BANDSPREAD SHORT-WAVE THREE—

See page 347

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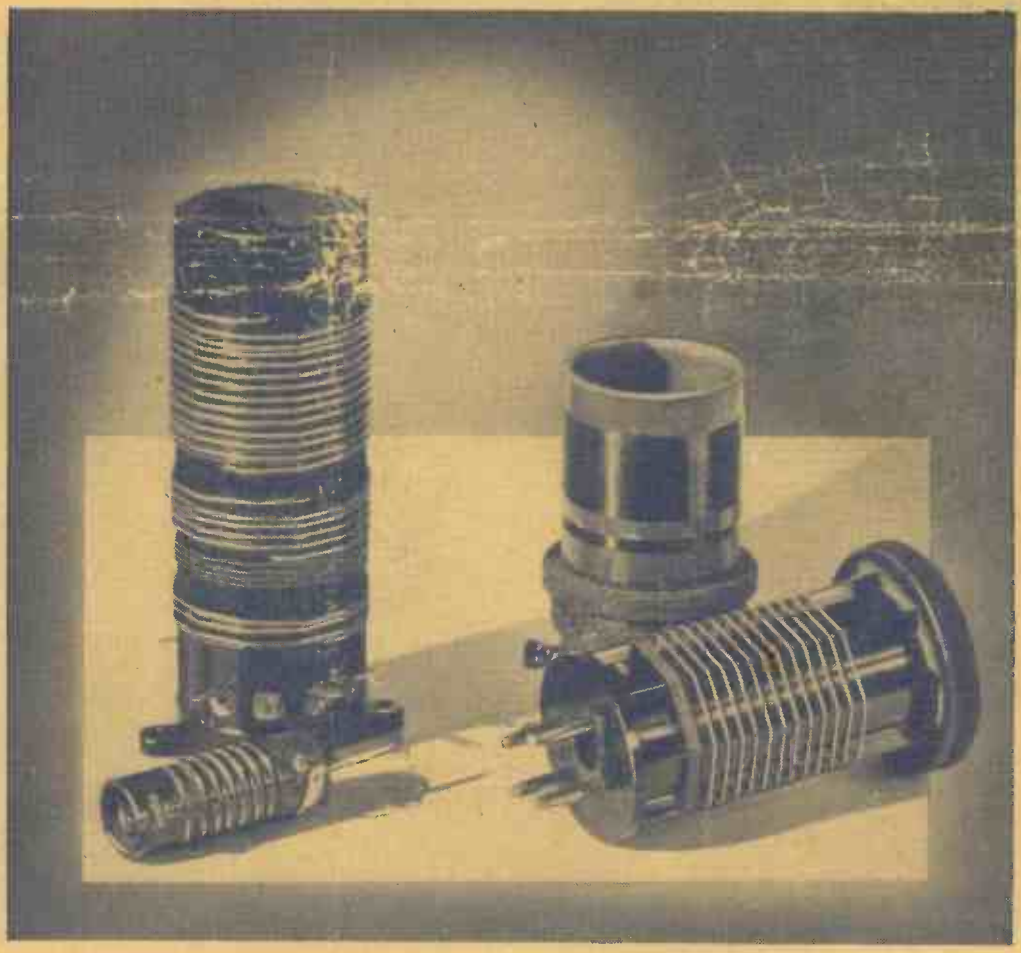
3D EVERY WEDNESDAY

Jan. 6th, 1940.

Contents



HOME-MADE COILS

Practical and Wireless
PRACTICAL TELEVISION
EVERY WEDNESDAY
Vol. XV. No. 381 Jan. 6th, 1940
EDITED BY
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ROUND THE WORLD OF WIRELESS

Short-wave Reception

THE increasing interest in short-wave reception has led many amateurs to dig out old apparatus or renovate short-wave receivers, but unfortunately the present period seems very unsuitable for short-wave long-range reception. Conditions have been very bad on some of the short-wave bands and it would appear that these conditions will remain until later in the month. However, by the use of suitable apparatus it is possible to obtain good results, but do not be disappointed if, when you try to get a given station, you are unable to hear it. If you need to increase the H.F. gain of a receiver, a two-stage regenerative unit such as is described in this issue will be of great assistance, or if you wish to build a new receiver, the three-valver also described in this issue will prove a very good general type of set. It should be remembered, in connection with short-wave reception, that very few amateurs can now be heard. Most countries have suspended amateur activities, and therefore there is very little to help in judging the performance of a receiver, other than the standard commercial broadcasts, and it is therefore necessary to listen at the correct times on the correct wavelengths, rather than to listen at any odd times in the hope of hearing something.

Statistics reveal that three out of every five radio employees are testers. The above illustration shows a tester checking motor-driven wavechange switches in the Ekco factory.

French Licence Increase

AS from the 1st of this month an increase has been made in the French wireless receiving licence fees. For crystal receivers the new rate is fr.15, and for valve receivers the new rate is fr. 90. A separate rate is charged for receivers used in places of public entertainment, and for this the rates are fr. 180 if the entertainment is free, and fr. 360 if a charge is made for admission.

Anniversary

THIS week marks the anniversary of the death of Professor Hertz (January 1st, 1894). On January 7th, 1927, the first transatlantic service was opened, and on the following day in 1923 the first outside broadcast was given by the B.B.C. This was a performance of the "Magic Flute" from Covent Garden.

Off to Hollywood

LULU BELLE and Scotty, top-ranking rural entertainers at WLW, are to be starred in the movies. They left recently for Hollywood, and on arrival will start production on "The Village Barn Dance."

Both have been under contract since August with Republic Pictures to be filmed in two shows this year, following the success of their first movie venture, "Shine on, Harvest Moon," which starred Roy Rogers.

Supporting the famous radio pair in the new picture will be Don Wilson, announcer on the Jack Benny programme; Vera Vague, network comedienne, and N.B.C.'s Kidoodlers. As soon as their work in Hollywood is completed, probably early this month, Lulu Belle and Scotty will return to WLW, to appear again on the "Boone County Jamboree" and their own morning programme.

Known in real life as Mr. and Mrs. Scott Wiseman, Lulu Belle and Scotty have been in radio six years. In 1936 Lulu Belle was selected radio's queen in a nation-wide listener poll.

Alternative Programme

THE B.B.C. announces that listeners who find difficulty in receiving the Home programme on either of the two wavelengths, 391 or 449 metres, are advised to try, after 6 p.m. any evening, the wavelength 342 metres. They may find that this wavelength, which is marked on most receivers "London Regional," will give them more satisfactory reception.

Symphony Orchestra

THE B.B.C. announces that the B.B.C. Symphony Orchestra, leader Paul Beard, conducted by Sir Adrian Boult, will visit the Town Hall, Cheltenham, on Thursday, January 11th, to give two concerts, one in the afternoon and one in the evening.

On Wednesday evening, January 17th, the Orchestra will visit the Central Hall, Newport, and on Wednesday evening, January 24th, the Orchestra will play at the Pavilion, Bath.

Extremes of Dance Music

ROBIN RUSSELL is to present on January 6th, a programme called "Extremes," which will be played by the "Sweet Rhythm Quartet," known for their broadcasts from Corstorphine, Edinburgh. "Extremes" will be of Cuban Rumba music and sweet rhythm. The players are Ronnie Austin (violin), Percy Pegg (piano), Ralph Smith (bass), Jack Collin (guitar), with Bette Roberts, vocalist.

Africa Flight

VAL GIELGUD'S "Africa Flight," which was produced for the stage last year, has now been adapted for broadcasting and will be heard on January 4th. This is the story of a 'plane which makes a forced landing in the heart of Africa. The theme of the play is the way in which different members of the crew and the passengers face up to the hazardous situation in which they find themselves.

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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.

Home-made Coils

Essential Factors which Must Be Considered When Designing and Making Coils, If Unsatisfactory Results are to be Avoided

By L. O. SPARKS

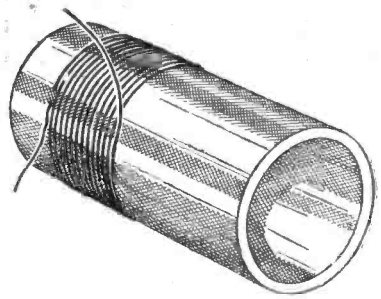


Fig. 2.—An example of single layer solenoid winding not difficult to construct.

CONSIDERABLE interest is now being shown by numerous constructors in the winding of the coils required for their receivers, or experiments, and it would appear that a few guiding remarks would not be amiss. For example, while coil design and construction can form a most interesting and fascinating subject, and, incidentally, save money, there are several considerations which, if not fully appreciated, can introduce very disappointing results.

Complete constructional details of coils for aerial and H.F. circuits, oscillators and I.F. transformers have been given more than once in past issues, and the present article deals with what might be termed practical considerations and simple formulæ associated with tuning coils of normal design.

General Design

The object of winding any coil for radio purposes is to provide a certain value of inductance, and if the property of inductance is examined, it will be seen that there are certain undesirable factors which must be avoided if the most efficient results are required. Without going into theoretical reasons too deeply, the following can be taken as those things which must be eliminated, as much as possible, when undertaking the winding of a coil. *Self-capacity. Resistance. Poor insulation. Large magnetic field* and *fragility.*

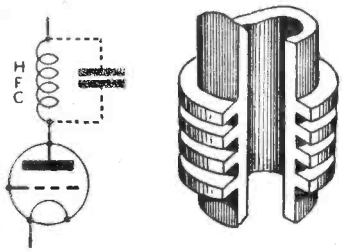
Self-capacity

When any winding has a high value of self-capacity, its effective inductance is reduced considerably or, in other words, part of the sole object of winding the coils is lost. A most striking example of this is a poorly-designed H.F. choke, the purpose of which is to stop the flow of high-frequency currents by presenting a barrier in the form of inductance. If the choke is formed by connecting several pile-wound coils, close together, on a slotted former of poor material, in series, then it is highly possible that the sections of the complete winding will act as the plates of a fixed condenser, and form, virtually, a condenser of measurable value. The resultant effect would be similar to connecting a small condenser across the choke; therefore, if one bears in mind that the reactance (this can be likened to resistance) of an inductor increases as the frequency increases, while that of a condenser decreases under the same conditions it will be appreciated that the H.F. choke will no longer present an impassable barrier to the H.F. currents, owing to the fact that the condenser will offer to them a path of very much lower resistance, and thus kill the sole object of the inductance forming the choke.

With ordinary tuning coils, particularly those intended for use on the medium and short wave-bands, this property of self-capacity will not only directly affect the overall efficiency and characteristics of the tuned circuits, but it will also reveal its presence when one comes to check the wave-band width of any given coil with a pre-determined variable condenser. The self-capacity would, in effect, increase the total capacity across the circuit and thus increase the minimum tuning wavelength. On the short and ultra-short wavelengths, when the frequencies soar to very high figures, the matter becomes more serious, so much so, in fact, that, as an examination of any good short-wave coil will show, the necessary windings are built up with turns quite widely spaced from each other.

The simplest way of avoiding this self-capacity, therefore, is to use coil formers of reasonable diameter, say, a minimum of 1½ins., and wind the coils in the simple single layer solenoid fashion. It can be noted, however, that the trouble is not so pronounced with coils designed for long-wave work, but this does not mean that it can be ignored completely, but owing to the lower frequencies concerned and the fact that a certain capacity across the coils will help to bring their fundamental wavelength closer to the band width required for this section, a little more latitude in design is permissible.

A solenoid single-layer coil to cover, say, 900 to 2,000 metres with a .0005 mfd.



Figs. 1 and 3.—Self-capacity can be likened to a small condenser across the winding, as shown on the left. A typical slotted former often used for the winding of the L.W. section is shown on the right.

variable condenser, would, unless very fine wire was employed, become rather clumsy for average set work, so one is forced to adopt the sectionalised winding method for this section.

Resistance

When speaking of resistance in relation to coil windings, it is not meant to infer the normal resistance to direct current, but that offered to the high-frequency alternating currents which are dealt with in the circuits preceding the detector valve.

The H.F. resistance of a conductor might be many times that which it would offer to a steady direct or a *low*-frequency alternating current, and this is largely due to what is known as the "skin effect." This effect obtains its name by reason of the peculiar paths taken by H.F. currents which, unlike the more familiar D.C., tends to avoid the whole mass of the conductor and seeks to flow on the outer surface or skin of the conducting material.

In addition to the above, quite serious losses can be introduced into coil circuits carrying H.F. currents by poor insulation and the presence of other conductors within the effective field of the winding under consideration. The losses can be caused by using formers of poor insulating material, poor dielectric strength of supporting insulating pillars or mountings holding the coil or any metal, such as other conductors or screens too close to the inductance; therefore care has to be taken in not only the design of the coil, but also its location in a layout. On the higher frequencies, *i.e.* short and ultra-short waves, these H.F. losses can become a very serious problem, so it must be appreciated that they represent a subject which, especially in that sphere of radio, must receive every consideration. Many constructors will, no doubt, have seen or used the S.W. coils wound with hollow copper tubing, such as those used in many amateur transmitting stations, and these can be taken as one example of the attempts to reduce the H.F. resistance of the circuit by providing the largest skin area possible, within, of course, reasonable limits.

So far as ordinary dual-range coils are concerned, the best one can do is to use formers of high insulating material, and wire of the heaviest gauge consistent with available space. This must not be taken too literally; it is not intended to suggest that 16 or 12 S.W.G. wire should be used for medium and long-wave requirements. If space permits using, say, 26 S.W.G. instead of 30 S.W.G. for the medium-wave section, then the former would be the more satisfactory, but the ultimate choice is so often governed by the size of the coil former, so the best way to set about designing a coil, when one does not have to consider space to a fraction of an inch, is to decide on what wire you are going to use and then select a former which will carry the required number of turns, but more about that later.

Some Old Circuits Revived

The Experimenters Describe Some Circuit Arrangements Which Have Almost Been Forgotten, But Which May be Worth Trying by Those Readers Who Have Not Previously Seen Them

IT is not always easy to think of new experiments which can be tried, but many readers will probably find interest in testing a few of the circuits used in the earliest days of broadcasting. In many cases it will be found that not only do the circuits provide interesting experiment, but that they are by no means inefficient. We were reminded of this

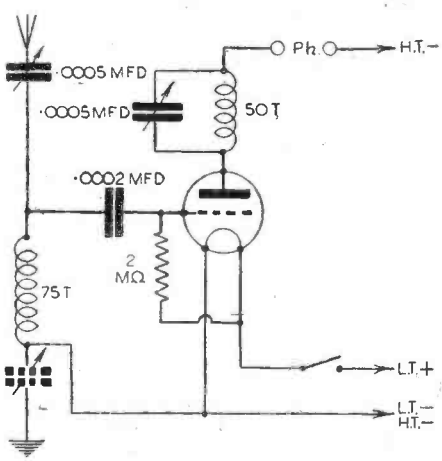


Fig. 1.—Two condenser positions for series tuning, and a tuned reaction circuit.

recently when turning the pages of an old notebook in which a record of all experiments carried out were recorded.

Series Tuning

One of the earliest entries, made in 1922, was based on the theme that a tuning circuit is most efficient when it contains a maximum of inductance and a minimum of capacity. It went on to record that reception with a single-valve (one of the old "R" valves, no doubt) receiver was appreciably better when using a series condenser for tuning, in place of the more customary parallel one. The connections to the aerial coil and tuning condenser were as shown in Fig. 1, where it will be seen that the series tuning condenser is between the aerial and the top of the grid coil. Incidentally, however, it could be used equally well in the earth lead, as indicated by broken lines. Often, the earth connection is better, since there are then no hand-capacity effects.

One fault with this arrangement is that selectivity is somewhat reduced by the series-tuning system. It is also evident that sensitivity must fall off as the minimum position of the tuning condenser is approached. The latter fault was less noticeable in 1922 than to-day, since the minimum capacity of a tuning condenser was much higher, in relation to the maximum, then than it is now. Still, you might consider it worth while to try this tuning circuit. The coil used in the 1922 tests was a number 75 plug-in, but a standard tuning coil can be employed.

"Tuned" Reaction

The old-fashioned "swinging-coil" method of reaction was used, where the reaction coil took the place of the H.F. choke used now, and was movably coupled to the aerial coil. Another form of reaction is shown in Fig. 1, however, this having formed the subject of another paragraph in the notebook. The underlying idea was that there is a certain amount of capacity between the grid and anode of a three-electrode valve, and that if the anode circuit were tuned to the same frequency as the aerial circuit, the capacity would serve for reaction coupling. As most readers are aware, a circuit tuned to a particular frequency has an infinite resistance to signal currents at that frequency.

According to the notebook, best results were obtained by employing a variometer for tuning the anode circuit, although reaction could be obtained with a coil-condenser circuit. The advantage of the variometer is that it is a variable-inductance device and is not shunted by a condenser. If you have an old variometer in the junk-box you can easily try this reaction arrangement, and draw your own conclusions. It should be mentioned that a variometer of the kind originally intended for tuning in the aerial circuit will not serve unless it is connected in series with a small coil consisting of about 20 turns on a 2in. diameter former. One of the type designed for tuned anode coupling will serve without the addition of a coil. The reason for the difference is that in the early days the aerial was always joined directly to the top of the aerial variometer, with the result that the inductance and capacity of the aerial were added to the corresponding properties of the tuning circuit.

The Original Reinartz

A modified form of Reinartz circuit is employed almost universally for reaction control to-day, but the original Reinartz, which was in use up to about 1923, was somewhat different from the modern version. A single-tapped winding was used for tuning and reaction, and the end of the reaction portion of the winding was connected to the aerial, as shown in Fig. 2. By this method of connection the reaction turns serve as both reaction and aerial-coupling winding. Reaction is controlled in the usual manner by means of a .0003-mfd. variable condenser, this being connected between the anode of the detector valve and the aerial.

An H.F. choke is shown in Fig. 2, and is desirable, although the circuit in our notebook does not include this; instead, the necessary H.F. impedance was supplied (or was supposed to be supplied) by the

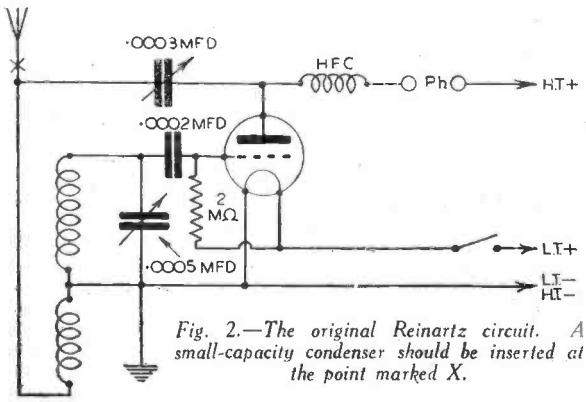


Fig. 2.—The original Reinartz circuit. A small-capacity condenser should be inserted at the point marked X.

'phones. If you wish to try this circuit you can use any standard tuning coil, or you can wind 75 turns on a 3in. diameter former, and take the earth tapping at the fiftieth turn. It will also be better to insert a .0002-mfd. pre-set or fixed condenser in the aerial lead at the point marked X in Fig. 2.

One Valve for H.F. and L.F.

Prior to 1926, or thereabouts, so-called

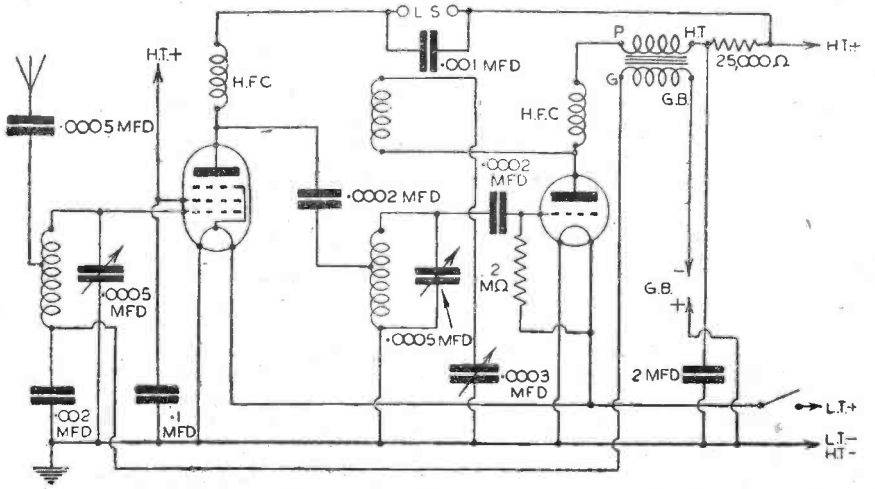


Fig. 3.—A modern version of an old-type reflex circuit, using a triode detector.

SOME OLD CIRCUITS REVIVED

(*Continued from previous page*)

reflex circuits were very popular, and we find several examples in our old notebook. The idea of the reflex, as many will remember, is that one valve is made to act as both H.F. and L.F. amplifier. It was usual, when using the reflex arrangement, to have a crystal detector preceded by the dual-purpose valve—which was an ordinary triode. Despite the widespread use of the valve-crystal reflex, we must confess that we never favoured it. The reason was that we were never able to obtain appreciably better results from it than we could from a carefully-adjusted single-valver with steady reaction. And our opinion on this matter has not changed during the past sixteen years, except that we are still more convinced that the inclusion of a crystal is more trouble than it is worth. No doubt there will be a few readers who will disagree on this matter, but we have given our opinion.

A Modern Reflex

The reflex circuit which we found most successful was similar to that now given in Fig. 3. It will be seen, however, that the Fig. 3 circuit has been brought fairly well up to date by the use of decoupling for the triode detector and the use of an H.F. (or L.F.) pentode for amplification. We have actually used a circuit of this kind during more recent years, and it is by no means as unsatisfactory as might be imagined. The quality would not please the music critic, but it need not be bad.

It will be seen from the circuit that the H.F. and detector stages are conventional, but that the secondary winding of the

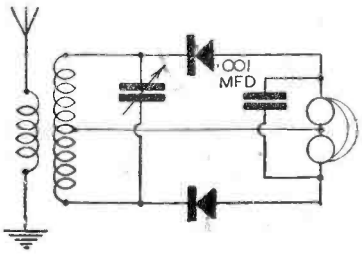


Fig. 4.—One of many full-wave-detector circuits which were tried with little success.

L.F. transformer is fed back to the grid circuit of the H.F. valve, instead of being connected to a third, or ordinary L.F., valve. The secondary has a .002-mfd. fixed condenser in parallel with it to by-pass H.F. currents in the tuning circuit, but it is often possible to reduce the value of this condenser to .001 mfd. without upsetting the H.F. stage; there is then a certain improvement in the "quality" of reproduction.

Standard components can be used throughout this circuit, and the voltage applied to the screening grid of the H.F. pentode should be as high as possible without impairing H.F. efficiency. The higher this voltage, the greater will be the L.F. output, although this can never be high when using an H.F. pentode. That is why it is worth while trying an economy output pentode, such as the Cossor 220 HPT. With that valve, and when using a maximum of 120 volts H.T., the screening-grid voltage can be about 90 and G.B. 3 or 4½ volts.

Full-wave Detection

One of the aims of those experimenters who favour the crystal detector has always been to obtain full-wave rectification, with consequent increase in volume. This is one of those things which looks all right on paper, but which seldom works out in practice. The circuit shown in Fig. 4 brought back memories of many valiant struggles when it was found in a 1921 notebook; it is one of many arrangements which were tried, with indifferent results. Two crystal detectors were used, and the series connection from the two earpieces was taken to a centre-tapping on the tuning winding of the coil. Despite all efforts to find the exact centre-tapping point, we were never successful in obtaining any better reception than could be obtained from a single crystal.

A Station-selecting Switch

An Improved Unit for Use in Conjunction with Motor-driven Preset Tuning Apparatus

A COMMON form of station-selecting switch for motor-driven press-button tuning apparatus consists of a rotor or commutator drum, which is mechanically coupled to a reversible electric motor and to the tuning shaft of the receiver, and a stator which supports a number of station-selecting contacts radially round the periphery of the rotor.

The rotor may consist of two commutator segments separated by narrow strips of insulating material; the stator usually consists of a semi-circular strip of metal formed with a longitudinal slot and mounted concentrically with respect to the rotor; station-selecting contacts are usually frictionally supported in the groove in the stator and may be slid in the groove and thus moved radially with respect to the rotor to vary the stations they select.

A disadvantage of this arrangement is that the angle through which anyone contact may be displaced in one direction is limited by the position of the adjacent contact in that direction: thus if a contact is set to select a station at one end of the wave-band, and it is desired to change the selection for a station at the other end of the waveband it is usually necessary to move the station-selecting contact nearest to the desired position into that position, and move the remaining contacts up one.

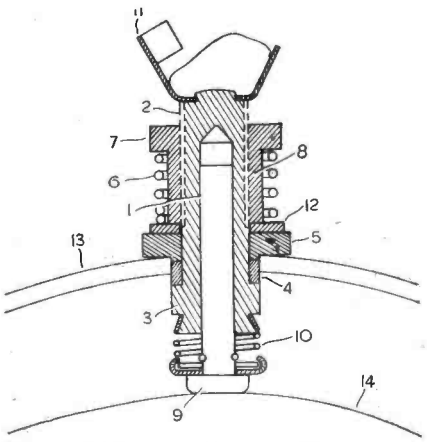
This tedious and time-wasting proceeding may be avoided by constructing the station-selecting contacts so that they may be removed readily from the stator groove.

An improved station-selecting contact of this kind is illustrated in the accompanying illustration and consists of a hollow post 1 formed with a knurled head, 2, and provided at the opposite end with a substantially rectangular flange or plate 3. A strip, 4, of insulating material of similar shape is mounted in the upper surface of the plate, 3, and the dimensions of the plate and strip are such that their width is less than the width of the slot in the stator and their length is greater than the width of the slot.

The stator is indicated at 13, and the post 1 may be placed in the stator slot by holding it by the knurled head with the long edges of the plate parallel to the sides of the slot, and it is then rotated through 90 degrees to prevent withdrawal.

The upper surface of the strip 4 is preferably cut away along its shorter edges whereby a projection is formed which lies between the side walls of the stator slot, and keys the station selector contact to the slot.

The post 1 is held in the slot by means of the insulating bush 5 which is urged by a spring 6, bearing against a washer 12, into engagement with the upper surface of the



Section of the improved station-selecting contact described in the text.

stator. The spring 6 also bears against a collar 7 on a sleeve 8, and the sleeve 8 is threaded internally and mounted on a screw threaded section of the post 1. The sleeve is rotated in the correct direction to force the bush 5 into firm engagement with the upper surface of the stator 13, and locks the post in the selected position within the slot.

When it is necessary to alter the position of the post the pressure on bush 5 is reduced by rotating the sleeve through half a turn in the opposite direction, so that the relatively light pressure of the spring 6 permits the post to be slid along the groove. When it is desired to remove the post from the stator slot the sleeve 8 is rotated through one or more turns to permit axial movement of the post, and the post is depressed to withdraw the projecting portion of the plate 3 and strip 4 from the groove and then turned through 90 degrees and lifted out of the slot.

A plunger or contact-making member 9 is slidingly mounted in the bore of the post 1, and is urged by a spring 10 into engagement with the rotor indicated by the line 14. The spring 10 is secured to the plunger 9, and the post 1, in any suitable manner to prevent the plunger from being completely withdrawn from within the post.

A terminal member 11 for a conducting lead may be riveted or otherwise secured to the heads of the post 1.

Tone Control by Negative Feedback

Further Notes on How Negative Feedback can be Used for Controlling Tone Value

(Concluded from page 332, December 30th issue)

A FURTHER embodiment of the system is shown in Fig. 5. The A.C. output potential used for counter-coupling is connected to the series connection of the resistances R_1, R and R_2. The sliding contact S is connected to the cathode of the valve V_1,

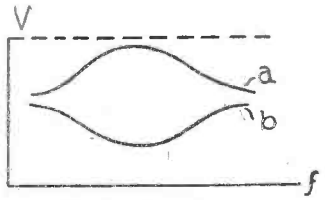


Fig. 6.—Control curves.

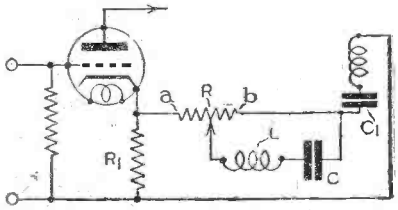


Fig. 7.—Series connection for the counter coupling.

whereas the resistance R is bridged by the parallel circuit L, L. Fig. 6 shows the control curves to be obtained. The counter-coupling, and thereby the amplification for the high and low tones remains chiefly unaltered during the control, whereas the counter-coupling, and thereby the amplification for the medium tones, is adjustable in wide limits. In one extreme position (b) the high and low frequencies, and given preference with respect to the medium frequencies, in the other extreme position (a) they are attenuated. In a receiver which has no complete fading compensation, the one extreme position (b) is suitable for reception of the local transmitter, and the other extreme position

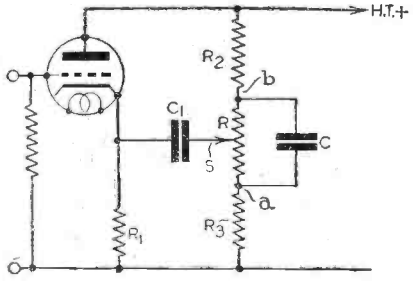


Fig. 11.—A single-stage amplifier circuit in which bass boost is provided.

for the reception of distant transmitters when the same medium volume has to be obtained. With constant medium input A.C. potential, the control results in an acoustically correct volume-control.

A symmetrical shape of the curves a and b, as shown, can only be obtained when the resistances R_1 and R_2 have the same value. The range of variation for the medium-tone frequencies is in this case given by the ratio $R : R+R_1$. If, however, R_2 is small with respect to R_1, the shape of the curves is similar to that of Fig. 2. If the resistance R_2 is large as compared with R_1, the shape of the curves is more similar to that of the curves in Fig. 4.

In the arrangement shown in Fig. 5, the grid bias of the valve V_1 is varied by the control in the same way as in the arrangement according to Fig. 1. This may also be achieved by a suitable selection of resistances or by connecting a capacitively-bridged resistance R_k in series with R_1, according to the circuit given in Fig. 1.

Similar control curves may also be obtained by using series circuits instead of parallel circuits. In the circuit given in Fig. 7, the counter coupling potential is at the

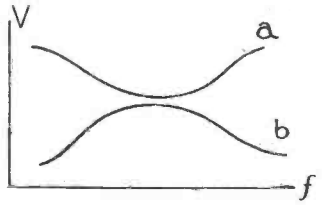


Fig. 10.—Further control curves.

series connection of the condenser C_1, of the resistance R and of the resistance R_1. The latter resistance is firmly connected in the cathode lead of the valve V_1. The right-hand end b of the resistance R is connected through the series circuit L, C tuned to medium frequencies, with the sliding contact S. The amplification curves which are obtained by moving the sliding contact correspond with those of Fig. 2.

In the circuit given in Fig. 8, the cathode resistance R_1, and not the resistance R connected in the lead, is provided with a sliding contact S, which is connected through the series circuit L, C with the earthed return lead. With this circuit it is also possible to obtain the control curves according to Fig. 2.

If in the circuit given in Fig. 1 the parallel circuit is replaced by a series circuit tuned to medium frequencies, we obtain the control curves shown in Fig. 9. In this arrangement the counter coupling and, therefore, the amplification for the medium tone frequencies remains also approximately equally large, whereas the counter coupling for the high- and low-tone frequencies may

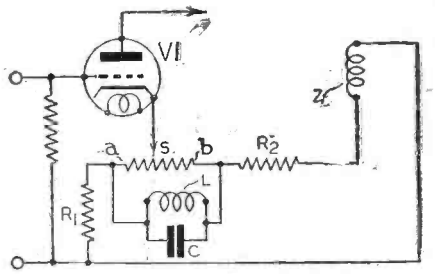


Fig. 5.—A further modification of the scheme illustrated in Fig. 3.

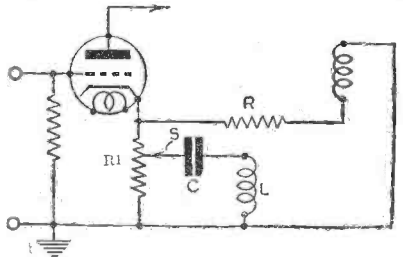


Fig. 8.—In this circuit the cathode resistance is provided with a sliding contact.

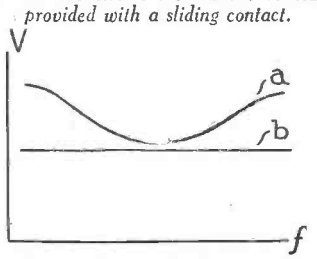


Fig. 9.—Curves obtained by the use of the series circuit.

be made small, whereby these frequencies are raised.

If in the circuit shown in Fig. 5, the parallel circuit is replaced by a series circuit, we obtain the control curves shown in Fig. 10, in which the high- and low-tone frequencies may be attenuated or raised as desired with respect to the mainly constantly counter-coupled medium-tone frequencies.

Circuits with control curves according to Figs. 9 and 10, are suitably applied in such cases in which one can reckon with a constant medium input A.C. potential, when a constant medium output volume is desired, and a pure tone control is intended.

Circuit arrangements with parallel circuits will often be given preference because the self-capacity of the coil goes into the capacity C. In the case of the series circuit the self capacity of the coil L has to be taken so small, that for the frequency range in question the capacitive resistance of the coil is still sufficiently high.

(Continued on page 348.)

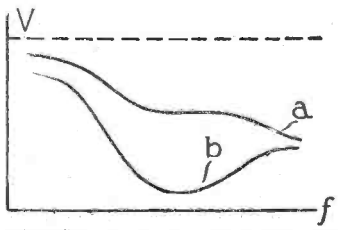


Fig. 12.—Control curves obtainable with the arrangement shown in Fig. 11.

Comment, Chat and Criticism

Musical Taste

Our Music Critic, Maurice Reeve, Discusses Popular Melodies

ONE'S taste, or fancy, is a most peculiar thing. Often it is quite unaccountable. And it is no more predictable in music than in anything else. Just as we meet on our travels with two of a kind—anything of the thousand-and-one things we handle during the course of our passage through this transitory life, two pieces of soap, maybe, or two kinds of cigarette, one of which, for no apparent reason, flourishes and luxuriates by the side of the other—so do we find with two pieces of music. An ordinarily musical man may hear two pieces of music of the same genre—anything from symphonies to swing—and both may appeal to him as being equally good in their own particular sphere. Yet one is bound to be the public's favourite. And again, when a work like Schubert's Unfinished Symphony is taken to the people's hearts out of a collection of nine, of which most people are almost ignorant, except the ninth, we don't ask why. Because, in a case like that, one possesses such an unmistakable quality and exercises such an irresistible appeal on our thoughts and emotions that the reasons are obvious, even though we may not be able to give adequate expression to them.

But the most remarkable instances are of works which the public insists on taking to its hearts and bestowing on them its signal favours, but which are, in the unanimous opinion of everyone who knows anything about the subject at all, inferior as works of art to their companions in the collection bound up within the same covers. Among such instances may be cited Rachmaninoff's famous Prelude in C Sharp Minor, Chopin's Study on Black Keys, Schubert's Ave Maria and Serenade, Elgar's "Pomp and Circumstance" march, containing "Land of Hope and Glory," and many others. There are scores of examples from opera, musical comedy and revue which are nothing but a collection of tunes and melodies. For some unaccountable reason the public takes one of them and crowns it favourite, when very often some of the others in the same show are just as good, and better. It is passing strange, and defies analysis.

Popular Melodies

Up to a point, so far as a general type of music or mood in music is concerned, there is a remarkable fact, the reason for which could only be solved by passing right beyond the confines of music and on to psychology and the national character and temperament themselves. I start my presentation of this fact (I shall not attempt to give reasons for it, here, at any rate) by appending a representative list of twelve compositions, the universal popularity of which few, if any, readers would care to dispute.

1. Moonlight Sonata, first movement.
2. Rachmaninoff's Prelude.
3. Chopin's Funeral March.
4. Handel's Largo.
5. "One Fine Day," from "Madame Butterfly."
6. "Softly Awakes My Heart," from "Samson and Delilah."
7. Valse Triste, by Sibelius.
8. "Annie Laurie."
9. "Last Rose of Summer."
10. Schubert's Unfinished Symphony.
11. The Indian Love Lyrics, by Woodforde-Finden, and
12. "In a Monastery Garden."

Please note that I have not attempted to place these in any order of supposed popularity. I have merely put them down as the titles occurred to me.

Whilst admitting the enormous popularity of works like "Poet and Peasant" and "William Tell" (both of which are more or less abruptly divided into two parts, grave and gay), I doubt very much whether there would be a majority vote for their inclusion in my list to the exclusion of any two of my first choices. In any case, it wouldn't affect the propriety of my selection if we judge the popularity of a composition by the welcome given to it whenever it is performed, which must, after all, remain the final arbiter. Of course, I am quite prepared to admit that, at given moments, works like "The Lambeth Walk" or "Tea for Two" might elbow their way through to the front of the queue. But I feel that their fashion is very ephemeral and transitory, whereas the others are permanent.

What is the extraordinary thing about this list? Why, that every piece in it is of a sad or contemplative character. There is not one single lively or jolly number in it from beginning to end. It is so remarkable, in fact, that you may think there is something "phoney" about it. But that is not so, as a brief examination will show.

I set out to think of twelve tunes which I thought the vast majority of people would find most acceptable on all ordinary occasions, such as when visiting theatres or cinemas, restaurants or cafés, etc., and for the life of me I couldn't think of one lively one that I, personally, hear played on such occasions. Turn on your radio and listen to the many salon combinations that broadcast so frequently; they play at least eleven of them more often than almost anything else. Ask gramophone record makers which records have the largest day-to-day sales. You may ask why Chopin's Funeral March? Why not Mendelssohn's Wedding March? Well, whilst neither are ever played as entertainment, the Funeral March stands by itself for its occasion, whilst the Mendelssohn at least shares the honours with Wagner's from "Lohengrin." Furthermore, a funeral march is public and is heard by millions of people, whilst a wedding is private and intimate. I venture to suggest that a public funeral without Chopin's work would be talked about as something of a novelty (has it ever been known), whilst thousands of bridal couples walk down the aisle to Wagner's music out of preference to Mendelssohn's.

A Surprising Encore

I will tell you of an experience I had a short while ago. Although I vouch for it, I shall forgive you if you choose to doubt it. It was remarkable, and surprised me and others at the time. The last occasion in which I gave a pianoforte recital at one of the biggest girls' public schools in the north of England—Casterton, at Kirkby Lonsdale—I was awarded the customary encore. But instead of playing something of my own choice I invited my audience to make their own selection—chancing to luck that I could grant it. After a few moments of contemplative silence, one young lady rose and requested Chopin's Funeral March! Furthermore, the suggestion was welcomed with rounds of applause and the performance of it accorded with as much enthusiasm as that given to anything else on my programme! Although it greatly surprised me as well as the Head Mistress and everyone else I met there, it was an indisputable proof of the trend of thought of a large body of people, and juveniles to boot, which I think would interest thinkers in other branches of thought as well.

Strauss waltzes would be certain to gain a large number of votes on any occasion, and at any time, but I cannot think of any merry and bright work that I would consider as likely to hold the affections of the majority, and to be agreeable to them on all average occasions, as the type of piece which makes up my list. Try and form one for yourself, and I'll wager that sad, dreamy, contemplative music will gain the majority of places every time. Think of the pieces of this kind that I did *not* find a place for but whose popularity is unquestioned: Liszt's Liebestraum, Chopin's Nocturnes, Debussy's Clair de Lune, Schumann's Träumerei, Rubinstein's Melody in F, as well as all the famous ballads like "Little Grey Home in the West," "Bird Songs at Eventide," "Until," "Because," "Trees," and a myriad of others. You'll hardly find a lively one amongst the first hundred.

PERSONAL PARAGRAPHS

George Taylor, who used to be with Whiteley Electrical, is now fixed up as Lincoln representative for J. Evershed and Company, the London printers. Mr. Taylor commenced his new duties on January 1st.

H. Mitchell is back again at the Burndept and Vidor offices as publicity manager. He had been at Baird's for some time.

Sir Louis Sterling has been elected vice-chairman and managing director of A. C. Cossor, Ltd., Mr. J. H. Thomas having resigned his managing directorship. Mr. Thomas has also tendered his resignation as chairman of the R.M.A.

ON YOUR WAVELENGTH

By Thermion

Back Issues Wanted

MR. C. P., of Muswell Hill, urgently requires PRACTICAL WIRELESS dated January 19th, 1935, January 26th, 1935, and February 2nd, 1935. These issues are entirely out of print, so if any reader can oblige perhaps he will let me have them.

C. P. served in the last war, but is unfortunately not able to serve in this as he was invalided from the service. Wireless is his sole recreation, and the issues concerned will help him to complete a set.

The Battery Racket

REPORTS continue to reach me that dealers are splitting up H.T. batteries and selling the individual cells at 4d. each. In each case I have reported the matter to the appropriate authorities. In the meantime, I suggest that the Associated Radio Battery Manufacturers should investigate this matter at once.

You have observed that the Board of Trade have an eye on the matter, for their first order under the Prices of Goods Act includes electric torches and accessories, including batteries and bulbs. Unfortunately, this Order did not come into force until January 1st. By that time manufacturers undoubtedly caught up with the delivery of price-maintained goods. The colossal demand has ceased, and the profiteers have vanished. I suggest that the Order should have been immediately operative. As from January 1st it was an offence to sell such goods at higher prices than those ruling on August 21st last, plus a permitted increase which must be calculated as defined in the Act. The hire purchase Trade Association has issued a bulletin on the matter in which it says that there is a duty on every supplier of goods during the continuance of the war to endeavour to keep prices down to the lowest possible level, as it is necessary that the cost of living shall not be needlessly inflated. The feeling in the country against profiteering is intense.

Presentation to Lt.-Col. Ozanne

ABOUT 60 members of the R.M.A. had their first war-time lunch at the Russell Hotel recently, with Mr. W. W. Burnham in the Chair. Mr. A. F. Bulgin presented Lt.-Col. G. D. Ozanne with a gold cigarette case, and a piece of jewellery for his wife, in appreciation of his efforts in organising Radiolympia. Mr. Leslie McMichael also referred to Lt.-Col. Ozanne's work. I, too, should like to pay my tribute, for I know the enormous amount of work he put in to make this year's Radiolympia a success. His efforts were only defeated by the war.

The Output Stage

IT is a prevalent idea that an improvement follows the fitting of a new speaker. Most speakers will function with an efficient receiver provided that they are connected in a suitable manner. This is because any valve operates most efficiently when the impedance connected in its anode circuit is of a fairly critical and definite value; this value is called the "Optimum Load," and is measured in ohms.

The Transformer Ratio

IT is evident that a speaker of different impedance could not be employed for each type of output valve, and therefore some simpler system must be devised. All listeners know that a transformer can be used to "step up" or "step down" A.C. voltages, and it is this instrument which is used for the purpose under discussion. If one knows the optimum load required by the valve and also the impedance of the speaker to be used with it, one can find a particular transformer ratio with which the valve and speaker will be matched. In the case of a moving-coil speaker the correct ratio is obtained by dividing the optimum load by the speaker impedance and taking the square root of the answer.

Readers' Change of Address Column

I AM happy to comply with a request made that I include a regular column of readers' changes of address. Where these addresses relate to the Army, I am, of course, unable to publish them, but I can include the reader's name and district and offer to forward letters. Readers who wish to keep in touch with one another are offered the facilities of this column.

Coupling Condenser Values

A TECHNICAL question I frequently receive relates to the values of coupling condensers. The value of the coupling condenser depends upon the stage of the receiver in which it is employed, and the correct value of the condenser is best found by experiment. In the case of a detector valve, the value depends to some extent upon the constants of the valve and upon operating conditions. In a power grid detector, for example, where the coupling condenser usually is smaller than the conventional .0003 mfd., say .0001 mfd., and the valve is operated at a high anode voltage and current, a much smaller grid leak, generally of the order of a quarter megohm, is necessary. A fairly wide range of choice is usually given for the value of the coupling condenser in low-frequency resistance-capacity coupled amplifiers. A capacity value between .005 mfd. and .05 mfd. will be perfectly satisfactory, but the actual choice depends very much upon the band of frequencies it is desired to pass. If the set builder wishes for full round tone with plenty of bass, then the value of .05 mfd. or even greater should be chosen, while a lower value, by cutting off some of the bass, will give a higher pitched and perhaps more brilliant tone.

Physical Jerks

THE B.B.C. has now good reason to believe that several million men and women listeners have settled down to the routine of the early morning broadcasts of physical exercises. It is the ambition of both instructors, as they move anonymously through the streets, to see in the carriage of men and women the difference that their instruction is making to the nation.

A Two-stage Pre-selector

A Useful Addition to Any Receiver to Ensure Long-distance Short-wave Reception

By W. J. DELANEY

LAST week we dealt with the problem of improving a receiver of the short-wave type to ensure reliable long-distance reception, but only existing apparatus was dealt with. It has before been pointed out in these pages, however, that the addition of an H.F. stage, or a pre-selector as it is often called, will enable much greater reliability to be obtained, not only so far as range is concerned but in relation to the removal of certain troubles which are often experienced in simple circuits lacking H.F. amplification. Even with a superhet of the communications type, if an H.F. stage is not included, the performance may lack certain of the effective handling properties met with in a receiver which is so fitted. It will therefore be gathered from the above remarks that a separate pre-selector is a worthwhile piece of apparatus.

Most units of this type which have been described employ a single H.F. valve, generally a pentode, and as such merely add a further tuned stage plus a certain degree of amplification. If, however, we intend to settle down to the building of such a unit there is no reason why, whilst we are about it, we should not make a two-stage unit, and in addition go to the trouble of incorporating some form of regeneration to add still further to its usefulness.

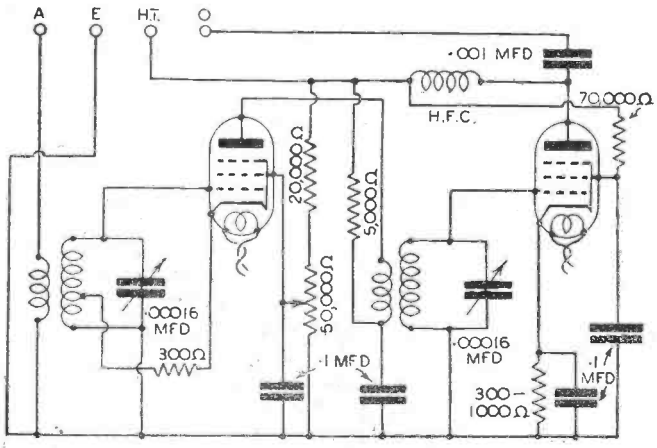


Fig. 1.—Theoretical circuit of the 2-stage regenerative pre-selector.

The Circuit

By using a variable-mu pentode this regeneration may very simply be obtained by the simple expedient of controlling the screen voltage, selecting the various voltages so that a smooth build-up may be obtained. A similar valve, suitably biased, may be used in the second stage, but without the control, adjusting the bias voltage so that a fairly good measure of amplification is obtained. The control on the first valve should be selected so that it will regulate the output from the unit in such a manner that overloading of the initial stages of the receiver with which it is used will not occur, and so that the maximum amplification may be obtained on distant stations. Fig. 1 shows a circuit on these lines, with, however, only one tuned circuit in each position giving a wave-range coverage according to the coils in use. There is, however, no reason why the unit should not be built with a set of coils, selected by a suitably ganged switch unit so that three or even four ranges may be covered. For mains use it will be necessary to provide some separate source of voltage supply, although there is a possibility that the receiver will have sufficient H.T. current available for H.T. purposes. Therefore, a small filament transformer only will be needed in the unit, and this should be controlled by a separate switch when the unit is required.

Suitable Components

For the coils, home-made components could be used, but separate small coil units will be found, for instance, in the Bulgin range, and this firm also supplies useful multi-contact switch units which may be ganged and thus the construction of the tuning sections of a unit of this type is simplified. For the screen voltage control a good reliable component should be selected, capable of carrying the total screen current. The tapping on the coils to which the cathode is connected to provide the reaction effect is not exactly critical, but should be about one-tenth of the total number of turns. The exact position should be found by experiment with the particular valves you intend to use, although the regulation of the screen voltage will be found to be so wide that a critical tapping point is not essential. Use non-inductive condensers for all by-pass purposes, and keep wiring as short as possible. It is desirable, but not essential, to separate entirely the two stages, a vertical screen on top of a small chassis serving to separate the valves and two tuning condensers, whilst a similar screen below chassis may isolate the separate sections of the switch unit. If desired, the tuning condensers may be in the form of a special short-wave two-gang unit, such as is found in the Eddystone or Raymart ranges.

How To Use the Unit

To enable the unit to be used the aerial must be removed from the aerial terminal of the receiver and transferred to the aerial terminal on the unit. A short lead, preferably screened, is then taken from the O terminal on the unit to the aerial terminal on the receiver, and the earth terminal on the unit is linked across to the earth terminal on the receiver. A lead is then taken from one of the maximum H.T. points in the receiver across to the H.T. terminal on the unit. As this is rated for the maximum H.T. which the valves will take it is preferable to take the lead from the L.S. positive terminal in the receiver. If it is found that any instability sets in it may be worth while to include a really good H.F. choke in the lead between the H.T. positive terminal on the receiver and on the unit, with a .001 mfd. mica condenser between the unit H.T. terminal and earth. This choke must, however, have a fairly high current rating as it will have to carry not only the total anode current of both H.F. valves, but also the screen currents and that flowing through the screen potentiometer. The unit is not a short-wave converter, and therefore it is necessary that the tuning ranges selected for the unit shall be the same as those covered by the receiver, and the main use of such a unit is on the short waves. In use, both receiver and unit should be switched to cover the same waveband, and then both unit and receiver are tuned together. The tuning of the unit will probably prove much sharper than that of the receiver, especially if the latter is only of the detector-L.F. type, and therefore some care is necessary to avoid passing stations by rapid tuning. Adjust the potentiometer so that the usual rushing sound denoting reaction is observed, and it should not need touching whilst the condenser is turned through its entire range on each band. With care it may be possible to find a value of resistance, or setting of the control, in conjunction with the tappings on the coils which will enable the control to be set and then the condenser turned from minimum to maximum on each coil range, with perfect control of reaction. In any case, it is a simple matter to adjust the control as soon as a station is tuned in, bringing this up only so far as is necessary to give a worth while signal free from interference.

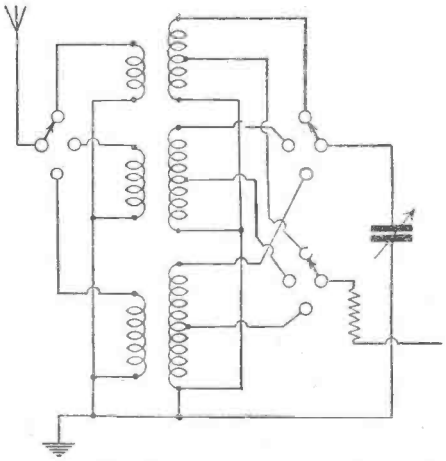
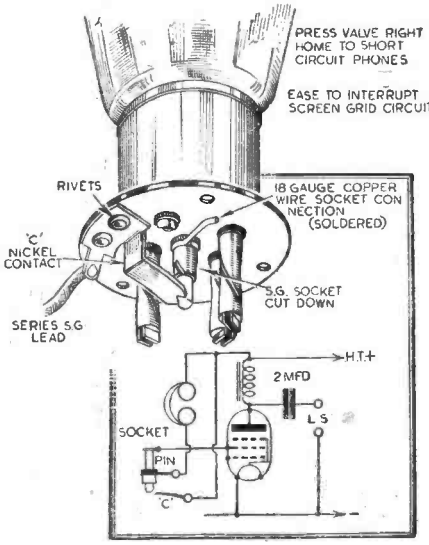


Fig. 2.—How to arrange wave-change switching

Practical Hints

A Valveholder Modification for Tests

THE principle illustrated in the accompanying sketch is simply that of interrupting the continuity of one or more valve socket connections, by introducing suitable contacts which engage with the valve pin or pins, due to the shortened valve socket.



A novel valveholder modification for testing purposes.

This scheme lends itself admirably for such conditions as interrupting screen-grid circuits for, say, the inclusion of headphones in oscillator circuits or output circuits, the temporary interruption of filament circuits, for cutting out pre-audio amplifier stages in gramophone pick-up reproduction, and in certain instances where single and double diode A.V.C. schemes are being experimented with.

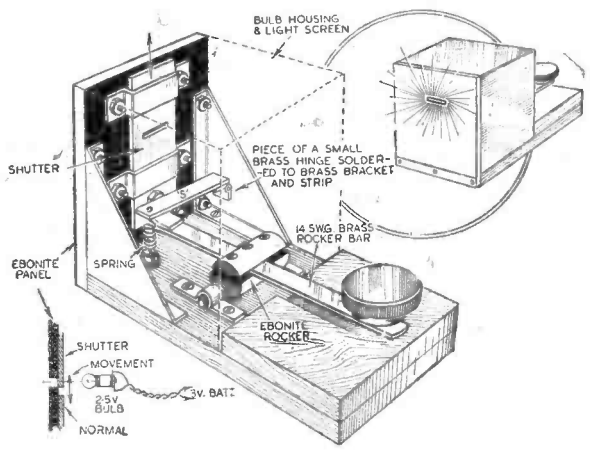
It is advisable in fitting the contact member to use suitable soft rivets to prevent the possibility of the contact shifting into short-circuit with adjacent pins or sockets. The sketch is self-explanatory, and the inset theoretical diagram examples very simply one adaption.—D. L. EASTON (Bushey).

A Flash Unit for Morse Practice

IN company with an enthusiastic friend, I have been trying to master the morse code with both oscillator and torch bulb unit, but owing to the objectionable effect of dazzle brought about by an unshielded bulb, it occurred to me that an improved flash unit could quite easily be made using a small shielded light aperture, the dots and dashes being carried out by a suitable shutter. To this end then, we both set about drawing up a few ideas on paper, the final choice being as illustrated. With a little patience we made two such units, dipping very frequently into the multitude of odds and ends which make up the proverbial wireless den.

It will be seen that the light aperture constitutes simply a slot in both the panel and the aluminium shutter, the shutter operating in such a way under the control of the spring loaded rocker arm of the morse key, that on each depression of the key the two slots are exactly in line, thus letting the light through, whilst on the key restoring, the shutter drops back governed by the spring bar "S," the shutter slot consequently sharply cutting out the light.

Various methods suggest themselves for the light source, so I have left details of this out of the sketch, which I think is self-explanatory.—R. W. DENNIS (Stratford).



A simple morse key and flash unit arrangement.

THAT DODGE OF YOURS!

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

SPECIAL NOTICE

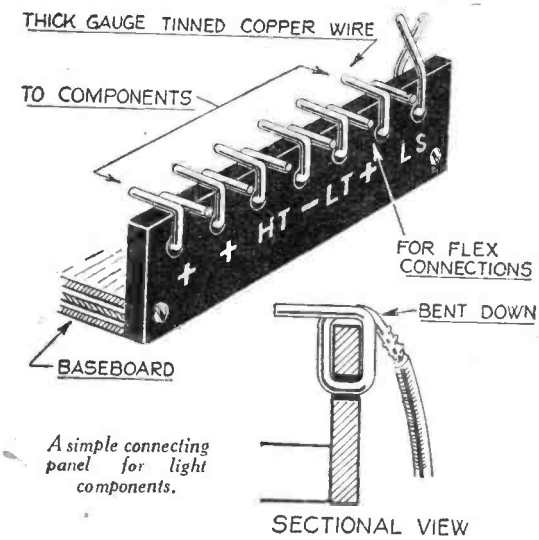
All hints must be accompanied by the coupon cut from page iii of cover.

A Simple Connecting Panel

QUITE an efficient connecting panel for anchoring wires and light components from the set, and flexes from the set to the batteries, etc., can be quickly made up from pieces of bakelite or ebonite and short lengths of stout gauge tinned copper wire.

The sketches are self-explanatory, but briefly the method of construction is as follows: Small holes are drilled in the panel at the required distances, and through these are passed the short lengths of wire, these being bent from their centres, and the ends taken over the top of the panel, leaving two projections as shown. To these projecting ends, the external and internal connections can be soldered, and for neatness, the external ends can be bent down after the flex connections have been soldered to them, as shown in inset.

Perhaps it would be inadvisable to use this type of panel in short-wave receivers, owing to the possibility of coupling due to the loop effect, but for medium and long waves, no such trouble is likely to be experienced.—R. L. GRAPER (Chelmsford).



A simple connecting panel for light components.

PRACTICAL TELEVISION

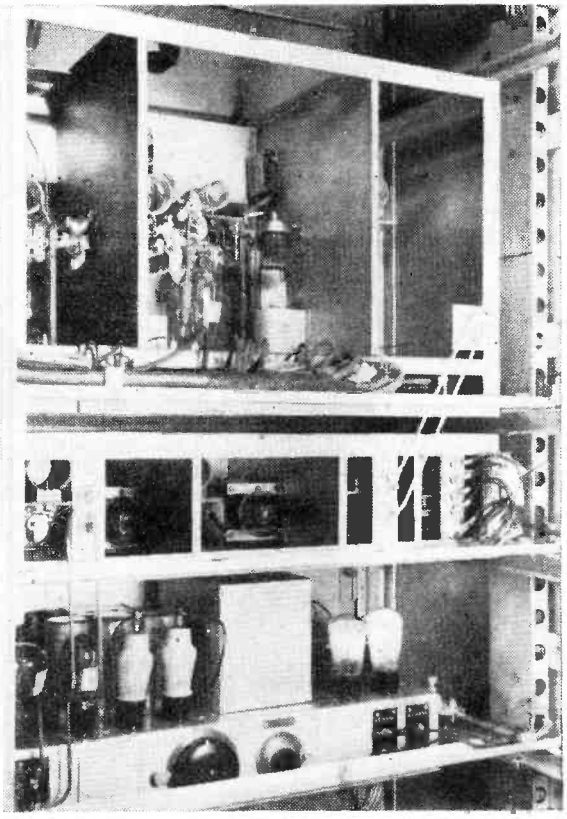
January 6th, 1940. Vol. 4. No. 184.

A Resolution

IN a recent issue the indefatigable Thermion added his plea to those of many others for the resuscitation of the B.B.C. television service. He pointed out what an admirable gesture that would be on the part of the Government, which is slowly but surely removing the restrictions on everyday life which were imposed at the outbreak of war. Without any exact knowledge of the turn of events which would occur when hostilities commenced, it is fair to say that the Government's action was fully justified, but subsequent experience has shown where restrictions can be relaxed, at least partially, without in any way upsetting the security of the nation. It is now learned that a leading city's Chamber of Commerce has written a letter to the Associated British Chambers of Commerce asking that the Government should be urged to encourage the continuance of research work in connection with television, which has brought a reply stating that the points raised in the letter would be considered by the Home Affairs Committee of the Associated British Chambers at their next meeting. This attitude is a most important one, for while the bulk of the nations' resources in both man power and material must inevitably be directed towards non-productive work for war purposes when judged on a commercial basis, it would be fatal to think that every industry must suffer in consequence. Before the war the radio industry was both directly and indirectly employing hundreds of thousands of men, and a vast capital sum of English money was invested. The advent of television, coupled with its promise of provincial extension, was destined to bring about a new wave of prosperity, and if all research in this science is allowed to lapse, then this country will lose the substantial lead it had established both in transmission and reception. No effort should be spared, therefore, to make the present Government realise the extreme importance of continuing research in all branches of television, if only on a partial basis. This will enable the companies badly hit in this respect to look forward with a measure of hope to the time when they can re-enter the market with the minimum of delay.

America Taking Stock

JUDGING by the accounts which have reached this country from the United States, it would seem that after nine months of television transmissions which have improved steadily since their initiation at the beginning of April, 1939, the Americans have been taking careful stock of the position which this new science has created. It is well known that man's natural instincts are such that he cannot live alone, he must be in touch constantly with his fellow creatures. Communication between individuals and nations has ever been foremost in his thoughts. Telephonic, telegraphic and wireless devices have made distance no object, but whereas the ear has been served so well the appeal to the eye has been kept within a relatively narrow compass. Using the present high-definition service the public who have witnessed the results have been quick to realise that individual portrayal instead of a group scene has a great advantage. First of all, it can be undertaken with relatively simple apparatus and handled without any great difficulty, but there is also something of greater importance. If a public function is attended it is the central personality which is the attraction, and yet in the crowd only a fleeting glimpse is obtained. The new science has made people realise that it is better to watch this man or woman in the comfort of the home by means of television so that one can get the close-up and participate in the intimacy denied to most amidst the jostling of others. Added to this it has already become apparent to the Americans that when television becomes a vital factor in the field of entertainment, it will give fresh wings to the talents of creative and interpretive genius, and will furnish a new and greater outlet for artistic expression. Considering the matter carefully, the potential audience in television in its ultimate development may reasonably be expected to be limited only by the population of the earth itself. New forms of artistry will be encouraged and developed, while variety, and more variety, will be the order of the day. Whereas the ear might be content with the oft-repeated song, the eye would be impatient with the twice repeated scene. The service will demand, therefore, a constant succession of personalities, a vast array of talent, a tremendous store of material and a great variety of scenes and background. There is also evidence that American advertisers are preparing to grasp the television performance as they have radio. It will, when Federal Communication Commission restrictions are released, permit demonstrations, and the audience will not have to imagine what a product looks like or how it operates. A new model motor-car or domestic utensil can be placed before the transmitter, and this will enable it to be introduced immediately to everyone looking into the television receiver. It has been said that one picture is worth more than a thousand words. Again, if this sponsored programme idea gained impetus there would be a revival of those advertising characters which have been displayed on cartoons and in the daily press. With television in the home, however, the advertiser would have to see that at no time was he an unceremonious guest.



The form taken by a crystal drive unit of a modern high-powered television transmitter working on ultra-short waves.

