THE AUSTRALASIAN

Radio World

PRICE, 1/-

Registered at the G.P.O., Sydney, for transmission by post as a periodical

VOL. 6 . . . . . NO. 1

JUNE 18 1941

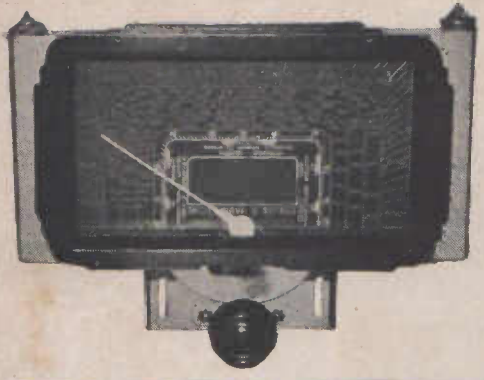
SUPER-SEVEN DUAL-WAVER

PARAPHASE AMPLIFIER

EXTENSION SPEAKERS

SUBSTITUTE VALVE DATA

YOU CAN'T BEAT CROWN PARTS IN THE "SUPER-SEVEN"

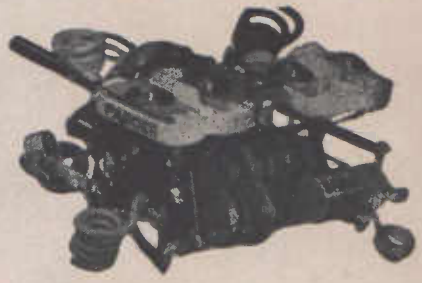


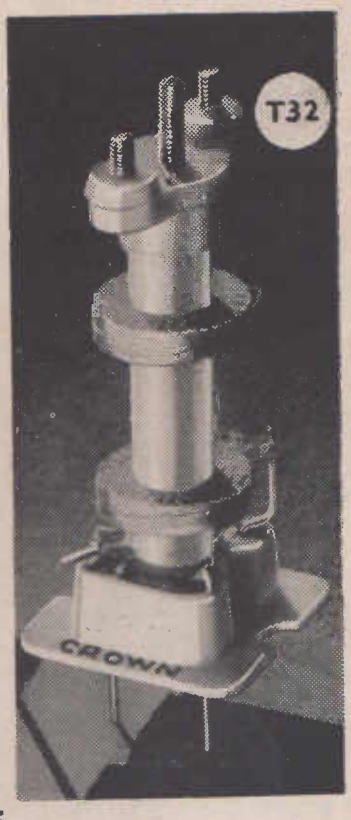
ABOVE: Crown FD3B Diol, "H" gang.
AT SIDE: Crown DC2/13-42 "H" gong Tuning Unit.
AT RIGHT: Crown TROL. Permatune I.F.T. Type T32.

Home constructors, dealers, manufacturers — everyone engaged in the Radio business, whether for pleasure or profit, agrees that it "poys to use Crown." You, too, will find the 100% Australian-made Crown lines measure up to all your requirements in performance and price. Order Crown components from your Crown distributor.

Order the following Crown components for the "Super-Seven"—

DC2. 13/42 H. **(1) T31. I.F.**
(1) T32. I.F. **(1) FD. 3B Dial.**





Crown

RADIO PRODUCTS PTY. LTD.

51-53 MURRAY STREET
PYRMONT - SYDNEY

Telephone MW 2628
(2 Lines)

THE RELIABLE LINE

EXTENSION LOUD-SPEAKERS

HOW TO INSTALL AND CONTROL THEM

TO ONESELF and one's neighbours, few noises are more objectionable than an unduly loud or overloaded radio receiver. Yet, there are many times when one wishes to listen to news or music and cannot be beside the radio set. Of course, a very simple solution to the difficulty is to provide a second receiver, and in some countries radio sets are to be found in almost every room.

An equally effective and very much cheaper way out of the difficulty is to run an extension speaker or speakers from the existing set and place these speakers exactly where they are required. In fact, the job can be made so simple that the only cost involved is the extra speaker, baffle or cabinet and wire. It can be very easily done by anyone who is mechanically minded.

Volume can be independently controlled at the speakers and, by very simple wiring arrangements, the choice is always available between the extension speaker, the main speaker or both. Furthermore, wires could be run to several rooms, and the extension speaker moved around as required.

It does not require the knowledge and experience of a radio engineer to fit up a system to take an extension speaker or speakers. Anyone with the slightest mechanical knowledge can do the job perfectly satisfactorily and at a very low cost. It is not even necessary to take the set out of the cabinet and, provided reasonable care is taken in making the necessary alterations or connections to the main speaker, there will be no possibility of affecting its response and efficiency in any way.

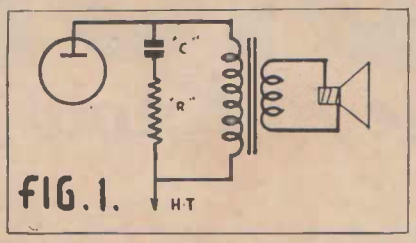


Fig. 1.—A filter to maintain load impedance relatively constant when extension speakers are used.

Naturally, slightly more power is required to run two speakers than one, but on almost every modern radio receiver there is always far more power than is required for normal volume levels. In fact, the average receiver can quite easily run two, three and sometimes four speakers quite satisfactorily.

Speakers used on older sets, and for that matter some of those used to-day, are easily outperformed by the latest high efficiency permanent magnet speakers. It is not surprising, then, that the modern extension speaker of the Rola permanent magnet type, if wired correctly, will give quality equal to and often better than the original speaker.

There are two main types of radio receivers — one working from a battery or batteries and the other directly from the a.c. mains. In the case of the former, what are known as permanent magnet loud-speakers are used. The virtue of this type of speaker is that the magnetic flux required for its operation is derived from a permanent magnet, and hence there are only two or three wires from the set to the speaker.

The a.c. type of set uses a speaker fitted with an electro magnet, the power for which is supplied by the receiver itself. The winding of this electro magnet is known as the field coil, and is used as a smoothing choke in the power supply of the receiver, so it must at all times be connected for the set to operate. In the case of the electro magnetic speakers there are either four or five connections. Sometimes designers use more, but they are only variations of the above. Because of the simplicity and general high efficiency of permanent magnet speakers, they are the more suitable for extension speakers. Furthermore, only two leads instead of four will have to be run.

The Output Stage

Valves used in the output stage are designed to work into certain specified values of load impedance to give a maximum power output with a minimum of distortion. Variations in this load impedance will cause distortion and loss of power output, particularly in the case of pentodes and tetrodes which are now used in the output of practically every radio receiver.

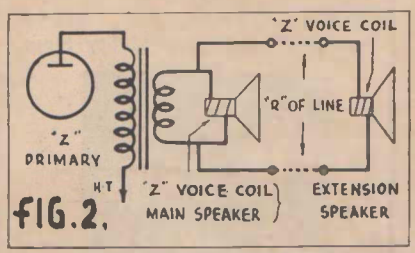


Fig. 2.—The simplest method of running extension speakers — an extension of the voice coil leads.

The impedance of the voice coil of a loud-speaker rises with frequency, the lowest value of impedance being at and near 400 cycles per second. By the time the frequency has reached 3,000 cycles per second, the impedance has doubled in value. As the load impedance on the output stage is provided by the voice coil impedance (which is reflected into the primary of the output transformer), it follows that if the voice coil impedance varies, so will the load impedance. This load impedance is kept

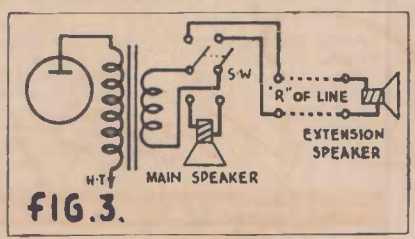


Fig. 3.— Connecting a double-throw double-pole switch so that either the main or extension speaker may be selected.

The Australasian

RADIO WORLD

Incorporating the

ALL-WAVE ALL-WORLD DX NEWS

Vol. 6 JUNE, 1941 No. 1

The "Australasian Radio World" is published monthly by A. G. Hull.

Editorial Offices: 117 Reservoir Street, Sydney, N.S.W. Telephone: MA-2455

Subscription rates: 1/- per copy, 10/6 per year (12 issues) post free to Australia and New Zealand.

RADIOKES

The Name to Know in Radio!

is the COIL KIT to specify for the

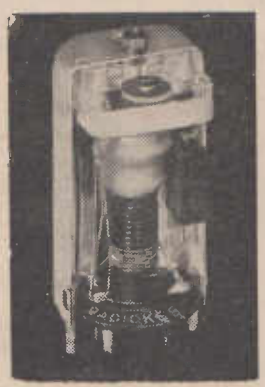
SUPER-SEVEN

Specify Radiokes components for this outstanding set — and you'll be getting the best there is! The highest standards of design and construction are rigidly adhered to and the Radiokes reputation for efficiency is your guarantee of MAXIMUM SELECTIVITY and SENSITIVITY.

RADIOKES BROADCAST COIL

Radiokes Broadcast Coil, Trolitul rigid construction, available in air-cored and permeability types.

Type, A.C., B Aer., R.F. or Osc.
List Price 6/6



Radiokes Intermediate Transformer

Radiokes B.C. Coil

RADIOKES INTERMEDIATE TRANSFORMER

One-piece mechanically-sound Trolitul formers and base — the highest standard I.F.'s available. A special feature is the round base suitable for round or square cans.

IFA (Air Core)	**7/6**
IFI (Iron Core)	**11/–**
IFP (Perm.)	**13/9**

Radiokes can give you delivery of any of the following Precision Products—

Audio Transformers	**I.F. Transformers**	**Terminals**
Audio Chokes	**Line Filters**	**Trimmers**
Bakelite Stampings	**Laminations**	**Volume Controls**
Coils of all types	**Midget Condensers**	**"Trolitul" Mouldings**
Coil Units	**Power Chokes**	**Formers, etc.**
Dials	**Solder Lugs**	

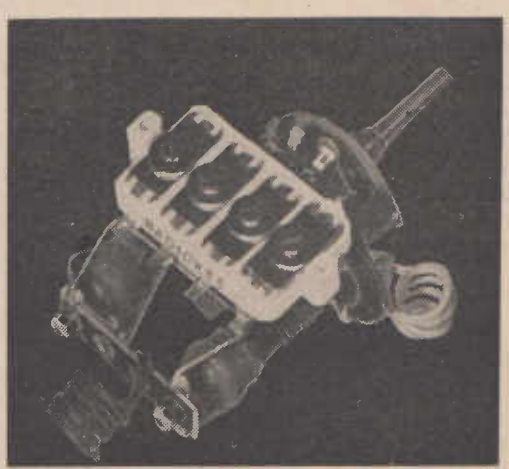
RADIO SUPPLIERS PTY. LTD.
Sole Agents for Radiokes Products,
Wingello House, Angel Place, Sydney. 'Phone B 4586.

If you have difficulty in obtaining any of these lines, let us have your name and address. Our new Radiokes Leaflet is available post free.

NAME .....

ADDRESS ..... R.W., June

Radiokes Coil Kit, CK1038 ... £1/7/6
Radiokes Permeability I.F.'s type PIF ..... each 13/9
Radiokes Dial DWD-5 ..... £1/2/6



RADIOKES DUAL-WAVE UNIT, DWU-1

This is a highly-selective unit with an exceptionally wide range. The DWU-1 matches "H" type gang condenser, and incorporates 4-in-1 padder. Solidly mounted with coils. Type DWU-1.

List Price 27/6

RADIOKES "H" TYPE COILS WILL TRACK ONLY WITH RADIOKES "H" TYPE DIALS.

reasonably constant by means of an output filter as in Fig. 1, consisting of a resistor "R" and condenser "C" in series, connected in parallel with the output transformer.

In this filter, with a rise in frequency, the impedance of the capacitor "C" falls, this being opposite to the effect of a rise in frequency on the impedance of a voice coil. With correct proportions of "R" and "C"

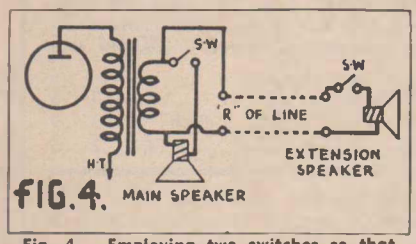


Fig. 4.— Employing two switches so that either or both switches may be used at will.

for a given load impedance, a condition can be met where a resultant load will be very nearly constant regardless of frequency. For the modern types of pentodes with a load impedance of 7,000 ohms, the values of "R" and "C" will be 10,000 ohms and .02 mfd., respectively.

