RADIOLOCATION—SEE PAGE 330

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Edited by F. J. CAMM

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COMMENTS OF THE MONTH BY THE EDITOR

Radiolocation

Aerial Warfare Revolutionised

THE new science of radiolocation bids fair to revolutionise modern warfare. The last war was responsible for the development of wireless telephony, a secret which was very carefully kept until after the war. It was warfare, therefore, which developed radio entertainment, and now radio entertainment has contributed a new war weapon to counter aerial attack, even as the tank countered the shock tactics of the German troops in the last war. We are anxious, however, that those who have contributed to its perfection should be accorded the proper credit. There were many who after the last war claimed to have invented the tank, to have conceived the idea of the tank, or to have been responsible for the invention of the tank.

The facts are that no one man was responsible for it. A man who makes a bald suggestion is not an inventor, otherwise H. G. Wells could claim the invention of the aeroplane and aerial warfare, for in his *War of the Air* he forecast modern aerial warfare in the latter part of the last century. The present writer had a vast amount to do with the development of the tank in the last war, and he was associated with the technicians of the many firms engaged in producing the prototype. Many of those who claim a little reflected glory for the invention of the tank were not heard of in connection with it, and now that the history of the last war has been written it is apparent that dozens of people had suggested to the War Office the bald idea that we should construct a landship mounted with guns. Radiolocation, it would seem, has not been the product of one man's inventive faculty. It is, however, such a remarkable step forward that it is very proper to give credit where it is due. Necessarily we are not permitted to publish details of it until the war is over. We are, however, permitted to say that it operates on a system of ether waves unaffected by fog, cloud, or darkness, and which are constantly sent out far beyond the limits of our shore. Any solid object, such as aircraft or a ship, that is in the path of these waves reflects back the signal which announces to the detecting stations its presence in the air, or on the water.

Advantages of Radiolocation

IT is not a new departure in radio science, but the application of existing knowledge, and principles. It is obvious that one of the advantages of the new system is that it is now unnecessary to maintain large patrols of fighters, and this alone will save the country immense expenditure on petrol and engine replacements, as well as releasing personnel for other duties. Experiments over the past six years have now been brought to fruition, and we can thus hope that a science originally developed for war purposes, for commercial communications, and for life-saving at sea, can now be applied to life-saving generally. The aeroplane conquered the air, and is now in itself dependent from a military point of view upon a science which was ancillary to its perfection. Many thousands of wireless operators are now required in connection with radiolocation, and we have been approached by the Air Ministry to issue an appeal to our readers with technical knowledge, particularly of transmitting, to get into touch with them. If readers willing to join the Service in this capacity will get into touch with us we shall be glad to put their names forward in the proper quarter. Envelopes should be marked in the top left-hand corner "Radiolocation." All applications will be treated confidentially. Members of the British Long Distance Listeners' Club are particularly invited to join. There are splendid opportunities in this new branch of the Services.

Wireless Examinations

MANY hundreds of our readers have already placed their technical knowledge of wireless at the disposal of the country, but those who have not joined, and who may not have the necessary requirements for radiolocation may enlist as wireless mechanics, and pass a grade III trade test. This will provide them with an opportunity for being trained in theory as well as in practical work. The course lasts from two to three months, and the trainee can then pass the grade II test. Upon passing this he may sit for an entrance examination for the Military College of Science, where he is taught advanced theory, workshop practice, and the practical side of radio servicing.

Books For the Services

THOSE intending to enter the Services should study the books we have specially produced for them, and which have been purchased in tens of thousands by those already in the Services. "The Radio Training Manual" is a valuable first course, and a study of it will enable the beginner to pass the initial test. The second book to study is the "Practical Wireless Service Manual," for this deals with fault-tracing and remedy. Follow this with a study of "Newnes' Short-Wave Manual." The "Practical Wireless Encyclopædia" is a reference book with the contents alphabetically arranged so that the pages virtually index themselves. It contains nearly every available radio fact and figure. The "Radio Engineers' Vest-pocket Book," specially printed on thin but tough paper to reduce its bulk so that it may be conveniently carried in the vest or uniform pocket, contains valuable tables, mathematical formulæ, and calculations used in connection with radio.

Further Practical Books

A HANDY catalogue of our technical books is available free to readers addressing a postcard to the Publisher, Book Department, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Other wireless books published from the offices of this journal are: "Wires and Wire Gauge Vest-pocket Book"; "Everyman's Wireless Book"; "Practical Wireless Circuits"; "Wireless Coils, Chokes and Transformers"; "Wireless Transmission"; "The Superhet Manual"; whilst for practical workshop instruction the reader should study "Newnes Engineers' Manual"; "Workshop Calculations, Tables and Formulæ"; "Practical Mechanics Handbook," and "Dictionary of Metals and their Alloys."

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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.

Colourful Listening

Something New for the Owners of Quality, High-power Amplifiers to Experiment With

"LET'S turn down the lights and have some music" is not an infrequent desire on the part of those who know their records, and like to make up a programme every now and again for an evening's entertainment. Those who choose their listening and appreciate orchestral items will also often arrange to have their listening accompanied by suitable room illumination. All of which goes to suggest that to most of us there is a definite tie-up between lighting effects and sound.

The theatrical producer knows all about this, and lights his stage in sympathy with the music. Moreover, he goes further than the principle of "Soft Lights, Sweet Music"; he does not rely only on intensity of lighting to match the intensity of sound, but he brings his artistic talents to bear by varying the colour *and* the intensity of the stage lighting.

Combining Colour and Sound

In the combining of colour and sound sensations everyone may have his own ideas of what should go together; should a dim, deep blue accompany low, melodious tones, or a dark, restful green? How would you react, chromatically, to a Beethoven crescendo? Do you favour a brilliant orange or a flaming red as an appropriate associated visual sensation? If you are not sure, why not try the experiment of providing lighting effects as a background to your listening.

Many technical readers would be surprised at the preparation and activity which goes on when a "live-wire" gramophone enthusiast gives a record recital; and it would not be long before they themselves became imbued with similar enthusiasm for the technical details, if not for the musical side of recitals. What technical details can there be associated with the playing of a few records in a private house, may well be the uninitiated reader's query. Well, by way of an answer, here is the description of the arrangements for a recital at an enthusiast's house, at which the writer attended. It was not an isolated experience by any means.

Stage Effects

The first feature that attracted one's attention was the small stage in an alcove of the room—an ordinary-sized room—which was dressed with curtains lit by footlights. Rows of chairs faced the stage, but at the back of the last row was one chair on its own. At each side of this chair was an upturned wooden box on which was mounted a variety of switches and other electrical controls.

A multiple cable emanated from these boxes and was led round the edge of the room to eventually disappear beneath the stage. The electrical equipment on the stage comprised three footlights, each coloured to one of the primary shades, while three more were fixed on the stage and hidden from view by short curtains.

The front curtain could be opened or closed by means of an endless cord operated by a small electric motor. The backcloth was also covered by two curtains which could be opened and closed in a similar manner.

The centre of the stage was occupied by an electrical reproducer which incorporated an automatic record-changing mechanism. The final piece of electrical equipment was the spotlight situated at the top front of the stage hidden from view of the audience.

This spotlight had in front of it a large disc in which were mounted small gelatine discs of various colours so that the colour of the spotlight could be varied over a wide range. The disc was mounted on the shaft of a small motor with a ratchet device which allowed the disc to be rotated step by step and to come to rest when one of the gelatine discs was directly opposite the lens of the spotlight. All these devices were, of course, connected to the cable which went to the controller's chair at the back of the room and it will be appreciated that some very interesting effects could be obtained.

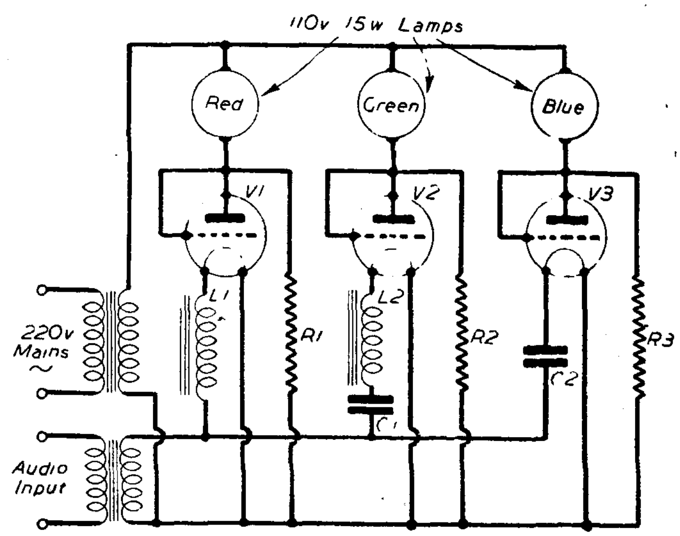


Fig. 1.—Circuit for valve-controlled coloured lamps.

It remained to the personal taste of the "manager" as to what lighting accompanied any particular type of music, but the general rule was to have dark blue for soft low passages and to work up through greens and yellows for crescendos, until the climax was reached with brilliant lights of orange and red.

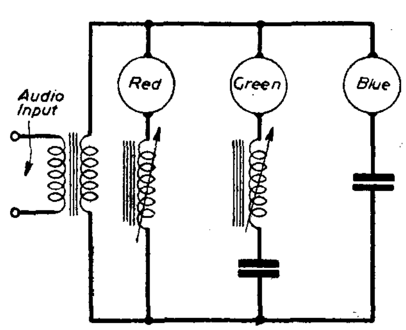


Fig. 2.—Circuit for directly-controlled 6 v. lamps.

Pictorial Background

Some records, or programmes of records, were terminated by a finale in which the stage was blacked out except for the spotlight, which had been arranged to project on to the back cloth which was revealed at the appropriate moment by drawing open the two curtains covering it. The back cloth would carry some impression or a picture, such as the *Retreat from Moscow*, which was used as a climax for ending a record of the "1812 Overture."

Then one programme where Wagner's "Ride of the Valkyries" was being presented, small quantities of photographic flashlight powder were ignited by means of a spark coil connected to sparking plugs to represent flashes of lightning on a vivid blue stage at the musical climax.

A recital run on these lines is a novel experience for any audience who have never previously attended such a unique function, but, as in most things of this nature, the producer has had far more enjoyment in preparing and rehearsing his effects many times before the show is given.

From the entertainment point of view, as far as the writer was concerned, the recital he attended at this particular enthusiast's house was intensely interesting, and the association of colour with music certainly assisted in the thorough appreciation of the music.

One thing, however, perhaps because of his technical interest in the show, detracted from a full enjoyment from the entertainment, and that was consciousness of the "manager" at the back of the room manipulating the controls. Despite the utmost care, there were at times irritating little clicks and noises which were a prelude to some change in the lighting, but in the circumstances we had to be tolerant.

The advent of television, however, took the writer's attention off this scheme for some years, but the closing down of the television service and the more frequent evenings at home, due to war-time conditions, brought fresh interest to the entertainment possibilities of records and record recitals with coloured accompaniment.

In America the idea has been commercialised in a very ingenious way by means of a radiogramophone on which is mounted a large sphere or globe of opal glass. Within the globe are various coloured lamps representing the primary colours, and the resultant colour and the intensity of the lights are automatically controlled by the reproduction from a special amplifier which is connected to the normal power pack. With the lighting in the room extinguished the colours from the lights in the globe will vary from dim to brilliant according to whether the music is soft or loud.

A glass globe is not, in the writer's

opinion, an ideal object to have as the centre of attraction, and there are great possibilities for extending the scheme by operating the lights on a small stage, as has been described. The lighting being automatically controlled there will only remain the control of the curtains, and press-buttons could be used for this purpose to eliminate all noise.

Automatic Effects

For the technically-minded, a description of how automatic effects are produced will be of interest.

The arrangement is commercialised by the Patterson - R.C.A. instrument, and the circuits are covered in the Patent 2,131,934 which was described recently in an American journal.

In Fig. 1, it will be seen that the audio signal provides current to heat the filaments of three directly-heated power valves. In the American amplifier, type 71-A power valves are employed, and the nearest to them in the English range of valves is the PX4. Comparisons of the chief characteristics of the valves are as follows :

	71-A	PX4*
Fil. Volts ..	5 v.	4 v.
,, Current ..	.25 A.	1 A.
Anode Volts ..	180	200
,, Current ..	20 mA.	40 mA.
,, Load (ohms)	4,800	2,500
Amplification factor	3	5
Output (watts) ..	.79	1.5

(* Characteristics at 200 v. on anode.)

It will be appreciated that the signal as applied to the loudspeaker of the receiver reproducing the programme must be amplified to produce the necessary wattage to heat the filament of the power valves, and a suitable amplifier is incorporated in the American equipment in front of the matching transformer, shown in Fig. 1.

Circuit Details

The amplifier circuit is precluded from Fig. 1, for the sake of simplicity, and a 10-watt power valve will serve in most cases. The total power required by the three valves which may have to be operated at maximum filament current will, in the case of PX4's, be 12 watts, so that there is no risk of over-running the filaments of the three valves from the output of a 10-watt amplifier.

The H.T. for the three " control " valves, as we may call them, is provided by a transformer giving 220 v. A.C. so that a simple 1 to 1 ratio transformer is required for connection to normal A.C. mains supplies.

In the anode circuit of each valve is a 110 v. 15 w. lamp which will be fully illuminated when its valve is giving maximum output. R1, 2 and 3 are the load resistances for the power valves V1, V2 and V3 which are acting as diodes with their grids connected to their anodes. The values of the resistances used for the 71-A American valves were about 2,000 ohms, but this may be the subject of experiment to obtain the desired smoothness of light control from the coloured lamps. The valves do not amplify, but merely control the current flowing through the lamps by means of the temperature of the filament. The temperature depends upon the amount of current flowing through the filament, and it will be observed that each valve has certain components in its filament circuit.

V1 has an iron-cored inductance which will prevent any high frequency current flowing through the filament of the valve, and will allow only the low frequency or bass notes to cause the valve to function, and its red light to glow.

V2 has a combination of a small L.F. choke with a condenser in series with it. This combination allows only the middle register of the audio frequencies to actuate the valve, and cause the green light to glow.

Finally, V3 is the high frequency or treble control for the blue light, as only a comparatively high frequency current can flow through the condenser which is in its filament circuit.

Audio-frequency Analyser

The whole arrangement is thus an audio-frequency analyser which sorts out the various tones in the reproduction and lights up the coloured lamps according to the tonal characteristics of the music.

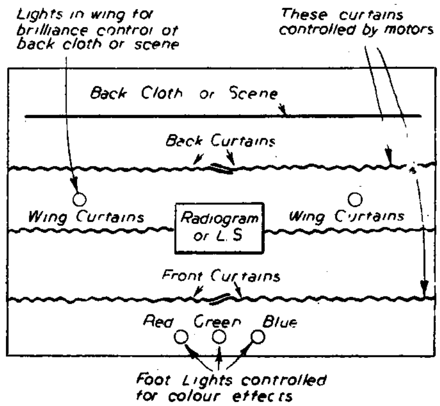


Fig. 3.—Diagram of simple stage layout for gramophone recitals.

In the Patent referred to, the inventor states that for the chokes small solenoids having about 1,000 turns of No. 26 cotton-covered wire provided with a sliding core of laminated iron, with a condenser of 4 mfd. for the green light, and the condenser of 2 mfd. for the blue lamp, may be tried for first experiments.

The inductance of the choke for the red lamp is less than the inductance of the choke in the green lamp circuit.

In one type of equipment covered by the Patent, a similar arrangement of power valves controls the brilliance of plain, uncoloured lamps which illuminate tall, translucent glass columns arranged behind coloured lamps. Thus, as the volume of reproduction increases so does the current passed by the valve, and hence there is an increase in the brilliance of the columns of lights which work up to a climax as the crescendos develop.

Using 6-volt Pilot Lamps

For early experiments in this interesting sphere of chromatic reproduction, or where, due to war-time conditions, it is not possible to obtain a number of large power valves for experiments with the circuits just described, similar effects may be obtained from 6 v. pilot lamps. The 6 v. type of scale lamp used in present-day receivers generally requires a current of only .3 amp., thus requiring a wattage of 1.8 to light it. Three of these lamps will thus require approximately 5.5 w. of output from a receiver to light them.

In most cases quite a useful light could be obtained from one of these lamps connected across the speech coil of a low resistance moving-coil speaker. Fig. 2 gives the circuit for an arrangement for audio-frequency analysis with three pilot lamps. This arrangement lends itself very well to miniature or model theatre work. Instead of a large stage built round a radiogramophone or electrical reproducer, a smaller stage could be arranged around a loudspeaker on a table, the speaker being suitably camouflaged as desired. The arrangement is more economical in material, and yet provides all the enjoyment of production which may be obtained from the full-size stage using about 10 or 12 watts. By employing a bunch of three 2 v. lamps in series for each colour, instead of one 6 v. bulb, quite good effects can be obtained.

This arrangement of lamps is very sensitive to the frequency changes in the music, and the power valve circuit is much better because the delay action of the thick filaments in the power valves smoothes out all flickering due to small changes of tone value, and gives a more general over-all average of rise and fall in sympathy with the reproduction.

Simple Stage Layout

Fig. 3 gives the layout of a simple stage, whether full size, or a smaller model stage, surrounding a loudspeaker. In the latter case, the movable curtains may be controlled by small tuning motors actuating wires on pulleys such as are used for the more intricate types of tuning scale drives. This type of motor may also be used to operate a vari-coloured disc in front of a miniature spotlight.

It is quite likely that the war will carry on through next winter, and the above description of what may be done in the way of colour blended with music may well serve to direct the interest of many radio experimenters who are looking for something new to try out, until their more normal activities are regained.

Changes in components may be tried out to obtain a different control and chromatic balance—while various combinations of colours—more than three if desired—may be experimented with.

If a non-technical record enthusiast can link up with a radio experimenter both will derive great enjoyment from well-planned home recitals run on theatre lines, with due credit on the programmes to the " Musical Director " and " Stage Manager."

In Memory of Sir Walford Davies

As a tribute to the memory of Sir Walford Davies, the B.B.C. is inaugurating a fund to endow a bed in Charing Cross Hospital, London.

Placed as it is in the centre of London, near the Temple Church and Savoy Hill, where Sir Walford Davies worked for many years, this hospital has been associated with the B.B.C. since the early days of broadcasting and already contains beds endowed in memory of the Very Rev. H. R. L. (" Dick ") Sheppard, and Mr. J. C. Stobart (the B.B.C.'s first Education Director), and a cot endowed by the B.B.C. Children's Hour. It also contains four Sir Henry Wood Jubilee beds for musicians.

The cost of endowing a bed in perpetuity is £1,000, and listeners who have enjoyed Sir Walford Davies' broadcasts are invited to contribute to the fund. If sufficient money is received, more than one bed will be endowed.

The death of Sir Walford Davies, in March last, took from listeners one of the most vivid of all broadcasting personalities. Since 1924, millions had heard his talks on secular and church music, and it is felt that numbers of these listeners will gladly share in the tribute to his memory. Contributions should be addressed to Sir Adrian Boult, B.B.C., London, W.1, and envelopes should be marked : " Walford Davies " in the top left-hand corner.