Using Crystal Control

THERE is no doubt that within recent years the increasing use of crystal control has contributed in no small measure to the accuracy and stability with which radio equipment has operated, this being particularly the case in transmitters. For certain work it is absolutely essential that a wireless transmitter should operate on one or more frequencies with a particularly high degree of accuracy. This has been emphasised in the television field, where the concern is the creation, and operation, of a high-powered station radiating on a single ultra-high frequency channel for the radiation of the picture modulation. Many do not realise how the design of the apparatus is more or less centred round this essential section of the equipment, and the accompanying illustration is therefore of particular interest, as it emphasises this point, and shows how it is worked in practice. First of all, in designing a high-powered transmitter for television purposes special attention has to be paid to the necessity for covering the maximum possible range at the carrier frequency, which has been chosen carefully to suit a given standard of definition for the picture. This frequency has to fall within the bands reserved for television services by international convention, while the high power chosen in comparison with sound broadcasting is essential because of the wide frequency band of the modulation, coupled with the degree of interference experienced from certain well-established forms of electrical

(*Continued on page 345*)

Loudspeaker Design

Further Data in Relation to the Design and Construction of Loudspeakers for Domestic Uses

(Concluded from page 332, December 30th issue)

WHILE the stiffness of the centring devices and the construction of the casing exert the greatest control on the performance of the loudspeaker at low frequencies, it is on the characteristics of the diaphragm, or cone, that the performance at other frequencies depends.

Some previous experience with commercial loudspeakers had shown that the cone supplied with a certain individual make of loudspeaker was capable of producing an exceptionally uniform characteristic of approximately the shape required—up to about 3,500 c./sec. It was discovered that this cone (hereinafter referred to as Type A1) had been manufactured abroad, but the manufacturer of the loudspeaker (Manufacturer A) had installed plant for manufacturing cones and was willing to co-operate in producing an equivalent or, if possible, an improved type of cone.

Only a few examples selected from the very large number of frequency characteristics obtained with different diaphragms can be reproduced here. Each of these curves (Figs. 2 to 5) was taken on the axis of the diaphragm at a distance of 2ft. from the front of the loudspeaker. In each case the diaphragm was assembled with an outer centring device of three tapes in an enclosed case. Since the curves were taken at different times throughout a long investigation the cases and mountings used were not always the same, but the differences involved would only affect the low frequencies (below about 300 c./sec.). On each chart is also shown for comparison a standard curve which represents the design objective for the axial frequency-characteristic of a loudspeaker of this type. The standard curve is that for a sound pressure rising at a uniform rate of 2.5 db. per octave—as it would be recorded by the equipment that was used for taking the records. This equipment is approximately equalised, so that the ordinates of the curves are roughly proportional to sound pressure for frequencies from about 100 to 5,000 c./sec.; at higher frequencies the sensitivity of the equipment falls away—to the extent shown by the deviation from rectilinearity of the standard curve.

The equipment is provided with different frequency-ranges, of which the range 0–5,000 c./sec. (Figs. 2 and 4) was often used since it covers the frequencies of greatest practical interest for the present purpose, The range of 0-9,000 c./sec. (Figs. 3 and 5) was also very generally used.

The curves in Figs. 2 to 5 are direct reproductions of the curves taken off the drum of the recorder; they, therefore, show all the minor irregularities in complete detail. A scale converting the linear law for the ordinates into relative values in decibels has been added to the curves.

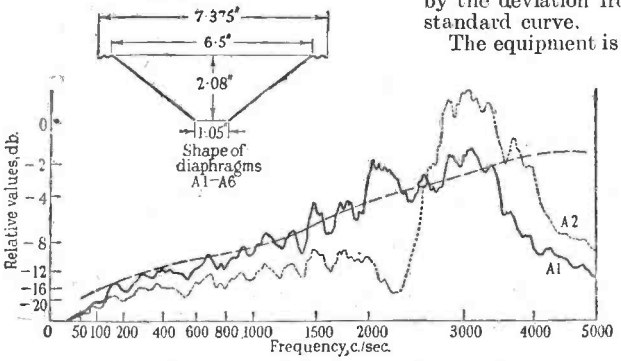


Fig. 2.—Comparison of diaphragms A1 and A2.

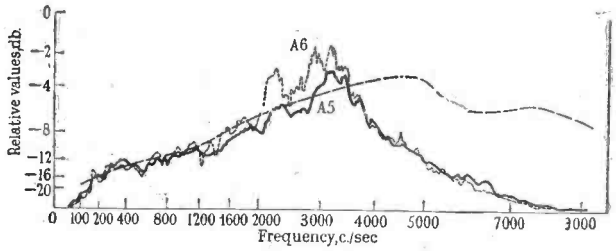


Fig. 3.—Comparison of diaphragms A5 and A6.

Diaphragms Supplied by Manufacturer A

The full-line curve in Fig. 2 is typical of the performance of the A1 type of diaphragm. This is a moulded paper cone, to all appearance of quite usual construction. The shape and dimensions of this cone are also shown on the same sheet, and these apply equally to the diaphragms to which Fig. 3 refers.

In attempting to obtain an equivalent performance the manufacturer first submitted a number of samples, all of which were true copies in size and shape but different in some details of manufacture. One of the worst of these samples—as judged by comparison with the standard curve—is the one designated A2 and shown by the broken curve in Fig. 2. A curve of this general shape has been very frequently encountered during the investigation.

Based on these tests the manufacturer then submitted a second batch of samples made with further small modifications of manufacture; and the full-line curve, A5, of Fig. 3 is typical of samples submitted later as direct manufacturing copies of the best sample of this second experimental batch.

Further experiments were made, but no further improvement has so far been obtained. Work on these lines, involving a close co-operation with manufacturers, could usefully be continued. The broken curve, A6, in Fig. 3, is typical of more recent supplies, which have a different code number but are probably of very similar manufacture.

A few of the samples have been subjected to chemical analysis and mechanical examination. None of these tests, except perhaps a breaking test, gave any differentiation between cones which were comparatively good or bad as regards performance. There was a general tendency for the better cones to give lower breaking-load figures for samples 1in. square cut from them, though such figures can be very variable as between samples from the same cone.

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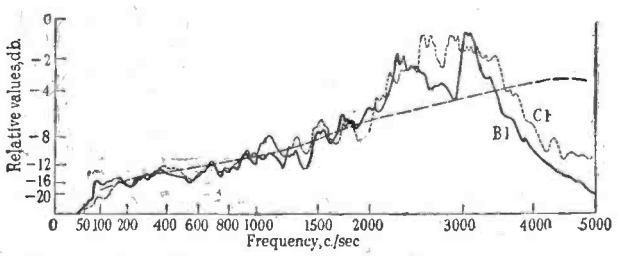


Fig. 4.—Comparison of diaphragms B1 and C1.

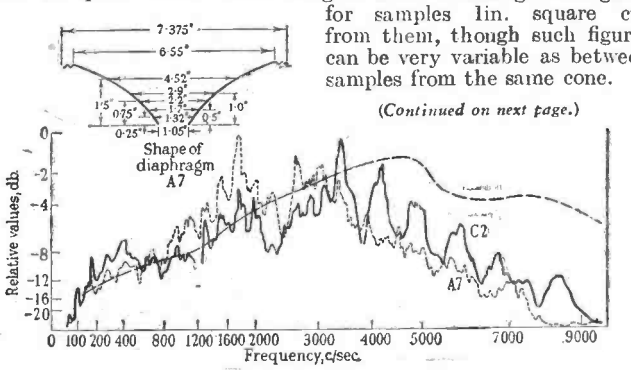


Fig. 5.—Comparison of diaphragms C2 and A7.

LOUDSPEAKER DESIGN

(Continued from previous page)

Some particulars relating to the cones to which Figs. 2 and 3 refer are given in the table. With regard to the manufacturer's code number, the figure following the stroke (e.g. "65" in "9772/65") gives the weight of the cone, in grains. This figure includes the weight of a flat surround extending to a diameter of 8.3in., which is cut away for assembly by the 3-tape suspension.

Cone No.	Manufacturer's Code Number.	Approx. thickness.	Breaking load for 1in. sample.
		mils.	lb.
A1	—	15	10-15
A2	9772/65	10	18-35
A5	9815/58	13	12-15
A6	9981/49	—	—

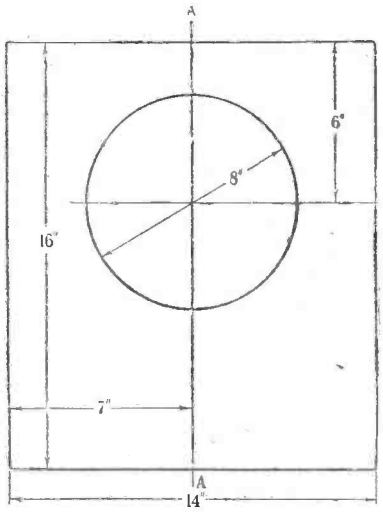
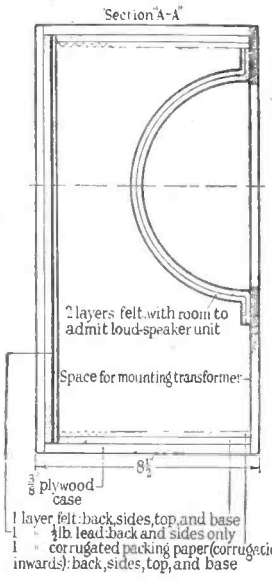


Fig. 6.—Details of the recommended speaker cabinet design.



Diaphragms Supplied by Other Manufacturers

A considerable number of diaphragms from the stock of other manufacturers has been tested, but only those were selected which were of suitable size and shape for mounting in the experimental loudspeaker unit. Record is made here of only the few samples whose performance approximates to the standard desired.

Diaphragm B1, shown in Fig. 4, is not moulded but formed from flat sheet paper into a straight cone, without corrugations. It is normally mounted with a cloth surround—in which condition it was tested. This cone is heavier than most moulded cones, and the main resonance is therefore at a somewhat lower frequency.

Diaphragm C1, also shown in Fig. 4, is the best example of the straight-sided cone diaphragms (moulded) obtained from Manufacturer C. A number of diaphragms obtained from this manufacturer were moulded with circumferential corrugations and the general characteristic of these diaphragms was an emphasis of the mid-frequency range, the greatest ordinate of the curve lying, in most cases, between 1,000 and 2,000 cycles per sec.

An interesting variation in shape is provided by forming the diaphragm with a flare. A diaphragm of such shape is represented by the curve C2 in Fig. 5, a feature of this curve being the relatively greater efficiency obtained at the higher frequencies, though the irregularities are more pronounced throughout the range than with the best of the straight cone diaphragms. An attempt was made to obtain the advantage of better response at high frequencies with less marked irregularities, and some samples of flared diaphragms were obtained from Manufacturer A. The performance of one of these is shown by Curve A7 in Fig. 5.

It was not considered that advantage was gained by the use of this type of diaphragm, and circumstances did not justify proceeding with the experiment. At the same time, the experiment shows that there is some promise of obtaining improvement of response at higher frequencies—without sacrifice of performance over the main frequency range—by a suitable shape and manufacture of flared diaphragm.

An Outline of the Specification Resulting from the Investigation

This section deals with the specification which was suggested as a result of the experiments. On it was based a commercial specification which was issued to a number of interested contractors. Latitude is allowed to the contractor over details which are not considered likely to affect the performance, e.g., the shape and size of the magnet. An outline of the specification follows.

The loudspeaker may be considered to consist of two main parts, namely, the case and the loudspeaker unit.

Case

The construction of the case is illustrated in Fig. 6. The case consists of a box of ⅜in. plywood, with an aperture 8in. diameter in the front. The two sides and back are lined with each of the following:

Felt (about ¼in. thick);
Lead sheet (8oz. per sq. ft.);
Corrugated packing paper (with the corrugations inwards).

The top and bottom are lined each with rectangles of the felt and corrugated paper, which serve to hold the linings on the sides and back into position. No adhesive should be used; two or three light tacks through the linings of the top and bottom only should be used to retain the linings in position.

Two layers of felt on the back of the front panel are held round the aperture to form a bag surrounding the back of the loudspeaker unit, when in position.

Loudspeaker Unit Magnet

Permanent magnet, not greater than about 250 cm.³ total size, developing at least 6,000 lines per cm². in an air-gap of 1.075in. external and 0.980in. internal diameter and 0.25in. deep.

Frame

Suggested construction is illustrated in Fig. 7.

The exact depth of the frame should be adjusted to position the coil correctly in the air-gap. Excessive obstruction behind the cone is to be avoided; for this reason the four bars connecting the outer ring to the inner part (which is secured to the magnet) are limited to ¾in. width.

Coil

Total of 53½ turns in two layers of 26¾ turns each, of 0.0092in. diameter enamel-covered copper wire. Ends of winding secured to former and left sufficiently long for connection to insulated soldering points (not illustrated) on the frame. The free lengths of these wires to be covered with cotton sleeving.

Spider

Stiffness imposed by the spider to axial movement of the cone should not be excessive. This can usually be achieved by the use of sufficiently thin material, irrespective of the shape and manner of fixing of the spider.

Cone

At present it is only possible to specify one make of cone, namely Type 9881/49, supplied by Manufacturer A.

In view of possibilities of variations of supplies, it will be required initially that 1 per cent. of cones obtained for use in the Post Office Engineering Department's contracts shall be tested by the Department for acceptance.

Edge Suspension

The outside diameter of the cone is 7⅞in. The clearance from the inner edge of the outer ring of the frame (7½in. diameter) is free except at three points where strips of unstretched tape, ¼in. wide, cemented at their ends to the cone and to the outer part of the frame respectively, comprise the suspension.

Stiffness of Suspension

The resonance frequency of the unit should be determined, before assembly in the case, by applying a constant p.d. of variable frequency to a circuit consisting of the coil of the loudspeaker unit and a resistance of 5 ohms, and by observing the

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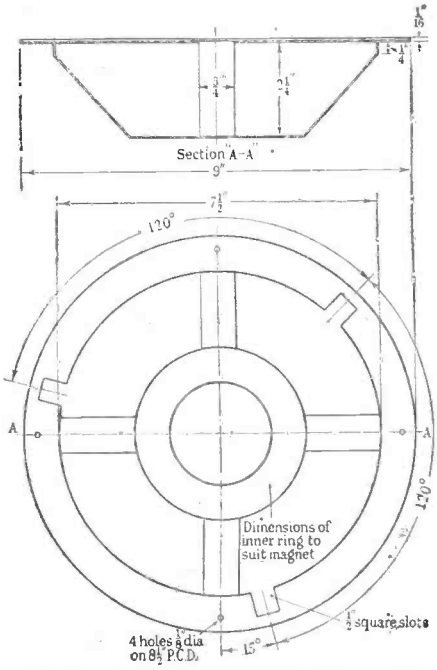

Fig. 7.—Suggested construction of the speaker frame.

LOUDSPEAKER DESIGN

(Continued from facing page)

frequency at which the p.d. across this resistance of 5 ohms passes through a minimum value. The frequency of resonance so determined should not be greater than 30 c./sec.

Conclusions

On the question of how to judge the quality of loudspeakers, the authors consider that the criterion of faithfulness of reproduction, comparing a variety of types of sound reproduced by the loudspeaker with the original sources, heard in the same room, cannot be improved upon. The room should, of course, be of a kind similar to that for which the use of the loudspeaker is intended, and the types of sound should be restricted to those which might ordinarily be heard, as original sources, in such rooms. In any such comparison the influence of the acoustics of the microphone studio should be negligible.

For loudspeakers to be used in living-rooms, this criterion appears to be satisfactorily met when the total power radiated by the loudspeaker in free space is independent of the frequency. This requirement is, at low frequencies, fulfilled to a close approximation by a moving-coil loudspeaker of usual type when it is mounted in a closed and adequately soundproofed case, so that the main resonance of the diaphragm lies near the lowest frequency which the loudspeaker is required to transmit at full efficiency, and when this resonance is sufficiently damped, e.g., by a covering of felt closely surrounding the back of the diaphragm.

The requirement of uniform power radiated can be simplified, for a loudspeaker of this kind with a paper cone diaphragm of about 7in. diameter, to one of axial sound pressure rising at a uniform rate of about 2.5 db. per octave. Diaphragms which produce a quite smooth characteristic of this kind for frequencies up to about 4,000 c./sec. can be manufactured by existing processes. The authors do not favour attempts to increase the response at higher frequencies by any means involving sacrifice of the smoothness of response already attained over the main audible spectrum. They prefer, in the absence of a diaphragm with smooth response up to higher frequencies, to expand the frequency range by a separate high-frequency unit—in cases where such a step is justified.

PRACTICAL TELEVISION

(Continued from page 342)

equipment. The form taken by the whole transmitter assembly will naturally vary in its particular details, but on general lines will comprise first of all the crystal controlled master oscillator. The requirements here are very rigid and often demand a frequency stability in the neighbourhood of one part in 50,000. This is only attained by careful design, and in the apparatus featured in the drive unit illustrated the crystal oscillator is housed in a thermostatically-controlled doubled oven to ensure even temperatures.

Projection of Television Pictures

There is still intense activity both in Europe and America in connection with the production of satisfactory television pictures whose size is comparable with that seen in the average cinema, it being felt that no matter in what direction television ultimately develops the need for large pictures will always be present. Many of the schemes favour a direct magnification of the brilliant primary received picture, this being undertaken by an expensive projection lens. Another school of thought, however, favour an intermediary method whereby a relay screen interposed in the path of a steady light beam is modulated by the received television signals, and quite good results have been claimed for this latter method of working. One of the most recent of these proposals uses an interposing crystal screen made up from native zinc sulphide. This is interposed in the path of a projection lamp beam, the screen being accommodated in an evacuated glass cylinder to which is welded a neck inclined at an angle of about 45 degrees. The incoming television signals modulate a beam of electrons directed along this neck so that it strikes the face of the screen obliquely. The resultant electric field produced in the immediate neighbourhood of this crystal screen causes the screen's optical polarising angle to rotate to a degree depending on the field strength, which, in turn, is changing in accordance with the degree of modulation applied to the electron beam by the received television signal. The beam of light from the projection lamp is polarised before it reaches the crystal screen face, and it is therefore subjected to further polarisation as it passes through. In this way it produces an enlarged image of the television picture by passing the light emerging from the back face of the crystal screen through a polarising filter and projection lens. The scanned sections of the crystal screen remain charged until they are neutralised by an auxiliary discharge electron beam, which works in synchronism with the main modulated electron beam, and which is timed to precede it by a very short distance. As can be seen, therefore, there is an important storage effect associated with an electronic device of this character and, if desired, this could be applied to bringing about a reduction in the line and frame frequency without seriously reducing picture detail or quality, and would help to solve the problem of flicker. The net result is a reduction in the sideband necessary to accommodate the radiated television picture, a factor, the importance of which looms large once schemes for increasing service coverage are considered in this or in any other country at some future date.

LATEST PATENT NEWS

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Abstracts Published.

HIGH-FREQUENCY TRANSFORMERS.—Telefunken Ges. Fur Drahtlose Telegraphie. No. 508042.

The selectivity of a radio-receiver is varied without substantial change in amplification by varying the coupling between two high-frequency circuits and simultaneously varying a reaction coupling

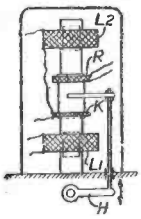

Fig. 1.

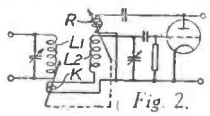

Fig. 2.

in the opposing sense. The auxiliary coupling coil K (Fig. 1) and reaction coil R are mounted on a former which slides on the former supporting the main circuit coils L1, L2, the movement being controlled by the lever H. As K approaches L1 to increase coupling, R recedes from L2 to reduce the feed-back and vice-versa. Coil K may be dispensed with by rotating L2 with respect to L1 and R which remain fixed in an alternative arrangement. The device may be operated manually or automatically. Specification 344017 (Group XL) is referred to.

ELECTROMAGNETS.—Gialluly, M. S. De, Macc, J., Paz, A., Cerf (nee Schladt), E., Scemama, L., Robert, P., Gory, M., and Villaron, R. No. 506421.

In a moving-coil loudspeaker comprising an electromagnet for producing the magnetic field and a speech-coil transformer, the cores of the electromagnet and of the transformer are structurally combined so as to form an uninterrupted magnetic circuit. As shown in Fig. 3, the core of the electromagnet comprises **E**-shaped laminations 25 forming the core 28 of the transformer. The primary and secondary windings 29, 30 (Fig. 4) of the transformer are mounted on the core 28 and the magnetic circuit of the loudspeaker is completed by a cylindrical polepiece 22 and a pole-plate 10. The core of the transformer which may be formed of **U**-shaped laminations may be closed by a laminated member which does not form a part of the core of the electromagnet, but is magnetically connected thereto. The housing 1 for the diaphragm 5 is connected to pole-plate 10 by screws 12 and the cores are enclosed by a cylindrical casing 36 and a disc 35 (Fig. 5), the terminals of the loudspeaker

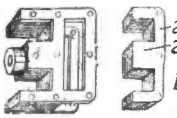

Fig. 3.

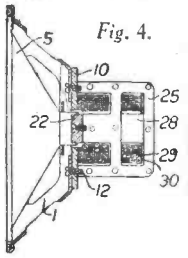

Fig. 4.

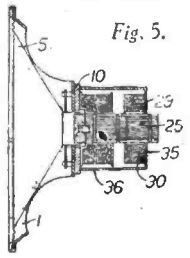

Fig. 5.

being mounted on the casing or on the disc. The core of the transformer may be closed by a member attached to, and magnetically insulated from, the core of the electromagnet, or the transformer may be mounted on the housing 1. The core of the electromagnet may be **U**-shaped and in a modification a transformer with a laminated core may be associated with a permanent magnet.

ELECTRIC TRANSFORMERS. — Kolster-Brandes, Ltd., and Newman, L. G. No. 507605.

A variable selectivity coupling comprises two tuned circuits the coils L1, L2 (Fig. 6) of which are mounted in variable proximity to the inductance L of a third circuit and having different coefficients of coupling

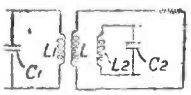

Fig. 6.

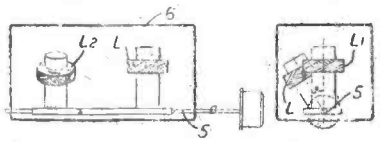

Fig. 7. Fig. 8.

therewith. Thus as coupling between L1 and L is increased, that between L2 and L is decreased and vice versa; a detuning effect is thereby produced each circuit L1C1L2C2 being detuned to opposite sides of the resonant frequency. According to the invention the inductance is constituted by the screening casing 6 of the coils L1L2 which are fixedly mounted with longitudinal and angular displacement on the spindle 5, as shown in Figs. 7 and 8.

NEW PATENTS

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Latest Patent Applications.

31455.—Telefunken Ges. fur Drahtlose Telegraphie.—Short-wave homing receiver. December 4.

Specifications Published.

515297.—Farnsworth Television, Inc.—Method of operating electron multipliers.

515302.—Pye, Ltd., Jones, W., and Edwards, B. J.—Television and like systems.

515304.—Scophony, Ltd., and Okolicsanyi, F.—Television receivers.

515209.—Electric and Musical Industries, Ltd., and White, E. L. C.—Television systems. (Addition to 491935.)

515158.—Rendall, A. R. A.—Thermionic valve amplifiers.

515311.—Chillingsworth, L.—Sound-reproducing apparatus.

515360.—Blumlein, A. D.—Television or other signal transmission systems.

515377.—Marconi's Wireless Telegraph Co., Ltd.—Microphone apparatus.

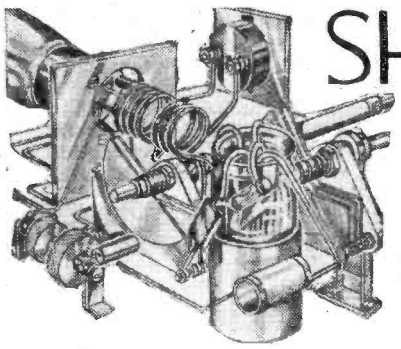
515383.—Kolster-Brandes, Ltd., Smith K. G., and Tiller, P. A.—Multi-range indicating devices for radio-receivers.

515292.—Cole, Ltd., E. K., and Martin, A. W.—Electric control apparatus for tuning radio-receivers.

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

PHOTO-ELECTRIC DEVICES

THE principles governing the action of a photo-electric cell have been known for very many years, but it is only of more recent date that this electronic device has found so many applications in industrial and commercial life. Its functioning in conjunction with various forms of auxiliary equipment has seemed so miraculous to the lay mind that it is often popularly termed the "Electric Eye," and yet it does not "see" in any sense of the term. Its capabilities are, of course, associated with the detection of variations in the light to which the active electrode surfaces are exposed. Even if the variations are extremely minute the cell is able to take cognisance of them, and when connected up to a valve amplifier or embodied with a secondary emissive multiplier, the light changes are converted to electrical changes which become amplified and so carry out various forms of work as a useful signal. It is learned that experiments have been conducted in America whereby photo-electric cells could be employed to utilise solar energy, although the powers as yet generated have been very small. By reducing frictional losses to a minimum and using a special type of electric motor, the incident light activating the electrode surfaces of a cascade of P.E. cells has been made to turn the motor at speeds depending on the quantity of light available. Sun rays and lamp rays have each been capable of generating minute fractions of a horsepower from the motor, and although at the moment the whole device seems little less than an ingenious toy, it may be developed to a commercial standard at a future date. In the same country several large manufacturing firms have been employing the photo-electric cell to act as a high-speed analyser. In one case a firm engaged in bean packing arranged for the separate beans to move along a conveyor belt at the rapid rate of ninety per second. They were made to pass across an "inspection beam" terminating in a certain colour sensitive photo-electric cell, and if the colour was below a certain pre-arranged standard a rapid action relay was brought into service which caused a jet of compressed air to blow each bad bean off the conveyor belt. In a similar way a machine was designed to incorporate a cell that rejected a packet of produce which had no label. Again, realising that when a packet of cigarettes is opened it is most impressive to see the printed name uppermost on every cigarette, some cigarette making firms use a machine which rotates the cigarette until the light ray, falling on the print, reduces the incident light on the cell and the cigarette rotation is thereby stopped, and in that position it is boxed.



SHORT-WAVE SECTION

A BAND-SPREAD THREE-VALVER

Constructional Details of an Interesting Receiver for Amateur and Short-wave Broadcast D.X. by A. W. Mann

SHORT-WAVE enthusiasts may be divided into three distinct groups. Those who confine their activities to the short-wave broadcast channels, the amateur 'phone and C.W. enthusiasts, and the all-round D.X. listener.

Various aerial systems are used, some of which are efficient, and others which, due to space or other restrictions, are of comparatively low efficiency.

A receiver which is capable of providing good average performance on an efficient aerial, and some measure of satisfaction on the inefficient type or compromise kind of aerial, would appear to be a rather expensive proposition.

The receiver described in this article has been used by the writer for a number of years in conjunction with his rotary aerial system, and on test, in conjunction with the commoner type aerials, provided gratifying results. The super efficiency of the former system due to variable directional properties, however, obviously provides the best possible results.

Before entering into details I would stress the fact that the coils, tuning condensers, valveholders, coil base, and L.F. transformer as incorporated, are amongst the best of their types obtainable—this factor contributing towards the efficiency of the whole.

Circuit Details

Figure 1 shows the theoretical circuit in which a stage of untuned high-frequency is inductively coupled to the grid coil of the detector stage. The latter being a triode of the H.L. 210 type.

This form of coupling is as developed by Messrs. Eddystone, and is most efficient. Proof of this is found in the fact that when this form of coupling is used in conjunction with the rotary aerial system mentioned above, when the system is rotated directionally to a particular transmitter, regardless as to frequency, and within the defined limits of receiver coverage, the effective signal gain is considerably greater than when alternative methods of coupling are used, all of which have been tried and tested when making comparisons.

Whilst it is possible to use an H.F. choke in the grid to earth line, the writer much prefers the non-inductive resistance of 250,000 ohms, as shown.

Whilst this applies generally, it applies more so in cases where resonance-tuned aerial devices are used, for reasons which will be obvious.

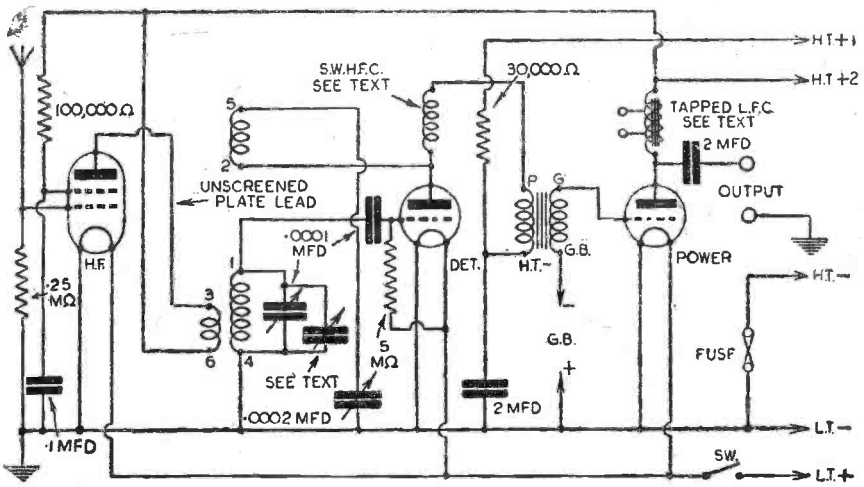


Fig. 1.—Theoretical circuit diagram of the three-valve receiver described in the text.

Coils

The coils specified are of Eddystone make and of the six-pin type, whilst the band-setting and band-spreading condensers are the units of the well-known and efficient Eddystone band-spread outfit.

A Ferranti A.F.4 transformer is used in the L.F. stage, whilst the tapped pentode choke is of Telsen make. Coils, bases, and valveholders are of Eddystone low-loss design, the output valveholder being of the five-pin type which will enable the experimenter to change over from power to pentode output. Satisfactory matching is possible as the output choke is suitably tapped.

With reference to the fuse, only use fuse bulbs of the correct type, and avoid the nonsensical idea of using a flash-lamp bulb which has a higher fusing point than the valves, a fact which appears to be unappreciated to a considerable extent.

The first essentials are a suitable panel and chassis. These together with a pair of substantial brackets should be built up into a complete unit of rigid construction.

Figure 2 shows a 14in. x 8in. metal panel of the crackle finished type, a 13½in. by 10in. by 2in. plywood chassis, faced with twenty gauge aluminium sheet, and the two panel brackets.

The chassis can be made ½in. shorter than the panel in order to avoid the difficulty of fitting same into a wooden cabinet which, as in nearly every case, will shrink slightly after a few months' use in a warm room, thus making chassis removal difficult.

Panel Layout

The layout of panel components is one that provides a comfortable operating position. Note that the band-spread dial and condenser are mounted ½in. above the centre line of the panel; also that the filament switch should be insulated from the metal panel *via* an ebonite bush. Fig. 3 shows the layout of panel and chassis components. T.C.C. fixed condensers are recommended, but alternative good makes may be used.

In order to reduce losses to the minimum, low-loss valve-holders and coil base are essential. Taking into account that this receiver will provide exceptionally good results on 10 m., it will be appreciated that conventional type valveholders of solid dielectric construction cannot be considered due to the fact that their construction makes the self-capacity comparatively high, and most unsuited to short-wave requirements.

H.F. Choke

The H.F. choke shown, and used originally, is one of the Graham Farish screened 12 m. to 2,000 m. type. I have by actual tests found this component to be efficient and free from resonance peaks from below 10 m. and up to 2,000 m. In any case, the full 9.5 m. to 170 m. range of this receiver is our principal concern, and no peaking troubles should be experienced. The screen of the H.F. choke should be effectively earthed via the chassis.

The H.F. choke is, of course, a standard all-wave type which many constructors will have on hand. If, however, a choke has to be purchased, the Eddystone special short-wave type 1010, covering an effective range of 9.5 m. to 170 m. should be obtained. The writer strongly recommends this component. It will be noted that the .0001 grid condenser, and 5 megohm leak are again specified. Almost every combination suitable to short-wave requirements has been tried, and the foregoing proved to be the most satisfactory in every way.

(*Continued overleaf.*)

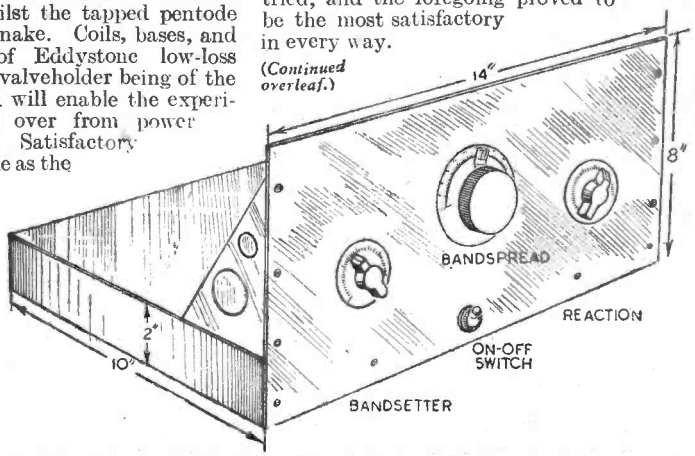


Fig. 2.—Chassis and panel assembly, showing the layout of panel components.

SHORT-WAVE SECTION

(Continued from previous page)

In order to eliminate wiring between these components, the grid condenser is of the T.C.C. tag type.

Band-spread Tuning

Next for discussion is band-spread tuning arrangements used in this receiver.

Before going further I would refer readers to previous articles dealing with band-spreading by the writer and others.

As previously stated the Eddystone band-spread outfit is incorporated in this receiver. The band-setting, or tank, condenser, is fitted with a ten-stop catch plate and ten-division scale, complete with pointer, whilst the band-spreading condenser has an integral slow-motion drive, a large diameter knob, and one hundred degree scale, the complete kit being designed for use with Eddystone four- and six-pin coils.

A useful amount of spread is obtainable on the 14 mc. band covering 40 degrees, using the 6LB coil. With the 6Y coil 80 degrees spread is obtainable on the 7 mc. band. A commendable feature is the carefully worked out overlap between the band-setter positions which assures that nothing is missed. A point worthy of consideration with regard to this receiver concerns calibration. With the coils and band-spread kit specified, the operator can calibrate the band-spread condenser dial over the full scale, in association with the individual stop positions of the band-setting condenser, through the full range of coils, and if desired, can prepare separate or composite calibration charts for reference purposes.

Taking into account that accurate calibration is the key in part to successful DX, other things being equal, it will be appreciated that the degree of accuracy made possible by means of the definite stop positions provided by the band-setting condenser, and the fact that once logged a station's frequency can, in conjunction with the band-spread dial, be spotted or registered accurately at any time as required, the DX possibilities appear rather attractive.

In order to get down to 10 m., a special home-made coil is required, this coil being wound on a standard Eddystone six-pin coil former as follows:

Ten-metres coil data.

Grid coil:
Two turns 20 gauge copper enamelled wire.
Aperiodic coil winding:
Two turns 30 D.C.C. wire interwound with grid coil.
Reaction coil winding:
Two turns 20 gauge C.E. wire as per grid coil.

Standard spacing between reaction turns, and double spacing between grid turns. Standard spacing also between grid and reaction windings.

There is no place for old valves in this receiver; an emission test is therefore advisable in cases of doubt, and the manufacturers' instructions should be followed relative to plate and bias voltages, etc.

Performance

The original model was in two-valve form, the untuned stage being added at a later date, and on completion of over twelve months' tests under all conditions, the performance in terms of results was remarkably good on all bands, including the 10 m. band, various U.S. amateurs and others on the Canadian border being heard in the afternoons at volume comparative with that of British 40 m. amateur 'phones. The same applies to other amateur 10 m. stations in various parts of the world.

The addition of an untuned H.F. stage further improved the overall performance of the receiver on all bands, including S.W. broadcast channels, and C.W. channels.

It is not claimed, however, that the untuned stage provides the signal gain to be obtained with a fully tuned T.R.F. stage, but should the latter be contemplated at some future date, the necessary modification can be carried out without difficulty.

An untuned stage is usually regarded as a buffer stage, and as a means of removing dead spots. The writer, however, always makes sure that dead spots are not in evidence, and tests are carried out with H.F. stage or stages out of circuit, such procedure enabling full advantage to be taken of H.F. in whatever form it is used.

In the original receiver dead spots are non-existent throughout the full tuning range, whilst reaction is smooth and constant, the reaction condenser being fitted with integral slow-motion drive, and of Eddystone make.

A receiver built along the lines suggested will prove equally suitable for amateur 'phone, C.W. and S.W. broadcast reception, in fact, will be found to be a good all round proposition, whilst the calibration and positive logging facilities it effects are such as are not to be found, as a rule, in the simple types of receiver, but are common amongst the more expensive communication types.

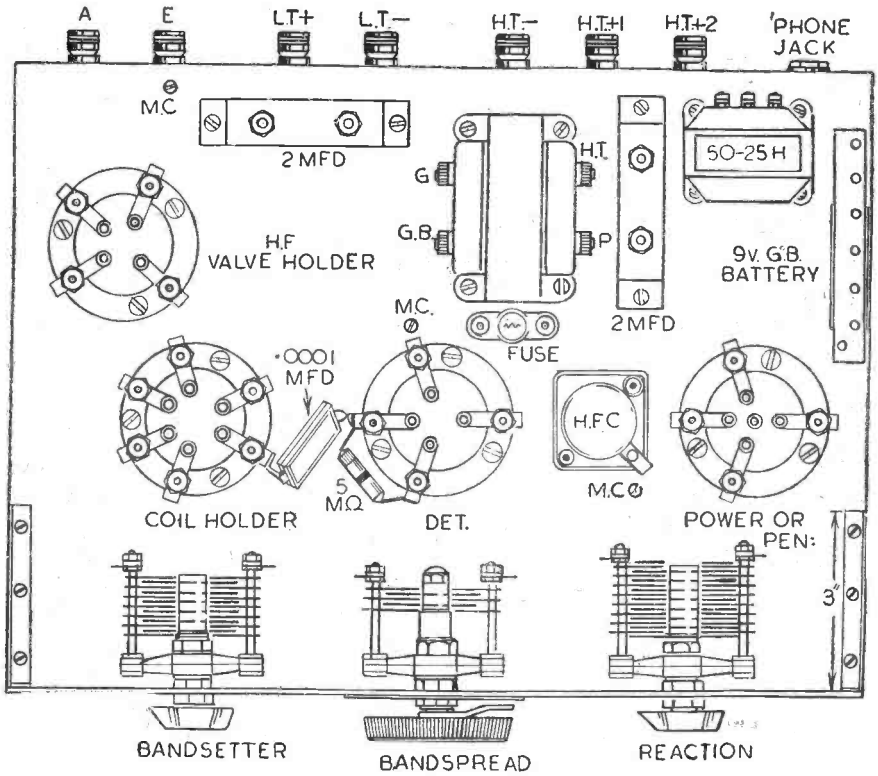


Fig. 3.—Diagram showing layout of chassis components.

TONE CONTROL BY NEGATIVE FEEDBACK

(Continued from page 337)

Single-stage Amplifier

Control curves of a similar kind may also be obtained with condensers alone. Such an arrangement is shown in Fig. 11, in the form of a single-stage amplifier. Between the anode and the earthed return lead of the valve is the series connection of the resistances R_2, R, and R_3. The resistance R is capacitively bridged by the condenser C for the high-tone frequencies. The sliding contact S is connected across the condenser C' with the cathode of the valve which is connected by the not capacitively-bridged resistance R_1 with the earthed return lead. The condenser C' has such value that a considerable potential drop occurs for the low-tone frequencies, but not for the medium-tone frequencies which potential drop makes the counter coupling for the low-tone frequencies small. The resulting control curves are shown in Fig. 12. In the one extreme position (b) the amplification for the low tones is considerably less than for the high, and particularly for the low-tone frequencies (? WR). In the other extreme position the amplification for the medium-tone frequencies has risen considerably, so that it is now larger than for the high-tone frequencies, whose degree of amplification has only increased very little. The degree of amplification for the low-tone frequencies has risen a little more so that it reaches almost the value for the amplification without counter coupling (dashed line). The circuit shown is recommended for receiving sets without complete fading compensation in which it is desired, for instance, because a loudspeaker of poorer quality is used, to achieve in any case a raising of the low-tone frequencies.

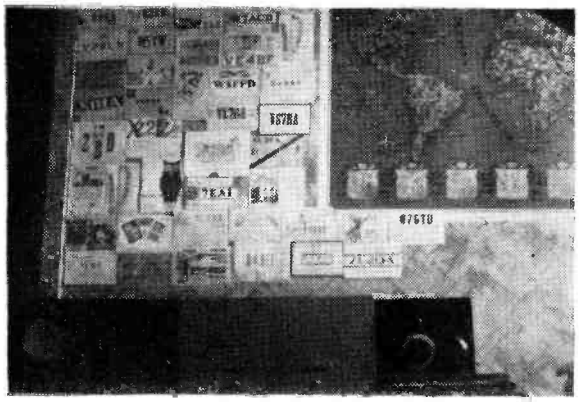
Open to Discussion

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).

Readers' Dens

SIR,—As a regular reader of your excellent journal, I am sending you a photograph, together with a description of my station, which, until the beginning of September last, operated under the call of 2HNO.

The receivers used are a Hallicrafter's "Sky Chief" (now pretty ancient, but still in good trim!) and a battery-operated



A corner of Leslie J. J. Morgan's den.

home-built 0-v-1 used exclusively for 28 megacycles. This latter set has band-spread, and transformer coupling between the two triode valves (a D 210 detector, and an H.L.2 L.F.). Both of these sets are to be seen in the photograph. The antenna preferred here for reception is a simple half-wave 20 metre doublet.

Results with this apparatus have been most encouraging; 107 countries have been heard on 'phone *and* C.W. on 14 megacycles, and 45 States of the American Union have been "hooked." The best verifications which I have received are: VR6AY 14mc/s 'phone; CR4MM, ZL2QA and K6BNR 14 mc/s C.W.; and CE2BX 28 mc/s 'phone.

First G reports have been confirmed by W2KNP (7 mc/s C.W.) and W7GTU (14 mc/s C.W.).

Also in the photograph is to be seen a portion of the C.W. transmitter which was in course of construction when the war broke out. This is now safe in the hands of the G.P.O., but it is my firm intention to outlive Hitler, and see what can be done with QRP C.W.—LESLIE J. J. MORGAN (Bournemouth).

SIR,—Being a reader of your very fine paper for quite a number of years now, I enclose a photograph of my den which may interest other readers. I would also like to state that I shall be glad to exchange my QSL with any reader anywhere, either S.W.L., A.A. or full call station, and will answer every one. Wishing your fine paper every success.—VINCENT UPTON (8, Falcon Terrace, Whitby).

Correspondents Wanted

SIR,—I have been a regular reader of your fine journal for the last two years, and must compliment you on the high standard of its contents. I would like to exchange my S.W.L. card with S.W.L.'s throughout the world, especially those in U.S.A., S. America and the West Indies. I would also like to correspond with any young reader in U.S.A. or S. America, interested in S.W. reception. Wishing your paper every success.—KENNETH I. PROCTOR (63, Thackeray's Lane, Woodthorpe, Nottingham).

SIR,—I would like to correspond with any S.W.L. who is keen on logging CW DX on 7 mc/s. In addition, I am willing to exchange my S.W.L. card by return of post with any reader who may care to send me his.

Herewith a log of 7 mc/s. stations received recently on my 1-valve S.W. Adapter:

On 'phone—PY2LN and PY4CT.

On cw.—LU4JA; K4DUZ, ERA, KD, FAI; HK8HB; YV1AP; XE1HR; K5AK, AM; 28 in PY1, 2, 3, 4, 5, and 7; all districts W.

Q.S.L.'s confirming 7 mc/s. reception have been received from VO1B; K5AM; ES5C; YU7AY; W1AW, KJU, 2HCM, 2LEE, KPK, KXK, EYS, 4FTV, 7GRI, 8QGS, and 9ERP.—W. M. GOFFIN (Newhall Vicarage, Burton-on-Trent, Staffs).

SIR,—May I express my appreciation of the new PRACTICAL WIRELESS.

I have been a reader for the last seven years, and have followed all the articles on short-wave radio.

Also, I would like to correspond with any member of the British Short-wave League, and also the secretary of that society.—E. PESTELL (123, Victoria Street, Grantham, Lincs.).

Exchanging S.W.L. Cards

SIR,—I should very much like to exchange my S.W.L. card with any "Ham," "A-A" man, or S.W.L., particularly BSWCC members, anywhere in the world. I also correspond 100 per cent. with anyone. Wishing your paper every success in the future.—A. B. RICHARDSON (The Watering, Parham, Woodbridge, Suffolk).

A reader, Vincent Upton of Whitby, sends us this interesting photo of his den.

Prize Problems

PROBLEM No. 381

BRANDON obtained some surplus components and made up an A.C. three-valve set, which when tried out, gave very bad hum. He made a few tests and finding nothing wrong with the wiring eventually decided that the L.F. choke, which was included in the usual position, was too small. He therefore obtained a similar component and placed this in the H.T. negative lead to add to the smoothing, but when he switched on the hum was worse. Why was this? Three books will be awarded for the first three correct solutions opened. Entries should be addressed to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 381 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, January 8th, 1940.

Solution to Problem No. 380.

Arthurs had an exposed spark-gap aerial lightning arrester fitted to his aerial, and this had become very dirty and was leaking. The gradual short-circuiting of the gap by dirt gave the increasing loss which he experienced.

The following three readers successfully solved Problem No. 379, and books have accordingly been forwarded to them:

(No Signature), 6, Digton Road, Wandsworth, S.W.18.

D. Bates, 99, Groveley Lane, West Heath, Birmingham, 31.

G. A. Collings, 27, Lawfield Road, Acton, W.3.

"P.T.O."

MOST of us these days have friends in the Forces, and most of them want something to read. Often billeted, or in training camps in the heart of the country, they find that, in the black-out, time drags interminably. Good reading matter is, for some odd reason, at a premium, and this is where every reader of this journal can help. A magazine that slips into the tunic pocket is a godsend, and a good example is *P.T.O.*—the British pocket "Digest" of the world's news and views. The February issue, for instance, contains an important article, "When We Have Won—What Then?" by Harold Nicolson, and another on Russia's startling claims for a gigantic new oilfield which is being developed a thousand miles from the nearest frontier. Many of us believe that the earth may not be the only planet to contain intelligent life, and this age-old problem is treated in "Is Mars Inhabited?"

P.T.O. is obtainable through any newsagent or bookstall, price 7d.

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.

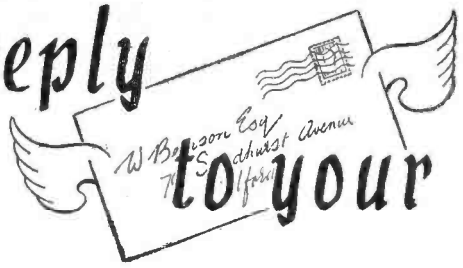
Issues of Practical Wireless ... **4d. Post Paid**
Amateur Wireless ... ... **4d.** ,, ,,
Wireless Magazine ... ... **1/3** ,, ,,

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	*Date of Issue.*	*No. of Blueprint.*
CRYSTAL SETS.		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve : Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	—	PW36B
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)	22.5.37	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)	12.6.37	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)	14.8.37	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
All-Wave "Corona" 4 (HF Pen, D, LF, Pow)	9.10.37	PW79
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF, Pen, D, Pen)	—	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	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
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
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)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
A.C. All-Wave Corona Four	6.11.37	PW81
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	31.7.37	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)	30.7.38	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))	19.3.38	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.		
Class B Three (D, Trans, Class B)	—	AW386
£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. 6d. each.		
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-Valve : Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
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-valver Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super	*Nov.* '35	WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM392
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

In reply to your letter



By-pass Condensers

"I enclose a circuit of an H.F. amplifier and detector stage which I am building and should like advice regarding the by-pass condensers which I have marked. I understand that non-inductive condensers are needed, but are these only available in tubular form? If so, I cannot find the 4 or 8 mfd. type of condenser in any list in this type. Perhaps you could help me regarding suitable types."—J. H. (Perranporth).

ALL H.F. by-pass condensers should be non-inductive, but the tubular condenser is not the only condenser which is of this type. Mica condensers are non-inductive and electrolytics are also of this type. In addition, certain of the paper types of condensers are non-inductive and this is generally indicated on the case by the letters N.I. In the case of the large capacities, therefore, the paper non-inductive condensers or the electrolytics may be used.

Contrast Expander

"I note that you have again referred to the Contrast Expander in your notes on the ideal set. I regret to say that I tried out a circuit of this type some time ago, having got the circuit from an American magazine, but it did not appear to make any difference to the reproduction from records. Have you found that it does really do what is claimed for it, as I should certainly like to improve my results by using such a circuit if I could be assured that it does work?"—L. K. (N.W.5).

THE circuit certainly does what is claimed for it when it is properly constructed. You may have used wrong values, wrong connections or unsuitable valves in your experimental tests. You can see for yourself, when such a unit is made, that it does actually modify the contrast, and in the special unit which we described we indicated how this could be done. A milliammeter is included in the anode circuit of the expander valve, and whilst listening to the reproduction you can see the current rise and fall with the volume of the music. Obviously some types of record need no expansion and the difference may hardly be noticeable, but a really good symphonic record, or an organ, will reveal the effects, especially in the latter case, in the reproduction of the pedal notes.

All-wave Aerial

"Once again I must call on your assistance in designing part of my radio equipment. Your previous advice regarding the receiver has been followed and I am more than pleased with the result, but now wish to improve the aerial so that I can rope in all those distant stations. Unfortunately I am living on the second floor of a three-storey house and the garden is only 15ft. in length. I do not want to put up a long pole in the garden and yet the indoor aerial does not seem all that I could desire. What is your advice to me now in this connection?"—K. D. (Bromley).

A VERTICAL aerial of the type we have often described is undoubtedly your best solution. If you do not wish to enter the upstairs flat, then a rigid aerial will have to be used. This should be a length of steel or copper tubing, according to what you can afford or obtain in these days, about ¼in. in diameter. Paint it with two or three coats of good outdoor paint to prevent corrosion and mount it on a strong bracket which will hold it about 12 or 18in. from the wall. The overall length of the tube should be not less than 6ft., longer if possible. To prevent swaying or bending, a length of wooden dowel may be driven down inside it. Solder a length of good covered stranded aerial wire to the lower end, and mount the bracket as high on the wall outside your window as possible.

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.

Strengthening Leads

"I find difficulty in keeping my battery leads in good condition, usually because the wire fractures where the lead enters a plug. The constant bending backwards and forwards seems to be the reason, and I note that in electric irons and similar apparatus there is a coil of wire to prevent this trouble. Is there any similar idea which can be applied to flex leads to help in overcoming this trouble?"—G. R. T. (Shrewsbury).

THE easiest plan, and one of the most effective, is to slip a piece of fairly heavy gauge insulated sleeving over the flex lead and then to push this down to the plug after this has been fitted. If you use the type of plug having an end hole, the sleeving may be pushed into this and will keep the flex from bending sharply, although not removing the flexibility.

Including a Meter

"I wish to make periodic tests of a set from points of view of anode current, etc. I have seen reference to jack connections in each circuit but this would appear to be expensive. Is there no simpler way of obtaining the same end?"—R. T. (Helston, Cornwall).

YOU do not state exactly which points you wish to test, but it should be remembered that special split pin adaptors are available which are inserted into valveholders between the valve and the holder and which permit meters or other apparatus to be included in various electrode circuits. A typical instance is the split anode adaptor which will enable a meter to be included in series with the anode lead for measuring current. Another is the split grid connector which permits a pick-up to be inserted or grid current to be measured. One adaptor with each pin split could be used by you and transferred from stage to stage as desired.

Bandspread Tuning

"Which is the best method of bandspread tuning? I know you have mentioned several different schemes from time to time, but I wish to include the system which gives the greatest control and easiest tuning in a new set which I am building up."—H. B. D. (Hornchurch).

UNDOUBTEDLY the standard arrangement of two condensers in parallel is the best. The small condenser used for spreading should preferably have a direct relation to the band-setting condenser so that the latter may be provided with a numbered dial or stop-plate device and then the bandspreader may be adjusted by means of a slow-motion drive to spread every degree of the band-setting condenser.

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.

J. McL. (Upperlands). The meter is not suitable for measuring the output from a mains unit. You must use a meter with a high resistance, preferably 1,000 ohms per volt.

H. G. (Birmingham). Coil-winding data will be found in our handbook, "Coils, Chokes and Transformers."

J. W. W. (Parkstone). We do not supply blueprints of commercial receivers. The makers may be able to assist you.

R. J. (Devonport). The condenser may be modified by removing three plates from both moving and fixed sections.

L. R. (Stechford). We would recommend the addition of a valve in parallel with the existing output valve, using, of course, exactly the same valve type.

K. E. (Gloucester). The current is much too high and indicates that the valve is receiving too much H.T. or insufficient G.B.

D. A. R. (Welshpool). The arrangement is definitely not recommended, and the valve-makers' instructions should be adhered to.

L. V. C. (Shrewsbury). Use the 28-gauge wire and keep it taut whilst winding. Insulation is not important in this case.

N. T. (Aberystwyth). A resistance of approximately 100 ohms could be used, but the current should not exceed 5 mA.

G. D. (Newport, Salop). Both components are obsolete, and you should select similar items from an up-to-date list.

W. V. (Perth). Write to the Economic Electric Company, Ltd., of 64, London Road, Twickenham.

S. E. L. (N.W.3). Scrape the carbon first and make certain that it fits tightly. We do not think the idea will turn out very successfully.

H. E. T. (Bognor). Try a much smaller condenser, not larger than .00005 mfd. If this fails, then re-wind the coil in question.

S. R. (Thundersley). A form of wave-trap would be preferable and would eliminate all of the troubles.

P. S. (Clapham). Only one H.F. stage would be necessary. Band-pass coupling in the detector stage would be advised in the second case mentioned.

S. W. (Malden). A large horn-type speaker would be probably best, but remember the additional room taken up. The good cone, properly mounted, would probably be indistinguishable with the amplifier mentioned.

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

FREQUENCY DOUBLING

ASSOCIATED with this drive unit are the frequency doublers and necessary amplifiers to provide sufficient electrical drive to supply the intermediate amplifier. With ultra-high frequency working it is usual to cut the crystal so that it oscillates at some fraction of the main carrier frequency, and by a series of doubling circuits bring this up to the required figure. For example, taking the B.B.C. 45 megacycle vision carrier the crystal frequency could be 1.406 megacycles, and by five stages of doubling this would give the 45 megacycles desired. Following on from this juncture we have the intermediate amplifier whose function is to obtain from the harmonic generator unit sufficient radio frequency voltage and power to supply the output amplifier. In the main output amplifier the choice of valves must be made between the glass type and the demountable water-cooled tetrode type, and readers will remember that in a recent issue the advantages of the latter were explained at fair length. In the case of a television transmitter the modulating system must be capable of handling both the synchronising pulses and the vision signal. Furthermore, at this stage the important point of the D.C. component has to be borne in mind if background illumination is to be maintained in the radiated picture in order to give a true representation of the scene being transmitted. In some cases the output stage is D.C., coupled to the grid circuit of the transmitter, and this D.C. component of the picture itself is restored at the grid of the modulator output stage.

NEW RECORDS

Brunswick

BING CROSBY makes a new recording this month with "Poor Old Rover" and "El Rancho Grande" (My Ranch), accompanied by The Foursome, on *Brunswick O* 2873. Judy Garland is featured on a 12in. record this month singing "In Between," which is one of the songs from her latest film, "Love Finds Andy Hardy," and "Sweet Sixteen"—*Brunswick O* 148. Alfred Piccaver, the popular tenor, has recorded on *Brunswick O* 2878 one of the songs from George Black's Show Shop of 1939—"The Little Dog Laughed," entitled "There's Danger in the Waltz," and couples it with "Yours for a Song."

TRANSFORMER INTERACTION

WHEN building a mains receiver it is often necessary to place the smoothing choke in such a position that no coupling with the mains transformer takes place. In some receivers such coupling will introduce hum. If one component is on top of the chassis and the other underneath, this may not satisfy the requirements mentioned, as the windings may still be in the same relationship. Similarly, standing the two components at right angles in a physical sense may not result in the actual windings being at right angles. Therefore, in such cases the components should first be carefully inspected in order to see in what direction the windings run, and then they may be placed so that the desired end is obtained.

Classified Advertisements

Advertisements are accepted for these columns at the rate of 2d. per word. Words in black face and/or capitals are charged double this rate (minimum charge 2/- per paragraph). Display lines are charged at 4/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, Strand, London, W.C.2.

RECEIVERS, COMPONENTS AND ACCESSORIES

SOUTHERN RADIO'S BARGAINS.

ALL GUARANTEED. POSTAGE EXTRA.

5/- —Parcel of Useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.

15/- —Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances. Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7". 15/- the Kit.

21/- —Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.

5/- —100 Wire-end Resistances, assorted capacities ½ and 1 watt, 5/- per 100.

5/- —6 Volume Controls, 5/-.

TELSEN 3-Range Meters (Volts and Milliamps), 4/-; Ormond Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; Telsen W349 Midget Iron Core Coils, 4/6; Step-up Transformers, 110-250 Volts, 7/-; 8 mfd. Electrolytic Condensers, 500 volts, 1/8. Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.

2/- —Tool or Instrument Carrying Cases, ex-Government Stock; Wood 9" x 7" x 7", 2/-.

SPECIAL Offer, Limited Quantity Torch Bulbs, 1.5v., 21/- per 100; 2.5v. and 3.5v., 17/6 per 100.

SOUTHERN RADIO, 46, Lisle Street, London, W.C. Gerrard 0653.

VAUXHALL.—All goods previously advertised are still available; send now for latest price list, free.—Vauxhall Utilities, 163a, Strand, W.C.2.

5/- BARGAIN PARCEL comprising Speaker Cabinet, Drilled steel Chassis, condensers, resistances and many other useful components. Worth £2. Limited number. Postage 1/-.—Bakers Selhurst Radio, 75, Sussex Rd., South Croydon.

BANKRUPT BARGAINS. Brand new 1939 models, makers' sealed cartons, with guarantees, at less 40 per cent. below listed prices; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

RELIABLE Switches, Resistances, and all quality radio and electrical components. Unparalleled range. Send 3d. stamps if you've not yet had catalogue No. 102. BULGIN, BARKING.

LOUDSPEAKER REPAIRS

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

REPAIRS to moving coil speakers. Cones/coils fitted or rewound. Fields altered or wound. Prices quoted, including eliminators. Pick-ups and speaker transformers rewound, 4/6. Trade invited. Guaranteed satisfaction. Prompt service. L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

NEW LOUDSPEAKERS

3,000 SPEAKERS from 6/6 each, P.M. and energised 4in. to 14in. including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

LOUDSPEAKER CONVERSIONS

BAKER'S Triple Cone Conversions Will Immensely Improve Reproduction of Your Present Speaker. Enables you to bring your speaker right up to date and obtain really realistic reproduction at the cost of a few shillings; free descriptive leaflet from the Pioneer Manufacturers of Moving Coil Speakers since 1925.—Bakers Selhurst Radio, 75, Sussex Rd., South Croydon.

CABINETS

A CABINET for Every Radio Purpose.

SURPLUS Cabinets from noted makers under cost of manufacture.

RADIOGRAM Cabinets from 30/-.

UNDRILLED table, console and loudspeaker cabinets from 4/6.

INSPECTION Invited.

H. L. SMITH and Co., Ltd., 280, Edgware Road, W.2. Tel.: Pad. 5891.

RECEIVERS, COMPONENTS AND ACCESSORIES

RADIO CLEARANCE, LTD., 63, High Holborn, W.C.1.

BRITISH BELMONT 8 Valve plus Magic Eye All-Wave A.C. Superhet Chassis, 4 wave-bands, two short, medium and long, fitted latest Mullard Octal Base American type Valves. Size of Chassis, 13½" x 10" x 3". Supplied with Valves and Knobs, but less Speaker.
Chassis only, £5/19/6 each.
Speaker for above, 17/6 each.

GRAMPIAN 10" 10 watt, 2,500 ohm Energised Speaker. Heavy Cast Frame .. .. 15/- each
With heavy-duty Pentode Speech Transformer 17/6 each
Heavy-duty Speech Transformers, Pentode Matching 2/11 each

PLESSEY 2-gang Straight Condensers .. 1/6 each
Ditto, 3-gang .. .. 2/- each

PLESSEY Motor Drive Press Button Unit. Supplied complete with 8-way Press Button Control. Precision job throughout. First Grade Motor. A.C. 24 volts 21/- each

POLAR ½ meg. Volume Controls, with S.P. Switch 1/6 each
Ditto, with D.P. Switch .. .. .. 1/9 each

YAXLEY type 4-pole 3-way Single Bank Switches 9d. each
2,500 ohm Fields Coils .. .. .. 9d. each
1 (One) gross Assorted Resistances .. 5/- per gross
Metal Chassis Drilled. 15" x 6" x 1¾" and 11¾" x 8" x 2¾" 1/6 each
Push Back Wire .. .. .. 12yds. 10d.

