standard.

H. S. (Gorton, M/c.). We have published an amplifier on the lines mentioned, but will deal with it again at a later date.

A. J. (Ilford). The address is 77, City Road, London, E.C., and 'phone number is CLI 9875.

A. C. S. (Dartford). A substitute of similar characteristics should still permit the set to function satisfactorily. Could you let us have further details regarding performance.

S. H. F. (Welwyn). Any standard set could be made up to incorporate the valve. What is the main difficulty?

W. B. (Goldthorpe). If the carbon has been lost the mike will have to be refilled. We suggest you return it to the makers for overhaul.

R. A. F. (Huyton). The reference is quite correct. The valve may be obtained direct from Messrs. Osram, or you can use a modern equivalent.

R. B. (Costessey). The only data we have published appears in our Service Manual. Here are main references to all types and bases, but obviously space prevents the publication of every individual make of valve. All types are, however, classified.

The coupon on page iii of cover must be attached to every query

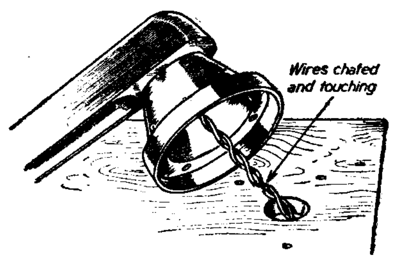
A Service Engineer's Log

Some Simple Faults, and How They Were Traced and Cured

IN the course of my work I have to deal with all kinds of receiver faults, from complete failure to "scratching noises in the speaker." And although I always carry a fairly complete kit of small tools and test gear when I am called out to an "emergency case" it is seldom that I have to use other than the simplest of them. This is no doubt because the faults which generally prove most baffling are those which can be repaired most easily.

Hum and Distortion

For example, I was recently asked to "vet" a superhet which gave perfectly good reception at some times, although at others there was a kind of intermittent hum combined with nasty distortion. The owner had noticed that it was often possible to stop the trouble by striking the receiver cabinet with his open hand; but this did not always work, and even when it did the fault usually recurred fairly soon. Loose connecting leads, slack mains connector, loose valves and badly-fitting screening cans were all suspected and checked without any fault becoming apparent.



Radiogram reproduction was found to "cut-out" sometimes while the gramophone was in use due to short-circuit of the pick-up leads where they passed through the motor board.

The owner then remembered that the fault had sometimes been known to clear when the wave-change switch was quickly turned from one position to another, and then back again. The switch was, therefore, examined and a check made to see that all contacts were clean and not strained. Again, no fault was found.

In making further superficial tests it was discovered that the electrolytic condenser in parallel with the bias resistor of the output valve was slightly loose on the steel chassis. To make a closer examination, the condenser (mounted by means of a central bolt) was removed. This showed that the chassis was slightly rusty underneath the condenser; removal of the rust with a strip of fine glass paper—emery cloth is not recommended because the abrasive is a conductor—and proper tightening of the mounting nut cleared the fault.

Radiogram Cutting-out

In another case the radiogram section was the cause of trouble. The turntable ran correctly, and when the needle was placed on the record good reproduction was obtained for a time. But by the time the needle reached about the middle of the sound track, reproduction first became "thin" and then ceased. If the motor was allowed to continue running, reproduction would sometimes start again, but not always. The fault was clearly of an intermittent nature because it did not always arise, and it was not confined to any particular records.

It did not take long to diagnose the trouble as being due to a short-circuit between the two pick-up leads at the point where they passed down the bush of the pick-up arm and the motor board. By removing the three mounting screws and raising the arm, the wires were reached and bound with insulating tape. A little more "slack" was allowed in the leads, and these were then made more secure against the under-side of the motor board.