Methods of Connection

Before running systems for extension speakers, it is necessary to decide upon the system most suitable for individual requirements. There

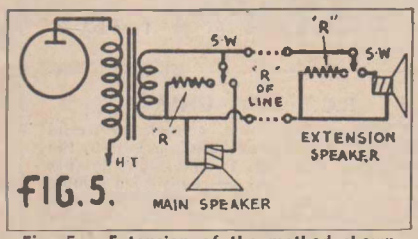


Fig. 5.— Extension of the method shown in Fig. 4 to provide for the maintenance of constant load on the line.

are three main methods of running extensions, each one having several variations:

(a) Low impedance voice coil lines.
(b) High impedance lines.
(c) The use of a 500-ohm line.

(a) Low Impedance Voice Coil Lines

The easiest and by far the cheapest method of connecting an extension using a voice coil line is as shown in Fig. 2.

In this method the extension speaker voice coil is connected in parallel with the main speaker voice coil. The only advantages of this method are its simplicity and low cost, although it is quite successful if used at average home levels. The length of the extension is limited because the resistance "R" of the line must not exceed 25 per cent. of the impedance "Z" of the voice coil, otherwise big losses will occur in the line.

If long extensions are run, heavy conductors must be used. These are expensive. Furthermore, the bigger the conductor, the harder it will be to conceal — a very important factor to consider when installing an extension in the home.

Wire suitable for short extensions would be type 1/20 bell wire, having a resistance of 2.36 ohms per 300-foot coil. For a voice coil whose impedance is 2.3 ohms, the maximum allowable resistance "R" will be:

$$\frac{2.3}{4} = .575 \text{ ohms}$$

This resistance would be given by approximately 75 feet of wire, this giving us an extension of $\frac{75}{2}$ or approximately 37 feet.

The second fault of this system is that it causes serious mismatching to the output valve when both speakers are operating simultaneously. If the impedance "Z" of the extension speaker is the same as that of the main speaker, then, because the two are in parallel, the impedance reflected in the primary of the transformer will be one half that reflected by a single voice coil.

Fig. 3 shows a method whereby the problem of mismatching is overcome provided the extension speaker voice coil is the same as that of the main speaker.

In this method, the secondary leads of the output transformer are disconnected with the voice coil of the main speaker and connected to a double pole double throw switch (S.W. in Fig. 3) by which the secondary may be connected to either the main or extension speaker. The disadvantages of this method are, firstly, the limitation of the length of the extension due to resistance of the

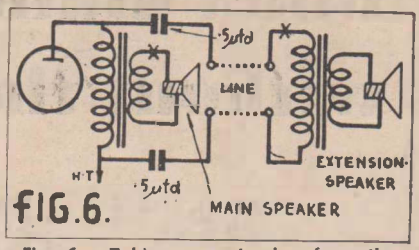


Fig. 6.— Taking an extension from the high impedance side of the output transformer

line, and, secondly, only one of the speakers may be used at once.

In Fig. 4 is shown a method whereby either one of the speakers may be used separately or both together.

If both speakers are used simultaneously, serious mismatching occurs as in Fig. 2.

Fig. 5 shows the correct and best method of installation of an extension speaker utilising the low impedance voice line. With this method

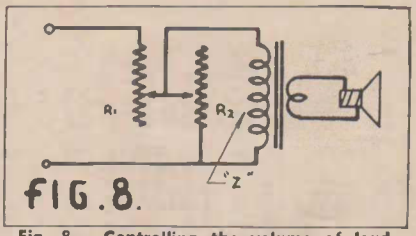


Fig. 8.— Controlling the volume of loud speakers by ganged potentiometers.

either speaker may be operated separately or both simultaneously without any mismatching. The transformer on the main speaker has been replaced by one designed to match two voice coils in parallel, i.e., half normal primary impedance.

Switches (S.W.) are of the single pole double throw type, and operate so that when one speaker is discon-

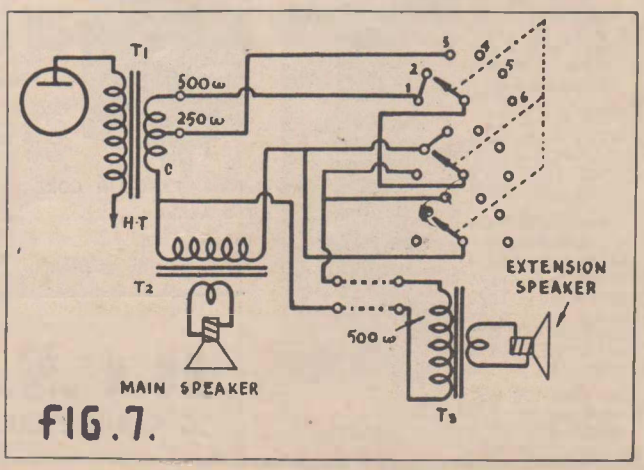
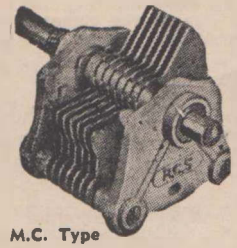


Fig. 7.— This sketch shows a system of installing an extension speaker using a 500-ohm line. With this scheme correct impedance matching is obtained under all conditions.

Don't Build the SUPER-SEVEN without the R.C.S. TROLITUL COIL KIT

R.C.S. TROLITUL MIDGET CONDENSERS



M.C. Type

R.C.S. Midget Condensers are made in two types, using Trolitul supports, thus guaranteeing practically no loss.

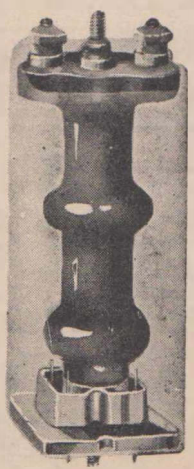
The 14-plate equals old style 23-plate capacity. The M.C. type may be ganged.

STAR AND M.C. MIDGETS

Max. Cap. mmfd.	Min. Cap. mmfd.	Plates	Star Cat. No.	Retail Price	M.C. Cat. No.	Retail Price
10	3	2	CV34	3/6	CV41	6/9
15	3	3	CV35	3/9	CV42	7/3
25	3.5	4	CV36	4/-	CV43	7/10
35	4	5	CV37	4/3	CV44	8/6
50	4	7	CV38	4/9	CV45	9/-
70	5	9	CV39	5/4	CV46	9/6
100	6	14	CV40	5/11	CV47	10/9

R.C.S. TUNED I.F.'s

The new R.C.S. permeability-tuned I.F.'s are wound on special Trolitul formers into which are inserted the adjustable iron cores. These R.C.S. permeability - tuned I.F.'s are the most dependable and efficient I.F.'s it is possible to produce. They should be used whenever the optimum in results is required.



IF162

465 K.C. I.F.'s
When two I.F.'s are used:
IF162 1st .. 13/9
IF163 2nd .. 13/9

When three I.F.'s are used:
IF164 1st .. 13/9
IF164 2nd .. 13/9
IF163 3rd .. 13/9

Air Core 465 K.C.
IF107 1st .. 7/6
IF108 2nd .. 7/6

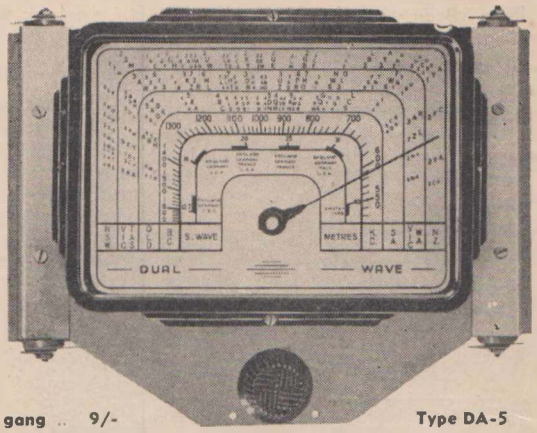
Air Core 175 K.C.
1E68 1st 7/6
1E69 2nd 7/6

When you build the "Super-Seven" you'll be building a "super set," but you must have R.C.S. Trolitul components to really get the best out of it. Trolitul insulation gives you high gain, high "Q" factor, and ensures maximum sensitivity and selectivity. Specify R.C.S. and be sure!

R.C.S. Trolitul Coil Kit for the "Super-Seven," K180	£1	7 6
R.C.S. Permeability I.F.'s, IF162 and IF163 each	13	9
R.C.S. DA-5 Dial	£1	2 6

R.C.S. DIALS

Types DA-1 and DA-2 are single glass dual-wave, the type DA-2 having been designed especially for use with the Five-Band Communications Coil Kit and "H" type condenser. Type DA-1 is a standard dual-wave dial for use with R.C.S. coils and "F" type condenser. The DA5 dial is for use on the 1600 to 550 k.c. and 13.7 to 40 metre bands, with "H' type condenser. All this series is edge - lit ond wedge - driven. Aperture for the escutcheon is approximately 7" x 4-7/8."



Type DA-5

DA-1 Standard D/W Dial, "F" condenser 22/6

DA-2 Communications Dial 22/6

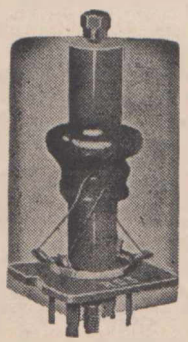
DA-5 13.7 to 40 metres, D/W dial, "H" condenser 22/6

DA-6 Mantel Set dial, D/W "H" gang 18/9

DA-7 Portable Kit Dial, D/W, "H" gang .. 9/-

DA-8 Same as DA-7, but ready assembled .. 13/6

R.C.S. TROLITUL BROADCAST COILS



These coils are available in both Air Core and Permeability tuned types. The latter are adjusted to ensure maximum efficiency in our laboratories.

AIR CORE "H" GANG

E342 Aeriol 6/6
E343 R.F. 6/6
E344 Os. 6/6

PERM. TUNED "H" GANG

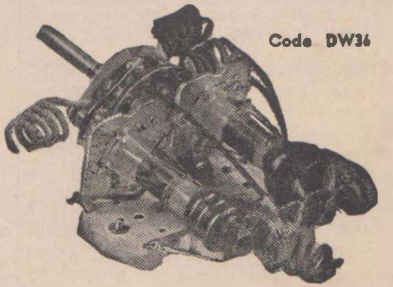
E345 Aerial 8/6
E346 R.F. 8/6
E347 Osc. 8/6

T.R.F. TYPE-AIR CORE

T88 Aerial 6/6
T89 R.F. 6/6
T87 R.F. with reaction 6/6

R.C.S. D.W. UNIT

Type DW36, as illustrated, consists of Aerial and Oscillator Coils, Wave Change Switch, the necessary B.C. and S.W. Trimmers and Padder mounted together, wired up ready to assemble into a set utilising 465 k.c., the bands being S.W. 13.7 to 40 metres, and B.C. 1600 to 550 k.c. Code DW36 ..... £1/7/6



Code DW36

R.C.S. D/W Unit, with R.F. stage — DW35 ..... £3/7/6

OBTAINABLE FROM YOUR LOCAL DEALER

R.C.S. RADIO Pty. Ltd.

50 GLEBE STREET, GLEBE Telephone: MW 2405

nected, a dummy load is connected in its place. The value of this dummy load is approximately 25 per cent. greater than the voice coil impedance.

Although in this system there is a loss of power in the dummy load resistor when one speaker only is being used, the correct load impedance is provided on the output valve, thereby maintaining its correct operating conditions for maximum power output and minimum distortion. It is important to note that each dummy load resistor must be capable of dissipating a power of at least half the maximum power output of the receiver or amplifier.

(b) High Impedance Lines

The method is very simple, and was one of the first methods ever used. Fig. 6 shows how an extension is made utilising the high impedance line.

This method consists of connecting the extension speaker input transformer in parallel with the main speaker input transformer through two condensers having a value of about .5 mfd. each. These condensers are in the circuit to eliminate the high d.c. voltage from the extension.

Again in this system, because of the two speakers being in parallel, we have mismatching of the output valve. More care has to be taken with the insulation of a high impedance line of this type because of the high a.c. voltages that are encountered.