ROLA P.M. Speakers, latest type 7¾in. Cone, with Pentode Transformer .. .. Boxed 14/6 each
Clock-faced Dials, 5" x 3¾", with printed 3-wave scale Ox-Copper Escutcheons and Glass .. .. 3/6 each
Ditto, less Escutcheons .. .. .. 2/6 each
Horizontal dials, with plain scale 7¼" x 3¼" and pointer 1/- each
100ft. Copper Aerials, Insulated .. .. 2/- each

FILAMENT TRANSFORMERS, Input 200-250 volts, output 4 volts 4 amps, 4 volts 6 amps .. 4/11 each
G.E.C. Mains Transformer, American windings, 350-0-350 volts, 65 m.a. 5 volts 2 amps, 6.3 volt 2.5 amp. Suitable for replacements in G.E.C. models 5/6 each
24 mfd. Can type Electrolytics, 150 volts working 1/6 each

PRESS BUTTON UNITS with 6 [illegible] Buttons, ready for wiring into set, with circuit .. .. 4/11 each
WEARITE Set of two Iron-Cored Coils, Aerial and H.F. Trans. with diagram .. .. .. 2/11 each
BULGIN 25 ohms Wire-wound pots .. .. 1/- each
Stranded Push-back Wire, 1d. per yard, 12 yards 10d.
CHASSIS Mounting Valve Holders, American, 4-, 5-, 6- and 7-pin, 4d. each. Octals 6d. each. Loctals 10d. each. 7-pin English type, 3d. each.
ROTHERMEL Piezo Crystal Speakers, 7½in. Cone. List 55/-. Our price, 10/6 each. 10in. Cone 12/6 each.
CRYSTAL PICK-UP, high grade American. Bronze finish, complete with arm .. .. .. 21/- each
POLAR N.S.F. 1 watt resistances, 4d. each, 3/9 dozen. All sizes up to 2 meg.
WEARITE MAINS TRANSFORMERS, R.C.B. type. 350-0-350 v. 80 m.a., 5 volt 2 amps. 6.3 volt 5 amps 6/11 each
Type R.C.4. 500-0-500 v. 150 m.a. 4 volts 2 amps, 4 volts 2.5 amps, 4 volts 5.6 amps .. .. 21/- each
PHILCO MAINS TRANSFORMERS. American Windings, 350/350 volts 65 m.a., 6 volts 3 amps., 5 volts 2 amps. .. .. 5/- each
Ditto, but 80 m.a. .. .. 6/6 each
Ditto, but 90 m.a. .. .. 7/6 each
WEARITE 110 k/c I.F. Transformers .. 1/- each
AMERICAN C.T.S. Volume Controls, finest made, divided spindles, length 2½in. with switch, 2,000, 5,000, 10,000, 25,000, 100,000 .. .. 2/6 each
Wire-wound 5 watt (less switch), 10,000, 25,000 ohms, 2/- each
WEARITE CHOKES, Screened .. .. 1/6 each
PLESSEY DRY ELECTROLYTICS, CAN TYPE.
12 x 16 mfd. 350 volts working .. .. 1/6 each
6 x 6 „ 500 volts working .. .. 1/6 each
12 „ 450 volts working .. .. 1/6 each
8 x 8 x 8 mfd. 500 volts working .. .. 2/11 each
16 x 8 x 4 x 4 mfd. 500 volts working .. 2/11 each
12 x 8 x 8 x 8 x 8 mfd. 500 volts working 2/11 each
16 mfd. 450 volts working .. .. .. 1/3 each
16 x 16 mfd. 350 volts working .. .. 1/6 each
B.I. Wire-end type, Bias Electrolytics.
50 mfd. 12 volts .. .. 1/6 each
50 mfd. 50 volts .. .. 2/- each
Tubular Wire-end non-inductive paper, all sizes up to 0.1, 5d. each, 4/9 dozen.
Metal Case 1 hole fixing Electrolytic Condensers, 550 volts working, 8 mfd. .. .. .. 3/- each
STANDARD TELEPHONE HEADPHONES, resistance 2,000 ohms and 4,000 ohms .. .. 6/11 pair
Volume Controls, 1,000 and 5,000 ohms, with switch. 1/3 each
.0005 3-gang Tuning Condenser Units, with trimmers. 1/9 each
PLESSEY Energised Speakers, 10in. Cone, 2,500 and 1,000 ohm field, with trans. .. .. 12/6 each
6in. Cone, 2,500 and 1,500 ohm field .. 5/11 each

(Continued in next column)

RECEIVERS, COMPONENTS, AND ACCESSORIES

(Continued from previous column)

RUBBER GROMMETS .. .. .. 4d. dozen
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EDITED BY F. J. CAMM
Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Switches and Switching

IT has often been said that the component part which gives most trouble in a wireless receiver is the switch. Whilst this may be true, due to the fact that this component receives the most use, it is very often due to the use of the wrong type of switch, or an unsuitable type of switch for the purpose. There are many different patterns of switch on the market and the beginner often thinks that they all operate in the same manner, and in an endeavour to save money he obtains a low-price component which, whilst it may be ideal for one purpose, may be unsuitable for continued use in the position in which he intends to place it. Wave-changing is probably the most important part of a circuit from the switching point of view, as low resistance is essential and perfect switching must be carried out or the receiver will fail to function correctly. It is often found that the receiver seems to be working properly, but signals are weak, and much time may be spent in looking for a fault which is merely due to poor contact in the wave-change switch. In this issue we give brief details of the various types of switch which are available and indicate some of the positions and circuits for which they are most suited.

Wire-stripping machines at the Ekco Works, adjustable to wires of all sizes, strips away the insulating cover . . . exposes just enough bare wire for soldering.

The B.B.C. Symphony Orchestra

THE B.B.C. Symphony Orchestra, leader Paul Beard, conducted by Sir Adrian Boult, will visit the Town Hall, Cheltenham, on Thursday, January 11th, to give two programmes, one in the afternoon and one in the evening. On Wednesday evening, January 17th, the Orchestra will visit the Central Hall, Newport, and on Wednesday evening, January 24th, the Orchestra will play at the Pavilion, Bath. Full details will be announced later.

Expeditionary Force Programme

AS from January 7th, the B.B.C. are including a special programme from 6 p.m. onwards on a wavelength of 342 metres. This programme is designed especially to appeal to the forces in France, and consists mainly of dance and similar light music, variety, sporting items, and so on. If the programme proves successful it will probably be expanded into a full daily programme.

Will Shakespeare

TIMING restrictions have developed a new technique for dealing with one form of radio play production. An example of this was seen in the production of "Macbeth," which dealt in sequence with the deterioration of the character of "Macbeth." The same technique, stressing the character of the central figure, is to be used in Barbara Burnham's production of Clemence Dane's "Will Shakespeare," on January 13th. In this production scenes from different acts of the play are knit together to throw up the character of Shakespeare.

The Black Galley

W. CUMMING TAIT, the Scottish playwright, has written a topical adventure play, entitled "The Black Galley," which will be produced for children by Christine on January 13th. It is a continuation of the adventures of David, Eric, and Rubla, about whom children heard in the serial called "The Mystery of Druid's Hill." In this play, listeners will hear the strange adventure of three boys who have been evacuated from a Scottish town to a wild part of the Highlands; how they encounter a mysterious ship known locally as the "haunted galley" and how they hear unusual noises in the dungeons of a ruined castle, which gives them a clue to the whole mystery.

Songs from "A Country Girl"

ONE of the most popular of George Edwardes' many famous productions, "A Country Girl," was produced at Daly's on January 18th, 1902, with a cast containing many stars, among them being C. Hayden-Coffin, Rutland Barrington, Willie Ward, Bertram Wallis, Huntley Wright, Maggie May, Ethel Irving, Topsy Sinden, Nina Sevening, and Evie Greene. It ran for 729 performances.

On January 12th, songs from "A Country Girl," composed by Lionel Monckton, with additional melodies by Paul A. Rubens, will be broadcast. The singers will be supported by the B.B.C. Theatre Chorus, trained by Charles Groves, and the B.B.C. Theatre Orchestra, conducted by Stanford Robinson. Production will be by Gordon McConnel and Stanford Robinson.

Talks for the Housewife

JANET QUIGLEY, who arranges the B.B.C.'s talks for women, has put together several interesting series for the new schedule from January onwards. These have necessarily a wartime atmosphere.

The Tuesday morning talks, for example, are entitled "Wartime in the Kitchen." The B.B.C. is in the closest possible touch with the Ministry of Food, and the talks have been designed to help housewives to solves the thousand and one new problems with which they are at present faced. If, for example, there is a glut in any commodity, listeners will hear of new and attractive methods of presenting this particular article of food. Speakers will include such familiar radio figures as Mrs. Arthur Webb, Mrs. Bosanquet, Ann Beaton, and Ann Hardy. The early (Thursday) morning marketing talks will be continued. These are designed to assist in the planning of the day's menus.

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The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

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

An All-wave Frame Aerial System

Details of a Recently-developed Screened Anti-static Self-contained Aerial

IN the latest General Electric receivers produced in the U.S.A. an interesting arrangement has been adopted in order to reduce "man-made static." The idea is to use a screened frame aerial inside the cabinet of the radio receiver for long waves, and to use the screen as the aerial on the short waves. The sensitivity of the Magic Eye tuning indicator is also varied on different wavebands.

Fig. 1 shows the circuit of a typical receiver in which the frame aerial 1 is shielded by the shield 2. An ordinary outside vertical aerial 3 is also shown, which may be employed, or not, as required by the user. These different aerials are arranged for connection to the input circuit of an R.F. amplifier 4. The output of the latter is supplied to the usual converter stage and I.F. stages of the receiver, which are indicated by the rectangle 6, feeding the diode detector 7. The rectified unidirectional and signal potentials appear across a resistance 8 connected between its anode and cathode. This resistance is shunted by a potentiometer comprising condenser 9 and resistance 10, having a variable contact 11. The signal potentials appearing between contact 11 and earth are supplied to the A.F. stages and the loudspeaker. Resistance 8 is, of course, by-passed for R.F. currents by the usual condenser 26, and has connected in series with it an R.F. filter comprising resistance 27 and condenser 28.

The aerial transformer 13 consists of primary windings 14 and 16, and secondary windings 17 and 18, and is adapted to transfer energy received from aerials 2 and 3 to the control grid and cathode of the R.F. amplifier 4. The wave-change switch 19 has three positions, B, C and D, the first connecting the receiver for operation on the broadcast band, position C connecting it for operation on the next higher frequency band, and position D connecting it for operation on a still higher frequency band. A second switch 19^1 is also employed, and has two positions, one effecting certain circuit connections when the frame aerial is used, the other position effecting circuit connections when the frame shield is employed as an aerial.

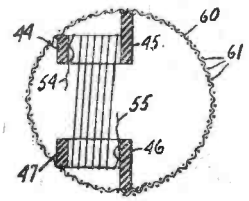


Fig. 3.—Arrangement of the end of the frame aerial windings.

Fig. 1.—Circuit of part of a receiver incorporating the frame aerial.

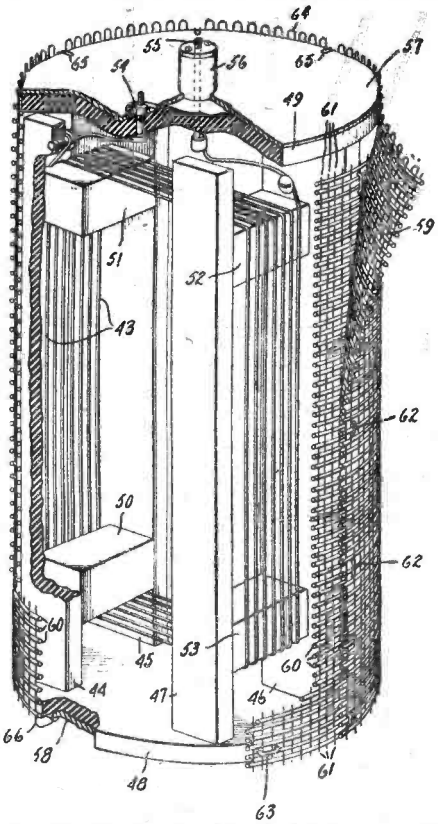


Fig 2.—Constructional details of the frame aerial.

Resonance Indicator

A visual resonance indicator 20 of the "Magic Eye" type, is shown in the lower portion of the diagram. Resonance is indicated by the fluorescing of a screen within the tube, which is controlled by the grid potential. The latter is varied by connecting the control grid through resistance 21 to the negative terminal of resistance 8. The potential of resistance 8 is also supplied to the control and suppressor grids of valve 4, and also through conductor 23 to any additional valves in the equipment 6, for A.V.C. purposes and an A.F. by-pass condenser is associated with resistance 22.

It will be noted that the switch 19 is in its B-position, the receiver thus being connected for broadcast band reception, while switch 19^1 is in its upper position, thus connecting the receiver for reception by the "frame" 1, which may be oriented for minimum reception of noise or other undesired signals. The frame shield 2 aids very substantially in eliminating the latter, and, as will be described later, its construction is such as to avoid detrimental capacity and resistance effects upon the frame.

Condensers 15 and 25 of the converter input and local oscillator circuits are ganged with condenser 5, as indicated in the diagram. A trimmer condenser 33 is also connected across the "frame," and provides for initial adjustment. In this way the receiver may be tuned through the broadcast band of from 540 to 1575 kc/s with as satisfactory alignment of the tuned circuits as if an outside aerial were used, with the added advantage that the "frame" can be installed out of sight in the cabinet. The frame shield 2 is earthed through the upper blade of switch 19^1, conductor 34, blade 36 of switch 19, conductor 37, lower blade of switch 19^1, and lower blade of switch 19 to earth. Simultaneously the primary winding 14 of transformer 13 is short-circuited to prevent absorption effects due to stray capacity coupling and the circuits of the other transformer windings are open-circuited by the switches 19 and 19^1, in the positions shown. At the same time the full potential of resistance 8 is supplied through resistance 21 to the control grid of the visual resonance indicator 20, resistance 39 being open-circuited at the lower contact of switch 19^1. In this condition maximum response of the indicator is obtained.

Using An Outside Aerial

If an outside aerial is available, it can be utilised merely by operating switch 19^1 in its lower position. The upper blade of this switch then earths the frame shield direct. The lower blade of switch 19^1 interrupts the short-circuit across the transformer primary winding 14, making it effective between aerial and earth. This winding may be of the usual type which

(Continued on page 365.)

Which Switch?

The Importance of Using the Right Type of Switch, and the Differences in the Various Types are Described in this Article

By W. J. DELANEY

THE beginner may be pardoned for expressing doubt as to the correct type of switch to use for a special purpose, as a perusal of a catalogue shows so many different types, yet many are described as of the same kind. For instance, one may see a wave-change switch and this may be of the push-pull type, or of the Q.M.B. type, and have two contacts or perhaps three. Similarly, the on/off switch

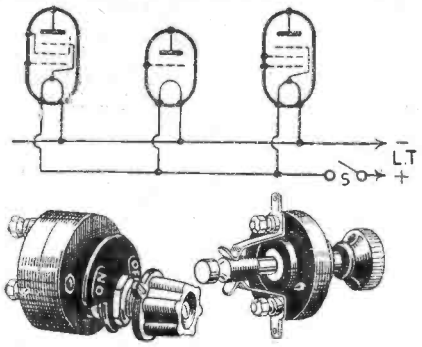


Fig. 1.—Filament switching in a battery receiver, and the usual types of switch which are used.

generally found in a battery receiver is of the push-pull type, yet some receivers are fitted with a Q.M.B. switch. Finally, the latter type of switch may be found described as a "toggle" switch, to add still further to the confusion of the beginner. Apart from the difficulties regarding the type of switch there is also the problem as to which switch to use in some receivers, in view of the fact that some current may be carried and thus the current rating of the switch has to be borne in mind. The simplest form of switch is the push-pull variety, and this may have two arms, with a moving plunger, or even four arms, and in some the plunger itself acts as one of the arms or contacts. This type of switch may be seen illustrated in Figs. 1, 2 and 3, which also show typical uses of the types illustrated. In addition, these illustrations also show alternative types which fulfil the same purpose.

L.T. Switching

In the simple battery receiver it is necessary to switch off when the receiver is not in use, and the usual procedure is to break one of the L.T. leads. Thus a simple two-pole short-circuiting switch is needed as shown in Fig. 1. But in the case of a battery receiver employing a potentiometer

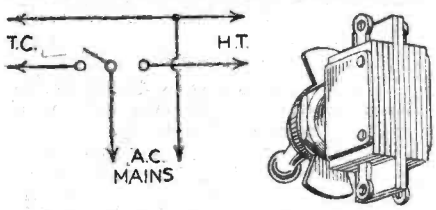


Fig. 6.—A single-pole change-over switch of the Q.M.B. type, and a typical circuit in which it is used.

across the H.T., it is also necessary to break the H.T. lead, and in this case a three-point switch is needed, the H.T.–lead being joined to the extra contact on the switch. The same simple type of two-contact or on/off switch may also be used in any position where it is necessary to open or break a circuit, provided that a high current is not being passed. A typical instance will serve to show what is needed, and this is illustrated in Fig. 5. As, however, this

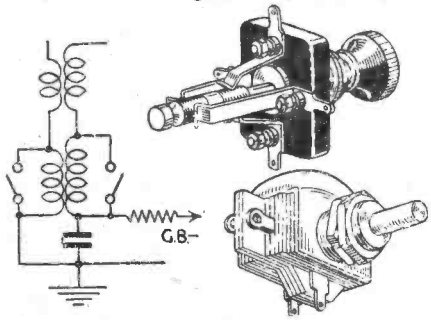


Fig. 3.—Here is a double-pole switch used for wave-change switching.

particular component is in the aerial circuit it may be desirable to protect it from dust and also ensure reliable contact at all times,

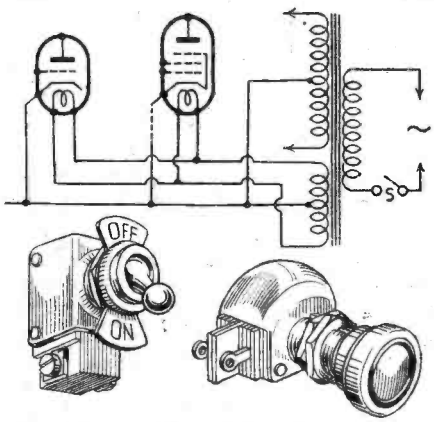


Fig. 4.—A Q.M.B. switch should be used for breaking a mains lead, as in an A.C. receiver.

and in this case one of the Q.M.B. or toggle types of switch, as illustrated, would be used.

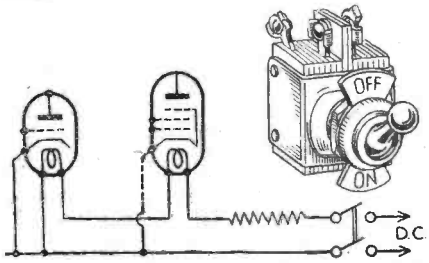


Fig. 7.—In a D.C. receiver both mains leads should be operated, and a Q.M.B. double-pole switch of the type indicated should be used.

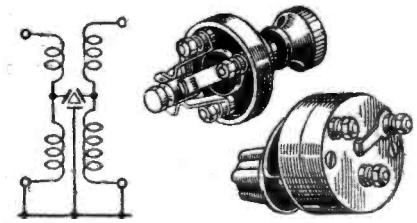


Fig. 2.—For wave-change switching, a three-point switch is often employed.

Wave-change Switching

For changing the wavelength in a standard medium and long-wave receiver the long-wave section of the coil is short-circuited, and if a single coil is used, then a simple two-point or on/off switch may be used. As, however, extra coils are added, as in a transformer circuit, additional points on the switch are required, and a typical instance is shown in Fig. 2. It will be noted that although two switches are indicated, one point on each switch is joined to the earth line and thus a single contact may be used for both of these, removing the need for one point and enabling a three-point switch to be used. Although the same circuit, so far as the coils are concerned, is indicated in Fig. 3, it will be noted that the application of grid-bias to the coil calls for the inclusion of a condenser in the earth lead, and it is no longer possible to use a three-point switch, or the G.B. supply would be short-circuited. Then a four-point switch has to be used as shown.

Pick-up Switching

For normal radio-gram. switching a single-pole change-over switch has to be used, and this may be of the push-pull type or of a special Q.M.B. type, the latter being preferred. This is on account of the fact that the grid of the detector valve has to carry H.F. currents for radio reception, and if the contact is poor or dirty, noises will be introduced or signal strength will be poor. For all mains circuits, where a current of any magnitude is passing, the toggle or Q.M.B. switch should be used, and in the simplest switching the on/off control of the mains input is a typical

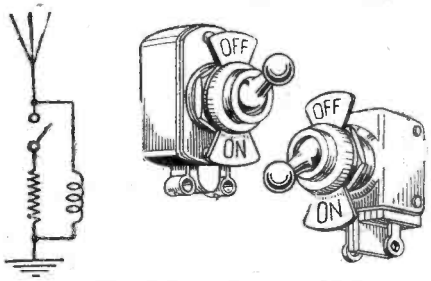


Fig. 5.—A "local-distance" switch and the circuit arrangement.

example. The circuit and two alternative types of switch are shown in Fig. 4, the switch on the left being of the same type as normal house lighting switches, whilst

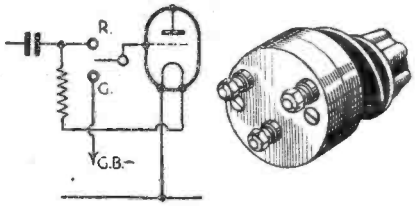


Fig. 8.—A single-pole change-over switch for radio-gram switching.

WHICH SWITCH?

(*Continued from previous page*)

that on the right has exactly the same internal movement, but has a rotary control action, and this enables panel controls to be matched more satisfactorily. An interesting version of the toggle switch is shown in Fig. 6, where the internal connections permit a change-over effect so that a trickle charger and an H.T. eliminator may be brought into circuit with the mains as desired. When the set is switched off, the trickle charger is switched on. On D.C. mains it is very desirable to disconnect both mains leads when the set is switched off, and thus a double-pole Q.M.B. switch is needed, the circuit and a typical sample being shown in Fig. 7.

Coil Switching

Modern receivers utilise several coils, and if the receiver is of the all-wave type this introduces further difficulties. Special switch units have, however, been introduced for this purpose, and three examples are shown in Fig. 9. These switches have low losses and make reliable contact and furthermore may be ganged together, using one for each coil. Special lengths of rod are supplied so that the desired number of switch units may be used. It would be impossible to give circuit examples in view of the many different forms of switching which may be used. Recently a small form of this switch has been produced, although it cannot be ganged. It is illustrated in Fig. 10, and the various arrangements which are available with this switch are shown in

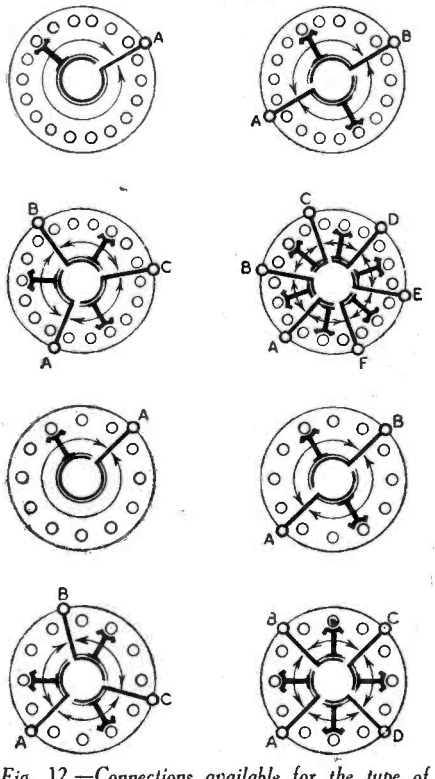
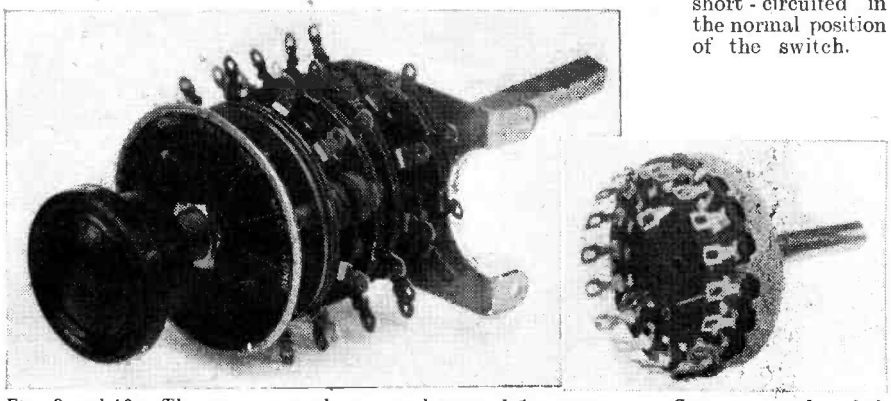


Fig. 12.—Connections available for the type of switch shown in Fig. 10.

Fig. 12. This indicates, by a heavy line, the contact point and the wiper and arm which are fitted. It will be seen that in one form a wiping arm may take selection on any one of 18 points, or two or more arms may be provided, and will select various contacts. This type of switch was used in our 30/- All-Wave 3 receiver, and the only point to watch is that the correct arm contact is selected for the appropriate contact points.

There is one final type of switch which, although not very well known yet, has many interesting applications. This is known as a "momentary action" toggle switch, and has only one permanent position. For instance, in one form the switch is permanently "on," and if the toggle is raised to the "off" position, it immediately flies back to the "on" position when the finger is removed from the switch. In a permanent "off" switch it will only be "on" whilst the toggle is held down. It is ideal for bringing into circuit a meter to measure anode current, for instance, the reading being noted whilst the switch is held "off," and the meter short-circuited in the normal position of the switch.



Figs. 9 and 10.—The rotary wave-change switch in two different patterns Connections and methods of operation of the model on the left are shown in Fig. 11 and for the switch on the right in Fig. 12.

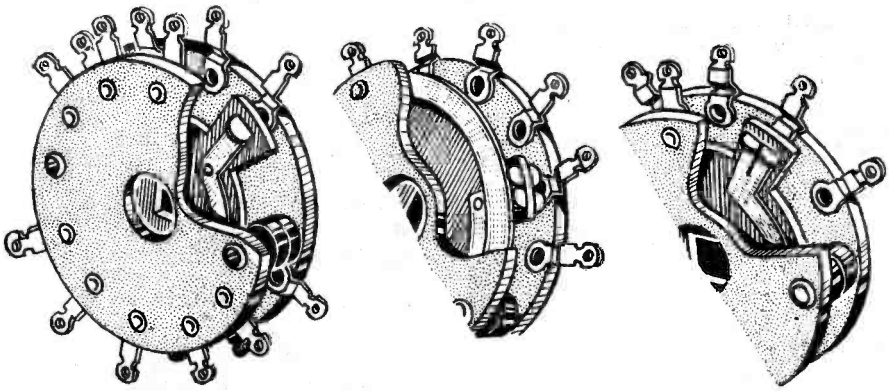


Fig. 11.—How the rotary switches (Fig. 9) are designed. Three different patterns are shown.

ELECTRON BOMBARDMENT

THE bombardment of electrons against a surface, either in a narrow directed stream, or as a random impact, is a very important process in the science of television. The function of this process is really twofold, one being related to the transmitting end of the chain, and the other at the receiving end. In the case of the former, the brightness variations of the scene to be radiated are translated into electrical signals, and if consideration is given to the iconoscope type of camera, it is these electrons which are made to fall on a metal mosaic which is insulated and charged at varying potentials over its surface. Secondary emission is the medium which brings about the desired discharge, and in carrying this out, several other factors are brought into being, and these have to be considered carefully when design problems are tackled. For example, there is the question of the saturation effects of the mosaic, the space charge brought into being in the immediate vicinity, secondary electron redistribution and the rate at which these secondaries are collected, the electrical charges on the glass envelope, etc. All these items occur in practice, and have served to make the operation of the device a far more complicated one than was originally supposed by those engaged on the initial development. Coming now to the other end of the chain we have the cathode-ray tube, which reverses the original process by converting the electrical signal variations into gradations of light and shade distributed over the screen in brightness areas. The electron stream impact in this case brings about a combined state of fluorescence and phosphorescence, causes a certain amount of heating to both the powder and the glass, and finally gives rise to secondary electrons which are collected by charged electrodes in the tube. It is clear that with this device the emission of the secondary electrons must determine the potentials and loss of energy of the electrons in the various sections of the travel stages, and with this is wrapped up the efficiency of the tube as a converter of electrical energy into light. The research laboratories are therefore concerned with the study of the functional relationships of these items one to the other, for by so doing the best possible picture quality will be obtained, it being assumed that the receiver and auxiliary equipment is performing at its maximum efficiency.

ON YOUR WAVELENGTH

By Thermion

A Midget Receiver

S. E. JAMES, of Croydon, Surrey, has sent me the details of a midget receiver which he has built in a gas-mask box. It is built on a baseboard 3¾in. by 3in., with a panel 3¾in. by 5in. This just fits in the end of the box, leaving enough space under the lid for the control, and the H.T. battery consisting of three 9-volt grid-bias batteries. On top of this battery, but carefully insulated from it, he has placed one of the old 8d. cycle batteries as the L.T. This is used with a 5-ohm resistance for the P.M.2 DX, and H.L.2 valves, and brings the filament current down to its correct amount. The aerial is formed by a wire which passes over the shoulder, and my reader says he can walk about with it using one earpiece. The appended photograph shows Mr. S. E. James's gear taken just before the war.

North Manchester Radio and Television Society

THE hon. sec. of the above club tells me that since the commencement of war their meeting-place has been moved from Whitefields to the centre of the city, close to the main station, for the convenience of members. He invites other members around Manchester to co-operate. This club is keeping a watch on local ramps in the wireless business, particularly in the battery line. The Consul for Finland has sent the club his sincere thanks for their sympathetic message to the radio listeners in Finland, which message has been passed on to the authorities in Helsinki.

Confiscation of Sets

THE secretary of the same club sent a questionnaire to the Engineer-in-Chief of the Radio Section of the Post Office, relating to amateur radio transmitters. You will see from the appended replies the nature of the questions.

"Relative to the confiscation of amateur radio transmitting apparatus, I have to inform you that it is the intention to return such apparatus to the owners after the war, and applications for restoration should be addressed to this Department on the cessation of hostilities.

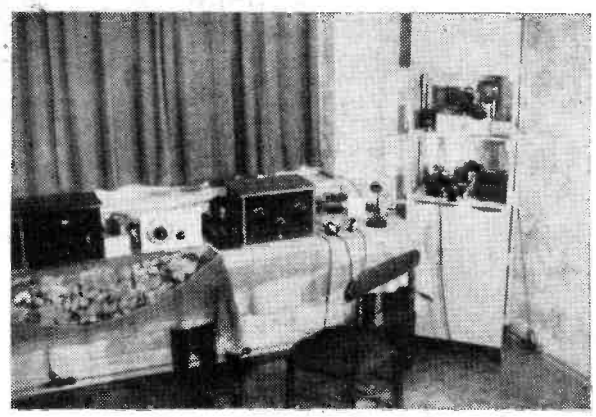
"You can be assured that every reasonable precaution will be taken to ensure the safe custody of apparatus whilst held by the Post Office.

"The call-signs previously held by licensees are cancelled simultaneously with the relative licences, and no claim to the use of a particular call-sign in any future licence granted could be allowed.

"If, and when experimental wireless facilities are restored, the question of an adjustment of fees and of the grant of fresh licences will be given consideration." (This was in answer to the following question: "Will new licences for transmitting have to be taken out after the war, or will those holding them at the time of confiscation be able to carry on with the old licence until the number of months, etc., for which it was still available are ended?")

"And So Say All Of Us"

WHEN Pat and Taffy, Pawky Saundy, readers all, once met,
Their common interests drawing them together,
They talked at length of radio and television, too,
Of sport and drama, literature, and weather;
And then said Pat—when these ran dry:
"Me bhoys, now get this sthrate.
Oi wouldn't miss 'P.W.' on no account at aal,
Oi orther ut, and so ut's never laate,
'Tis the only raddio paaper that's lift av aal the lot,
If Oi missed ut—shure 'twould make me rave an' shwear.
Troth Oi'd crack the schkull av annywan that thried to kape ut back
"Loike they sarved ould Paddy Riley at the Fair."



A corner of Mr. S. E. James's den.

"Well, look you," said the Welshman (late of Llanfer P.G.)
(Use the alphabet to find the rest and finish "gogogoch")
"If I wass not get my copy, dychrynllyd, what a blow!
Oh, yes, intect to gootness, quite a shock."

"Aweel," said Pawky Saundy, "masell ah'll no deny,
It's graund tae think its price is no increased.
Ah like the braw wee paper, but ah like mah siller mair.
If they'd raised the price, mah purrrchase micht 'a ceased;
Forbyc ah dinna always like their joaks aboot the Scot,
Though maybe they in fun are only penned,
But ye couldna rin the Empirrre if it wisna for oorsels,
A fauct that canna be tac widely kenned.
Still, ah willna argy-bargy, for nae doot the loons mean well,
If it wisna for their energy sae tirrreless.
Laundsakes! It would be frichtfu' gin Wednesdays cam aroond
If we had nae news o' radio and wirrrreless."

And thus for once—and only once
In history do we find
John Bull and Saundy, Taffy, Pat,
Are of the self-same mind,
And in the long, dark days of war
Share to the full this view—
"Thank heaven, jitters have not stopped
Our paper, Like ourselves
IT MEANS TO SEE THINGS THROUGH.

NOTE TO READERS.—"Dychrynllyd" is *not* a Welsh swear word, it only means "horrible" or "frightful." It is pronounced, roughly, like "duchrunthlid."

"TORCH."

Another Battery Racket

E.C.1, of the North, exposes a racket which is going on in that district. One dealer is selling "special" torch batteries consisting of a grid-bias battery cell neatly covered with pink-coloured paper containing the magic legend:

"A.R.P.
Anti-Dazzle
Battery
4d."

Apparently, this dishonest profiteering will continue in spite of the Government.

Television in Germany

ACCORDING to recent newspaper reports television is proceeding in Germany in spite of war conditions. We should certainly reconsider the question over here.

The Short-wavelength Muddle

IN my reference library I have several books which purport to give a list of short-wave stations, and their allotted wavelengths. I also have the list issued by the B.B.C. in connection with their publications. None of them agrees. Even the list issued by the B.B.C. from time to time differs as to important stations. The time has arrived when short-wave transmitters should be compelled to announce their wavelengths and stick to them. The present chaotic conditions merely indicate that the short-wave transmissions are run by muddlers. Quite often the sudden changing of a wavelength will cause severe interference with an adjacent station. Those interested in listening on the short waves are finding it most confusing to have to search around each night for a station which does not maintain its wavelength. This in itself causes further interference. Perhaps my readers would care to discuss this problem, and to give reasons why so many short-wave stations stray from their announced wavelengths. There cannot be any tenable reason for this. I should also welcome details of the worst offenders.

The 1940 Sets

I GATHER from manufacturers that they are not spending any considerable sums of money in experimental designs for the 1940 receivers. Instead, they are directing their efforts to produce cheaper and simpler receivers so that they can market them without having to increase price. Many of the old constructors who deserted the pastime are now coming back to it and are finding in short-wave listening an interesting means of occupying the evenings they are now compelled to spend at home.

PRACTICAL TELEVISION

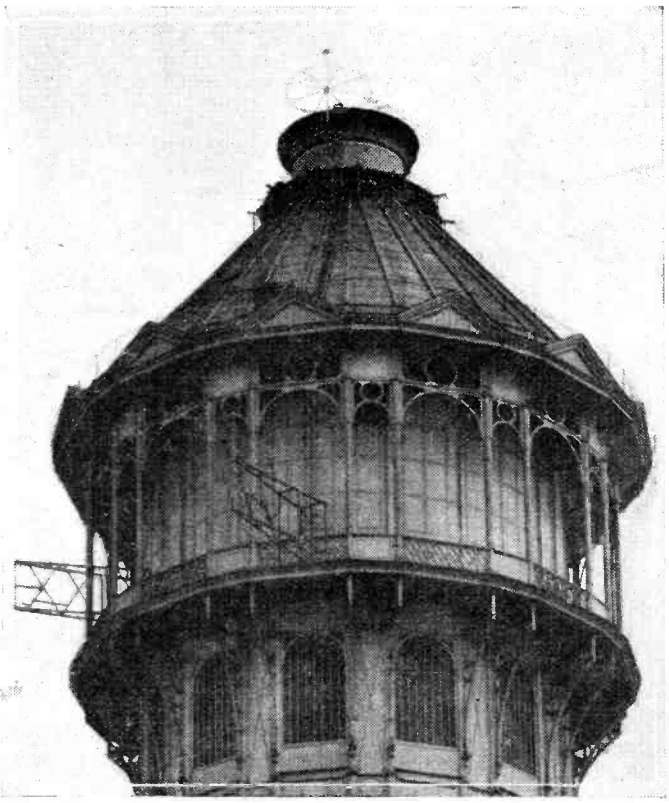
January 13th, 1940. Vol. 4. No. 185.

Television Transmitting Aerials

ALL the work devoted to improving the efficiency of an ultra-short-wave radio transmitter used for a television service will be nullified if it is not used in conjunction with an aerial array having a very high performance factor. To increase the range of propagation this section of the whole installation must be so designed that the energy losses are reduced to the barest, and considerable research has been applied to this side of the problem both in this country and abroad. For example, it is a well-established fact that a conductor one quarter of a wavelength long is an efficient aerial, but if this is erected at a great height, so as to increase the range of signal reception, then losses may accrue in the feeder cable connecting the aerial to the output circuit of the radio transmitter proper. It has been demonstrated recently that one way to reduce these losses is to adopt a special form of earthing system for the feeder. This is done by using capacity wires which are less than a quarter wavelength long, and tuned to the carrier frequency, thereby giving a low impedance at the point to which they are connected. This simulates a low earth impedance, and bears a relationship to the capacity earth screens which were used with broadcast aerials some years ago, when real earthing facilities were not available. In some cases this capacity earth for television transmitting aerials is made up in the form of spokes radiating from the feeder located at the centre. These spokes and rim are adjustable in length if more than one carrier frequency is to be employed, but can be designed to a fixed length in the case of a single radiating carrier frequency which is usually the case. An actual design based on somewhat similar reasoning, that is improving the radiating efficiency of the television aerial, is illustrated in the accompanying photograph. This shows the corona aerial at the top of the chimney breast of one of the Crystal Palace towers. It was designed to give maximum horizontal radiation, and the eight spokes are clearly visible as an array a definite fraction of a wavelength below the vertical radiating conductor. Surmounting this dipole is a small disc to give capacity tuning, and the whole installation was used in conjunction with a 10-kilowatt transmitter. Another method of reducing losses and improving horizontal radiation is to employ dipole aerials with reflectors and if the radiation is to be uniform in all directions, then this becomes a spoked array something like a skeleton cylinder, as in the case of the B.B.C. station at Alexandra Palace.

Preventing Screen Damage

IT is well known that if the beam of electrons in a cathode-ray tube is allowed to remain stationary, so that the point of impact on the fluorescent screen is evidenced by a tiny brilliant area of fluorescence, then the screen will be burned at that point. That is why instructions are furnished stating that the beam must be kept on the move when patterns or pictures of brilliant intensity are being built up on the tube face. Even so, a measure of wear and tear is inevitable if the same section of the available screen area is used over and over again, while special precautions have to be adopted to offset the damage resulting from a failure of the time base generator to impart the combined horizontal and vertical motion to the electron beam. As an alternative to these methods another scheme has been suggested which has for its main object a prolongation of the life of the cathode-ray tube in terms of the retention of screen efficiency. For this purpose the tube employed has a much larger screen area than is necessary for the particular purpose for which it is to be employed. The screen, or screen and tube, according to the method of instruction, is then made to rotate about its central axis, while the area of scan is arranged to be eccentric to this axis. Fitted to the outer rim of the screen are vanes, and at predetermined intervals the electron beam is deflected so as to strike these vanes, and by this action rotate the screen in much the same way as the rotor of a turbine is revolved by the direction of steam jets against specially shaped vanes. The same principle could of course be applied to the photo electric or mosaic assembly screens used in the different forms of electron cameras, for here again the active life of the apparatus is very often a function of screen, and the damage that may result from the continuous impact of the high velocity scanning beam of electrons.



A good example of a spoked aerial array capable of giving efficient radiation in a horizontal direction.

The Attenuation of High Frequencies

THE increasing use of the higher frequencies for all forms of communication, where long distances do not have to be considered, has extended very materially the amount of research which is being applied to the propagation characteristics of waves in that part of the spectrum. Obviously, the degree of signal attenuation will vary according to whether the transmissions are effected over water or land or a combination of both, while reflections from the various upper ionised layers of the atmosphere present no mean problem to those who are concerned with point to point working. Quite recently an investigation was carried out in America into the rate of attenuation up to distances of approximately 10 miles over land, the band of frequencies involved being from 80 to 1.5 megacycles, that is, the short and ultra-short spectrum. The results proved most interesting and showed that from 1.5 up to 4 megacycles there was an increasing attenuation with frequency but that from 4 to 80 megacycles the degree of attenuation remained almost constant. On the other hand, with frequencies below 12.5 megacycles there was a greater attenuation measured during the hours of daylight than could be measured when the sun had set. By careful interpolation of the results it was shown that the variation of signal strength with distance could be expressed by an inverse power equation. In other words, between 80 and 4 megacycles the signal varied inversely as the 2.3 power of the distance. It was also found that the variation of attenuation with respect to frequency could be predicted, but that in daytime these predicted results were always less than the measured values.

Remote Control of Radio Systems

Some Interesting Details of Speech-controlled Radio Transmitters in America

THE location of aerials is generally controlled by factors affecting radio reception or transmission, and thus the most favourable site may very likely be at some distance from the central office through which the radio and land channels will be connected. The radio receivers and transmitters must be near the aerials, and in the past this has required the establishment of the station operating force at some distance from the switching centre. For the smaller radio links, where the equipment is simpler and the operating attention required is too small to justify the establishment of a permanent operating staff, the radio equipment has been designed for remote control, and all operating is done from the connecting central office. With this arrangement, periodical visits to the radio station are all that is required for ordinary maintenance. This method, which was first used with aeronautical ground stations, has also proved effective for radio receivers in ship-shore or harbour craft service, and for both transmitters and receivers for such low-power radio links as that between Green Harbour and Provincetown.

Simple Control Circuit

The operating functions that must be remotely controlled vary, for the most part, with each installation, so that standardisation has not been feasible. In all cases, however, a variety of control pulses transmitted over the voice line between the radio terminal and the central office are employed to actuate a suitable set of relays. An example of one of the simpler forms of control circuit is that used for the pole-mounted radio receivers and transmitters at Provincetown. Here it was necessary to be able to turn on either the receiver alone, or the receiver and transmitter together, or to add to the circuit an oscillator for test purposes.

As shown in Fig. 1, a simplex control circuit was formed by a connection to the midpoint of the transformers, both at the telephone terminal and at the radio equipment. With this arrangement, the control current flows over both sides of the telephone line in the same direction, and by using a combination of positive and negative pulses to ground, with a suitable combination of relays at the radio terminal, either the receiver, or the transmitter and receiver, may be turned on, or both of them may be turned on together with the test oscillator to set up a test.

With this system two keys are provided at the telephone office; one to connect positive and one negative battery to the simplex circuit. With neither of these keys operated, relay A at the radio terminal is operated, and neither receiver, transmitter, nor oscillator is in operation. To bring in the receiver alone the positive battery key is operated at the central office, and positive current flowing over the line operates the receiver relay at the radio terminal. This releases the A relay through a back contact, thus putting ground on the receiver control lead and turning on the receiver, and operating the test relay to prevent operation of the test oscillator.

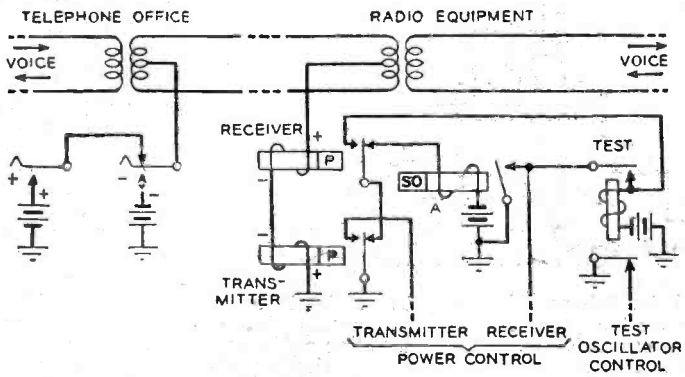


Fig. 1.—Simplex control circuit used to control radio receiver and transmitter at Provincetown.

To bring in the transmitter in addition, the polarity of the control current is changed by operating the negative key. This releases the receiving and operates the transmitting relay, and the latter energises the transmitter through its front contact. During this transition the A relay remains released because of its slow-operate characteristic, and thus the receiver remains in operation and the test relay is held operated to prevent the excitation of the test oscillator.

Testing Receiver Operation

To test the receiver operation, the receiver, transmitter and test oscillator must all be in operation at the same time. To bring about this condition, both keys at the telephone office are restored to the normal position, which allows the A relay to operate and the test relay to release and start the oscillator. The negative key is then operated, which actuates the transmitter relay, bringing in the transmitter, and opens the circuit to the A relay—thus allowing it to release and bring in the receiver.

With such a simplex control circuit there are three possible conditions of current flow—positive current, negative current and no current—and by employing various sequences of two or three of these conditions, and suitable relay combinations at the radio terminal, a number of operations may be secured. A few years ago a circuit of this type was employed to control frequency and aerial selection at a radio transmitter. A key at the control station connects a telephone dial to either an aerial-change or frequency-change circuit, and the subsequent dialling selects the aerial or frequency desired.

The arrangement of apparatus for this is shown in Fig. 2. When the dial is pulled back, battery is connected to the line through the contacts of a pulsing relay and, depending on whether the battery is positive or negative, the A relay at the transmitting station will operate the aerial or frequency-selecting relay. On release of the dial the battery is reversed a number of times equal to the digit dialled, and the selector at the transmitter will move ahead an equal number of steps to make the desired selection. Relay B remains operated throughout the pulsing, while relay A follows the pulses in order to actuate the selecting relay.

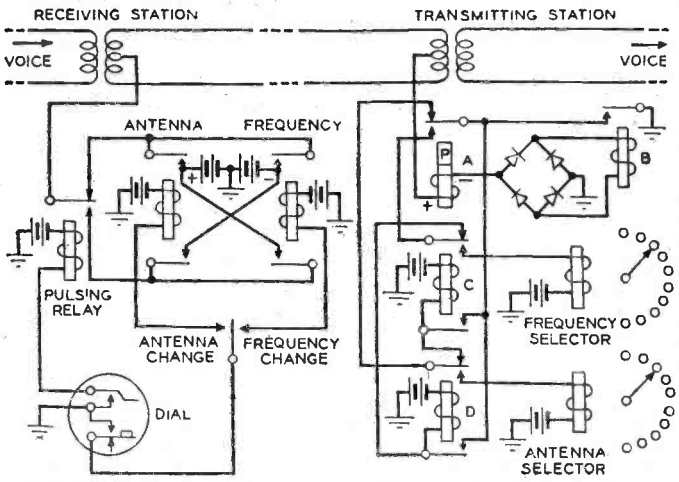


Fig. 2.—Simplex dialing circuit used for selecting frequencies and aerials at Miami.

Instead of using a simplex circuit, it is possible to send positive or negative pulses to ground over the two sides of the line separately, or a current may be circulated around the circuit in the usual manner. Both of these latter methods were used recently to turn on and off a radio receiver and to control its gain.

(Continued overleaf)

REMOTE CONTROL OF RADIO SYSTEMS

(Continued from previous page)

Combined Simplex and Circulating Circuit

For the 223 radio-receiving equipment, a combination of simplex and circulating circuit is employed. This receiver is normally energised all the time, so that no arrangement need be provided for turning it on or off. It incorporates a codan, however, that operates a relay whenever carrier is being received, and a circuit must be provided over which the carrier-operated relay can operate a relay at the central office to perform a number of circuit functions. In addition means must be provided for operating a test oscillator, reducing the gain of the receiver to meet certain operating conditions, and operating or releasing a lock-up relay used in connection with the signals transmitted when the regular power fails.

The circuit, shown in Fig, 3, employs a two-position emergency power-signal key and a three-position key. One is the unoperated position, and the other two are marked "gain control" and "test oscillator control." With the keys in the unoperated positions, a circuit is closed from the positive pole of the battery through both windings of a codan-controlled relay, a simplex line circuit, through two opposed windings on each of two polarised relays at the receiver, the primary winding of the power-control relay, and thence to a front contact of the codan relay. When the codan relay operates, current flows over this simplex circuit to operate the relay at the central office. This current has no effect on two of the polarised relays at the receiver because it divides equally between the opposing windings on each, and no effect on the power-control relay. It also has no effect on the operation of the line as a voice circuit; its only effect is on the codan-controlled relay.

When the three-position key is in either of the operated positions, current flows down one side of the line and back the other, and operates one or the other of the balanced polarised relays depending on the direction of flow. Operation of the gain-control key reduces the gain of the receiver to a predetermined point, and operation of the test-oscillator key in a similar manner operates the oscillator-control relay to the test oscillator.

The receiver includes an emergency power supply which is switched on automatically whenever the regular power fails, and is disconnected when the regular power comes back on. The central office is notified of a failure of the power by a circuit at the receiver that connects the test oscillator and transmits a steady tone. Since the circuit cannot be used while the tone is on, an additional control circuit is provided to disconnect the tone after the power failure has been noted at the central office. The tone is also applied when the regular power comes back on, and then another control circuit is required to remove the tone.

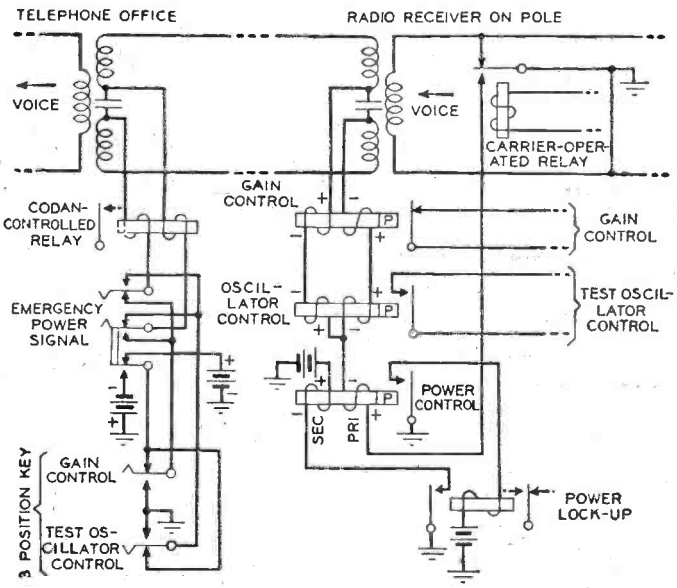


Fig. 3.—Control circuit for 223A radio receiving equipment.

Testing Tone

To stop the test tone after the receiver has transferred to the emergency battery, the emergency power-signal key at the central office is operated. This key switches the entire control system from negative-grounded battery to positive-grounded battery, and reverses the circuit so that the three-position key operates in the normal manner. Change in the polarity of the signalling battery operates the power-control relay at the next closure of the contacts of the carrier-operated relay. The power-control relay operates the power-lock-up relay, causing these relays to lock up under each other's control and release the signalling tone. To stop the test tone after commercial power has been restored, the emergency power-signal key at the central office is released. Release of this key restores the normal negative-grounded battery to the signalling circuit. At the next closure of the contacts of the carrier-operated relay, the current through the primary winding of the power-control relay is large enough to overcome the effect of the holding current in the secondary winding, so that this relay releases, and releases the power-lock-up relay to restore the circuit to its normal operating condition.

These circuits are typical of the various arrangements that can be provided for controlling radio equipment over a connecting voice-frequency line. The particular form they take is dictated for the most part by the number and type of operations that these circuits are required to perform.

The above details are reprinted from the *Bell Laboratories Record.*

Music Plans for 1940

THE chief items in the B.B.C.'s broadcast music plans for the early part of 1940 are as follows:

The absence of an alternative programme has made it necessary for every concert to appeal to an infinitely wider audience than in pre-war days, and it is felt that the widening of appeal must come through the shortening of programmes where artistically possible and rigorous concentration on the highest grade of music and performance.

Special concerts will be given by the B.B.C. Symphony Orchestra at local centres in January as follows: Thursday, January 11th, Cheltenham Town Hall; Wednesday, January 17th, Newport Central Hall; and Wednesday, January 24th, Bath Pavilion.

A series of monthly concerts to be given in the presence of an invited audience is being planned. These will combine the idea of the concerts of Contemporary Music which the B.B.C. has given in London since 1926 and some of the best material revived or first produced in programmes broadcast under the title of "Special Recitals." Thus the programmes will have a special appeal to music-lovers, though a part of each concert will appeal to a wider public.

The policy of broadcasting every week a classical symphony conducted by Sir Adrian Boult will be continued. In this series the B.B.C. Symphony Orchestra, under Sir Adrian Boult, has already broadcast Beethoven's Seventh Symphony; Brahms' Fourth Symphony; Schubert's C Major and Mendelssohn's Scottish Symphonies.

It is hoped that the B.B.C. Music Productions Unit will be able to include occasional performances of opera specially adapted for broadcasting, and also special shows on Sundays which will include performances, from time to time, of Gilbert and Sullivan opera. Feature programmes, such as "Brief Interlude," "The Table Under the Tree," "Cities of Music," and regular orchestral concerts will be given under the direction of Stanford Robinson.

A weekly organ recital will be included alternately in day-time and evening programmes.

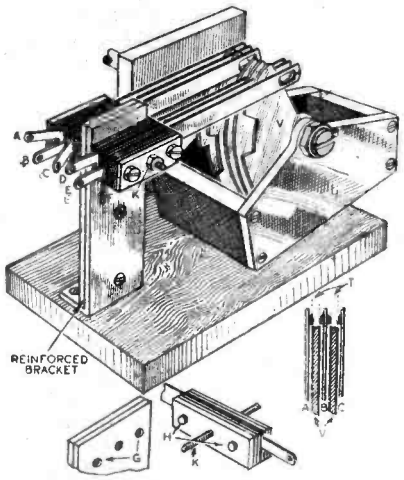
The B.B.C. Salon Orchestra programmes will assume an increasing individuality. This will be contributed, for instance, by the regular inclusion of free transcriptions of, or fantasias upon, current popular successes, or successes of the last thirty years, made by experts like Ben Berlin, Michael Krein, Fred Hartley and Max Saunders. A regular ingredient will be English folk music, selected by Gerrard Williams from the library of the English Folk Song and Dance Society, transcribed and arranged by him for the Salon Orchestra. Numbers featuring solo work by leaders of the orchestra, who are among the foremost contemporary British players, will also be included.

Outside light orchestras, particularly those popular before the war, both in London and the regions, will be engaged to the maximum extent, having regard to studio accommodation, regulated not by the B.B.C., but by considerations of National Defence, and by the available programme space. In the third week of January, for example, twelve outside orchestras will be heard in the programmes.

Practical Hints

A Motor-control Movement

I HAVE been trying to perfect a motor-control movement in which the condenser settings are governed by a cam action along the lines indicated in the article on "Improving and Stabilising Remote Control," which appeared a few years ago in *Practical and Amateur Wireless*. After pondering over a number of schemes, I finally hit upon the idea of using two nests of contacts obtained from a telephone relay which I purchased quite cheaply.



A novel motor-control movement.

I found that if properly aligned, the contacts (A to F) could be positioned or interleaved with the vanes of a condenser, that is to say, with the moving vanes (V).

On rotating the vanes, I noticed that owing to the thickness of the vanes (T) exceeding the width of the contact air gaps —as illustrated by the inset diagram—an even and definite contact sequence was obtainable. I immediately set about making a cam "unit" as a separate piece of apparatus to permit its adaptation under different conditions of operation during my experiments.

To this end, I constructed the cam unit in such a way that after assembly and coupling to the motor unit, the vanes could be lined up so that the cut-out portions would meet the contact sequence desired at the different settings. Ebonite was used for the cam assembly, an old variable condenser movement being commissioned for the vane sequence, these vanes being cut, as depicted, and separated by the old method of brass washers on a square section shaft.

The method I adopted for rigidly mounting the contact nests consists of a reinforced aluminium bracket of 16 gauge, the two sections being clamped with 4BA bolts, as shown.

Owing to the slight protrusion of the nest fixing screws (H), it was necessary to slightly sink two holes (G) in each side of the bracket so that these protruding screws could recess neatly. In this way the nests are prevented from turning after assembly. Final fitment is secured by using a length of 8BA threaded brass rod (K), and nuts as depicted in the inset sketches.—E. V. CASTLE (Putney).

THAT DODGE OF YOURS!

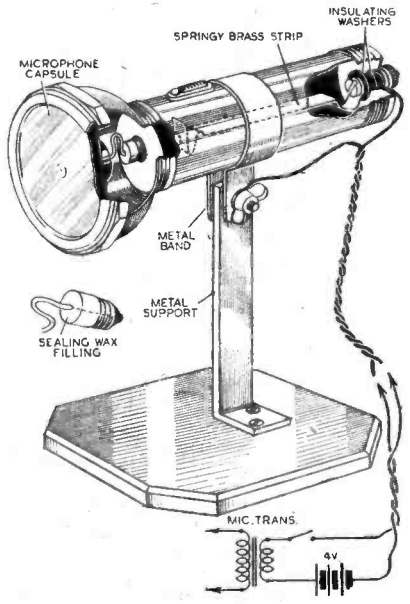
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending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

SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.

A Small Microphone

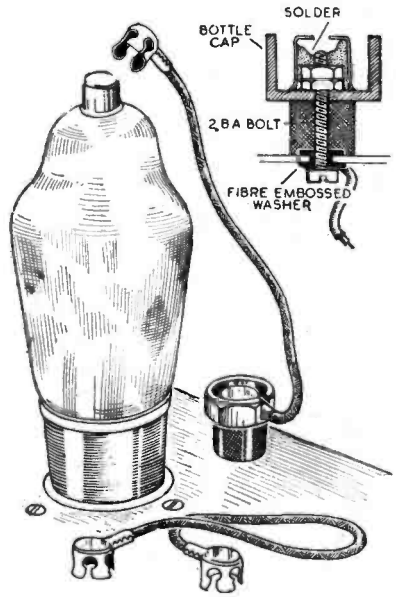
BEING in need of a small microphone, I hit on the idea of utilising an old torch case for a hand or stand mike, as shown in the accompanying sketch. The torch case had a glass front, 2¼in. diameter, and this I removed, together with the reflector. I next purchased a G.P.O. carbon mike capsule, price 1s. 6d., and fitted it in the end of the torch in place of the glass front. The adapter is made by taking an old pea-lamp and removing the bulb and cement. A lead from the bottom of the mike capsule is then soldered to the bottom contact of the adapter, which is then filled with sealing wax, or pitch. The bottom of the torch case is drilled with a $\frac{3}{16}$in. hole in the centre to take a 4BA screw which is insulated with two bakelite washers. A piece of thin springy brass is bent, as shown, one end of which is drilled and clamped under the screw head, the other end making contact with the end of the adapter. The other connection is made to the metal case of the torch.—P. S. M. MATTHEWS (Leicester).



An old torch case is utilised for making this microphone.

A Safety Device for T.C. Connections

WHEN servicing a receiver the other day, I had reason to remove the anode cap of a valve while the set was switched on, and although one deprecates such actions, I thought in this instance that with a little care, and as a common screen and anode circuit was in evidence, there would not be any trouble. But I accidentally short-circuited the cap to chassis, with the result that a feed resistance became overloaded, and, as could be anticipated, this resistance was located in a very awkward position in the wiring layout.



A method of ensuring safety for T.C. connections.

This little experience prompted the idea of a detachable fly lead connection, suitably insulated, as shown in the accompanying illustration.

The scheme consists simply of mounting another valve cap (obtained from an old valve) on an ebonite rod, being shrouded by adapting a brilliantine bottle cap as depicted in the inset diagram.

To insulate the cap which, as will be noticed, is soldered to the lock nuts of a 2BA bolt (soldering being carried out by drilling a small hole in the top of the valve cap) fibre embossed washers are fitted when the bolt passes through a metal chassis. A slot cut in one of the "flats" of the bottle cap permits the easy fitment of the valve cap connector.—S. A. LONG (Letchworth).

Comment, Chat and Criticism

More Composers' Idioms

Our Music Critic, Maurice Reeve, Discusses the Outstanding Characteristics of the Music of Grieg and Wagner

WHAT is the definition of the quality or ingredient which goes to make one man's music so different from another's? What is that "something" that gives Grieg's music, for instance, that peculiar tang or flavour which makes it so characteristic of the man, and so different from any one else's that, having once heard one single piece by the Norwegian master, whose father was a Scotchman, we could tell his stuff a mile off? And the same with Liszt or Wagner, and in more subtle ways, Bach or Beethoven. We talk of this one's or that one's idiom in the same way that we talk of Johnnie Walker as something quite different from Haig, or Black and White. And in the same way that an inveterate smoker of Gold Flake will go a long way before smoking any other brand, so will the musician name one man's music apart from another's, even when he has never heard the current example of it before. It is a most intriguing problem that has baffled much profound thought and scholarship. And perhaps it will interest my readers if I express some opinions on the subject this week. I cannot include musical quotations, but I will name a few well-known works which you may care to refer to.

Similar Mediums

I think we can take it for granted that no composer ever set out after careful study of his predecessors or contemporaries to "invent" a mode of musical speech and then go away and patent it. There is nothing whatever to stop anyone plagiarising, say, Wagner—presumably out of admiration for that master, and avoiding an actual copy—to such an extent that we would be forced to say: "Why, the man's music is just like Wagner's." This has frequently been done with Debussy. But as Debussy perfected an entirely new medium—the whole tone scale through which to express himself—a medium of great pungency and aroma—I have no doubt we are slandering those gentlemen who also work in that same medium when we say they are imitating Debussy. The two things are entirely different. To run up and down the keyboard in whole tones and call it Debussy, as to pound out torrents of dominant and diminished sevenths and say "that's Liszt," is a misuse of terms. What we are really doing is showing the public the medium that Debussy and Liszt worked on at the same time, as we admit we cannot think of anything to say beyond what they said. That is not necessarily their idiom. Ask anyone of these supposed plagiarists to make a reasonably accurate imitation of Wagner's "Wedding March" from "Lohengrin," or Grieg's "Wedding Day," and they would most likely fail completely. No, to get at that "something" which makes one man's music so entirely different from another's, we must look much deeper than that. And that is where we get baffled, and up against an almost insoluble problem.

It is subconscious, like one's personality. In fact, it is part of one's personality. Having found the secret, I have no doubt they afterwards exploit it for all they are worth. If we study the actual notation of different composers' thematic and melodic material, we can be struck with certain characteristics that run through their works. It should not be overlooked, however, that this is only one of several departments, and not the most important at that. Their harmonisation, their treatment of form, their employment of rhythm; all these are factors that must be carefully studied. In fact, it will be obvious to anyone that the union of all these ingredients becomes the work itself—a melody or a theme is merely a part.