Reproduction Fades

A fault which is not particularly unusual, and yet which often seems to baffle people is one which results in the set operating normally for some time after it is switched on and then "fading out." Very often it is noticed that distortion sets in before signal strength falls to any marked extent. This trouble is usually confined to mains receivers, and in many cases results from overheating of a valve—frequently the output valve. Due to over-heating, the grid becomes red hot and begins to act as a cathode, emitting an electron stream. The fault is referred to as grid emission, for obvious reasons, and can be due to lack of air circulation through the receiver; more often, however, the only satisfactory method of effecting a cure is by replacing the valve responsible for the fault. The valve is nearly always an old one which has "had its day," and is really in need of replacement quite apart from the grid-emission trouble.

Superhet "Groan"

A fault which I had to investigate recently caused the set to groan badly if the tuning condenser were set to any station on the lower half of the scale. The receiver was a superhet, and at first it was suspected that the frequency-changer valve might be responsible. Temporary replacement of this disproved the idea, so a search had to be made elsewhere. It was soon found that the screen of the first I.F. transformer was not making good contact with the metallised chassis; the fault had been made worse by the owner of the set attempting to re-set the I.F. trimmers. This had thrown the whole set out of alignment, so that it had to be taken back to the workshop so that it could be accurately lined up, using a modulated oscillator.

The same fault has sometimes been traced to a bad earth connection from the by-pass condenser used in the decoupling circuit for the oscillator anode of the F.C. valve.

Power-supply Contacts

In looking for the cause of crackling noises there are many set users who overlook what should be the most obvious of possible reasons. For example, I was asked to repair a three-valve battery set which was subject to this trouble. After I had removed, cleaned and slightly opened out with a screwdriver the three wander plugs, and made sure that the flexible leads were properly connected to the plugs, the trouble had disappeared! With mains sets this form of trouble is often due to the fact that the mains plug has dirty pins.

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

Blueprints, 6d. each.

	Date of Issue	*No. of Blueprint*
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)	2.2.38	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, RC, 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

SUPERHETS.

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 HF 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
Rome 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-valve Short-waver (SG, D, LF, P)	22.7.39	WM383

Superhet: Blueprint, 1s. 6d.

Simplified Short-wave Super	*Nov. '35*	WM397

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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)	—	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

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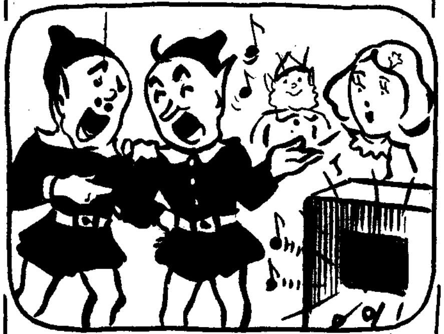

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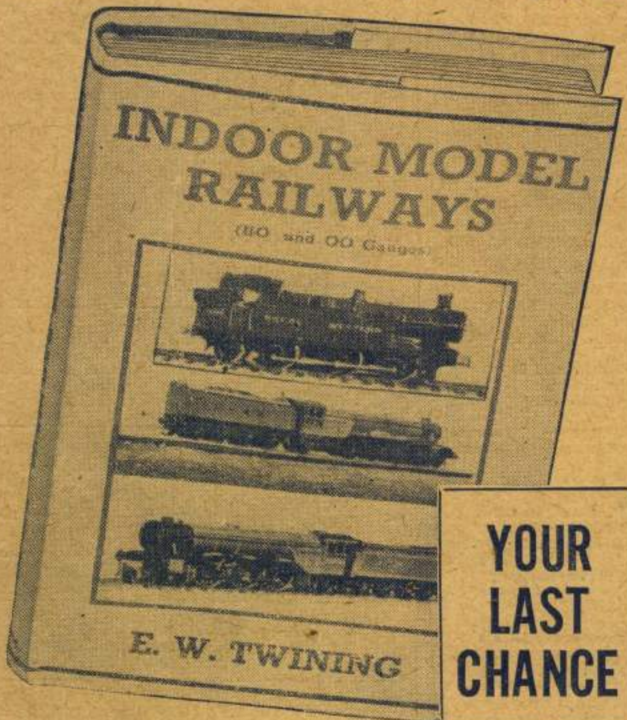

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