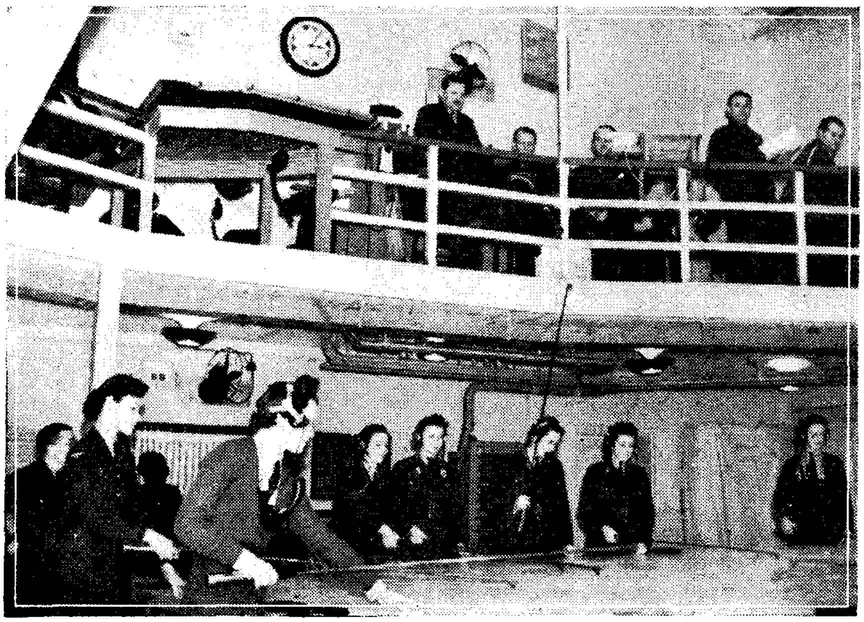
Radiolocation

A Brief Account of the Wireless Means of Locating the Presence and Position of an Approaching Enemy Aircraft

At a conference held recently at the Air Ministry, Air Chief Marshal Sir Philip Joubert revealed that one of the "mysterious" devices which is countering the night bomber is radiolocation. Although its development began years before the present war, it has remained a secret until now; in fact, it largely contributed towards the success of the R.A.F. during the Battle of Britain last September.

Radiolocation is not a new departure in radio science but the application of existing knowledge. The urgent need of the R.A.F. to have early knowledge of impending air attack resulted in the conversion of a laboratory experiment into a vital weapon of war. One man, Mr. R. A. Watson Watt, visualised the great possibilities of the new device. He is now scientific adviser on tele-communications at the Ministry of Aircraft Production, and in 1935 he headed a team of brilliant scientists who worked with him on the problem from the start. They got together a team of clever young men and worked for months in absolute secrecy until they were able to show that radiolocation was a proved reality. Experiments went on continuously for four years.

As war became imminent their efforts were intensified, and so urgent did the need for radiolocation become that they made themselves the first series of radiolocators to give warning of the approach of German aircraft.



Air Ministry Photograph. Crown Copyright Reserved.

In an R.A.F. operations room, where radiolocator messages are plotted on large table maps.

How It Works

Briefly, this is how the radiolocator works: Wireless waves, which are unaffected by darkness or fog, are constantly radiated to act as a scouting medium far beyond the limits of our shores.

If a solid object such as a ship or aircraft is encountered it sends back a reflection. Day and night distant outposts of the air are "manned" by wireless electronic watchmen, ready to flash tidings of the enemy's approach with the speed of light.

This system makes it largely unnecessary to maintain standing patrols of fighters, saving the country immense expenditure on petrol, engines, wear and tear on aircraft, and also has relieved the tremendous strain on personnel which otherwise would have been unavoidable.

Trained Personnel Wanted

Under the impetus of war the system has developed rapidly, and the experiment that started six years ago is now a huge organisation constantly growing. The scientists are making improvements, and the manufacturers are keeping pace, but there is a shortage of trained personnel to service the growing number of locators. The three Services have been combed for suitable men and women.

Mr. R. A. Watson Watt.

Dealing with the call for men to operate the device, Sir Philip said it was a marvellous opportunity for young men to "get in on the ground floor" of one of the most remarkable developments of modern times.

Technical Civilian Corps

It has been announced by Sir Archibald Sinclair, Air Minister, that a new technical civilian corps is being formed to operate and maintain the radiolocators. Skilled men from overseas will be enrolled for work here in the repair and maintenance departments of the Navy, Army and Air Force, in a non-combatant capacity. Schoolgirls and boys are to be trained for the radiolocator organisation. They must be good at physics and mathematics, and have reached the school certificate standard.

Air Ministry Photograph. Crown Copyright Reserved.

Girl telephone operators of the W.A.A.F. handling radiolocator messages.

Detection Methods—2

The Chief Considerations Which Govern the Choice of Detection Systems, and the Advantages and Disadvantages of the Systems Previously Described

by The Experimenters

LAST month we explained, in fairly general terms, how the three principal systems of valve detection operate. The systems are: leaky grid (sometimes called cumulative grid), anode bend, and diode; there is also power grid, but this is merely a modified method of using the leaky-grid system.

To put the matter in its simplest form, we could state that leaky grid is most suitable for use in a small, "straight" receiver, in which sensitivity is of first importance; that anode bend is seldom used in receivers nowadays, although it is useful for valve voltmeters; and that diode detection is best in a large receiver where there is a good deal of amplification prior to the detector—or second-detector—stage.

It must be appreciated that although the diode is capable of dealing with considerably larger signal inputs than are either of the other methods, and although it can also give a much higher output, it is comparatively insensitive. Additionally, since it passes current, the current being drawn through the preceding tuning circuit, it provides a fairly heavy damping effect. In a superhet, where the frequency applied to the second detector is lower than the signal frequency, this damping is not of a serious nature.

Sensitivity of Leaky Grid

The leaky-grid detector is by far the most sensitive, chiefly due to the fact that it provides useful amplification as well as acting as a detector or de-modulator. It operates on the straight portion of the anode current-grid volts characteristic, and this explains the good amplification which it gives. Admittedly, this type of detector draws grid current, so damping the tuned circuit. But the current is not as high as would normally be drawn by a diode. Moreover, the damping caused by this grid current can be more than counterbalanced by the use of reaction; as many readers will remember, the effect of reaction on the grid tuning circuit is that of negative resistance, so that it compensates for losses in this circuit.

Handling Capacity and Distortion

The only important disadvantage of leaky-grid detection is that the detector is fairly easily overloaded. That is why it is not suitable for use after a number of H.F. or I.F. stages. As we saw last month, if the grid voltage (provided by the signal) swings to the left of the bottom bend in the characteristic curve, distortion takes place due to a combination of grid-leak and anode-bend detection, which causes "flattening" of the anode-current curve.

This can be overcome by increasing the anode voltage, and modifying the values of grid leak and condenser, so that the characteristic is moved farther to the left, or negative side. That is precisely what is done in power-grid detection. It should be made clear in passing that the altered values of grid-circuit components does not affect the position of the characteristic, but merely alters what might be described as the time factor of that circuit.

Anode Bend

And now we can look at anode bend from a more practical angle. On first thoughts it would seem to offer an advantage in that it does not damp the tuning circuit, because no grid current is allowed to flow. But since reaction cannot be used very satisfactorily with anode bend (due to the comparatively high-capacity anode by-pass condenser) the actual damping—assuming the leaky grid with reaction and the anode bend without—is, in effect, no less than with leaky grid. In a "straight" receiver in which reaction was not used, and where there was appreciable amplification before the detector, the anode-bend detector would show to advantage. But as far as receivers are concerned, this is just about the only case in which anode bend could be said to be preferable to the other methods.

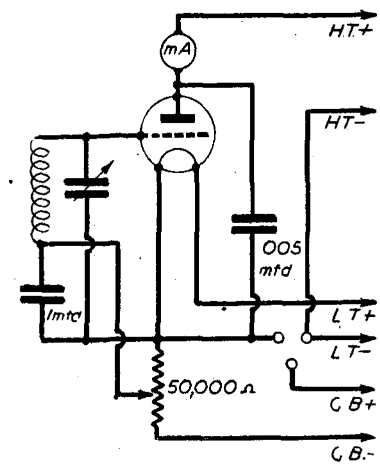


Fig. 1.—An anode-bend detector used as a valve voltmeter. If used in a receiver, an anode load would be required and the anode by-pass condenser should have a lower value—not more than .002 mfd.

It has often been stated that anode bend gives less distortion than does leaky grid, but provided that overloading does not take place, such a statement cannot be completely substantiated. As mentioned above, the only really important use of anode bend at the present time is in valve voltmeters. Its advantages for this purpose are: that it can be biased back so that the standing anode current is zero, and that it does not damp the tuned circuit.

Since the standing anode current may be reduced to zero, any change in current due to the application of an H.F. voltage to the grid can be measured on a sensitive milliammeter with a small full-scale deflection. Fig. 1 shows a typical valve-voltmeter circuit where a potentiometer is used to control the bias voltage; in practice it may be sufficient to use simply a tapped G.B. battery unless a high degree of sensitivity were required such that the valve were biased back just to cut-off and not beyond that point.

Bear in mind that automatic bias could not be used, because under no-signal conditions there would not be any anode current to give the required voltage drop across a resistor in series with the negative H.T. lead.

Component Values for Leaky Grid

Now we can consider the circuit requirements for different types of detector. Fig. 2 shows a grid-leak detector with reaction, and the component values indicated are those suitable for an all-wave receiver. If the set were required for short-wave reception only, it would generally be better to reduce the capacity of the grid condenser to .0001 mfd., and to increase the value of the leak to about 5 megohms. It will be seen that the leak is returned to L.T.+, which is most usual; with some valves the negative L.T. connection is to be preferred. For a "hot-stuff" short-waver it is still better to join it to the slider of a potentiometer (25 to 100 ohms) connected across the L.T. leads.

Since we obtain a fair amount of amplification from the valve the most suitable type is one with a high amplification factor and fairly high mutual conductance. For battery valves, a mutual conductance in the region of 1.5 mA./volt generally indicates a good leaky-grid detector, whilst for mains valves the corresponding figure is about 3.5 mA./volt. Detector valves have a medium value of impedance—about 18,000 ohms for battery types and 12,000

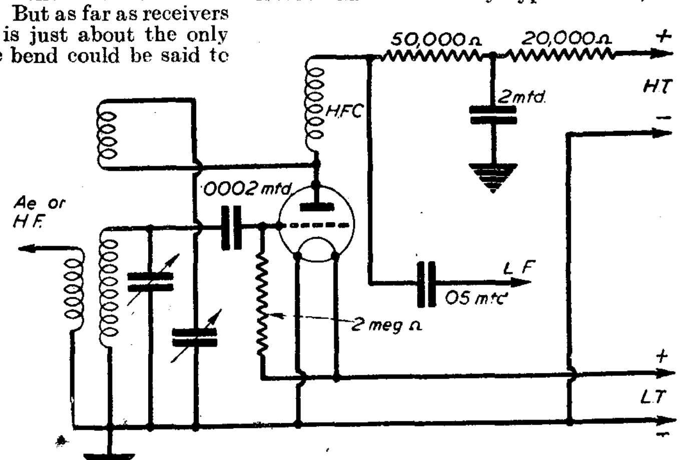


Fig. 2.—A grid-leak detector with reaction, showing average values of components.

ohms for mains types. These figures are, of course, very approximate and vary appreciably in different designs. It will generally be found, however, that valve manufacturers make one type of valve which is specially recommended for leaky-grid detection. In addition to having a high amplification factor, fairly high mutual conductance and medium impedance, the electrodes should be rigidly constructed and supported so that vibration, which causes microphonic noises, is eliminated as far as possible.

Load Resistance

The anode-load resistance should normally be three or four times the internal resistance of the valve, provided that with such a resistance it is possible to apply a sufficiently high voltage to the anode. As a rough approximation, a voltage of 60 for a battery valve and 100 for a mains valve can be considered as satisfactory.

Regular readers will remember that we have often recommended the use of screen-grid or pentode valves as leaky-grid detectors. These have the advantage that very smooth reaction control is made possible by supplying the screening grid through a potentiometer. The principal objection to these valves is that it is impossible to provide a sufficiently high anode load, and a compromise has to be made. The method of operation as a leaky-grid detector can be considered as fundamentally the same as that of a triode.

Valves for Anode Bend

For an anode-bend detector, it seems fairly obvious that we require a valve with a pronounced bend toward the bottom of the curve. It is found that the best type is one with a high amplification factor and high internal resistance. As there is little call for anode-bend detectors at the present time it may not always be possible to choose an ideal triode, and there may be a definite advantage in using a screen-grid or pentode type. The circuit given in Fig. 1 applies in its general form to a receiver detector, although it would require an anode load of high resistance (or impedance if a choke were used). Here again there is some difficulty in providing a sufficiently high load without cutting down the applied anode voltage very drastically,

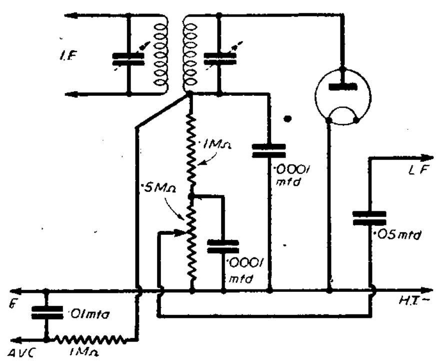


Fig. 3.—A very simple form of single-diode circuit, where the diode is used for second detection and automatic volume control. It is often desirable to include an H.F. stopper resistance in the lead to the grid of the L.F. valve.

and a compromise has generally to be made.

The Diode Second Detector

There are so many arrangements of diode detector that it is scarcely possible to give even a typical circuit, although the fundamental circuit shown in Fig. 3 indicates the main points. A single diode is shown, and a portion of the rectified voltage is tapped off, smoothed through a resistance-condenser system and applied to preceding variable-mu valves as automatic-volume-control bias. As we have pointed out, a large output is possible if there is sufficient input, and, therefore, an ample D.C. voltage can be developed for biasing purposes. The .5 megohm resistance, shunted by a .0001-mfd. condenser, acts as the main load for the diode, while the .1 megohm resistor and a second .0001 mfd. condenser act as decoupling or as a "stopper" arrangement to keep H.F. out of the L.F. circuit.

It is customary to use a potentiometer as the main load resistor, so that a variable low-frequency voltage can be applied to the following L.F. valve. In other words, the potentiometer load resistor also acts as an L.F. volume control.

This simple A.V.C. arrangement is not entirely satisfactory in practice due to the fact that a negative bias is applied to the preceding variable-mu valves when even the weakest signal is tuned in. It is therefore desirable to introduce a fixed opposing voltage so that A.V.C. bias is applied only after a certain pre-determined signal level has been reached. We cannot go fully into that matter here, since it is rather outside the scope of the present article. It has been dealt with in previous articles on A.V.C. Neither is this the place to discuss the many practical methods of using double-diode-triode valves for such purposes as quiet, amplified and delayed A.V.C. All of these are, however, developments of the simple system which we have outlined.

Reception of C.W.

Before leaving the subject it is worth while pointing out that a diode is not normally the most suitable form of detector or second detector for use when C.W. reception is required. In fact, for that purpose it is hard to beat the leaky-grid type, either with reaction or with a separate heterodyne oscillator. A separate oscillator could be used along with a diode, but since only 'phones are normally used for C.W. a small detector input is sufficient and therefore the grid-leak detector is the most practicable. For a "communications" receiver, however, which is required for telephony and C.W., and for both speaker and 'phones use, the diode may be preferred, along with a separate heterodyne oscillator.

Broadcasts to Schools

During the first year of the war the School Broadcasting Programme was planned from term to term. For the school year 1940-41 the B.B.C. returned to the practice of planning on a yearly basis, and last July a brief Annual Programme was issued. Despite air raids and the intensification of war-time conditions throughout the country since then, the School Broadcasting Service has been maintained without interruption. For 1941-42—the third "educational year" of the war—the programme is again planned on a yearly basis.

The News Commentary for Schools, which is broadcast daily from Mondays to Fridays, gives background information to the news, and it has proved popular with schools and the general public alike. Consequently, it has been decided to continue it in the intervals between the normal school broadcasting terms and it will be broadcast on every day of the year (excluding Saturdays, Sundays, and possibly Christmas Day and Boxing Day).

During the three school broadcasting terms, which extend over thirty-five weeks, in addition to the daily News Commentary, thirty broadcasts a week are intended for children of varying ages and in different types of school. The broadcasts vary from "Music and Movement" and "Let's Join In," intended for infants, on the one hand, to such series as "Intermediate French," "Talks for Fifth Forms" on "Science and the Community" and "Talks for Sixth Forms," intended for senior secondary school pupils, on the other. Between these two extremes are ten series intended for children in junior schools, eight for children in senior schools and six intended for a wide range of children in both junior and senior schools. Most of the main subjects in the school curriculum figure in the programme.

Concert Series

In the Orchestral Concert series on Friday afternoons, a half-hour concert by one of the B.B.C. orchestras will be given every third week and the intervening weeks will be devoted to illustrated talks on the principal work to be played at the next concert and on its composer. The "Music Making" broadcasts are also to continue. Science will be represented by three series—"Nature Study," for juniors; a series on "General Science," for seniors; and the well-established series entitled "The Practice and Science of Gardening," in which experts talk on the gardener's practical problems, the science behind them and the wider problems of agriculture.

With so many town children evacuated to the country the special series for rural schools on Tuesdays, called "Country Work and Country Ways," is likely to have a special appeal. These broadcasts are designed to encourage children in rural areas to look about them with a new interest and undertake project work on all kinds of things affecting life and work in the country.

Physical training broadcasts (two series) will continue for the benefit of schools with limited facilities for work on this subject, and the weekly "Current Affairs" talk will be given for children in their last year at school.

Talks on America

America has an important place in the schools programme. The Senior Geography broadcasts, for example, will have the general title: "Making the Americas," and in the Autumn Term they will deal with Canada, Newfoundland and the West Indies; in the Spring Term with the U.S.A.; and in the Summer with Latin America. American history will be one of the threads in the Senior History series on Thursday afternoons; and in the Autumn Term on Friday afternoons will be a series under the title, "If You Were American." The scripts of these broadcasts will be prepared by Nora Waln.

The B.B.C.'s Annual Programme of Broadcasts for the year 1941-42 is now available and teachers may obtain copies on application to the Secretary, Central Council for School Broadcasting, Bedford College for Women, Regent's Park, London, N.W.1.

ON YOUR WAVELENGTH

By Thermion

The Brains Trust

READERS by this time are aware of my unchangeable and unchanging views on crooners and jazz. Now I have another complaint to make regarding the B.B.C. programmes, and it concerns that fantastic item known as the Brains Trust. Among others, Joad and Huxley contribute to what is supposed to be an entertaining radio feature. I do not know who selected this title, but I do suggest that it is just a trifle vainglorious, with just a soupçon of braggadocio, for these gentlemen to consider themselves as being necessarily brainy. I do not question their qualifications in their respective spheres. As I am without experience of them I am prepared to accept them. What I now wish to impart is that their broadcasts do not lead me to suppose that they are brainy. The programmes coming under this heading which I have heard to date consist chiefly of their answers to specific questions of which they have not previous intimation. Their answers are spontaneous. Now, in the ordinary way, one would be led to believe that an item with the highfalutin title of the Brains Trust would contain at least something indicative of brains or some question which was answered in a manner which left no room for opinion or doubt.