Grieg

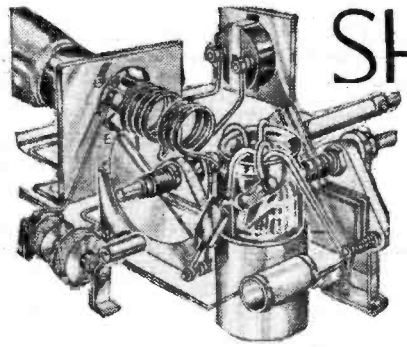
Grieg is one of the most characteristic writers who ever lived, if not one of the deepest or most profound. His idiom stands out a mile, and we can easily have a look at his music, now, to illustrate this article, the more so as we have already mentioned him. Here is a short list of some of his most famous melodies. "Solveig's Song"—both the minor and major sections; Piano and Violin Sonata in C minor, first and last movements, and the first and second subjects in each—four themes in all; "Morning" and "In the Hall of the Mountain King," from "Peer Gynt"; the theme from the beautiful Ballade for Piano; and the exquisite song, "Ich Liebe Dich." This is a short list, but as it comprises some of the master's very finest compositions, it can justly be called representative. In all these themes there is the striking recurrence of the drop of a third at some point or other. It is most often a drop, though in "Ich Liebe Dich" it becomes a rise. Also in the second subject of the sonata. Further, there may be more than one third in sequence. But the interval of a third is there, and it persists throughout a large number of Grieg's works. So persistent and so forceful is it, that we are quite obviously entitled in calling it a characteristic of Grieg's music that largely contributes towards making his music what it is—something quite different from anyone else's, and a music that stands out a mile whenever we hear it.

Wagner

As Grieg confined himself to the smaller musical forms, his music would naturally be a very convenient medium for studying this question from a melodic point of view. It limits our research within convenient boundaries, whereas with Beethoven or Wagner we find ourselves, as it were, on the limitless tracts of some vast continent with enormous journeys to traverse between each two points. Wagner, I think, is the most characteristically individual and personal of all the composers. Nobody had ever done anything remotely like his work before; he hammered it out from his own crucible and probably owed less to his predecessors than any of the other great masters (he was, however, a man of great erudition and vast learning).

If you take the very first bar of his Prelude in Act I of "Tristan"—the "love potion" theme—the first bars of the Prelude to Act III of "Die Meistersinger"—the Motif of "Poetic Illusion"—and the divine Brünnhilde motif from "Götterdämmerung," you will find one of Wagner's most personal idioms—the biggish interval of a fifth or a sixth either preceded (ex. 1 and 3) or followed (ex. 2) by the small intervals of tones or semitones. Dozens of his celebrated motifs are built up on this pattern, and the trait can be traced right throughout his output—Senta's Ballad from the "Flying Dutchman" shows it.

A study of a composer's harmonic or rhythmic characteristics would entail quotations from their works—a procedure not possible on this page.



SHORT-WAVE SECTION

AN A.C. TWO-VALVER

Reprinted from *Amateur Wireless*, Dated November 10th, 1934, Which is Now Out of Print. The Blueprint is No 453

THIS is a two-valver for all the usual short-wave channels, working entirely from its self-contained mains power pack—suitable for all A.C. supplies from 20 to 250 volts, and frequencies from 40 to 100 cycles.

It is a detector and pentode combination (see Fig. 1), the third valve being a full-wave rectifier for the mains supply of high tension. The detector valve comes under the heading of "high slope," which means that it has a very good amplification factor for a medium impedance. The factor is 40—and in practice this means a very sensitive valve.

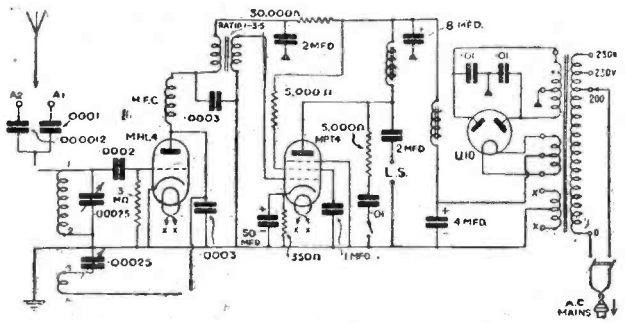


Fig. 1.—Theoretical circuit diagram of the A.C. Two-valver.

Then the pentode output valve has an amplification factor of 100, which again helps to strengthen the weakest of input signals. Altogether, this two-valve combination, with its robust power from the mains, gives great amplification to the faintest whispers from the world at large.

The Power Supply

This incorporates a mains transformer having a normal output of 230 volts—but the valve needs 250 volts. It operates quite well, however, on the output which is delivered. The only alternative would have been a much larger transformer than is actually needed.

Smoothing is a very great point about a short-wave mains set. But it is not a difficult business, especially with modern components. Two electrolytic condensers are used for the capacity part of the smoothing. In conjunction with these is a specially low-resistance choke of high inductance. There are 12 mfd. of capacity with this choke—more than enough to ensure absolute silence.

Silence until the oscillation point, anyway. Then there comes into the picture a thing called modulation—which can be cured with two .01 mfd. fixed condensers across the anodes of the mains rectifying valve. These have therefore been included in the circuit.

The smoothing in this set is so complete that you can hear absolutely no sign of hum unless the set is actually oscillating. As you will never be listening with the set in this condition, the slight hum that comes up then does not matter.

So much for the power supply. The set itself is designed to take advantage of home-made short-wave coils, which are made as follows. (See Fig. 2.)

A set of three coils is needed, the smallest coil tuning from about 12 up to 28.5 metres. Although this coil goes up to 25 metres it is not intended that you should tune in 25-metre signals on that coil.

The second-sized coil does that. It tunes from 19 to 59 metres, and thus gives you the 25-metre signals with a high inductance - to - capacity ratio — signal strength will, therefore, be good.

The third-sized coil tunes from 55 to 175 metres, and is quite suitable for reception of 160-metre band signals.

All these ranges assume a .00025 mfd. tuning condenser with a reasonably low minimum capacity—and a similar value of condenser for reaction.

There are two windings for each coil unit. These are entirely separate, making four connections in all. No. 1 goes to the grid of the valve, No. 2 to earth. That is for the tuning coil. No. 3 goes to the moving plates of the reaction condenser and No. 4 to the anode of the valve. That is the reaction winding, of course.

Now for the actual construction. You want three pieces of ebonite tubing, 3in. long and 1½in. diameter, this including the ribs. You will want twelve Clix valve pins with three nuts for each pin. For the complete set of coils about 6ft. of No. 20 gauge round tinned-copper wire and 8ft. of No. 20 gauge enamelled wire will be needed. The tinned-copper wire is needed for the smallest and middle-sized coils, the enamelled for the largest coils.

Order of Construction

The order of construction is simple. Drill first the ebonite former to take the pins, which should fit tightly. Then, with pliers and a vice, stretch some of the wire until it gives, when it will be ready for winding on the former.

Dealing with the smallest coil, start at the first pin and wind on as tightly as possible 3 turns, finishing off at pin two. Start again at pin three with 3 more turns, finishing off at what will be pin four.

The middle coil is wound in the same way, except that between pins one and two there are 8 turns, and between three and four there are 5 turns.

Now we come to the largest of the short-wave coils, wound with the No. 20 gauge enamelled wire. There is no spacing between the turns, the coil being wound simple solenoid fashion. You need 23 turns between pins one and two, and 10 turns between three and four.

Don't forget when anchoring the ends of this wire that the enamel must be scraped off, otherwise there will be no pin contact.

The base for the coils is quite easily made from a strip of ebonite and two supports, as shown by the sketch. The sockets are spaced exactly the same distances as the pins in the coils, of course. You will notice that the reaction winding pins are closer together than the tuning-coil pins. This avoids the possibility of wrongly inserting the complete coil unit in the base.

The three coils tune easily over all the useful wavebands on short waves, with the wavelengths overlapping in such a way that you can always be sure of a high inductance-to-capacity ratio for the most-used wavebands.

Many persist in using a longish aerial. For such readers, we have included a specially small input condenser, so that even with the longest aerial, the set will still be able to muster up a good oscillation. There are actually two series aerial condensers, the smaller being of only .000012 mfd. and the larger the usual .0001 mfd. With the average 45 to 60ft.

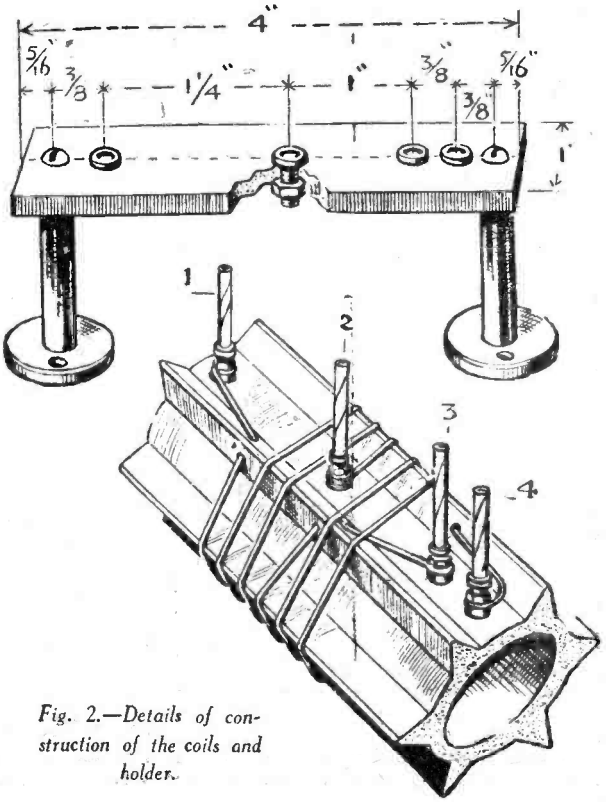


Fig. 2.—Details of construction of the coils and holder.

SHORT-WAVE SECTION

(Continued from previous page)

aerial the larger condenser connection is advisable.

For detection, we have employed the usual leaky-grid system, but note that the grid-leak itself, which is of 3 megohms, goes direct to the chassis or earth.

We come now to the very important question of anode by-passing—an aspect of short-wave technique often sadly overlooked. If you will glance at the circuit, you will see that we have used the usual anode H.F. choke—actually it is a special short-wave one—but with it there are associated two by-pass condensers.

Both have the same value—.0003 mfd., these going to earth from each side of the choke. In this way, the high-frequency by-passing is complete—and no high-frequency will trickle through into the low-frequency section to introduce hand-capacity effects when you want to wear phones.

It is much more scientific to eliminate the high-frequency as soon as its job is over—rather than to let it wander about in the low-frequency side and then by-pass it at the phones.

The low-frequency coupling for the pentode output valve is perfectly standard. There is the usual decoupling circuit in the primary winding, of course. This consists here of a 30,000 ohms resistance and a 2 mfd. fixed condenser. Rather essential, all this, as the set is working from the mains.

The pentode circuit, too, is perfectly standard. Perhaps it is worth noting that there is a 50 mfd. electrolytic across the automatic bias resistance—thus ensuring complete stability of operation. The 350 ohms resistance in the cathode lead provides the correct working bias for the specified valve—this being derived from the main high-tension supply in the usual way. In the anode circuit of the pentode there are one or two very important points to note. For one thing, you will see that a choke-filter system is included to isolate the phones or loudspeaker winding from the mains high-tension current. A choke takes the place of the phones or loudspeaker winding, and the A.C. speech currents pass to the desired winding through a 2 mfd. condenser that effectively prevents the passage of the direct current.

If you are going to use headphones, this filter is absolutely essential unless you want to risk a nasty shock. Even with the filter, you may possibly notice a slight tingling when you touch one of the leads—this being quite harmless, though—the A.C. currents representing the actual signal.

LIST OF COMPONENTS

- One aluminium chassis, 12in. by 9in. by 3in. (Peto-Scott).
- One H.F. choke, type S.W. (B.T.S.).
- One L.F. choke, type CC38M (Savage).
- One L.F. choke, type HT35 (Wearite).
- One set of home-made coils, as described.
- One fixed condenser, .000012 mfd., type CM2 (Bulgin).
- One fixed condenser, .0001 mfd. type tubular (Dubilier).
- One fixed condenser, .0002 mfd. type tubular (Dubilier).
- Two fixed condensers, .0003 mfd. type tubular (Dubilier).
- Three fixed condensers, .01 mfd. type tubular (Dubilier).
- Two fixed condeners, 2 mfd. type BB (Dubilier or T.C.C.).
- One fixed condenser, 1 mfd. type BB (Dubilier or T.C.C.).
- One fixed condenser, 4 mfd. type electrolytic, 500 volt (Dubilier or T.C.C.).
- One fixed condenser, 8 mfd. type electrolytic, 500 volt (Dubilier or T.C.C.).
- One fixed condenser, 50 mfd. type electrolytic, 50 volt (Dubilier).
- One variable condenser, .00025 mfd. short-wave (J.B.).
- One variable condenser, .00025 mfd. Popular Log (J.B.).
- One full-vision dual-ratio slow-motion dial, type Arcuate (J.B.).
- One 4-pin chassis-mounting valveholder (Clix).
- One 5-pin chassis-mounting valveholder (Clix).
- One 7-pin chassis-mounting valveholder (Clix).
- One strip, marked L.S.+ and L.S.— (Clix).
- One strip marked A1, A2 and E (Clix).
- Four plugs, marked Aerial, Earth, L.S.+, L.S.— (Clix), type 16.
- One fixed resistance, 350 ohm (Erie).
- Two fixed resistances, 5,000 ohm (Erie).
- One fixed resistance, 30,000 ohm (Erie).
- One fixed resistance, 3 megohm (Erie).
- Connecting wire and sleeving (Goltone).
- Four dozen 3in. 6 B.A. bolts and nuts (Peto-Scott).
- 14yds. twin flexible lead (Peto-Scott).
- One double-pole on-off switch, type S104 (Bulgin).
- One single-pole on-off switch, type S102 (Bulgin).
- One L.F. transformer, 1-3.5 ratio, type Niclet (Varley).
- One mains transformer with windings 230-0-230 volts, 35 mA; 2-0-2 volts, 1 ampere; 2-0-2 volts, 2 amperes.
- One permanent magnet loudspeaker, type PM52 (W.B.).
- One MHL4 met. valve (Osram).
- One MPT4 valve (Osram).
- One U10 valve (Osram).

Secondly, across the loudspeaker terminals—or virtually so—is what we are pleased to refer to as a static suppressor. Actually, this is our old friend, the high-note cutter—a 5,000-ohm resistance in series with a .01 mfd. fixed condenser. In series with these two components is a little on-off switch, so that the effect of the high-note cutter can be brought in as required by conditions.

When static is bad, you will want to cut down the background as much as possible—and this you can do by switching in the high-note cutter. Most of the noise is at high frequencies and an appreciable easing of the torments of static—especially on phones—can be noticed when the device is in circuit.

Under good conditions you will want to make the most of the pentode incisive quality—and then is the time to switch out the high-note cutter, enabling the pentode to reproduce speech with clarity, and music with great brilliance.

There is really nothing more to say about the circuit, except that it is a sound piece of engineering that will give no trouble when interpreted as a metal-chassis set.

Which brings us to one or two points in the construction you ought to know about before embarking on the assembly. The set is built on an all-metal chassis.

If you obtain a flat sheet of aluminium, you can bend it into chassis shape yourself. Do the bending on the edge of the bench or table with a smooth piece of wood—don't hammer the metal or you will spoil the job. No need for a sharp bend—the chassis may be nicely rounded.

One of the modern tuning condensers with a very open scale dial has been specified. This is provided with fast and slow motions—the slow motion being a real short-wave asset. The scale is marked from 0 to 180 degrees—the only really satisfactory method of divisioning on the short waves with a set of this type.

Reaction is applied in the usual way with a variable condenser which you will find mounted on the left of the tuning condenser. On the right of the tuning is the little mains on-off switch. That completes the front controls—but don't overlook the switch at the back for the static suppressor.

School Broadcasting in War-time

WE are informed by the B.B.C. that, despite necessary modifications imposed by war-time conditions, "Broadcasts to Schools" will, from January 8th onwards, occupy an important place in the programmes. Details of the broadcasts for the Spring Term, 1940, are now available.

In its main outlines, the programme follows along the lines laid down in peace-time. Mondays are devoted to Herbert Wiseman's "Singing Together," World History, Book Talks for the Senior English Course. The Practice and Science of Gardening, Preparatory Concert broadcasts, and English for "Under-Nines" (action stories and plays). Herbert Wiseman has chosen his songs for their simplicity and, while titles will be found in the music leaflet, most songs appear in well-known song books.

World History will be a continuation of last term's series by Rhoda Power, with the title "The Strange Adventures of John and Professor Wiseman." Simple and vivid stories from world history will introduce schools to such characters as Peter the Hermit, Akbar the Great, and Mahomet.

The Book Talks in the Senior English Course will again be given by S. P. B. Mais. He has chosen a varied list, including works by Dickens, John Buchan, Kipling and Daniel Defoe.

Tuesday's programmes include a continuation of Edith Dowling's popular Physical Training broadcasts; Talks for Fifth Forms, which will again be entitled "Science and the Community," and have been planned by J. Lauwerys; and a series, "For Rural Schools," entitled "The River." The centre of interest in this series is the story of an imaginary river described by an intelligent old tramp called Matt Wetherby, who has spent most of his life wandering by its banks. Senior English (Good Writing), also to be broadcast on Tuesdays, has been planned as a contribution to a general background in English. L. du Garde Peach will give three talks on Play-writing and dramatic readings and feature programmes will also be broadcast.

"Current Affairs" is a new Wednesday series in which "Alf," the lively young lorry-driver well-known to listeners to "History in the Making," will come to the microphone with an expert on various topical subjects. A new series for juniors entitled "Home Listening," has also been included for broadcasting on Wednesdays. Designed specially for those children under eleven who, owing to war conditions, are working at home either alone or in groups of not more than ten, with or without the supervision of a teacher, the series is entitled "Mr. Cobbett and the Indians," and introduces a milkman back from Northern Canada, full of stories about Red Indians, lumberjacks and fur trappers, which he relates on his "round."

"Music Making," with Sir Walford Davies in charge, Biology and Junior English (plays and stories) will also be broadcast on Wednesdays.

Finally, each Friday, Senior English broadcasts (rhyme and reason) will be given by L. A. G. Strong.

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.

CLAYESMORE RADIO CLUB

Hon. Sec.: I. H. Gordon, Clayesmore School, Iwerne Minster, Blandford, Dorset.

ON Friday, December 15th, most of the members saw the film, "Cossor in the Making," kindly loaned by A. C. Cossor, Ltd.

On Saturday, December 16th, at 7.30 p.m., the club's annual dinner was held in the club room, which was gaily decorated for the occasion. All the catering arrangements were carried out by the members themselves, and the chief guest of the evening was the Headmaster, Mr. E. M. King, who has always taken a keen interest in the club's activities. In a brief speech the club secretary reviewed the work of the club during the past year, and also thanked all those who had assisted in the building up of the club. The secretary is relinquishing the work of the club as he is leaving the school this term; the name of his successor will be announced later.

NORTH MANCHESTER RADIO AND TELEVISION CLUB

Secretary: R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, nr. Manchester.

AT a public meeting of the above society, held on December 14th, 1939, at 17-21, Victoria Station Approach, Manchester, the following announcements and suggestions were made and approved, and have since been put into force:

1. It was decided that a message of seasonable greetings should be sent to radio enthusiasts in other parts of the world through the various consuls in Manchester. In former years it has been possible to convey such greetings via amateur transmitters during tests, etc. (This message was passed on to all within two days of the meeting.)

2. It was decided that the public be asked to advise the officers of the society if they came across any cases of radio apparatus of an inferior type being offered to them at exorbitant prices during the war period. The society is offering its services to the public to help in any matters concerning radio, and is prepared to co-operate in any plans, etc., which any radio dealers or manufacturers care to put forward, regarding production and selling during war-time.

3. The temporary confiscation of amateur transmitting apparatus was discussed, and a letter from the Post Office Engineering Section was read, covering certain points discussed, and stating that apparatus would be returned to the owners at the end of hostilities. Several other points about this matter are being taken up with the P.O. authorities, and full details will, it is hoped, be available for the next meeting.

4. As the result of the Post Office refusing to send listeners reports of reception, etc., to stations in countries to which correspondence is strictly censored (these countries have been announced in the Press), it was announced at the meeting that the secretary (Mr. R. Lawton) was negotiating with the Chief Postal Censor an arrangement whereby it will be possible for S.L.W.'s, etc., to get reports on reception through to stations in the censored countries, and also receive acknowledgments of same. (See this paper and the local Press for further details.)

Among the remaining items of interest were the number of protests from those present, following the reading of a letter from the B.B.C., *re* the society's suggestion that talks on short-wave radio reception should be broadcast. The letter was considered very unsatisfactory and, as a result of the protests, correspondence is to be continued on the subject with the B.B.C. The next meeting will be held at 17-21, Victoria Station Approach, Manchester, commencing at 7 p.m., on January 23rd (Tuesday). The attendance at these meetings will decide whether future meetings will be held or not, so, radio "fans" and enthusiasts, if you want to have a society active in Manchester during war-time give the meetings your support, so that the interest can be maintained, and the rights of the radio enthusiasts, and the radio-minded public, can be carefully watched.

AN ALL-WAVE FRAME AERIAL SYSTEM

(Continued from page 354)

resonates with the aerial capacity at a frequency lower than the lowest one to be received. At the same time, the lower contacts of switch 19[1] connect resistance 39 between the grid of the tuning indicator and earth, sufficient current then flowing through resistances 21 and 39 to reduce the sensitivity of the tuning device to give an equivalent response with the outside aerial as with the "frame."

For operation in the next higher frequency band (i.e., the C band) switch 19 is moved to its middle position. On this band the middle position of switch 19 increases the sensitivity of the visual tuning indicator 20 by its lower armature open-circuiting resistance 39. The external aerial 3 may be omitted entirely, frame aerial shield 2 being used in its place. This is effected by operating switch 19[1] in its upper position, thus connecting the shield to the aerial terminal of the receiver, so that it operates as an aerial on the S.W. band, reception proving very satisfactory.

For operation in a still higher frequency band D switch 19 is moved to its lowest position. The aerial circuit then extends from shield 2 through conductor 34 and the entire transformer primary winding 16 to earth.

Constructional Details

The construction of the frame aerial and shield is shown in detail in Fig. 2, the frame comprising turns of conductor 43 wound upon cross pieces 50, 51, 52 and 53, fastened to uprights 44, 45, 46 and 47 extending between end discs 48 and 49. The earth, or low potential end of the frame goes to terminal 54, and the high-potential end to terminal 55, located within the insulated top bearing 56. An insulated bearing is also provided on the lower disc, so that the whole structure can be rotated. The cross-pieces and uprights, together with the end discs, can be of wood, but the latter are provided with conductive surfaces 57 and 58, of sheet copper, for example, which serve as shields for the top and bottom turns of the frame aerial. The sides of the latter are shielded by a screen 59—preferably of mesh form, comprising vertical strands 60 of conductor, with horizontal strands 61 of wool, cotton or other non-conductive material. This screen is big enough to go round the end discs, and overlaps them slightly at the top and bottom, being stapled to the formers as indicated at 62 and 63. The top ends only of the vertical conductors are joined together, as shown at 64, and also soldered to the copper end plate 57 at a number of points 65. The lower ends of the vertical conductors 60 are left free and insulated from each other, to prevent the circulation of currents in them, but as it is desirable that the lower end shield 58 be connected to the upper one 57, and to the other parts of the shield, one vertical conductor is connected to it as shown at 66, thus maintaining all parts of the shield at the same potential.

It will be seen in Fig. 2 that the axis of the frame aerial is eccentrically placed in relation to the axis of the cylindrical shield. This arrangement is better illustrated in Fig. 3, showing the high potential end 55 of the frame aerial located on a diameter of the shield, while the other end 54, normally earthed, and at low radio frequency potential, may be arranged in closer proximity to the shield. The capacity effect of the latter upon the "frame" is thus reduced.

In use the receiver will normally be placed in the most convenient position in the house, and the frame aerial rotated to the position giving maximum noise-free reception. It is then left in that position, and it has been found that, in this way, and through action of the shield 59, reception conditions are greatly improved, noise currents being much reduced.

Valve Replacement Pointers

Receiver Performance can Often Be Improved by Replacing Worn-out Valves with Others of Newer Types, but Certain Precautions should be Taken when This is Done

IT is, apparently, a very simple matter to obtain and fit new valves to take the place of others which have failed, or which have been in use for so long that their emission has fallen. If in every instance the new valves were exact replicas of those previously in use, the matter would be perfectly straightforward, but it is often necessary or desirable to use different replacements. In the case of a set in which the valves are of fairly old types—possibly obsolescent even if still obtainable—far better results may be obtainable by using valves of newer and more efficient types.

On the other hand, the simple substitution of the more efficient valves might result in more difficult operation or in general H.F. or L.F. instability. There are not many snags where a battery set is concerned, and if a variable-mu valve is used to replace a fairly old type of screen-grid or screened-pentode, stability can nearly always be ensured by adjustment of the V.M. volume control. On the other hand, it will often be found that the receiver breaks into oscillation if the volume control is turned full on. Sometimes adjustment of the screening-grid voltage will overcome the trouble, but in other cases it may be necessary to provide better decoupling, and also to screen the anode lead if this is more than a few inches in length.

Stopper Chokes

Another method which is often successful, despite its simplicity, is to include a small H.F. choke in the anode circuit, between the H.T. line and the anode-coupling component (choke or tuning coil). Incidentally, this simple method of preventing instability can frequently be used with success in the frequency-changer stage of a superhet; in that case, a choke may be inserted between the primary of the I.F. transformer and H.T.+, and another between screening grids (internally joined together) and the dropping resistor in the screen circuit. The choke required is of extremely simple type, and can be made by winding about 10 turns of wire on a ½in. diameter former. Screening is not always essential, but the effect of enclosing the component in a small earthed metal cylindrical box may be tried.

Valve-base Types

If the detector valve is to be replaced, and it was originally a triode, we should favour the substitution of an H.F. pentode or screened tetrode, which will give better reaction control and thus help to increase the range of the receiver. For preference, the screening grid should be supplied through a 100,000-ohm potentiometer, which will serve as an excellent additional reaction control.

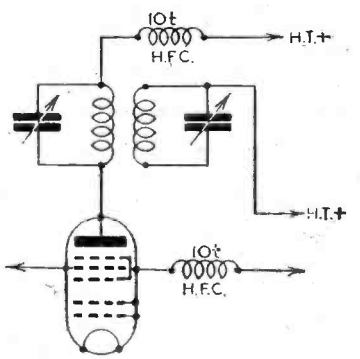
In all cases there is something to be said for replacing existing four-pin and five-pin valves by their seven-pin counterparts. The reason is that seven-pin valves are being fitted increasingly by receiver manufacturers; this means that, in time, new valves of these types will probably be more easily obtainable. Of course, there are some valve types not available with seven-pin bases, in which case the suggestion just made cannot be followed.

Where battery output pentodes of the four-pin type, with side terminal, were previously fitted they should certainly be replaced by five-pin types, for the side-terminal valves are not now readily obtainable in many instances.

by The Experimenters

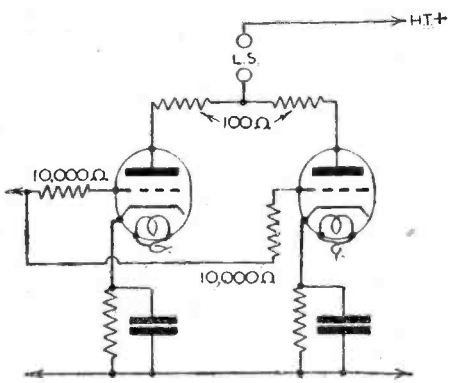
Economy Tetrodes

Another point in connection with pentode replacement is that it is generally better to fit a new valve of the tetrode type. The connections are precisely the same as those for a corresponding pentode, but the valve is usually more efficient. Many of the latest types are more economical of both L.T. and H.T. than their predecessors, and this point is worth bearing in mind, now that batteries are not always easy to obtain, and when there is often more difficulty in connection with accumulator charging.



Small, 10-turn H.F. stopper chokes will often prevent instability when wired in the anode and/or screening grid circuit of a frequency changer or H.F. pentode.

As an example, it is often possible to replace a valve such as the Cossor 230 PT by a 220 OT. The former is a power pentode taking .3 amp. on the filament, and having a maximum anode and screen current of 17 mA; the latter has a filament taking .2 amp., while the maximum H.T. current is about 11 mA. The "economy" tetrode will not handle as great an input, and has a smaller maximum undistorted output, but it is actually more efficient if the input is cut down—by a reduction in H.T. voltage, for instance.



It is sometimes satisfactory to replace a large output valve by two similar smaller valves in parallel. They should be decoupled, and this diagram shows how this can be done adequately.

Most of the points mentioned above in relation to battery valves are similarly applicable to mains types. There is, however, an additional point to be watched, which is that the correct value of bias resistor for the new valve might be different from that specified for the original one. If that is so, the bias resistor should be changed before installing the new valve, even for test purposes.

Output Valves

When fitting a new output valve in a mains set of the more powerful type a new difficulty will sometimes arise nowadays. This is due to the recently introduced regulations against the sale, purchase or possession without special permission of valves which could be used for transmission. The regulations, details of which were given on page 285 of PRACTICAL WIRELESS dated December 16th last, refers to "electronic valves capable of an anode dissipation exceeding 10 watts." This figure, it should be noted, is not the maximum undistorted output of the valve, for that is only about one-third of the anode dissipation, on the average.

It is not yet quite clear exactly how the regulation will work out in practice, for it is hardly likely that we shall be entirely precluded from obtaining replacement valves for a receiver, but some difficulty might be experienced. One way out of the difficulty might be to wire two lower-power valves in parallel, inserting a 10,000-ohm stopper resistor in the grid lead to each, and using a bias resistor of half the resistance and twice the wattage normally required for a single valve. A better method is to connect the anodes together, feed the two grids through the stopper resistors, wire the heaters in parallel and "return" the cathodes separately through their own bias resistors—which should then be of normal rating. Sometimes it is also a good plan to include a 100-ohm resistor in each anode lead, taking both of these to the H.T.+ line; this ensures ample decoupling, which is desirable if the valves have slightly differing characteristics. Actually, it is far better in every way, of course, to modify the output stage to push-pull. Two tetrodes or triodes in push-pull will give two and a half times the output of one of the valves.

Heater Supply

There will seldom be any difficulty with regard to the heater current since the previous valve would probably have been of the directly-heated type with a filament current of two amps, as against the one amp each for the heaters of the new valves.

(Continued on page 369.)

THE FUTURE OF TELEVISION

The Following Notes Have Been Received from Mr. S. Sagall, the Managing Director of Scophony Limited

DURING the last war, while Europe was otherwise engaged, the United States captured the film market. A world industry worth probably six hundred million pounds passed largely under the control of Wall Street financiers and Hollywood film magnates. There is now a grave danger that the same will happen to television, an industry which over the next ten years in this country alone will probably be worth *one hundred and fifty million pounds*.

So that enemy aircraft should not be able to take bearings by picking up the ultra-short wave signals radiated from Alexandra Palace, television transmissions were stopped on the outbreak of war. As a result the young television industry, which was emerging successfully from the laboratories into the commercial field, practically ceased. Many hundred thousand pounds' worth of television apparatus installed in homes, as well as sets lying in the factories and warehouses, became useless.

Progress in U.S.A.

The United States are, however, pushing ahead with television transmissions. The indications are that television is destined to grow there by leaps and bounds. If the war were to last two or three years I am convinced that America would gain absolute commercial and technical supremacy in the field in which we held up to the outbreak of the war undisputed leadership.

But need television be "blacked-out" for the duration of the war? No, this need not be so.

As a result of a quite thorough examination of the position in all its aspects, I am going to urge upon the Postmaster-General and Lord Cadman's television committee to consider seriously the question of restarting television transmissions. If the objections of the Defence Authorities to the transmission of television by radio are incontrovertible, the possibility of introducing television over wires, i.e., over telephone lines or their equivalent, should now be carefully considered by the Government Departments in conjunction with representative television interests.

Wired Transmissions

The practical technical feasibility of wired transmissions over short distances with the aid of intermediate repeater stations has been proved in this country and abroad. Such transmissions could take place under war-time conditions, and in some respects they would be an improvement on pre-war broadcasts. Obviously, there could be no strategical objections to "plug-in and view" television. Such a wired service, when it becomes universal, may even be used for "sound" and visual announcements of the Defence Authorities. It may be useful to remember in this connection that earlier in the summer it was stated by the Postmaster-General that encouragement would be given to the extension of "sound" broadcasting over wires for reasons of national security and safety.

There are technical, financial, entertainment and administrative problems involved in my "plug-in and view" plan. Some of the major ones have already been considered, others may still have to be worked out. There are, of course, technical difficulties, but I am advised by experts that they are not insuperable. Moreover, the technical problems involved would provide an interesting outlet for the ingenuity and resourcefulness of some of the world's finest television technical brains concentrated in the various research laboratories and at present more or less idle or diverted to channels which are, perhaps, less useful.

The technical advantages of wired television are that atmospherics will not interfere with it, and viewers will not be irritated by flashings on the screen caused by passing motor-cars, trams, or by neon signs and electro-medical apparatus.

Financially, the scheme I venture to outline has considerable merits. Neither the Government nor the B.B.C. would be required to finance it. On the contrary it would provide a considerable additional source of revenue to the Exchequer. The plan would therefore overcome one of the greatest of the pre-war obstacles to the growth of television, namely, the difficulty of providing adequate finance for attractive programmes and for the expansion of the service. Indeed, just before the war the point had been reached when the ten million or so listeners to the sound programmes had a valid criticism to make, in that the B.B.C. were utilising part of the licence money in order to provide television programmes for the benefit of a few.

Co-operation Ensured

I am assured by leaders of the entertainment industry that they would co-operate wholeheartedly in the provision of wired television. Indeed, without the aid of the experts in the art of visual entertainment, namely, the film industry, it is impossible to provide an adequate visual service.

A wired television system would really be the ideal method of making television accessible to the bulk of the population. In its wake would come a rental system for television sets. After all, no one owns a telephone nor does anyone buy an electric meter. A television set, which is a complicated piece of apparatus, will always be much more costly in the first place than an ordinary radio set. A certain amount of servicing may also be required. All the public are interested in is (a) adequate entertainment, and (b) trouble-free service. If the public were satisfied that these two essentials were being fulfilled the majority of householders and flat-dwellers would be prepared to pay, say, a sum of 5s. a week or the like for the rental of the set, the rental to include a contribution towards the provision of the programme. The "plug-in and view" service would, therefore, pay its way without encroaching either upon the resources of the B.B.C. or upon the taxpayers' money.

What a boon it would be to the community if during the long wintry evenings when the gloom of unlit streets prevents many of them from going to their normal sources of entertainment, they were able to sit at home and have their entertainment provided by television.

And, of course, the reintroduction of television would enable Britain to maintain her lead in the field gained as the result of years of patient research work.

Home-made Coils—2

Further Details about Coil Construction are Given in this Article, Together with Two Essential Formulae

By L. O. SPARKS

ONE of the most essential items in the equipment of those interested in coil construction is a reliable wire table or, to avoid confusion, a table giving all the necessary data connected with conducting wires of standard gauges. Such tables can be found in most electrical handbooks and in many of the small booklets issued by wire manufacturers, but for the benefit of those who are without such valuable information, it should be noted that a very comprehensive table is contained in "Wireless Coils, Chokes and Transformers," a book which can be obtained from these offices.

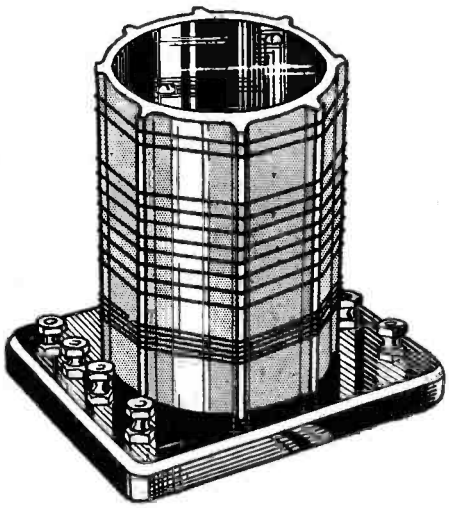
Space prevents a copy of the table being given in these pages, therefore, it can only be said that it forms a most useful reference when one is concerned, as when undertaking any winding work, with such things as the diameter, the number of turns per inch, the resistance per yard or the current carrying capacity of any one particular gauge of wire. For example, it was suggested last week that one could select a wire of a certain gauge and then, knowing the number of turns required, decide on the size of former required for the work under consideration. A glance at the wire table will indicate the length of former necessary to carry any number of turns, and this alone will save a considerable amount of time and possibly labour. This is hardly the correct procedure to adopt when designing a coil, as there are other things to be considered first, but it is mentioned to show but one simple application of a wire table and to indicate how valuable it can be if used wisely.

Poor Insulation

The insulation between adjacent turns and layers is of prime importance, especially when dealing with high-frequency and high voltages, and the constructor cannot pay too much attention to this item which in so many instances appears to be treated with scant consideration.

With coils used in pre-detector stages quite serious losses can be introduced by using wire having a low insulation factor, and the average constructor does not appreciate sufficiently the effect of the atmosphere on cotton or silk-covered wires. If such windings are allowed to become damp, and this does not mean sufficiently damp to be felt, due to moisture in the atmosphere, the whole efficiency of the winding will be affected, and therefore it should be realised that some means must be provided to protect the winding from such possible source of trouble. Faulty or cracked enamel or enamelled wire must be watched for, and care should be taken when winding to avoid perspiration or grease from the hands from coming in contact with such wires when carrying out the actual winding. This applies in particular to wires of very fine gauges.

When considering such windings as those required for L.F. chokes or mains transformers, where the winding has to be built up in layers, the importance of insulation becomes two-fold, as there is not only the danger of loss of efficiency but of short-circuits and burn-outs which, when bearing in mind the high voltages sometimes associated with such components, can become a very objectionable and costly business. Great care, therefore, must be taken to see that the wire itself is suitable in all respects for the voltage and current concerned, and that each layer is adequately



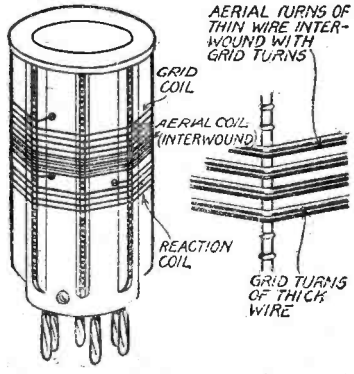
An early type of large-diameter S.W. coil, which is a good example of spaced windings.

insulated from each other by means of "empire cloth," or other suitable insulating material. With mains transformers in particular, it is always wise to take all precautions as regards insulation.

Magnetic Fields

By virtue of the properties of inductance, an electro-magnetic field is created around any normal winding when it is carrying a current. There are certain forms of windings which tend to reduce the external field, but in this article we are only concerned with the more simple straightforward types of windings, so the following points should be noted.

The effective range or area of the magnetic field around any given winding is governed



A modern type of S.W. coil showing aerial, grid and reaction windings.

by the strength of the current flowing through it, but in view of the fact that a field does exist under operating conditions, it becomes necessary to use sufficient care when placing inductances to see that such fields do not introduce losses or interaction between two or more components. In this respect, therefore, coils of large diameter are likely to call for more consideration than those of smaller diameters; unscreened windings will be more subject to interaction than those which are screened, but any screening which is employed must not, itself, be within the magnetic field, otherwise serious losses will be introduced due to eddy currents set up in the screening metal.

Fragility

When constructing any coil, a considerable amount of labour and dissatisfaction can be saved by making sure at the start of operations that the completed winding will be robust. A frail winding, i.e., one wound on a former lacking sufficient strength or rigidity, will always prove a source of trouble. If it is a tuning coil, the inductance value is likely to vary due to movement of the winding, while if it is a choke or transformer, the whole winding will, no doubt, collapse just as the last layer is being put on.

Always select a former or bobbin with sufficient rigidity for the work in hand and, with the latter, see that the cheeks are securely fixed to the body of the bobbin.

Formulae

Unless a hit and miss method is employed, one is forced to use certain calculations to determine the value of the inductance required for a given circuit with which it is desired to tune through a given waveband. Use can be made, if they are to hand, of charts which give the relationship between capacity (the tuning condenser) and the inductance (the coil) required for a given wavelength, but if these are not available, then the formula wavelength $= 1{,}885\sqrt{LC}$ may be used, when the wavelength is in metres, L, the inductance in microhenries, and C, the capacity in microfarads.

Knowing the value of L required, the following calculation will give the essential factors for the construction of the desired coil.

$$L = \frac{.2\ A^2\ N^2}{3A+9B}$$

when A is the mean diameter of the coil in inches, B is the length of the winding of the coil in inches, and N is the number of turns. By twisting this around, the number of turns required can be determined from

$$N = \sqrt{\frac{3A+9B}{.2A^2}} \times L$$

The above holds good for L for single layer coils of the solenoid type mentioned and shown last week, but if a coil having more than one layer has to be made, then the lower line of the formulae for L becomes $3A+9B+10C$, where C equals the radial depth of the winding in inches.

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).

Feature DX Broadcasts

SIR,—The appended list of special transmissions will, no doubt, be of interest to some of your readers:

Short-wave Transmissions.—Jan. 21st, 22.00-23.00 G.M.T., I2AA, Ethiopia, 9,650 kc/s.

Broadcast Band.—Jan. 8th, 08.00-09.00 G.M.T., CKCW, Moncton, Canada, 1,370 kc/s; Jan. 13th, 08.00-09.00 G.M.T., CHLT, Sherbrooke, Canada, 1,210 kc/s; Jan. 13th, 08.00-09.00 G.M.T., CFAR, Flin, Flon, Canada, 1,370 kc/s; Jan. 14th, 05.30-06.00 G.M.T., KOB, New Mexico, U.S.A., 1,180 kc/s; Jan. 14th, 06.00-07.30 G.M.T., WTAM, Cleveland, Ohio, U.S.A., 1,070 kc/s.

This DX programme promises to be one of the biggest shows ever put on the air for DX'ers!!

Jan. 14th, 07.00-08.00 G.M.T., CMHJ, Cienfuegos, Cuba, 1,160 kc/s; Feb. 18th, 07.00-08.00 G.M.T., CMHJ, Cienfuegos, Cuba, 1,160 kc/s.—N. BURTON, Assistant European Representative, International DX'ers Alliance (London, E.8).

"The Kestrel S.W. 4"

SIR,—In reference to my query in regard to "The Kestrel S.W. 4," I am glad to say that the set is now working perfectly, and I am more than pleased with its performance.

My experience should be a warning to other constructors. In order to economise I made alterations to the design: wood chassis, different components (which necessitated altering the layout), etc.

Result: poor performance, blind spots, excessive reaction, and in the end I spent more money than I should have done if I had stuck to the original design.

I have now constructed an aluminium chassis, followed the layout, and now have a set to be proud of.

I have learnt my lesson, and it will do me a lot of good. Wishing you every success in the New Year.—R. HOWARD (Rowlands Castle, Hants).

"P.W." Short-wave Sets

SIR,—I thank you for sending me my B.L.D.L.C. enrolment card. I have been studying for an exam., so have had very little time for any radio work. The first set I built was the Simple Short-waver in the beginning of 1938. Last year I made the two-valve Simple Short-waver. I have had remarkable success with the above receivers. I have logged 500 Hams and best DX on B.C. bands were VLR, Chungking and Tokio. I use six-pin plug-in coils, and a 15ft. indoor antenna. I built the above receivers in Scotland, where I was at school, but owing to the war I did not return. I find that reception results here are much better than in Scotland. Incidentally I was up at Fort Augustus in the Highlands. Of course, the fact that there are many mountain ranges about up there may make a difference to reception. But, anyhow, I am more than satisfied with the above-mentioned receivers. In Scotland, when I was using the one-valver, I had a medium-wave plug-in coil, which worked very well. We are very unfortunate over here as to the price of parts. There is a 33⅓ per cent. duty on all wireless parts, which is no joke when one wants to build a set.—MORGAN O'CONNELL (Killarney).

The "Pocket Two": Correspondent Wanted

SIR,—I should like to correspond with any of your readers who are building or anticipating building your "Pocket Two."

I should also be pleased to correspond with any member of the B.L.D.L.C. or the W.F.S.R.A.

I have been experimenting with short-wave wireless for several years, both in this country and abroad, and have found your journal of great assistance.—L. D. JEFFERY (Railway Transport Office, Central Ordnance Depot, Weedon, Northants).

Correspondents Wanted

SIR,—Through the medium of your excellent weekly I should like to ask any short-wave listener residing near my address to please communicate with me. I have only recently moved to the address given below, and through doing so have lost touch with my S.W.L. friends at my old QRA; therefore, if any listeners living near me would care to call or write I shall be greatly obliged.

I am very keen on short-wave listening and transmitting, and I have about 80 QSL cards from various parts of the world. May I take this opportunity of thanking you for such a fine weekly as PRACTICAL WIRELESS. I have been taking it for the past three years and find it gets better every month.—LESLIE BROWNING (5, Charles Street, Gloucester).

Exchanging S.W.L. Cards

SIR,—I have been a keen reader of your most excellent journal for nearly three years now, and have found it most helpful in solving problems which arise in short-wave experimenting. I shall be very pleased indeed if any short-wave listener in any part of the world would exchange S.W.L. cards with me, and all cards will be answered direct, if possible. Here's wishing your paper long life and success in the future.—D. W. SURMAN (1, Brent Road, Dad's Lane, Stirchley, Birmingham).

DX on the Medium Waves

SIR,—Please add my name to Mr. Burton's, regarding DX on medium waves. A set of the superhet type would be greatly welcomed. I have no doubt that you agree, since the selectivity needed in present-day sets makes all other types, in my opinion, out of date. In my district, at any rate, it would have to be a battery type.—H. MITCHELL (Cawthorne).

Prize Problems

PROBLEM No. 382.

JACKSON had an accident and blew the three valves in his battery set. He decided that it would therefore be advisable to fit a fuse and purchased one of the baseboard mounting types of fuseholder and proper fuse and mounted this on his baseboard. Some time later, when he was cleaning up, he did something which resulted in a short-circuit of H.T. to filaments, and the valves again blew, but the fuse was found afterwards to be intact. He was assured that it was the correct type and should have blown and saved the valves. Why did it fail to do so? Three books will be awarded for the first three correct solutions opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 382 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, January 15th, 1940.

Solution to Problem No. 381.

The choke which Brandon used was too small for effective smoothing. The second choke was similar, but when connected in the H.T. negative lead it was also so placed that the inductive field coupled with that of the other choke and thus the hum was induced from one to the other with an increase in the hum. He should have placed the second choke in series with the existing one, both in the H.T. positive lead.

Only one reader successfully solved Problem 380, and a book has, therefore, been awarded to J. P. Cook, c/o 29, Salt Hill Way, Slough, Bucks.

VALVE REPLACEMENT POINTERS

(Continued from page 366)

The centre-tap of the heater winding must, however, be joined to the earth line when changing to I.H. valves. If a centre tap is not provided, the same result can be obtained by using the potentiometer which was previously wired across the winding and earth-connected through the bias resistor.

If a new output valve is used singly, and this requires an L.T. current appreciably less than that taken by the valve employed originally, it might sometimes be desirable to connect a "load" resistor in parallel with the winding, this being designed to "absorb" the difference in current. Thus, if the winding is designed for two amps at four volts and the new valve takes only one amp, a four-ohm resistor could be used. With most transformers having good regulation this complication is not necessary.

A Transformer Point

When two L.T. windings were used originally—one for the I.H. valves and a separate one for a D.H. output valve—and an I.H. valve is to be used for output, it may be thought desirable to connect the two windings in parallel. This should not be done, for the I.H. valve can be fed from the separate winding. If two windings are joined together, and they should be wired so that they are out of phase, the effect is comparable with that of short-circuiting the transformer. This is because, at any one instant, the positive end of one winding would be connected to the negative of the other, and vice versa. Not only would the output voltage be practically nil, but the transformer would overheat and damage might result. Apart from this, paralleling of two windings, which have probably different characteristics, is not good practice.

Practical Wireless
BLUEPRINT SERVICE

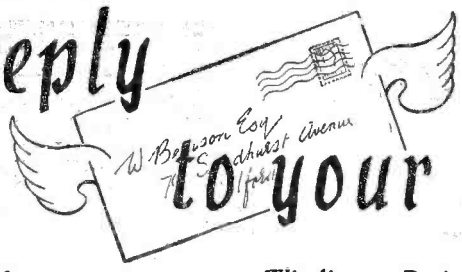
These Blueprints are drawn full size.
Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices, *which are additional to the cost of the Blueprint*. A dash before the Blueprint Number indicates that the issue is out of print.
Issues of Practical Wireless ... 4d. Post Paid
Amateur Wireless ... ... 4d. „ „
Wireless Magazine ... ... 1/3 „ „
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	Date of Issue	No. of Blueprint
CRYSTAL SETS.		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set ..	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
All-Wave Unipen (Pentode) ..	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve: Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	—	PW36B
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) ..	22.5.37	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) ..	12.6.37	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)	—	PW52
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) ..	14.8.37	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	PW73
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	PW1
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
All-Wave "Corona" 4 (HF Pen, D, LF, Pow)	9.10.37	PW79
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC)).. ..	3.9.38	PW90
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen) ..	—	PW18
A.C.-D.C. Two (SG, Pow) ..	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve: Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	7.1.39	PW35C
D.C. Premier (HF, Pen, D, Pen)..	—	PW35B
Ubique (HF Pen, D (Pen), Pen)..	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	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
All-World Ace (HF Pen, D, Pen)..	28.8.37	PW80
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)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
A.C. All-Wave Corona Four ..	6.11.37	PW81
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 ..	31.7.37	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)	30.7.38	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))	19.3.38	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.		
Class B Three (D, Trans, Class B)	—	AW386
£5 5s. S.G.3 (SG, D, Trans) ..	—	AW412
Lucerne Ranger (SG, D, Trans) ..	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	10.5.34	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)	—	WM380
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)	—	WM329
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.		
Consolelectric 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. 6d. each.		
Heptode Super Three A.C. ..	*May* '35	WM359
"W.M." Radiogram Supe. A.C...	—	WM366
PORTABLES.		
Four-valve: Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)..	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-Valve: Blueprints, 1s. each.		
S.W. One-valver for America ..	15.10.33	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
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter ..	—	WM380
Three-valve: Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C. ..	—	WM352
Four-valve: Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) ..	*Aug.* '35	WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	*Mar.* '36	WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-).. ..	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone-Master (1/-) ..	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

In reply to your letter



Push-pull Transformer

"I am going to build a set with push-pull output and should be glad if you would inform me as to the correct ratio which the transformer should have. I wish to obtain the best possible quality and expense is not a consideration."—F. S. P. (Edinburgh).

WE are unable to answer this question direct, as there are several forms of push-pull, each of which calls for special requirements. The standard form of Push-pull, known as Class A, utilises two power or super-power valves biased to the centre point and the standard push-pull transformer for this circuit is generally about 3.5 or 4 to 1. The Class B push-pull circuit calls for a special transformer with a low-resistance secondary winding and the ratio is generally about 1 to 1. The Quiescent push-pull circuit utilises pentode valves and the ratio of the transformer is generally about 1 to 9.

Light Switch Fault

"I find that a lot of interference is caused by the light switches on the walls of my house. When these are operated they sometimes work properly, but other times there is a roaring in the set if this is switched on, and it can only be stopped by operating the light switch once or twice. Can you explain the reason and cure for this trouble?"—R. J. (Stechford).

THE trouble is probably caused by a faulty switch. If the switches are old, they may have weakened and fail to make good contact at every operation. On the other hand, they may be of the type which is not spring loaded and when operated the contacts may not be firmly pressed home. Finally, they may merely need cleaning, but we suggest that you call in an electrician to inspect the switches and carry out the necessary adjustments.

Modern Coils

"I have found a number of old circuits of various types of receivers which I would like to try, but unfortunately the coils which were recommended are not now on the market. Is it possible in all circuits merely to substitute modern coils and adopt the connections recommended by the makers? I should be glad if you could answer this query as I am sure it will interest many other readers who are also keen constructors and experimenters."—G. H. (Highbury).

UNFORTUNATELY it is not always possible to substitute coils without making circuit alterations, or changes in wiring. For instance, in its simplest form, such modification would consist in the re-wiring of the reaction condenser, as this may be on either side of the reaction winding, and in some coils this winding is internally joined to the secondary coil. There is also the possibility that the circuit you wish to build incorporated some special feature which necessitated special coils and modern coils may be totally unsuitable. It is therefore necessary to study carefully each circuit and if necessary inquire from the makers of the new coil whether it will be suitable for the circuit it is intended to try.

Winding a Resistor

"I wish to wind one or two resistors for a power amplifier. The total current carried is about 1 amp. and I should like to know if there is a gauge of resistance wire which has some even value of resistance to facilitate the working out of my various items. What wire do you recommend, and what is the price?"—F. E. R. (Highbury).

ORDINARY nickel-chrome, 24 S.W.G. will carry 1.3 amps. in a solenoid winding and has a resistance of approximately 4 ohms per yard. This should be quite suitable for your requirements. We do not know the purpose of the resistors, but the fact that a simple solenoid of wire has inductance should not be overlooked by you, and you may find it desirable in most cases to double the required quantity of wire and wind the resistor with the doubled wire to annul the inductance. The wire in question, enamelled, will cost about 4s. 6d. per oz. and there are approximately 258 yards to the lb.

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.

The Monitor

"I wish to build the Monitor 3 for bedside use and I want to use headphones whilst listening at night, yet able to use a speaker when my people are out. What alteration will have to be made for this purpose? I have some headphones with a resistance of 2,000 ohms. Will these be suitable? I have no aerial in the bedroom and wonder therefore if a Pix invisible aerial would do, as our house is surrounded with trees. Finally, can it be built without soldering, as I can't solder?"—P. F. R. J. (Redhill).

THE Monitor should be quite suitable for your requirements, and good results should be obtained from an indoor aerial of the type mentioned. Headphones could be connected in place of the loudspeaker, but to avoid the difficulty of disconnecting the speaker each time a change-over switch could be employed, with a silencing switch on the speech coil of the speaker. The headphones in this case would be filter fed, the speaker transformer acting as a choke. If volume is too great on the headphones, you might find it worth while to include the 'phones in the anode circuit of the detector valve, a fixed condenser feeding the 'phones direct from the detector anode circuit, and the other side of the 'phones connected to earth. A simple on-off switch between 'phones and earth would enable you to switch out the 'phones when using the loudspeaker.

Musical Instruments

"Did you give in any of your back numbers instructions for making a musical instrument with valves, probably two years ago? I should be very grateful if you could let me have the back numbers which I will pay for."—A. G. C. (Northwood).

WE are not clear as to the exact type of instrument you require. It is possible to fit a microphone to any musical instrument and feed the output from the microphone through a standard valve amplifier in order to amplify the sound. Alternatively, a stringed instrument may have the bridge carrying the strings in contact with the diaphragm of a microphone or gramophone pick-up to provide amplification. A more up-to-date idea is to fit small electro-magnets near the strings and to feed the output from these to an amplifier. Another instrument, and the one to which you may refer, utilises the oscillation produced by valves as the medium for producing a sound from the loudspeaker, and by varying the pitch of the oscillation you alter the tone of the note produced. A reacting detector valve followed by an L.F. amplifier may be employed, with a metal rod connected to the grid terminal of the detector valve. By placing the hand near the rod the note will be varied and tunes may be played. This is the fundamental principle of the Theremin instrument.

Stepping Down A.C. Mains

"I have a commercial receiver operated by a mains section rated at 120 volts A.C. I have now moved to a house where the mains are 250 volts. Could I step down the voltage to 120, and if so could you give me winding details of a transformer which would be suitable for my purpose."—W. W. (Gillingham).

IT is quite possible to step down the mains and this is a common practice. Unfortunately, however, it is necessary to use a transformer designed to deliver an output wattage suitable for the receiver and therefore we cannot give you winding details of a suitable component without knowing the load of your set. A suitable component could be obtained ready made from Messrs. Heayberd, and you should write to them, giving them details of the receiver, when they will supply a suitable transformer.

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.

L. S. A. (Birmingham, 5). We think the idea excellent and the values given should give the most satisfactory results.

R. F. M. (St. Albans). Must you use the extra valve? Apart from the increased consumption of H.T. and L.T. there will be very little gain and it would be uneconomical.

H. G. (Barnsley). Two of the components should be omitted—the fixed condenser you marked in blue pencil and the L.F. choke. These are unnecessary with the transformer coupling.

B. F. N. (Malta). The first-mentioned is preferable and we understand is on sale at your address.

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

Notes from the Test Bench

Renewing Dials

THERE are still many receivers in use in which engraved ebonite dials are being used. Generally these have deep cuts for the degree markings and these are filled with white enamel or paint. After some time they may become discoloured and difficult to read. They may be renovated, however, and made almost as good as new by dipping them in ordinary turps for a short time and wiping with a rough cloth, so that all the old paint is cleaned out. If necessary they may be scratched, taking care to avoid over-running the original markings, and then the dial should be wiped carefully with a piece of rag carrying a small quantity of good white paint or enamel. This will fill the markings, and a clean rag should then be wiped over to remove excess from the dial itself. When dry the dial should be as good as new.

Terminal Connections

WHEN making a short-wave or similar receiver, where fairly heavy-gauge wire is used for connection purposes, some constructors experience difficulty in making connection to the shank of a terminal. Owing to the small space available the connection is not usually made soundly, and an idea worth remembering is that which was employed in old-pattern Government apparatus. The shank of the terminal was drilled down for a short distance, and the wire used for connection was of such a gauge that it just fitted inside the hole down the terminal shank. If the wire is tinned, and flux is inserted inside the terminal hole, and the wire then inserted, upon the application of the soldering iron carrying a good "blob" of solder, it will run down into the hole and the connecting wire will then be firmly attached to the terminal and be, in effect, an extension of the terminal shank. Ordinary terminals may be drilled by clamping them in a vice, first running a nut down the shank, which may afterwards be removed to take off any burr which may be made on the end threads.

Classified Advertisements

Advertisements are accepted for these columns at the rate of 2d. per word. Words in black face and/or capitals are charged, double this rate (minimum charge 2/- per paragraph). Display lines are charged at 4/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, Strand, London, W.C.2

RECEIVERS, COMPONENTS AND ACCESSORIES

RADIO CLEARANCE, LTD., 63, High Holborn, W.C.1.

BRITISH BELMONT 8 Valve plus Magic Eye All-Wave A.C. Superhet Chassis, 4 wave-bands, two short, medium and long, fitted latest Mullard Octal Base American type Valves.
Size of Chassis, 13½" x 10" x 3". Supplied with Valves and Knobs, but less Speaker.
Chassis only, **£5/19/6** each.
Speaker for above, **17/6** each.

GRAMPIAN 10" 10 watt, 2,500 ohm Energised Speaker. Heavy Cast Frame .. .. **15/-** each
With heavy-duty Pentode Speech Transformer **17/6** each
Heavy-duty Speech Transformers, Pentode Matching **2/11** each

PLESSEY 2-gang Straight Condensers .. **1/6** each
Ditto, 3-gang .. .. **2/-** each

PLESSEY Motor Drive Press Button Unit. Supplied complete with 8-way Press Button Control. Precision job throughout. First Grade Motor. A.C. 24 volts **21/-** each

POLAR ½ meg. Volume Controls, with S.P. Switch **1/6** each
Ditto, with D.P. Switch .. .. .. **1/9** each

YAXLEY type 4-pole 3-way Single Bank Switches **9d.** each

2,500 ohm Fields Coils .. .. .. **9d.** each
1 (One) gross Assorted Resistances.. **5/-** per gross
Metal Chassis Drilled. 15" x 6" x 1½" and 11½" x 8" x 2½" **1/6** each
Push Back Wire .. .. .. 12yds. **10d.**

ROLA P.M. Speakers, latest type 7½in. Cone, with Pentode Transformer .. .. Boxed **14/6** each
Clock-faced Dials, 5" x 3½", with printed 3-wave scale Ox-Copper Escutcheons and Glass.. .. **3/6** each
Ditto, less Escutcheons .. .. .. **2/6** each
Horizontal dials, with plain scale 7½" x 3½" and pointer **1/-** each

100ft. Copper Aerials, Insulated .. .. **2/-** each

FILAMENT TRANSFORMERS, input 200-250 volts, output 4 volts 4 amps, 4 volts 6 amps .. **4/11** each

G.E.C. Mains Transformer, American windings, 350-0-350 volts, 65 m.a. 5 volts 2 amps, 6.3 volt 2.5 amp. Suitable for replacements in G.E.C. models **5/6** each

24 mfd. Can type Electrolytics, 450 volts working **1/6** each

PRESS BUTTON UNITS with 6 Press Buttons, ready for wiring into set, with circuit .. .. **4/11** each

WEARITE Set of two Iron-Cored Coils, Aerial and H.F. Trans. with diagram .. .. .. **2/11** each

BULGIN 25 ohms Wire-wound pots.. .. **1/-** each
Stranded Push-back Wire, **1d.** per yard, 12 yards **10d.**

CHASSIS Mounting Valve Holders, American, 4-, 5-, 6- and 7-pin, **4d.** each. Octals **6d.** each. Loctals **10d.** each. 7-pin English type, **3d.** each.

ROTHERMEL Piezo Crystal Speakers, 7½in. Cone. List 55/-. Our price, **10/6** each. 10in. Cone **12/6** each.

CRYSTAL PICK-UP, high grade American. Bronze finish, complete with arm .. .. .. **21/-** each

POLAR N.S.F. 1 watt resistances, **4d.** each, **3/9** dozen. All sizes up to 2 meg.