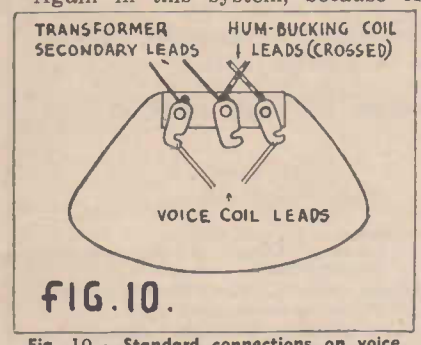


Fig. 10.— Standard connections on voice coil terminal strip on most Rola electro-dynamic speakers.

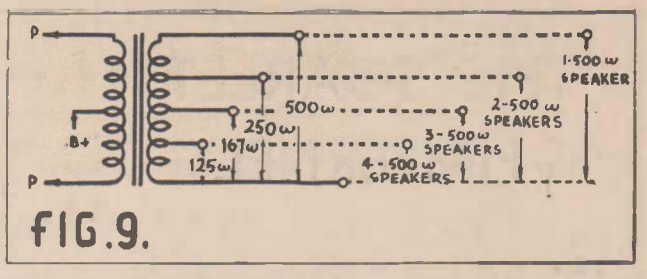
With this method, as in Fig. 2, there is no choice of speaker, but by inserting two switches in the two points marked "X" on Fig. 6, this disadvantage is overcome, without mismatching. Both speakers can be used simultaneously with the mismatch already mentioned.

The length of a high impedance extension is limited by the capacity between the two wires. This capacity has the effect of short circuiting the high frequencies. If the impedance of the extension speaker is increased, so the resultant impedance will approach the correct value for the output valve.

★

Fig. 9 (right): Indicating how multiple speakers each with an impedance of 500 ohms, are connected to the aut put transformer.

★



This, however, will cause a smaller power to be fed to the extension because the ratio of the power to each speaker is directly proportional to the ratio of their impedances. The higher the impedance is made, the more effect the capacity of the line will have on the high frequencies.

Summing up the methods, we find that the low impedance voice coil lines are limited in length due to resistance. In the case of high impedance lines, the limitation is due to capacity and insulation.

(c) The Use of a 500-Ohm Line

A third and very successful method making use of a line having an impedance of 500 ohms is at our disposal. Resistive and capacitive effects are not serious, and use of this type of line has been adopted as standard practice.

This method consists of converting the output from the set or amplifier to a line with a secondary impedance of 500 ohms. The extension speaker and the main speaker each have primaries to match this line. If either speaker is used singly, the impedance of the line would be 500 ohms. If the two are used together (in parallel), the imedance of the line would need to be dropped down to half this value, i.e., 250 ohms, in order to provide matching.

It is, therefore, necessary to provide some means of altering the output impedance to match the number of speakers on the line.

Fig. 7 shows a system of installing an extension speaker making use of a 500-ohm line. In this system correct impedance matching is provided with either main or extension speaker used separately or both together.

The changeover is made by means of a multiple all-wave switch. This switch consists of three gangs, each having six contacts. Although only three positions are used, this switch was chosen because it is a standard type. The cost of installation of an extension using this method is higher than for abovementioned methods, but it is the most successful.

From the wiring diagram, it can be seen that when the switch is in position 1, the extension speaker which is provided with an input transformer, T3, having an input impedance of 500 ohms, is connected to the 500 ohm output transformer. Position 2 of the switch connects the main speaker, whose input transformer has been changed for one having an impedance of 500 ohms, to the 500-ohm winding.

In Position 3 of the switch the main and the extension speaker are connected in parallel, giving a resultant impedance of 250 ohms. They are then connected to a 250-ohm tapping on the 500-ohm output transformer, T1.

Independent volume control of extension and or main speaker may be used as shown in Fig. 8.

Resistors R1, the series element, and R2, in parallel with speaker input, are two potentiometers ganged together and connected so that when resistance in one is decreased, resistance in the other is increased.

Resistor R2 should have a value of at least five times the impedance "Z" of the speaker whose volume is being controlled. Resistor R1 has a value equal to the combination of R2 and Z, i.e., $\frac{R2 + Z}{5}$.

Z input is 500 ohms, then R2 will be:—

$500 \times 5 = 2{,}500$ ohms

$R1 = \frac{2500 + 500}{5} = 600$ ohms

As the potentiometer R2 is con-

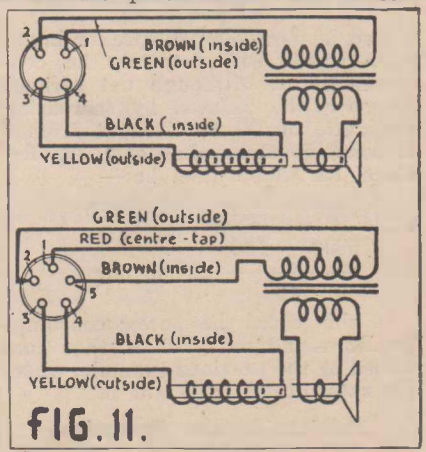


Fig. 11.— Showing the standard color code conections for electro-dynamic speakers. On permanent magnet speakers, the field coil is completely omitted.

nected in parallel with speaker input, some power will naturally be consumed by it. Although not serious, this may be reduced by increasing the ratio of R2 to Z input from 5 to some greater value, say, 10. Resistor R2 would then be:—

$$500 \times 10 = 5000 \text{ ohms},$$

while R1 would be:—

$$\frac{5000 + 500}{10} = 550 \text{ ohms}.$$

In this case, the power consumed by R2 would be one-half that consumed by the previous example, where the ratio of R2 to Z was 5.

Multiple Speaker Extensions

In public address or factory call systems, it is sometimes necessary to have more than one extension speaker. On systems of this type, the amplifier is generally equipped with an output impedance of 500 ohms. The input impedance of each speaker is simply ZL x N where ZL is the line impedance and N is the number of extensions, the extensions being connected in parallel across the line.

Most public address systems are portable and are used for various types of work, such as sports meetings, lectures, etc. Now, on some jobs, it may only be necessary to use one speaker, while on others, two, three, four, and sometimes more than four speakers will be required. As it would not be practical to change the input impedance of each speaker every time more speakers were required to be connected, it has been adopted as standard practice to equip all speakers with 500-ohm inputs.

The output transformer is then designed to have a 500-ohm output tapped 250, 167, 125 and 100 ohms. This allows for the use of one speaker only being connected to the 500-ohm tap. If two speakers are required, they are connected in parallel across the 250-ohm tap and so on, for three, four and five speakers.

Further Data

Further information on this subject can be obtained direct from the Rola Company, who have given considerable attention to the subject and will only be too happy to assist readers.

The "PARRYPHASE" PUSH-PULL CIRCUIT

From the pen of C. Parry, the development engineer responsible for the already popular series of articles on acoustical compensation, comes this ingenious suggestion for paraphase push-pull.

AMONG the several methods developed to provide antiphase voltages for the grids of a push-pull output stage is that which is known as "paraphase." There is much to be said both for and against this method, but it is not the purpose of this article to discuss relative merits of any particular systems.

Basic Principle

Although the idea is by no means new, it is as well to discuss briefly the salient points in the light of subsequent discussion.

In Fig. 1 it will be seen that the driving voltage for V_1 is split by RR_1. The portion V9 tapped off is applied to a separate amplifying device V_2, and then applied to grid of V_3. Since a phase reversal takes place within V_2, it is obvious that push-pull action may take place if now the attenuation of the tapping for V_2—

$$\left\{ \frac{R_1}{R + R_1} \right\}$$

is made equal to the dynamic amplification of V_2—

$$\left\{ \frac{M\ RL}{RL + Rp} \right\}$$

then the voltage E_1 will equal E and true push-pull will result.

One of the disadvantages of this system is, of course, the phase shift, which occurs at low and high frequencies, and the accompanying unbalance. By using a further grid coupling network for V_1, as shown by the phantom circuit, which has a time constant equal to R_3C, the low end may be maintained, but this introduces further complications in the plate load of V4.

Some Points

The high-frequency shift may be more serious and cannot be easily eliminated. Again, in production, the resistors R and R_1 must be maintained within close limits to prevent unbalance occurring due to a change in their ratio.

It will also be realised that hum voltages in the plate circuits of V4 and V_2 will not balance, and so hum may result.

Notwithstanding these facts, if care is taken, the simple circuit shown will provide very satisfactory operation.

It will be realised that a high gain valve may be used for V4, and its characteristics will in no way upset balance conditions. Thus it is quite feasible to use any tone compensation device across the points A B.

The simplicity of the circuit has led many designers to incorporate V_2V4 in a single valve, such as the 6A6 or 6F7. This can, of course, be done quite easily, but it is important to realise that, as common currents flow in the common cathode circuit, this must be effectively by-passed, and this automatically excludes the use of feedback to the cathode circuit.

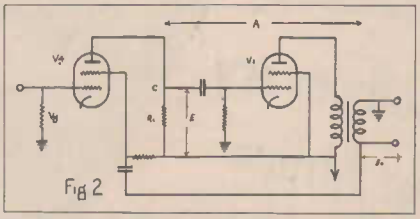


Fig. 2, which explains how the inverse feedback is applied.

So much for the paraphase principle.

Screen Feedback

As there will be many who would not care to build an amplifier using pentodes in the output without also applying some method of feedback, we will consider this in further detail.

Take the basic circuit of Fig. 2. It is impossible to feedback to the cathode, and undesirable to go to the control grid of V4. Nevertheless, overall feedback has desirable advantages.

The idea of screen injection has been discussed before, and a very effective circuit using this principle appeared in Radiotronics No. 89, 1938.

Nevertheless, feeding the inverse voltage from the primary of the output transformer seems to suffer from certain practical disadvantages. The two halves of the primary and the secondary should be tightly coupled, while unbalance seems to be further increased. Precautions are often necessary to prevent oscillation, and the home set-builder frequently finds himself in trouble.

New System

The obvious point from which any feedback voltages should be taken is the voice coil winding, since in this case it will automatically take care of transformer discrepancies. Also it is clear that the voltages fed back from this point are dependent on conditions of unbalance, but do not tend to affect unbalance in any way.

Let us therefore consider the voice coil voltages fed back to the screen of V4 by condenser C (the normal screen by-pass condenser — Fig. 2).

If Rt is the triode plate resistance formed by the screen and plate of V4, and Ut the amplification of this triode, then there is developed across RL an antiphase voltage given by —

$$Ep_1 = \frac{Eo\ Ut\ RL}{RL + Rt}$$

Now, a voltage Vg on the grid of V4 will produce a voltage across RL given by —

$$Ep = \frac{Vg\ Up\ RL}{Rp + RL}$$

where Up and Rp refer to the pentode characteristics of V4 with the screen as in Fig. 2. Now, Ep_1 will either add or subtract from Ep, depending on whether Eo is positive or negative. If the polarity of the voice coil is correctly chosen, then Eo is negative and the actual plate voltage is given by —

$$E = Ep - Ep_1 = \frac{Vg\ Up\ RL}{Rp + RL} - \frac{Eo\ Ut\ RL}{RL + Rt} \quad .. (1)$$

If A is the overall amplification from the point C to the voice coil, then obviously Eo = AE.

We can thus substitute in (1) and

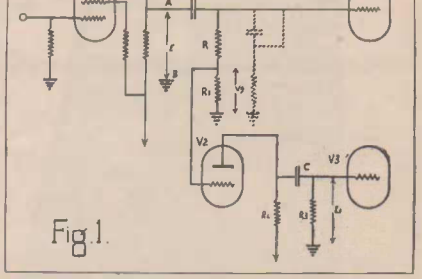


Fig. 1, showing how the out-of-phase signals are derived.

find the ratio of the gains with and without feedback; that is —

$$E = \left\{ \frac{Vg\ Up\ RL}{Rp + RL} \right\} \left\{ \frac{1}{1 + \frac{AUtRL}{RL + Rt}} \right\}$$

with feedback.

Without feedback, the voltage across RL is, of course, unaffected

(Continued on page 11)


AMERICAN AIR LINES
UNITED AIR LINES
TRANSCONTINENTAL & WESTERN AIR
EASTERN AIR LINES
BRANIFF AIRWAYS
Practically every Major Airline
Uses Eimac TUBES
Dependability, stamina and outstanding performance capabilities are perhaps more important to airline communications than to any other service. That's why Airline radio engineers are the ranking leaders—why equipment they select is the very finest.
It is no mere coincidence that Eimac Tubes were selected by most every major airline in the U. S. A. In actual performance, Eimac has established itself as the leader in this field—the tried and proven tube for aircraft ground stations. This fact should have an important bearing upon your choice of vacuum tubes. See nearest representative, or write.
Eitel-McCullough, Inc. • San Bruno, California
G. A. O'Reilly... TWA engineer...says, "We have many Eimac 450T's with nearly 10,000 hours of satisfactory service.
FOLLOW THE LEADER
in the field of radio communications
There's an Eimac tube to fit your needs from 35 watts to 2000 watts plate dissipation . . . Get full information now
Foreign Division
FRAZAR & CO., LTD..
301 CLAY STREET • SAN FRANCISCO, CALIFORNIA, U. S. A.
Cable "FRAZAR"

PARRYPHASE

(Continued from page 9)

by Eo and equals the first bracketed term of the above equation.