The questions and the answers which I have heard border on the ludicrous, the answers particularly being merely expressions of opinion; with many of them I entirely disagree, and in any case I could find many other answers equally valid, equally empirical, and which take extreme licence in the realm of vaticination. Here is an example of the style of question I heard: "Why does a man pull a face when exerting himself, as when using a spanner?" The answer was that centuries ago a man pulled faces to frighten his enemies! Another question: "Why is it that there is no fruit coloured blue?" and another "What is love?"; a further example of this exhibition of great brain power: "If scientists were in charge of the world would they effect an improvement?" The answer to most of these questions was yes and no—and, of course, there could be no positive answer to any of them, for the answers are matters of opinion and could be debated till the crack of doom.

These questions do not display any show of brains in their answering, and you do not need to bring a Joad or a Huxley to the microphone to answer them. As trifling, yet amusing drowsy drawing-room back-chat they would pass, and a better title for the broadcasts would be "The Idle Half-hour," "You Won't Agree," or "Passing the Time Away."

Wrong or Right?

IF the B.B.C. wishes to run a real brains trust it should propound questions capable of positive answers. There are always questions which cannot be answered, or if answered by conjecture leave the useful loophole that those supplying the answer can never be found wrong—nor right for that matter. Any schoolboy can ask tomfool questions, such as "Why is water wet?" and each can supply the tomfool answer. The B.B.C. should not, therefore, elevate these trifling matters to the brainy level, nor seek to give them a brainy cachet by inviting professors to answer them. Alternatively, such professors should be given questions which would give them a chance of exhibiting their brains, as distinct from using their ability to make amusing guesses. Professors, as a general rule, are not brainy. They have exhibited a mental retentivity in absorbing a large amount of the world's heritage of knowledge, of facts discovered and set on record by really brainy people, such as Euclid and Archimedes.

What are Brains?

OF course, I realise that this raises the whole question of what are brains? It is not the prerogative of the academician, for poor people without the advantage of university education have produced by far the bulk of our scientific inventions, our aeroplanes, our locomotives, our transport system, our watches and clocks, our wireless receivers, glass, pottery, weaving processes, and so on. Very little indeed has emanated from professors. On the other hand, professors write learned treatises on Socrates and Virgil. They conjecture upon how the world began, and other matters which remain conjecture. They will burst open the tombs of the Pharaohs, and tell you the age of the sarcophagi. Is this an exhibition of brains? Like Joad and Huxley I will leave the question unanswered. I leave open the columns of this journal for Huxley and Joad, Campbell and Haldane to provide the answer. I am willing to wager that they cannot provide an exact answer to it. In this, of course, they will be erring in good company, for I similarly cannot provide an answer. Here, however, are a few questions for inclusion in their next idle half-hour.

Why has war consistently become more terrible? Why does a ball roll down hill instead of remaining stationary? Why do listeners like crooners and jazz? Why do women wear carnival hats in the street? Why should not a woman disport herself in her nightdress, and not object to doing so in her bathing costume? Why does the cock crow when the hen delivers the goods? Why do gentlemen prefer blondes, or do they prefer blondes? These are but a few of the questions which I require the Brains Trust so-called to answer. So, Messrs. Huxley, Haldane, Campbell, Joad and Co., would you kindly note my address, and let me have an answer to the questions not later than the 28th of this month, please? Thank you so much.

"Talking-paper"

I NOTICED recently that a method for the reproduction of sound on paper, invented a few years ago by a Russian scientist named Skvortsov and perfected after his death by a group of his colleagues, has been put to industrial use by the foundation of the first phono-paper factory in Moscow. Opened in December last, the factory produced in that month 5 million feet of "talking-paper" (so named by its inventor). This year the factory is expected to produce 330 million feet of "talking-paper."

"Talking-paper" can be played on an ordinary radio receiving set which has been adapted for this purpose by a group of Russian engineers. Paper thus promises, in the near future, to replace such relatively expensive materials as graphite and celluloid for sound recording. A phono-paper roll can be sold at one-fifth or one-sixth the price of a corresponding number of phonograph records.

"Talking-paper" has a number of advantages over the common sound recordings now available. For example, a roll of "talking-paper" can be played thousands of times without the quality of the sound deteriorating, whereas an ordinary phonograph record can be used only 60-100 times. Moreover, should the tape be accidentally torn, it can easily be repaired by gluing.

Skvortsov's method is very simple: the sound waves, inscribed by the usual methods on a film, are printed and duplicated on ordinary paper. To reproduce the sound a ray of light is thrown on to a photo-element in a light stream of varying intensivity. The photo-element transforms the light waves into electrical waves, which in turn are transformed into sound waves by means of a wireless amplifier.

Our Roll of Merit

Our Readers on Active Service—Seventeenth List.

J. Spencer (Pte., K.O.S.B.s), Dunbar.
V. Hone (R.A.F.), Mortimer, Berks.
W. E. Williams (Pte., R.A.S.C.), Rhyl, N. Wales.
Herbert Nixon (AF/L), Gibraltar.
R. C. Troll (A.C.1, R.A.F.), West Drayton.
J. Dawson (Pte., R.A.M.C.), Chichester.
H. Railton (Sgt., R.A.S.C.), Bushey Heath.
Denis Alfred (Pte., R.A.P.C.), Bournemouth.
F. L. Leach (Cpl., R.A.F.), Coningsby.
S. G. Haynes (Sgmn., A.A. Corps), Chester.
H. Smith (L/Cpl., R.A.M.C.), Addlestone.
R. A. Storey (A/S/Sgt., R.A.O.C.), Lower Kingswood.

P.A. EQUIPMENT—4

Further Notes on the Design and Working of Amplifiers——By "SERVICE"

THE next link in a P.A. installation after the microphone and mixer amplifiers described in the last article will depend upon the output of the equipment. In a small installation having only some 20 to 30 watts output a single amplifier unit comprising one or two low-gain, high quality L.F. stages feeding into a couple of valves of the KT66 type in push-pull would suffice, but in order to survey all the equipment in a modern P.A. installation we will review the design of a large rack with a total output of some 400 to 500 watts.

Before the input of such an installation can be effectively loaded, the signal from the microphone and mixer units must be considerably amplified, and this is carried out by "driver" stages situated on the same rack as the output unit.

Driver Amplifiers

The driver amplifier increases the signal voltages to a value large enough to "swing" the grids of the large output valves which are employed in big installations. For this reason the amplifiers are sometimes referred to among P.A. engineers as "swingers." A typical driver amplifier would comprise a medium impedance input valve of the MHL4 type which would be resistance-capacity coupled to the push-pull input transformer feeding two power valves of the PX4 or PX25 class.

The output transformer of this driver unit would be the push-pull input transformer of the final stage comprising the 250 w. or 500 w. valves.

For rapid fault finding and also for general maintenance tests the driver amplifier is usually provided with its own milliammeter which could be quickly switched into the anode circuit of each of the valves by means of a rotary switch or plug and three sockets so that the anode currents can be quickly measured.

To obviate high potentials on the test leads and to keep the meter out of the H.T. circuit where it might introduce unwanted coupling effects, the meter is connected in the cathode or return circuits where, of course, it will be just as effective but only subject to low voltages.

The driver amplifier will contain its own mains transformer and H.T. supply circuits so that it is entirely self-contained and may be easily withdrawn from its place in the rack to be replaced by a spare amplifier if desired.

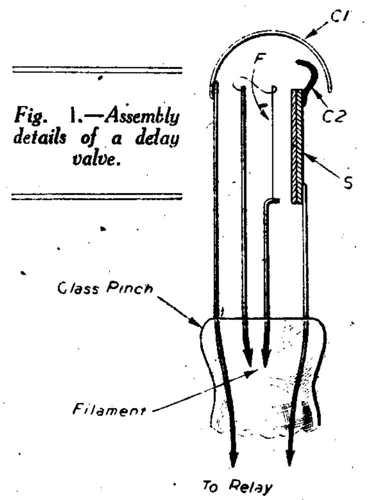
Audible Monitoring

It is often arranged to have a pair of test sockets which are wired up across the input to the amplifier so that headphones may be plugged in for audible monitoring of the incoming programme. This is desirable when fading from one source of input to another so as to be able to turn the volume control down to zero on the amplifier while the change is being made. Once the required programme has been selected and brought up to the correct strength by the mixing or fading units, the master volume control on the driver amplifier is rotated to a predetermined position found by experience which provides the desired volume level from the loudspeakers.

Of course, the inclusion of a test socket in the driver amplifier is also very useful for quickly ascertaining where a fault lies when a breakdown occurs which is of a type which will give no indication by a change of reading on the milliammeter. By plugging in the headphones it can be determined whether the signal is reaching the driver amplifier or whether, having reached it, it has become lost by some disconnection in the amplifier circuit.

The signal from the driver amplifier is fed to the grids of the large output valves. Whereas the design of driver amplifiers follows domestic receiver and gramophone record reproducer practice except for more liberal spacing and quality of components, the design of large output stages dissipating hundreds of watts calls for many precautions and interesting circuit arrangements which are worthy of detailed consideration.

Fig. 1.—Assembly details of a delay valve.



For example, in many large amplifiers the dust covers at the rear of the rack are of the type which make contact with the sockets when the cover is in position, thus completing the latter part of the circuit, generally an H.T. circuit. When the covers are withdrawn the circuit is broken and thus the possibility of shock to the operator is prevented.

Where there are several dust covers, such as there may be in a tall rack comprising several units, each dust cover would be fitted with plugs and sockets and the mains supply to the input to the whole rack would be fed in series through all the plugs and sockets so that directly one of the dust covers was removed the mains supply would be broken.

Transformers

In large installations, even when specially designed for a particular job and not made up from a number of standard units fitted to a rack, many separate mains transformers will be used to supply the various stages of the amplifiers. It would not be an economical proposition to build one large transformer with dozens of various windings for E.H.T., H.T., G.B., L.T., etc. By making each function of the amplifier dependent on its own transformer, wiring is simplified, replacement is easy and far less expensive in the event of a breakdown and the first cost is smaller.

Instead of a bulky transformer with exceptionally high quality of insulation throughout, only one or two smaller components for the output valves need be built to such a high specification, the other transformers conforming to more usual standards.

In amplifiers employing very large output valves the grid bias potential is generally supplied by a separate supply comprising its own mains transformer and rectifying valve. The anode voltages for large valves is often anything from 1,000 v. to 3,000 v., and the grid potentials are correspondingly high, and it will be appreciated that should the bias supply fail, severe damage could occur to the output valves and their associated components. It is therefore arranged that should the bias circuit become inoperative a relay comes into action and cuts off the H.T. supply to the output valves.

Bias Potentials

In order to obtain balanced operation of the output valves the bias potentials are applied to the grid circuit of each valve via a potentiometer, which may be adjusted until each valve is supplying the same anode current.

Apart from lack of bias a positive potential applied to the grids would be disastrous, and as this state of affairs could occur with a very large signal input which was greater than the value of the negative bias applied, precautions are taken that prevent the grid ever becoming positive. One way of accomplishing that is to connect a double diode valve so that one of the diodes is connected to one of the grid circuits and the other diode connected to the remaining circuit of the output valves. Thus, should the circuits ever become positive the diodes connected to them will also become positive and the diode valve will draw current which will pull down the voltage to a negative or neutral value.

G.B. Circuit Precautions

The method by which the H.T. circuit may be controlled by the G.B. supply is to have a relay across the G.B. supply so that as long as current is flowing through the relay from the G.B. supply circuit the contact of the relay will be held in a position that allows the mains supply to reach the H.T. transformer. Should, however, the G.B. fail, the current through the relay windings will cease and the contact will fly open through the action of a spring and thus break the H.T. supply. Incidentally, this arrangement also automatically safeguards the amplifier in the event of the mains supply failing, as the relay would open and would not close again until the G.B. circuit and the other circuits of the output stage had been put into operation again after the breakdown.

The H.T. supply for high voltage circuits is generally derived from mercury vapour rectifier valves. These gaseous rectifiers operate with quite a bright blue glow due to the ionisation of the gas molecules and require special treatment where large currents are to be drawn from them. If the H.T. voltage is applied to the anode of the valve at the same time as the filament is switched on, only a low current of some 60 mA. may be drawn from the valve. If a greater load is put upon it the filament disintegrates, causing a very short life.

If, however, the filament is allowed to heat up first before the H.T. potential is applied to the anode, then the special coating of the filament will emit due to its own properties, and a much heavier current of some 250 mA. may be safely taken from the valve.

Delay Valve

With potentials of some 1,000 v. and 2,000 v. at 100 mA. and more, as would be required for a large 200 w. or 400 w.

amplifier, the H.T. must be switched on only after the filaments of the rectifiers have thoroughly warmed up the coating to obtain the layer output and the procedure is automatially attended to by what is termed a delay valve. This device is encased in a glass envelope and has the appearance of an ordinary valve, but the internal assembly is as shown in Fig. 1.

First there is the filament "F," which heats a bi-metal strip "S." Now, when a length of metal is heated it will expand, but all metals do not expand at the same rate for the same amount of heat applied to them. Therefore, if two small strips of dissimilar metals are clamped tightly together and then heated they will buckle when they try to expand and thus we obtain a movement generated by heat. This movement of a bi-metal strip has many applications in all spheres of engineering.

In our present considerations the bi-metal strip "S" in Fig. 1 causes the contacts C1 and C2 to come together. By connecting an electrical circuit between these two electrodes in the delay valve we obtain a delay action on the circuits connected to the valve after a lapse of a few seconds. Naturally, only a small current can flow through the contacts C1 and C2, but quite sufficient can be obtained through a suitable circuit to actuate a relay which will in turn operate a large contactor switch which can control the mains supply to the H.T. transformer of the amplifier.

H.T. Supply Transformer

It will be noted that the H.T. supply transformer is an entirely separate component and has no L.T. or other secondary windings. The L.T. supply for the filaments of the mercury-vapour rectifiers is obtained by another separate transformer, thus giving independent control.

Reverting to our consideration of the delay valve, the delay period depends, of course, upon the heating of the metal strip, and this depends in turn upon the heat generated by the filament. Therefore by means of a variable filament resistance we can control the delay time by adjusting the current flowing through the filaments and thus have either a fast or slow action.

If the voltage across the filament is made low it takes longer time for the filament to heat the strip to the point where it buckles so that a long delayed action is obtained. For the control of mercury-vapour rectifiers a period of about 45 seconds is generally allowed for the filament of the valve to reach its maximum efficiency, and after this time the delay switch will come into operation and H.T. will be applied to the anodes of the rectifier valves.

Bridge Circuit

Often four of these valves will be used arranged in a bridge circuit to supply a voltage of some 2,000 volts. It is so arranged that directly the H.T. contactor switch is pulled over by the action of the relay circuit, the filament circuit of the delay valve is broken, so that should ever the mains supply to the amplifier be cut off the delay action will automatically come into operation again when the mains supply is reconnected, thus making the whole procedure automatic.

D.C. for operating the relay and delay valve circuit is obtained from the grid-bias supply and Fig. 2 is a typical circuit which will enable the above description to be followed through more easily.

In this circuit, T1 is the H.T. supply transformer connected to the arrangement of mercury-vapour rectifiers. It will be seen that the primary of this transformer is not connected directly to the mains supply, but goes first to the relay and contactor switch contacts 4 and 6. The mains supply is taken to contacts 5 and 7 of this switch, but as shown in Fig. 2 the contacts are open so that there is no connection between T1 and the mains supply.

T2 is a separate transformer supplying L.T. for the filaments of the mercury-vapour rectifiers and is permanently connected to the mains supply within the amplifier.

Finally, there is T3, which provides H.T. and L.T. for V1. This may be a normal 350-0-350 rectifier valve giving the necessary potentials to potentiometers (not shown) in the grid circuits of the output valves. An extra winding on this transformer provides L.T. for the filament of the delay valve, D.V.

It will be seen that one side of the filament circuit for this valve is via VR, which is the control that determines the period of the delay action as already described. The other side of the filament circuit is via the contacts 2 and 3 of the relay switch which are shown in their closed position.

Smoothing Circuits

When the mains supply switch is closed, the filaments of V1 and D.V. go into operation. V1 and its associated smoothing circuits C1, C2, C3, C.K. and R provide the required G.B. voltage and the bi-metal strip in D.V. starts to heat up. After the delay period the strip buckles and the contacts within the valve short across to each other. Current then flows from the positive side of the G.B. circuit through the relay to the negative side of the circuit. The relay is so energised and pulls up the contacts 2, 5, and 7. Contact 2 thus leaves contact 3 and breaks the filament circuit to D.V., but the contact goes over to contact 1 so that, although D.V. goes cold and its contacts open, the relay is connected to the positive side of the G.B. circuit by another route. Thus the relay remains energised with its contacts in the closed position.

At the same time as the above action has been taking place, contact 5 closes on to contact 4 and contact 7 on to contact 6, so putting the mains on to the primary of T1.

It will be apparent from the above why it is necessary to employ separate transformers for many of the supply circuits to the various parts of large amplifiers, so that individual control may be obtained, if desired, quite apart from the technical reasons related to constructional articles given earlier in this series.

Apart from the protection afforded to the mercury-vapour rectifiers by the action of the delay valve, all the other components in the H.T. supply circuits are safeguarded against the application of an abnormally high H.T. voltage. This would occur during the warming up of the output valves during which time they would not be drawing their full amount of current, so that with little or no load on the supply, the voltage would rise to a dangerous value.

The arrangement just described of a relay action for mercury-vapour rectifiers is not the only circuit that may be used, but it explains the general features of most arrangements.

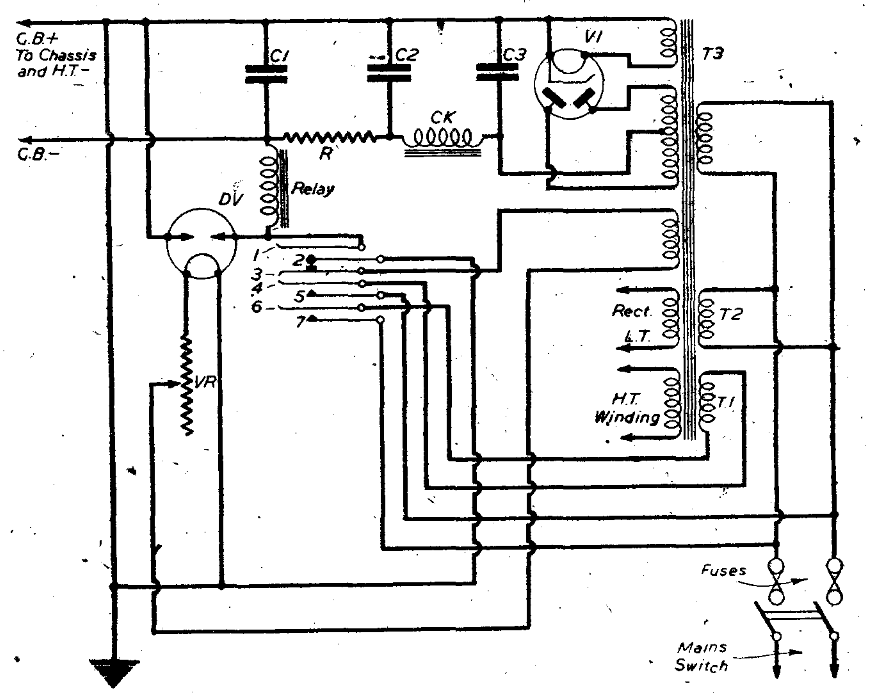


Fig. 2.—How the H.T. supply in a large amplifier is controlled by a delay valve and G.B. circuit.