WEARITE MAINS TRANSFORMERS, R.C.B. type. 350-0-350 v. 80 m.a., 5 volt 2 amps. 6.3 volt 5 amps **6/11** each

Type R.C.4. 500-0-500 v. 150 m.a. 4 volts 2 amps, 4 volts 2.5 amps, 4 volts 5.6 amps.. .. **21/-** each

PHILCO MAINS TRANSFORMERS. American Windings, 350/350 volts 65 m.a., 6 volts 3 amps., 5 volts 2 amps. .. .. **5/-** each
Ditto, but 80 m.a. .. .. **6/6** each
Ditto, but 90 m.a. .. .. **7/6** each

WEARITE 110 k/c I.F. Transformers .. **1/-** each

AMERICAN C.T.S. Volume Controls, finest made, divided spindles, length 2¼in. with switch, 2,000, 5,000, 10,000, 25,000, 100,000 .. .. **2/6** each
Wire-wound 5 watt (less switch), 10,000, 25,000 ohms, **2/-** each

WEARITE CHOKES, Screened .. .. **1/6** each

PLESSEY DRY ELECTROLYTICS, CAN TYPE.
12 x 16 mfd. 350 volts working .. .. **1/6** each
6 x 6 „ 500 volts working .. .. **1/6** each
12 „ 450 volts working .. .. **1/6** each
8 x 8 x 8 mfd. 500 volts working .. .. **2/11** each
16 x 8 x 4 x 4 mfd. 500 volts working .. **2/11** each
12 x 8 x 8 x 8 x 8 mfd. 500 volts working **2/11** each
16 mfd. 450 volts working .. .. .. **1/3** each
16 x 16 mfd. 350 volts working .. .. **1/6** each

(Continued in next column)

RECEIVERS, COMPONENTS AND ACCESSORIES

(Continued from previous column)

B.I. Wire-end type, Bias Electrolytics.
50 mfd. 12 volts .. .. **1/3** each
50 mfd. 50 volts .. .. **2/-** each
Tubular Wire-end non-inductive paper, all sizes up to 0.1, **5d.** each, **4/9** dozen.

Metal Case 1 hole fixing Electrolytic Condensers, 550 volts working, 8 mfd. .. .. .. **3/-** each

STANDARD TELEPHONE HEADPHONES, resistance 2,000 ohms and 4,000 ohms .. .. **6/11** pair
Volume Controls, 1,000 and 5,000 ohms, with switch. **1/3** each

.0005 3-gang Tuning Condenser Units, with trimmers. **1/9** each

PLESSEY Energised Speakers, 10in. Cone, 2,500 and 1,000 ohm field, with trans. .. .. **12/6** each
6in. Cone, 2,500 and 1,500 ohm field .. **5/11** each

RUBBER GROMMETS .. .. .. **4d.** dozen

BATTERY Output Pentodes, well-known make. **4/6** each

BATTERY Double Diode Triode, well-known make. **3/11** each

RAYTHEON First-grade Valves, largest stockists, all types in stock, including Glass Series, Glass Octal Series, Metal Series, Bantom Series, Single-ended Metal Series, and Resistance Tubes, all at most competitive prices; send for Valve Lists.

All Orders Must Include Sufficient Postage to Cover Hours of Business: 9 a.m.—6 p.m. Weekdays. Saturdays 9 a.m.—1 p.m.

RADIO CLEARANCE, LTD., 63 High Holborn, London, W.C.1. TELEPHONE: HOLborn 4531.

SOUTHERN RADIO'S BARGAINS.

ALL GUARANTEED. POSTAGE EXTRA.

5/-—Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.

15/-—Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7", 15/- the Kit.

21/-—Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.

5/-—100 Wire-end Resistances, assorted capacities, ½ and 1 watt, 5/- per 100.

5/-—6 Volume Controls, 5/-.

TELSEN; Ormond Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; 8 mfd. Electrolytic Condensers, 500 volts, 1/8. Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.

2/-—Tool or Instrument Carrying Cases, ex Government Stock; Wood 9" x 7" x 7", 2/-.

SPECIAL Offer, Limited Quantity Torch Bulbs 1.5v., 21/- per 100; 2.5v. and 3.5v., 17/6 per 100.

SOUTHERN RADIO, 46, Lisle Street, London, W.C. Gerrard 6653.

VAUXHALL. Rola 8in. P.M. speakers, 14s. 9d.; Rola 10in. P.M. speakers, 18s. 6d. Complete with input transformers.

VAUXHALL. Collaro A.C. gramophone motors, boxed, 29s. Modern pick-ups, 11s. and 18s. 9d., with volume controls.

VAUXHALL. TCC aluminium containers. 8 mfd. 600 v., 3s.; TCC cardboard 8 mfd. 500 v., 2s.; 8 plus 8 mfd., 3s. 6d.

VAUXHALL. Volume controls, 2s.; with switch, 3s. Tubular condensers, 0.1 mfd., 3d.; 0.25 mfd., 4d. Resistors, 1 watt, 4d.

VAUXHALL UTILITIES, 163a, Strand, London, W.C.2. Post paid over 2s. 6d. Write for free list.

BANKRUPT BARGAINS. Brand new 1939 models, makers' sealed cartons, with guarantees, at less 40 per cent. below listed prices; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

"STAND-BY" Crystal Set. Specified coil, 2s. case, 9d.; or complete kit of parts, 10s. 3d., post free.—T. W. Thompson and Co., 176, Greenwich High Road, S.E.10.

BANKRUPT BARGAINS.—All new goods. Spartan 5v. A.C. superhets press button, £5/15/-. Truphonic 5v. all-wave superhets, A.C., 7 gns. Belmont all-dry portables, superhet. 5 gns. Portadyne 8 gn. superhet portables, £6. Portadyne 4v. battery all-wave superhets, £6. Many others. Will quote requirements. Full stock valves and service goods.—Butlin, 6, Stanford Avenue, Brighton.

Practical and Wireless
★ PRACTICAL TELEVISION ★
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ROUND THE WORLD OF WIRELESS

Valve Characteristics

THERE are many listeners to whom valve characteristics still appear to be mysterious figures issued by a manufacturer specially for commercial set designers. Actually, of course, these characteristics are essential for everyone who uses the valve and are just as important and easy to understand as the data issued by the maker of a car. When purchasing a car you want to know its petrol and oil consumption per mile, its acceleration, and other factors, and in just the same way the "performance" of the valve should be studied when selecting a valve for a receiver. It is quite a simple matter to take the valve data and to draw up the characteristic curves, and all that is required is a voltmeter and milliammeter, in addition to the filament, H.T. and G.B. battery supplies. All the facts such as amplification factor, impedance slope, etc., may then be obtained and the process will not take long. By making up a small test unit it is then possible to test a valve from time to time in order to ascertain whether or not it is becoming worn out or otherwise in need of replacement. An interesting article on this subject will be found on page 374.

"Babes in Arms"

A RADIO version of the new Metro-Goldwyn film, "Babes in Arms," will be broadcast on January 19th. This film, featuring Mickey Rooney and Judy Garland, has its London première this month. Douglas Moodie, who is preparing the radio version, has already provided listeners with microphone versions of many famous films, including "Top Hat," "Congress Dances," and "One Night of Love."

"Babes in Arms" is founded on the Broadway success by Richard Rodgers, with music by Lorenz and Hart. It tells the story of old-time variety performers who have fallen on hard times, but whose children, determined to save the family fortunes, start a new show on their own with overwhelming success.

Appointed to Governor's Staff

POWEL CROSLEY, Jr., president of the Crosley Corporation, operators of WLW, WSAI, and the international station WLWO, of Cincinnati, has been appointed to a colonelcy by Governor John E. Miles, of New Mexico. He will serve as aide-de-camp on the Governor's staff.

Rationing

ONE of the main topics of the day wherever women meet is rationing. Joan Littlewood, who has done a great deal of feature work in the North, has been out and about in the Manchester district finding out what people are thinking and talking about on this subject. With a recording van Joan has been making a round of shops, ranging from some of the big city stores down to the shops of small back-street tradesmen and has recorded the impressions both of shopkeepers and shoppers. In another sphere she has tapped both ends of the social scale, giving the views of a manager in one of the city's big hotels and, by way of contrast, what a tramp has to say on the subject.

A recent portrait of Henry Hall, whose guest night broadcasts are increasing in popularity. He is seen in the picture with Horatio Nicholls, well-known composer.

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The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

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

The Stuff to Give The Troops!

HAROLD FORRESTER, an Edinburgh bookseller, who has a wide experience in satisfying the tastes of different kinds of readers, gives advice on the "stuff to give the troops," to listeners who may think of buying books to send to friends who are with the Services. His talk will be heard in the forenoon of Saturday, January 20th.

A Popular Wodehouse Character

WITH many Wodehouse fans, Ukridge is quite as popular as Bertie Wooster or Jeeves. Ukridge stories are now being adapted for broadcasting by Anthony Dale, and will be given in programmes from time to time. The first is to be produced by Peter Creswell on January 20th. This is the very amusing Dog College story.

Radio Sales in U.S.A.

THE year-end sum of radio sets sold during 1939 is expected to total 9,000,000, a high spot for the industry. Receiver sales are stated to be currently running about 26 per cent. of 1938, when the total was 7,100,000. The radio sales for 1939 bring the number of sets in use by American listeners to a total of 45,200,000 as 1940 opens, taking into consideration that about half of the sales made in 1939 were replacements. It is also announced that in conjunction with the increased sales there is also increased quality. The dollar volume of all sets sold in 1939 is running at 30 to 35 per cent. ahead of 1938.

General Sir Edmund Ironside to Broadcast

GENERAL SIR EDMUND IRONSIDE, Chief of the Imperial General Staff, will come to the microphone on January 21st to make an appeal on behalf of serving men and their dependents. Contributions will be gratefully acknowledged and should be addressed to General Sir Edmund Ironside, at 23, Queen Anne's Gate, London, S.W.1.

"The Way of an Angel"

ONE of the best known Yorkshire dialect playwrights is James R. Gregson, the Huddersfield dramatist, whose play, "The Way of an Angel," is to be produced by Edward Wilkinson, on January 27th. This play, which is one of the Yorkshire drama series, has three characters, and was originally presented by the Huddersfield Thespian Society.

Valve Testing

How to Determine the Characteristic Curve, the Amplification Factor, and the Impedance of Valves is Explained in This Article by L. O. SPARKS

THE majority of constructors wish at some time or other to check the characteristics of the valves they use, and this is no doubt responsible for the many requests received for details of a valve-testing unit.

To design a unit which would satisfy all demands is no easy matter, bearing in mind the very wide range of valves now in use, and the fact that those fitted with multi-pin bases are as common as the more simple four and five-pin types, a valve tester which would be capable of catering for all classes of valves would naturally have to become a much more complicated piece of apparatus than many readers seem to appreciate. It is not, therefore, intended in this article to give the constructional details of what might be termed a universal valve tester, although in all fairness to the Technical Staff it must be mentioned that such an item is receiving their careful attention, but rather the general outlines of a unit which will serve the purposes of most constructors and provide the basis for individual design and constructional work.

If, for example, a constructor wishes to find a subject which will lend itself to any originality, ingenuity and skill on the part of the designer-constructor, then the unit in question is an ideal item for such considerations, especially during the long winter evenings.

So far as designing goes, there are many things which will call for careful thought, such as compactness, accuracy, range of application, what method of circuit changing to be employed, current and voltage supplies and, of course, ease of manipulation.

Essential Requirements

As will be seen later, the most simple of valve testers requires a reliable milliammeter and two voltmeters. If a dual range voltmeter is to hand, reading, say, 0 to 10 volts and 0 to 120 volts, that can, of course, be used instead of the two separate voltmeters. A potentiometer, some valve-holders, one or two switches, and a suitable piece of material for a panel, plus a small box or cabinet in which to house the unit, form the main requirements. It is highly possible that most constructors have the majority of these items amongst their equipment.

Before proceeding with the details of how to apply the various tests, the fundamental circuit of a simple tester, shown in Fig. 1, should be examined, as it will make the explanations of the testing procedure more easy to follow.

It will be seen that provision has been made to allow the anode current, the anode voltage and the grid voltage to be measured at will, and these will be referred to as Ia, Va and Vg respectively in the remarks below.

The potentiometer across the battery supplying the voltages for Vg is not absolutely essential as the voltage can be varied by adjusting the supply voltage via tapping points on the battery, but the potentiometer gives a smoother and more accurate setting. Another simple refinement, not shown in the diagram, could be obtained by fitting a variable resistance in the positive H.T. supply. A value of 50,000 ohms would be suitable, provided the component is of a good and reliable make.

Testing Procedure

The simplest test to apply to a valve is to determine its emission which, in turn, will allow its anode current/grid voltage curve to be plotted and give a visual indication of one of the valve's characteristics.

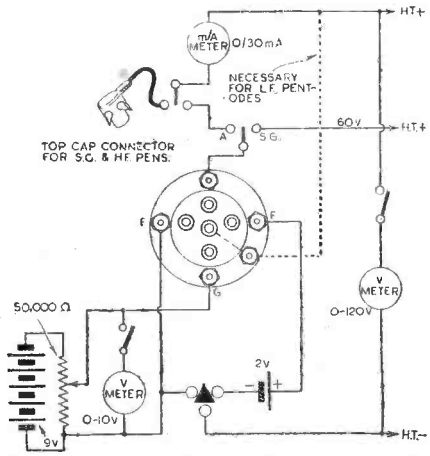

Fig. 1.—A suggested circuit for a simple valve tester. Refinements can be added to suit requirements.

Most valve makers publish sufficient details about their various types to enable one to check results and thus see if the one under test is normal. For example, it will be noted that current values are specified against certain anode, screen and grid voltages, so when comparisons are being made the voltages mentioned should be applied.

Assuming that a simple triode valve is being tested, the following procedure should be adopted. With the valve in the holder and its filament accumulator connected, connect the grid to the *negative* side of the filament supply and plug in the H.T. supply, adjusting it until its voltmeter indicates 120 volts. Note the anode current, i.e., Ia, and plot it on squared paper as shown by the point x in Fig. 2. Now adjust the grid-battery potentiometer until the grid voltmeter shows 1 volt, and then read off Ia again and mark its position (y) on the graph (Fig. 2). Repeat this procedure, increasing Vg by 1 volt each time a reading is taken, until the point z is reached, which denotes what is known as the cut-off point of the valve under test. When all readings have been taken, connect all points with a line, thus forming the completed curve, as shown by the solid line in Fig. 2. From this, the value of Ia can be read off for any value of Vg between zero and that required to produce cut-off.

With S.G., H.F. and L.F. pentode valves, a constant H.T. positive voltage must, of course, be applied to the screening-grid during the above operations. The value of this voltage will depend on the type of valve and the maker's specification.

Amplification Factor

The amplification factor or, as it is more often called, the Mu of a valve, is a very important item as it indicates what gain or signal amplification one might expect from it when it is operated under ideal conditions. A glance at any valve maker's booklet will reveal that the Mu of a valve varies over a very wide range, according to the numerous types, but whatever type is under consideration, its amplification factor can be determined quite easily.

Assuming that the valve used for the previous test is being examined, the following readings must be taken. With Vg at zero, i.e., the arm of the potentiometer making contact with the negative filament/H.T. line, adjust the Va to 100 volts and then note Ia. Now increase Va to 120 volts, and when the meters are steady adjust the grid potentiometer until the value of Ia—which increased when Va was increased—returns to its first or original value. Measure accurately Vg and then carry out the following simple calculation.

$\frac{Va2 - Va1}{Vg}$ or, in other words, divide the difference in the two anode voltages applied, i.e., 120—100=20, by the grid voltage applied to restore the anode current reading back to its value when 100 volts was applied to the anode. Supposing that Vg was 2 volts, then the amplification factor, or the Mu, of the valve equals

$\frac{20}{2}$ or 10.

The Mu is simply denoted by a number which is an arbitrary term.

When carrying out this and any other tests connected with valve characteristics, it is absolutely essential to make frequent checks to see that all applied voltages are remaining constant, including the filament or heater voltage, as any fluctuations or inaccurate readings will upset all calculations.

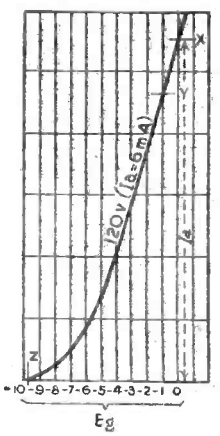

Fig. 2.—The anode-current grid-volts curve mentioned in the article. Note cut-off point and the effect of negative bias.

Impedance

Another vital characteristic of a valve is its impedance or A.C. resistance as the value of this plays a very important part in the design and selection of suitable inter-valve couplings. The impedance of a valve, which is expressed in ohms, can be determined by applying the following tests. With Vg at zero, apply 100 volts to Va and note the current reading Ia. Now increase the value of Va by a definite amount, say, 20 volts and note new reading of Ia. The impedance can now be calculated from the formula:

$$\frac{\text{Change in anode volts} \times 1{,}000}{\text{Change in anode current (mA's)}}$$

Assuming that the change in anode current for the above example is 4 mA's, then the impedance would equal

$\frac{20 \times 1{,}000}{4}$ or 5,000 ohms.

4 MAGNIFICENT NEW YEAR PRESENTS

FOR ALL Practical Wireless READERS

HERE is a wonderful 1940 surprise for every one of our readers—a Grand Presentation Offer of Four Superb Gifts. There are gifts for the man in the home, gifts for the housewife, or gifts to send to someone on active service! You can choose whichever one you like. Be sure to read below the full descriptions of these amazing presents.

Choose Whichever You Like

1 DE LUXE SANDWICH OR CAKE STAND. This is heavily chromium-plated. A swing handle is provided so that the complete stand may, if desired, be placed in a shallow drawer. Best quality heavy English Glass is used, etched with a pleasing flower design, and the edges are smoothed. A present every woman will proudly show off to her friends!

2 STURDY POCKET FLASK. The very thing for A.R.P. workers on duty or men on active service. Made in very strong glass, covered with the finest leather. Provided with polished cup manufactured from the most hygienic metal for drinking. With screw top.

3 5-PIECE TEA SET comprising Tablecloth 36 in. square with 4 Serviettes each 9½ in. square. Created specially for this offer in a linen finish, and trimmed with fashion's latest edging. Dyed in neutral shade to harmonise with any colour scheme. Hard wearing, this Gift Set will keep like new for years.

4 GOLD-NIB FOUNTAIN PEN. This Gift is equal in value to any pen selling in the shops for 7s. 6d. It is fully guaranteed and fitted with solid 14-ct. gold nib, iridium tipped. Lever filling with chromium-plated pocket clip and fittings, and unbreakable jet black barrel.

HOW TO GET YOURS

First, place a standing order for TIT-BITS for at least 10 weeks, with your newsagent to-day.

Next, fill up the Reservation Form and the Address-Label beside it. Stamp Address-Label with ½d. stamp and post both forms to the address given. You can use ½d. stamp on your own envelope if you do not seal it. Be sure to strike out on both forms the Gifts you do NOT require.

When we receive the Reservation Form and the Address-Label from you, we will at once reserve whichever Gift you have selected, and immediately send you a Voucher. On this you affix 10 Date Tokens cut from the bottom left-hand corner of the back cover of TIT-BITS for 10 consecutive weeks. Start with the Token appearing in TIT-BITS now on sale (marked TIT-BITS 27.1.40) or that in next week's TIT-BITS.

When your Voucher is complete, you send it together with a Postal Order for only 1s. 9d. to include all packing, carriage, insurance, handling, etc., and your New Year Present will be dispatched to you. Do not send the 1s. 9d. now.

This offer applies only to persons residing in Great Britain and N. Ireland.

THESE New Year Gifts are presented—one to every reader—for only a small proportion of their value. You send 1s. 9d. for your gift, and this includes all postage, carriage, insurance against breakage where necessary, etc. To qualify you collect 10 Date Tokens from TIT-BITS, the weekly that has been a family favourite for many years. And so, while every one in your home is enjoying TIT-BITS week by week, you will be collecting the Tokens that will bring you one of these attractive New Year Gifts. Don't miss this wonder opportunity—the gifts cannot again be offered to "Practical Wireless" readers.

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Strike out Gifts NOT required.	CAKE STAND	FLASK	TEA SET	PEN

Receiving English News from Abroad

This Article Explains Methods of Obtaining Good Reception of News Transmissions from Various Parts of the World

By FRANK PRESTON

THE DX enthusiast can find plenty of interest in the reception of news broadcast in English from all parts of the world. Most of the transmissions from neutral countries are free from bias and often deal with slightly different subjects from those covered by the "Home Service" transmissions. Additionally, the foreign broadcasts, or broadcasts from our own Empire stations, are especially useful when the B.B.C. medium-wave transmissions are missed.

An abridged list of news bulletins which are given in English from various parts of the world is given in the panel on page 385. Those who require a complete list—regularly modified as changes in transmission times occur—will find one in the *Radio Times*. It will be seen that the wavelengths employed for these news bulletins are chiefly on the short-wave bands, although stations such as Rome can be well received on medium waves.

"Beamed" Transmissions

Although generally the most distant, many of the American transmissions can be received well on a fairly efficient receiver provided that a good aerial is used. This is partly accounted for by the fact that some of the transmissions from stations such as WGEA, WGEO and WCBX are "beamed," or sent out by directional aerials, to Europe. Very often these transmissions can be picked up with the most modest type of set, but for regular reception it is necessary to use an efficient receiver.

Provided that the broadcast receiver is of the all-wave type, little or no alteration should be required to enable good signals to be obtained, but if the set is not a sensitive superhet, there are a few simple modifications that might well be made. In the first place, it is nearly always worth while to add some kind of band-spread tuning system, if only to simplify the picking-up and identification of the many available transmissions. Bandspreading is far more important with an all-wave receiver than with one designed especially for S.W. use, because the tuning condenser is of about .0005 mfd. capacity. In consequence, the minutest movement of the tuning knob is sufficient to pass completely over one station.

A Tuning Modification

In the case of a "straight" set, band-spread can most easily be added by fitting a 25 mmfd. condenser, with good slow-motion drive, and providing a switch so that it can be put in parallel with the single tuning condenser of a Det.-L.F. set, or in parallel with the detector-circuit tuning condenser of an H.F.-Det.-L.F. set. The connections are indicated in Fig. 1,

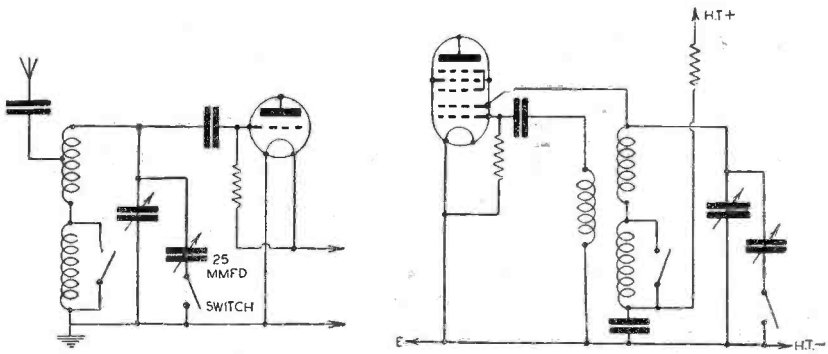


Fig. 1.—Band-spread tuning can be applied to most receivers by connecting a 25mmfd. condenser in series with an on/off switch, across the principal tuning condenser. This will, of course, affect dial readings on short waves.

where it will be seen that a simple on/off switch—any reliable pattern will serve—is placed between the moving vanes of the condenser and earth. If desired, the switch can be omitted and the condenser left in circuit continually, but that would necessitate retrimming in a selective receiver. For preference, the re-alignment should be carried out with the fine-tuning condenser set to its midway position, but this may not be possible because of the low capacity of the trimmers.

In any event, it is important that the lead to the fixed vanes of the condenser should be kept short, and that the new condenser should be placed as near as convenient to the tuning condenser to which it is connected. If there is insufficient room for the extra condenser on the panel, or if placing it there would spoil the symmetry of the controls, it might be satisfactory to mount it on the end or top of the cabinet, or even on an inclined sub-panel underneath the lid, where it can easily be reached by opening the lid.

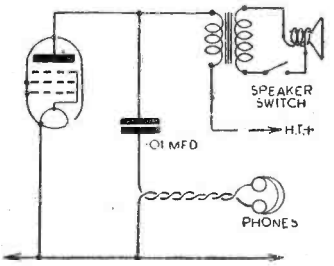


Fig. 2.—A satisfactory method of connecting 'phones and fitting a speaker cut-out switch.

Modifying a Superhet

When using a superhet, the same general idea can be used successfully. This time the condenser should be wired in parallel with the section of the gang tuning condenser connected to the oscillator coil. In most cases it is better to fit the switch previously mentioned, and sometimes it is found desirable to fit the condenser in an earthed screening box. Even when these precautions have been taken it may be found that slight readjustment of the trimmer of the oscillator section is required, this adjustment being made when the fine-tuning condenser is out of circuit and the set tuned to medium waves.

We never recommend that alterations should be made to commercial receivers, but those referred to above can generally be made without great difficulty by an experienced constructor. Before making any permanent connections and before mounting the new condenser, however, it would be wise to test the alteration to make sure that no harm will be done. It is also important that the circuit of the set should be carefully studied before even temporary alterations are made.

Calibration

Once the new condenser has been installed, it should be possible to calibrate its scale on the different short-wave bands, by carefully setting the main tuning condenser to exactly 19, 25 and 31 metres, for example. Accurate calibration is not, unfortunately, always possible because of the rather "open" marking of the original tuning scale. Sometimes it is possible to arrange an accurate guide by gluing on to the edge of the scale a square of white card with a fine ink line across it. The advantage

(*Continued on page 385.*)

ON YOUR WAVELENGTH

By Thermion

Sir John Reith's New Job

SO Sir John Reith returns, although in an indirect way, to broadcasting. In his new job as Minister of Information he will, of course, control news. Sir John is not, of course, a journalist. Whilst he was Director-General of the B.B.C. he did in fact on a number of occasions, and, of course, facetiously, refer to journalists in somewhat slighting terms. There are many who do not understand the qualifications and the particular work of a journalist. They think his life is one round of social functions, and that he is permanently under the affluence of inkohol. They think that an Editor's job is to dot i's and cross t's. Although a journalist, I have no hesitation in saying that journalism demands a higher degree of education, knowledge and the experience only gained in the university of life than any of the other professions. Sir John has in his time met all of the important journalists—including me!—and thus he will be able to bring to bear on his new job a knowledge of the requirements of the Press and the public. He will know how to prevent the whispering campaigns, which the undue suppression of news or the publication of half truths encourages. My best wishes for his success in his new job.

Our New Sister Journal

MY congratulations also to the dynamic Editor of this journal who, I see, is founding yet another important weekly publication — *Practical Engineering* — the first issue of which will be published on Thursday, January 25th. The new journal is a weekly, and costs 4d. It is planned to appeal to all engaged in the engineering trades. Designers and draughtsmen, works managers and shop foremen, fitters and turners, millers, planers and shapers, welders and sheet-metal workers, tool makers and gauge makers, erectors and maintenance engineers, inspectors and viewers, in fact, every one associated with mechanical engineering and its kindred trades, such as plastics, should read *Practical Engineering*—the new and modern engineering weekly. Make a note of the date, Thursday, January 25th, and order a copy from your newsagent to-day.

The Torch Battery Ramp

I HAVE stirred up a hornets' nest in my exposure of the ramp which is going on in connection with batteries. Perhaps I should have used the word vampires instead of hornets, for what can be said of people who in a time of emergency will stoop to the filthy low trick of breaking up high-tension batteries made for a maximum discharge of about 15 mAs, and sell them for use in torches requiring at the least over a quarter of an ampere, and usually about half an ampere. One of my Midland readers saw an advertisement in one of the Midland papers which said: "Thousands of batteries in stock, bring your case; all sizes." This advertisement was inserted at a time when even the battery manufacturers could not deliver. Our reader investigated the case and found that some enterprising gentleman had taken over the shop and was selling 1½-volt H.T. cells in series of two at 9d. each. They were wrapped in white paper, and were printed in blue with the magic words "Double Life Battery—British Make." One of the difficulties in the battery trade has been the enormous number of different sizes of case for which the manufacturers are expected to supply batteries. The time has come when the battery manufacturers should standardise no more than three sizes of torch battery, and thus force the stupid people who manufacture ridiculous battery cases to go out of business. Some of the torches which are sold are too tiny to give more than a few minutes' life from the midget battery they can accommodate. The public must be encouraged to buy a proper size of torch.

A Quaint Request

ONE of our readers, Mr. J. A. C., of Forfar, sent us recently a letter which said: "Enclosed are six QSL cards as verifications of reception reports. Please send B.L.D.L.C. A.C.R. certificate at your earliest. His verifications were from British home stations, and so we replied, pointing out that we could not accept veris of British home stations for an A.C.R. certificate. I should have thought that this would have been obvious to the meanest intellect, for anyone would be entitled to a certificate under such an arrangement. Not so our reader, however, for he replied: "I wish to draw attention to the fact that I fulfilled all the conditions as published. Your non-acceptance of a British card to represent the European zone is just silly. Where is Britain if not in Europe? Besides, anyone in Britain can receive European stations at any old time, using any old set, in any half-efficient conditions. I could send you a dozen or so European cards from countries other than Great Britain. Having clearly carried out the conditions as published I *demand* a certificate and will not be satisfied until I get it!"

The Editor replied: "According to you we should award a certificate to anyone who receives any sort of station, even though the station is on his doorstep." This reader should have sent the verifications from the European stations which he says he receives for investigation, and in spite of his *demand* he will not receive an A.C.R. certificate. Moreover, he has not clearly carried out the conditions.

The sole object of granting the A.C.R. certificate is to give some encouragement to those short-wave enthusiasts who are capable of building and operating a receiver which will receive the more distant transmissions which, owing to their geographical positions, atmospheric conditions, and, in many cases, low power, necessitate a reasonable amount of skill, patience and efficiency on the part of the receiving station.

It has always been a rule that a station operating in Great Britain shall not be accepted for the European class, as it is perfectly obvious to anyone with the slightest experience of short-wave work that reception of a G station is in no way a criterion of the efficiency of either the operator or his equipment.

Wireless for the Blind

I AM pleased to note the announcement by The National Institute for the Blind that more than £10,000 has already been received in response to the broadcast appeal by an "unknown blind man" on Christmas Day. He was appealing for the fund which provides and maintains wireless sets in the homes of needy blind people.

Several children have answered the blind man's call by raiding their money-boxes, and many old-age pensioners have sent something. Quite a number of the gifts are from the B.E.F., one being described as "the result of a whip-round in our dug-out."

A Viennese musician, now a fugitive from the Nazis and living on a small allowance given by the Christian Council for Refugees, sent the pennies he had been saving for the purchase of a wireless set. "I find I can no more live without music than I can live without bread," he wrote. "Anyhow, I have my sight. My shadows are transitory, but those of the blind remain."

B.B.C. Symphony Orchestra

THOSE of my readers who follow the activities of the B.B.C. Symphony Orchestra should listen, on January 17th, to the broadcast from Newport, where the orchestra is visiting the Central Hall. This broadcast opens with a great string work, the Introduction and Allegro for String Quartet and String Orchestra by Elgar. Parry Jones will sing a big scena from "Tannhauser," denoted in the programme as "Tannhauser's Pilgrimage," which gives the orchestra an opportunity of rendering the brilliant Venusberg music of the opera. The broadcast ends with Tchaikovsky's symphonic poem, "Romeo and Juliet." It is interesting to recall that this was first suggested to Tchaikovsky by his elder colleague Balakireff, who felt that Tchaikovsky was the very man to write such a work successfully. His idea was to have an introduction—something after the style of a chorale—presenting Friar Lawrence; then a bustling section would tell of the feud between the two families and lyric melody would represent the young lovers; the coda would represent the tragic end of the story. The piece was composed much on these lines, but it is safe to say that as sheer music it has such lovely tunes and rises to climaxes of such passionate intensity that most of those who know it so well barely give a thought to the original story which inspired it.

INTERFERENCE SUPPRESSION

A New Type of Limiter for This Purpose is Described in this Article

THE effectiveness of the method of interference suppression which involves reducing the output of the receiver while the interference is present has now been proved, and schemes of this character are consequently of interest.

A circuit arrangement of this type has recently been developed in the R.C.A. Laboratories, and is shown in Fig. 1. The system includes a tuned input circuit including a capacitor 10 and an inductor 11 through which the modulated carrier impulses are applied to the cathode and anode electrodes of a detector 12. This input circuit also includes a radio frequency filter network 13-14-15 and a resistor 16. The detected modulation impulses produced in the resistor 16 are applied to the control grid 17 of an electron discharge device 18 through an input circuit which includes the grid 17, the resistor 16, the ground terminal 19, the lower section 20 of a bleeder resistor 21, and the cathode of the device 18.

The cathode-anode or output circuit of the device 18 includes a resistor 22 and a section 23 of the resistor 21. With these connections, the received impulses are amplified by the device 18 and applied to the control grid 24 of the limiter 25.

The limiter 25 is provided with an anode 26 to which is applied a relatively low potential, a screen grid 27 to which a relatively high potential is applied from the upper terminal of the resistor section 28, a cathode 29 which is connected to ground through a resistor 30, and a resistor 31 which is connected between the anode 26 and a grid 32 to afford a screening action, whereby greater output of the limiter is facilitated.

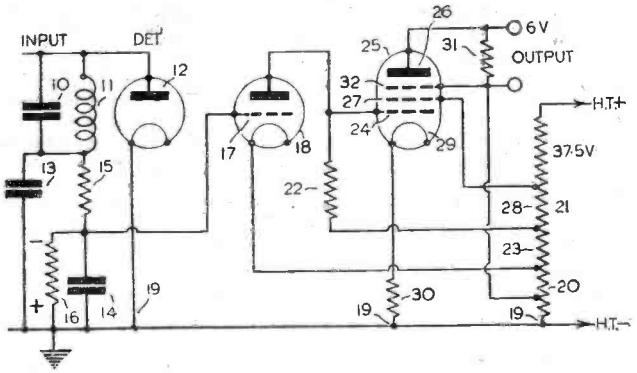
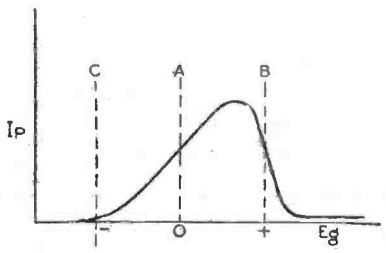
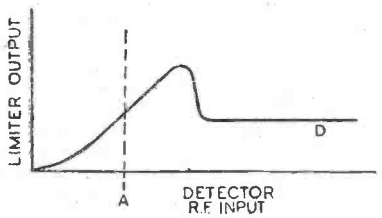


Fig. 1.—A circuit incorporating a tuned input and a limiter arrangement as described in the text.

Fig. 2 illustrates the control grid potential-anode current characteristic of the limiter 25, grid potential being plotted as abscissæ, and anode currents as ordinates.

It will be observed that A and B are voltages of the control grid 24, which produce equal output current of the limiter 25. If the cathode-anode voltage of the device 18 (the potential of the resistor section 23) is so adjusted that B volts are applied to the control grid 24 when the cathode-anode current of the device 18 is cut off and, with zero signal at the detector 12, the voltage of the cathode of the device 18 is so adjusted that C volts are applied to the limiter control grid 24, the detector input-limiter output characteristic illustrated by Fig. 3 results. Otherwise stated, the limiter output assumes the normal no-signal value when the input becomes excessive. This condition during the overload or rejection period is highly advantageous in that the noise otherwise resulting from abrupt changes in output is avoided.





Figs. 2 and 3.—Control grid potential-anode current characteristics, and limiter output curve respectively.

Limiter Output

It should be understood (1) that this reduction in the output level of the limiter 25 in response to excessive input level is produced by the limiter cathode 29 being driven more positive due to the potential drop of the resistor 30, (2) that such excessive level also drives the grid 17 sufficiently negative to interrupt the output current of the device 18, and (3) that interruption of output current of the device results in the application to the limiter control grid 24 of a potential by which the limiter output is caused to assume the D value (Fig. 3), this potential being applied through an input circuit including the grid 24, the resistor 22, sections 23 and 20 of the resistor 21, the ground terminal 19, the resistor 30, and the cathode 29.

The voltage of the carrier applied to the detector 12 should be maintained by A.V.C. or other suitable means at the value A in the centre portion of the positive slope of the curve of Fig. 2. The modulating impulses then move up and down this portion of the curve and excessive input produces operation in the D region of the curve, resulting in a limiter output current equal to that for zero modulation.

It is desirable, although not essential, that the radio-frequency channel ahead of the detector 12 be relatively broadly tuned. Following the limiter 25, of course, a normal audio amplifier may be provided.

The limiter which has been described may be applied to the R.F. side of the receiver. Certain minor modifications are, however, desirable to ensure best results. The resistance load 31 in the anode circuit of the valve 25 should, of course, be replaced by a suitable R.F. impedance such as a choke or tuned circuit, and the cathode resistance 30 is preferably shunted by an inductance with a blocking condenser in series so as to reduce the lag in the voltage drop across the resistance due to stray shunt capacity. If it is desired to reduce the output from the limiter to zero for high amplitudes of interference, the voltage developed at the cathode may be fed over a high resistance to the anode, thus neutralising the residual output of the limiter. A suitable circuit arrangement incorporating these modifications is shown in Fig. 4.

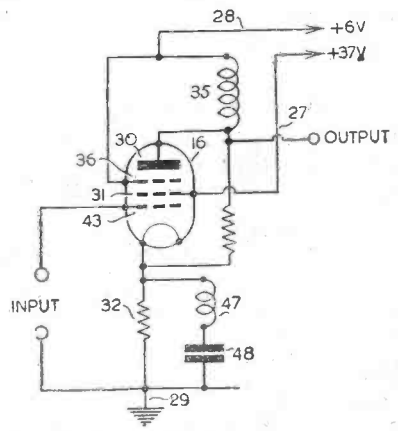
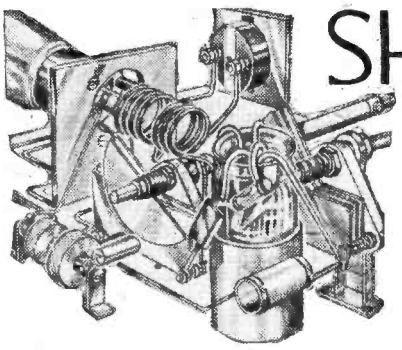


Fig. 4.—A circuit arrangement incorporating the modifications described.

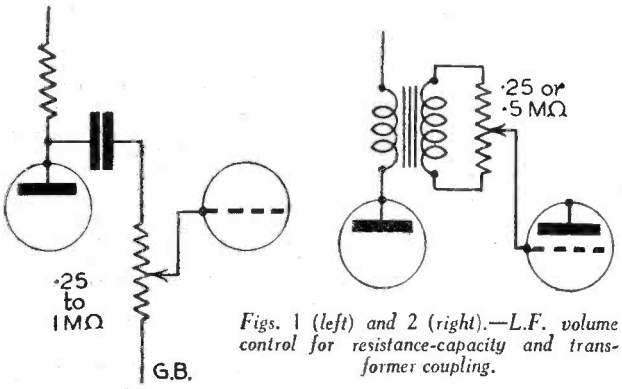


SHORT-WAVE SECTION

How to Fit Volume Control Systems to Short-wave Apparatus

By W. J. DELANEY

WHILST short-wave signals may be received at all times of the day, it is an undoubted fact that the most interesting signals are picked up after dark, and many of the better types of American programme are only available in the early hours of the morning. The keen short-wave listener is thus generally listening-in when the other members of the household are in bed and asleep and this means that in the ordinary way headphones have to be worn. If a loudspeaker is fitted and reception is being carried out on the speaker, then a volume control is absolutely essential in order to avoid disturbing the other members of the household, whilst if headphones are fitted in place of a speaker, then volume must be cut down in order to avoid blasting in the 'phones. A good receiver will, of course, be provided with a volume control, but there are many cases where such a fitment is not provided and the problem is then where to apply such a device—preferably with the minimum of alteration to the receiver. There are many schemes available, and each possesses some merit which makes it ideal for one listener, whilst it may not perhaps suit another receiver or another listener.



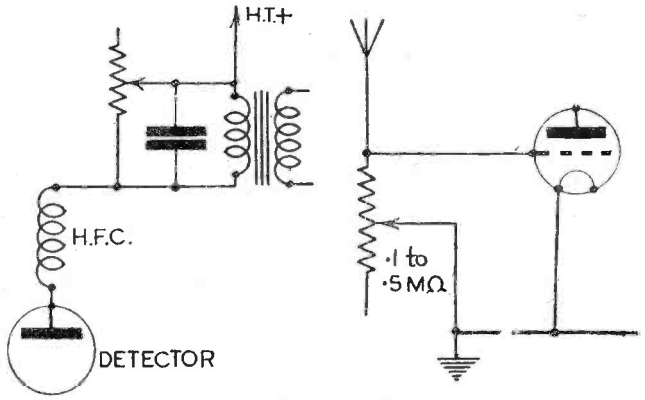
Figs. 1 (left) and 2 (right).—L.F. volume control for resistance-capacity and transformer coupling.

H.F. or L.F. Control?

The control of signal voltage may be carried out on the H.F. side or on the L.F. side of the receiver, and no doubt the usual L.F. controls are familiar to most listeners. These are of a type found in standard broadcast receivers, the usual scheme being a variable grid leak in an R.C. coupled stage, or a similar component connected across the secondary of the L.F. transformer—preferably in the first stage, if there are two or more L.F. stages. The circuits of both of these are shown in Figs. 1 and 2, and if you are now using an ordinary R.C. arrangement all that is necessary is to replace the fixed grid leak by a potentiometer having a similar value, whilst if transformer coupling is fitted, the component is joined across the secondary terminals of the transformer. In both cases the grid connection is taken from its present position and joined to the arm or centre terminal of the volume control. So much for the simplest scheme. If it is desired to apply the control without altering any wiring, and L.F. control is desired, a variable resistance may be joined across the primary of the first transformer as shown in Fig. 3. There is, however, one drawback to this arrangement, to be found in the fact that the anode current of the preceding valve will flow through the resistance as well as through the transformer primary. It will be seen that the effect is gradually to short-circuit the transformer primary, and as this is part of the L.F. coupling, any noise present in the primary circuit will be transferred to the secondary, amplified and heard on the output side. Thus, a noisy control will prove very troublesome in use, but there is a simple way of avoiding this, and that is by connecting a fixed condenser across the arm of the control and the "live" end. The value of the condenser may prove critical, as it may affect tone, or even the smoothness of the reaction control. A general value is 1 mfd., but you may care to experiment to find a more suitable capacity. The value of the resistance is not so critical, and either 10,000 or 25,000 ohms should prove useful, or some value between these extremes.

H.F. Controls

On the H.F. side there is not a great deal which can be done. If the receiver employs an S.G. or H.F. pentode valve a variation in the screen voltage will enable volume control to be carried out, or if a variable-mu valve is employed the usual bias variation will prove effective. Unfortunately, however, these valves are not very popular for normal H.F. circuits on short waves, and thus the scheme is not of wide application. There are, however, dozens of receivers which employ an aperiodic H.F. stage. This usually consists of an H.F. choke or fixed resistance in the aerial circuit in place of a tuning coil. In most receivers the choke, if this is used, may be replaced by a fixed resistance; but this must be non-inductive, remember. By replacing the resistance by a variable component, there is an ideal way of controlling volume—the circuit is shown in Fig. 4. It will be seen that when the arm of the resistance is at the lower end, we have the standard resistance arrangement. As it is turned towards the "top" of the resistance it is successively short-circuited and this not only reduces the signal voltage present across the resistance, but at the same time gradually short-circuits the aerial to earth, and thus it acts very well as an input volume control. It is, in fact, often regarded as the only really effective short-wave volume control. The only snag is the value of the resistance. Until a suitable value has been found you may experience difficulty. Either erratic volume-control effects, or noises, or even sudden jumps in volume may be obtained, especially if a "swash" plate type of resistance is used. As this rotates it may make uneven variations in the resistance and this may result in difficulty in controlling the volume. If a wire-wound component is used it may give rise to noises or prove jumpy due to short-circuited turns or uneven windings on the resistance element. One of the carbonised or graphite controls having a wiping carbon block is really best and the value should be between .1 and .5 megohms—again a trial being necessary to find which is most suitable for the particular receiver in use.



Figs. 3 (left) and 4 (right).—Volume control at detector output, and aerial volume control.

Comment, Chat and Criticism

Composers' Idioms Further Considered

Their Style and Characteristics are Discussed in This Article by Our Music Critic, Maurice Reeve

LAST time I touched upon this subject I not unnaturally enlarged upon a melodic characteristic of two of the most individual and personal of all composers, Wagner and Grieg. So persistent and oft-recurring were these two features in their melodies and themes that we naturally concluded that their musical minds worked, even sub-consciously, in some groove or to some pattern, the reason for which can, partially, at any rate, be traced back to their musical antecedents (*vide* article on "Nationalism in Music"). It is obvious that we should begin a study of this subject with an examination of melodies and themes, because they confront us first of all. Every work begins with a theme of some sort or other; it is, in fact, the *raison d'être* for the work—that, and subsidiary themes; whilst songs and their like are nothing but themes or melodies. A good theme, like Schubert's in the Unfinished, "hits one in the eye" so forcibly that it at once becomes an ever-living reality. They are the first things we would be expected to catch on to. But a composer's personal style or idiom by no means begins and ends with his themes or the way he spaces his notes in making one up.

Melody and Theme

It may be of interest if I define the difference between a melody and a theme. A melody is complete in itself, whereas a theme is not. Play over one verse of any of Schubert's songs and you will find that, musically, it gives complete satisfaction—it concludes with a full stop. But play over any of the THEMES from his Unfinished Symphony and, although just as beautiful, they do not satisfy. They leave a feeling that something has to follow—they do not end on a full stop.

As mentioned in my article on Chopin, that master's persistent use of his national dance rhythms, even in his bigger works in the classical forms, is a great characteristic, and stamps his writing with an individuality as much as any other ingredient in his music. It also, of course, stamps him as a Pole of unmistakable complexion.

Liszt's torrents of diminished sevenths—the like of which had never previously been heard, nor have since been heard—were one of his most conspicuous traits. Unlike Chopin, however, he seldom employed his native Hungarian rhythms outside works which, like the famous Hungarian Rhapsodies, set out to specifically exploit them. Brahms' fondness for tenths, and for the hands far apart at the extreme ends of the keyboard (I refer to his piano music, of course), are two of his pet devices, though as regards the latter one he followed in the steps of his great predecessor, Beethoven (see Waldstein Sonata, 32 and 33 Variations, and many other works).

Debussy's marvellous use of the whole tone scale, the passion of Albeniz for crossed or interlocked hands—and for the use of the melodic minor—Bach's contrapuntal style and sequences usually built on a pedal point; Handel's vigorous masculinity: these and many more things go to make up a composer's style differentiating him from other writers—incidentally, no composer ever used dance rhythms more often than J. S. Bach. Hundreds of his movements are moulded after them.

Arrangement

But how exactly one must arrange the notes and build up a movement in order to arrive at, say, Handel's vigorous masculinity or Elgar's English-ness, is a huge subject requiring many tomes. Therein lies the real formula, of course. That is why you would have to study if you wanted to faithfully copy Handel or Elgar, just as you would have to procure the recipe of a dish you had tasted somewhere and which you wanted to cook for yourself. But I doubt very much whether a composer's idiom could be condensed into a recipe for others to imitate and reproduce, not even the strongest individuality such as Liszt or Grieg. The master's handling would always be conspicuous by its absence. And although Lucullus himself might give us his formula for his nectar or ambrosia, we would ourselves have to be Lucullus to reproduce it so that no one could tell which from t'other. As the inscription says on Beethoven's tomb, "I am Bacchus who makes the nectar for Man's delight."

Musical Form

Then comes a master's handling of the musical form on which he is going to plan and build up his work. From the musician's point of view this must come first in importance; everything else depends upon it. The proportions and design of the building and the influence it is going to exercise on future writers. Beethoven is universally considered to be the world's greatest musician on two counts—the mastery of his handling of the larger musical forms, and the reforms and innovations he made in them which have all been accepted as law by subsequent composers; and the nobility and loftiness of the character of his music. But that the first of these qualities (although the second, largely dependent on the first, is the supreme quality in all art) would be sufficient to keep Beethoven on his throne may be proved by a comparison with other musicians of the same school. Brahms, for instance, wrote magnificent music, and of the loftiest and most altruistic character, but he made few innovations.

He accepted Beethoven's legacy gratefully and dutifully, and fashioned in it, leaving little new so far as the constructive pattern of music is considered. He didn't divert the historical river bed of music one iota; it continued to flow along its course serenely and beautifully, through him and in spite of him. He greatly beautified its banks and ornamented its environs, whereas Beethoven hewed out of plains and mountainsides huge new gorges and clefts for it to rush through down to the sea. Consequently his music is stamped and dyed with that unmistakable characteristic of struggle, strife and seeking which is unique amongst all musicians, and which cannot be reduced to a formula of "gaps of a third," or this, or that. It stamps the music with an indelible personality of the deepest profundity, and in a manner that no mere harmonic trick or device can hope to rival. And when we also realise that, for its day, Beethoven's music was just as original in this respect (the flattened ninths in the Eroica Symphony and the Moonlight Sonata made the world jump out of its lethargy, and still make us gasp to-day) as it was architecturally, we get some measure of its mighty proportions.

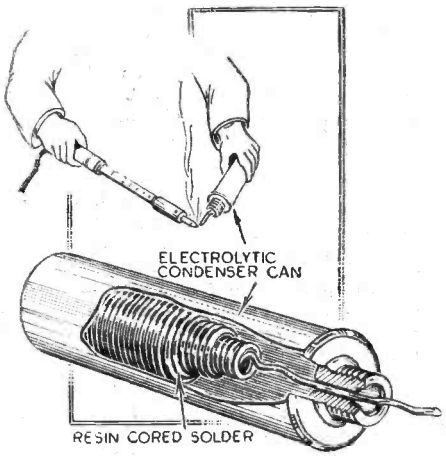
Melody, Harmony and Rhythm

It might be serviceable to conclude this week's notes with an enumeration of the items which are necessary for the fashioning of a satisfactory piece of music. Unquestionably the first need is a plan. What form is it going to be written in? If one of the large forms—a symphony or sonata, with movements, then more than the conventional "first movement" is required. What is the mood of the piece going to be? The third or sixth Beethoven Symphony, the op. 53 or the op. 57 Sonata? Then come melody, harmony and rhythm. These, of course, are largely governed by the mood—the state of the composer's mind. Melody is obviously first because, although harmony and form are more important to the finished work, it is difficult to imagine a composer getting his music paper and pen out until some "tune" or other has come into his mind. It is that "tune" which is the focal point round which the work is built—its very life. In the case of a short work it becomes melody; in a symphonic work, a theme. Then, according to the manner of treatment decided upon, enter the extremely important questions of the employment of a coda, the length of the development section, and many more. All of these bear the imprint of the composer's individuality—a Beethoven coda is as strongly stamped as a Beethoven melody or anything else—and all form integral parts of that most mysterious and enigmatic thing—a work of music.

Practical Hints

A Holder for Solder

BEING a service engineer I am constantly using solder, and have evolved a holder which is quite easily made and very handy in use. It is made from the case of an old electrolytic condenser. The first step is to remove the threaded base and all the



A handy holder for cored solder.

inside material. A coil of solder is wound round a pencil about as long as the case, and with two or three layers. The pencil is removed and the coil is put in the case. The end from the inside of the coil is put through the hole in the base, which is then replaced.—E. SURTEES (Middlesbrough).

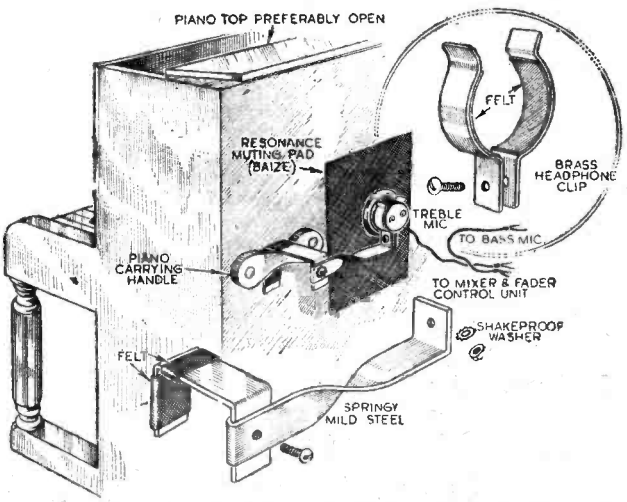
Adapting Headphones as Piano Mikes

WHEN carrying out some experiments on piano reproduction through my radio set, I decided, in view of the fact that the piano is situated at an angle to one corner of the room, to obtain an accentuated treble and bass response leaving the middle register to the differential reproduction of the two headphones.

This scheme called for a suitable means of anchoring for each headphone, and in order that resonance effects would not influence reproduction, I carried out various tests to determine the most suitable location for each 'phone.

Apart from the location of the headphones, it was necessary in each instance to glue a pad of baize on to the piano fabric, as indicated in the sketch.

I found that with the simple angle brackets depicted, a rigid and vibration-proof fitment to each piano carrying handle was obtainable, using



An efficient method of adapting headphones as piano mikes for experimental purposes.

THAT DODGE OF YOURS!

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SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.

twisted mild steel extension arms, and springy brass clips, for the headphone attachments.

The rest of the assembly detailing is clearly defined in the illustration, which also indicates briefly the wiring to a mixer and fader control unit.—S. F. STOKE (Forest Gate).

Small Condenser Construction

WHILST experimenting with small condensers and resistances, I hit upon the idea illustrated. It will be seen that the only requirements for the construction of a number of condensers of different values are as follow:—

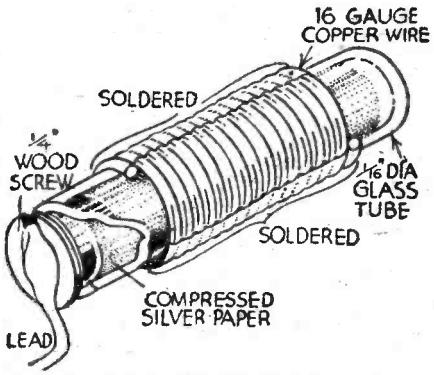
(1) A few short lengths of different gauge bare copper wire.

(2) A length of glass tubing (internal diameter, one-sixteenth inch approx.).

(3) Some silver paper, and a few ¼in. wood screws.

When the silver paper has been compressed—by the head of a nail or strand of 16-gauge wire—heat the tube and silver paper until red hot, care being taken to see that it does not bend or warp, allow it to cool and complete by winding the wire and soldering same—to short all the turns together. The screw constitutes one method of contacting with the solidified silver paper.

Great care should be exercised when compressing the paper to ensure that no cut fingers are sustained through slipping.—W. R. HOBBS (Ilford).



A novel method of making small tubular condensers.

Series Dropping Resistance

WHEN designing a mains set some constructors prefer to use the trailer (series dropping) resistance to feed the screen in preference to a potentiometer. While the former method is in many ways desirable, great care should be taken to see that the required voltage drop is obtained, as many modern mains screen-grid valves take very little screen current. We came across a well-known type recently which, although of more than average efficiency, had a negligible screen current, and the use of a 5 megohms series resistance failed to make any measurable decrease of the screen voltage.—D. WATTS (Hendon).

Screen-pentode Detectors

WHEN fitting a screen pentode detector in place of an ordinary diode detector, it will often be found that a set oscillates at the bottom of the short-wave dial when reaction is turned to minimum, due, of course, to the readiness with which this type of valve will oscillate. To avoid tampering with the actual reaction winding, which is probably housed in a can, a resistance may be placed in series with the coil (between anode and coil). Its value can, of course, only be found by experimenting, but 1,000 ohms is suggested as a starting point. A resistance of a composition type should be used as, generally speaking, a wirewound resistance is unsuitable.—C. QUENTON (London, N.).

Checking Frequency Response

How to Check the Output of Any Type of Receiver

A QUESTION which nearly every listener asks himself from time to time is whether or not the receiver in use is delivering a faithful output, so far as quality is concerned. The question of purity is one which concerns every amateur, and nearly every listener claims that his set gives the best reproduction which he has heard—on a home-broadcast receiver as distinct from a demonstration of laboratory type of apparatus. The faults which are most likely to occur in a receiver are poor reproduction of very low notes and of the very high notes, together with undue prominence of certain notes at various parts of the scale. These are generally due to unwanted mechanical resonances which are difficult to eradicate. The human ear is not, however, equally responsive to all frequencies. As a matter of fact, it is most sensitive to frequencies of the order of 1,000 cycles per second, which corresponds to notes about two octaves above middle C on the piano.

The Accommodating Ear

For the lower frequencies (below 100 cycles) and for the extreme upper register (above 8,000 cycles) the response of the ear is much more feeble. Now, unfortunately, it is just those frequencies to which the ear is the least sensitive that some loudspeakers reproduce the worst, so the natural deficiency of the ear is aggravated by what may be termed the artificial deficiency of the speaker. On the other hand, the human ear is notoriously accommodative and is more easily deceived than any other human organ. It therefore recognises and accepts for reasonably life-like reproduction sounds which vary considerably from the original produced in the studio, and it is a fact that listeners may become so used to what is really very poor reproduction that they do not realise the extent to which the sounds produced by their loudspeaker fall short of perfection.

It is, however, not a difficult matter to carry out at home one or two practical tests which will indicate roughly what kind of response curve a speaker has. To carry out really accurate tests, expensive and very accurately designed apparatus is required, and this is generally outside the means of the average listener.

Apparatus Needed

To commence with the simplest and cheapest test, it can be ascertained easily whether a speaker has a reasonable bass response by applying a 50-cycle note obtained from the A.C. electric light mains. Connect a fairly long length of flex, say, 5 or 6 yards, to the grid and cathode terminals of one of the low-frequency valves, and run this flex as close as possible to some wires carrying the alternating current house supply, such as the mains lead to your receiver or the flex connecting a standard lamp, for instance. *No connection, of course, should be made to the light supply itself.* The result will be that the appreciable alternating voltage at a frequency of 50 cycles will be picked up by the trailing flex and will be amplified by the valves and applied as a strong 50-cycle signal to the speaker. If this component has a reasonable bass response, a good volume of deep hum should be heard. Unfortunately, this test only gives an indication for one particular frequency, but if a good performance is obtained at 50 cycles it is fairly safe to say that there is nothing wrong with its bass response.

Gramophone Records

A far more accurate series of tests can be carried out with the aid of special gramophone records giving constant frequency notes. These constant frequency records are not usually stocked by gramophone dealers, but they can be obtained, or it may be possible to borrow them from a progressive radio dealer. They are issued by the H.M.V. company and are numbered and grouped as follows:

DB4034	8500 — 8000 — 7500 — 7000 — 6500 — 6000 — 5500 — 5000 — 4500 — 4000 — 3750 — 3500 — 3250 — 3000 — 2750 — 2500 — 2250.
DB4035	2000 — 1800 — 1600 — 1400 — 1200 — 1100 — 1000 — 900 — 850 — 800 — 750 — 700 — 650 — 600 — 550 — 500.
DB4036	450 — 425 — 400 — 375 — 350 — 325 — 300 — 275 — 250 — 225 — 200 — 180 — 160 — 140 — 120 — 100.
DB4037	25 — 30 — 40 — 50 — 60 — 70 — 80 — 90. Gliding Frequency. 8,500 to 25 cycles. Constant level above 300 cycles per second.

These records are of the 12in. type and cost 6s. each.

In addition, there is a special Sound Demonstration record, No. DB4033 (6s.) which has on one side Frequency—Amplitude—Interference — Modulation, and on the other, Harmonics—Resonance—Characteristic Sounds—Music and Speech.

A five-pocket album to hold the above records (No. 252) is available and includes a Stroboscopic Speed Indicator, and the new Automatic Record Groove Indicator, as well as a full description of the records and suggestions for their use.

Each record produces a practically constant volume at given frequencies. The last record, which has a "sliding" note will probably prove most useful to the amateur who is not concerned with elaborate frequency tests at different parts of the musical spectrum.

A Simpler Method

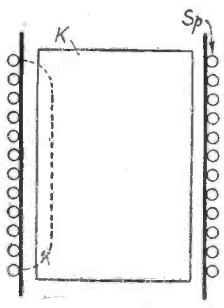
There are other less accurate devices which anyone can try at home if he possesses a fairly sensitive microphone. The microphone should be installed in a room away from the speaker, and sounds, as near as can be judged, of equal intensity should be produced, running right up and down the scale. This can be done by means of a piano or by means of other stringed instruments. If you possess a violin, this will be excellent for the upper frequencies, but a 'cello will be required to give a good test in the deeper notes. With such a test, of course, it is difficult to judge when the sounds performed at the microphone are of equal intensity, but they do give a fair indication of performance.

A Moulded Iron Core for High-frequency Coils

WHEN moulded cores are used for high-frequency coils, the core is traversed not only by magnetic field lines but also by electrical field lines. The accompanying illustration, in which Sp is the coil and K the core, shows one such electrical field line in broken line. Since the dielectric constant of the moulded core is very high, and moreover, may have a very high temperature co-efficient, the behaviour of the core as a dielectric may become unpleasantly obtrusive when the coil is used as a frequency-determining element, especially on short waves. It would, of course, be possible to screen the core by means of an electrically conductive shield, but this would obviously involve the use of an additional component, namely, the shield.

Semi-conductive Bending

An alternative method, which avoids this disadvantage, is to use a semi-conductive medium for binding the finely divided iron powder of which the core is composed, a suitable material being carbon in an extremely finely divided state. It is true that this gives rise to a conductance appreciably higher than the susceptance of the capacity formed by the iron core as dielectric —although not so high as that of the iron —but the advantage is that the behaviour of the dielectric is no longer an important factor. The upper limit to this conductance is set by the additional attenuation brought about in the core as a result of eddy currents and depends on the frequency in question and the dielectric constant of the material. The best compromise is therefore obtained by making the conductance of the whole core just so high that the eddy current losses are still supportable and the dielectric losses are low in consequence of the semi-conductive shunt. Theoretically, it would be sufficient to have only the outer layer of the core formed in the manner suggested, but unfortunately this would lead to production difficulties.