Then the ratio of gain without feedback to gain with feedback is —

$$\frac{E_1}{E} = \frac{1}{\dfrac{1}{1 + AUtRL}}$$

$$= \frac{RL + Rt}{\dfrac{RL + Rt + AUtRt}{RL + Rt}}$$

$$= \frac{RL + Rt\ (1 + AUt)}{RL + Rt} \quad \ldots\ldots (3)$$

This factor therefore represents the amount by which the gain is reduced when this particular feedback is applied.

It may be shown that a gain reduction of about 2.5, for 6V6G valves, will give performance approximately equal to triode operation.

Substituting known values in the above equation gives us a figure somewhat in excess of this, so that we may consider the system quite satisfactory.

Effects of Feedback

It is a point to note that the feedback is not adjustable and in fact no attempt has been made to achieve this. In the light of the circuit considered this has been regarded as relatively unimportant. The constants of the final amplifier have been so chosen as to give a slight high-frequency droop. This, together with the adequate control of resonances by the feedback, provides a highly-satisfactory tonal response.

Referring again to the equation developed, some interesting conclusions may be drawn (these remarks apply in general to all feedback systems). It will be realised that the gain reduction is almost proportional to A. Thus any change in the amplification of V_1, due to load changes and so on, are almost perfectly taken up within V4.

Loss Within Feedback Path

Assuming that the feedback remains negative, it is very important to realise that, while the amplification of the system drops by the above factor, this also represents the maximum "lift" which it can bring about at any frequency for which A is less than at the calculated frequency.

More explicitly, if, by some means or other, we introduce a loss between C and the voice coil which is greater than this factor, the output which otherwise would be fairly constant at all frequencies must drop.

Thus it is quite feasible to put small condensers within the feedback path to cut down high-frequency response provided the feedback remains negative. This is simple in this circuit, because the feedback path is quite linear and does not introduce undesirable phase shifts itself. Further, the shift which occurs in the transformer at high frequencies is taken by, or over-ridden by the shift produced by any such condensers. In general, however, it is not really necessary to do this. Where proper variable acoustic compensation is required, the designer is advised in this instance to provide this before V4 and not attempt it after.

The decrease is gain of V4 is quite permissible as it is quite high, and an extra stage would be all that would be required for microphone work.

It remains now merely to put both principles discussed together and the resultant circuit is in Fig. 3.

Applying the 6J8

In searching for a suitable valve to use for V4 and V_2 (Fig. 1), attention turned to the very popular 6J8. It was felt that the oscillator section would be suitable for paraphase operation, the pentode section for amplification and inverse feedback. Some doubts existed in regard to coupling between the two sections, as it was thought at first that this might exist sufficiently to upset the paraphase action. However, in practice the valve worked quite efficiently. The early assumption, too, that separate bias would be necessary for both pentode and triode sections was justified in initial experiments. However, by correctly proportioning the resistors in each of the elements, a compromise was found which allowed both sections to operate at an optimum point, so a single cathode resistor and bypass sufficed. Under the operating conditions shown sufficient drive for the 6V6 grids is easily developed without overloading any part of the 6J8, so the output stage may be properly driven without fear of distortion.

Paraphased Feedback

The advantage of the feedback chosen is further apparent, as any discrepancies occurring within the 6J8 are within the feedback path and so are diminished. The term "paraphased feedback" will also now be self-explanatory, since the feedback voltage is in effect applied in the correct phase relation to both 6V6G grids. As with other feedback systems working from the voice coil, the correct polarity of this must be observed or oscillation will result. In view of the feedback applied, the time constant of C_2R_9 (Fig. 3) is quite adequate even on low frequencies, and the response in this region is exceptionally good.

In Practice

In practice the optimum ratio of R R₁ (Fig. 1) is determined roughly by calculation and finely by adjustment. Thus in our particular case the values chosen were proved experimentally to give proper balance at mid-frequencies.

(Continued on page 12)

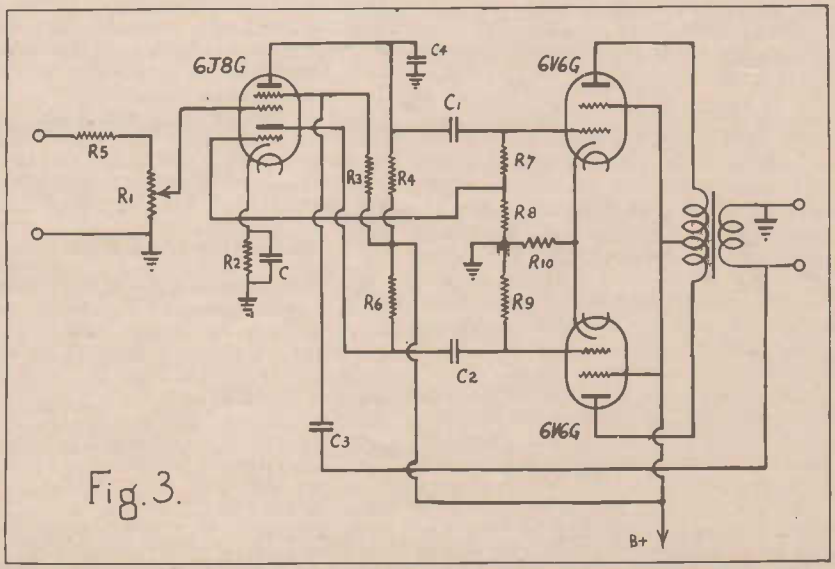


Fig. 3.

Circuit diagram of the amplifier. Suggested component values would be:—R1, .5 megohms; R2, 1,500 ohms; R3, 1 megohm; R4, .5 megohm; R5, see text; R6, .25 megohm; R7, .5 megohm; R8, 65,000 ohms; R9, .5 megohms; R10, 160 ohms; C, 25 mfds.; C1, .02 mfds.; C2, .05 mfds.; C3, .5 mfd.; C4, optional, over .0005 mfds.; T, output transformer, centre-tapped with 10,000 ohms plate-to-plate load.

SYSTEMATIC SERVICING

CONCLUDED FROM THE MAY ISSUE

Test No. 6 includes a complete line-up of the receiver. An all-wave signal generator is necessary for this test, preferably one with its output calibrated in microvolts so that the actual sensitivity of a receiver may be measured and passed as normal for a receiver of the type. Alignment should be perfect, and if the dial is frequency calibrated, the stations should come in on the correct readings.

When sensitivity and calibration are finished, the receiver should be passed to Test No. 7.

Test No. 7 is for the purpose of checking. The receiver should be checked for tonal quality, sensitivity, selectivity, dial calibration, speaker rattles, and for a slipping dial, as well as for other loose parts about the chassis. When passed as O.K. it should be replaced in the cabinet, checked again for dial position and loose knobs, and the cabinet polished.

Test No. 8 is merely running the receiver for a period of time — preferably as long as possible, on a line voltage slightly higher than that to which it is accustomed. Country areas, particularly, have high line voltages, and this test is really more of a check on all the parts, to make sure that none will break down. The writer uses a transformer having a 230v. primary and tapped secondary up to 270v.

The various tests are summarised in concise form below:—

(1) Service call. Check valves, aerial, arrester, power line and flex, knobs and dial.
(2) Remove from cabinet and clean out dust. Check valves carefully; inspect power transformer and rectifier.
(3) Check all condensers and resistors with condenser analyser and ohmmeter. Check condensers for capacity and leakage. Check volume and tone controls.
(4) Check all voltages and currents with multi-range meter.
(5) Loudspeaker test; check for rattles, and test field and matching transformer. Inspect voice coil leads for breaks.
(6) Complete line up and sensitivity check with signal generator.
(7) Check tone quality, sensitivity, selectivity, dial calibration, speaker for rattles, dial and knobs. Replace in cabinet and polish.
(8) Check on slightly higher line voltage.

The receiver is now checked in almost every possible way. The chassis has been cleaned, the cabinet polished, all defective parts replaced, and the set re-aligned perfectly. In fact, the radio should be as good as the day it came out of the factory.

It is as well to clean and polish the cabinet of every set. Remember that the owner cannot see what has been done inside, and that outside appearance always counts for a great deal.

Common Service Troubles

It is now proposed to consider some of the more common troubles encountered in radio service, and to discuss briefly the likely causes of such troubles. The conditions for discussion are listed below.

(1) No signal.
(2) No signal on shortwave bands.
(3) Intermittent signals — signals cut out.
(4) Weak signals.
(5) Fading.
(6) Distortion.
(7) Hum.
(8) Noise.
(9) Oscillation or instability.

(1) **No signal.** This is doubtless the easiest fault to rectify, since it is definite. Valves may light up, but cease to function; they should be tested for emission as well as for element shorts. If there is no H.T. voltage, look for a shorted filter condenser, shorted plate or H.T. by-pass, open choke or speaker field, open in "B" circuit or an open coupling condenser.

The speaker transformer may be open and in the case of a pentode power valve, this fault can be recognised by the elements of the valve becoming very hot and glowing brightly. The connection to the speaker voice coil may have broken, or the voice coil itself may be open.

(2) **No signal on shortwave bands.** This fault is generally caused by a faulty contact in the wave-change switch. Clean the contacts with carbon tetrachloride, but do not apply any grease. The oscillator may be faulty and fail to oscillate at the higher frequencies. The set may be out of alignment on the short waves.

(3) **Intermittent signals.** This fault may be caused by a valve. Run the receiver until the valves get hot, tune in a programme, then tap all the valves with a pencil. A valve may be gassy and operate for a few minutes, then cut out. A slightly gassy valve may test all right in a valve checker, yet cause cut-out and fading if used in oscillator or a.v.c. circuits.

There may be an intermittent break in the speaker field or speaker transformer. The speaker voice coil leads may be partially broken. There may be a resin joint in the wiring. Dirt or metal flakes may be present in the plates of the gang condenser. Volume control or wave-change switch may be faulty. Coupling condenser may be opening intermittently.

(4) **Weak signals.** Valves may be old or faulty in other respects. Secondary of R.F. or I.F. transformers may be open. Voltages may be low, due to leaky filter or by-pass condenser. Coupling condenser may be partially open. May be a short in the speaker field. Receiver may be out of alignment. Aerial primary may be open. Volume control may be open. Bios resistor may be open or up in value. Coils may be damp; bake them out and impregnate.

(5) **Fading.** Fading is generally a hard fault to find unless it is caused by valves, which should be tested thoroughly. Leaky a.v.c. by-pass con-

PARRYPHASE

(Continued from page 11)

The balance is thus maintained within the required limits of 3%.

The use of feedback has the important advantage of overcoming those earlier defects mentioned, since unbalance is more or less "swamped," and the ratio of R R_1 is not so critical.

The feedback path also has the economical advantage of requiring no extra parts.

Final Points to Note

A good clean 6-8 watts can be obtained with very low harmonic content, and the frequency response without any alterations provides really delightful listening. For those who care to load up Piezo electric pick-ups, there is quite adequate gain to put series resistors up to several megs. in position R5 and so obtain full advantage of the response of this type of reproducer.

In some cases a slight additional filtering may be necessary for the 6J8 as shown by the dotted lines, but where the usual well-filtered supply is used this will hardly be necessary.

In conclusion we feel that the cheapness and simplicity of this circuit with the very effective and rather novel feedback make it well worth the building, while the tonal response and transient reproduction are really remarkable.

densers are common causes. Coupling condenser may be defective. Volume control may be defective. Wiping contacts on the shaft of the gang condenser may be dirty. Clean off all grease with carbon tetrachloride. R.F. or I.F. bias resistor might be altering in value.

(6) Distortion. Distortion is a common complaint with modern radios. In most cases it is due to a leaky coupling condenser between the detector plate and audio grid. An open filter condenser destroys the return path for A.F. currents, and causes distortion as well as hum. If an a.v.c. by-pass condenser is shorted, strong signals will overload the R.F. or I.F. stages and distortion will result.