Sometimes a condenser is charged through a resistance across a neon lamp, which arrangement is rather like a time base. When a certain voltage is reached across the condenser, the neon lamp "fires" and the rush of current through the lamp from the condenser is made to actuate the relay controlling the H.T. circuit.

In other methods, a clockwork mechanism is set in motion when the mains supply is first connected, and the mechanism operates the H.T. switch after a predetermined lapse of time.

Full-wave Rectifiers

For amplifiers requiring H.T. voltages up to about 500v., ordinary full-wave rectifiers may be employed, and these require no special switching arrangements as do the mercury-vapour type of half-wave rectifiers.

Where an installation calls for a certain amount of power not very much in excess of a small standard amplifier, two of these smaller units, each feeding a number of speakers, will often prove less expensive than going to a higher power single unit amplifier with its more complicated safeguarding devices. This point, however, comes more under the heading of planning installations, which will be the subject of articles later in this series.

(Continued in col. 3, next page)

Listening on the Short Waves

Stations Heard During Twelve Hours' Listening on the Short Waves

By R. LAWTON

SHORT-WAVE listening appears to have become very popular since the war began, because people find it an additional entertainment to listen to the opinions and programmes of other nations.

However, the shortage of information concerning short-wave stations, when and where they can be heard, etc., seems to be causing many listeners much disappointment, and on many occasions recently I have been asked by many people what stations a person should be able to receive on an all-wave receiver. In view of this obvious public interest in short-wave listening these days, I spent about twelve hours on a recent Saturday, from 13.00 to 01.00 (new B.S.T.), listening on the short-wave broadcast bands, and made a note of all the short-wave stations which I considered could be heard on any average all-wave receiver used in this country. The following are the stations received, and almost any short-wave listener should be able to receive them, unless the receiver is in a bad area, or reception conditions very bad. It should perhaps be mentioned that remarks concerning stations in Germany, Italy, and other enemy occupied countries have not been mentioned in this list for obvious reasons, but lack of such information is hardly likely to worry the ordinary listener, as the main "tripe" broadcast from such stations these days is usually not worth listening to, unless perhaps for a laugh now and again.

48-49-metre Band

Until after 21.00 in the evening very little was heard on these bands except for an R4/5 signal in the afternoon from VQ7LO. Nairobi (Kenya Colony), on 49.31 m., and SBO, Motala (Sweden), on 49.46 m., at R6. After 21.00, SBO increased in strength to R8, as also was a signal from HVJ, Vatican City, on 48.47 m., closely followed by Moscow (U.S.S.R.), on 49.75 m., at R7. By midnight several distant stations could be heard; the best were WRUL, Boston (U.S.A.), R5/6, on 49.67 m., WPIT, Pittsburgh (U.S.A.), R4/5 on 48.86 m., CHNX, Halifax (Nova Scotia), on 48.94 m., and CRCX, Toronto (Canada), on 49.26 m., both at R3/4.

41-metre Band

During the whole period of listening there was nothing of any note worth recording on this band, except for good signals from two Daventry stations, GSW (41.49 m.), and GRS (42.46 m.), both received at R7.

31-metre Band

This band proved more interesting, and in the early part of the listening period, VLQ, Sydney (Australia), on 31.20 m., was heard at R5, and VUD3, Delhi (India), on 31.28 m., R5/6. Just after 20.00, OFD, Lahti (Finland), on 31.58 m., and TAP, Ankara (Turkey), on 31.70 m., were both received strongly at R7/8. Later in the evening WGEO, Schenectady (31.48 m.), and WBOS, Millis (31.35 m.), both in the United States, were heard at R4/5.

25-metre Band

This band was the best and most interesting of all and, in the writer's opinion, many interesting hours of listening can be spent on this band alone. All signals mentioned were heard between 18.00 and 22.00, commencing with RNE, Moscow (U.S.S.R.), on 25 m., at R6/7; SBP, Motala (Sweden), 25.63 m., R7; VLQ2, Sydney (Australia), 25.27 m., R5/6; VLQ7, Sydney (Australia), 25.25 m., R4/5; Rabat (Morocco), 25.13 m., R6/7; WCBX, Wayne (U.S.A.), 25.36 m. R4/5; WRUL (U.S.A.), 25.45 m., R6/7. A weak signal from JZJ, Tokio (Japan), on 25.42 m. (R3/4), and an interesting English news broadcast from Radio Brazzaville (Fr. Eq. Africa), at R6 near 21.30, completed the results on this band. As a matter of interest, the latter station announces itself as the Free French Radio Station in Free French Africa, and the wavelength is 25.06 m.

19-metre Band

The first station to be heard on this band was Moscow (U.S.S.R.), on 19.76 m., at R7 around 13.30, and then the next signals of any interest received were around 18.00 when the following three stations in the U.S.A. were heard, WPIT, Pittsburgh (19.72 m.), R5; WGEO, Schenectady (19.57 m.), R5/6; WCBX, Wayne (19.65 m.), R4/5. Later about 20.30 a further U.S.A. station was received quite well on 19.55 m., it was WRUL, Boston, at R5/6.

The 16-and 13-metre bands introduced very little to listen to, the only signal worth mentioning was from WNBI, Boundbrook, (U.S.A.), in the afternoon on 16.87 m., at R4/5.

In addition to the stations in the usual short-wave broadcast bands, the following six were also received outside the broadcast bands, SUX, Cairo (Egypt), 38.14 m., R6; Moscow (U.S.S.R.), 39.76 m., R7; PMA, Bandoeng (Java), 15.48 m., R5/6; HBQ, Radio Nations (Switzerland), 44.94 m., R6/7; CSW7, Lisbon (Portugal), 30.80 m., R6/7; and HS6PJ, Bangkok (Thailand), 15.77 m. at R4/5. The receiver used during this listening period was a commercial all-wave type (seven valve), and the aerial was an ordinary outdoor inverted L type.

Note.—All times given are in the new B.S.T. (two hours ahead of G.M.T.).

French Evening Programmes

MANY people in this country who have been listening with interest to the evening programmes broadcast to France on 373 metres may have been unable, for the last week or so, to receive these programmes at the accustomed times. The French news bulletin, hitherto broadcast at 8.15 p.m., has now been advanced to 9.15 p.m., DBST, and the French Half-hour programme has been advanced from 8.30 p.m. to 9.30 p.m. DBST. In addition to the transmissions on the medium wavelength, the programmes may be heard on the following short-wave bands:

French News		*French Half-hour*	
Call Sign	*Metre Band*	*Call Sign*	*Metre Band*
GSA	49	GSA	49
GSW	41	GSW	41
GRX	31	GRX	31
GSC	31	GSC	31
GSP	19	GSO	19
GSO	19	GRU	31
GRU	31	GSN	25
GSN	25		

P.A. EQUIPMENT

(Continued from previous page)

Output Transformers

It will be appreciated that the output transformers in large amplifiers have to deal with quite high potentials across their windings, quite apart from the steady D.C. voltages of the H.T. circuit. There may be anything in the neighbourhood of 50 volts across the secondary winding and the constructions of these transformers to withstand all the necessary stresses and strains make the components very expensive. It is necessary, therefore, to guard against excessive overload which could be brought about by too high a signal input or to the disconnection of the load across the transformer secondary.

A simple way of doing this is to arrange a spark gap across the primary windings so that the voltages at a predetermined value will break down the resistance of the air gap and cause a spark which, as it allows a current to flow through it, will reduce the potential across the windings to a value within the specification of the transformer. Sparking should never occur, but if it does, the attendant will know that something is wrong and should look round for a fault.

Fuses

Quite apart from the various precautions taken to safeguard components in the amplifier, fuses will be fitted in all circuits in which their presence would safeguard the mains supply and the internal supply circuits to the various units comprising the rack. For example, there may be two 10 amp. fuses, one in each of the mains lead; a couple of 2 amp. fuses for the driver amplifier; an H.T. fuse in the secondary circuit of the H.T. transformer both in the final output stage and in the driver output stage.

Output Matching

An important feature of a power amplifier is the matching of the output stage to the loudspeaker wiring network, but as this is intimately bound up with cable impedances and loudspeaker arrangements we will consider the matter as a whole in a later article.

Prize Problems

Problem No. 422

ROBERTS constructed a receiver of the H.F. Detector, L.F. type, using an H.F. pentode, in the first stage, and an L.F. pentode in the output stage. Volume was controlled by a variable condenser in the aerial circuit and by the reaction condenser. Reception was satisfactory on the medium-wave band, but although chirps could be heard at the corect dial position of the long-wave stations, a definite telephony signal could not be formulated on this band. Why was this, and what is the best remedy for the trouble? 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. 422 in the top left-hand corner, and be posted to reach this office not later than the first post on Monday, July 14th, 1941.

Solution to Problem No. 421

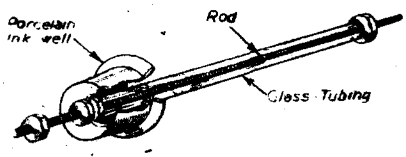
If the pentagrid valve was oscillating, a definite increase in H.T. current consumption should be registered by short-circuiting the oscillator reaction winding, or by short-circuiting the grid leak of the oscillator section of the valve.

No correct solution was received for Problem No. 420.

Practical Hints

An Efficient Aerial Lead-in Tube

ALL that is needed for this lead-in is an old porcelain inkwell, a piece of glass tubing, a brass rod and four nuts. First, I bored a hole in the bottom of the inkwell big enough for the rod to go through, and screwed one of the nuts on to the rod until it was about 1in. from the end. Then I slid the inkwell on to the rod and screwed on the other nut. Care must be taken when tightening this nut, or the porcelain will crack if too much pressure is exerted. Then I slid the glass



An efficient aerial lead-in made from odds and ends.

tubing over the rod, which in my case was 9in. long, and screwed a nut on the other end to keep the glass tubing steady.—D. MALE (Wellington).

A Dial-lighting Arrangement

IN a receiver of the communications type, or any other employing a separate switch for controlling the H.T. supply, a single dial-light may be used to indicate whether H.T. and mains, or merely mains, are switched on. All that this necessitates is to connect the bulb in series with the mains lead. Now, with a set which consumes about 75 watts, on switching on the mains, the valve heaters only will be in circuit, and about 30-40 watts will be used. This means that between 120 and 170 mA. will flow through the bulb, which, being an ordinary flashlamp

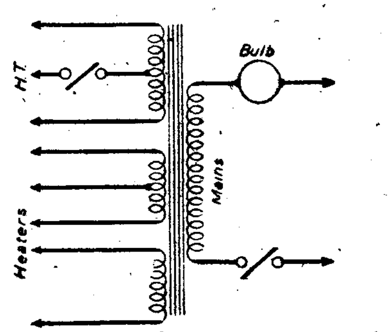


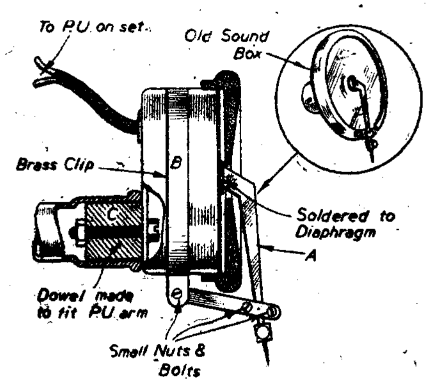
Diagram of a dual-purpose dial-light.

bulb, will only light at about half brilliance. When the H.T. is switched on, the full mains load is taken, and, in the example mentioned, some 300 mA. will light the bulb to full brilliance. Thus, it is seen by the brilliance of the bulb when the H.T. is on. For sets consuming a larger wattage, a low voltage, higher current bulb must be used. The bulb also makes a good mains fuse in this position, and gives an idea of the consumption of the set.—C. W. CRAGG (Oakham).

A Simple Pick-up

THE accompanying sketch shows a simple pick-up I have made from odds and ends requisitioned from the scrap box. To the diaphragm of an old earpiece

I soldered the part A, which was taken from a disused sound-box. The clip B, made with a piece of thin strip brass, is bent round the earpiece body, and clamped with a small bolt and nut, as indicated. The piece of wood dowel, which fits into the end of the pick-up arm, is attached to the back of the earpiece by a long bolt and nut, as shown. When completed, I



A serviceable pick-up made from odd parts.

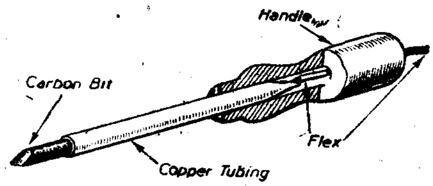
found this simple unit gave fairly good reproduction on both speech and music.—E. BITTON (Barrow-on-Humber).

A Novel Soldering Device

FROM a piece of copper tubing, about ¼in. diam., a 6in. length was cut, one end being pinched tight over the bared ends of a length of single flex. The pipe was set in a wooden handle, and the wire brought out in the manner of an ordinary electric soldering iron. A carbon rod was taken from a torch battery and pointed one end, then pressed into the free end of the tubing, as indicated in the sketch.

To use the soldering bit, 4 or 6 volts is taken from a transformer, or accumulator, the wire connected to positive, and a lead is taken from negative and clipped, by means of a crocodile clip, to the article to be soldered.

The speed and ease with which a set can be wired with this device is remarkable,



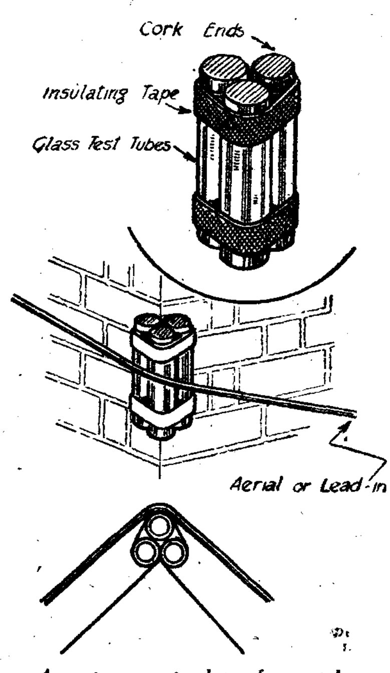
Details of a novel soldering device.

the heat being instantaneous, and located in the point of the carbon bit.—R. G. GUY (Truro).

Corner Insulator for Aerial Lead-in

AT one time, much attention was paid to the aerial lead-in and its insulation, and while this should be equally important to-day, if consistent results are to be expected, this matter is frequently overlooked. This is due to the high standard of performance possible by receivers themselves, and the aerial is often quickly erected with little thought for its insulation, the lead-in very often passing round a corner of a building with only the covering of the wire itself as insulation. Where this latter method has of necessity been adopted, it will be found that the simply constructed corner insulator shown in the accompanying sketch will prove very effective.

This insulator takes only a few minutes to construct, and merely consists of three glass test tubes size about 3in. by ½in. dia., bound together in the form of a rough triangle by insulating tape, as shown. The finished insulator is inserted under the aerial or lead-in wire, the tension of the wire itself keeping the insulator in position. Provided that the glass tubes are of a thick type, when arranged as indicated they will stand up to a surprising strain without fracture, but if it is thought preferable, wooden rods, completely filling each tube, might be used in place of the corks.—R. L. GRAPER (Chelmsford).



A neat corner insulator for aerial or lead-in wire.

CONNECTING

Methods of Connecting Built-in and Extension … and Tone

THE questions of choosing a correct transformer ratio and of deciding upon the best connections for a speaker frequently cause difficulty in the minds of readers. In most instances the questions are in respect of speakers which are to be operated remote from the receiver, but to understand the matter it is best to start by considering the factors which apply to both built-in and remote speakers. As most readers appreciate, the correct matching a moving-coil speaker to the output stage is of prime importance, and is governed almost entirely by the ratio of the output transformer; this is generally built into the speaker, and may have primary tappings to permit of the use of alternative step-down ratios.

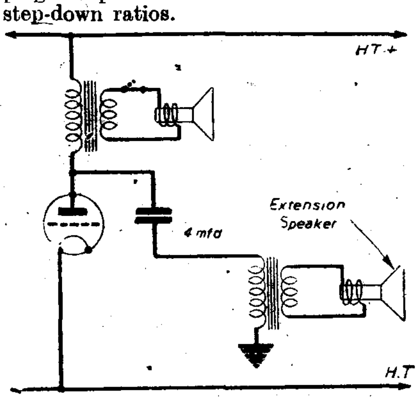


Fig. 1.—Connections for a P.M. speaker connected to a triode output valve, and for an extension speaker of similar type.

Matching the Output

If we assume the use of a good speaker transformer, we can take it that matching is determined entirely by the ratio. This ratio can be arrived at in a fairly simple manner by dividing the optimum load of the output valve or valves by the impedance of the speaker speech coil, and taking the square root of the result. This matter of taking the square root must not be overlooked, since it makes a vast difference, as will be seen from an example.

Suppose that a triode output valve is used, and that this has a rated optimum load of, say, 10,000 ohms; suppose, also, that the speech coil has an impedance of 12 ohms at 500 cycles (a low-average audio-frequency). The correct ratio for the transformer required is therefore the square root of 10,000 divided by 12. If we divide we get approximately 830 as the result, and the square root of this is 29, to the nearest approximation. In other words, the transformer should have a ratio of 29 : 1. It may not always be most convenient to carry out the division before taking the square root, since it may be noticed that both numerator and denominator are complete squares. Thus, if the optimum load were 10,000 ohms, and the speech-coil impedance 16 ohms, it will be seen that the root of 10,000 is 100 and of 16, 4. Therefore, we take the square root of each and then divide one by the other; in the example taken the required ratio would be 25 : 1.

Impedance

It will have been noticed that it is the impedance of the speech coil which we have considered—not the D.C. resistance. In some instances the D.C. resistance is given instead of the impedance at a certain audio-frequency—generally between 400 and 100 cycles per second. In that case, it is generally found sufficiently accurate to consider the impedance as twice the D.C. resistance.

Optimum Load

With the average triode, or pair of triodes, in push-pull, output is not normally affected to any serious extent if the matching is correct to, say, 70 per cent. at 500 cycles, but closer matching is desirable when using some types of pentode and tetrode if maximum efficiency is to be ensured. In passing, it may be pointed out that the optimum load to be considered in the case of two valves in push-pull is twice that of either of the valves. Thus, if two valves each having an optimum load of 2,000 ohms were connected in push-pull, the ratio of the output transformer would have to be found by taking the overall optimum load as 4,000 ohms.

Extension-speaker Connections

Fig. 1 shows the usual connections for a moving-coil speaker connected in the anode circuit of an output triode. The connections would be the same, of course, for a valve of any other type. Also shown are the connections for an extension speaker. It will be seen that this is parallel fed by using the primary winding of the transformer of the built-in speaker as an output choke, and feeding the extension speaker through a large fixed condenser. The earth connection to the extension speaker may be made direct at a point near to the speaker.

A practical point about this circuit is that the fixed condenser should be placed as near as possible to the valve anode so that the whole of the extension lead outside the set is insulated; that is so that should the lead be earthed in any way the H.T. supply could not be short-circuited.