Section of an H.F. coil.

PRACTICAL TELEVISION

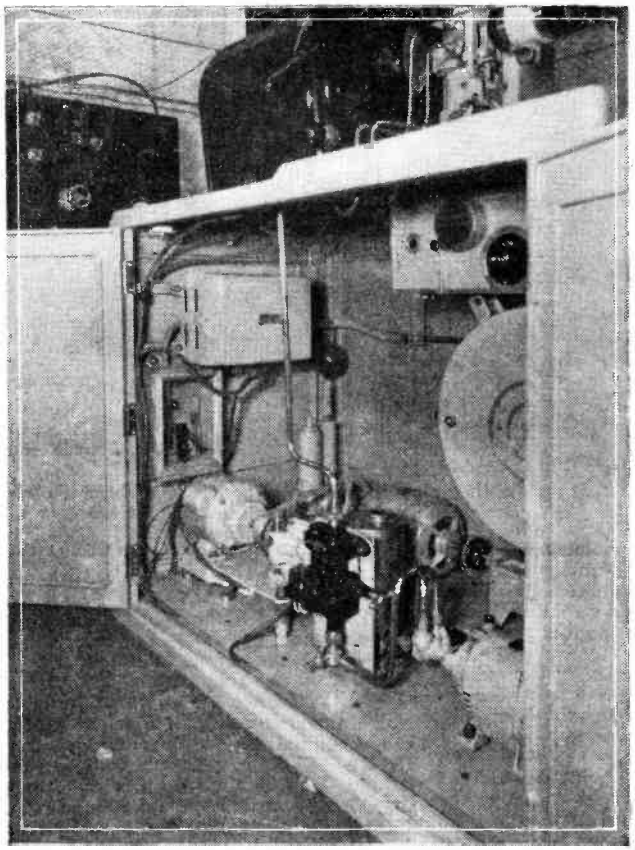
January 20th, 1940. Vol. 4. No. 186.

Adequate Protection

WITH all the various forms of equipment which together make up the plant for providing a high-definition television service, it will be appreciated that every precaution must be taken to ensure that the possibility of a breakdown is reduced to the barest minimum. In many cases this entails the complete duplication of certain sections of the equipment, particularly the ultra-short-wave radio transmitter, cameras and portions of the amplifier chain. Schemes have to be worked out to enable a rapid changeover to be effected in cases of emergency, for it is realised that where a service to the public is involved, this has to be maintained at 100 per cent. efficiency with every means at the disposal of the authorities charged with providing that service. Coupled with this are the methods adopted to give adequate protection to the apparatus and assist in every possible way that the chance of breakdown is remote, or, alternatively, if some part of the apparatus fails, then remedies or repairs can be undertaken expeditiously without involving the whole of the equipment and extending the damage. In this connection it is interesting to see how one company responsible for the supply of machines for televising standard talking films introduced protective measures. This will be made clear by a reference to the accompanying illustration, which shows the bedplate on which was mounted the arc lamp, shutter mechanism, film gate, lens, etc., which projected the film pictures frame by frame on to the device converting the degrees of light and shade into the electrical television signals. Inside this bedplate were housed the driving motors for the mechanism, the take-up spool box and pumps. These pumps caused water to circulate through tubes to the film gate so as to keep it operating at a low temperature. If the pumps failed for any reason then before the gate had a chance to heat up, the plant was shut down automatically. If the film became jammed in the gate then a shutter was released to cut off the intense beam of light from the arc lamp, thereby preventing the film from igniting and causing wholesale damage to the unit. The same form of shut-down occurred if the film broke and the relays, pumps and piping employed for these protective purposes are readily visible inside the massive casting which normally has a pair of doors kept closed during running periods.

Television by Wire

IN spite of continued representations from many quarters asking for a reconsideration of the television broadcasting position in this country, the authorities, for a variety of reasons, still maintain that it is impossible to renew the ultra-short-wave radio service on a basis similar to that ruling before the war started. Active minds have, therefore, turned their attention to alternative schemes for providing the public with entertaining pictures in their homes during the long hours of black-out. Naturally, this can only be effected by some form of wired television, using either special cables of the coaxial type or employing short runs of telephone cable with amplifiers and correctors in much the same way as the B.B.C. were doing for some of their outside broadcast relays a few months ago. Where the money is to be found to pay for really entertaining programmes has not yet been settled, but problems of television signal distribution should not prove too difficult now that knowledge on this subject has advanced so rapidly during the last two or three years. The best situations are obviously blocks of flats, indeed, before the war it was not unusual to find that one of the amenities put forward to entice tenants to a new block of flats was the knowledge that a wired television service had been arranged for during building, so that it was available for use as required in much the same way as the common services of electricity, water and gas. To busy people this was a tremendous advantage, for it relieved the tenant of any worries concerning aerial erection and landlord's permission for feeder cable runs, with the result that special departments were being formed by some manufacturers to treat this side of the television work as a separate sales outlet.



Showing some of the protective devices employed in equipment for televising standard talking films.

Various Schemes

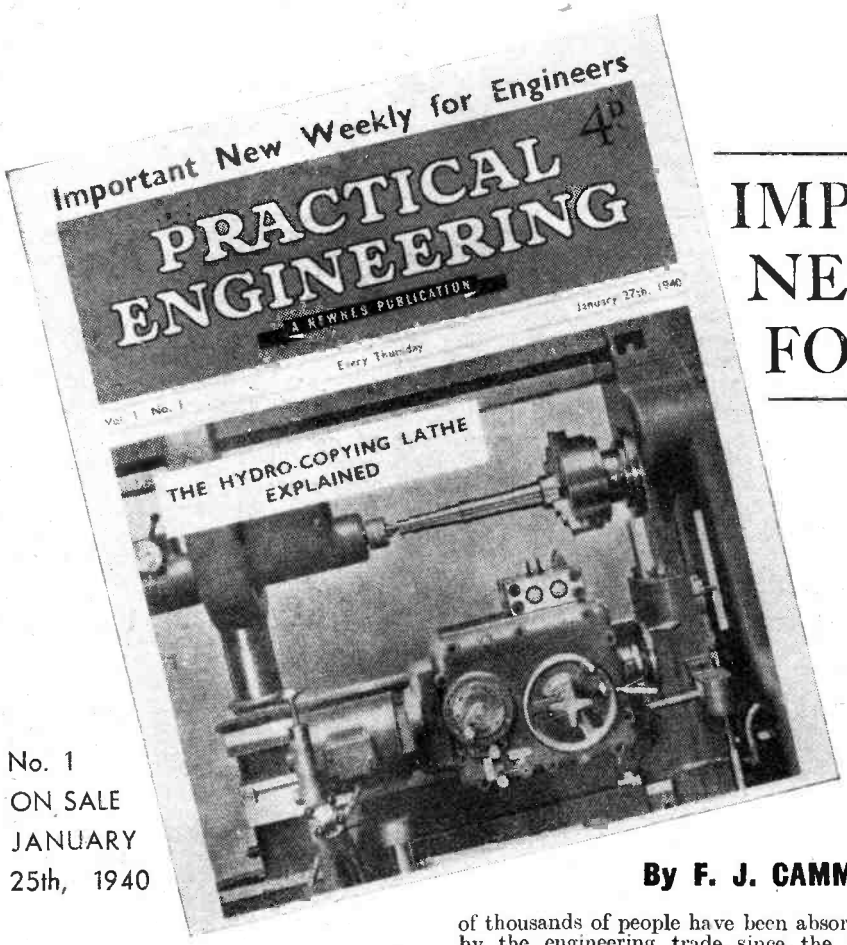
THERE are several ways in which the local distribution of television signals could be undertaken within a small radius, such as one or two blocks of flats, once the pictures had been received by a more elaborate form of wire rediffusion. Both in America and on the Continent experiments have already been made with a fair measure of success whereby the signals are handled at modulation frequencies as distinct from working at carrier frequencies. The original idea was to have in the subscriber's room a cathode-ray tube as the picture reproducer without any auxiliary equipment in much the same way as a broadcast relay subscriber at the present day has a loudspeaker for which he pays a nominal rental fee. This entails the use of a cable capable of passing the vision signals together with the line and frame-deflecting signals to the C.R. tube, while separate provision has to be made for the sound. While the rental may prove high in a scheme of this character during the initial development period, there is no doubt that with expansion the sum involved for a subscriber to enjoy amenities in this form would be quite economic. Another alternative would be to distribute at modulation frequencies but have a time-base generator producing the cathode-ray beam deflection as part of the subscriber's unit and synchronise this with the transmission by pulses fed over the same line. Actual demonstrations of both these forms of working have already been given, so it is only a case of commercialising the idea on a proper basis, in order to fit it in with any fundamental scheme that may be proposed as an alternative to straightforward radio reception, as normally undertaken.

Carrier Frequency Distribution

A SOMEWHAT easier method and one which has already been used with success in flat installations in this country is to distribute the signals at carrier-frequency. At the termination of the line in this case there is available a signal which is exactly the same as would be secured if reception was undertaken direct from the dipole aerial's feeder cable. Distribution amplifiers for this purpose are already available, capable of feeding up to a few hundred television sets direct. One of the problems involved is the design of satisfactory junction boxes so that at each point where a receiver is plugged in, the line is terminated with its own characteristic impedance so as to secure the maximum transfer of energy and prevent reflections.

(*Continued on page 385*)

PRACTICAL ENGINEERING



No. 1 ON SALE JANUARY 25th, 1940

IMPORTANT NEW WEEKLY FOR ENGINEERS

By F. J. CAMM.

I TAKE pleasure in announcing that on Thursday, January 25th, the first issue of my new weekly publication, entitled *Practical Engineering*, and on which I have been engaged for many months past, will be published at 4d.

It was over a year ago that I formed the conclusion that there was a need for an up-to-date weekly publication dealing in a modern way with the new processes, new industries, and new trades which have grown up in connection with mechanical engineering; for it is obvious that in the last quarter of a century the engineering trades have undergone radical changes. Accordingly, I consulted many of the most important firms engaged in engineering, and found that they, too, shared my views. *Practical Engineering* represents the outcome of my visits and discussions. Although planned over a year ago, it has taken those months to select suitable contributors, and to negotiate with suitable authorities on special subjects. These have been retained specially for the new journal, and they will, as with PRACTICAL WIRELESS, also act as advisers to readers on all matters relating to engineering.

I have been encouraged to go ahead with this journal in spite of the war which, quite naturally, introduced problems which did not figure in the original scheme. The engineering professions, however, have assumed a new significance since the outbreak of war. The factories of this country are working at top speed. Tens of thousands of people have been absorbed by the engineering trade since the war commenced. The new journal will thus act as an important link between machine-tool manufacturers, their purchasers, and their users. The late Prince Albert once said that if he wished to *talk* about a subject he sent for an architect, and if he wanted something *done* he sent for an engineer.

The British Engineering Industry is rightly considered as the workshop of the world, for nearly every important process, machine, and system was originated by British engineers. The mass-production system of interchangeability and rapid manufacture of parts was introduced by British engineers, and the numerous new materials now employed were the discovery of British chemists and metallurgists.

The engineer is called upon to-day to manufacture a vastly greater range of products than he was a quarter of a century ago. The motor-car, the aeroplane, the motor-cycle, the container-vending of goods, typewriters, clothing, furniture, buildings, and agricultural work—all to-day call for the services of the engineer.

Apart from the greatly enlarged range of manufacturing processes which this extension of engineering has brought about, new and special machines have been created to cope with them. New steels and new alloys have been introduced. Many new and important subsidiary industries, such as plastics, have been created and, with them, new professions. The tool-maker, the gauge-maker, the capstan setter, the sheet metal worker, the drop-forger, the operator of the hydraulic press, the foundry worker, the miller, the planer, the shaper, the borer, the fitter, the turner, the precision grinder—these are but a few of the occupations which to-day employ tens of thousands of skilled people. Even the electrical trade is now largely dependent upon the mechanical engineer.

Many months ago it was suggested to us by the executives of important engineering firms that there existed a need for a modern weekly periodical covering authoritatively and extensively the whole field of modern mechanical engineering processes. Support was given to this suggestion by our inquiries among many of the leaders of the engineering trades.

Practical Engineering, the first issue of which will be published on January 25th, is intended to fill this gap in engineering periodicals. Entirely modern in its selection of subjects, it will deal week by week with every workshop process, and the use of every type of machine employed in this country. The leading authorities on special subjects have been retained to serve the new journal, which will be published every Thursday at 4d. The staff are practical engineers, having the highest qualifications.

Practical Engineering will be read by all the key executives in the metal working industry, by the designers, the shop superintendents, by the production and plant engineers; in fact, by all those who are in a position to influence the purchase of machinery and equipment. The powerful resources and unrivalled distributing methods of the famous firm of George Newnes, Ltd., will ensure that this new high-class journal will be read by engineers in every factory, works, and machine shop throughout the country.

We shall not only deal with modern processes of manufacture and machine tools, but also with works layout, time-saving methods, the drawing office, finishing processes, test equipment and inspection; in fact, with every sub-division of the mechanical engineering industry. We shall review new machines and equipment and explain by practical articles, illustrated by first-class drawings, the latest methods of manufacture.

We have been encouraged to publish *Practical Engineering* because we feel that such a journal is even more vital to-day than it was several months ago when the idea was first mooted. It will perform a national service, and, we hope, encourage an even livelier interest in mechanical engineering. The news and other features will keep the reader fully informed of the latest development in this and other countries. The Advice Bureau, consisting of a panel of experts, exists to advise engineers on all matters relating to their business. An important feature will be the informed criticism of matters affecting the engineering trade.

RECEIVING ENGLISH NEWS FROM ABROAD.

(*Continued from page 376.*)

of this is that the face of the card can be made almost to touch the pointer, whereas the scale itself is probably as much as ¼in. away. Such a spacing results in a marked parallax error. If tuning is by a shadow passing under the scale, parallax is generally avoided, and a calibration line for each of the wavebands can be marked directly on the scale.

Using 'Phones

Even with a moderately sensitive all-wave receiver reception will vary considerably with changing conditions. But regular reception can often be ensured by making provision for connecting a pair of 'phones. These should be connected between the anode of the output valve and earth—through a fixed condenser—as shown in Fig. 2. By this means the speaker transformer continues to carry the anode current to the output valve, and the correct output matching is retained. If provision is made for connecting an external speaker it is usually quite safe to use the terminals or sockets provided for making the 'phone connections. Should there be any doubt about the method of wiring these terminals, insert a .01 mfd. fixed condenser in each 'phone lead; this is to make sure that the 'phones are completely insulated from the H.T. supply.

On certain commercial receivers the extra-speaker terminals are so wired that a low-resistance speaker is required. In that case it would be necessary to employ a step-down output transformer "in reverse"; that is, with the secondary winding connected to the set and the primary to the 'phones. Isolating condensers are not then required, for the transformer prevents any direct connection being made with the H.T. circuit.

CONDENSED LIST OF NEWS BROADCASTS IN ENGLISH.

12 (*midnight*)	*Moscow*, 49.75, 31.25, 25, 19.95 *m.*; *WCAB*, 49.6 *m.* (*Mon.*).
12.30 *a.m.*	*Budapest*, 32.88 *m.*; *B.B.C. Overseas*, 31.32, 25.53 *m.*
1.0	*Paris-Mondial*, 30.99 *m.*
1.55	*WCAB*, 49.5 *m.* (*Mon., Wed., Sat.*).
3.0	*WRCA*, 31.02 *m.*; *Paris-Mondial*, 25.56, 25.24 *m.*
4.0	*WPIT*, 48.86 *m.* (*Mon. - Sat.*); *B.B.C. Overseas*, 31.32, 25.53 *m.*
4.30	*Paris-Mondial*, 30.99, 25.24 *m.*
6.55	*WCBX*, 48.62 *m.*
8.0	*Moscow*, 19.76 *m.*
9.15	*Melbourne*, 31.32 *m.* (9.20 *on Sun.*).
9.45	*Rome*, 19.61 *m.*
10.45	*B.B.C. Overseas*, 16.86, 13.97 *m.*
11.0	*Rome*, 25.4, 16.84 *m.*
11.30	*B.B.C. Overseas*, 16.86, 13.97 *m.*
1.0 *p.m.*	*WCBX*, 13.91 *m.*
1.15	*B.B.C. Overseas*, 16.84, 13.93 *m.*
1.30	*Vatican City*, 25.55 *m.* (*Tues.*).
2.0	*WPIT*, 19.72 *m.* (*Mon. - Sat.*).
2.50	*Hsinking* (*Manchukuo*), 25.48 *m.*
3.25	*Madrid*, 30.43 *m.*
4.0	*B.B.C. Overseas*, 19.82, 16.84 *m.*; *WCBX*, 13.91 *m.*
4.30	*Paris-Mondial*, 19.68 *m.*
5.0	*WGEA*, 19.57 *m.*
6.0	*Vatican City*, 19.84 *m.* (*Sun.*).
6.30	*Hsinking*, 25.48 *m.*
6.45	*Radio-Eireann*, 531 *m.* (*ex. Sun.*).
7.0	*Vatican City*, 48.47 *m.* (*Tues., Fri.*).
8.0	*Moscow*, 49.75, 37.22, 31.51, 31.25 *m.*
8.5	*Tokio*, 41.34, 25.42 *m.*
8.30	*WGEO*, 31.48 *m.* (*Sun.*).
8.45	*Melbourne*, 25.25 *m.* (*ex Sat.*).
9.0	*Belgrade*, 49.18, 31.56, 25.56, 19.69 *m.*
9.15	*Rome*, 420.8, 31.15 *m.*
9.30	*Lahti*, 1,807, 31.58, 1.75 *m.*
9.45	*Radio-Paris*, 1,648 *m.*; *Radio-37*, 360.6 *m.*
9.55	*WGEO*, 31.48 *m.* (*Mon.-Fri.*); *WGEA*, 19.57 *m.* (*Mon.-Fri.*).
10.0	*Radio-Eireann*, 531 *m.*; *Chungking*, 25.21 *m.*
10.15	*Burgos*, 238 *m.*
10.30	*St. John's* (*Newfoundland*), 31.37 *m.*
11.0	*WRUL*, 49.67 *m.* (*ex Sun.*).
11.25	*WGEO*, 31.48 *m.* (*Mon.-Sat.*).
11.30	*B.B.C. Overseas*, 31.32, 25.53 *m.*
11.45	*WCAB*, 49.5 *m.* (*Tues., Wed., Fri.*); *WCAB*, 31.28 *m.* (*Mon., Thurs., Sat.*).

One of the difficulties often met when using headphones with a set not originally intended for them, is that background noises (usually "sizzlings") are very pronounced. This can be minimised by turning the tone control towards the bass position or by connecting a .02 mfd. condenser and a 10,000 ohm fixed resistor in series across the extra-speaker terminals.

Switching Out the Speaker

Signal strength on the headphones is increased if the built-in speaker is put out of action, and if there is no switch for this purpose an ordinary on/off switch may be included in the speech-coil circuit, as also shown in Fig. 2. The switch is inserted between one secondary terminal of the output transformer and the speech winding. The switch must be of a reliable type—or else there will be crackling noises when the speaker is in use—and must be mounted close to the speaker. If necessary, it can be operated by means of an extension rod. Should it be desirable for any reason to place the switch more than a few inches from the speaker, see that the connecting leads are of heavy-gauge flex, for the secondary circuit has a very low resistance and an extra ½ ohm might affect the available output.

RADIO CLUBS & SOCIETIES

SLOUGH AND DISTRICT SHORT-WAVE CLUB

Hon. Sec.: K. A. Sly (G4MR), 16, Buckland Avenue, Slough, Bucks.

Headquarters: Toc H Headquarters, William Street, Slough, Bucks.

Meetings: Alternate Thursdays at 7.30 p.m.

THE meeting held on December 21st, 1939, proved very interesting, the chief item being a further talk by Mr. Houchin (G3GZ) on the Fundamentals of Radio, this time the speaker dealt with the principles of the oscillator, and pointed out some of the fallacies found in some of the transmitters which he had examined. He then described the fundamental principles which he hoped would be embodied in members' transmitters when they could once more get on the air.

The last meeting, held on January 4th, 1940, was the annual general meeting. The agenda was very full; the first item being the election of new officers. Mr. Paine (G6PR) was re-elected chairman, Mr. Houchin (G3GZ) vice-chairman, Mr. K. A. Sly (G4MR) secretary, Mr. F. J. Tuckfield treasurer, and Messrs. Gilbert, Baldwin, and Hine were elected to the Committee. The secretary then read an account of the past year's activities followed by the presentation of the balance sheet by the treasurer. Morse practice followed, the meeting being closed by query corner.

Members are still required, and anyone who comes to one of our meetings will be welcome. Members of His Majesty's Forces will be made honorary members.

PRACTICAL TELEVISION

(*Continued from page 383*)

Furthermore, it is necessary to ensure that there is no possibility of interaction between receivers in reasonable proximity to one another. This is usually done by arranging attenuator pad boxes which give an attenuation in signal of the order of 40 to 50 decibels. Spurious signals fed back from the receiver due to defects in design are therefore reduced to a very low level when compared with the television signal input. At the main distribution amplifier position, provision is usually made for a monitor picture to be observed by the visiting engineer, for as a rule the amplifier is not under continuous observation. Time-switches ensure that the complete circuits are made alive for operational purposes during the pre-arranged periods of transmission. If there is a resident engineer in the block of flats then warning-signals of a visual or aural form can be provided to allow for the few occasions when breakdowns arise. Should the proposals which are now on foot materialise, then it is certain that one of the local distribution schemes which have been described briefly will be used, and it will be interesting to see which one proves the most satisfactory.

A Neon-tube Test Unit

A Simple Piece of Test Apparatus for the Experimenter

THE apparatus described in this article is a very economical and versatile tester and audio-frequency oscillator which should prove useful to any radio amateur. The component parts will usually be found in the "junk box."

This unit may be used as a sensitive continuity tester for point-to-point testing, and also for the testing of the component parts of a receiver or transmitter such as condensers (mica, paper or electrolytic), transformers, coils, resistors, chokes, etc.

The oscillator may be used as a code practice set, keying monitor or audio-oscillator. The frequency of the oscillator is variable from 50 to 10,000 cycles/second.

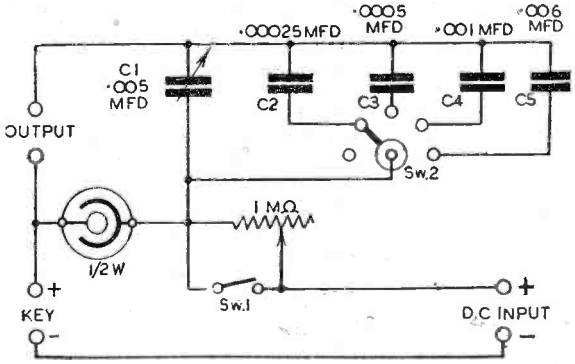


Fig. 1.—Wiring diagram of the simple Neon-tube test unit. Either batteries or external power pack may be applied.

The component parts are connected as shown in the diagram, Fig. 1.

Operation

For point-to-point testing, and as a continuity tester, a 90v. D.C. supply is connected to the terminals marked "D.C. Input." Sw. 1 is thrown to the "Off" position. The apparatus to be tested is connected to the terminals marked "Key" by means of test prods.

In testing chokes (both audio and radio frequency), transformer windings, resistors up to 1 megohm, coils, etc., a steady glow indicates a continuous circuit; an intermittent flash indicates poor connection or intermittent circuit; and failure of the Neon lamp to glow indicates an open circuit or no connection.

In testing condensers (paper or mica type) a good condenser will cause one flash of the Neon lamp when the condenser is connected to the test prods. A condenser that causes the Neon to glow faintly and does not flash has poor insulation and should be discarded. Failure of the Neon lamp to glow indicates an open condenser and a continuous glow indicates a shorted condenser.

Testing Electrolytic Condensers

In testing electrolytic condensers, be sure the correct *polarity* is applied to the condenser under test, and also do not apply more than the rated voltage. The majority of electrolytic condensers will withstand 90 volts, but some of the by-pass variety are designed only for use at lower voltage, and must not be tested with 90 volts. These low-voltage condensers may be tested by measuring the resistance of the condenser, and any that do not have a fairly high resistance should be rejected. (Note: In using a resistance meter in this test reverse the test prods if a low reading results, as the polarity of the resistance tests may be causing the low reading.) Electrolytic condensers may be tested at their rated voltage by increasing the voltage at the terminals marked "D.C. Input" to the proper value. Electrolytic condensers will cause the Neon lamp to flash once when connected or at regular intervals; if the rate of flash is not over 15 times per second the condenser is satisfactory. Condensers which flash more often are leaky, and will cause trouble sooner or later. Condensers which do not flash intermittently but cause a partial glow of the Neon lamp are leaky and should not be used. A shorted condenser will cause a bright glow of the Neon lamp, and failure of the lamp to glow indicates an open condenser.

As a Keying Monitor

In using the unit as a code practice set, or keying monitor, connect a 90v. D.C. supply to terminals marked "D.C. Input," throw switch "Sw. 1" to the "On" position, connect the headphones to terminals marked "Key." Close the circuit by means of the key and adjust resistance R1 until a steady note is obtained, then adjust "C1" and "Sw. 2" until desired tone is obtained.

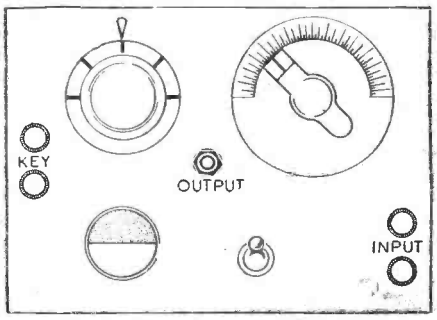


Fig. 2.—Panel layout for the test unit.

As a Modulator: Signal Generator

The unit could also be used as a modulator for a radio-frequency oscillator or "signal generator," and as such would furnish a modulated signal of any frequency within the limits of the audio-oscillator. In connection with a valve voltmeter a fairly accurate response curve could be run on a radio receiver. The audio-frequency should be compared with a known standard or estimated by ear in each case, and the voltage at input and output for each frequency measured with the valve voltmeter.

The Neon tube circuit will oscillate more uniformly if allowed to run for several hours, previous to the test, at twice its rated voltage.

A Moving Scale with Magnetic Cursor

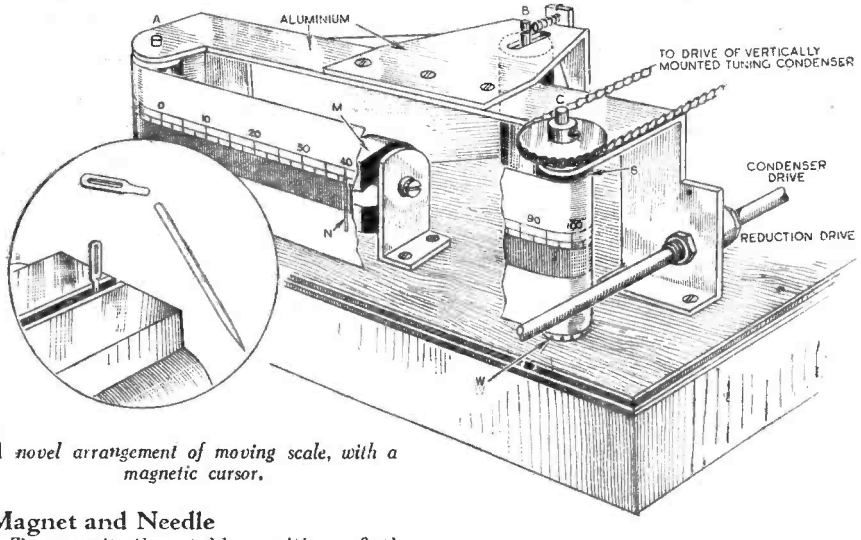
A Novel Arrangement which will Appeal to the Experimenter

WHEN contemplating the design of a new scale for a reconditioned receiver, a rather attractive scheme suggested itself when the writer idly experimented with one of the "Eclipse" midget high-density magnets of the horse-shoe pattern.

There must be few people who are not familiar with the more obvious characteristics of the common magnet, such as the principle of influencing steel or iron objects through the medium of a sheet of paper, and it is this simple method which is the basic function of the cursor in this arrangement.

A fine sewing needle (N), and one which is as straight as possible, is vertically positioned on the paper scale, being held so by the influence of the strong midget magnet (M) referred to above.

The paper scale only is governed by the control of the tuning condenser movement, whilst the needle simply rolls over the moving paper scale.



A novel arrangement of moving scale, with a magnetic cursor.

Magnet and Needle

To permit the stable position of the needle during the scale movement, it is, however, necessary to break away the eye of the needle as is depicted in the inset illustration, which shows the use of a vice for a clean and safe method of breaking, using, of course, a pair of pliers.

The magnet is mounted directly on to the receiver chassis, being clamped by two 16-gauge aluminium or brass brackets, as shown, careful centring in relation to the scale being carried out. The scale movement is reasonably compact, and entails work which the majority of constructors will find little difficulty in executing neatly. It consists of a series of three wooden rollers, A, B and C, assembled in triangular formation on the chassis, and mounted on a shaped 16-gauge aluminium chassis.

The tension of the paper scale is maintained by spring loading the rear roller (B) at both ends.

Condenser Drive

The condenser drive is carried out by chain coupling, but reduction is left to a conventional drive head of epicyclic pattern, the chain wheels have a 1 : 1 ratio. To mount the rollers, the bearing shafts in each case pass right through the wooden doweling, being cleated by grub-screws let into countersunk holes, and securing by one or two threads in tapped holes previously made in these ¼in. shafts.

To retain the paper scale consistently on the vertical rollers, a number of wire nails (W) are equally spaced and driven into the bottom of each roller.

At the extremes in the scale movement, suitable stopping is brought about at the condenser, thus it is unnecessary to make provision for this in the scale assembly. Correct alignment in relation to the magnet and needle may be carried out after the final constructional detailing.

To ensure a smooth paper movement, the scale should comprise a good class of ivory paper, procuring as long a strip as possible, but invariably it will be found necessary to make one or more joins, according to the proportions of the scale; but different substitutes are plentiful, and the writer has experimented with extremes in quality such as hot pressed cartridge paper and one-sheet Bristol board, the merits of each being dependent on the tenacity of the spring-loaded roller and the driving roller.

Driving Roller

In the model illustrated it will be seen that the driving roller is covered with a thin rubber sleeve (S), obtained by cutting up an old domestic washing glove and gluing to the roller.

Finally, a word on the magnet and needle relationship to the paper. Too rough a paper will tend to cause a jerky movement, so a little patient experimenting in this respect is advisable, making sure that the attractive influence of the magnet on the needle does not deviate the scale from a truly vertical position.

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.

Abstracts Published.

TELEVISION RECEIVERS. — Telefunken Ges. Fur Drahtlose Telegraphie. No. 501532.

In a television receiver, in which the screen of a cathode-ray tube 11 (Fig. 1) is viewed in a mirror 12, the cathode-ray tube is tilted away from the observer so as to reduce the likelihood of the observer viewing the screen directly.

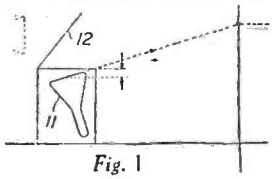


Fig. 1

CATHODE-RAY TUBES.—Baird Television, Ltd., and Nuttall, T. C. No. 501535.

In a tube wherein an electrode 4 (Fig. 2), upon which an electrostatic image is reproduced by a scanning beam, controls a flooding electron beam to form a luminous image, the flooding beam is produced only during those times when the scanning beam is not incident upon the control electrode to produce charges thereon.

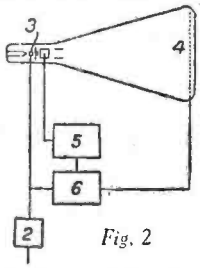


Fig. 2

In television systems, the scanning time may be reduced to 50 per cent. of the line period to obtain a long line for the flooding beam. When the scanning beam is not in operation, other signals, e.g., corresponding to other images, may be transmitted and reproduced in further tubes more especially in colour and stereoscopic systems. The luminous images may be projected on to a screen. The image signals are supplied to the control grid 3 from an amplifier 2. The line frequency component of scanning is effected by means of an oscillator 5, from which pulses are supplied through a shaping circuit 6 to the electrode 3 to change the scanning beam into a flooding beam. Impulses may also be applied from the circuit 6 to the conducting core of the mosaic 4.

CATHODE-RAY TUBES; LIGHT VALVES.—Bosch, F. J. G. Van Den. No. 501816.

A cathode-ray produced by a gun 11 (Fig. 3) scans a screen 12 capable of developing under the bombardment of the scanning beam localized static charges which affect the orientation of a multitude of soft iron particles or filings suspended in a clear liquid so as to permit the passage of light between the particles on to a larger screen The screen 12 may be the ordinary zinc sulphide screen and the liquid, preferably a light oil such as paraffin, fills a disc-like container 15 clipped on to the end of the tube. Light from a powerful source 14 projects on to a further screen an enlarged and intensified replica of the charge image built up on the screen 12 by the modulated scanning ray.

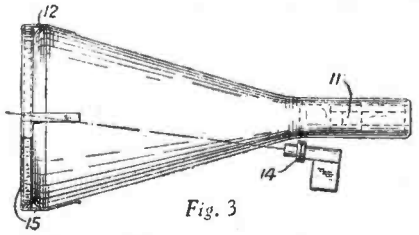


Fig. 3

NEW PATENTS

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

Specification Published.

515982.—M-O Valve Co., Ltd., Aldous, W. H., and Espley, D. C.—Thermionic rectifier.

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

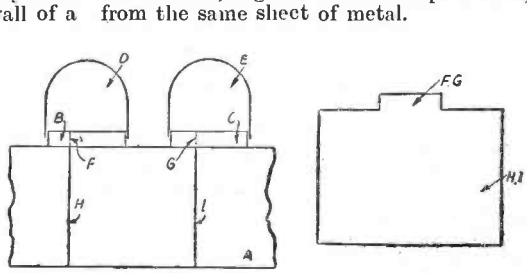
Improved Circuit Layout

WHEN using metal or similar single-ended valves, in which all the valve connections are taken out at one end of the valve, it is usual to provide a screen between the grid and anode connections in order to reduce feed-back.

This screen can very conveniently take the form of an extension of the wall of a screening box separating successive amplifier stages. Fig. 1 shows such an arrangement in which *a* represents part of the amplifier case, *b* and *c* are two valve sockets which are fitted on the case (chassis) *a* and are used to carry metal tubes *d* and *e*. The screening surfaces *f* and *g* are continuations of partitions *h* and *i* which screen the circuit elements belonging to the individual amplifier stages electrostatically and electro-magnetically. These partitions will often be found to render coil cans unnecessary.

Screening Partitions

Fig. 2 shows one of the partitions, and it will be seen that the continuations *f* and *g* used for the screening of the valve leads are cut out, together with the partitions, from the same sheet of metal.



Figs. 1 and 2.—Screening boxes, and detail of screening partition.

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).

"Practical Wireless" with the B.E.F.

SIR,—Not only do I find your paper of great interest, I also have found for years one page of great importance to me, and that is the "In Reply to Your Letter" page. These replies gave me my first urge to have a try to dabble with wireless. As I am now serving with the B.E.F. I greatly miss listening to DX, etc., on my old two-valver which I built myself.

Nevertheless, I am pleased to say that my wife sends on your fine paper to me each week while I lie in hospital. Although we have plenty of reading matter PRACTICAL WIRELESS is sought after by all the patients here.—A. EDEN (No. 2 General Hospital, B.E.F.).

Correspondent Wanted

SIR,—I have been a reader of your fine publication for the past four years, and have found its articles very helpful. I shall be glad to get in touch with any short-wave fans in my district.—R. FARLEY (59, Westdale Road, Plumstead, S.E.18).

DX on Medium Waves

SIR,—With reference to your recent article on medium-wave DX, I beg to add my sentiments. Having been a reader of your journal since its inception, and, prior to then, of *Amateur Wireless*, since 1924-5, I think I can claim to have seen quite a few changes in the world of radio. Commencing my activities with a humble crystal set in 1924, I graduated to a single valve (Bright Emitter!) thence to simple (Det. L.F.) two and three valvers, venturing in 1926 to tuned anode (H.F.) and sundry neutralised circuits. My first S.W. set came in 1927, which was a lucky year for DX. In that year I managed to receive W2XAF (then a remarkable feat!). It was not, however, until some years later, 1931-2 to be exact, that I succeeded in receiving any medium-wave DX. I then successfully received WGY (Schenectady) on a straight (1—v—1) battery set, using an indoor aerial! My interest in B.C.L. radio seemed to wane about that time, and I turned my attention to short waves once again; this time to the transmitting side, and in 1935 I was issued with my first A.A. permit. The following year, 1936, I was granted a full ticket, with the call sign G5UJ. Since that time, right up to the commencement of hostilities, I have been conducting various experiments, and have had the utmost pleasure out of my hobby. Now, unfortunately, owing to the war, I am banned from this particular side of my activities, and naturally incline towards the other end of the scale, i.e. medium-wave (B.C.L.) DX, etc., as an alternative. Many ex-hams will, I am sure, turn their attention in this direction sooner or later. Your paper has catered widely for this class of experimenter, therefore I would suggest, if possible, a short series of suitable circuits, or sets, which could be built up from the usual assortment of gear, etc., usually to be found in the ardent experimenter's workshop (not the more finished sets, demanding expensive Litz wound coils, and sundry, and complicated, tuned circuits).

Surely such a set would be possible of design and construction, even should it fail to give the super selectivity of the more advanced superhet circuit. Again thanking you for the splendid articles, circuits, etc., and not forgetting our old friend "Thermion," with his weekly contributions which go so far to make your paper always worth reading. I trust 1940 may prove a "trumper" year for your endeavours and that you may continue in publication right through hostilities, until *peace* is once more established, and many years beyond that.—S. GEOFFREY DOOD (Rotherham).

A 7 mc/s Log from Scotland

SIR,—Noticing the increasing interest of your readers in 7 mc/s logs I herewith submit mine. The RX here is a 1-v-2 working from an eliminator (home-built), and the time is from 23.00 G.M.T. onwards.

7 mc/s *Phone:* PY1FX, PY2LN, PY4CB, PY4CT, PY4DE, PY4DJ, LU2EE, LU3KV, PU9AW.

7 mc/s *C.W.:* PY1FD, PY2IM, PY2NH, PY2OE, PY2HH, PY2KG, W9CTG and LU2BD.

Latest QSL's received are: VQ8JM (Mauritius), OQ5IM (14 mc/s C.W.), but I have stopped sending reports since the beginning of hostilities.

Like many other readers I was troubled with very bad fading on the "Home Service" stations, but discovered I could cure it by removing the earth wire from the set. Wishing PRACTICAL WIRELESS the very best in 1940.—J. STEWART (Bonhill, Dumbartonshire).

Prize Problems

PROBLEM No. 383.

AFTER using his three-valve battery set for some time, Atkins decided that he would like to go in for short-wave listening, and accordingly purchased a well-known make of short-wave converter. He tried this with his receiver, adopting the connections recommended by the makers, but it failed to function. He had both the converter and his receiver tested and they were both found to be in order. What was wrong? Three books will be awarded for the first three correct solutions opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 383 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, January 22nd, 1940.

Solution to Problem No. 382.

When Jackson mounted his fuse-holder he overlooked the fact that his metal chassis would short-circuit the terminal heads, as they were level on the underside. He should have placed a layer of insulating material under the holder and not bolted it down so tightly.

Only two readers correctly solved Problem No. 381, and books have accordingly been forwarded to H. Dixon, 7, Clarence Place, off Castle Road, Scarborough. J. Lyslap, "The Shack," 29, Victoria Park, Kirkcudbright.

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.

Issues of Practical Wireless ... 4d. Post Paid
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/3 " "

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	*Date of Issue.*	*No. of Blueprint.*
CRYSTAL SETS.		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve: Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	—	PW36B
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)	22.5.37	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)	12.6.37	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)	14.8.37	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	PW73
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)	8.9.38	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
All-Wave "Corona" 4 (HF Pen, D, LF, Pow)	9.10.37	PW79
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve: Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF, Pen, D, Pen)	—	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	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)	24.7.37	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	31.7.37	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)	30.7.38	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))	19.3.38	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		WM401
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.		
Consocelectric 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. 6d. each.		
Heptode Super Three A.C. *May* '35		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)	—	AW417
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
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
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve: Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve: Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) *Aug.* '35		WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-) *Nov.* '35		WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-) *Mar.* '36		WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW402
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

In reply to your letter

Speaker Matching

"I have a receiver with a valve in the output stage, which, according to the maker's lists, requires a load for proper matching of 4,000 ohms. The speaker which I wish to use, and which has given me very good service for a long time, is rated at 1,250 ohms, and so that I can get the best from it I should like to know what ratio of transformer must be used. The speaker has a transformer with various terminals giving different ratios, but on test I do not seem to notice a great deal of difference. But I should like to use the proper ratio and should, therefore, be glad if you could give this."—S. G. (Bolton).

FOR the speaker and valve load in question the ratio of transformer required is approximately 2.7 to 1. Your tests were probably made with the low ratio tappings, and these may all have been round about 3 to 1, and thus you would fail to notice a great deal of difference in the results. The formula for obtaining transformer ratio for speaker matching is:

$$\text{Ratio} = \sqrt{\frac{2 \times \text{Total valve impedance}}{\text{Speaker impedance.}}}$$

This formula applies to moving-coil speakers, and it is usual in the case of the old-pattern horn or reed type of speaker to take the total valve impedance only, and not double the impedance as in the above formula.

Double Decoupling

"Is there any objection in the arrangement shown in my sketch for decoupling a detector stage? I have used a 50,000 ohms anode resistance, with two 25,000 ohms decouplers, having 2 mfd. fixed condensers from each side of the decouplers to earth. It seems to have cut out the trouble I was experiencing, but I am wondering if there is any drawback in using such a scheme."—L. J. H. (Hinckley).

THERE is nothing wrong in the scheme, but you may find that you could have obtained the desired end in an alternative way. You have used two series resistances, and two condensers which are, in effect, in parallel, and thus one resistance of 50,000 ohms and a 4 mfd. fixed condenser may have worked just as well. On the other hand, there is sometimes a difficulty in removing instability by simple decoupling schemes, and a double circuit such as that you have tried may have to be used. It is generally better, however, to try to find the cause of the trouble so that normal methods may be applied, rather than to use elaborate decoupling schemes.

Negative Feed-back

"I wish to apply negative feed-back to my push-pull amplifier, but am uncertain regarding the proper method of doing so. Could you give a circuit and values for the necessary components? I am using two Osram KT.66's in the output stage."—D. L. (Dunstable).

IF you are using transformer coupling in the push-pull stage, you should employ one of the split-secondary L.F. transformers so that each "leg" of the output stage may be isolated. The feed-back components are merely a resistance and condenser joined between anode and grid, and to enable the decoupling to be applied the feed-back is taken to the centre or low-potential end of the grid winding on the transformer. Therefore, with the split second transformer, each low-potential end is joined to earth through a 5,000-ohm resistance, and a resistance of 100,000 ohms is joined from the anodes of the output valves through a .25 mfd. condenser to the low-potential end of the grid winding. It is recommended that a 100-ohm resistance be joined in each anode lead if you have not already done this, and furthermore that a 100,000-ohm resistance be shunted across each half of the secondary winding.

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.

Reaction Control

"I am having difficulty in getting smooth reaction on the set. I have tried all condensers, but they do not appear to make things better. The coil is an old pattern (I believe home-made) and I wonder if this is the cause of the trouble. Can you suggest any improvement or way out of the difficulty?"—B. M. (Southampton).

THE reaction winding may be too large, and thus need a very small capacity for reaction control purposes. We suggest you first make certain that H.F. choke and grid condenser and leak are suitable, and then try the effect of a smaller winding. These remarks only apply if the reaction is fierce, that is, oscillation takes place before the signal has been built up to sufficient volume. If, however, it is difficult to make the set oscillate, even with a large condenser, then the reaction winding is too small or is too far away from the grid winding.

Faulty Smoothing Condenser

"I have a small Universal mains set which has developed a fault in the form of very rough music and speech, the latter, in fact, being almost indistinguishable. I wonder if you can, from this, tell what is wrong with the set and how to cure it. I am using it on A.C. supply, 240 volts."—R. H. (S.E.11).

THE trouble sounds very much like a raw A.C. supply getting through to the set—that is, ineffective smoothing. We imagine that the receiver is one of the "Midgets" with a field speaker winding used as a smoothing choke, and think that the most likely cause of the trouble is an open-circuited smoothing condenser. This is, no doubt, an electrolytic, and we suggest that you try the effect of connecting a new electrolytic condenser between each side of the field and earth. This will no doubt cure the trouble.

Valve Screening

"I use in my set a metallised valve in the detector stage, but am troubled by instability. When I was testing round the set I found, however, that when I held my hand tight round the detector the trouble stopped, although the valve is metallised and I have connected the correct filament pin to earth. This is indicated by a label 'E' stuck on the valve. Can you suggest why the metallising fails to stop the trouble in this case, and why my hand does do it?"—B. D. R. (Newport, Mon.).

THE metallising is generally carried down on to the bakelite valve base and a ing of wire is taken round the point where glass and base join, and this wire is taken to the filament pin. If the glass bulb has become loosened, or has broken, the metallising may not be joined to the filament pin, and thus is not being earthed. On the other hand, the metallised surface may have fractured at the point where the wire makes contact, and this is having the same effect. Probably the best solution is to obtain one of the small aluminium valve screens and place this over the valve and earth it, when your trouble should be removed.

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.

E. A. M. (Denton). Briefly, the anode current flow is controlled by the incoming signal, resulting in an anode current variation. This variation, flowing through the anode load, results in voltage differences across the load, and these are passed on to the next stage.

P. N. R. (Gravesend). We are unable to supply blueprints of commercial receivers. You should write to the makers.

G. T. (W.2). You will probably find that the trouble is due to the transmitter, and is one of the difficulties met with in the new arrangements caused by the war. There is no cure.

A. E. (Kenfig Hill). The amplifier will work with any good pick-up such as that mentioned by you.

T. W. (Leeds 12). The disc machine is now obsolete and in any case there are no television transmissions now.

J. B. (Southampton). We would not advise the modification. Could you let us have your reasons, when we may be able to suggest some alternative scheme? A stamped, addressed envelope will ensure a postal reply.

W. T. (Edinburgh). We have no details of the particular set and therefore cannot give instructions for modifying it.

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

Notes from the Test Bench

Colour Codes

THE majority of resistors are colour-coded by having the body painted one colour, one of the ends coloured, and a dot or a band of colour round the body about the centre point. There are, however, several manufacturers who are adopting a somewhat different procedure, and in place of colouring the entire component, rings or bands of colour are placed at one end. In this case the first colour band is the equivalent of the body colour, the next is the equivalent of the tip colour, and the remaining band is equivalent to the usual dot. The three bands are thus read in order—body, tip, dot. The colour references are repeated for the benefit of those who are not familiar with them :

COLOUR	*FIGURE*	*No of noughts*
Black	0	0
Brown	1	0
Red	2	00
Orange	3	000
Yellow	4	0000
Green	5	00000
Blue	6	000000
Violet	7	
Grey	8	
White	9	

H.F. Chokes

WHEN using an all-wave receiver some difficulty is often experienced in obtaining smooth reaction effects on all wavebands. The use of a properly designed all-wave choke should, however, ensure that the choking effect is adequate, and if such a component is used, and reaction is erratic, attention should be paid to other components in the detector stage. If, however, any doubts exist as to the suitability of the choke the idea of connecting special short-wave chokes in series at each side of the choke should be tried. Another idea which is not often seen in practice is to include a low-value non-inductive resistance on each side of the choke, in place of the short-wave chokes. Values up to 5,000 ohms may be tried.

Microphone Leads

WHEN using a microphone and it is desired to place this some distance from the amplifier, it is quite in order to use long leads, provided that they are screened. If a transverse current type of instrument is used, the transformer and battery associated with the mike should be placed as near to the instrument as possible, and the secondary then connected, via the extension leads to the receiver. Do not use the long leads on the primary side, as this may give rise to various troubles apart from the introduction of hum.

Classified Advertisements

Advertisements are accepted for these columns at the rate of 2d. per word. Words in black face and/or capitals are charged, double this rate (minimum charge 2/- per paragraph). Display lines are charged at 4/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, Strand, London, W.C.2

RECEIVERS, COMPONENTS AND ACCESSORIES

RADIO CLEARANCE, LTD., 63, High Holborn, W.C.1.

BRITISH BELMONT 8 Valve plus Magic Eye All-Wave A.C. Superhet Chassis, 4 wave-bands, two short, medium and long, fitted latest Mullard Octal Base American type Valves.
Size of Chassis, 13½" x 10" x 3". Supplied with Valves and Knobs, but less Speaker.
Chassis only, **£5/19/6** each.
Speaker for above, **17/6** each.

RICE-KELLOGG SENIOR 12" Moving Coil Speakers, 20 watts, 1,000 ohms, 11 ohms Speech Coil. Without Speech Transformer, **32/6** ; with Transformer tapped 3,000 ohms and 7,000 ohms, **35/-**.

GRAMPIAN 10" 10 watt, 2,500 ohm Energised Speaker. Heavy Cast Frame .. .. **15/-** each
With heavy-duty Pentode Speech Transformer **17/6** each
Heavy-duty Speech Transformers, Pentode Matching **2/11** each

PLESSEY 2-gang Straight Condensers .. **1/6** each
Ditto, 3-gang .. .. **2/-** each
PLESSEY Motor Drive Press Button Unit. Supplied complete with 8-way Press Button Control. Precision job throughout. First Grade Motor. A.C. 24 volts **21/-** each

POLAR ½ meg. Volume Controls, with S.P. Switch **1/6** each
Ditto, with D.P. Switch .. .. .. **1/9** each

YAXLEY type 4-pole 3-way Single Bank Switches **9d.** each
2,500 ohm Fields Coils .. .. .. **9d.** each
1 (One) gross Assorted Resistances.. **5/-** per gross
Metal Chassis Drilled. 15" x 6" x 1½" and 11½" x 8" x 2½" **1/6** each
Push Back Wire .. .. .. 12yds. **10d.**

ROLA P.M. Speakers, latest type 7½in. Cone, with Pentode Transformer .. .. Boxed **14/6** each
Clock-faced Dials, 5" x 3½", with printed 3-wave scale Ox-Copper Escutcheons and Glass.. .. **3/6** each
Ditto, less Escutcheons .. .. .. **2/6** each
Horizontal dials, with plain scale 7½" x 3½" and pointer **1/-** each
100ft. Copper Aerials, Insulated .. .. **2/-** each

FILAMENT TRANSFORMERS, input 200-250 volts, output 4 volts 4 amps, 4 volts 6 amps .. **4/11** each
G.E.C. Mains Transformer, American windings, 350-0-350 volts, 65 m.a. 5 volts 2 amps, 6.3 volt 2.5 amp. Suitable for replacements in G.E.C. models **5/6** each
24 mfd. Can type Electrolytics, 450 volts working **1/6** each

PRESS BUTTON UNITS with 6 Press Buttons, ready for wiring into set, with circuit .. .. **4/11** each
Stranded Push-back Wire, **1d.** per yard, 12 yards **10d.**

CHASSIS Mounting Valve Holders, American, 4-, 5-, 6- and 7-pin, **4d.** each. Octals **6d.** each. Loctals **10d.** each. 7-pin English type, **3d.** each.
ROTHERMEL Piezo Crystal Speakers, 7½in. Cone. List 55/-. Our price, **10/6** each. 10in. Cone **12/6** each.
POLAR N.S.F. 1 watt resistances, **4d.** each, **3/9** dozen. All sizes up to 2 meg.
WEARITE MAINS TRANSFORMERS, R.C.B. type. 350-0-350 v. 80 m.a., 5 volt 2 amps. 6.3 volt 5 amps **6/11** each
Type R.C.4. 500-0-500 v. 150 m.a. 4 volts 2 amps, 4 volts 2 amps, 4 volts 2.5 amps, 4 volts 5.6 amps, **21/-** each

PHILCO MAINS TRANSFORMERS. American Windings, 350/350 volts 65 m.a., 6 volts 3 amps., 5 volts 2 amps. .. .. **5/-** each
Ditto, but 80 m.a. .. .. **6/6** each
Ditto, but 90 m.a. .. .. **7/6** each
WEARITE 110 k/c I.F. Transformers .. **1/-** each
AMERICAN C.T.S. Volume Controls, finest made, divided spindles, length 2½in. with switch, 2,000, 5,000, 10,000, 25,000, 100,000 .. .. **2/6** each
Wire-wound 5 watt (less switch), 10,000, 25,000 ohms, **2/-** each

PLESSEY DRY ELECTROLYTICS, CAN TYPE.

12 x 16 mfd. 350 volts working	1/6 each
6 x 6 „ 500 volts working	1/6 each
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8 x 8 x 8 mfd. 500 volts working	2/11 each
16 x 8 x 4 x 4 mfd. 500 volts working	2/11 each
12 x 8 x 8 x 8 x 8 mfd. 500 volts working	2/11 each
16 mfd. 450 volts working	1/3 each
16 x 16 mfd. 350 volts working	1/3 each

(Continued in next column)

RECEIVERS, COMPONENTS AND ACCESSORIES

(Continued from previous column)

B.I. Wire-end type, Bias Electrolytics.
50 mfd. 12 volts .. .. **1/6** each
50 mfd. 50 volts .. .. **2/-** each
Tubular Wire-end non-inductive paper, all sizes up to 0.1, **5d.** each, **4/9** dozen.
Metal Case 1 hole fixing Electrolytic Condensers, 550 volts working, 8 mfd. .. .. .. **3/-** each
STANDARD TELEPHONE HEADPHONES, resistance 2,000 ohms and 4,000 ohms .. .. **6/11** pair
Volume Controls, 1,000 and 5,000 ohms, with switch. **1/3** each
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PLESSEY Energised Speakers, 10in. Cone, 2,500 and 1,000 ohm field, with trans. .. .. **12/6** each
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RUBBER GROMMETS .. .. .. **4d.** dozen
BATTERY Output Pentodes, well-known make. **4/6** each
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RAYTHEON First-grade Valves, largest stockists, all types in stock, including Glass Series, Glass Octal Series, Metal Series, Bantom Series, Single-ended Metal Series, and Resistance Tubes, all at most competitive prices ; send for Valve Lists.

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ALL GUARANTEED. POSTAGE EXTRA.

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15/-—Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7", 15/- the Kit.

21/-—Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.

5/-—100 Wire-end Resistances, assorted capacities, ½ and 1 watt, 5/- per 100.

TELSEN ; Ormond Loud-speaker Units, 2/6 ; Crystal Sets, 5/6 ; Westectors Type W2, 2/6 ; 8 mfd. Electrolytic Condensers, 500 volts, 1/8. Crystal Detectors, 2/- ; Crystals, 6d. ; Marconi V24 Valves, 9d.

2/-—Tool or Instrument Carrying Cases, ex Government Stock ; Wood 9" x 7" x 7", 2/-.

SPECIAL Offer, Limited Quantity Torch Bulbs 1.5v., 21/- per 100 ; 2.5v. and 3.5v., 17/6 per 100.

SOUTHERN RADIO, 46, Lisle Street, London, W.C. Gerrard 6653.

VAUXHALL.—All goods previously advertised are still available ; send now for latest price list, free.—Vauxhall Utilities, 163a, Strand, W.C.2.

BANKRUPT BARGAINS. Brand new 1939 models, makers' sealed cartons, with guarantees, at less 40 per cent. below listed prices ; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

5/- BARGAIN PARCEL comprising Speaker Cabinet, Drilled steel Chassis, condensers, resistances and many other useful components. Worth £2. Limited number. Postage 1/-.—Bakers Selhurst Radio, 75, Sussex Rd., South Croydon.

COULPHONE RADIO, Ormskirk. 1940 Brand. New goods only. Collaro motors 12in. turntable, 25/-. Speakers, valves, receivers. 1½d. stamp lists.

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

REPAIRS to moving coil speakers. Cones/coils fitted or rewound. Fields altered or wound. Prices quoted, including eliminators. Pick-ups and speaker transformers rewound, 4/6. Trade invited. Guaranteed satisfaction. Prompt service.
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Staff:
W. J. DELANEY, FRANK PRESTON,
H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Quality Amplifiers

THE design of an amplifier to deliver really good quality has been discussed before in these pages. Usually it is recommended that a very high audio output be aimed at, as the amplifier may then be run well within its capacity and better quality thereby obtained. For many domestic purposes, however, a PX4 type of valve will deliver sufficient output to enable the valve to be run within its maximum rating and still provide sufficient volume for normal purposes. Many listeners, in fact, do not like a loud signal, especially for talks and similar items. They prefer a quiet, subdued output which must be listened to without any background of talking or other noises. For these purposes the amplifier described in this issue will be found ideal, the maximum rated output being (fully loaded) 3.5 watts. The valve is, of course, of the type having an anode dissipation greater than 10 watts and accordingly a licence has to be obtained in order to purchase it. This is not a difficult procedure, however, and it will only take a few days to obtain the required permit. There are, however, many amateurs who already have a valve of this type by them or an equivalent, and this may be used without difficulty. The amplifier has been built from spare parts, but a fully detailed list of parts used is included for those who wish to reproduce the original design.

Drama and Feature Plans for 1940

LISTENERS are to hear more serial plays like "The Four Feathers," more extracts from current stage plays, more comedies of the Wodehouse kind, and more radio documentaries like "The Shadow of the Swastika." These are some of the prospects held out by the B.B.C.'s Drama and Feature plans for the New Year.

Val Gielgud, Director of Drama, is pursuing his policy of introducing frequent radio serials owing to the great popularity of "The Four Feathers," "The Count of Monte Cristo," and "Scenes from Pickwick," all of which have had an immense listener following. Recently Norman Edwards's specially written serial thriller, "Curiouser and Curiouser," began. Another projected serial is "White Velvet," by Sax Rohmer. Anthony Hope's "Prisoner of Zenda" is to be followed by its companion romance, "Rupert of Hentzau." Kipling's "Jungle Book" will, like the "Just So Stories," be serialised for broadcasting.

The last act from Shaw's latest play, "In Good King Charles's Golden Days," is shortly to be broadcast, with Ernest Thesiger and Irene Vanbrugh in the leading parts.

ON "MOON RIVER"

"Moon River, a lazy stream of dreams . . ." Seven nights a week, at 12.30 a.m., E.S.T., these words are heard over WLW as "Moon River," one of the most consistently popular late-hour programmes, comes on the air. The words were spoken by King Whyte, who is pictured above. He has now been called for military service in the Canadian Forces, and his place has been taken by Lon Clarke.

Editorial and Advertisement Offices: "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363. Telegrams: Newnes, Rand, London. Registered at the G.P.O. as a newspaper and for transmission by Canadian Magazine Post.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

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

"Songs of the British Isles"

"OUR Bill," from the Cotswolds and "Charlie" from Devonshire will compère the seventh of the series of programmes entitled "Songs of the British Isles," which will be presented by Gwen Williams and George Lestrange on January 28th. The programmes comprise folk songs, traditional and national airs and dialect songs of England, Scotland, Ireland and Wales.

In the seventh of the series, three of the best-known singers from their respective countries will take part. They are James McCafferty from Northern Ireland, John Tainsh from Scotland, and Haydn Adams from Wales. The flag will be kept flying on behalf of England by the compères, "Our Bill" and "Charlie," played by Freddie Grisewood and Charles Wreford respectively. They will be heard in dialect and will probably sing a song or two also. The B.B.C. Theatre Chorus, trained by Charles Groves, and the B.B.C. Theatre Orchestra will be conducted by Stanford Robinson.

Return of Glasgow Orpheus Choir

LOVERS of choral singing will, on January 27th, welcome back for their second war-time broadcast the famous Glasgow Orpheus Choir under Sir Hugh S. Roberton. The Choir will begin its programme by paying tribute to the memory of Robert Burns in the anniversary week of his birth by singing Granville Bantock's arrangement of "Scots Wha Hae." It is a tradition of the Choir to sing the old Scottish tunes to which the metrical psalms used in Scottish churches have been set. In this programme the tradition will be represented by the tune "Crimond." Items specially arranged for the women's voices of the Choir will also be broadcast and a selection of other choral music will include Gaelic mouth music.

Crosby Band on "Caravan" Series

BOB CROSBY and his band have replaced Benny Goodman's orchestra on the weekly "Caravan" series over WLW and NBC, which began on Saturday, January 6th, at 10 p.m., E.S.T. Helen Ward, songstress, and the Bobcats, "jive" group within the band, will be featured.

Bob, brother of the illustrious Bing, has had a rapid rise to popularity since organising his outfit several years ago. Exponent of the Dixieland type of dance music, his players are considered outstanding interpreters.

Tone Correction

Various Forms of Filter, Corrector and Booster

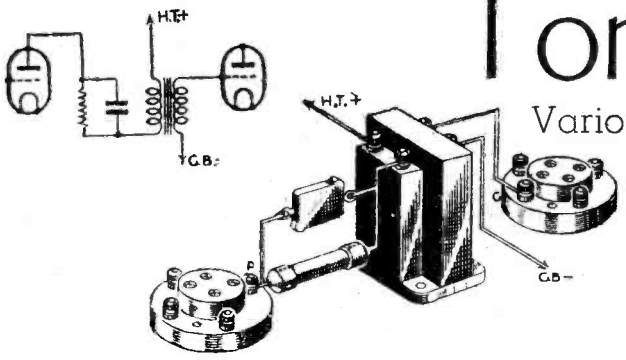


Fig. 1.—A device for cutting bass in a transformer-coupled amplifier.

IT has often been explained in these pages that bass attenuation can be effected by reducing the value of the coupling condenser C in a resistance-capacity-coupled amplifier. The same result, it should be noted, can be obtained by reducing the value of the grid leak R (See Fig. 2). This can be explained by considering the condenser C and the leak R in series as a kind of fixed ratio potentiometer. By decreasing the value of C the impedance of that arm of the potentiometer is increased to a greater extent for low notes than for high, and the voltage available across the resistance R will be reduced for low notes, whereas for high notes there will be little change. If, however, the value of the resistance R is reduced, the relative impedance ratio will be altered in exactly the same way. It is not possible to give actual values, but interesting experiments in tone control can be made by trying the effects of various values of grid leak.