Iron filings or dirt in the voice coil of the speaker, as well as loose turns on the voice coil, will cause distortion. Other common causes are open grid resistor, incorrect plate and screen voltages, faulty valves, insufficient R.F. filtering of detector output, and a faulty volume control.

The writer has had cases of receivers developing distortion after about an hour's use. In nearly every case this was traced to the grid of the pentode output valve swinging positive, this condition coming about when the receivers were working on high line voltage. In some cases leaky coupling condensers caused the trouble, while in others the valves were at fault.

It is a common occurrence to find receivers faulty in the home, yet perfectly satisfactory at the workshop. That is why, in describing the systematic tracing of faults, receivers are subjected to a high line test.

(7) Hum. Hum may be caused by weak or gassy valves, or valves with a heater-to-cathode short. An open filter condenser will cause hum, as well as an open volume control, grid resistor, or an open bypass condenser, particularly in back bias circuits. A short in a speaker field or filter choke, a faulty rectifier, or faulty power transformer, are common causes.

Hum may also be caused by inductive coupling, improperly grounded filament circuits, a faulty filament centre-tap resistor or lack of a good earth. The connections to the hum bucking coil in the speaker may be reversed.

(8) Noise. Noise is rather a difficult matter to deal with, since it may be from one of three sources. It may be due to a fault in the receiver, to interference being received by the aerial, or to interference being introduced via the power line. Noise entering the receiver via the aerial or power line can be filtered out to a large extent. It will be assumed that the noise is in the receiver itself.

The wipers on the gang condenser shaft may be dirty, valves may be faulty or have loose elements, or the volume control may be dirty or defective. Audio transformer primary may be faulty, R.F. choke or R.F. or I.F. primary windings faulty. Leaky condensers and noisy resistors are also common causes. Valve cans or coil cans may be loose. Poorly soldered connections, defective electrolytic condensers, and poor contacts on wavechange switches may cause noise. R.F. chokes used in the plate circuits of mercury vapour rectifiers may be faulty.

(9) Oscillation or instability. The commonest causes of oscillation and instability are faulty or gassy valves, open screen or cathode bypass condenser, open H.T. bypass condenser, open oscillator grid leak, valve and coil shields not earthing, and dirty wipers on the gang condenser. The gang condenser itself must be securely earthed.

The whole purpose of this article has been to stress the need for organisation and efficiency in radio service work. There is no reason why repairs should not be conducted on as systematic a basis as the actual construction of the radio set. Good organisation and a definite system mean lower operating costs and better workmanship. Every radio service job should be so thorough and done with such care that the owner has no possible cause for complaint.

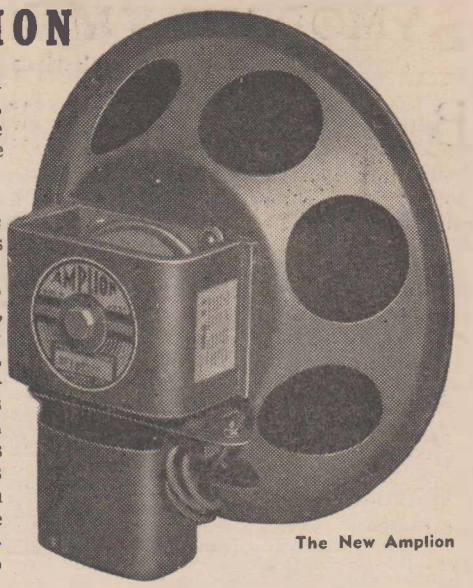
Every radio should be returned in as perfect condition as when it left the factory, and good for a further twelve months' trouble-free reception. This builds customer satisfaction and business; an increased business means more profit.

NEW 8" AMPLION

A new range of Amplion 8-inch speakers has been announced, superseding those which have given so much excellent service during the past years.

The new range shows considerable improvement in performance and efficiency over the previous models.

Features of the new speakers include complete dust-proofing, large corrugated voice coil suspension, welded construction, housing and magnetic circuit assemblies which have dimensions previously only associated with larger loud-speakers. The cone is moulded and impregnated, and has been designed in conjunction with the voice coil and spider to give maximum efficiency at all frequencies within the working audio range.



The New Amplion

The plotted curve shows that the response does not vary more than plus or minus 3 db. between 55 and 5,000 cycles, with the reference level at 1,000 cycles. The bass resonant peak is at approximately 75 cycles, and is not more than plus 3 db. and the curve thereafter falls off gradually, so that even lower frequencies are well reproduced. In the upper register a particularly clean response is achieved, and at 6,000 cycles the curve is down only 7 db., whilst it continues usefully beyond 7,500 cycles.

Permags.

The new 8-inch electrically-welded permag. range covers a very useful series of speakers. The 8P14 is a new permag. with 14 oz. magnet. The 8P20 is an intermediate size with 20 oz. alnico magnet. An entirely new type, the 8P30, is a de luxe high-fidelity 8-inch speaker at a moderate price, being listed at £3/15/-; it has an exceptionally good frequency response over wide range. The voice coil diameter of this speaker follows standard Amplion high-fidelity practice and is 1¾-inch. The coil impedance is 12½ ohms, which is one of the reasons for the greatly-enhanced frequency response.

The 8-inch permag. range is completed, of course, by the well-known Amplion cine-type permag., the 8P83, which has an Alnico magnet of exceptional quality, now producing 12,000 gauss in the air gap.

Every current type of Amplion loud-speaker is electrically-welded, ensuring permanent alignment of the annulus and freedom from service troubles.

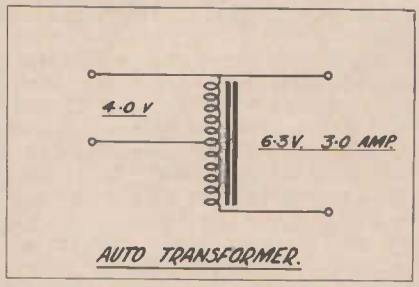
MODERN VALVES FOR OLD

Australian-made Substitutes for Every Socket

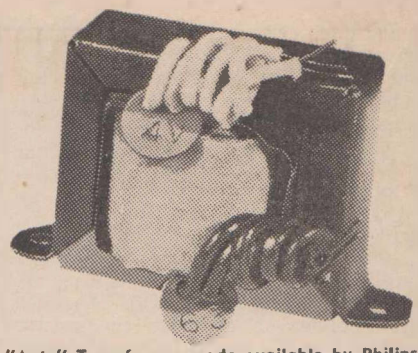
BECAUSE of the difficulty of obtaining certain types of imported valves, heartening news from Philips, to the effect that many modern Australian-made valves are suitable for use as substitutes, comes at a most opportune time.

Below we list some of the Philips valves that may be employed in this way. Details are given in each case of the minor circuit rearrangements necessary. The recommendations, however, are intended purely as a general guide to technicians who, realising the "idiosyncrasies" of each receiver, will examine circuits closely before proceeding with the suggested substitutions.

ABC1P—EBF2P—4v. to 6v. transformer. Screen and plate tied together (pins 7 and 8).
AF2—EBF2G—4v. to 6v. transformer. Octal socket. Change plate lead on top to grid lead. Diodes not used.
E447—EBF2G—4v. to 6v. transformer. Octal socket. Change plate lead on top to grid lead. Diodes not used.
E445—EBF2G—4v. to 6v. transformer. Octal socket. Change plate lead on top to grid lead. Diodes not used.
E455—EBF2G—4v. to 6v. transformer. Octal socket. Change plate lead on top to grid lead. Diodes not used.
AF3—EBF2P—4v. to 6v. transformer. No connection to Pin No. 6. Diodes not used.
EF5—EBF2P—No connection to Pin No. 6. Diodes not used.
EF6—EBF2P—No connection to Pin No. 6. Diodes not used. If for technical reasons a "sharp cut-off" tube is essential, then type 6J7G could be used; an octal socket is then required.
EF8—EBF2P—No connection to Pin No. 6.
EF9—Diodes not used. This substitution may not always be satisfactory, and reference should be made, where possible, to the circuit of the apparatus, particularly to the uses the suppressor grid may be put to (A.V.C., etc.). This applies to both EF8 and EF9.
E446—EBF2G—4v. to 6v. transformer.
E452T—Diodes not used. Change plate lead on top to grid lead. If for technical reasons a "sharp cut-off" tube is essential, then type 6J7G could be used. Octal socket required in both cases. This change should not be attempted if the E442, E446 or E452T is used as an "autodyne first detector" of a superhet. It would then be preferable to change the oscillator coil and substitute an EK2P or 6A8G.
E442—
CF2P—EBF2P—No connection to Pin No. 6. Diodes not used. See that total filament voltage drop is still within the "voltage regulation limits" of the barretter lamp (80-200 volts for type C1).
E444N—EBF2G—4v. to 6v. transformer; octal socket. Tie diode plates together. Change plate lead on top to grid lead.
EBC3P—EBF2P—Tie screen to plate (Pins 7 and 8)
E454—EBF2G—4v. to 6v. transformer. Octal socket. Tie screen to plate (Pins 3 and 4). (R.M.A. numbering of socket pins.)



Schematic diagram of the Philips "Auto" Transformer. As difficulty may be experienced in identifying the common and the tap of the transformer (for earthing purposes), it is recommended that both the existing 4-volt filament leads going to the filament pins of the socket be removed and joined to the leads of the "Auto" transformer marked "4-volt." This should be done even though one of the filament wires at the socket is only connected to "earth." The leads of the "Auto" Transformer marked "6.3-volt" are then connected to the filament pins of the valve socket without further earthing.



"Auto" Transformer made available by Philips for use in connection with the substitution of valves as recommended in the accompanying article. This reproduction is slightly smaller than actual size.

AK1—EK2P—4v. to 6v. transformer
AK2P (change socket in the case of AK1). Cathode resistor 500 ohms. Adjust oscillator plate voltage (anode grid 2) to 200 volts and the screen grid voltage (grids 3 plus 5) to 50 volts. (Oscillator grid resistor, 50,000, should be connected between grid No. 1 and cathode.)
EK1P—EK2P—Cathode resistor 500 ohms.
CK1P Adjust oscillator plate voltage (anode grid 2) to 200 volts and the screen grid voltage (grids 3 plus 5) to 50 volts. (Oscillator grid resistor, 50,000, should be connected between grid No. 1 and cathode.) In the case of CK1 see that the total filament voltage is still within the limits of the barretter. (80-200 volts for type C1).
AL2—6F6G—4v. to 6v. transformer. Octal socket. (Grid lead connected at socket instead of top cap of valve.) Bias resistor 400 ohms (-16.5v.).
E463—6F6G—4v. to 6v. transformer. Octal socket. 400 ohms bias resistor (-16.5v.).
AL3—EL3P—4v. to 6v. transformer.
E443HN—47—0.86 ohm resistor in series with filaments (to carry 1.75 amps). Bias resistor 450 ohms (-16.5v.).
EL2—6F6G—Octal socket (grid lead connected at socket instead of top cap of valve). Bias resistor 400 ohms (-16.5v.). If low filament current is of importance, then 6K6G may be used. These types (6F6G and 6K6G) only O.K. if filament

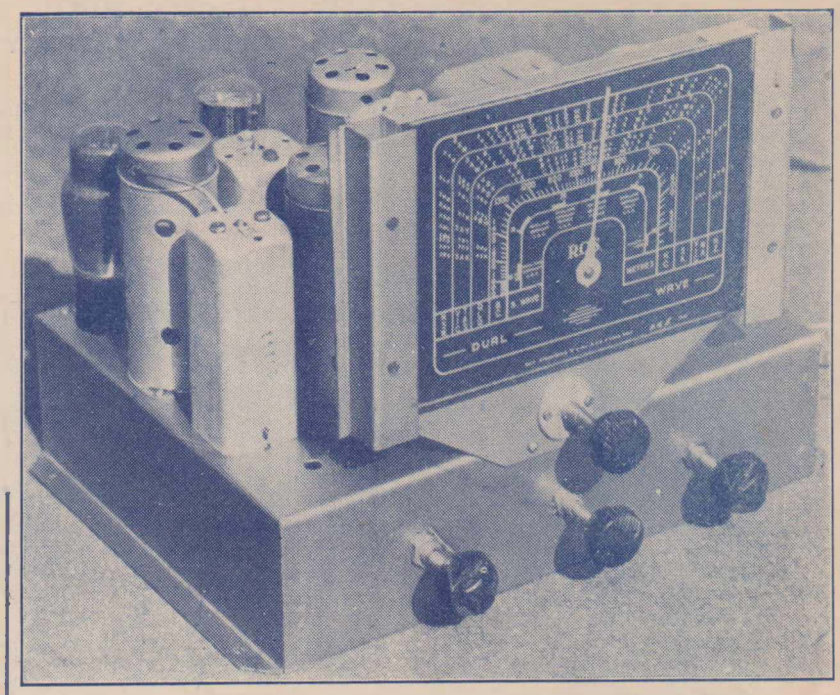
(Continued on page 39)

DE-LUXE SUPER-SEVEN

SUPERLATIVE PERFORMANCE AT REASONABLE COST

FEATURING

- ★ **Compensated Acoustics**
- ★ **Direct-Coupled Phase-Changer**
- ★ **Push-Pull Beam Power Output**
- ★ **Controlled Inverse Feedback**
- ★ **Dual-Wave Tuning**



A front view of the chassis.