The transformer of the extension speaker should have a ratio similar to that of the built-in speaker, although the matching is not always critical. In any case, most speakers specially made for extension use have a transformer with a tapped primary, so that a variety of ratios can be chosen by moving one lead to different terminals, by transferring a wander plug to different sockets, or by rotating a switch arm. The optimum ratio can then be found by trial, but it is more easily found if some idea is first gained as to whether the ratio should be towards the "high" or "low" end of the scale.

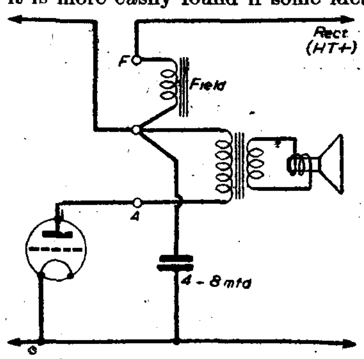


Fig. 2.—How an energised M.C. speaker is connected so that the field winding may be used as a smoothing choke.

Speaker Switching

When using an extension speaker it is desirable to be able to switch out of action the built-in speaker, since this tends to increase the output from the extension speaker in addition to "silencing" that which is not required and improving the matching. This can best be done by breaking the speech-coil circuit by means of a switch, as shown by broken lines in Fig. 1. Care must be taken in doing this, since there are often only two very short flexible leads from the secondary winding of the transformer running direct to the speech coil. It is important that any new leads shall not interfere with the free movement of the speech coil, and that the resistance of the new leads plus the resistance of the switch contacts shall be negligible. The importance of the last-mentioned point will be clear when it is remembered that the total resistance in the secondary circuit may be only a few ohms, and that signal output will be lost if any voltage drop occurs across additional circuit resistance. It is therefore best to use stout flexible leads running to a good-quality switch mounted near to the speaker transformer.

One speech-coil lead should be unsoldered from the transformer secondary terminal or tag and fitted to a new terminal which should, for preference, be mounted on a small insulated strip attached to the transformer; this is to ensure that speech-coil movement is not interfered with. The switch leads can then be taken from the transformer and from the new terminal.

Items of …

Batteries for the Deaf

THE Board of Trade recently announced that arrangements have been completed for the manufacture of an adequate supply of high-tension batteries to meet the needs of deaf persons who use hearing aids. Owing to Service requirements of batteries it has, however, been found necessary to curtail considerably the number of different types of these batteries and manufacture will be restricted to an agreed range of standard types.

The new types have been designed to cover the requirements of all existing United Kingdom makes of hearing aids which employ high-tension batteries, but it may be found that some instruments will need minor modification in order to accommodate them. No modifications will be required in the mechanism of any instrument.

Users of hearing-aids are advised to communicate with the manufacturers of their apparatus, who will inform them of the most appropriate new types of battery and of any modifications to their sets which may be necessary.

Commercial Television in U.S.A.

IT is interesting to note that prominent department stores are among applicants for television stations in various parts of America. This implies that retailers are quick to realise the potential importance of television advertising to local audiences. At the start of commercial television, most sponsored programmes will be local in nature, both in entertainment content as well as advertising value.

THE SPEAKER

Speakers, and of Providing Remote Volume Control

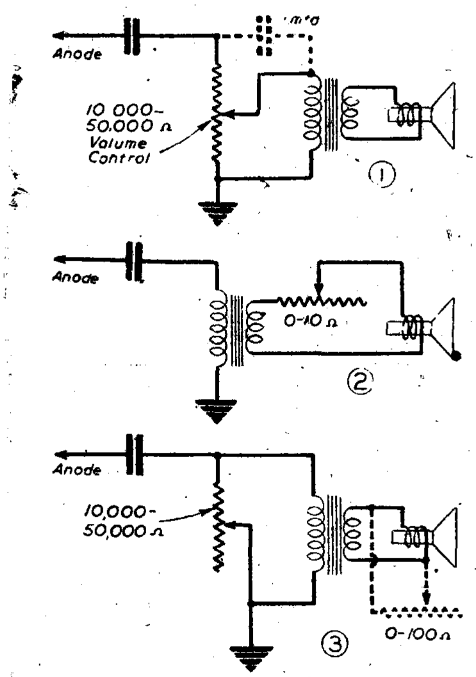


Fig. 3.—Three alternative methods of controlling volume with an extension speaker. Actual values of components depend upon the output stage.

Energised-speaker Connections

Difficulty often arises in "sorting out" the connections to an energised moving-coil speaker which has only three terminals or sockets. Of these, one is the end of the field winding, one the end of the transformer primary winding, and the other a series junction between the two. This will more readily be understood from Fig. 2. The terminals will generally be marked in some manner, but if not the field winding can be recognised, due to the fact that it has a higher D.C. resistance than has the transformer primary. In many cases, for example, the field winding has a resistance of 2,500 ohms, while the transformer primary has a resistance of only about 200 ohms. The difference is so great that a sufficiently accurate check can be made with a milli-meter and a G.B. battery, or even with a pair of 'phones and a battery.

Effect of Field-coil Resistance

The resistance of the field winding will probably be found stamped somewhere on the speaker, since it is important that this be known. If the resistance were the fairly usual figure of 2,500 ohms it will be apparent that an appreciable voltage drop must occur across it, and therefore that the valves would be severely under-run if allowance were not made for this in the design of the H.T. power unit. Trouble might also arise even if the voltage drop were not excessive because the field winding was of much lower resistance, say 1,000 ohms. To provide the necessary wattage to energise the field a comparatively high current would have to be passed through it; the current normally passed is the total H.T. current consumed by the receiver.

The actual wattage required depends very largely upon the particular speaker, but it should generally be at least 10 watts for reasonably efficient operation, whilst three or four times this figure is often desirable. For 10 watts to be dissipated in a 1,000 ohm resistance it is necessary to pass a current of 100 mA through it (watts = amps. squared times resistance, or amps = square root of watts divided by resistance in ohms).

Remote Volume Control

Reverting to extension speakers, which are essentially of the permanent-magnet type unless fitted with their own power unit, we can consider methods of controlling the

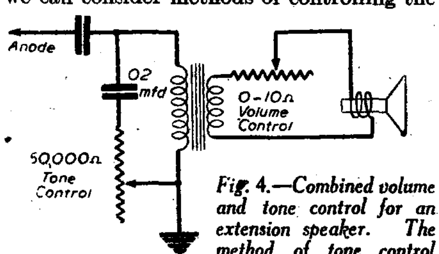


Fig. 4.—Combined volume and tone control for an extension speaker. The method of tone control shown could be used in conjunction with one of the other forms of volume control illustrated in Fig. 3.

volume at the speaker. Three methods are illustrated diagrammatically in Fig. 3. The first is probably most widely used, but we prefer the second, where a variable resistor is wired in series with the speech coil and transformer secondary. The first is more easily applied, because it does not make necessary the cutting of the speech-coil lead. It may cause a fairly marked variation in tone, however, unless the fixed condenser indicated by broken lines is not included in circuit.

It will be noticed that a range of maximum values is shown for the volume-control potentiometer; as a very rough guide it may be suggested that this value should be about twice the optimum load of the output stage, but it is not critical.

In the second method, the variable resistor takes the place of the on-off switch shown for the built-in speaker in Fig. 1. A fairly wide range of control will be given if the maximum value of the resistor is equal to the resistance of the speech coil, but if a wider range of variation is required a larger

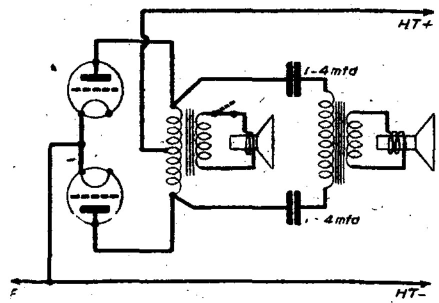


Fig. 5.—A push-pull output circuit, with extension speaker connections also shown. Volume and tone controls for the extension speaker may be connected as shown in Fig. 4.

resistance could be used. The same general rules must be followed in fitting the control as those laid down for the switch, and the resistor used should have a definite "short-circuit" position at one end. It may also have an "off" position at the other end of its range so that the extension speaker can be switched off simply by turning the control past the minimum-volume position.

The third method shown in Fig. 3—or rather the two similar methods—is often very satisfactory, although in theory it would appear to have a rather marked effect on tone as well as volume.

Control of Tone

When remote tone control is required the simplest method is that shown in Fig. 4, where a fixed condenser and variable resistor are wired in series across the primary of the speaker transformer. The component values shown are average ones, but could be modified with advantage in the case of certain valves. In general it may be stated that the condenser should be rather smaller, and the resistor rather larger than those used in the set itself, assuming that there is no "off" position for the built-in control. When using the external speaker the tone control in the receiver should be set to its "high note" or "treble" position.

Extension Speaker with Push-pull

The simplest method of connecting an extension speaker to a push-pull output stage is shown in Fig. 5, where again it will be observed that the built-in output transformer is used as an output choke. To ensure good matching, the transformer on the extension speaker should have approximately the same ratio as the overall ratio of the built-in transformer. It is desirable to include a switch in a speech-coil lead to the built-in transformer, as in the arrangement shown in Fig. 1. The switch is indicated by a broken line. All the other precautions—positions of feed condensers, low resistance in switch circuit and so forth—given in respect of Fig. 1 should be observed when following the connections shown in Fig. 5.

Interest

Broadcasting in War-time

BROADCASTING as an "instrument of war" was dealt with recently by Mr. F. W. Ogilvie, Director-General of the B.B.C., in a talk to India on the first anniversary of the opening of the B.B.C. service in Hindustani.

"Over the greater part of the world to-day," he said, "broadcasting is an instrument of war; is something, that is, which not merely reflects and describes military events, but helps to shape their course." Mr. Ogilvie went on to say that friends from India often asked about the progress of war-time broadcasting in Europe. They wanted to know how much people in German-occupied Europe listened to British broadcasts. Mr. Ogilvie continued: "A proper answer cannot be given now, for obvious reasons. But this can be said. In Germany and Italy, apart from other evidence, it is remarkable how increasingly the enemy find it necessary, in addressing their own listeners, to attack British broadcasts. They obviously follow our broadcasts closely, and they attack them day by day; although their own listeners have nominally been prohibited all along, and with heavy penalties, from listening to foreign broadcasts at all—a crime which in Germany is called 'spiritual self-mutilation.'

"And in occupied countries—Poland, Czechoslovakia, Norway, Holland, Belgium, France, the Balkans—there is evidence not merely that people listen, and listen intently, but that their courage is upheld by their listening."

Problems of Amateur Receiver Design—12

Questions Governing the Choice and Design of the Power-supply System

By FRANK PRESTON

THE matter of supplying a receiver with high and low-tension current appears so elementary that it seldom receives the full attention which it deserves. This is especially the case with battery receivers, where the constructor believes that if he has a two-volt accumulator, 120-volt high-tension battery and a 9-volt grid-bias battery all is well.

In the first place let us deal with the accumulator, assuming the use of standard two-volt valves. If the set has four valves its total L.T. consumption will be in the region of .5 amp. And suppose that the set is used on an average of 20 hours a week; this means that it will consume what we might describe as 10 ampere-hours in one week, or 40 ampere-hours in a month. If the accumulator is charged at a service station the most suitable capacity for the conditions set out above would be 50 ampere-hours (at the 10-hour rate). This means, in the simplest possible terms, that the accumulator would deliver 5 amps. continuously for 10 hours, or .5 amp. for 100 hours before becoming run down.

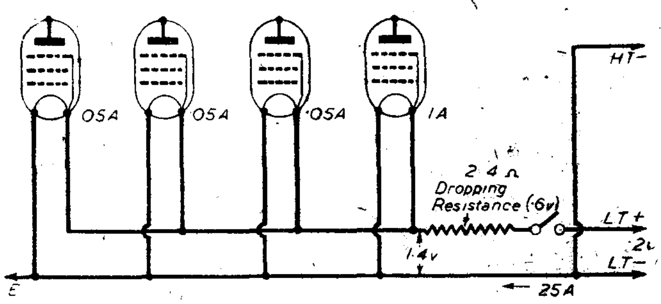


Fig. 1.—How a fixed resistor may be used to operate 1.4-volt valves from a 2-volt accumulator. The values shown will vary according to the number and types of valves in the set.

Amp.-Hour Capacity

Since the current drain is only one-tenth of that delivered on a 10-hour discharge the effective capacity would be rather higher than 50 ampere-hours, but allowing for the accumulator dropping slightly in efficiency after a good deal of use, it would be fairly safe to estimate its "life per charge" on the nominal rating. In passing, a warning should be given that in a few cases of unbranded or "cheap" accumulators the capacity given is not at the 10-hour rate—and possibly not at any other recognised rate! Also, it is not uncommon with good makes of accumulator for radio-set use to give the capacity at the 20-hour rate (which is generally more applicable) but this is generally in addition to the 10-hour figure.

Since the cost of accumulator charging —that is the price charged by service stations—does not normally vary very much with the capacity, it is obviously an economy to use accumulators with the largest practicable capacity. But there is a limit here, due to the fact that it is desirable that all plate-type accumulators should be charged at intervals not greatly in excess of one month. In consequence, there is seldom any advantage to be gained by having a battery whose capacity is much greater than that required for, say, five weeks' service. This does not apply to the accumulators having two very thick plates, and which are especially designed for use where the current drain is very small and charging is not necessary at intervals of less than seven or eight weeks.

Mass-Plate Accumulators

In general, these "mass-plate" type accumulators are most suitable for receivers taking up to, say, .3 amp. L.T. On the other hand, they are very convenient for higher outputs, up to their rated maximum, if a trickle charger is used, the accumulator being given a refresher charge every few days. A similar rule can be applied to ordinary plate accumulators when a trickle charger is available. That is, one of smaller capacity than mentioned above can be used economically if a trickle charger is available. Even then, however, the discharge at the 10-hour rate should not be exceeded.

All-Dry-Battery Valves

A number of readers now use the 1.4-volt-filament battery valves, the filaments of which are normally run from a dry cell forming part of the complete dry-battery unit (H.T. and L.T.). This arrangement is excellent in many respects, since the H.T. and L.T. capacities are so designed that the two sections of the battery run down at a similar rate. With a portable receiver it is practically essential to stick to the combined battery—because accommodation is not provided for any other type. But in the case of a "home" receiver, it will often be found more economical to adopt an alternative arrangement, partly because of the difficulty of obtaining the special batteries in certain districts.

One method is to use a standard type of dry H.T. battery along with a large 1½-volt bell cell for L.T. supply. Where there are facilities for accumulator charging, either at home or at a service station, it is in some respects better to use a 2-volt accumulator with series voltage-dropping resistor, as shown in Fig. 1. It is very important that the resistor should not have too low a value, however, and valve life will often be slightly prolonged by working at below 1.5 volts (the actual rating is 1.4 volts, to allow for the voltage-drop due to the internal resistance of a dry battery). The required value of resistor can easily be determined by the use of Ohm's Law; simply divide .6 (2 volts minus 1.4 volts) by the total L.T. current taken by all the valves whose filaments are in parallel. Thus, if the set includes three valves each taking .05 amp., and an output pentode taking .1 amp., the total current would be .25 amp., and the resistance required would be 2.4 ohms. One good method is to use a 2-ohm fixed resistor in series with a small variable one of about 1-ohm maximum resistance; the optimum setting can then be found by trial and, if necessary, adjusted slightly as the accumulator runs down.

Eureka resistance wire of 36-gauge has a resistance of 14.84 ohms per yard, so it will be seen that the required 2-ohm resistor could be made from 5ins. of this wire. The wire referred to has a current-carrying capacity of .5 amp., and would therefore be quite suitable for our purpose. If 6in. of wire were used the variable resistor could be dispensed with, but there would be no margin of control. A practical point concerning the making of a resistance of this nature is that the wire should be wound on a glass rod, with the turns spaced (since bare wire would probably be used). If the necessary resistance wire is not available, a 5-ohm variable resistor could be used, but it would be wise to fit a stop at a point slightly below the calculated required resistance value. This point could be estimated by taking the proportion between the total and required resistance values. Another alternative would be to use copper wire wound in the form of an H.F. choke, but this would be comparatively bulky.

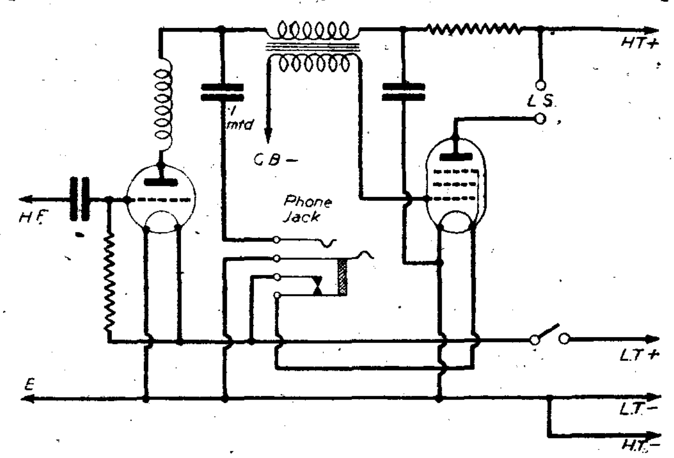


Fig. 2.—How a 'phone jack in the detector circuit can be used to bring the 'phones into circuit and to switch off the last valve. An ordinary open-circuit jack could be used in conjunction with a separate filament switch if this were more convenient.

H.T. Supply

The supply of high-tension is generally even more important than the supply of filament current, because dry batteries should be used with the utmost care in present circumstances. In the first place, we will assume that an eliminator is not to be used. Standard-capacity dry H.T. batteries should never be discharged at more than 10 milliamps, while it is very desirable to keep the discharge rate well below this figure since, roughly, the life is inversely proportional to the square of the current. This approximation is good enough, at any rate, for discharge rates above, say, 7 mA.

Reducing H.T. Consumption

The first requirement, then, if a standard-capacity battery is to be used, is that the current consumption of the set should be reduced as much as possible. This can be done by using the highest grid-bias voltage compatible with satisfactory reproduction, by reducing the setting of any variable-mu volume control as much as possible, and by cutting out L.F. stages and using 'phones when speaker reproduction is not necessary. One very convenient method of providing for the last-mentioned change is to fit an open-circuiting jack in the anode circuit of the detector valve, as shown in Fig. 2. This allows the 'phones to be connected in the detector anode circuit, and when they are plugged in the L.T. to the output valve is broken. This is practicable in all cases except when 1.4-volt valves are in use with a 2-volt accumulator and series resistor; in that case the filament circuit should not be broken, since that would cut down the L.T. current and thereby reduce the voltage drop across the resistor. That, in turn, would cause the voltage applied to the other filaments to rise above the correct figure.

This difficulty could be overcome in many cases by increasing the bias voltage applied to the output valve to twice its normal value, the change being made while the set is switched off. This would reduce the anode current of the output valve practically to zero.

Automatic Grid-bias

The use of automatic grid-bias is very helpful in ensuring that the anode current is kept at a minimum, since there is no chance of the bias failing due to a run-down battery. At the same time, quality is not affected when the H.T. battery is partially run-down, because the anode current drawn is then reduced, and so is the applied bias. Automatic bias has previously been dealt with in this series of articles, so it is not necessary to explain it again here. The value of bias resistor is seldom critical, and it is always best to use the highest resistance possible without spoiling the quality of reproduction. With home-constructed receivers it is often a good plan to use a variable resistor, mounted inside the set, and to set it to the highest satisfactory value when the set is first tested out.