Bass cut in the case of a transformer-coupled amplifier may be achieved by connecting a resistance of, say, 10,000 to 20,000 ohms in series with the primary winding, between the winding and the anode of the valve, and shunting this resistance with a condenser of from .01 to .02 mfd. capacity.

The effect of a resistance alone would be to make an overall drop in volume, but the presence of the shunting condenser permits a greater proportion of the higher note energy to reach the transformer, whilst energy corresponding to the lower notes will be to a greater extent absorbed in the resistance (Fig. 1).

Fig. 3 shows a bass booster for use in a resistance-capacity-coupled amplifier. It will be seen that the anode resistance is divided into two portions: R, which should be approximately equal to the valve impedance, and R_1, of about twice the value. R_1 is shunted by a condenser of .01 to .02 mfd. capacity. As far as bass notes are concerned, the impedance of the coupling resistance is R plus R_1, and full amplification is obtained. For the higher notes, however, the impedance is less because of the capacity shunt, and amplification will be reduced.

High-note Compensation

The effect of very selective tuning circuits is to cut the side bands corresponding to the higher audio frequencies. To an extent this loss of upper register can be compensated for by employing a pentode-output valve. A better and more scientific plan is to use a low-frequency coupling which amplifies high notes more than low notes.

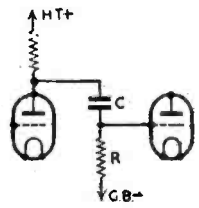
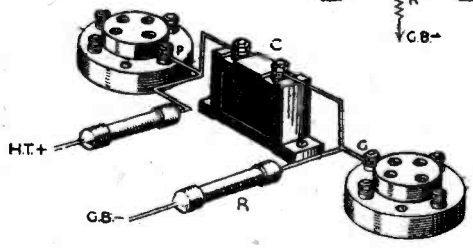


Fig. 2.—In an R.C. coupled amplifier, the reduction of either C or R will reduce the bass response.

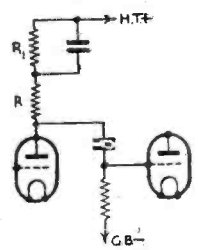


In the case of a resistance-capacity-coupled stage, this can be achieved by using, instead of a pure anode resistance, a resistor in series with an inductance of about half a henry, the resistance being approximately equal to the valve impedance (Fig. 4). Here the impedance of the circuit increases with frequency and is therefore greater for high notes than for low. Since the overall amplification depends upon the impedance of the external circuit compared with that of the total circuit, the gain for high notes will be greater than for low.

This arrangement has one grave disadvantage, however, in that this rising characteristic is operative over the whole range of audio frequencies, so that very high frequencies, including the squeals of atmospherics and the whistles of heterodyning stations will be very much over-accentuated. Fortunately, it is not difficult to avoid this effect. The method is to adopt a circuit which, indeed, amplifies the high notes more than the low but only up to a certain frequency, above which the high notes are not amplified but actually suppressed.

Frequency Cut-off

The circuit is shown in Fig. 5, and is similar to that in Fig. 4, with the exception that the inductance arm is tuned by a small condenser. The values of the inductance and condenser are so chosen that this part of the circuit is tuned to a fairly high audio frequency, in the neighbourhood of 4,000 cycles. At, or about, that frequency the circuit will give maximum amplification and will thus replace much of the high note characteristic. Above 4,000 cycles, however, amplification rapidly falls off until there is more or less complete cut-off. The actual resonant frequency of the circuit can be adjusted to suit individual needs, but it will be found that the figure suggested gives a very satisfactory degree of correction and at the same time avoids heterodyne whistles to a very great extent. Certainly all whistles of frequencies above 6,000 will be suppressed.



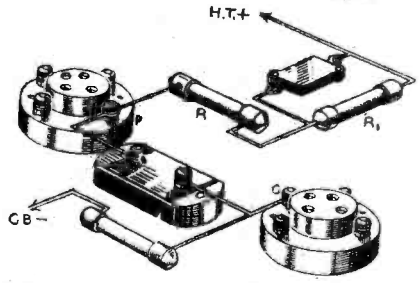


Fig. 3.—A bass booster for an R.C. coupled circuit.

For this circuit the inductance may be an ordinary high-frequency choke, but the value of the condenser must be chosen by experiment unless the makers of the choke publish specific information on this point.

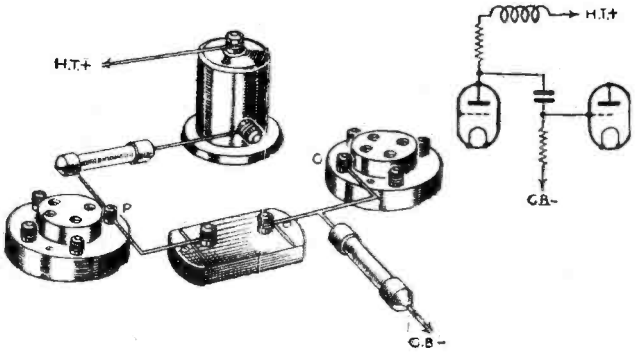


Fig. 4.—The arrangement for a simple treble booster.

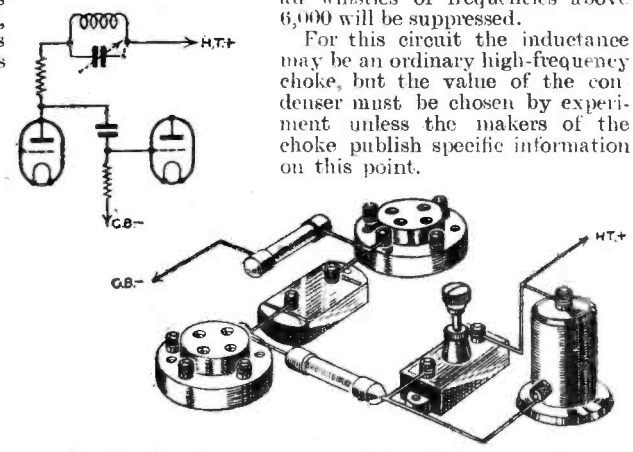


Fig. 5.—A treble booster giving a definite high-note cut-off.

and Filters

Circuit are Discussed in this Article

Another form of heterodyne eliminator which has been used is the tuned-acceptor circuit. This consists of an inductance and variable condenser in series, and is connected in parallel with the circuit from which it is required to eliminate the heterodyne whistle. Thus, the acceptor may be connected across the resistance of an R.C. coupling, or in parallel with the loud-speaker. By tuning the circuit to the frequency of the whistle it is desired to suppress, the acceptor achieves a very low impedance to energy of that particular frequency, which is thus by-passed from the main circuit. The arrangement is shown in Fig. 6; the inductance may have a value of about half a henry, while the condenser may be of the pre-set type and of .001 mfd. capacity. This circuit suffers from the disadvantage that it is only operative at one particular heterodyne frequency, namely, that to which it is tuned. It is true that it may be retuned for other frequencies, but this does not fall in with modern ideas of simplicity of control. Present-day practice, therefore, favours another form of heterodyne whistle eliminator, namely, a low-pass filter, which is a circuit designed to pass all audio frequencies up to a certain value, after which there is a more or less sharp cut-off. Such a circuit can be inserted at various points in the receiver, either between stages or in the output circuit. Where the filter is to be added to an existing set, the latter is the best position, and one of the many commercial forms may be inserted either in series with an ordinary high-resistance speaker or in the primary circuit of the output transformer.

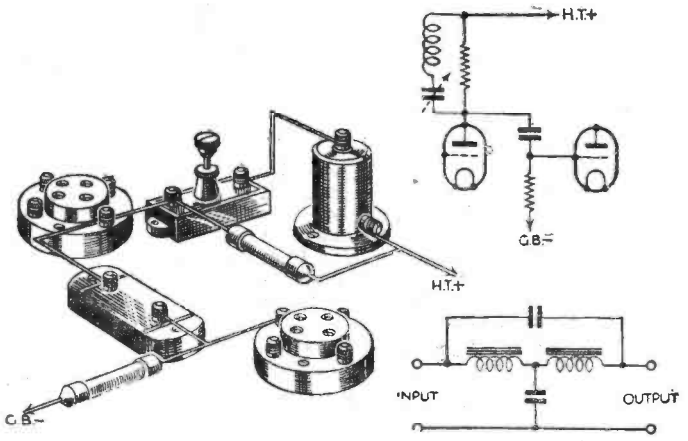


Fig. 6.—A tuned acceptor whistle eliminator.

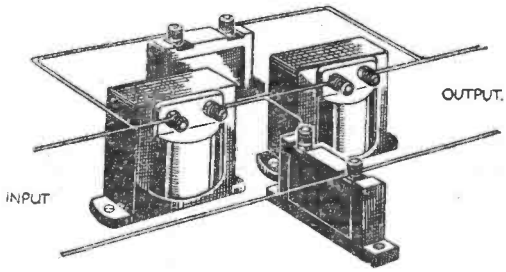


Fig. 7.—A low-pass filter for eliminating heterodyne whistles in the output stage.

A typical form of this filter circuit is shown in Fig. 7. Complete filter units of this type, designed to cut off at some definite frequency such as 3,500 or 5,000 cycles, are obtainable. Fig. 8 indicates two alternative multiple-filter circuits. Fig. 9 shows a typical arrangement, using air-cored chokes, employed as a scratch filter with a gramophone pick-up.

Tone Control

Another system of combining tone control and whistle suppression is shown in Fig. 10, and consists of a resistance R_5 inserted directly in the grid circuit of the first stage of the low-frequency amplifier section of the receiver. It follows a resistance-capacity intervalve coupling, the bias for the grid of the L.F. amplifier being furnished from the resistance R_3. R_3 should be about 500,000 ohms, while the shunting condenser C must not have a capacity exceeding .001 mfd.

Any form of volume control which reduces all frequencies uniformly will eventually result in a serious loss of apparent strength of both very high and very low frequencies, and the bass and very high frequencies will become so attenuated that reproduction will be marred by the over-preponderance of the middle frequencies. Of the numerous methods put forward for avoiding this defect, the one here described, consisting of an adaptation of the tuned-acceptor circuit, is the most satisfactory. The arrangement is shown diagrammatically in Fig. 11. R_1 is the usual volume-control potentiometer, in this case applied to a gramophone pick-up. In addition to the slider tapping, which gives the control of volume, there is a permanent tapping at about one-fifth of the way from the bottom end of the potentiometer. Across the bottom fifth of the potentiometer is connected the acceptor circuit, which comprises an inductance L of about 50 millihenrys, and a .5 mfd. condenser C, with a variable resistance R_2 of 5,000 to 10,000 ohms, all connected in series. The inductance and condenser tune to about 1,000 cycles—the variable resistance in series broadens the tuning and makes the control operative over a band of frequencies in the neighbourhood of 1,000. When the main slider is at the top of the potentiometer, corresponding to big volume, the effect of the acceptor is slight, but at a lower setting the proportion of the middle register absorbed by the acceptor increases progressively, thus maintaining normal tonal quality. An arrangement such as this can very easily be made up by the amateur. It is possible to obtain potentiometers with two sliders, but, alternatively, the tapping for the acceptor can be made by careful soldering.

As this is probably one of the circuits which will provide most interest for listeners who are interested in experimental work, on account of its rather novel form and the use of non-standard apparatus, it might be worth while to give one or two suggestions as to the best method of finding the best working values. Use a standard volume-control potentiometer (the value will be

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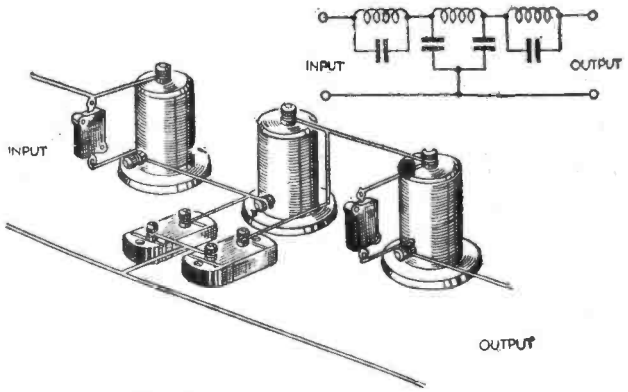


Fig. 9.—One arrangement of gramo-scratch filter.

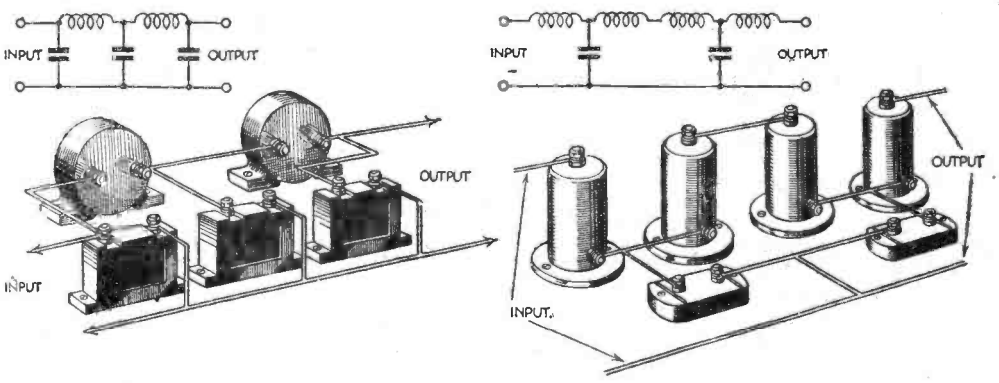


Fig. 8.—Alternative arrangement of multiple filters.

Locating Faults

Methods of Tracking Down the More General Troubles Met With in Receivers are Discussed by the Technical Staff

FROM the correspondence received by the Query Service Department, it is very evident that it is not only the beginners who experience difficulty in locating receiving faults which arise from time to time. While one can fully appreciate a new-comer to the hobby being at a loss as to the cause of the trouble, and the necessary procedure to adopt to trace it, it seems rather peculiar that, say, constructors of several years' standing cannot (or will not) apply their knowledge in such a manner that the fault can be localised. Whether this failure indicates that their knowledge of radio only covers assembling a few components and wiring them up according to a full-size blueprint, or whether it shows that, while their knowledge might be quite sound, they lack the ability to apply it in a systematic sense to individual sections of a receiver, one cannot say, but it is hoped that the brief details given in this article will help all to tackle their problems in an active manner, rather than sit down and adopt, so to speak, a defeatist's attitude, and send out frantic S O S's.

As it is not possible to tabulate all likely defects and their symptoms, some of the more general troubles will be discussed, as it should be possible, by applying a little reasoning, to track down even obscure faults by following the suggestions given below. If some predetermined procedure is adopted by the tester, he will find, after a little practice, that he will undertake to service receivers or amplifiers large and small with much more confidence than when hit-and-miss methods were applied at random. One's abilities will, quite naturally, be limited by one's practical and theoretical knowledge, and so it behoves all serious constructors, especially the beginners, to take every opportunity to increase their knowledge as much as possible. These nights of black-out offer good opportunities for a little serious reading of good text-books on the subject.

General Tests

When testing any apparatus which is new or unknown, always take the precaution of including a suitable fuse in the H.T. negative supply or, as in the case of a mains-operated receiver, apply a simple continuity test between H.T. positive and the common negative earth line. This procedure will prevent any additional harm being done if, by chance, the fault is connected with the H.T. supplies to the various parts of the circuit. With battery-operated receivers, always make quite sure that the H.T., L.T., and G.B. batteries are above suspicion. One cannot always trust verbal evidence on such matters, as it is not unknown, as *very many* practical examples have proved, for a faulty or dirty connection or cell to be entirely responsible for various alleged faults.

If it is possible, make quite sure that all wiring connections are secure and that all components are so fixed that they will not float about or come adrift if the set is turned over during further stages of its examination, before applying any voltages.

No Signals

A multitude of faults can produce this annoying effect. If no special clue is available, then one must start at the very beginning and apply the following routine tests. After bearing in mind the above general remarks, and before applying any voltages, remove each valve in turn and, with a simple continuity tester, *i.e.*, a small dry battery in series with a low reading voltmeter, or a high-reading galvanometer or milliammeter, test the filaments or heaters for continuity. If these tests do not reveal any faults, replace valves and check current consumption of receiver. This can most easily be done by connecting a suitable milliammeter in series with the H.T.

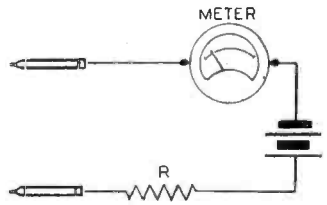


Fig. 1.—Circuit of a test meter showing range-increasing resistance R.

negative lead. For battery-operated sets a meter having a maximum reading of 25 to 30 mA's should be sufficient, but for mains sets a higher maximum reading would be advisable, say, 50 to 100 mA's, according to the number and type of valves employed.

Biasing Voltages

If a reasonable total current consumption is indicated, that will denote that H.T. and biasing voltages are more or less satisfactory, but this should be verified by noting mA-meter reading and removing one valve at a time and seeing what current it is taking. This will be shown by the fall in the meter reading. Note, this procedure is not applicable to mains sets where the current consumption of each valve should be checked by connecting the meter in the H.T. supply to each anode in turn.

These tests will also show if the H.T. feed to each valve is complete, i.e., any valve not indicating a current flow should be subjected to further examination. For example, voltage tests between anode and H.T. negative and screening grid and H.T. negative, when valves of the S.G. and pentode types are being inspected. With mains valves, the cathode circuit must also be examined as a break in the bias resistance or the connection between cathode and earth (H.T.—) will also result in absence of anode current.

High anode current calls for careful checks on anode and/or screen voltages and bias voltages, when such are applied. High H.T. or low G.B. will be responsible, while the opposites will produce low anode currents.

If the G.B. value is in order for the valve concerned, then attention should be given to the H.T. supply, which, if correct at the H.T. battery or rectifier, is no doubt being reduced to a low value by an unsuitable value of resistance, i.e., decoupling or anode load.

It must be realised that when speaking of H.T. and bias voltages, any tests applied to determine these values naturally bring under observation all components in the anode circuits, i.e., H.F. chokes, coils, switches, coupling and de-coupling condensers, L.F. transformers, L.S. or primary of output-transformer, and the reaction circuit, in the case of a detector.

On the G.B. side, one must also check up on the continuity of the grid return circuit, i.e., the coil, grid-leak or secondary of L.F. transformer.

Localising the Trouble

Assuming, at this stage, that the set under test is a simple three-valver of the H.F.-detector-L.F. type, the following procedure should be adopted to limit the field of tests to single stages, thus allowing the tester to eliminate as many likely points of trouble as possible.

In this instance, it would be advisable to concentrate on the detector valve, and the preceding H.F. stage and the output stage can be cut out of circuit in the following manner. Connect the aerial through a small fixed condenser to the connection

(*Continued on page 405.*)

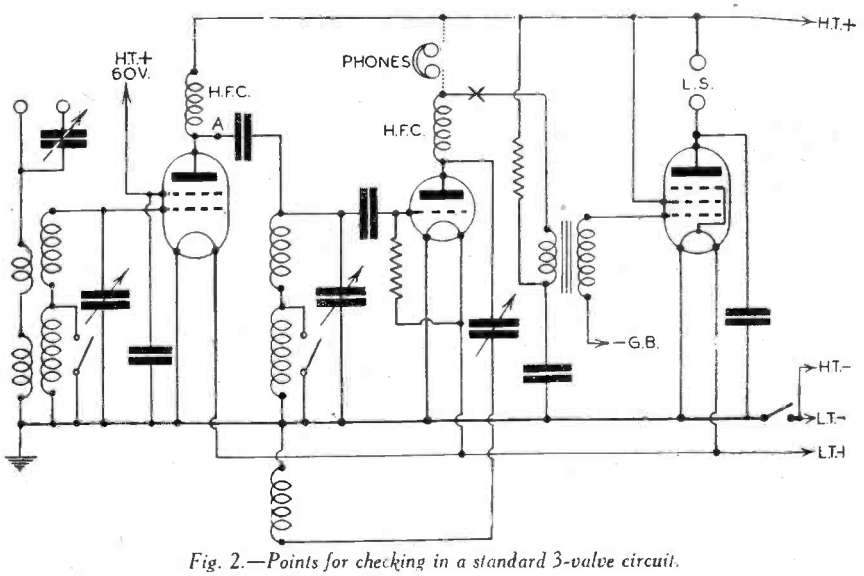


Fig. 2.—Points for checking in a standard 3-valve circuit.

ON YOUR WAVELENGTH

By Thermion

The Television Question Again

ONCE again I put in the plea that the television programmes should be reinstated. I do not believe that our enemies abroad would rely upon such an indirect method of direction-finding as using the television signal. I know that aircraft instruments have reached a stage where they are independent of such methods. In these days, when the black-out is causing most of the population to spend longer periods at home in the evenings, anything that can be done to entertain them should be done. The television service, of course, serves the Home Counties, but there are 8,000,000 people in Greater London, and the reinstatement of the television service might encourage the sales of television receivers. Some hundreds of people at present have expensive television receivers which they cannot use.

The B.I.R.E.

I UNDERSTAND from Sir Harold Moir that the Institution of Radio Engineers proposes to continue to hold its examinations, and as far as possible assist in the requirements of commercial enterprises. Meetings have, of course, been left in abeyance, although it is hoped to recommence meetings very shortly. Meanwhile, papers which would have been read at Members' Meetings are to be published in the Journal of the Institution. The decision to push ahead with the publication of the Journal was taken by the Council after careful consideration, and although war-time costs may affect the size of the Journal, it will, henceforward, be published at least once every quarter.

In deciding to proceed with this matter, the Institution claims to be the first Radio Institution in the world, apart from the American Institute of Radio Engineers, whose activities are solely concerned with Radio Engineering who regularly publish their own proceedings.

Torch Battery Prices

I SEE that the Central Price Regulation Committee have warned retailers that they must not charge more than the prices marked on most torch batteries, and that such must not be offered for sale at more than that price. Such prices were, of course, announced by the battery manufacturers as long ago as November 6th, and these included certain price increases. The public are invited not to pay more, and to report any cases where list prices of British batteries are exceeded. Some of the foreign batteries are, of course, dearer, and it is not possible to control such prices. Members of the public should be wary of batteries the labels of which have been tampered with.

The B.E.F. Programme

HAVE you tried the B.E.F. programme now put out by the B.B.C on 342 metres? I have listened to it on a number of occasions, and found the alternative programme very good. I generally find that the transmission is marred by slow fading, although so far I have always been able to "hold it." Many of my friends, however, tell me that they cannot receive it at all in certain districts around London. Others can get it, but only at poor strength.

Of course, we must not complain, for we are only "eavesdroppers." Nevertheless, I hope that the programme is received much better by those for whom it is intended than it is by most listeners of my acquaintance.

One suggestion which has been made is that the transmission is "beamed" to our troops in France, but I have other theories concerning the fading and lack of punch.

"This Land of Ours"

THE history of American cities, related in terms of the pioneers who founded them and succeeding generations responsible for their development, is being presented in a new dramatic series, "This Land of Ours," which began on WLW on Sunday, January 14th, at 10.30 p.m., EST.

The programmes, which replace "Salute to the Cities," will be presented in a form differing substantially from the latter. The elements of comedy, energy, pathos and accident which played a part in the building of each city will be brought out in scripts by E. Carder of the WLW Continuity Division, who will visit each city to obtain material for the series.

The initial programme told the story of Richmond, Indiana, incorporated in 1840. On the personal history of a man and his wife, from youth to old age, was superimposed highlights in the story of the city, ranging from the first council meeting to the present. One dramatic sequence dealt with the selection of a name for the city from three submitted to its inhabitants. The name Richmond was offered by David Hoover, an uncle, three generations removed, of former President Hoover.

A full dramatic staff will participate in the new series, with Harold Carr as production supervisor. A 30-piece orchestra, directed by Uberto Neely, will supply appropriate music, and, at the close of the programme, a serenade to the city whose history has been dramatised.

In his search for authentic information, Carder will comb each city thoroughly. He plans to see the mayor, newspaper editors, officials of historical societies and old residents—the latter to provide the "flavour" of the city's life as they found it in the past.

I think this idea could be applied to this country, which has a wealth of historic interest.

Response to Broadcast War Appeals

IT is gratifying to note that the record sum of £78,000 has already been collected as a result of Lord Baldwin's appeal for Seamen and their Dependants on December 17th; this figure includes Lord Nuffield's cheque for £25,000 The previous record collection was in response to Lord Southwood's Wireless for the Blind appeal at Christmas, 1938, which realised £42,103.

The response to broadcast appeals since their resumption on November 5th has reached the outstanding figure of £175,981 1s. 2d. This exceeds the sum collected by similar appeals in any whole year up to and including 1935.

The second most successful appeal of the war was that of the Polish Ambassador on behalf of the Polish Relief Fund on November 19th, which realised £27,400. Miss Gracie Fields' appeal for Voluntary Hospitals brought in £18,000, while the "unknown blind man" who appealed for the British Wireless for the Blind Fund at Christmas secured £12,850.

Comparison with the response in the corresponding months of 1937 and 1938 is interesting.

In November, 1937 and 1938, the appeals yielded £12,588 10s. 11d. and £14,718 1s. 6d. respectively, compared with £39,202 16s. 9d. in November, 1939. The December, 1937 and 1938 figures were respectively £45,456 18s. 6d. and £56,574 15s. 2d., compared with £119,778 4s. 5d. in December last.

The response to the appeal on behalf of the Finland Fund broadcast by Dr. Tancred Borenius on January 7th is already £17,000, and many letters have yet to be opened.

B.B.C. Monitoring Service

THE vital importance of broadcasting in time of war needs no stressing. Emphasis, however, on outgoing broadcasts might overshadow the enormously important work undertaken by what is known inside the B.B.C. as the Monitoring Service.

On the outbreak of war, the B.B.C., on behalf of the Ministry of Information and at its charge, put into operation an intereception station by which, ever since, a day and night check has been kept upon foreign broadcasts from enemy and neutral countries. Throughout every twenty-four hours, a team of expert linguists with a wide knowledge of international affairs, listens to and notes down about one hundred and sixty foreign bulletins, containing in bulk over three hundred thousand words. This involves the reception of the foreign broadcasts in a hut on a hilltop somewhere in England, and the output of this receiving station is at present more than a quarter of a million words a day. Detailed digests are sent to various Government departments who have, since the outbreak of war, found the service of ever-increasing importance.

Grid Bias for Midget Portables

When a Very Compact Portable is Operated from a Low-voltage H.T. Battery, G.B. Voltage May Be Very Critical. Methods of Biasing Accurately in Such Circumstances are Explained - - - By FRANK PRESTON

WHEN planning a pocket portable or other midget set which is intended for operation from a comparatively low-voltage H.T. battery, a difficulty is often encountered in arranging the bias for the output valve—generally a small power or economy tetrode or pentode valve. In many cases the valve used for output requires a G.B. voltage of only about 3 at 100 volts H.T.; consequently, at, say, 50 volts H.T. the correct bias would probably be less than 1½ volts. In fact, it would in nearly every case be found that the receiver would operate perfectly well without G.B., the grid-bias lead simply being returned to the earth line. Unfortunately, if this connection were used the consumption of H.T. current might be higher than it need be. As almost every reader is aware, the anode current consumption is reduced as the grid-bias voltage is increased.

Odd Voltages

If the valve would "take" 1½ volts G.B. there would not be any difficulty, for a single cell could be used. If the battery used for H.T. supply were provided with bias tapping points the matter would be perfectly straightforward and the arrangement convenient. But if the correct bias voltage were slightly less than or greater than 1½ volts some trouble might be anticipated. In general, when only 'phones are used the "thinner" reproduction obtained by using slightly more than the nominally correct amount of bias would not be of any consequence. On the other hand, the use of an excessive bias voltage results in a loss in L.F. amplification, and hence in volume. This cannot be afforded in a simple and ultra-compact set of the type under consideration.

There are various methods of surmounting the difficulties which have been mentioned, the simplest of which consists of employing automatic grid bias. This is always to be recommended for any type of battery receiver, but there are many constructors who are inclined to fight shy of it because they think that there are some obscure difficulties. Before considering that aspect, therefore, it will be better to look at the matter from another angle.

Bias from the L.T.

It is not always appreciated that a certain amount of bias can be provided by the L.T. accumulator alone. This is explained by the fact that there is a voltage drop across a valve filament, and therefore a small potential difference exists between the centre of the filament and each end. This is shown in simplified diagrammatic form in Fig. 1, where the valve indicated is a pentode for convenience. The potential existing between the two ends of the filament is equivalent to the voltage of the accumulator, and, therefore, the voltage between the centre of the filament and each end of it is half the accumulator voltage; 1 volt for 2-volt valves.

If it were assumed that the filament emits electrons from its centre only, it would be easily understood that a negative bias voltage of unity could be obtained by returning the grid circuit (secondary of the L.F. transformer, coupling choke or grid leak) to the negative side of the accumulator, which is generally wired to the earth line. On the contrary, a 1-volt positive bias could be obtained, if desired, by returning the grid circuit to the positive terminal of the L.T. supply. In practice, of course, the matter is not as simple as this, for the whole of the filament is in use, although the emission from certain parts of the filament is greater than from other parts. Most experiments which have been made indicate that maximum emission occurs from the negative end of the filament; that is, in nearly every case, the end which is joined

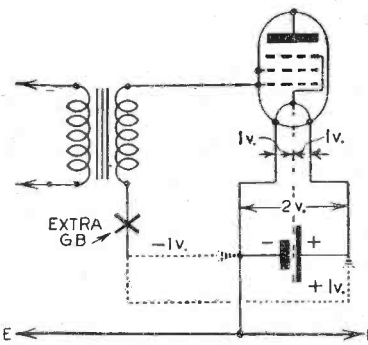


Fig. 1.—It is possible to use the voltage drop across the filament to provide a small amount of bias—although not half the L.T. voltage.

to the common H.T. and L.T. negative supply points. Because of this, the negative potential available is very small.

Positive and Negative Compensation

But, in practice, it is possible to make some use of the difference in potential across the filament, and when an exceptionally low anode voltage is employed sufficient bias can be obtained by returning the grid circuit to the negative side of the filament. It might be thought that no use can be made of the positive bias (usually slightly greater than the available negative bias) to be obtained by returning the grid to the positive side of the filament. That is not the case, however, for this small bias can be employed to "cancel out" a part of the voltage provided by an external G.B. battery or cell. Thus, it might be possible to reduce the effective voltage of a 1.5-volt

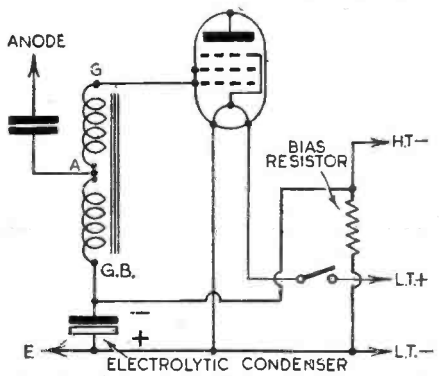


Fig. 2.—Automatic grid-bias is always to be preferred. Connections shown here refer to a parallel-fed transformer arrangement, supplying a pentode.

cell to about 1.2 volts by connecting it as indicated in Fig. 1 to the positive end of the filament.

In many instances it will be found worth while to try the effect of transferring the positive lead from the bias battery or cell from the negative to the positive L.T. point so that the most suitable bias voltage can be found. This applies only when the anode voltage is unusually low, and when a very small G.B. voltage is required. When dealing with a larger receiver operating in these conditions it would probably be better to use a 50,000-ohm potentiometer in conjunction with the grid-bias supply, but this is obviously out of the question for a miniature set.

Auto Bias

Automatic grid-bias is by far the best solution to the biasing problem with any type of battery set, and there are no difficulties which need be anticipated. Basically, all that is required is a resistor in the lead from the H.T. negative wander plug to the L.T. negative line. This is shown in Fig. 2. Then the grid circuit is returned to the negative end of the resistor; that is, to the end joined directly to the negative socket of the H.T. battery or eliminator. There is a voltage drop across the resistor, of course, due to the high-tension current which flows through it. It is this voltage drop which provides the bias.

By using the well-known Ohm's Law it is possible to determine the correct value of resistor, but in making the simple calculation it must be remembered that the *total* anode current for all the valves in the set passes through the resistor—not just the current for the valve being biased. In practice, it is scarcely necessary to make a calculation when dealing with a simple two-valver operated from an H.T. battery of low voltage. When the bias required is in the nature of one volt a 250-ohm resistor (½-watt or 1-watt) will serve quite well. When there are three valves, the value can be reduced to 200 or 150 ohms.

Finding Resistor Value

To the more scientifically minded, this method of procedure will appear very haphazard, as it is, but it has the merit of being good enough for almost all normal requirements. Those who wish to be more accurate can easily find the best value by experimenting with a "plain" (as opposed to a graded) variable resistor or potentiometer of about 1,000 ohms maximum value. Starting with the full resistance in circuit, the value can gradually be reduced until

(Continued on page 405)

PRACTICAL TELEVISION

January 27th, 1940. Vol. 4. No. 187.

Proper Control

IN the radio transmitting room of a modern television broadcasting station every facility must be provided for the engineers in charge to exercise adequate control over the vision signal, prior to its being fed to the ultra-short-wave aerial array. This is of extreme importance, for at this last stage in the chain of events, from scene to be televised to the radiated electro-magnetic wave, steps can be taken within certain limits to rectify any defects and ensure that the signal conforms to the standards agreed upon by the authorities charged with providing the service. For this to be undertaken satisfactorily, suitable monitoring equipment has to be incorporated, and in this way a constant watch can be maintained and adjustments effected quite readily by the supervisory staff. As an illustration of how this work can be undertaken under practical conditions, reference can be made to the accompanying illustration, which shows a corner of a modern high-powered ultra-short-wave television station. In the foreground is the control desk, and mounted in the centre of the sloping back is a cowl over the screen of an oscillographic cathode-ray tube. The horizontal trace on this tube can be seen very clearly, and under running conditions the waveform of the video signal, that is, vision modulation and injected synchronising pulses, is traced out on the screen. This simple device shows straight away whether the form of modulation is correct (positive or negative). The ratio of synchronising pulse to full depth of picture modulation can be examined and adjustments undertaken immediately if this figure does not conform exactly to the published standards.

Emergency Provisions

DEFECTS in the shaping of the synchronising pulses are also made visible at this point if they should exist, while blurred pictures brought about by maladjustment of the corrector circuits will be in evidence and show the expert straightway where the fault lies. On this same control desk are the meters which portray the voltage and current conditions in various sections of the equipment, together with the starting buttons and control handles. When running up a radio transmitter of this type, and also when closing down, the various operations must be carried out in a definite order, otherwise a breakdown may occur, and at this desk the engineer in charge has complete control of the equipment in much the same way as a captain of a ship on the bridge. In an emergency, panic buttons can be depressed, and this will close down the station, but drastic measures of this nature are only resorted to under very extreme conditions. Behind the control desk can be seen the monitor rack on which is traced out the complete picture, so that a check can be made on its characteristics during the whole period that a transmission is on the air. To the left of this are further modulator oscillographs for vision and synchronising, while in the background are the racks housing the equipment for the transmitter proper. Built on clean engineering lines, with every part of the apparatus readily accessible for servicing and routine inspection purposes, the example chosen is indicative of modern practice both in Europe and America although, naturally, the details vary according to the power employed and the design used.

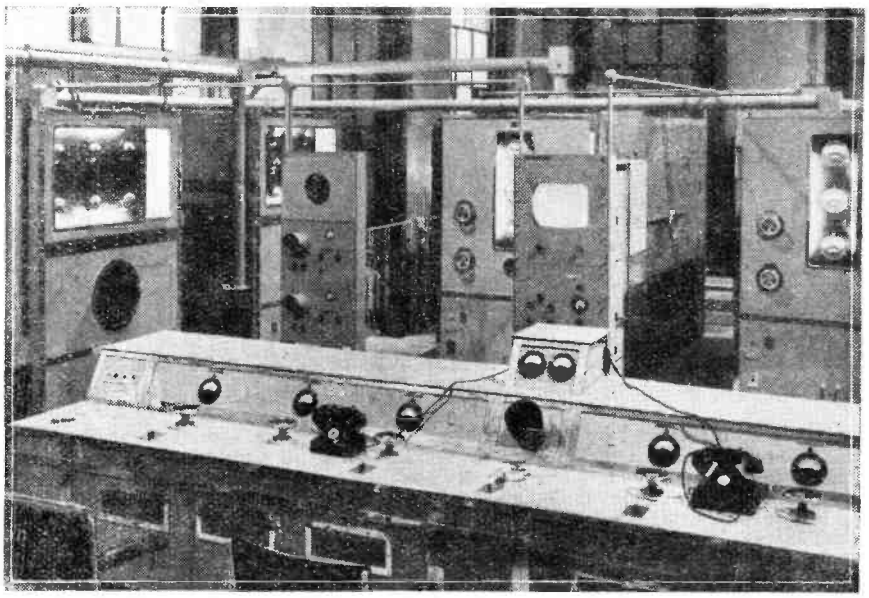
Television in the Air

AMERICA has followed up the work already carried out in Europe in connection with the reception of television signals in an aeroplane by conducting experiments at a very high altitude. This work was sponsored by the Radio Corporation of America in conjunction with the National Broadcasting Co., and when over 20,000 feet above Philadelphia, the television experts in the machine came within range of the standard United States transmissions and saw on the cathode-ray tube of their receiver housed in the aeroplane, the standard test pattern which is normally radiated so that set owners can adjust their controls. After this the occupants watched a football match in progress, and finally, when approaching their landing field they were rewarded with pictures of their own machine. It appears that electron cameras of an outside broadcast unit were situated at the spot and they focused on the circling machine and kept it within the field of view of the lens right up to the point of landing. It has been suggested that this last section of the performance represents in broad principle one method whereby an aeroplane can reach an airport safely, although the field may be shrouded in fog. An infra-red sensitive camera would have to be employed, and the pilot, once within range, would be enabled to see pictures of the approach of his machine towards the landing ground by watching a television set in his own cockpit. How satisfactory this will prove in actual practice cannot yet be ascertained, but it is an alternative to the many other blind landing schemes which have been used or proposed to aid the safety of pilots forced to fly in bad weather conditions.

Sideband Filters

THE television transmission standards which are in use at the present time by America for all the transmission centres on the air are vastly different from those which were employed in this country. A six-megacycle channel is assigned for the radiated sound, vision, and synchronising signals, and the carrier of the picture transmitter is located at a point 1.25 megacycles from the lower limit of the sideband, it being appreciated that single sideband working is the order of the day in that continent. The sound-signals are radiated below this 1.25 megacycle limit, and the scheme adopted is such that any signal which reaches to below 0.75 megacycle of the channel allocation is not accepted by the receiver employed to tune-in the transmission. It is essential, therefore, that any lower sidebands should be suppressed at the transmitter as otherwise serious interference may be caused to any other television or national service which happens to be operating on adjacent channels. For this reason specially-designed filters have to be incorporated in the transmission equipment, so that no unwanted signal reaches the radiating aerial system. As a general rule this equipment is embodied in the transmission line from the output stage of the transmitter to the aerial. It will be obvious that under no circumstances must there be any suggestion of reflected energy in the line, otherwise the quality of the picture would be ruined by multiple images. Special attention has therefore to be given to the maintenance of a constant resistance at the frequencies employed, while steps have to be taken to

(*Continued on next page*).



A typical layout of a modern high-powered ultra-short-wave television transmitting station.

PRACTICAL TELEVISION

(Continued from previous page.)

dissipate the energy rejected from the radiation channel. Due to the very high selectivity factors involved, coupled with the ultra-high frequencies used, it has been found satisfactory to make the circuit elements actual sections of concentric transmission lines. This form of sideband filter has actually been in use for the official transmissions which were inaugurated in March of last year, and from observations made to date appears to function quite satisfactorily.

Magnetrons for Reception

THE magnetron valve has been applied to a variety of special purposes, and one of the latest uses is for the reception of ultra-short-wave signals. In this adaptation of the valve the filament is located centrally between two split anodes arranged cylindrically round the filament. Normally, the electrons released from the surface of the filament would travel in straight paths towards the pair of anodes, but for this scheme the route taken is altered to one of spiral formation. To produce this a strong magnetic field is arranged by an external winding to act in a direction parallel to the filament. The time of flight of each electron from filament to anode is thereby regulated by the strength of the field. In use, a dipole receiving aerial is joined to the split anodes by Lecher wires, and stabilising discs at each end of the electrode assembly are linked together, and pass through an impedance to a tapping on the voltage source feeding the split anodes. Rectified signals are produced across this load resistance and they are in turn fed to the grid of an amplifying valve in the receiving circuit.

Electron Multiplier Considerations

MORE and more attention is being given to the work of improving the practical applications of electron multipliers, for it is realised in the field of electronics that their use is becoming more and more important in scientific and commercial life. It is always interesting, therefore, to keep a careful watch on developments in this direction. For example, it is known that in many cases the grid type of electron multiplier is not working at its best when having to handle very small fluctuations of voltage. This arises from the fact that in addition to the A.C. variations being amplified, the D.C. component of current is amplified in an identical measure. One scheme which has been proposed to overcome this factor is to use a series of electron multipliers in cascade, either as completely separate units or housed together inside the same glass envelope. Each of these multipliers would be arranged to have a limited gain, and be coupled together by any of the well-known methods of circuit coupling, which effectively remove the D.C. component. Yet another attempt to improve performance is concerned with the very high output impedance of these devices which on many occasions restricts their use owing to the limitation of impedance matching in the output circuit. In one scheme it is proposed to counter this defect by making the output electrode of such a form that it has a non-uniform surface, so that the secondary emission of the electrodes at this stage is dependent on the voltage applied, and the section of the surface to which electron impact is directed. It is claimed that in this way relatively low output impedances have been obtained, thus enabling better matching conditions for practical use to be achieved.

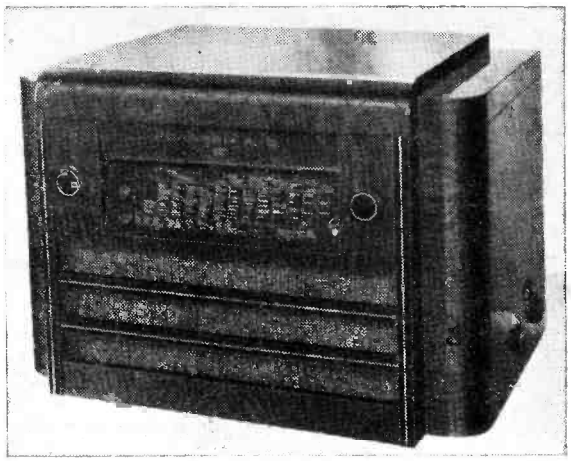


Fig. 1.—In outward appearance this projection set resembles a normal all-wave radio receiver.

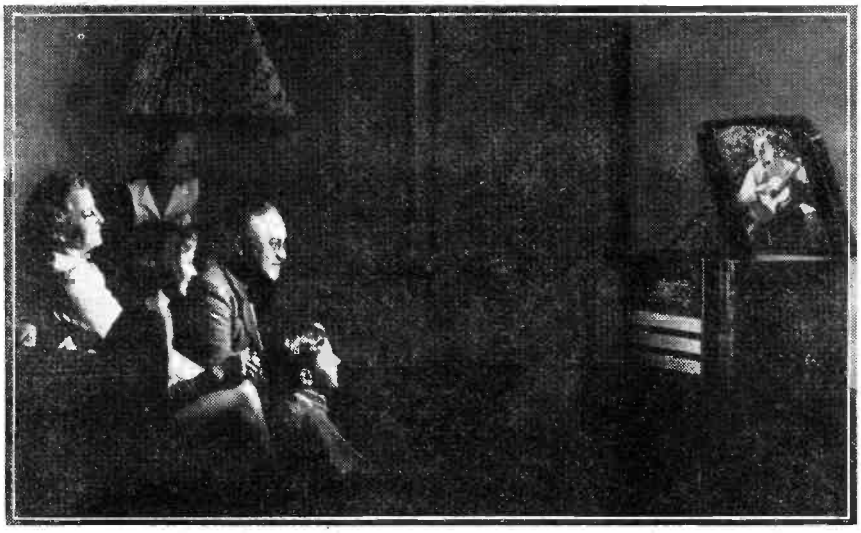


Fig. 2.—The compact projection type television receiver, with reflecting screen, in use in the home.

Home Projection Sets

ALTHOUGH the German television industry has standardised on a cheap home receiver model, some of the leading manufacturers are continuing to produce other sets in readiness for the market. One of the most interesting receivers in this class is a table model projection set which is of a very compact design. This is seen in Fig. 1, and to all intents and purposes it is an all-wave radio receiver with the minimum of controls. By referring to Fig. 2, however, it will be seen that the lid can be raised, and this houses a special type of reflecting lens screen which has been developed by Fernseh A.G., the company responsible for the big lens screen which gave such remarkable results at the 1938 Berlin Radio Show. Although family viewing is shown being undertaken in a completely darkened room, the picture, which is approximately 20ins. by 16ins., is particularly bright. In addition to the contribution made by the new screen itself towards this condition of viewing, another important factor is the small projection tube which has been designed for this purpose. A front and rear view of this new tube is seen in Fig. 3 and the relatively small overall size can be gauged by comparison with the standard form of receiving valve. Instead of projecting the picture right through the fluorescent screen material with its consequent loss of light, the small built-up picture is projected from an opaque screen mounted obliquely inside the small cylindrical glass walls. The main anode connection is brought out to side terminals and the voltage used is 25 kilovolts. By using such a high voltage and employing a long tube with a remote electrode assembly together with electromagnetic focusing and deflection, a brilliant, sharp picture is built up on the screen. Due to the non-normal impact of the scanning beam on the tube's screen, a correction has to be applied to eliminate keystone distortion, but this has been done satisfactorily and even at close viewing distances the picture has excellent pictorial value.

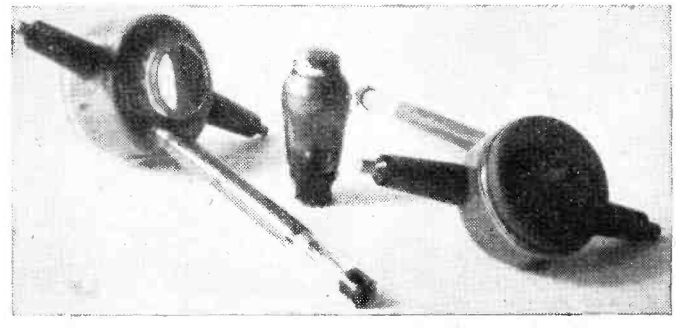


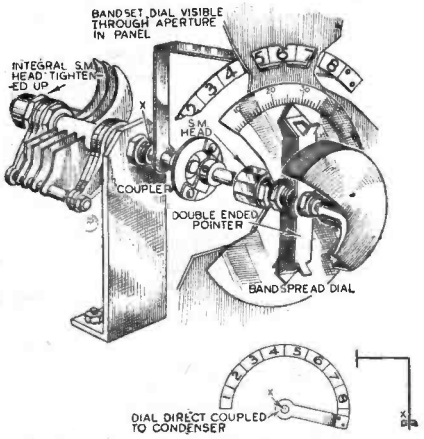
Fig. 3. — The new version of the home projection C.R. tube, using an obliquely mounted opaque picture screen.

Practical Hints

A Bandspread Drive

BELOW, I give details of a very simple mechanical bandspread drive which I devised for use in my short-wave receiver.

The condenser which I had previously used had an integral reduction device of 8-1, and by coupling this to an additional slow-motion driving head, as shown in the



A simple mechanical bandspread drive.

sketch, a total reduction (in my case) of 72-1 was obtained. The pointer traversing the "bandspread" dial must be double ended, and by providing it with suitable projectors it can be used for more rapid "band-setting." This pointer is fastened to the usual place on the driving head, i.e., to the condenser through its integral reduction device.

The "band-set" dial is home constructed, and is divided into a number of divisions equal to the reduction rates of the condenser's integral device (in my case 8). The actual position of the dial depends on the form of mounting, etc., and a suggestion is given in the sketch. The dial is coupled direct to the condenser vanes.

In order to eliminate possible slipping, it is best to tighten up the condenser's integral reduction device slightly, and then if the knob is rotated when the vanes are all in (or out), it will only be the additional driving head that slips. For the same reason, care must be taken if the pointer is used as a quick "band-setter," as suggested. —J. W. HORWOOD (West Bergholt).

A Screened Input Jack

BEING unable to obtain a shielded jack for a mains-driven amplifier at short notice, I hit on the following dodge. I obtained an empty mustard tin, of oval shape, about 1¾in. deep. First, I drilled a ⅜in. hole in the centre of the lid (to take the neck of an ordinary single circuit jack), and then I drilled another ⅜in. hole in the bottom of the tin for the output grid lead.

THAT DODGE OF YOURS!

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

SPECIAL NOTICE

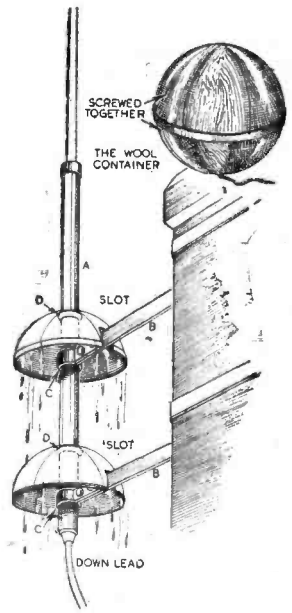
All hints must be accompanied by the coupon cut from page iii of cover.

It was but a minute's work then to push the jack through the lid (using it instead of one of the spacing washers) and screw it up tight to the panel. I then pushed the lead through the hole in the bottom of the tin—pushed the box on to the lid, and the jack was completely enclosed and screened. The remainder of the grid lead between the screening box and the valve pin was covered with metallised braiding, soldered at one end to the box, and earthed to chassis at the other. This removed the last vestage of hum, and also has the merit of cheapness.—JAS. THIRELFALL (Blackpool).

Preventing Aerial Leakage to Earth

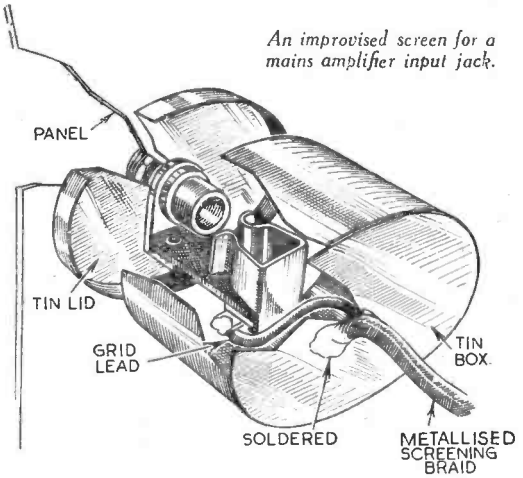
THE accompanying sketch shows a dodge for minimising aerial leakage to earth due to rain, or moisture accumulating during misty weather.

The vertical aerial, A, is supported by brackets, B, fixed to the chimney stack. The aerial rod is insulated from these brackets at the points marked C. To keep the insulating material reasonably dry for preventing leakage I used the two halves of a circular wool container, which can be purchased at any cheap stores for 6d. A hole is made in the centre of each part, and also a slot in each to fit over the brackets, as indicated in the sketch. Collars, D, are also fitted to support the semi-circular shields, the joints at these points being sealed with bitumen.—L. BURTON (Sheffield).



A novel dodge for preventing aerial leakage to earth.

An improvised screen for a mains amplifier input jack.



A Simple Qua

Constructional Details of a Intended for Reproduction

HOWEVER good the B.B.C. Home Service may be, it cannot please every listener all the time. It can only hope to please some of the listeners part of the time.

The absence of any alternative programme has resulted in a great deal of attention being paid to gramophone record reproduction, and we describe here an amplifier which is very suitable for this class of work. Its cost, including two valves, rectifier and mains transformer, is less than £5 10s. It is very simple to build, uses only standard and inexpensive components, is economical in operation and, with a good pick-up and loudspeaker, will give a wealth of entertainment and good reproduction from gramophone records.

Further, by the addition of a simple leaky-grid detector unit, which may conveniently be pre-tuned, the amplifier can be converted into a suitable three-valve receiver for the B.B.C. Home Service. As such, it has already given a good account of itself in an isolated area.

The input to the receiver consists of a potentiometer volume-control feeding into the grid of a high-impedance triode valve of the M.H.4 class. The features of high amplification factor, combined with high mutual conductance to be found in this class of valve, enable a high stage-gain to be obtained, and the P.X.4 output valve can be adequately loaded, by transformer coupling, without the need for an intermediate L.F. stage.

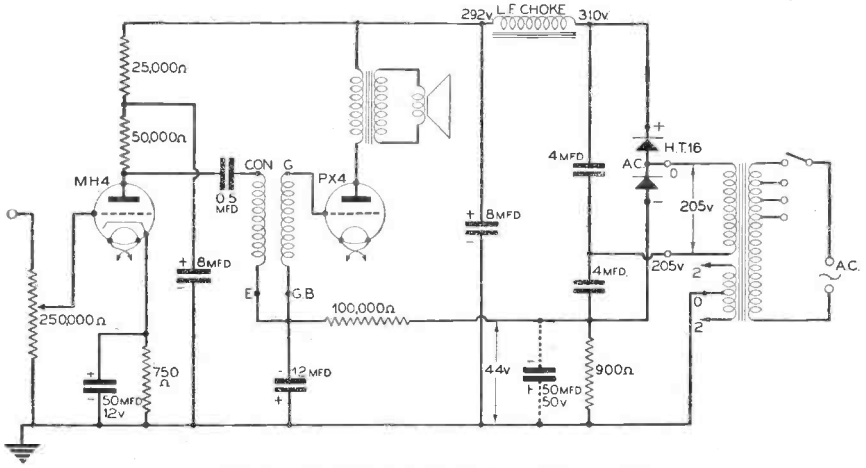


Fig. 1.—Theoretical circuit diagram of the amplifier.

Circuit Details

The anode circuit of the valve is decoupled by the 25,000-ohm resistance and 8-mfd. condenser (see theoretical diagram Fig. 1), while bias is applied to the valve by means of the self-bias resistance of 750 ohms connected in the cathode circuit. The bias resistance is shunted by the usual 50-mfd. electrolytic smoothing condenser.

The optimum load of the M.H.4 valve is 50,000 ohms, so a load resistance of this value is included in the anode-circuit.

The voltages developed across this load resistance are fed via a 0.5-mfd. coupling condenser to the primary of the parallel-feed transformer of ratio 1 : 4, the secondary of which is connected to the grid circuit of the P.X.4 output valve.

This valve has a mutual conductance of 6.0 mA./volt, with an amplification factor of 5, and gives considerable power output with an anode voltage up to 300 volts.

The valve is of the directly-heated type, and bias is usually obtained by the insertion of a self-bias resistance between the centre-tap of the filament transformer winding and the chassis, to which, of course, is connected H.T. negative of the rectifier. This biasing arrangement means a separate filament winding for the P.X.4 valve, and another for the M.H.4 (or any other preceding valves, as well of the indirectly-heated type). A common filament winding with the bias resistance in the centre-tap/chassis circuit is quite impracticable when indirectly heated, and directly-heated valves are fed from a common filament winding.

Grid-bias Arrangement

To overcome the necessity of using a non-standard mains transformer with two separate and independent filament windings, we have resorted to a rather unusual method of obtaining the grid-bias for the directly-heated output valve.

If a resistance is inserted between the H.T. negative terminal of the rectifier and the earth-line (chassis) the current flows from the rectifier through the smoothing circuit and valves and back to the rectifier through the bias-resistance, and produces a voltage drop across it.

This means that the chassis (earth-line) is more positive than the true H.T. negative of the rectifier by a voltage depending upon that produced across the resistance, i.e., on the total current flowing through the resistance and the value of the resistance.

If, therefore, we insert a 900-ohm self-bias resistance between H.T. negative of the rectifier and chassis, connect the grid circuit of the output valve to the rectifier H.T. negative terminal, and earth the centre-tap of the filament winding in the normal manner, we make the grid more negative than the heater by the amount of the voltage developed across the resistance, and thus apply grid-bias to the valve. The 900-ohm resistance produces a voltage drop of some 44 volts, which is the bias necessary for the P.X.4 valve with an anode voltage of 292 volts. The usual cathode by-pass condenser may be connected across this resistance, but it is very important to note that it must be of the 50-v. working type and that the positive terminal must be connected to the chassis,

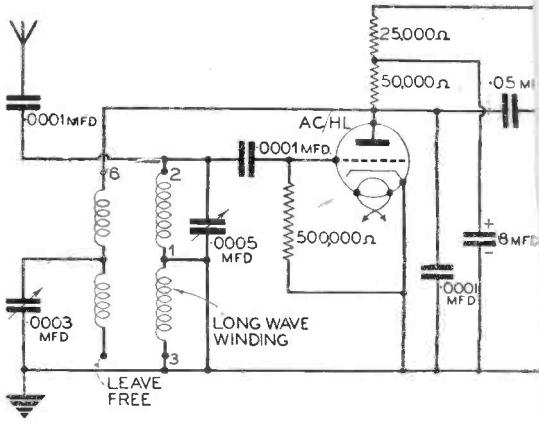


Fig. 2.—Circuit diagram of a suggested detector unit for use wit

LIST OF COMPONENTS FOR A SIMPLE QUALITY AMPLIFIER

AMPLIFIER	£ s. d.	£ s. d.
2 insulated terminals, Bulgin type T.L.	0 0 7	
1 250,000 ohm volume control and switch, Dubilier type J	0 4 0	
2 5-pin valveholders, Bulgin VH.48	0 1 0	
1 25,000 ohm ½-watt resistance, Dubilier F½	0 0 3	
1 50,000 ohm ½-watt resistance, Dubilier F½	0 0 3	
1 750 ohm ½-watt resistance, Dubilier F½	0 0 3	
1 8 mfd. surge-proof electrolytic condenser, Dubilier 0281, style A	0 4 0	
1 0.5 mfd. tubular condenser, Dubilier 4608/S	0 1 8	
1 parallel fed L.F. transformer, ratio 1 : 4, Bulgin "Senator"	0 6 6	
1 50 mfd. 12 volt dry electrolytic condenser, Dubilier 3016	0 1 6	
1 M.H.4 valve, Osram	0 7 6	
1 P.X.4 valve, Osram	0 9 6	1 17 0
POWER PACK		
1 Westinghouse H.T.16 Metal Rectifier	0 13 0	
1 mains transformer, suitable for H.T.16, Varley E.P.37	1 5 6	
1 smoothing choke, 20hy. 120mA. 250 ohms, Varley DP.51	0 12 0	
1 4+4 mfd. paper condenser block, Dubilier BE.355	0 13 0	
1 8 mfd. surge-proof electrolytic condenser, Dubilier 0281, style A	0 4 0	
1 900 ohm 10-watt power resistor, Bulgin A.R.I.K.	0 1 0	
1 100,000 ohm ½-watt resistance, Dubilier F½	0 0 3	
1 12 mfd. 50v. electrolytic condenser, Dubilier 3016	0 1 6	
	3 10 3	
	5 7 3	

The above prices may be subject to some slight increase in some instances due to war conditions.

ality Amplifier

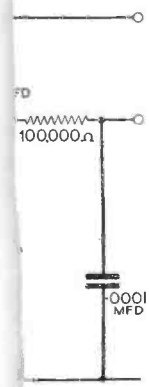
a Useful Unit Especially of Gramophone Records

as the latter is more positive than H.T. negative (see dotted connections, Fig. 1).

A cheaper, and probably just as simple, means of smoothing the bias to the output valve is to decouple it by means of a resistance and 12-mfd. electrolytic condenser, as shown in the theoretical diagram. It is important that this resistance should not exceed a value of 250,000 ohms with the P.X.4 valve, and 100,000 ohms is a good value to use and quite effective.

It should be noted that the current of the M.H.4 valve also flows through the biasing resistance, but it is so low as to make no appreciable difference to the bias voltage developed across the resistance. Actually, the bias developed is just under 4 per cent. higher than the correct bias for the P.X.4 valve, but this does no harm. Slight over-biasing is far preferable to under-biasing.

Should it be decided to run other valves from the same filament winding, it will be necessary to take into account their total current consumption and to alter the value of the biasing resistance accordingly. For example, suppose the total consumption of the valve in use rose to 60mA and that the resistance was kept at a value of 900 ohms. It is quite a simple matter to calculate from Ohm's Law that the voltage developed across the resistance would be 54 volts, and this would mean that the P.X.4 valve was greatly over-biased. In this case, it would be necessary to use a resistance with a value of only 700 ohms to obtain a bias of 44 volts.



h the amplifier.

The fact that the earth line, or chassis, is positive in respect of the true H.T. negative does not affect the bias applied to the M.H.4 valve. This is an indirectly-heated valve and derives its bias from the voltage drop across a resistance in the cathode circuit. The grid is taken to chassis and thus becomes more negative than the cathode by the amount of the voltage developed across the resistance. The fact that the chassis itself is more positive than H.T. negative does not affect the question of the grid-bias applied to this valve at all, but does result in a potential difference between the heater and cathode of the indirectly-heated valve by an amount equal to the voltage developed across the resistance in the H.T. negative lead. The insulation between the cathode and heater, however, is more than sufficient to withstand this, and there is no fear of breakdown in this direction.

The H.T. power supply is obtained from a Westinghouse metal rectifier type H.T.16 connected in the voltage-doubler circuit, with an A.C. voltage input of 205 volts. This gives an output of 310 volts at 52mA (the current of the P.X.4 and M.H.4. valves) and is smoothed by a choke of 250 ohms D.C. resistance and an 8 mfd. electrolytic condenser. The smoothed H.T. voltage is just over 290 volts. This arrangement allows of the use of a permanent-magnet type of loudspeaker.

Voltage Doubler

Note that the negative side of the voltage-doubler condensers is taken to H.T. negative and not chassis.