DURING the past couple of years there have been three popular types of receivers. From what we can gather, the sets most popular with our readers have been either the small one or two valvers, the five-valve dual-wavers or the big de-luxe type of high-fidelity receivers.

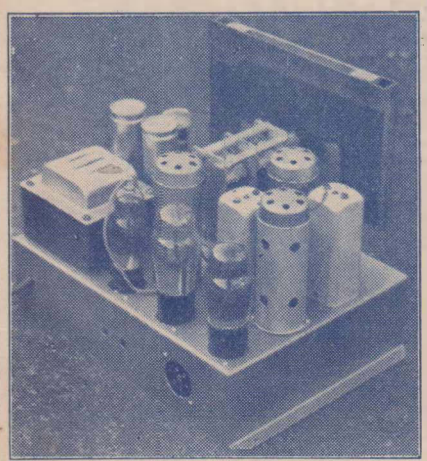
It seems to us now, however, that there is a definite gap between these two latter types. We hasten to fill the gap with a circuit design for a set which gives exceptional value, only a shade dearer to build than the ordinary five-valve dual-waver, and which gives the same power and tone as the big high-fidelity jobs.

In a nutshell, the idea is to use the tuning end of the simpler set with the audio end of the de-luxe job.

It is an undisputed fact that a superheterodyne with an r.f. stage ahead of the frequency changer is going to give longer range for a given noise level than a similar set without the r.f. stage. As a result it has been normal practice to always include an r.f. stage in any de-luxe type of set. Improvement in the efficiency of modern coils, however, made the r.f. stage hardly necessary. Even without the r.f. stage, it is possible to get extreme sensitivity without undue noise level. We were not at all surprised to hear recently that one of our leading manufacturers is listing a full range of about 25 types of receivers for the 1941-1942 season, but not one of them is listed to carry an r.f. stage.

There is quite a considerable difference in the cost of a kit of parts for receivers with and without the r.f. stage. The main difference is in the cost of the coil kit, the average dual-wave coil bracket for the simpler sets listing around 30/-, as against more than double this amount for a coil kit with the r.f. stage. Other additional expense, apart from the actual cost of the valve itself, includes the difference in price between a two-gang and a three-gang tuning condenser unit, the valve socket, shield and other sundries.

SINCE the splendid reception owarded to our "Acoustic Compensoted" superhet in the Morch issue there has been a steady demand for a more elaborate version to embody Parry's remarkable design for a push-pull amplifier. Here is the answer and it is a splendid proposition. Performance is truly "de-luxe," yet a kit of parts can be obtained at a most reasonable figure.



Another view, showing the compact layout.

Ample Sensitivity

We cannot logically lay any claim to the actual sensitivity of this set being equal to that of a similar set fitted with an extra valve as an r.f. stage. We would, however, state quite definitely that the sensitivity is ample for all normal requirements and quite up to the standard achieved by r.f. stage sets of a couple of years ago.

By doing without the r.f. stage we find that it is possible to produce a receiver which has stunning performance, yet the kit of parts costs only a few shillings more than for an

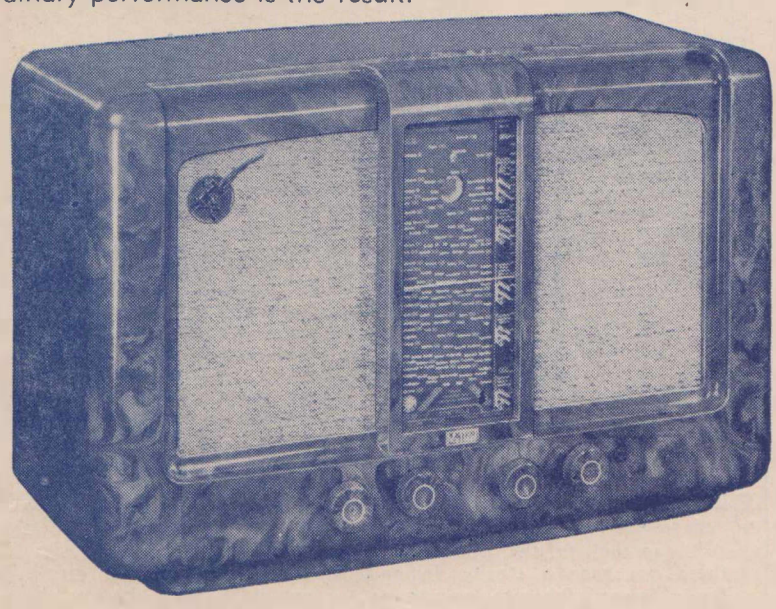
(Continued on page 17)

"ONE IN A MILLION"

Says A. G. HULL

• • • • • **NOTED RADIO AUTHORITY**

"The Mullard Model 67 is a battery set in a million. It gives extreme sensitivity and selectivity, yet is not at all extravagant, either in initial cost or upkeep. . . . Keen attention has been paid to every minor detail having any bearing on efficiency, and extraordinary performance is the result."



★

5v. DUAL WAVE DE LUXE TABLE MODEL

TYPE 67

(for Battery and Vibrator Operation)

★

SPECIFICATIONS AND TECHNICAL DATA

Power Operation: MODEL 67, one 2-volt "A" and three 45-volt "B" Batteries (or if adapted for vibrator operation by the addition of Mullard Special Vibrator Converter Unit — one 6-volt "A" battery).

Wave-bands: 540/1600 K.C.'s (Australasian broadcast) and 16/50 Metres (Short-wave).

Reproduction: Full-size 8" **ROLA** Permanent Magnet Speaker.

Dial: Large-size vertical type, with horizontal pointer, introducing a new vogue in station markings. This novel Mullard Dial Scale gives you the actual place names from which the Australasian broadcasts emanate, together with extra large call-signs for all the principal stations. Escalator Short-wave Scale with alphabetical subdivisions for tuning ease.

Cabinet: Robust figured-walnut bakelite one-piece mould . . . the largest one-piece mould ever produced in Australia. . . . Dimensions: 20¾" x 13¼" x 8."

Controls: 1 — Volume Control. 2 — Tone Control. 3 — Tuning Control. 4 — Wave-change switch. (Controls 1 and 2 combine main switch and dial light switch, respectively.)

Valves: Special dual and triple-purpose **MULLARD Master Valves.**

Warranty: Covered by the comprehensive **MULLARD** guarantee for a period of twelve months.

£32/10/-

Complete with batteries

(Vibrator powered £5/5/6 extra)

Mullard

"RADIO FOR THE EMPIRE'S MILLIONS"

MULLARD-AUSTRALIA PTY. LTD., 367-371 KENT STREET, SYDNEY.

Tele.: MJ 4688

SUPER-SEVEN

(Continued from page 15)

ordinary set. To the dealer who wants to turn out a set to sell at a reasonable price, yet give performance which will completely overwhelm the ordinary receiver, we can recommend this circuit as a splendid proposition.

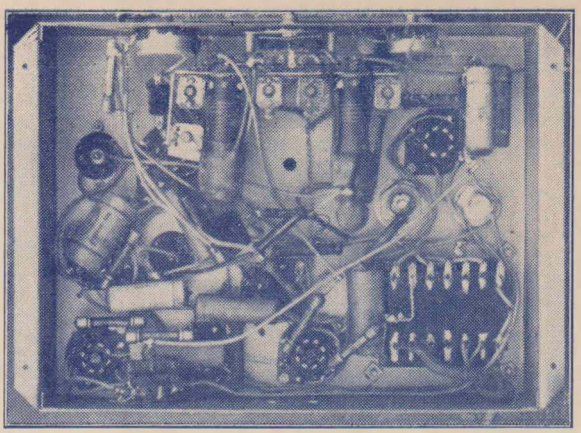
Circuit Design

The design is straightforward in every way and is simple to build and to put into perfect alignment. Hum is kept at a low level, even without the use of any filter choke apart from the filtering action of the field coil. Power output is around eight to ten watts, which is quite as much as any commercial speaker is going to handle comfortably. Frequency response is adjustable over a wide range by means of the acoustic compensation feature which is embodied. Further details of this method of controlling the audio response was contained in the February, March and May issues.

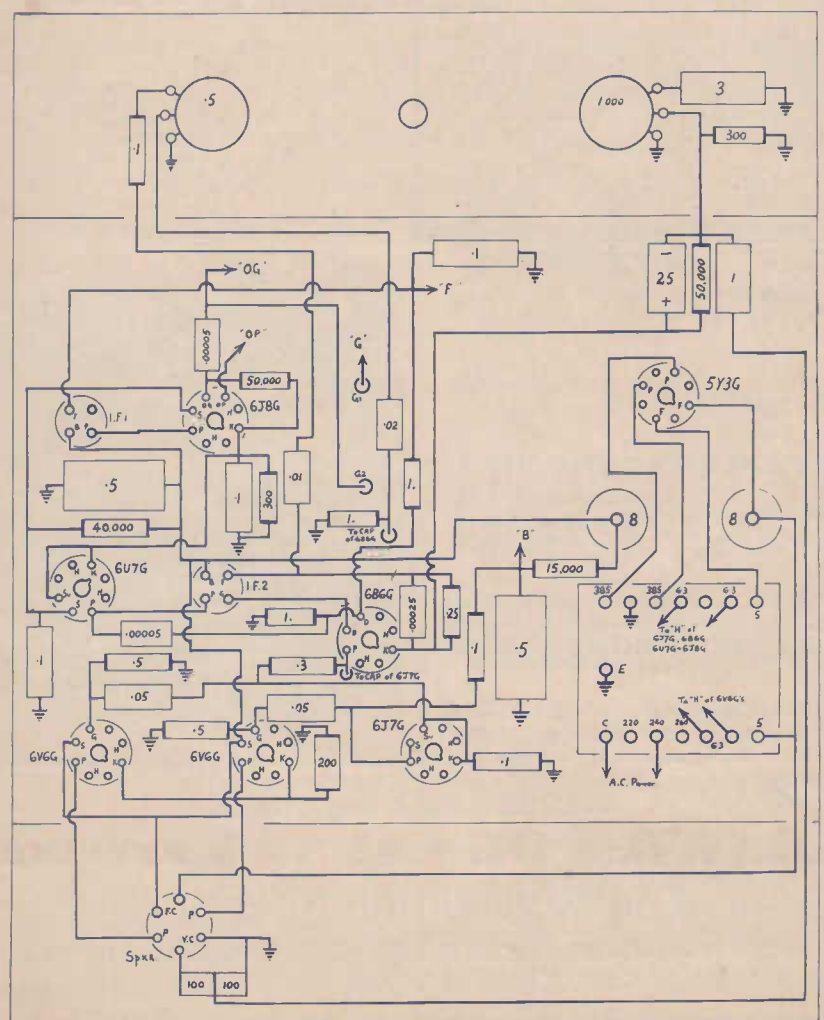
★

AT RIGHT: A photograph of the wiring, which can be followed in conjunction with the picture diagram (below) to make the construction easy.

★



By the turning of the control knob of a 1,000-ohm potentiometer, the lows or highs can be accentuated, either separately or together, thereby compensating for the characteristics of the speaker, resonance of the cabinet or the acoustic properties of the room. It has also a practical advantage in allowing the tone to be adjusted to suit individual taste. Some people, especially of the fair sex, have ears which do not appreciate high-note response; others feel that they cannot have brilliance without highs. Either taste can be immediately satisfied with the acoustic compensation featured in the circuit. It is obtained by a fairly simple method of controlled inverse feedback. This feedback operates from the voice coil of the speaker and feeds right back to the cathode circuit of the first audio valve, cutting down the harmonic distortion to a level which should be quite indistinguishable, even to a trained ear.