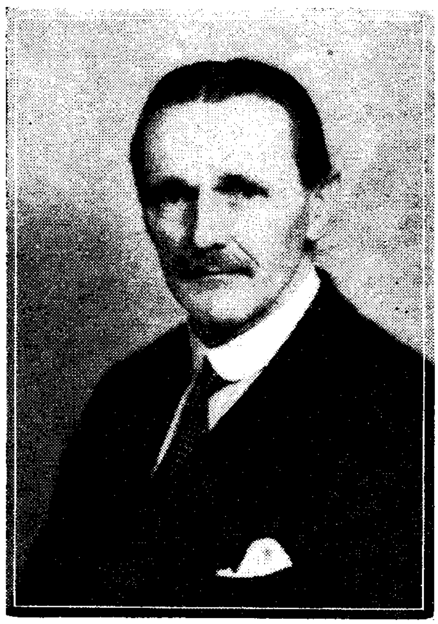
Large-capacity H.T. Batteries

When the H.T. current consumption is in excess of 7-10 mA. it is always better to use a "double-capacity" H.T. battery; should the current exceed 15 mA. a "super-capacity" battery is most economical if there are any reasons why an eliminator, Milnes unit or H.T. accumulator should not be used. As mentioned when dealing with class B and Q.P.P., a special type of battery or H.T. unit is necessary when using either of these forms of amplification. The reason is that the H.T. current fluctuates widely from a very low value to 30 mA. or so. Thus, a very low internal resistance is necessary.

Eliminators and other forms of H.T. supply for battery and mains receivers will be dealt with in later articles of this series.

Personal Paragraphs

Colonel Sir A. Stanley Angwin, D.S.O., M.C., T.D., M.I.E.E., whose name recently figured in the King's birthday honours list, was educated at the East London College (now known as Queen Mary College), and received his practical engineering training with Messrs. Yarrow and Co., Ltd., engineers and shipbuilders. He joined the Post Office Engineering Department in 1906 and shortly after was transferred to Glasgow.



Colonel Sir A. Stanley Angwin.

When the Territorial Force was inaugurated he raised the Lowland Division Telegraph Company, which was comprised almost entirely of Post Office staff. The unit was mobilised in 1914 and formed into the 52nd Divisional Signal Company with Major Angwin as Officer-in-Command. He served through the war with the unit in Gallipoli, Egypt, Palestine and France and was awarded the M.C. and D.S.O. After the war he commanded the 44th Home Counties Divisional Signal Company until 1927, when he was appointed Deputy Chief Signal Officer, first in the Territorial Army, Eastern Command, and then in the Supplementary Reserve, Royal Corps of Signals, a post he held until 1939. He was awarded the T.D. for 20 years' service in the Territorial Army.

On return to civilian life he was brought to London to join the Wireless Section of the Engineer-in-Chief's Office, which was then in a state of rapid expansion. He took a large part in the design and construction of the Leafield, Cairo and Rugby radio stations, and in the inauguration of the transatlantic telephone service. Under his direction the Radio Section developed equipment for short-wave radio telephony, and built up the multiplicity of overseas radio services which has given this country a predominating position in world telephony. He has taken a large part in international work and as British delegate he attended the Madrid and Cairo Telecommunication Conferences, the Lisbon and Bucharest meetings of the Comite Consultatif Internationale Radiotelephonique and the Lucerne and Montreux European Broadcasting Conferences.

Sir Stanley is a member of the Institution of Electrical Engineers, and an Associate Member of the Institution of Civil Engineers, and has read papers before both Institutions on telecommunications subjects. He has been chairman of the Wireless Section of the Institution of Electrical Engineers, a member of the council, and is now a vice-president. Among many other activities he has been a member of the Government Television Committee since its commencement, and he takes a keen technical interest in the development of television. In 1933 he was promoted to Assistant Engineer-in-Chief and in 1935 he was advanced to the post of Deputy Engineer-in-Chief. He succeeded to the post of Engineer-in-Chief in June, 1939.

* * * *

The Postmaster-General has announced the appointment of **Mr. D. J. Lidbury,** C.M.G., D.S.O., to be Assistant Director-General of the Post Office.

Mr. Lidbury has been Regional Director of the London Postal Region since April, 1938.

Entering the Post Office as assistant surveyor in 1908, he was transferred to headquarters in 1912. He served in the European War from 1914 to 1920, became Director of Army Postal Services, which post he held until 1935, was mentioned in despatches, and awarded the D.S.O. As assistant secretary at headquarters from 1935 to 1938, he was in charge of the branch responsible for the carrying out of the Regionalisation Scheme in the Post Office.

On the completion of that task, Mr. Lidbury became Regional Director of the London Postal Region in 1938. Early the following year he went to Buenos Aires as the chief British delegate and chairman of the first commission of the International Postal Union Congress.

From July, 1939, to November, 1940, he was seconded to the Ministry of Home Security, where he acted as Principal Assistant Secretary. He resumed duty at the G.P.O. as Regional Director of the London Postal Region in November last.

In the New Year's honours Mr. Lidbury was awarded the C.M.G.

* * * *

N. C. Tritton, of Brisbane, Queensland, Australia, who recently came to this country as private secretary to Mr. Menzies, has been appointed to the staff of the B.B.C.'s Overseas Division. He will be responsible for the study of the broadcast audience in the area covered by the B.B.C.'s Pacific Transmission, which includes Australia and New Zealand.

* * * *

After twelve years' association with H.M.V. and Marconi, **J. S. Galbreath** has joined the staff of Philips Lamps, Ltd., in Glasgow, on the electrical side.

* * * *

A. McVie, general manager of Kolster-Brandes, Ltd., has been appointed a director of that company.

* * * *

G. H. Walton has been appointed works manager of British Insulated Cables, Ltd., on the retirement of E. A. Bayles, who continues his association with the company in a consultative capacity.

ROUND THE WORLD OF WIRELESS

B.B.C. European Service

AS from Sunday, June 8th, the period 9.30 to 10 p.m. G.M.T., in the late night transmission of the B.B.C.'s European service, has been allocated as follows:

9.30 p.m., G.M.T.—News and talks in Italian.
9.50 p.m., G.M.T.—News and talks in Dutch.
10.0 p.m., G.M.T.—News in English.

This cancels the news bulletin in Serbo-Croat previously broadcast from 9.45 to 10 p.m., G.M.T. The B.B.C. service to Yugo-Slavia is thus reduced by one bulletin per day, but in its place broadcasts will be given in Serbo-Croat from the Cairo station of Egyptian State Broadcasting.

Blitzed History

THE B.B.C. are broadcasting to America dramatised stories of famous London raid-damaged buildings.

Westminster Abbey and Dr. Johnson's house in Gough Square have already been treated in this way. Chelsea Royal Hospital will be the subject of another broadcast.

B.B.C. Man Lost in the "Hood"

AMONG the list of officers lost in H.M.S. *Hood* is the name of Lieut. Bernard Stubbs, R.N.V.R., who was formerly B.B.C. news observer, and well known to listeners for his naval commentaries at the beginning of the war. He was 32 years old.

U.S.A. S.W. Stations and National Defence

STATION WLWO, America's most powerful short-wave international station, now operating with 75,000 watts, is among the American stations that will take part in a plan to mobilise short-wavers for national defence. The plan also is designed to promote international good will, according to James D. Shouse, vice-president in charge of broadcasting for the Crosley Corporation, which operates WLWO.

Plans have been formulated for the organisation with representatives of five other international station operators at a meeting in Washington, D.C. The organisation is a voluntary one established to assist the Government in national defence through short-wave activity.

Cuban Amateur Reserve

THE President of the Cuban Republic has issued a decree to the effect that all Cuban amateurs are to be formed into a voluntary emergency reserve to be known as the Auxiliary Corps of Radio Amateurs. Under the guidance of the Ministry of Communications, the corps will be a valuable reserve of trained men with equipment for use in a national emergency.

U.S.A. Commentaries Broadcast to Germany

BROADCASTS originating in the U.S.A. are now being given regularly in the B.B.C.'s German programmes. Every Thursday after the 10.0 p.m. G.M.T. news, listeners in Germany hear Beach Conger, the well-known American journalist, reviewing current events in his country and giving the latest news of America's ever-growing activity as the "arsenal of democracy." A monthly feature is a talk by Dr. Thomas Mann, who lives in California. His talk is recorded in Hollywood, flown to New York, and thence broadcast to Britain for re-recording.

News commentaries on current affairs are also given from time to time by Professor Arthur Newell, an American who has worked for many years in the interests of Anglo-American understanding.

New Radio Loop

ANEW loop aerial, manufactured by RCA. in the United States, is to be used to enable aural direction finding in aircraft when used with receivers which will match the adapter kits. This new loop is remotely operated by means of a flexible cable and tuning mechanism, and enables the pilot or radio operator to take bearings for "position fix" while in flight.

The outstanding feature in this new loop is that of remote control which allows the compass receiver to be placed anywhere in the 'plane; the distance from the tuning mechanism being governed by the length of the control cable, which is 12ft. long.

Wristlet Radio

A LIEUTENANT in the Polish Army and Mr. I. Solar, a Dunfermline electrical engineer, have devised a wristlet broadcasting set. It is designed to help rescuers locate people trapped beneath wreckage. The set, which weighs only six ounces and is 3ins. in diameter, can send out oscillations on a fixed wavelength by slight pressure on a celluloid strip. An ordinary portable set can pick up these oscillations and thus enable rescuers equipped with a receiver to locate a trapped person. It will operate for forty-four hours continuously on a small dry battery and will cost less than five shillings when mass produced. The Home Office are to test it.

Haile Selassie, the Emperor of Abyssinia, making a speech in front of microphones, from the Palace at Addis Ababa, after his return to the capital of his liberated country.

Broadcasting to the West Indies

FURTHER developments have taken place in the B.B.C.'s service to the West Indies which three months ago was "stepped" up to three weekly programmes each of twenty minutes duration. Four programmes were now broadcast weekly, during which men and women from the West Indies serving with the Forces in this country come to the microphone to broadcast personal messages to their families at home.

While these personal broadcasts are primarily for West Indians serving with the Forces, opportunity may occur from time to time for other West Indians resident in this country and for people with relatives in the West Indies to send messages. Requests should be addressed to the West Indian Department, Broadcasting House, London, W.1.

Australia's Transmitters

ACCORDING to a recent report there are now a total of 129 broadcasting stations in Australia. Of this number 26 medium-wave and three short-wave transmitters are operated by the National Broadcasting Service. The others are commercial stations. The average power of the transmitters is very low, being approximately 1.6 kW.

Edinburgh Classes for Service Men

IT is stated that sufficient applications have been received by the Edinburgh branch of the Scottish Radio Retailers' Association for day classes to be started in co-operation with the education authorities for the training of service men to fill the gaps in the industry caused by the demands of the Services. Some of the necessary equipment for training purposes has been given by wireless firms in the city.

Receiver Sales in Canada

DURING 1940 the total number of receivers sold in Canada was approximately 438,000, this being an increase of over 20 per cent. on the previous year's sales. The sales of U.S. receivers in Canada, which have been rising steadily since 1932, are likely to be adversely affected by the recently imposed taxes on sets.

BOOKS RECEIVED

ELEMENTARY MATHEMATICS FOR WIRELESS OPERATORS. By W. E. Crook. Published by Sir Isaac Pitman and Sons, Ltd. 64 pages. Price 3s. 6d. net.

AS the author of this book remarks, in his preface, "you cannot understand or even study wireless without some knowledge of simple mathematics." This book covers sufficient ground on the subject to give the wireless operator all the mathematics he needs to know on his course. The book is divided into five chapters bearing the headings: Arithmetic; Algebra; Geometry and Trigonometry; Graphs; and Mechanics. The text is illustrated with numerous diagrams.

THE OBSERVER'S BOOK ON RADIO NAVIGATION. By W. J. D. Allan. Published by George Allen and Unwin, Ltd. 106 pages. Price 2s. 6d. net.

THIS small handbook is intended to assist the wireless operator and observer to deal with all problems as they arise, in order to ensure that rapid and smooth working which is essential to good navigation. The author rightly assumes that a knowledge of the electrical side is of value to the navigator, and to this end the first part of the book is devoted to the elements of electricity. Other subjects dealt with include The Directional Loop; The Cardioid; Coastal Refraction; Night Effect; Plotting; Long Range Loop Bearings; Homing; Ground D/F Stations; and Route Markers and Approach Beacons. The book contains numerous diagrams.

THE T. AND C. RADIO COLLEGE

NOW that "Radiolocation" is very much in the news, it is interesting to note that The Technical and Commercial Radio College, of Reading, are introducing a special course for men wishing to qualify for Radiolocation duties. We would point out that this college has already successfully trained hundreds of men for service with the R.A.F., and prospective candidates can be assured that by taking a course at this go-ahead college they will receive the training necessary to properly equip them for their work with the R.A.F. Even if you know little about radio, you can study at home in your spare time, and become proficient by availing yourself of the College's special method of tuition. Interested readers should write for particulars of the radio courses to the T. and C. Radio College, 29, Market Place, Reading.

A NEW DIG-FOR-VICTORY POSTER

Ideas Wanted

THE Ministry of Agriculture has accepted an offer from *The Smallholder*, the well-known war food-growing journal, to co-operate in finding a successor to the famous Dig-for-Victory "foot and spade" poster. *The Smallholder* has arranged to do this by means of a Poster Idea Competition. The sender of the idea considered by the judging committee to be the best will be awarded a First Prize of £100. Five additional prizes each of £5 will be awarded for the next best efforts.

Entries should be addressed to: "Dig-for-Victory" Poster, *The Smallholder*, Tower House, Southampton Street, London, W.C.2, and sent in as early as possible but not later than Monday, July 21st, 1941. Name and address of sender (in block capitals) should be placed on the back of each attempt.

The New "Westalite" Rectifier

An Improved and Compact Unit with a High Standard of Performance

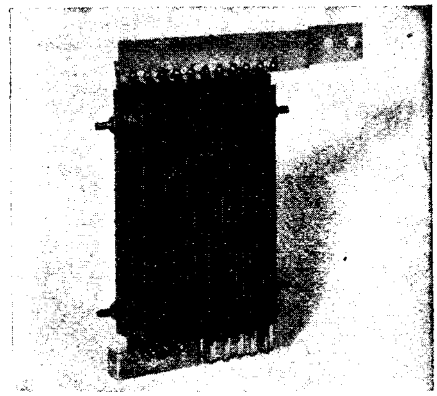


Fig. 1.—Typical Westalite plate bank rectifier.

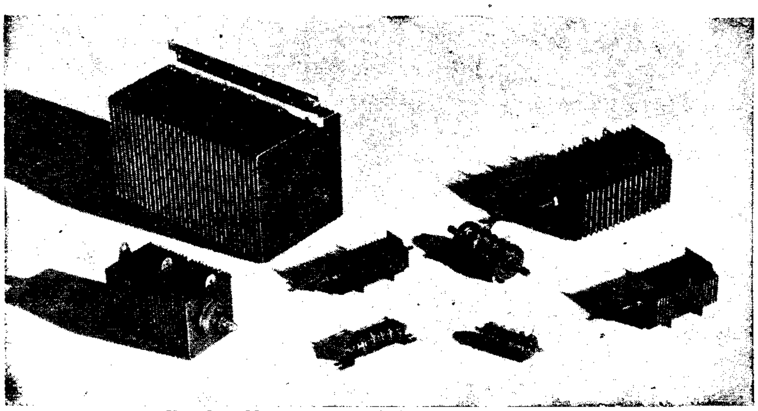


Fig. 2.—Various types of Westalite rectifier units.

THE Westinghouse Copper-oxide Rectifier, first introduced to the public in 1926, is well known to radio constructors, and has found its way into most branches of the electrical industry, where it has established a reputation for reliability.

After developing the rectifier for application to the most suitable markets, the Westinghouse Research Laboratories carried out a series of experiments with a view to improving the unit, and as a result, a considerable reduction in size and cost, coupled with an improvement in efficiency, has been effected. An improved type of rectifier has now been produced which is suited for the larger power applications.

The Westalite Rectifier, as it is called, has a slightly better electrical performance than had previously been obtained, and also a considerable reduction in bulk and weight, with a consequent reduction in cost.

Constructional Details

The new rectifier consists of a steel plate in which is formed a thin layer of a special selenium compound. A thin layer of alloy serves to make contact with the selenium compound, and rectification takes place at the junction of the alloy and the compound, in so far as current readily flows from the steel plate to the alloy layer, while the junction offers a very high resistance to current flowing in the opposite direction.

A range of elements of varying sizes is available which permits the smallest and most economical rectifier to be built for any particular requirement. Figs. 1 and 2 show some of the types of unit so far developed, and indicate the variety in sizes. The rectifier elements are mounted on one or more spindles, a number of elements being connected in series or parallel, according to circuit conditions. In some cases cooling fins are fitted, which enable a considerable increase in output to be obtained from a given area of rectifier element. These fins, which are sometimes made of an aluminium alloy to reduce weight, embody a boss on the centre which acts as a spacing washer, thus maintaining the fins at the most efficient pitch for cooling purposes. This method of assembly results in a considerable saving of time, as less components have to be handled, and at the same time the electrical and thermal resistances are minimised, thus increasing efficiency. The construction of a rectifier unit, fitted with combined cooling fins and spacers, is shown in Fig. 3. Particular notice should be taken of the generous leakage surface which reduces the risk of flashover to earth in the case of a rectifier operating in an atmosphere of metal or carbon dust.

For certain duties, it is advantageous to immerse the rectifier in oil for a cooling medium. This applies particularly where the atmosphere is corrosive, such as in an electro-plating shop. Rectifiers which are not oil immersed are protected by a special highly resistant non-porous varnish.

Performance

The electrical performance of the Westalite Rectifier is generally better than that of the equivalent copper-oxide rectifier. The efficiency is also maintained at a high value down to very low loads. The chief feature of the new rectifier is its small bulk and weight, which is due largely to the maximum safe working temperature being much higher than that of copper-oxide, the same high safety factor in the rating being maintained.

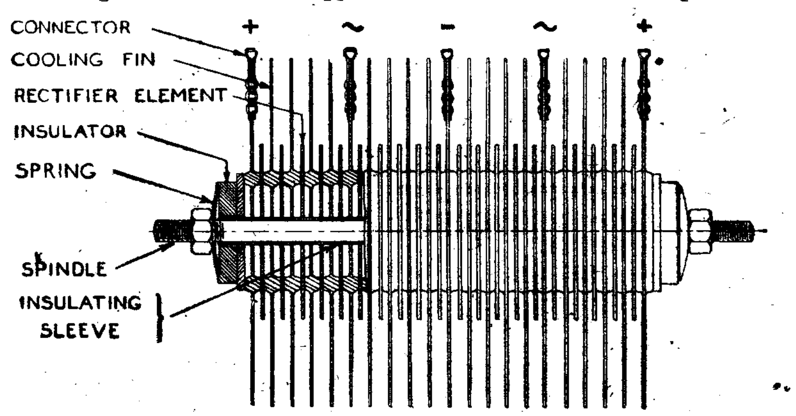


Fig. 3.—Sectional view of Westalite rectifier unit, showing the combined cooling fins and spacers.