The voltage-doubler condensers are of the paper type, 500 v. D.C. working. Actually, the voltage they have to withstand never exceeds 400 volts, so that it is possible to substitute them with the cheaper electrolytic type. If it is desired to do this, it is advisable to obtain the condenser manufacturers' approval, when the type of rectifier in use, input voltage and load current, should be specified.

For those who wish to use a mains-energised loudspeaker, the input to the rectifier may be increased to 240 volts, and there is a tapping on the mains transformer to allow of this. In this case, the unsmoothed output of the rectifier at 52mA is some 390 volts, which, after being smoothed by a speaker field of 2,500 ohms D.C. resistance, leaves a voltage of approximately 265 volts for the amplifier valves.

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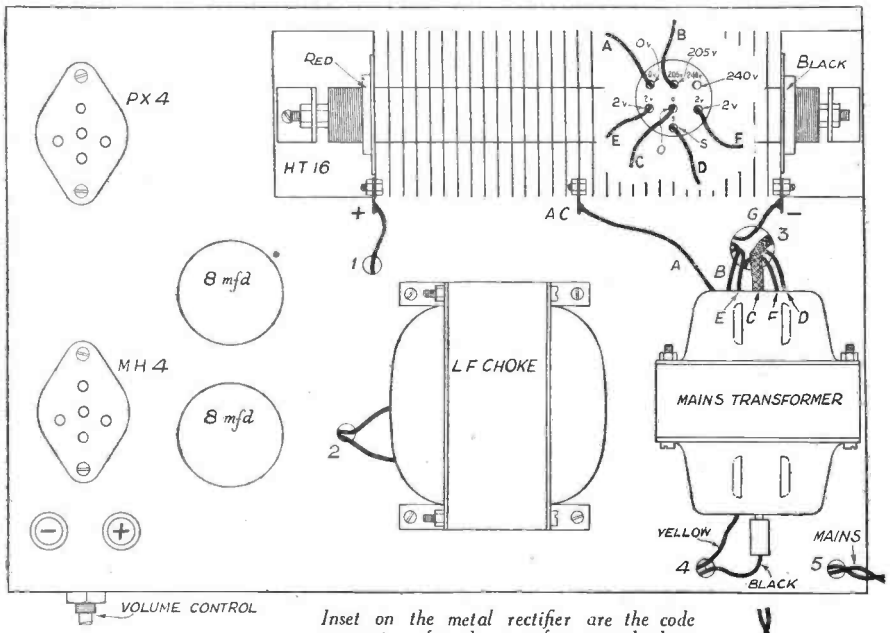
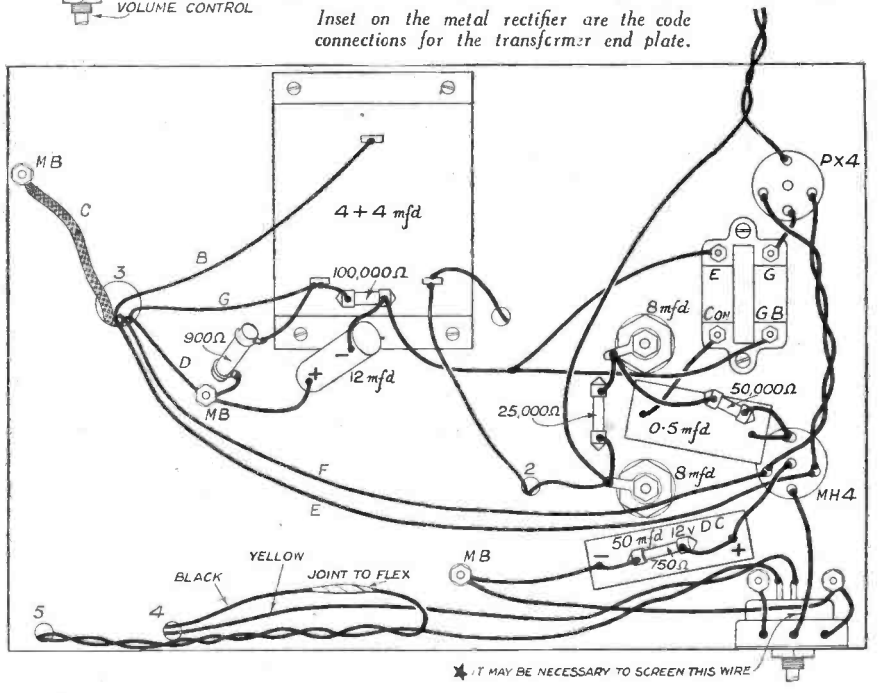
WIRING DIAGRAM OF THE AMPLIFIER



Inset on the metal rectifier are the code connections for the transformer end plate.



A SIMPLE QUALITY AMPLIFIER

(Continued from previous page).

As the action of the Westinghouse metal rectifier is instantaneous, a surge voltage of some 600 is produced when first switching on. The use of a directly-heated output valve limits this surge to matter of seconds only, but, even so, it is more than sufficient to break down the normal type of dry electrolytic smoothing condenser. For this reason, it is absolutely necessary to use surge-proof condensers such as the Dubilier type 0281 style A, or else to incorporate a thermal-delay switch to prevent the H.T. voltage reaching the condensers until the valves have had time to warm up, when the fact that they would take their full current immediately the H.T. was applied would prevent any large voltage surge.

Owing to the high mutual conductance of the two valves used in the amplifier, there may be some slight tendency to parasitic oscillation, which can be cured by the usual grid-stopper resistances. These were not found at all necessary in the experimental amplifier constructed.

When the volume control is turned full on, slight motor-boating may occur, depending on the "goodness" of the valves in use. This may be cured by reducing the value of the coupling condenser from 0.5 mfd. to 0.25 mfd., or by the inclusion of a stopper resistance in the grid circuit of the M.H.4, but it should seldom be necessary to have the set working full out, unless the amplifier is operating in a very large room.

Constructional Details

Construction is so simple as to need little comment. The set is constructed on an aluminium chassis, this being very substantial, easy to work, and providing good shielding and a convenient earth-return circuit, besides being very much nicer to look upon than the wooden baseboard type. The components are mounted as shown in the diagram (page 403). Make sure when mounting the rectifier that it does not rotate on its spindle and short to chassis through the cooling fins. Also, when the set is in use, take great care not to touch the rectifier at all, as the fins are connected to the actual rectifying washers, and are thus alive.

The rectifier, mains transformer, etc., are first mounted in position, the resistances and small condensers being suspended in the actual wiring, which is an extremely simple job. Once the chassis itself has been built, it should be possible to mount the components, wire up and have the amplifier ready for testing within the hour.

Having completed the wiring, there is little to be done beyond settling down to enjoy gramophone record reproduction.

There is no fuse in the amplifier, so it may be desirable, at least if you have any doubts at all as to the correctness of your wiring, to insert a 250 mA. fuse between the rectifier negative terminal and the bias resistance.

The simplest way to test the receiver is to connect a moving-coil voltmeter across the bias resistance (positive connection to chassis), switch on, and note whether or not a voltage is produced across the resistance. A reading should be obtained almost immediately.

Detector Unit

A simple detector unit for use with the amplifier is shown in Fig. 2, and consists of an AC/HL type valve tuned by an unscreened Bulgin coil type C.69, of which only the medium-wave windings are used. The long-wave grid winding is shorted out as indicated in Fig. 2, but don't connect terminal 4 of the reaction winding to earth, or you will short-circuit the H.T. supply. Leave this terminal free.

The usual 0.0001 mfd. grid condenser and 500,000 ohm grid leak are used, and the anode circuit is decoupled by a 25,000 ohm resistance and 8 mfd. condenser, and the usual load resistance of 50,000 ohms is also incorporated. The rectified voltages developed across this resistance are fed to the amplifier via the 0.05 mfd. condenser and 100,000 ohm H.F. filter resistance. H.F. filtering is completed by the two 0.0001 mfd. condensers. Reaction is also employed in the usual manner with the reaction condenser on the "earthy" side of the reaction condenser to avoid hand capacity effects.

Note that the detector valve is operated without any cathode bias.

The selectivity of such a unit is of course very low. Used near the transmitter it will allow of the best quality reproduction without any interference, nearby stations being "swamped" by the local. In more distant areas, however, it may be found necessary to use a 0.0001 mfd. pre-set condenser in the aerial lead and to adjust this, at the same time advancing the reaction control to a point just below oscillation, in order to increase selectivity. Used in this fashion, the unit is giving a good account of itself in the west of England.

The tuning condenser and the reaction control may conveniently be pre-set so that it is only necessary to switch on to receive the B.B.C. Home Service.

An efficient unscreened coil, such as the one suggested above, allows maximum stage gain to be employed, and it has been found possible, by careful adjustment of the aerial series and reaction condensers, to receive three or four foreign broadcasts with but very little interference. The unit is, however, intended for "home consumption" only.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 1

Frequency Formula

Formula for frequency is: $f=\frac{10^6}{2\pi\sqrt{LC}}$ where L = inductance in microhenrys and C = capacity in microfarads.

Wavelength of Tuned Circuit.

Formula for the wavelength of a tuned oscillatory circuit is: $1884.96\sqrt{LC}$, where L = inductance in microhenrys and C = capacity in microfarads.

Inductance

The formula for inductance in microhenrys is: $L=\frac{9.86lD^2N^2K}{1000}$ where L = inductance, D = diameter of coil in centimetres, l = length of coil in centimetres, N = number of turns per centimetre, and K = a constant. See table.

Inductance Reactance

Calculated from the formula $2\pi fL$, where f = frequency and L = the inductance.

This Table shows the Value of K, which must be Calculated from $\frac{D}{l}$

$\frac{D}{l}$	K	$\frac{D}{l}$	K
4.00	.3654	1.25	.6381
3.75	.3743	1.00	.6884
3.5	.3944	.90	.7110
3.25	.4111	.80	.7351
3.00	.4292	.70	.7609
2.75	.4545	.60	.7885
2.5	.4719	.50	.8181
2.25	.4972	.40	.8499
2.0	.5255	.30	.8838
1.75	.5579	.20	.9201
1.5	.5950	.10	.9588

No. 2

Capacity of Variable Condensers

$$C=\frac{.0885NS}{1{,}000{,}000\ d}$$

Where N = Number of moving vanes.
S = Area of one moving vane in square centimetres.
d = Air gap between moving vanes and fixed vanes in centimetres.

H.F. Transformer Ratio. $(n)\ n^2=\frac{R}{R_0}$

R being the dynamic resistance of the tuned circuit and R_0 the A.C. resistance of the valve.

Stability in Screen-Grid Stages.

One Stage.

Stable if $\frac{\omega\ g\ Co}{\sigma_1(\sigma_2+\sigma v)}$ is less than 2.

Co = residual anode-grid capacity in farads.
= .001 × 10—12 for Cossor S.G. Valves (all types).
= .0045—10—12 for Cossor MS/Pen A.

σ_1,σ_2 = conductance of grid and anode* circuits respectively.
= 1/R where R = dynamic resistance in ohms.

σv = anode filament conductance of valve.
= $1/R_0$.

Two Stages.

Assuming identical tuned circuits throughout, and ignoring damping effects of valves on tuned circuits.

Stable if $\frac{\omega\ Co\ g}{\sigma^2}$ is less than 1.14 (Tuned Anode).

or if $\frac{\omega\ Co\ g}{\sigma^2}$ less than $1.14n^2$ (Tuned Transformer).

where σ = conductance of tuned circuit (secondary) and n = transformer ratio.

* In the case of transformer coupling, or its equivalent, replace σ_2 by $n^2\sigma$, where n = transformer ratio, σ = conductance $\left(=\frac{1}{R}\right)$ of tuned secondary.

No. 3

Wavelength-Frequency Conversion Table.

Metres to Kilocycles.

Metres.	*Kilocycles.*	*Metres.*	*Kilocycles.*
5	60,000	370	810.8
6	50,000	380	789.5
7	42,857	390	769.2
8	37,500	400	750
9	33.333	410	731.7
10	30,000	420	714.3
25	12,000	430	697.7
50	6,000	440	681.8
100	3,000	450	666.7
150	2,000	460	652.2
200	1,500	470	638.3
205	1,463	480	625
210	1,429	490	612.2
215	1,395	500	600
220	1,364	510	588.2
225	1,333	520	576.9
230	1,304	530	566
235	1,277	540	555.6
240	1,250	550	545.4
245	1,225	560	535.7
250	1,200	570	526.3
255	1,177	580	517.2
260	1,154	590	508.5
265	1,132	600	500
270	1,111	650	461.5
275	1,091	700	428.6
280	1,071	750	400
290	1,034	800	375
295	1,017	850	352.9
300	1,000	900	333.3
310	967.7	950	315.9
320	937.5	1,000	300
330	909.1	1,250	240
340	882.3	1,500	200
350	857.1	1,750	171.4
360	833.3	2,000	150

Note.—To convert kilocycles to wavelengths in metres, divide 300,000 by the number of kilocycles.

To convert wavelengths in metres to kilocycles, divide 300,000 by the number of metres. One megacycle = 1,000,000 cycles or = 1,000 kilocycles. Thus, 30,000 kilocycles = 30 megacycles.

LOCATING FAULTS

(*Continued from page 396.*)

which is normally taken to the top of the S.G. valve, and insert a pair of headphones in series with the detector anode. These should be connected as close as possible to the anode terminal on the valveholder, but if an H.F. choke is embodied they should be connected between the H.T. side of the choke and the H.T. supply. With these arrangements the circuit will be operating as a single valver, and will, therefore, prove whether the H.F. coupling coil, the detector grid-circuit components and the reaction circuit are above suspicion. If any doubt exists about the operation of this stage, tests should be applied to all associated parts until the results are sufficient to warrant the tester assuming that everything is operating in a normal manner.

After this stage, the L.F. or output valve can be brought into circuit by connecting the 'phones or speaker to the L.S. terminals and, of course, completing the connections for the L.F. coupling between detector and output. By doing this, all the components associated with the L.F. coupling and the output valve will be put under test, while operating voltages on these two valves will also have to be correct for satisfactory results.

Particular attention should be given to the increase in signal strength, the quality of reproduction and the stability of the circuit at this stage, as these will prove the efficiency of the L.F. coupling and the output valve, and, of course, the values of applied H.T. and G.B. A milliammeter should be connected in series with the anode of the output valve to denote whether distortion is present and, incidentally, to check up on operating conditions. If the meter needle tends to kick *down* on loud passages, it will show that *insufficient* grid bias is being applied, but, if, on the other hand, the needle kicks upwards, then excessive bias is being used.

GRID BIAS FOR MIDGET PORTABLES

(*Continued from page 398*).

the optimum setting is found, but bearing in mind that it pays to have the highest value at which sufficient volume and satisfactory reproduction can be obtained.

When the best setting has been found, the value of the portion of the resistance element in circuit can be estimated by the position of the knob or slider. Thus, if it were one-quarter way round from the maximum-resistance position the value would be 750 ohms. Once the required value has been found, a fixed resistor of the nearest equivalent value can be fitted. It will be seen from Fig. 3 that an electrolytic condenser is connected in parallel with the bias resistor to act as an H.F. by-pass. The value of this is not critical, and the working voltage need not be more than 12, so a convenient capacity would be either 25 or 50 mfd. A condenser of the flat, bakelite-case type, or a tubular would be suitable and sufficiently compact.

L.T. Voltage Drop

There is another method of biasing which can occasionally be used. For example, if the two dry cells giving a total voltage of three were used to operate two-volt valves, the voltage-dropping resistor could be placed in the negative L.T. lead and bias obtained by returning the grid circuit to the negative terminal of the battery. This method has only a narrow application, and the idea of feeding two-volt valves from a three-volt supply is not one normally to be recommended.

TONE CORRECTION AND FILTERS

(*Continued from page 395*).

.25 to 1 mfd., according to the particular pick-up in use) and assemble the remaining components of the tone-control circuit. Then connect various small values of fixed resistance between the lower end of the volume control and earth—that is, to take the place of the "fixed" portion of the volume control already referred to. A few experiments will enable you to find a resistance which will have the least effect at the maximum volume setting, and which is just having a noticeable effect at minimum setting of the volume control. It will not, of course, be possible to obtain the full tone-control effect owing to the fact that the arm of the volume control will not be able to travel across the fixed resistance which has been included in series.

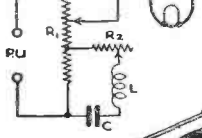
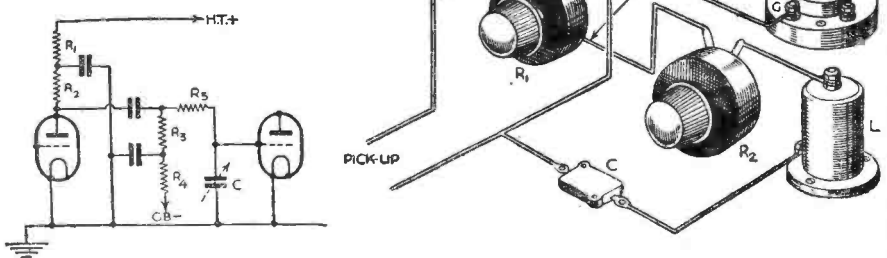


Fig. 11.—A constant-tone-control device for pick-up volume control.



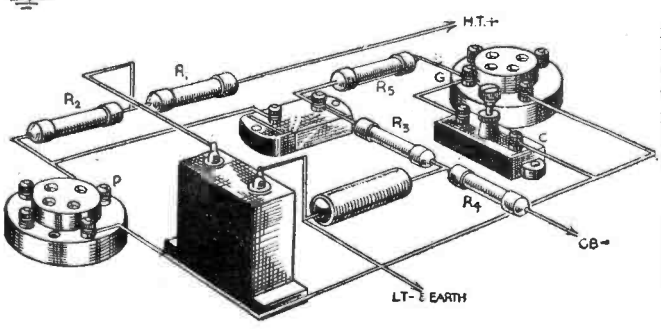
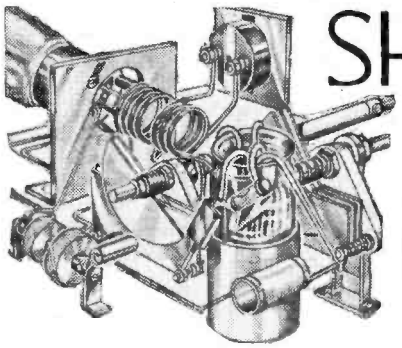


Fig. 10 (left).—A combined tone control and heterodyne whistle suppressor.



SHORT-WAVE SECTION

SHORT-WAVE MECHANICS

Suggestions of Things to Make for the Mechanically-minded Short-wave Enthusiast

By W. J. DELANEY

THERE are two main types of listener—those who are mainly interested in the stations they can receive and the logs they can compile, and those who are more concerned with the construction and operation of the receiver. Among the latter there are many who are not only interested in the mechanics of the apparatus but who are also very good workmen, in many cases with quite elaborate workshops. This is borne out by the many ingenious suggestions which have been sent in from time to time for inclusion in our hints page. The ordinary standard broadcast receiver (for medium and long-wave reception only) does not, however, lend itself so well to mechanical ideas as the short-wave receiver, and it is in this class, therefore, that the highest ingenuity is shown. For those who have suitable workshop equipment there are many ingenious and interesting ideas which may be tried out or built up, and the following details will give some ideas for those who may not yet have delved into this branch of radio construction.

Condenser Drives

The modern receiver is incomplete without a really good slow-motion drive, and on short waves this drive must have not only a really good slow-motion action but must also be easy to handle. Many good components in this connection are rendered unsuitable for short-wave work simply because they are not capable of being smoothly adjusted by very small steps. Here then is one field for constructional work, but whilst experimenting with drives it would be a good plan to endeavour to incorporate in the drive a band-spreading device. This should be of such a type that it is not only adjustable separately but that it interlocks with the main drive. That is, supposing for instance that the band-spreading device gives 10 degrees band-spread movement for each degree of the main dial, it should also be so arranged that the setting for, say, 50.9 degrees can always be repeated by exactly the same settings of both the main and the band-spread device. This is not simple, but there are many interesting schemes which can be tried using either the special gear wheels, worm drives and similar items from the well-known constructional toy, or by pulleys and cords. The latter must, however, be so arranged that there is no slip which will result in different settings of the driven member for given dial indications.

It might be possible to arrange two windows through which the dial markings show, so that the decimal figure could be given its correct relation to the main dial settings, although an obscured dial, that is, one which only shows its individual setting, is not ideal owing to the fact that the direction in which it should be turned for a known setting is not immediately obvious. A large dial could be perforated so that the band-spread setting is viewed through it, or dual pointer devices are more reliable, but there is endless scope here for experimental work.

Coil Switching

A good short-wave set utilises separate small coils for narrow bandwidths, and this simplifies tuning. Unfortunately, this generally means coil changing, and many sets are restricted to only two short-wave bands, these being rather too wide for comfortable long-distance working. Plugging-in individual coils is tedious but the most satisfactory scheme for the real short-wave fan, and therefore some form of coil-changing mechanism is a good line for experiment. One well-known American communications receiver has the coils arranged in sets of three for each waveband in a die-cast aluminium box occupying nearly half the underside of the chassis. The connections for each set of coils are brought out to wiping contacts and the entire box is carried across the chassis, from one side to another, through a worm drive or rack and pinion movement. Definite stops are provided when each set of coils is brought into circuit, and a pointer on the panel indicates the band to which the set is tunable. This is a remarkably fine movement and very accurate and reliable in use, but is not difficult to copy with suitable workshop appliances. Rack and pinion may be obtained at any good photographic dealer's or scientific instrument stores, and the box could be built up with sheet metal. It must be rigid and well screened, and the movement must be really smooth.

As an alternative, especially where only one coil is needed on each band, as in the simpler type of receiver, the coils to give the required coverage could be mounted on a rotating disc, arranged either horizontally or vertically, and again wiping contacts can be arranged round the periphery. When concerned with coil-switching, however, a perfectly firm contact must be obtained when the coils are in circuit, as failure to do this will result in noisy working and perhaps in signal losses.

To avoid noises when the coils are changing from one band to another, a switch could be operated through the coil-changing mechanism to break the H.T. negative lead and thus render the set "dead" between band setting.

Signal Lights

Many constructors have already incorporated dial lights of the two-colour type which indicate when the set is switched to long or medium waves, and this idea may be incorporated in the above wave-band switching devices, only instead of coloured lights, small windows with indications showing the band covered could be fitted and the lights behind the windows brought into circuit with the coils, thus showing instantly to what range the set is adjusted.

The well-known Science Museum receiver is built for two stations only, and has two windows—National and Regional. These are illuminated as the set is adjusted and this idea may be extended upon in a modern home-built set to indicate any station to which the set tunes, in place of a tuning dial. This is ideal for operating in conjunction with a push-button mechanism, although the depressed button will indicate the station. It cannot, however, be seen from across a room, and with the small illuminated windows, any doubt as to which station is being heard may be dispelled at a glance, even across a fair-sized room, if the window idea is incorporated. Obviously with these dial-light ideas, some care is necessary in a mains receiver of the A.C. type, to avoid hum due to the number of leads which may be used and which will no doubt carry the raw A.C. supply for the lights. They will, of course, be run from a 4-volt winding on the transformer, and if there is not a spare winding of this type available for the purpose, they may be taken from a 4-volt winding which delivers current to spare after supplying one or more of the valves in the receiver.

Obviously every idea has not been included in this article, but there should be some grounds for providing the mechanic with ideas which will help him to pass away the time during these dark nights.

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).

Our New Year's Set

SIR,—With reference to the request on page 319, December 30th, 1939, issue, regarding "New Year's Set."

May I humbly suggest that many of your readers would be very interested in a receiver of the type as described on page 254, December 9th, issue. This seems to be substantiated by Mr. W. Burton, in his letter on page 329 of the same issue.

I would suggest: (1) That the L.F. portion of the set be made optional (i.e., a switching device for cutting out same when not required). Thousands of listeners live within "good volume range" of the "home" programme, and, generally speaking, L.F. in such a receiver would be a waste of current, except when required for "distant" reception.

(2) Wavelength range should be optional, i.e., specification of components to include two waveband coils, or (and) three wavebands.

If receiver only designed for two wavebands (medium and long) this would allow many short-wave enthusiasts to incorporate their own short-wave attachment.

(3) Provision for 'phone reception after fourth valve (D) to allow of long-di tance reception, thus, the set would be suitable for entertainment purposes, and also provide an added attraction for the "logger" and long-distance receptionist. —R. KAIL (Birmingham).

Exchanging S.W.L. Cards: A DX Log

SIR,—I would like to exchange my S.W.L. card with any S.W.L., A.A., or full-ticket ham anywhere on the globe. I have been an S.W.L. for just over two years and have heard 67 countries on 14 mc/s.; the receiver used is a home constructed 0-v-2 run off a mains eliminator, and used in conjunction with a 30ft. indoor aerial running N.W.-S.E.

All continents have been received, also 37 states of the U.S.A. My best DX includes:

CE3AT, 3CG, 4AC; CN1, CN8; CO2JJ, 2JP, 2RR; CT2BP; CX1AG, 2CO, 2TN, 3CJ, FA, HC; HH2HB; HI3N; HK1AG, 2CC, 3CI, 3CO, 4TF; J2BC; KA1FH, 3KK; K4, K5AM, K6OQE, NYV; LU3, LU4, LU5, LU7, LU8; PK4KS, PY1, PY2, PY3, PY4, PY5, PY7AR, PY9AE; SU, T12RC, TG9BA; VE1, VE2, VE3, VE4, VE5EK, VK, VO1, VO2, VP1WB, VP2, VP3CO, VP5TZ, 5VN, VP6, VP7NS, VP9L, 9R; VQ2CM; VS7RA; VU2FA, W (all districts), YV1, YV5ABF, 5AK; ZB1, ZB2; ZC6HS.

I should also like to get in touch with any reader of this paper who has got a call-book to dispose of.

In closing, I wish your very interesting paper every success.—LEONARD F. CROSBY, 7, Fleetwood House, East Hill Estate, Wandsworth, S.W.18.

Back Number Wanted

SIR,—As it is impossible to buy the coil ready made for the 150-mile crystal set, I shall be glad if any reader would loan me a copy of *Amateur Wireless*, dated October 27th, 1934, as this issue is out of print; it explains the making of the coil and set in question.—A. H. BARKER, 5, Rosebank, Main Road, Upper Dovercourt, Essex.

Correspondent Wanted

SIR,—Thanks for my B.L.D.L.C. card. Recently I have taken considerable interest in corresponding with S/W enthusiasts, but as yet I have only two pen-pals to correspond with, and I should be very pleased to correspond with anyone interested. I have been a reader of PRACTICAL WIRELESS for nearly four years. I have made the Rapid Two and am very pleased with the results.—F. C. HART (18, Debden Road, Saffron Walden, Essex).

Exchanging S.W.L. Cards

SIR,—I am a reader of your fine magazine, and always like to see lists of "calls heard" logged by other S.W.L's. I have been an S.W.L. for two years, and during that time have logged 2,500 hams in all continents. Seventy countries have been heard on 20m. 'phone. The RX is a home-constructed 0-v-2 using batteries, and my aerial a doublet running N-S.

I have been QRT since October. DX heard during October includes 170 W's (in all districts and 39 states), HI, YV, LU, PY, KA, EK, CE, ZS, TF, CP—all on 20 m. 'phone.

I should like to exchange my S.W.L. card with anyone (S.W.L.s, A.A. or hams), and will QSL the same day as I receive their card.—D. BOOTMAN (65, Eagle Road, Wembley, Middlesex).

Prize Problems

PROBLEM No. 384.

SMITHERS wanted a super-capacity H.T. battery (66 volts) for his receiver, but owing to battery shortage could not obtain one. The nearest he could get was a low-priced small capacity battery, and he eventually decided to get this. Knowing that the capacity was dependent upon the size of the cells, he decided to go to the trouble of connecting all the cells in parallel in his battery in order to increase the capacity, and he accordingly did this. When he connected it to his set, however, he failed to obtain any signals. Where had he gone 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. 384 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, January 29th, 1940.

Solution to Problem No. 383.

Atkins overlooked the fact that a short-wave converter can only be used with a receiver employing H.F. amplification, and his set was a detector-2 L.F. combination.

The following three readers successfully solved Problem No. 382, and books have accordingly been forwarded to them:

B. Young, "Braay," Oetways Lane, Ashtead, Surrey.
J. W. Filer, 57, Elemore Lane, Easington Lane, Hetton-le-Hole, Co. Durham.
F. W. York, 177, Thirlmere Avenue, Tilehurst, Berks.

Comment, Chat and Criticism

In the Concert Room

Some Memorable Occasions Which Linger in the Memory, Described by Our Music Critic, Maurice Reeve

AN important part of the education of a professional musician—and certainly not the least pleasant—lies in the attendance of concerts and recitals given by the great executants of the day. The critical listening to works that are being studied when they are played authoritatively is of the utmost value and necessity. If the work being performed is well known beforehand, many an error—very often of minute dimension—can be spotted which otherwise goes by unnoticed in the practice room. Also the larger sweep of phrase and movement are heard in perspective, as if we were looking at a play being acted from the stalls instead of as one of the participants on the stage. This is a most valuable asset, as otherwise we are dependent either on our own personal judgment of our work or on that of friends or acquaintances—neither of which is always impartial. Then come the all-important questions of tone, dynamics, style, and the general *tout ensemble* of the artist on the concert platform.

Gramophone and Radio

It may be pleaded, of course, that the gramophone and the wireless are effective substitutes. In some ways they are. No one could deny that the possession of a record of something we are learning, and the ability to play it over and over again without having to leave our practice room, is of the utmost convenience and value. So much so, in fact, that many schools and private teachers are co-operating their use. Incidentally it must relieve the professor of much of his responsibility, and the pupil of his nervous tension. When we mark the record at the exact spot where we want to start it, as the wireless lecturers do, we have instruction and example combined, to the *n*th degree.

But it is of something else I want to talk about this week—the personal element. Can this be wholly eliminated without losing a vital spark? Can we dispense wholly with the personality of the artist, and still feel we have the complete thing? Whilst admitting the undeniable fact that the composer is greater than the performer—that the work transcends the performance—we should be able to enjoy two arts at the same time rather than one. It is the duty of the executant to breathe life into the music—to be the intermediary between the composer and ourselves and, whilst never transgressing from what should be to him the immutable commands of the author, he should be big enough to add his own personality to the original. The two together form an irresistible combination, and to suggest that any mechanical reproduction wholly supplies the reality is to suggest that a photograph is the equivalent of a living person. Composing and performing are twin arts, the one the servant of the other. Or perhaps I should use the expression companion. For a humble and menial approach to the music is just as objectionable in its results as one of arrogant and unwarranted superiority.

St. James's Hall

I have been the privileged witness of many wonderful scenes and the delighted partaker of unforgettable experiences in the concert hall. The first of all was when I was taken to the old St. James's Hall as a small lad of some four or five summers, to hear the inimitable de Pachmann—that magical Chopin player and platform buffoon—and remember vividly both his playing the Waldstein Sonata, and my sitting up on the back of the chair with my feet on the seat. Of pre-1914 memories I best remember Paderewski, Godowsky, Sauer, Rosenthal, Backhaus and a truly wonderful sixteen-year-old Hungarian genius, von Lengyel, whose performance of the Liszt Sonata has probably never been surpassed. Although pianists claim first place, I vividly recall other instrumentalists such as Ysaye, Mischa Elman, Kreisler, etc. Of these Paderewski must take precedence. Not only was he a supremely great pianist, but his personality absolutely unique and terrific. With him the personal element entered into the music to a greater degree than with any other artist of his time, but as he was of the most catholic tastes he gave us a perfect combination of the twin elements already alluded to. That he was first-class entertainment nobody can forget who saw him in his heyday. The packed hall was always in a fever heat of excitement and expectancy. He always kept them waiting several minutes over the advertised time of starting. He also charged them between two and three times the normal concert prices. Then, when his lean, spare figure, surrounded with the most marvellous aureole of red hair, eventually stepped on to the platform, the audience would rise to its feet and break into a pandemonium of applause lasting several minutes. Using his own Erard piano, worn threadbare with his work, he would pound it with a series of satanic blows struck from the level of his head. When these came to an end in the tonic chord of the first piece on the programme, further salvos would greet him. But when he commenced in earnest, what a player! What a poet! A prince of pianists!

L.S.O. Concert

I heard him three times before 1914—in two recitals and once at a memorable L.S.O. concert, when the one and only Arthur Nikitsch conducted him in his own concerto. His reappearance after the war—1923, I think, was unforgettable. Time and sorrows had greatly mellowed him, and his playing had taken on an added philosophy, and a sweeter reasonableness.

The years immediately following the war produced a natural reaction, and a musically starved populace welcomed almost anybody, and everybody, with open arms. Paderewski's return I have mentioned. Just as vociferous and joyous was Kreisler's, who came back in a series of four wonderful recitals, all of which I shall never forget. At the first one the warmth of the greeting (he was the first as well as the greatest of the ex-enemy masters to return—alas, they are again our opponents)—so moved him that his performance was almost negligible. But all was forgiven—the huge audience just cheered and cheered.

Post-war Masters

Giants of the post-war decade—most of whose appearances I have heard—were, in addition to Paderewski and Kreisler, Busoni, leonine colossus of the keyboard; Cortot, sleek Frenchman; Rachmaninow, he of the Prelude; Heifitz, the modern Paganini; Menuhin, greatest of executive prodigies; Toscanini, prince of conductors; Galli-Curci, the modern nightingale; Gigli, Caruso's only possible competitor; Casals, the only great 'cellist, and one of the world's great artists. These are the really magical ones whose names fill a concert hall of any size in any part of the world, and whose deeds cause a catch of the breath, and a thump of the heart. Busoni is now dead and Paderewski retired. I should not have forgotten Melba or Chaliapin—both no longer with us, either.

There are literally scores of other splendid artists as well. Pianists are ten a penny, and conductors almost as cheap. Neither is there a shortage of fiddlers.

Cortot is an extraordinary chap, and the only first-class artist I know whose memory fails him in public. I witnessed two very painful incidents when on both occasions he clutched his temples and uttered "Oh mon Dieu, mon Dieu"! The music did not come back to him, and he had to resume it at the most convenient point. I remember Nikitsch's baton flying into the audience—purposely, I think, and Heifitz breaking a string and having to start his piece over again on another fiddle. A bass string also snapped during a recital of Rosenthal's, and the clang reverberated right round the hall—a most unusual incident. The pianist always gets the credit for breaking a string, and is deemed a great showman in consequence, though such a thing is quite impossible. Even to break a hammer is rare. Such is luck!

THE ARGON CHARGER

T. W. THOMPSON, the makers of the specified transformer for the Argon L.T. charger, inform us that the Osram Argon valve is no longer obtainable, and the only counterpart of this is the Philips' rectifying valve (type 1038), which retails at 14s. 6d. This valve has identical characteristics to the Argon and can, therefore, be substituted without any modification to the original design.

Extending Your Loudspeaker

A Few Hints on How to Obtain the Best Results

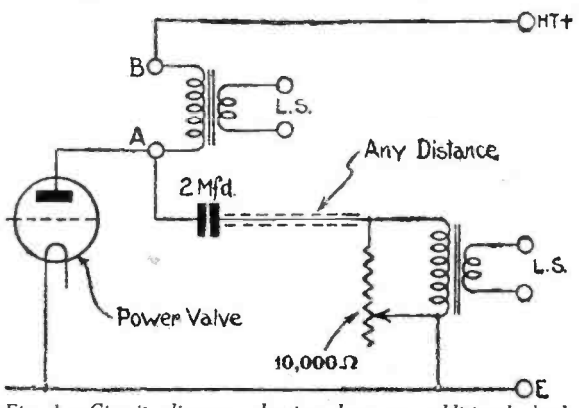


Fig. 1.—Circuit diagram showing how an additional loudspeaker can be added to a commercial set with built-in speaker.

SINCE the advent of the console type of set, with self-contained loudspeaker, it has been something of a problem to know exactly how to connect an external loudspeaker, either for use with the internal one or on its own.

Almost every set on the market to-day has terminals for the connection of an external loudspeaker. This is all very well if you are going to use an external loudspeaker whose impedance characteristics are just the same as those of the internal loudspeaker. This is not very likely, and the problem remains unsolved, in spite of those two neat terminals at the back of the set.

Losing Quality and Volume

Quite apart from this problem of the commercial set, very few listeners seem to be able to work two loudspeakers from the same set without losing quality or volume, or sometimes both. There are so many occasions on which an extension of the loudspeaker system is wanted that we really think a few practical ideas will be welcome.

Let us consider first the type of set our readers are most likely to be using—a set with an output circuit connected internally to a loudspeaker having an integral transformer. If you look at Fig. 1 the points marked A and B stand for the loudspeaker terminals. Normally, wires go from these two terminals to appropriate terminals on the primary of the loudspeaker's transformer. This is fine for just one loudspeaker, but exactly what are you to do when you want to connect up another loudspeaker?

We will assume that you are still going to use the present loudspeaker but that you want to hook on externally another loudspeaker of different characteristics.

Its Own Transformer

We are assuming that the external loudspeaker also has its own transformer. What you have to do then is to connect up your present output to this transformer, without disturbing the present matching of the internal loudspeaker.

A 2-microfarad fixed condenser is the link between. Take a wire from the A end of the existing transformer to one side of the 2-microfarad condenser. This A connection is found in practice by trial and error, not really difficult because on one terminal you will hear nothing, and on the other the extra loudspeaker will work.

To the other side of this condenser join a wire, which can be as long as you like—to the next room, down the garden, anywhere—and connect it to one side of your external loudspeaker. The other side of the loudspeaker is connected to earth. By this we mean to a nearby water-pipe, radiator, or actually to an earth plate.

You will then find that the two loudspeakers will work very well together, but one may give more volume than the other. You may be able to overcome this by altering the tapping on the primary of the transformer of the external loudspeaker, but a more satisfactory method is to use a volume-control for the external loudspeaker. The easiest way of arranging this control is to connect a resistance of 10,000 ohms across the primary of the loudspeaker transformer. This is, of course, a variable resistance, and will not appreciably affect the internal loudspeaker.

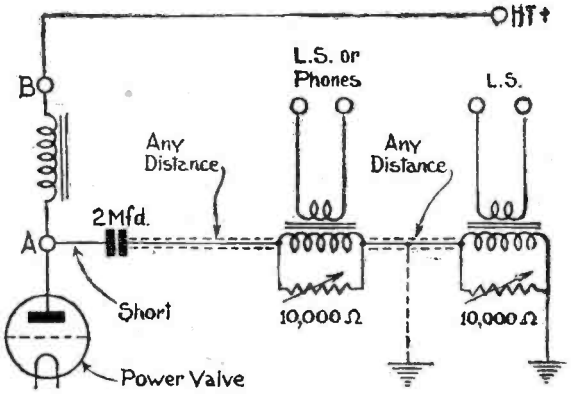


Fig. 2.—Adding a loudspeaker (or loudspeakers) to any receiver—particularly those without built-in units.

Now, it is quite possible that you may want to use two external loudspeakers as well as the internal one. This is just as simple to arrange. Instead of earthing the primary of the first transformer, connect this to the primary of the transformer of the second external loudspeaker. You then earth the remaining connection on the second transformer. The volume control is fitted as before—a variable resistance across the primary winding.

You may have a simple set without an internal loudspeaker—just a set with a plain output circuit and no choke or transformer. This you may want to use with one or more distant external loudspeakers of mixed impedances.

The Fig. 2 circuit shows you how this can be done. A and B are the loudspeaker terminals. Between these two terminals connect a 30-henry choke capable of passing the anode current of the output valve. Then from the point A, which comes from the anode of the output valve, take a lead to one side of a 2-mfd. fixed condenser. The other side of the condenser should be connected to one side of the first loudspeaker.

This may be either the primary of the transformer of a moving-coil loudspeaker, or the winding of any ordinary balanced-armature loudspeaker.

Using Two or More

If you want only one external loudspeaker, you earth the remaining side of it. If you want to use two or more loudspeakers, you connect the blank side of the first one to the one terminal of the following loudspeaker, as shown by Fig. 2. As you will see, the remaining side of the last loudspeaker is always earthed to some convenient point.

For levelling up the volume of the external loudspeakers, you can make use of the volume controls already suggested, that is, 10,000-ohm resistances across the loudspeaker windings or transformer primaries.

Whenever the extended loudspeakers are at a considerable distance, take care to use fairly thick gauge wire. We suggest single flex, such as is used for electric-light connections.

You might note that the Fig. 2 system can just as easily be adapted for using a pair of headphones with a loudspeaker. The variable resistance across the headphones will have to be adjusted so that volume is reduced to a comfortable strength.

With these few hints in mind many of you will be able to make your own arrangements for extending the loudspeaker, or for connecting up a loudspeaker in addition to the one already in the set.

It is sometimes not fully realised how much more useful a set can be made by such an extension.

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.

Issues of Practical Wireless ... **4d. Post Paid**
Amateur Wireless ... ... **4d.** " "
Wireless Magazine ... ... **1/3** " "

The index letters which precede the Blueprint Number indicates 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	*Date of Issue.*	*No. of Blueprint.*
CRYSTAL SETS.		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
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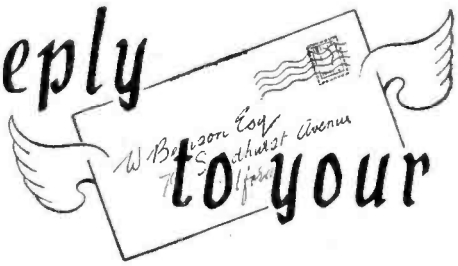
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D, (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	12.6.37	PW41
Hall-Mark Cadet (D,LF,Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF 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)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D, (Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D, (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three(HF Pen, D, Pen)	11.5.35	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)	24.7.37	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	31.7.37	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)	30.7.38	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))	19.3.38	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. 6d. each.		
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
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
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier(1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392(1/-)	*Nov.* '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	*Mar.* '36	WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

In reply to your letter



Mains Chokes

"In the 'Wireless Encyclopædia' you describe a cure for H.F. interference via the mains. I have two Eddystone Screened All-wave Chokes but I have been told that these chokes will not do. If this is so will you please inform me what chokes to use."—J. H. W. (Nottingham).

THE chokes you mention are intended for ordinary anode circuits, where the current will probably not be greater than 10 mA. The chokes referred to for the elimination of interference on the mains will carry the total mains current of the receiver, and this will, of course, be greatly in excess of 10 mA. Furthermore, there is some risk of leakage unless special chokes are employed, and these usually consist of a single layer of heavy-gauge wire, on a large diameter former. They should be enclosed in a non-metallic box so that there is no risk of a short-circuit of the mains taking place. If you wish to wind your own chokes for this purpose we suggest a 2in. diameter paxolin former, and a winding of 100 or 150 turns of No. 22 D.C.C. wire.

Class AB1

"I have seen a circuit in which it is stated that Class AB1 amplification is employed. I know that Class A is ordinary push-pull and that Class B is a special arrangement with a fluctuating anode current, but I regret that I have not seen a description of the combination AB with the figure 1. Could you explain, briefly, what the arrangement is and its advantages or recommend an article which covers this subject?"—J. H. (Bognor).

BRIEFLY the arrangement is used where a large power output is required, but the question of the H.T. consumption is not of importance. Usually very low impedance valves are employed, preferably triodes. We have referred to this method of amplification in previous articles, but hope to cover it again at some future date.

Chassis Substitute

"I have started to build a set to a published design, but the specification included an aluminium chassis. I cannot get this and I also find that aluminium is scarce and I cannot get any copper either. Is it essential to adhere to the specification in this respect, or could I use ordinary wood?"—P. R. O. (N.12).

IN many cases the metal chassis is mainly for rigidity, although it provides at the same time a measure of screening. If you examine your design you may find that there is very little screening effected by the chassis itself. Provided that you watch common earthing points, and join these together, and used screens for coils and chokes or other unscreened components which are placed on opposite sides of the chassis, it may be possible to obtain just as good results with an ordinary wooden chassis. Careful attention must, however, be paid to the particular layout and design.

Poor Selectivity

"I wanted to make up a small one-valver for the Home Service broadcasts and had sufficient material all except the coil. I wound this from spare materials, using a glass former (old lamp chimney cut down) and 50 turns for the coil with a .0005 mfd. condenser. I have a Pressland selector in the aerial lead, but the Home Service station is all over the dial and no movement of the condenser makes the slightest difference to the volume. I use a 20ft. aerial, 30ft. high, and have checked and re-checked connections time and again. Can you tell me how to tune the station?"—I. R. (Kingsbury).

AT your address the selectivity should be average, and with the aerial series device you should be able to find a maximum tuning setting. If, however, all connections are in order and the condenser is not defective, the only suggestion we can make is that you have inadvertently used resistance wire for the coil. This would flatten the tuning, although it might not be possible to tune to the correct frequency and thus the sweep of the condenser with the coil in question does not permit a maximum point to be obtained. Check the type of wire you have used, and if it is ordinary copper wire, then wind a primary winding over the existing winding, using only 10 or 15 turns, and add a few turns to the secondary. This should give you a more selective arrangement.

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.

Resistance Capacity

"Is it true that although praised so highly, resistance-capacity coupling is not all that it is claimed to be? I have been told that there is frequency distortion, time lag and other drawbacks which are not met in transformer coupling, and that a good transformer is just as fine, from a quality point of view."—K. H. (West Croydon).

RESISTANCE-CAPACITY coupling has the advantage that the resistance in the anode circuit (the load resistance) is independent of frequency and thus should amplify all frequencies equally. There is a drawback in that the signal voltage is developed across the coupling condenser and the grid leak, whilst the voltage is tapped off for the next valve only across the grid leak. Thus, there is a loss of voltage across the condenser. There are other factors such as the self-capacity of the resistances, etc., and provided that a properly-designed and really good transformer is used, it will give just as good results as a resistance-capacity coupling. A poor transformer will not, however, give the quality of a poor resistance-capacity coupling.

Condenser Marking

"I have a small condenser which is marked with the letters pfd., and I should be glad if you could give me an idea what this rating is. I have not been in wireless long and have not seen such a capacity before."—F. T. (Lowestoft).

THE rating is the same as mmfd.—micro-microfarads. One pfd or one mmfd. is equal to .000001 mfd. There is, presumably, a figure in front of the letters mentioned, and you should therefore be able to ascertain the normal rating from that. Incidentally, the pfd. rating is not often used to-day, the mmfd. value being more common.

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.

C. J. B. (Norwich). Unfortunately the effect is due to the changes which the B.B.C. have had to make. There is no cure, and the conditions have been enforced by national security and are beyond the control of the B.B.C.

G. W. (Bolton). You can use the speaker with the set in question. Obviously, however, all stations will not be capable of giving good loud results on the speaker.

H. S. (Droylsden). We can only suggest that you communicate with the makers of the set and repeat your complaint. The set may be in need of adjustment.

A. J. M. (Bolton). The H.F. Radio Company, of 22, Howland Street, Tottenham Court Road, London, W.C.1, can supply the item mentioned.

G. R. (Inverness). Write to Peto-Scott for the price and details of the coil mentioned. We understand that it is still available.

W. M. S. (Colchester). The set in question was not described in our paper, and we cannot therefore supply a blueprint. The paper in question is no longer on the market.

W. T. (Edinburgh). We have not tried the particular unit mentioned but we understand that it is a standard item and it should be quite a simple matter to fit to any standard receiver. Unfortunately, we have no details of your set which was described in a paper not now on the market and therefore we cannot advise you definitely.

A. M. G. (Paisley). We have given simple details, but not for a model comparable with the item mentioned. We have described a two-valve mains short-wave set—blueprint AW 453. The output of the amplifier would be approximately 6 watts.

R. N. S. (Worthing). Good enamelled 7/22 would be preferable in your case. Use either the rubber-covered or the same wire right through if possible. Any joints should be soldered. A buried earth is definitely desirable. The third pin mentioned is quite O.K.

B. R. (Northallerton). The small condenser is merely a trimmer to balance out any stray capacities introduced by the wiring.

D. M. (Hinckley). The coil costs 3s. 6d., the transformer 5s.

G. T. (Hove). We suggest a lower resistance, about 10,000 ohms. The condenser should be 1 mfd.

T. E. G. (Bletchley). A better transformer is recommended. Do not use a ratio higher than 3 to 1. The battery is quite suitable.

M. A. (Perth). Two of the valves are obsolete, but you may use them if they are still giving good performance. The only difficulty will be in replacing them when they fail.

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

RADIO CLUBS & SOCIETIES

EASTBOURNE AND DISTRICT RADIO SOCIETY
Hon. Sec.: T. G. R. Dowsett, 48, Grove Road, Eastbourne, Sussex.

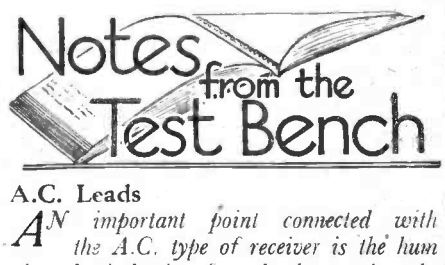
AT the society's meeting held on Tuesday, January 9th, the annual general meeting was held. The secretary thanked members who had very kindly helped the society in 1939. Some meetings were fixed for 1940. The society at the present time has a membership of 15.

Full information for joining the society can be had from the hon. secretary at the above address. Annual subscription, 5s. a year or 2s. 6d. half yearly.

THE CROYDON RADIO SOCIETY
Hon. Publicity Sec.: E. L. Cumbers, 14, Campden Road, S. Croydon.

MR. P. G. A. H. VOIGT, the well-known loud-speaker designer, made a welcome appearance before the Croydon Radio Society at the monthly meeting on Thursday, January 4th, in St. Peter's Hut, Ledbury Road, S. Croydon, the chairman being the popular Mr. P. G. Clarke.

Much attention was paid to gramophone pick-up and records. Needles alone figured in a fascinating discussion, it being mentioned how experts used fibre ones, because these had greater flexibility than steel varieties. As a result record wear is decreased. Then Mr. Voigt passed on to newer types of pick-ups. A very likeable one used a sapphire jewel point, but after September 3rd, 1939, was no longer available to the British public. Another pick-up which did good things was a make known as the silent stylus, and the action of its needle was described in detail on the blackboard. Needless to say, Mr. Voigt had brought some specially chosen records, and played them most successfully on his Corner Horn Loudspeaker. Absence of needle scratch was most marked, due to the very light weight of the pick-ups mentioned above, and also the Piezo crystal type of instrument. Incidentally, more will be heard of the latter's design, for at the next meeting on Thursday, February 1st, Mr. H. G. Ménage, of R. A. Rothermel, Ltd., will speak on "Latest Developments in Piezo Crystals." PRACTICAL WIRELESS readers are invited, and are reminded that meetings are now held on the first Thursday of the month.



A.C. Leads

AN important point connected with the A.C. type of receiver is the hum given by induction from leads carrying the heater supply, which is raw A.C. In some cases it has been found that the hum may be removed by bringing certain of the A.C. leads close to each other, so that the fields interact and thereby cancel each other out. This is similar to the idea of using twisted flex leads for the same purpose. We have seen a receiver, however, in which the A.C. leads were of ordinary solid tinned copper, run through insulated sleeving and laid perfectly parallel throughout the set, and no hum of any kind could be heard. It is recommended, however, that twisted flex be employed for the utmost reliability.

Mains Input

A FURTHER point in connection with A.C. mains receivers concerns the mains input voltage rating. Where the exact mains voltage is not marked on the transformer it is generally recommended to use the next lowest marking. It should be remembered that the H.T. winding is approximately 1 *to* 1 *ratio with the input side on the ordinary type of receiver and thus any variation in the mains input side will give a corresponding variation in the H.T. voltage. The heaters, however, due to the step-down ratio will not be so widely affected.*

Classified Advertisements

Advertisements are accepted for these columns at the rate of 2d. per word. Words in black face and/or capitals are charged, double this rate (minimum charge 2/- per paragraph). Display lines are charged at 4/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, Strand, London. W.C.2

RECEIVERS, COMPONENTS AND ACCESSORIES

RADIO CLEARANCE, LTD., 63, High Holborn, W.C.1.

BRITISH BELMONT 8 Valve plus Magic Eye All-Wave A.C. Superhet Chassis, 4 wave-bands, two short, medium and long, fitted latest Mullard Octal Base American type Valves.
Size of Chassis, 13¾" x 10" x 3". Supplied with Valves and Knobs, but less Speaker.
Chassis only, **£5/19/6** each.
Speaker for above. **17/6** each.

RICE-KELLOGG SENIOR 12" Moving Coil Speakers, 20 watts, 1,000 ohms, 11 ohms Speech Coil. Without Speech Transformer, **32/6**; with Transformer tapped 3,000 ohms and 7,000 ohms, **35/-**.

GRAMPIAN 10" 10 watt, 2,500 ohm Energised Speaker. Heavy Cast Frame .. .. **15/-** each
With heavy-duty Pentode Speech Transformer **17/6** each
Heavy-duty Speech Transformers, Pentode Matching **2/11** each

PLESSEY 2-gang Straight Condensers .. **1/6** each
Ditto, 3-gang .. .. **2/-** each

PLESSEY Motor Drive Press Button Unit. Supplied complete with 8-way Press Button Control. Precision job throughout. First Grade Motor. A.C. 24 volts **21/-** each

POLAR 100,000 Volume Controls, with S.P. Switch **1/6** each

YAXLEY type 4-pole 3-way Single Bank Switches **9d.** each

2,500 ohm Fields Coils .. .. .. **9d.** each
1 (One) gross Assorted Resistances .. **5/-** per gross
Metal Chassis Drilled. 15" x 6" x 1¾" and 11½" x 8" x 2¾". **1/6** each
Push Back Wire .. .. .. 12yds. **10d.**

ROLA P.M. Speakers, latest type 7½in. Cone, with Pentode Transformer .. .. Boxed **14/6** each
Clock-faced Dials, 5" x 3½", with printed 3-wave scale Ox-Copper Escutcheons and Glass .. .. **3/6** each
Ditto, less Escutcheons .. .. .. **2/6** each
Horizontal dials, with plain scale 7¼" x 3¼" and pointer **1/-** each

100ft. Copper Aerials, Insulated .. .. **2/-** each

FILAMENT TRANSFORMERS, input 200-250 volts, output 4 volts 4 amps, 4 volts 6 amps .. **4/11** each

G.E.C. Mains Transformer, American windings, 350-0-350 volts, 65 m.a. 5 volts 2 amps, 6.3 volt 2.5 amp. Suitable for replacements in G.E.C. models **5/6** each

24 mfd. Can type Electrolytics, 450 volts working **1/6** each

PRESS BUTTON UNITS with 6 Press Buttons, ready for wiring into set, with circuit .. .. **4/11** each
Stranded Push-back Wire, **1d.** per yard, 12 yards **10d.**

CHASSIS Mounting Valve Holders, American, 4-, 5-, 6- and 7-pin, **4d.** each. Octals **6d.** each. Loctals **10d.** each. 7-pin English type, **3d.** each.

ROTHERMEL Piezo Crystal Speakers, 7½in. Cone. List 55/-. Our price, **10/6** each. 10in. Cone **12/6** each.

POLAR N.S.F. 1 watt resistances, **4d.** each, 3/9 dozen. All sizes up to 2 meg.

WEARITE MAINS TRANSFORMERS, R.C.B. type. 350-0-350 v. 80 m.a., 5 volt 2 amps. 6.3 volt 5 amps **6/11** each
Type R.C.4. 500-0-500 v. 150 m.a. 4 volts 2 amps, 4 volts 2 amps, 4 volts 2.5 amps, 4 volts 5.6 amps, **21/-** each

PHILCO MAINS TRANSFORMERS. American Windings, 350/350 volts 65 m.a., 6 volts 3 amps., 5 volts 2 amps. .. .. **5/-** each
Ditto, but 80 m.a. .. .. **6/6** each
Ditto, but 90 m.a. .. .. **7/6** each

WEARITE 110 k/c I.F. Transformers .. **1/-** each

AMERICAN C.T.S. Volume Controls, finest made, divided spindles, length 2½in. with switch, 2,000, 5,000, 10,000, 25,000, 100,000 .. .. **2/6** each
Wire-wound 5 watt (less switch), 10,000, 25,000 ohms, **2/-** each

PLESSEY DRY ELECTROLYTICS, CAN TYPE.
12 x 16 mfd. 350 volts working .. .. **1/8** each
6 x 6 „ 500 volts working .. .. **1/6** each
12 „ 450 volts working .. .. **1/6** each
8 x 8 x 8 mfd. 500 volts working .. .. **2/11** each
16 mfd. 450 volts working .. .. .. **1/3** each

B.I. Wire-end type, Bias Electrolytics.
50 mfd. 12 volts .. .. **1/6** each
50 mfd. 50 volts .. .. **2/-** each
Tubular Wire-end non-inductive paper, all sizes up to 0.1, **5d.** each, **4/9** dozen.
Metal Case 1 hole fixing Electrolytic Condensers, 550 volts working, 8 mfd. .. .. .. **3/-** each
Volume Controls, 1,000 ohms, with switch. **1/3** each
.0005 3-gang Tuning Condenser Units, with trimmers. **1/9** each

PLESSEY Energised Speakers, 10in. Cone, 2,500 and 1,000 ohm field, with trans. .. .. **12/6** each
6in. Cone, 2,500 and 1,500 ohm field .. **5/11** each

RUBBER GROMMETS .. .. .. **4d.** dozen

(Continued in next column)

RECEIVERS, COMPONENTS AND ACCESSORIES

(Continued from previous column)

BATTERY Output Pentodes, well-known make. **4/6** each

BATTERY Double Diode Triode, well-known make. **3/11** each

RAYTHEON First-grade Valves, largest stockists, all types in stock, including Glass Series, Glass Octal Series, Metal Series, Bantom Series, Single-ended Metal Series, and Resistance Tubes, all at most competitive prices; send for Valve Lists.
All Orders Must Include Sufficient Postage to Cover. Hours of Business: 9 a.m.—6 p.m. Weekdays. Saturdays 9 a.m.—1 p.m.
RADIO CLEARANCE, LTD., 63 High Holborn, London, W.C.1. TELEPHONE: HOLborn 4631.

SOUTHERN RADIO'S BARGAINS.
ALL GUARANTEED. POSTAGE EXTRA.

5/-—Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.

15/-—Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7", 15/- the Kit.

21/-—Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.

5/-—100 Wire-end Resistances, assorted capacities ½ and 1 watt, 5/- per 100.

TELSEN; Ormond Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; 8 mfd. Electrolytic Condensers, 500 volts, 1/8. Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.

2/-—Tool or Instrument Carrying Cases, ex Government Stock; Wood 9" x 7" x 7", 2/-.
SOUTHERN RADIO, 46, Lisle Street, London, W.C. Gerrard 6653.

VAUXHALL. Rola 8in. P.M. speakers, 14s. 9d.; Rola 10in. P.M. speakers, 18s. 6d. Complete with input transformers.

VAUXHALL. Collaro A.C. gramophone motors, boxed, 29s. Modern pick-ups, 11s. and 18s. 9d., with volume controls.

VAUXHALL. TCC aluminium containers, 8 mfd. 600 v., 3s.; TCC cardboard 8 mfd. 500 v., 2s.; 8 plus 8 mfd., 3s. 6d.

VAUXHALL. Volume controls, 2s.; with switch, 3s. Tubular condensers, 0.1 mfd., 3d.; 0.25 mfd., 4d. Resistors, 1 watt, 4d.

VAUXHALL UTILITIES, 163a, Strand, London, W.C.2. Post paid over 2s. 6d. Write for free list.

BANKRUPT BARGAINS. Brand new 1939 models, makers' sealed cartons, with guarantees, at less 40 per cent. below listed prices; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

COULPHONE RADIO, Ormskirk. 1940 Brand New goods only. Collaro motors 12in. turntable, 25/-. Speakers, valves, receivers. 1½d. stamp lists.

"STAND-BY" Crystal Set. Specified coil, 2s. case, 9d.; or complete kit of parts, 10s. 3d., post free.—T. W. Thompson and Co., 176, Greenwich High Road, S.E.10.

N.S.F. and Ferranti wire-end resistances. Half and one watt. 30 different capacities. 2/-. Reliable microphones, complete with transformer, 3/6. Ditto, sprung type, 5/6. Trickle chargers, Westinghouse rectification, 2-volt, ½ amp., 9/6. Small (loud) buzzers on base, 1/3. Ditto, miniature bakelite case, 1/9. Chassis mounting valve holders, 4, 7 and 9-pin, 2½d. each, 2/- dozen. Sator wire-wound volume controls, 1,000, 10,000, 20,000, 25,000 ohms, 1/- each. All new guaranteed goods. Orders under 5/-, postage extra.—Post Radio Supplies, 328, Upper Street, London, N.1.

BANKRUPT BARGAINS. All new goods. Bakelite torches complete, U2 type battery, 2/6. 5 and 15 watt lamps, 1/3. Midget all-dry portables, £5. Truphonic 5v. A.C. all-wave 1939 11 gns. superhets, 7 gns. Portadyne superhet portables, £5/15/-. Well known make 8v. 1939 A.C.-D.C. all-wavers, 8 gns. Spartan A.C. 5v. 1939 superhets, £5/15/-. Battery combined mains superhet transportables, £7. Portadyne 1940 battery all-wave superhet, £6. Many others. State requirements please. Second-hand 8v. D.C. Murphy radiogram, cost £34/10/-. Quite as new, 11 gns. Ekco, second-hand A.C. 86, 65/-. Phillips A.C.-D.C. superhet, £3. Ekco, second-hand A.D.65, £3. Full stock Triotron valves and service goods.—Butlin, 6, Stanford Avenue, Brighton. 'Phone: Preston 4030.

HEADPHONES.—Reconditioned and guaranteed. G.E.C., B.T.H., Sterling, Nesper, Brandes, Western Electric, Siemens, 4,000 ohms, 5/- pair. Telefunken, lightweight, adjustable, 7/6. Western Electric single earpiece, 2,000 ohms, with cord, 2/6.

CRYSTAL with silver cat's-whisker, 6d. Complete detector parts, 1/-. Glass tube detector on ebonite base, 1/6. Sensitive permanent detector, 1/6. Postage 1½d.—Post Radio Supplies, 328, Upper Street, London, N.1.