Direct-Coupled Audio

To the student of technical design there is an interesting feature in the way in which the first audio stage employs direct-coupling. This scheme was originally suggested in our issue for November of last year, and has since been used quite widely, always with excellent results. It is a safeguard against overloading of the driver valve, and the signal transfer is efficient without appreciable frequency discrimination or the introduction of distortion due to phase displacement.

The audio end of the set makes an ideal amplifier for the reproduction of gramophone recordings, and the chassis can well be used in a suitable cabinet to provide a complete radio-gramophone outfit.

The Parts List

Most of the parts are ordinary stock lines, readily available at any dealers, but there are one or two points worth mentioning. For the acoustic compensation control there is a 1,000-ohm potentiometer. Any ordinary potentiometer of this value can be used, but may be found to be a little critical in adjustment. A special potentiometer, designed for the purpose and

(Continued on page 18)

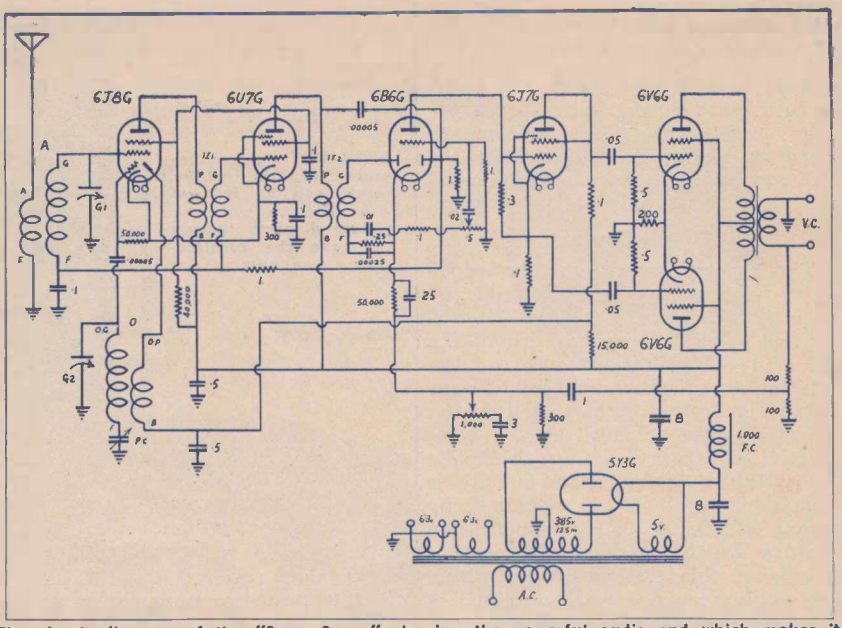
SUPER-SEVEN

(Continued from page 17)

fitted with a tapered resistance element is available in the Britannic line of components and is recommended. Across this potentiometer is a condenser of a capacity of 3 microfarads, with a voltage rating of 200 volts or lower. This condenser is another line which is not truly stock, but a special Britannic condenser has been made available for the purpose. If this condenser is not readily available, a satisfactory substitute can be found in the form of a 5 mfd. 40-volt electrolytic condenser. The only point needing to be watched in the event of the substitution is in the matter of the polarity, the negative side being earthed.

Whilst on the subject of the feedback circuit and its associated components, we might draw attention to the 1 mfd. coupling condenser between the voice coil circuit and the potentiometer. With this value at 1 mfd. there may be a chance of motor-boating when the control is set to the maximum bass position, in which case the condenser should be replaced with a lower capacity.

An ordinary tubular condenser with a capacity of .1 or .5 mfd. will usually give sufficient bass boosting,



The circuit diagram of the "Super-Seven" showing the powerful audio end which makes it ideally suited for use as a radio-gramophone.

the former value being used in the original set. We must admit, however, that our taste does not run to an appreciation of boominess.

The Layout

The layout of the original set is a little crowded. We used a stock chassis which had been designed for a contemporary and, to our way of thinking, there was hardly room for packing in the many minor components. We got through the job in a hurry, as usual, but we doubt if

the result would take a prize for neatness. Once our sets have been photographed and experimented with fully, they are simply cut down again, so that the components may be used in a set for next month's issue. Building sets in this way does not offer any incentive for careful work and, as a result, we tend to push the components in the quickest way, knowing that if the set then works to expectations there is every chance that duplicate sets built to the same circuit, but more carefully, will also perform well. This is borne out in practice, according to the splendid reports received from builders of other circuits, especially the recent "Acoustic Compensated" dual-waver of five valves.

DE LUXE SUPER-SEVEN

Parts List

1—Base, 12" x 9" x 3" (Arcadian).
1—Coil kit, with intermediates (Britonnic).
2—Gong condensers (Stromberg, type "H").
1—Dial to suit (R.C.S., Radiokes, Crown).
1—Power transformer, 125 m.a. (Radiokes).

CONDENSERS:
2—.00005 mfd. mica (T.C.C.).
1—.00025 mfd. mica (T.C.C.).
1—.01 mfd. tubular (T.C.C.).
1—.02 mfd. tubular (T.C.C.).
2—.05 mfd. tubular (T.C.C.).
3—.1 mfd. tubular (T.C.C.).
2—.5 mfd. tubular (T.C.C.).
1—1 mfd. paper condenser (see text).
1—3 mfd. paper condenser (see text).
1—25 mfd. electrolytic condenser, 40v. (T.C.C.).

RESISTORS:
1—1,000-ohm tapered potentiometer (Britannic).
1—500,000-ohm volume control (I.R.C.).
2—100-ohm 1-watt (I.R.C.).
1—200-ohm 1-watt (I.R.C.).
2—300-ohm 1-watt (I.R.C.).
1—15,000-ohm 1-watt (I.R.C.).
1—40,000-ohm 1-watt (I.R.C.).
2—50,000-ohm 1-watt (I.R.C.).
1—.25-megohm 1-watt (I.R.C.).
1—.3-megohm 1-watt (I.R.C.).
3—1-megohm 1-watt (I.R.C.).

VALVES:
1—6J8G, 2—6U7G, 1—6J7G, 1—6B6G, 2—6V6G 1—5Y3G (Mullard, Brimar, Philips, Radiotron).

SPEAKER:
10,000-ohm plate to plate load, 1,000-ohm field (Rola, Amplion).

SUNDRIES:
7—octal sockets; 1—6-pin socket; 4—valve cons, knobs, power flex, hook-up wire, terminol strips, solder lugs, screws, etc.

We do feel, however, that we ought to offer some excuse for the rough wiring and assembly which is revealed in the photographs of the underside of the chassis.

Shielding

After the set is put into operation it may be found that some shielding of the leads to the volume control may be desirable to eliminate a sizzly little hum or an audio squeal. In the meantime, however, we do not advise shielding. We suggest that the set be wired up according to our picture dia-

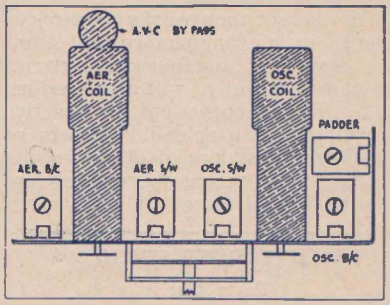
(Continued on next page)

SUPER-SEVEN

(Continued from page 19)

gram without shielding first. Too much shielding is detrimental to efficiency.

Valve shields are not likely to be essential in the audio end of the set, but they look neat and cost little, so



Layout of the trimmers on the Britannic coil bracket.

most builders prefer to fit them over all valves except the power valves and the rectifier.

Speaker Socket

For the inverse-feedback circuit it is necessary to have leads from the voice coil of the speaker. A convenient idea is to mount the input transformer on the base of the chassis, as was done in the case of the original Acoustic Compensated set. With this chassis we show the alternative way of using the conventional type of speaker, but fitting a special six-pin plug, instead of the five-pin plug which is normally fitted to a push-pull speaker.

It will be necessary, therefore, for the builder to fit this special six-pin plug, paying great care to get the connections correctly wired. As will

BRITANNIC COLOUR CODE

AERIAL COIL

A	White	G	Blue
E	Purple	F	Black

OSCILLATOR COIL

G	Yellow	P	Green
E	Purple	B	Red

INTERMEDIATES

P	Green	G	Purple
B	Red	F	Black

be seen from the picture diagram, the speaker socket is wired with the field across the filament pins, and one of these also being used as the high-tension supply for the centre-tap of the speaker transformer. The voice coil leads are brought back to the opposite pins, with the two plates connecting to the P and K pins of the socket.

If the speaker transformer is mounted on the base a four-pin speaker socket can be used, the two filament terminals being the field con-

nections and the other two the voice coil connections.

Unfortunately, in the original layout there is no convenient position for an input transformer, as it is not advisable to mount it in close proximity to the power transformer, and long leads from the plates, running across through the other wiring, would not be good practice.

Voice Coil Polarity

As will be remembered by those who have followed Parry's articles on compensated acoustics, as published in the February, March and May issues, the voice coil has polarity, and if incorrectly connected the whole audio end will be unstable In practice it is simply a matter of building up the set without the feedback lead attached to the voice coil at all. Then get the set working without feedback, and make sure that everything is normal. Then the feedback lead can be attached to one side of the voice coil and the other earthed. If the set squeals when switched on, it will indicate that the polarity is the wrong way around, and the earth and feedback connections will have to be reversed to put things right.

There are only two ways in which the connections can be made and, when they are wrong, the set lets you know about it in no uncertain manner. It might therefore be said that to get the right connections is a simple matter.

Voltages

It will be noticed that in our circuit we have used a bias resistor for the output valves which is a little higher than normal. Usually a 165-ohm resistor is fitted, but we suggest the higher value. It will give the valves just a little more bias with increased stability and will cut down the plate and screen currents a shade, so that the high tension voltages will work out nicely throughout, and there will be adequate energising for a good twelve-inch speaker, as will be the normal type fitted to a set of this kind.

Alternative Valve Types

Owing to the conditions existing in the trade at the moment there may be some difficulty in getting the valves specified, although they are the standard types being manufactured locally. Some alternatives are permissible. With a shade of luck it will be found possible to get the same results with a 6K8G converter valve instead of the 6J8G. For the intermediate stage a 6K7G can be used. For the phase-changer valve a 6C5 can be used instead of the 6J7G, a slight alteration being needed to the wiring to make the socket connections correct.

For the rectifier the good old type 80 can be used by substituting a four-pin valve socket.

Alignment and Adjustment

Some hints on the proper alignment and adjustment of the set can be obtained from the article on dual-wave coil brackets which is to be found elsewhere in this issue.

IMPROVED DIALS FOR "CLUB SPECIAL"

From E. H. Turnor Pty. Ltd., of 119 Hawke Street, West Melbourne, we have a letter enclosing samples of celluloid dial scales for the "Club Special." These scales are offered to readers at 1/- (plus postage) for the plain black and white design on celluloid. With a slight greenish tint the price is 1/3 and for a fully-coloured dial the price is 1/9.

With a light behind them, they are a vast improvement over our original paper dials, and we strongly advise builders of this set to avail themselves of the opportunity of getting one of these improved scales.

Our thanks to Mr. Worswick, director of E. H. Turnor Pty. Ltd., for his interest in the "Club Special" and his offer of the above assistance.

SERVICE TECHNICIANS' EXAMINATION

On Saturday, August 16, a special examination will be held in Sydney by the Institution of Radio Engineers (Australia) to enable practising radio service technicians to qualify for admission to the Service Division of the Institution as graduate members. The examination will comprise both radio theory and practice.

Similar examinations have been held by the I.R.E. in Brisbane and Melbourne with beneficial results to the public and to the radio profession, as it ensures that technicians so qualified are able to render good service to the many thousands of radio owners.

Application forms and particulars are available from the General Secretary's office of the Institution, Science House, 157 Gloucester Street, Sydney.

NIC

WAVES"

ives . . .

TY. LTD.

LBOURNE

In Mr. Magrath's own

g the trade with a range
n to give 100% results,
ess to their efforts, and
epeat business."

Intermediates and parts
andards.