The life of the Westalite Rectifier, like its copper-oxide counterpart, is of long duration, many of the latter having been in service for nearly 14 years without the need for maintenance or replacements.

General information concerning the many applications of the Westalite Rectifier is covered by separate pamphlets issued by the Westinghouse Brake and Signal Coy., Ltd., Pew Hill House, Chippenham, Wilts, and for its application to radio equipment reference should be had to the publication "The All-Metal Way."

"IN TOWN TO-NIGHT"

WHEN "In Town To-night" closed down for the summer on June 21st, the programme celebrated its 250th performance.

"In Town To-night" has been produced continuously since the winter of 1933, with the exception of summer breaks each year, and over two thousand people have taken part in the programmes. Those interviewed include nationals of every country in the world and range from foreign princes, dukes and potentates to chimney sweeps and dustmen. Contact in the studio reveals that both the dukes and the dustmen are intensely interested in each other. Despite the raids of September and October last year, all the people turned up every Saturday night as they had previously done in peace-time.

About 99 per cent. of the people interviewed had never broadcast before. Every big film star who has visited this country has been included in the programmes. All the thousands of personalities have been interviewed in person with the exception of a children's party last Christmas, which was recorded.

A great feature of "In Town To-night" is that in the rehearsals producers and personalities sit down to tea together, and those of lordly line are delighted by chat across the table with navvies and cockney tradesmen. There was an amusing incident when two Piccadilly flower-girls were being interviewed and one had "mike-fright" right up to the moment when she was due to broadcast. Her companion suddenly turned to her and said: "You had the measles when you were young. You got over that and you'll get over this." The nervous flower-girl then spoke perfectly.

Comment, Chat and Criticism

Outline of Musical History–22

By Our Music Critic, MAURICE REEVE

BEETHOVEN gave his own first public concert-recital on April 2nd, 1800, and from that year till 1803, when the production of an opera was contemplated, he moved about from one address to another. Eventually he moved to Baron Pasquali's, where rooms on the top floor were specially reserved for him and in which he used to lock himself up for long periods, for study and contemplation. But even with this he was not contented, and he found other quarters in the city which he was constantly changing. He hated the city in the summer and always followed the Vienna custom of spending it in the lovely countryside round about. Many of his greatest works, certainly the *Mount of Olives*, *Fidelio*, and the *Eroica Symphony*, are products of solitary strolls through the country.

He then commenced work on his opus 1 of what now forms the catalogue of his printed works. It is "Three Trios, for piano, violin and violoncello." They were published by Artaria of Vienna on October 21st, 1795, and dedicated to Prince Carl von Lichnowsky. They were followed on March 9th, 1796, by opus 2, "Three Sonatas for clavecin or piano" (the first of the "32") and dedicated to Joseph "Papa" Haydn.

Three Distinct Styles

To-day, almost everyone follows the example of Ferdinand Ries in dividing Beethoven's music into three distinct styles or periods. They overlap a bit according to the category of work being dealt with —Sonata or Symphony or Quartet, etc. So far as his piano music is concerned, the first period is said to terminate with the Sonata in B flat, op. 22, written in 1800, orchestral music with the second Symphony in D, written in 1802.

The first works are full of the enthusiasms of youth and the desire to achieve in what had already become his one reason for existence itself. They are full of that spirit which led him to say that Haydn hadn't taught him anything. They are overflowing with vigour, and self-confidence, and the joy of living. He was approaching 30, and money troubles were behind him. He was also fortunate to gain the confidences of many charming and beautiful ladies. "I live in the midst of music," he wrote; "scarcely is one thing finished before I commence another. As I am writing now I often do two or three things at one time." Came the quintet in E flat, op. 4, two sonatas for piano and 'cello, op. 5, piano sonata, op. 7, three string trios, op. 9, three piano sonatas, op. 10, piano trio in B flat, op. 11, three sonatas for piano and violin, op. 12, Grande Sonate Pathétique, op. 13, and many others.

Sonata, Op. 7

The influence of Mozart and Haydn are strong in all these delightful works, especially in the slow movements. The Sonata, op. 7, reveals, perhaps, the greatest originality, or the first buds in the Beethoven garden, as one might say. It is a long work of great power and energy and dedicated to one of his many aristocratic young lady pupils, Countess Babette von Keglevicz. All authorities agree that this work is quite a landmark in the young Ludwig's early career, and shows more attempts, and successful ones—to break away from the traditions and conventions of the day—than almost any other work of the early period. The triplets in the trio foreshadow the "Moonlight," and the whole work is of a strong and bold pattern.

The critics were quick to seize on those points in all these works which were obviously new departures from the accepted examples, to date, of Haydn, Mozart, etc. The slow movement of the Sonata in D, op. 10, No. 3, is a splendidly tragic piece of writing, and the clusters of crushed seconds in bars 84 and 85 one of the finest things in all his music. The "Grande Sonate Pathétique," op. 13, is, for its size, a masterly and justly famous work.

In the meantime, sets of variations on themes from Handel, Mozart's *Don Giovanni* and *The Magic Flute*, on a Swiss song and others, testify that he had to cater to fashion and the amusement of at least the less seriously-minded guests at his many soirées. He even composed a drinking song for Josephine Brunswick's husband, Count Deym.

Then came the first concerto for piano and orchestra, in C, the quintet for piano, oboe, clarinet, bassoon and horn; six string quartets, the second pianoforte concerto, the septet, and the first symphony —1800.

First Concertos

The concertos are wholly delightful, especially the C major, and the fact that they still please sophisticated audiences and virtuosi in spite of the many magnificent examples subsequently written, including his own numbers 4 and 5, testify to their value. His first attempts at concerto-writing were made in Bonn; the youthful work in E flat and the fragments of a violin concerto in C. Beethoven himself preferred the one in C, the second creation of the two, as he would only accept ten ducats for the other instead of the twenty he received for the other works of the same year.

Ludwig arrived at quartet-writing after he had produced mature works in several other music forms; also after lessons in quartet-writing under Förster, whose own examples were then much played. He was thirty when op. 18, consisting of no less than six quartets, was published. At a similar age Haydn had written over twenty. Beethoven's owe less to Haydn's influence than most of the other compositions of this "first period," and they seem to have owed their origin to Count Apponyi, although the dedication went to Prince von Lobkowitz. Chamber music was usually published in batches of three or six, and the order of these in op. 18 is Beethoven's own. They appeared in two lots with what he considered the two weakest of the set diplomatically placed at numbers 3 and 6! The manuscripts have been lost.

Charming works, with hints of the efforts he was obviously making to break away from the past, but definitely inclined that way. Number 1 must have cost him much anxious thought; no fewer than sixteen pages of the sketch book were devoted to touching up the first subject. It came in for future polishing when the whole work was revised in 1800. Number 2 is nicknamed the "Compliment," from the supposed resemblance in the opening phrases to a ceremonious meeting between two eighteenth-century elegants. The whole set shows how he succeeded in equalling up the four instruments to a greater degree than either Mozart or Haydn had succeeded in reaching.

The first Symphony, in C major, op. 21, was completed at the commencement of 1800. Sir Donald Tovey calls it "a fitting farewell to the eighteenth century." It might be considered notable as showing Beethoven with his feet—musical feet—planted firmly on the ground and his gaze fixed upon the dawn of the new era.

"Prometheus"

The following year was produced the ballet *Prometheus*, and the similarity between the opening of the overture, and that of the Symphony testifies to the fact that they were both in the composer's mind at the same time. The story of the ballet is "of Prometheus, a lofty spirit, who found the men of his day in a state of ignorance, and civilised them by giving them the arts and sciences. Starting from this idea, we are shown two statues brought to life and made susceptible to all the passions of human life by the power of harmony. Act II is placed in Parnassus, and shows the apotheosis of Prometheus, who brings the men created by him to be instructed by Apollo and the Muses, thus endowing them with the blessings of culture." This description comes from a contemporary theatre bill; the original book of the ballet was lost. Beethoven seems to have combined the three myths of Orpheus, who was endowed with god-like power by music, Prometheus, the heroic benefactor of mankind, and Pygmalion, the sculptor whose statue came to life.

The music contained some of his best up to that time. The overture is in advance of the Symphony, and in places anticipates Leonora III.

In the finale is a theme which he used in the finale of the Third, Eroica, Symphony, and for a splendid set of variations. The ballet was a great success, and doubtless gave him a breathing spell, at least, from monetary troubles. Its first performance took place at a memorable concert, the programme of which consisted of that work, the Scond Symphony and the Third Pianoforte Concerto, in which he played the solo part. The last rehearsal took place in the theatre at 8 a.m. Ries says: "A terrible rehearsal. By half-past two everyone was tired out and more or less discontented. But the genial Prince Lichnowsky, who was present from the beginning, had brought some huge baskets laden with meat, wine, and bread and butter, and he was soon hard at work, pressing the good things upon each tired musician with both his friendly hands. After this all went well."

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

Interesting Notes on Members' Experiments

THIS month we are again handing over these columns to members who have been good enough to send in letters giving particulars of their activities, and other matters of general interest. We are pleased to note that in spite of these difficult times, many members are giving active support to the Club, and are carrying on with their constructional work, which reminds us of a letter recently received from member 6952, showing how good results can be obtained through perseverance. Here it is:

"You have in the past made many appeals for members to write and tell of their experiences, so here is my report for the last two months.

"I first decided to build my S.W. converter up again, and this time I put it on a wooden chassis; everything was thoroughly cleaned and soldered, wires were kept short, and I really thought that now my set would work better, as previously it was housed in an old box, covered in dust, and had yards of unnecessary wiring. At any rate, on trying this new set I got poor results, the set would not oscillate on the higher frequencies and a bad hum was present—I considered it a washout, and so I decided to start again. It took about a fortnight to build set No. 3, but when I tried it out results were magnificent. I feed it into a 6-valve A.C. set, so now I have a 7-valve superhet to explore the air. In view of my experience I would advise all who try to build converters not just to keep wires short, but *very, very short*!

Amplifier and P.U.

"I have also been fixing up an amplifier and P.U. for gramo. records for a play. Just one thing of interest cropped up; we had arranged the amplifier so that with the hall empty, and with quite a lot of noise going on, we could make the records ear-splitting as well as having some spare volume. However, when the audience arrived, and we switched on, the result was that those near the front were nearly deafened, and those at the back had quite good volume. We had overlooked the fact that 'audience noise' is much greater than is usually imagined, so that at times the amplifier was drowned. If anyone can help me in this matter, that is, without using more than two speakers, I would like to have their hints and suggestions.

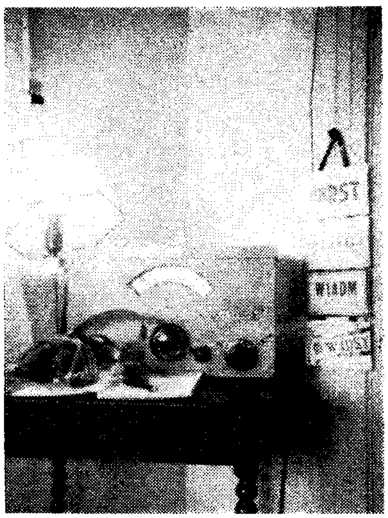
"I have had a lot of difficulty in identifying some S.W. stations, when nothing is announced in English. I heard this call recently:

"Radio Andorra (Andara? Angora?) on about 25–26 m. at 8.30 p.m. D.S.T., with a lady announcer; at times a gong is struck. Speech is in French and Spanish. Any further information about this station will be welcomed. (By the way, I know it is not Radio Ankara). I shall also be glad to receive any letters from S.W. listeners about my age—17 years."—Charles A. Marshall, 59, Rutland Avenue, Scotforth, Lancaster.

Making the Best of It

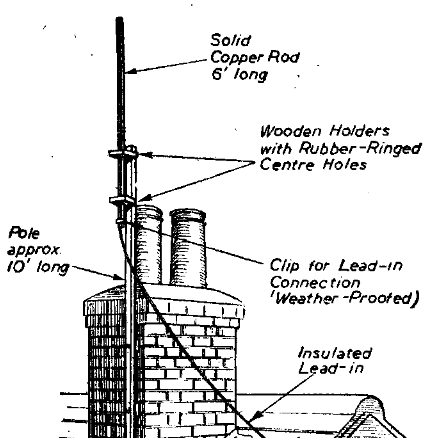
MEMBER 6,225—Hendon—writes as follows:

"I append a short description of my rig. As there is no other available space in our house I have had to resort to one corner of my bedroom as a listening spot; to make matters worse, this room is in the front of the house, so there is little chance of erecting an efficient antenna without spoiling the view. This latter point necessitates the use of an indoor aerial slung under the roof, and about 20ft. long (E.-W.).



The listening post of member 6225.

"The receiver itself is a mains 0-v-1 set with an electron-coupled detector, transformer coupled to a triode LF stage (both valves have 4v. heaters). H.T. is supplied through a full-wave metal rectifier in conjunction with transformer, large smoothing choke and condensers giving a ripple-free D.C. There are two L.T. transformer windings, one for the valves and one for a 4v. ½A. dial light. As for the H.F. side of the circuit, bandspread tuning is employed with a 9-1 dial on the spreader, and in conjunction with home-made coils of 18 s.w.g. wire. The whole set is built into a zinc chassis and cabinet (with hinged lid) and painted grey. The photo. shows the Rx with log-book, 'phones, etc. All amateur reception is done on 14 mc/s."



The vertical S.W. aerial used by member 6773. The top of the aerial rod is approximately 52 ft. from the ground.

Good Listening

MEMBER 6,773—E. M. Barlow—who hails from S. Yorks, sends the following report of his recent activities:

"Here is a little news from this area. DX has been poor on the whole since January's 'bags.' Best DX for May is as follows: MTCY, 11.8 mc., 22.10, R5, QSA2+, May 2; MTCY, 11.81 mc., 23.14, R6, QSA3, May 3; Hsinking, Manchukuo, FQ8-?, 11.99 mc., 22.34, R7, QSA4, QRN, May 4; Radio Brazzaville, 11.89 mc., 22.30, R8, QSA4, May 6; 11.9 mc., 21.50, R6, QSA3+, CW, QRM, May 9; 11.99 mc., 22.30, R7, QSA3+, May 11; 11.04 mc., 22.45, R7, QSA3+, May 12; 11.99 mc., 22.51, R8, QSA4, May 12; CR7BE, 9.61 mc., 22.54, R8, QSA4, QSB, R7, May 6; CR7BE, 9.61 mc., 22.50, R6, QSA3+, CW, QRM, QSB, R4 at times, May 13; FQ8-?, 11.99 mc., 22.25, RY, QSA3+, May 16; Radio Brazzaville, 11.99 mc., 23.07, R9, QSA5, FB, May 18; 11.99 mc., 22.25, R6, QSA4, Bad QRM from German station, May 21.

"All reception on a commercial 6v. communications receiver, with either inverted 'L' aerial, N.S., 40ft. by 40ft. or 50ft. high vertical copper rod—6ft. dipole.

"The above is the very best DX. WRCA, WBOS, WGEA, WGEO, WRUL, WCBX, WNBI, EO, OFD, PAP (YUA), RW96, RNE, EAQ1, EAQ2, CSW6, CSW7, CSW8, 8AA, SMO, SMP, SK are received nearly every evening.

"Experiments here recently have been confined to the construction of this dipole antenna, and the construction of a small standard low-frequency amplifier for L.S. on the 'Ultra' B/CL RX used here.

"Enclosed please find rough sketch of the new dipole recently erected."

Radio Magazines Wanted: News in English

MEMBER 6,535, Mr. John E. Hodgkins, 43, Hawthorn Avenue, Bury, Lancs, writes as follows:

"Will any members who have any American radio magazines to spare please let me know and I will pay postage on them. Also, I shall be glad to get in touch with any 16-year-old member who is interested in S.W. listening. For the benefit of other members here is a short list of news bulletins in English heard recently at this Q.R.A.:

BST	Call and Q.R.A.	Wavelength.
13.45	PMA (Batavia, N.E.I.)	15.48 m.
19.15	TAP (Ankara, Turkey)	31.7 m.
19.30	WCBX (Wayne, N.J., U.S.A.)	25.35 m.
20.45	(Brazzaville, Fr. Eq. Africa)	25.06 m.
21.15	FET22 (Oviedo, Spain)	42.01 m.
21.30	WRUL (Boston, Mass., U.S.A.) (News commentary)	25.45 m.
22.30	JLG2 (Tokio, Japan)	31.57 m."

Contacts Wanted

MEMBER 6,838—S. Nash, 9, Holybrook Road, Reading—would like to get in touch with local B.L.D.L.C. members with the view of comparing notes on radio matters.

Member 160—F. L. Leach, 38, Wellington Street, Gloucester—is desirous of contacting anyone residing in the Boston or Lincoln district who is interested in amateur radio.

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).

Blitzed Radios

SIR,—The following particulars of an emergency measure will, in many cases, enable the listener to restore reception within a few minutes of his set being put out of order by the blast of a bomb.

The most probable casualty being the loudspeaker (especially the cone, speech coil, and usually both), and the most probable time of the casualty occurring late at night, an immediate replacement of the damaged component is out of the question. You can, however, disconnect the speech coil from the output transformer secondary, and take a pair of insulated leads to the terminals of your house-bell. High quality reproduction should not be expected in such a case, but you may be delighted—as I was recently—to hear your house-bell announcing that "The King is Still in London." A little consideration of the matter will reveal that there is really nothing strange in the behaviour of the bell. Occasional ringing on overload may be prevented by a slight readjustment of the components of the bell (usually a screw and a spring) used to break and make the magnetising current.

If the set has external loudspeaker sockets already fitted, and the connections to it are taken from the speech coil, as they are sometimes, use may be made of them, and time and trouble may thereby be saved. When the bell is once properly adjusted (on any station), and the set incorporates an automatic volume control, it will never ring when receiving speech, but may still do so occasionally when musical items are being received. This is an important point, as it enables one to receive news, announcements, talks, etc., undisturbed, these broadcasts being of greater interest during war-time than vocal and instrumental numbers.—MÁTÉ LÁSZLÓ TELCS (Maidenhead).

Identification of S.W. Stations

SIR,—In the May issue of PRACTICAL WIRELESS you published a letter from John Parkin (Hull), in which he asked about a station in Havana, and another station on about 25.2 metres. The call sign of the Havana station is COK, and the wavelength 25.93 metres. Regarding the other station I find there is a reply in your July issue stating that it was the New British Broadcasting Station (a German-sponsored station supposedly in Britain, but actually in Germany, which broadcasts "Stop the War Now" propaganda).

Personally, I believe the station John Parkin refers to is the Bulawayo station in Southern Rhodesia, which I picked up myself round about the date he mentions, at that time, playing dance records and closing down with "God Save the King" at 9 p.m. B.S.T. Reception of this latter station was extremely poor and I was unable to obtain the call sign or frequency. The address of the Havana station is "Station COK, Sports Palace, Havana, Cuba."

In your May edition I noticed a request by E. J. Roberts for anyone who has verified Guatemala City to communicate with him.

I have picked up TGWA on both the 19 and 31 m. bands, the latter being a very powerful signal, every morning from 5.15 to 6.45 a.m. B.S.T. The stations over which they broadcast at this time are TGWB (the station E. J. Roberts verified, TGZ being the alternative call sign) on 49 m. band, TGWA on 31 m. band, TGWC on 2,320 kc/s, and TGW on the broadcast band.

In the June issue you published a request by a Welsh reader for identification of a station calling London at approximately 10.45 p.m. B.S.T. The station he refers to is LSX, Buenos Aires, on 28.99 m., and the Oriental music he refers to is actually typical Argentinean music, though it sounds strange to British ears.

On June 8th, at 5 a.m. B.S.T., I heard WGEA announced on 48.47 m., and according to the announcer, WGEA broadcasts daily on this wavelength, from 9 to 10 p.m. Eastern Standard Time, with their beam antenna directed towards Latin America.—OSWALD LITTLE (Annfield Plain).

Heard on a Home-made 4-valver

SIR,—Regarding the station mentioned by your reader, F. Whaley (Taunton), this is undoubtedly a German station posing as British; it calls itself the "New British Broadcasting Station." It also broadcasts on Sundays at 5.30 p.m. B.S.T., and has been operating for several months.

I have heard a station saying "This is WNA calling DFO, Berlin." I wonder if this is the experimental Rumanian station which announces in English at 2.15 p.m. G.M.T. (32.4 m.) as the wavelength seems the same? During the last month I have heard, among others, the following stations: Ankara, Delhi, Helsinki, Neron Java (15.48 m.) at 12.45 G.M.T.; Sydney, Brazzaville, Spain (FKA22 ?), Budapest, and a good number of Americans. Most of these can be received regularly.

The set is a home-made 4-valver, but the reception mentioned was with 'phones on the first L.F. so that in effect the set was a Det., L.F. (R.C.C.). The coils and H.F.C. are home-made, and there are no low-loss components. Finally, all my radio knowledge was gained from PRACTICAL WIRELESS, and I shall be glad when it again becomes a fat weekly.—F. G. RAYER (Longdon).

Medium-wave D.X. Stations

SIR,—Recent letters concerning medium-wave reception have proved to be most interesting, and I enclose my latest log of some of these stations for the benefit of other readers:

282 m.—A Canadian Home Service station heard at 2.30 a.m.

462 m.—WIF (1.30 a.m.). Reception of both about R5-6.

499 m.—A conversation in English between two distant transmitters (1.30 a.m.-2.30 a.m.) at R4-5. (Can any listener identify this station ?)

I would be very pleased to hear from any reader concerning this topic, also from any beginner in Morse code. I will undertake to answer all letters.—ERIC WILSON (3, Back Meal Street. New Mills, Nr. Stockport).

Experimental Circuits

SIR,—Congratulations to the writer of the article, "Experimental Circuits," in the June issue.

This is the type of article that many experimenters have been waiting for, and this one in particular is just what is wanted, as there are so many most unusual circuits illustrated, particularly those numbered 2, 6, 8, 9 and 10 (which I've never seen before !).

Like many other readers, no doubt, I intend trying out these circuits, and hope to get some interesting results.—P. W. BARNETT (St. Albans).

Correspondent Wanted

W. W. POLLARD, "Devonia," London Road, Datchet, Bucks, would like to get in touch with any short-wave enthusiasts in the district with a view to correspondence and personal contact.

LATEST PATENT NEWS

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

Latest Patent Applications

5440–5441.—McGee, J. D., Miller, H., and Freeman, G. S. P.—Electron-discharge devices.

5553.—Robinson, J.—Radio receiving, etc., systems.

5353.—Standard Telephones & Cables, Ltd.—Amplitude range-control in signal-transmission systems.

5354.—Standard Telephones & Cables, Ltd.—Amplification of electric waves.

5356.—Standard Telephones & Cables, Ltd.—Receiving - circuits for signalling systems.

5358.—Standard Telephones & Cables, Ltd., and Earp, C. W.—Arrangement for conversion of frequency modulation to phase modulation.

5719.—Standard Telephones & Cables, Ltd.—Apparatus and methods for sound-absorbing.

5720.—Standard Telephones & Cables, Ltd.—Frequency multipliers.

5721.—Standard Telephones & Cables, Ltd.—High-frequency receivers.

Specifications Published

535904.—Standard Telephones & Cables Ltd., and Smyth, C. N.—Tuning devices and indicators for radio-receivers.

535907.—Standard Telephones & Cables, Ltd., and Black, D. H.—Radio receivers and automatic gain control arrangements therein.

536089.—Blumlein, A. D.—Thermionic valve amplifiers.

536070.—British Thomson-Houston Co., Ltd.—Thermionic discharge devices.

536153.—Hazeltine Corporation.—Periodic wave generators, particularly applicable for use in television.

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.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received by the First Post on the third Monday in each month for publication in the next issue.

NORTH MANCHESTER RADIO AND TELEVISION SOCIETY

Hon. Sec.: R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

IT has been suggested that meetings of the above organisation be held in the Prestwich, Whitefield area from time to time during the period of the war. Dates and the number of times meetings will be held are not yet fixed, so if all interested will write to the secretary at the above address stating when they would like meetings to be held, an attempt will be made to choose a night or day suitable to the majority. Old members of the organisation are particularly asked to note this announcement.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

European and Colonial Representaive: Arthur E. Bear, 110, Adams Gardens Estate, London, S.E.16.

IN spite of the war this club has been able to carry on. Many of our British members, however, are finding it difficult to renew their membership owing to the war. We should therefore like to inform them that we would be pleased to send a copy of our International Short-Wave Radio magazine to anyone who makes application to International Short-Wave Club, East Liverpool, Ohio, U.S.A. A great many PRACTICAL WIRELESS readers are members of this organisation. We should also like to hear from members who are in H.M. Forces. These should write to the club at the London address, given at the head of this note.

AMATEUR RADIO CONFERENCE IN MANCHESTER

AN Amateur Radio Conference was held in Manchester on Sunday afternoon (June 8th), at which there were radio enthusiasts and amateurs from Cardiff, Sheffield, Flixton, Sale, Leigh, Ashton, Whitefield, Westmorland, Blackpool and Bury, etc. A good-will message was agreed upon, addressed to President Roosevelt and American radio enthusiasts, and same has been passed to the American vice-consul in Manchester for forwarding to the U.S.A.

The future of amateur radio was a point which was discussed very carefully, and after considering as to whether an F.C.C. would be made workable in this country, and the splitting of bands for 'phone and C.W. work, the conference decided to make the following recommendations which they hope will help to form any new conditions which may be contemplated, when the time comes for the re-issuing of amateur transmitting licences, after the war. It is suggested that there be three grades of licences, and the following are the ways in which it is suggested that they work:

A. Licence to be granted to beginners on the lines similar to those covering the A.A. licence in the pre-war days.

B. A morse-test of 12 w.p.m., with a fairly simple technical test, should entitle a person to operate a 'phone or C.W. transmitter with a power of up to 25 watts on restricted bands.

C. A morse-test of 18 w.p.m., with a rather stiff technical test, should entitle a person to operate a 'phone or C.W. transmitter on all the amateur bands, with increased power.

There was quite a lot of discussion on the subject of whether there should be certain bands set aside for C.W. and others just for 'phone.

The use of radio in Home Defence was another point discussed, and the chairman emphasised the fact that very little in the way of voluntary radio work was offered to the radio amateur who was still in civilian life, and he said that he thought that there must be many radio enthusiasts now doing A.R.P., A.F.S., and other work, who would much rather do work connected with a subject that they were already conversant with. Two instances given where it was thought that radio enthusiasts might be used were the new "Radio Net" system, referred to in the press recently by a Canadian Minister, and also the new amplifying system recently introduced, and used for located persons trapped below wrecked buildings.

Another item which created a great deal of interest was a discussion on the shortage of radio components, etc. A very good "Pool" suggestion was put forward by a member of the Leigh and District Amateur Radio Society, and it was decided at the conference that the system be tried out in the Manchester area, and clubs in Ashton, Sale, Leigh and Manchester promised to co-operate. The scheme briefly is that each club supplies the other clubs with a list of the surplus radio components, etc., which it may have, then any district short of any certain components can look at the list and find which area possesses spare ones, a form of exchange or sale will then take place between the organisations concerned.

At the close of the meeting it was suggested that a further one should be held at the same place, but next time with the addition of one or more talks on matters of interest to radio enthusiasts. The date suggested was July 27th, but at the time of writing it has not been possible to fix anything definite. Details of any future meetings of this description can be obtained by sending a stamped, addressed envelope to Mr. R. Lawton (address at top of this column), who will be glad to notify any radio amateur or enthusiast when arrangements have been made for the next meeting.

Replies to Queries

D.C. Resistance and Impedance

"I am in possession of a moving-coil loudspeaker, which is listed with a speech coil of 8 ohms impedance. When I tested with my Avometer it did not register any D.C. ohms resistance. Can you give me the ratio of A.C. ohms compared with D.C. ohms, as the problem I have in mind is to wind the speech coil of 8 ohms impedance, but I have no formula as to how many turns of wire I should put on the former to give 8 ohms? Could you advise me of a practical way of arriving at the impedance of any speech coil when its ohms are not known? Also, the same query arises as regards the output transformer on my push-pull amplifier; although this transformer is matched to suit valves of 3,400 ohms, I only get a reading across the transformer of approx. 200 ohms on my meter."—J. Rogers (Dudley).

IT appears that you are rather confusing D.C. resistance and impedance to A.C. The valve of impedance, in ohms, is much higher than the D.C. resistance, also in ohms, being dependent upon frequency. Thus, the impedance of a choke or any type of inductance is (neglecting any capacity across it) equal to the square root of $(R^2 + 2\pi fL^2)$, where R is the D.C. resistance, π is 3.14, f is the frequency in cycles per second, and L is the inductance in henries.

A fairly general, though not strictly accurate, rule for speech coils is that the impedance is about two and a half times the D.C. resistance at a frequency in the region of 1,000 cycles. Thus, an 8-ohm (impedance) speech coil would have a D.C. resistance in the region of 3 ohms. With regard to the transformer, it should be appreciated that the better the quality, the lower the D.C. resistance. This is a general rule, and you will see from catalogues that a choke or transformer of given inductance is priced inversely as its D.C. resistance.

Potentiometer Connections: Auto G.B.

"Could you please inform me how to wire up the potentiometer to a 7-pin Osram QP21, since there appears to be only pin No. 6 to connect? Also, can automatic G.B. be applied, as I should like to add it to my set, the basic circuit being the Vitesse superhet?"—J. Bance (Otley).

THE QP21 is not intended for use with a potentiometer to supply the screening grids, since these electrodes are internally connected together. Actually, potentiometer feed is not necessary, due to the accurate balancing of the two halves of the double pentode. You will be quite in order in following the connections to which you refer.

Automatic bias is not practicable in this circuit, due to the fact that the anode current is constantly varying in accordance with the amplitude of the signal applied to the Q.P.P. output stage.

Coil Windings

"Would you please inform me as to the correct number of turns, and size of wire for the following coils, using 1½in. former? 100 to 350 metres, 350 to 600 metres, 1,200 to 2,000 metres. I want to use these coils for a small absorption-type wavemeter."—William G. Reid (Plymouth).

WE would advise you that it would not be practicable to cover the wavebands you mention with only three coils. Instead, you will require coils approximately as follows, assuming the use of a .0005 mfd. tuning condenser and formers of 1½in. diameter:

95–250 metres	..	35 turns
200–500 metres	..	75 turns
400-800 metres	..	100 turns
900-2,000 metres	..	220 turns

The first two coils may be wound with 22-gauge d.c.c. wire, and the other two with 24-gauge enamelled wire. It would be desirable to give the cotton-covered wire a coat of shellac varnish after winding to render the insulation proof against moisture.

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.

Using an Eliminator on A.C. on D.C.

"The H.T. supply was obtained from the mains, which were D.C. I made my own eliminator. If I use the set where I am at present stationed, I could not use the eliminator, as it is A.C. current here. Could you advise me in what way I should have to change my present H.T. supply unit so as to use it here?"—J. Dawson (Chichester).

YOU can certainly operate the receiver from the A.C. mains by using the smoothing unit which you have, in conjunction with a mains transformer as a rectifier. Provided that your unit was suitable for D.C. mains, it will be satisfactory for A.C. working, when used with the transformer and rectifier mentioned. You do not state the values of the resistors, but they may remain unaltered provided that the output from the rectifier is approximately the same as that from the D.C. mains with which the unit was used.

A suitable rectifier would be the Westinghouse type H.T.15, fed from a transformer with an output of 250 volts, 80 mA. This transformer can be obtained through any good radio dealer, whilst the rectifier can be obtained similarly, or from Westinghouse Brake and Signal Co., Ltd., Pew Hill, Chippenham, Wilts, who will also supply you with full details of the rectifier. In passing, it should be mentioned that the L.F. transformer you indicate is not ideal as a smoothing choke, although it will work if the H.T. current is low.

Universal Meter Queries

"I have constructed the 'Universal Meter' described in your 'Radio Service Manual,' and the meter is working perfectly. My particular instrument is completely self-contained in a case 16in. by 16in. I now wish to increase its utility by using the 0-1 mA milliammeter for reading the mutual conductance of valves.

"I have all the valve-holders in position, together with rotary selector switches. Before proceeding, however, I would appreciate your advice on the following points:

1. What is highest anode current, and voltage likely to be required for valve testing?
2. Should H.T.+ tappings be taken from H.T. secondary on transformer or by resistances after rectification?
3. What voltages should I select on H.T. selector, G.B. selector, and filament selector?
4. What method is adopted for obtaining the 2-volt D.C. for battery valves?
5. Where must the milliammeter be connected?

"I have wired the valve-holders as described in the 'Radio Service Manual,' i.e., anodes in parallel, filaments in parallel, etc. Will this wiring hold good for the mutual conductance test?"—C. E. Clothier (Watford).

THE anode current will depend on the type of valve under test, and may vary from 2 mA's to, say, 40 mA's when an output valve is under consideration. The correct anode and screen voltages are always given in manufacturers' leaflets.

H.T. tappings can be taken from secondary of mains transformer. It is quite in order to use raw A.C. for such purposes. The voltages will depend on the valve. G.B. supply is obtained easiest from an external battery.

Raw A.C. can be used for 2-volt filaments for testing purposes, provided that care is taken to apply correct value.

The mA meter must be connected in the anode circuit. The mutual conductance is obtained by noting the change in anode current when G.B. is varied by 1 volt. The valve-holder wiring is in order.

Portable All-dry Battery Set

"I have purchased an American all-dry battery set called the 'Admiral' which works on A.C. or D.C. I have a cord resistance for it, and it works quite well on 250 A.C. ashore, and on battery power, but I wish to run it on a ship's mains of 110-120 D.C. Although the rectifying valve filaments light up, I cannot get a sound out of it. I have tried it with and without the resistance, but can get no results. Can you advise me, please?"—Lewis J. Martin (Walton-on-Thames).

WE regret that we cannot be as helpful as we should wish, since we are not in possession of any details of the particular American receiver you mention. As you probably know, there is a very large number of sets of this general pattern, American made, and it is hardly possible to keep a complete file of them all.

It is probable, however, that there is a fixed or semi-fixed resistor in the receiver for varying the voltage drop; this would be in addition to the cord resistor. In that case, it would probably be necessary to cut out this resistor when working on 110-120 volts. On the other hand, it is possible that the receiver is intended only for mains of 200-250 volts.

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

Practical Wireless
BLUEPRINT SERVICE

These Blueprints are drawn full size.

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

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

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

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

PRACTICAL WIRELESS

	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 : Blueprint, 1s.		
The Signet Two (D & LF) ..	24.9.38	PW76
Three-valve: Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans)) ..	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow) ..	—	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	—	PW39
Hall-Mark Three (SG, D, Pow) ..	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	—	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	—	PW49
Cameo Midget Three (D, 2 LF (Trans)) ..	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC)) ..	—	PW55
The Monitor (HF Pen, D, Pen) ..	—	PW61
The Tutor Three (HF Pen, D, Pen)	—	PW62
The Centaur Three (SG, D, P) ..	—	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	—	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	—	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det, Pen) ..	—	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	—	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen) ..	—	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen) ..	—	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) ..	—	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)	—	PW32
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen) ..	—	PW35B
Unique (HF Pen, D (Pen), Pen ..	—	PW36A
Armada Mains Three (HF Pen, D, (Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))..	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen) ..	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-valve : Blueprints, 1s each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47

SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
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F. J. Camm's 2-valve Superhet ..	—	PW52
Mains Sets : Blueprints, 1s. each		
A.C. £5 Superhet (Three-valve) ..	—	PW43
D.C. £5 Superhet (Three-valve) ..	—	PW42
Universal £5 Superhet (Three valve)	—	PW44
F. J. Camm's A.C. Superhet 4 ..	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four ..	—	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model .. / Push Button 4, A.C. Mains Model	22.10.38	PW95
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One-valve : Blueprint, 1s.		
Simple S.W. One-valver	23.12.39	PW88
Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen) ..	—	PW68
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Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS.		
Blueprint, 1s.		
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE

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1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
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Full-volume Two (SG det, Pen) ..	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
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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
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Simple-Tune Three (SG, D, Pen)	—	WM327
Economy Pentode Three (SG, D, Pen)	—	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans) ..	—	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen) ..	—	WM389
Certainty Three (SG, D, Pen) ..	—	WM393
Minitube Three (SG, D, Trans) ..	Oct. '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
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Self-contained Four (SG, D, LF, Cl. 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.		
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Mains Operated.		
Two-valve : Blueprints, 1s. each		
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Mantovani A.C. Three (HF, Pen, D, Pen)	—	WM374
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Harris' Jubilee Radiogram (HF, Pen D, LF, P)	May '35	WM386
SUPERHET.		
Battery Sets : Blueprints, 1s. 6d. each.		
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The Request All-Waver	June '36	WM407
1935 Super Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. each.		
Heptode Super Three A.C. ..	May '34	WM359
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PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
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SHORT-WAVE SETS. Battery Operated.		
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S.W. One-valver for America ..	15.10.38	AW429
Roma Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
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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
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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)	P.W. 22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super ..		WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each		
Two-valve Mains Short-waver (D, Pen) A.C.	P.W. 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.		
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MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
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Induction; effect of rotating a coil in a magnetic field.
Mutual and self induction and inductance; effect of inductance on growth and delay of current.
Capacity; charging storage and discharge of condensers; through resistance and inductance.
Alternating currents; vector diagrams; effect of resistance variation; effects of L and C in A.C. circuit; phase difference of currents; resonance in a series circuit; parallel circuit of L and C; Q factor.
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Suitable Candidates will be interviewed at local centres, and, if successful, will be enlisted and appointed Acting Sergeant Tradesman. For those who are on the Schedule of Reserved Occupations, special arrangements will be made to enable them to be enlisted. In the event of any applicant found to be reserved under Schedule of Reserved Occupations special application will be made for relaxation of the Schedule. No guarantee can be given that this application will be successful.

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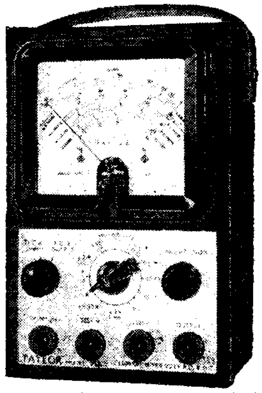

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