ITANNIC

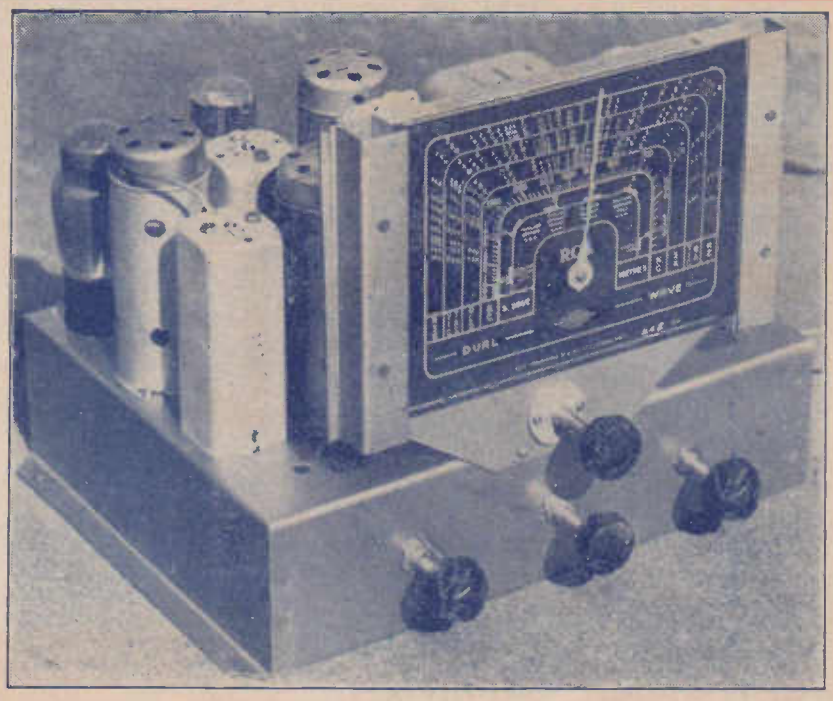
- - I.F. TRANSFORMERS
MPONENTS

A. E. HARROLD
tte Street, Brisbane. Phone: B 2729

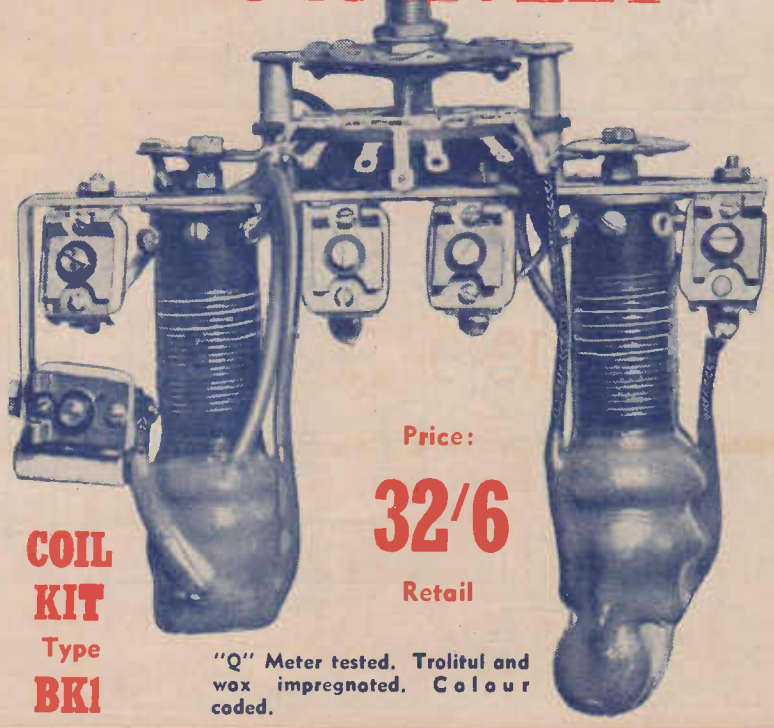
BROS. (Melbourne) LTD.
Launceston
TRALIA:

CARLYLE & CO.
Perth

OGEON & DENFORD
Perth



The "SUPER-SEVEN" features BRITANNIC EXCLUSIVELY



COIL KIT
Type
BK1

Price:
32/6
Retail

"Q" Meter tested. Trolitul and wax impregnated. Colour coded.

DUAL-WAVERS MADE EASY

Some notes on the application and adjustment of dual-wave coil brackets

IF WE were asked to name the biggest improvement in radio since the introduction of the superheterodyne we would feel inclined to mention the dual-wave coil bracket.

A few years ago it was general practice to enclose each coil in its own screening can, and the bigger the better. Some sets used coil cans which were four inches in diameter. Three inches was practically a standard.

Then one day along popped the dual-wave bracket. Just a bend of iron, with a switch in the middle and a couple of formers running up from it, these brackets appeared too rough and ready to be any good. The idea of having unshielded coils mounted down amongst the set wiring appeared to be dead wrong. Yet practical experience has shown that these units give excellent performance in every way. The expected instability from lack of shielding failed to materialise, and trouble is never heard of in this direction.

Alignment

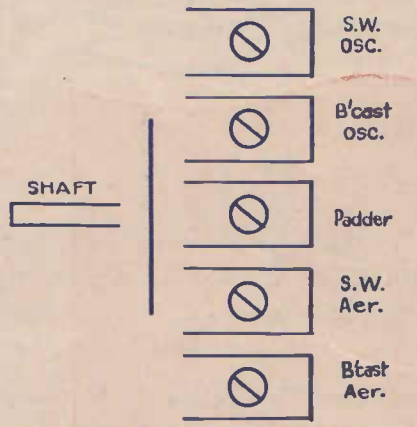
The introduction of the dual-wave brackets made the dual-wave superhet the simplest type of set to build and put into perfect adjustment. For sure-fire results we would always recommend a dual-waver using one of the many popular brands of dual-wave brackets. Incidentally, we might mention that we are unable to give a positive answer to the oft-asked question, "Which is the best?" So far as we can see there is no difference in the efficiency of the several brands available and all are capable of giving excellent results if the maker's instructions are watched closely. Principal of these concerns the matter of dial tracking, which is a handy check to alignment if the coils, gang and dial are correctly matched. It is not the slightest use trying to match an old-style coil bracket with the latest type of gang condenser and then fitting a dial of some obscure brand and hoping that the stations will fall according to the dial markings. Luck is seldom as good as all that!

Alignment seldom amounts to more than a fraction of a turn at one of the trimmers, and if the coil unit does not appear to track properly it is always a good idea to suspect other difficulties first and make a double check of the by-passing, earthing of the gang and such points before upsetting the trimmer adjustments more than a turn.

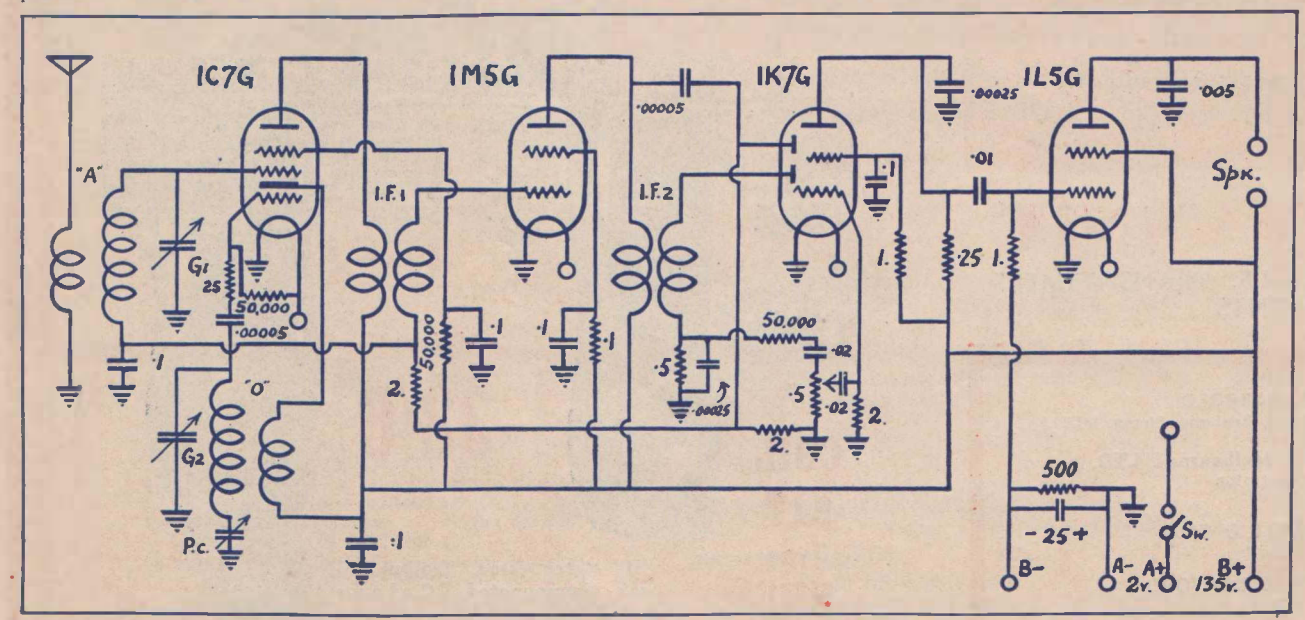
Some Hints

Here are a few random suggestions about points which should be watched when using coil brackets.

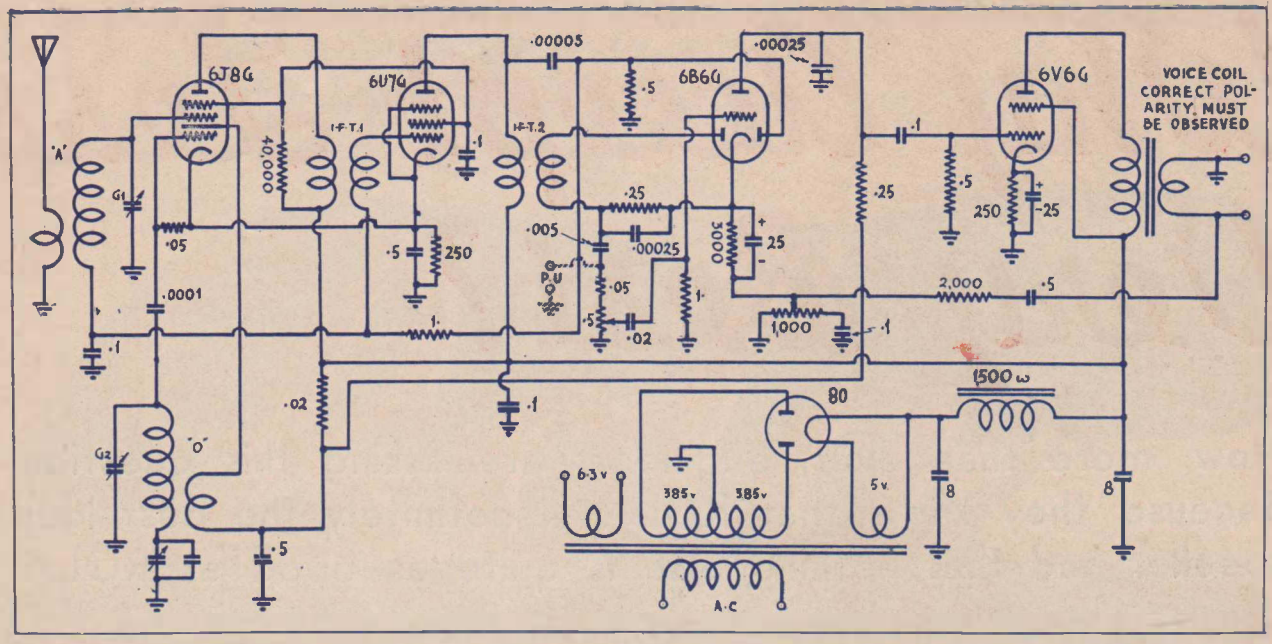
The circuit used should be a dependable one, of course, but no matter where it comes from it should be checked to make certain that it agrees with the maker's recommendations. It is particularly important to see that the main high tension supply of the set is by-passed with a tubular condenser in parallel with the second filter condenser, but at the r.f. end of the set. It is sometimes claimed that the electrolytic filter condenser is quite an efficient r.f. by-pass and should be ample in itself. In practice this may be borne out in nine out of ten cases, but yours is almost sure to be the tenth. A suitable tubular by-pass condenser costs a shilling or less, so don't skimp on this point. You'll have no difficulty in finding a place to tuck it away amongst the wiring, even if it isn't shown in the circuit from which you are working.



Trimmer layout for R.C.S. and Radiokes coil brackets.



A suggested circuit for a good dual-wave battery set — the "Master 4" — from our April issue.



Suggested circuit for a reliable dual-waver for A.C. operation — the "Acoustic Compensated" superhet, which was detailed in our March issue.

Lengths of Leads

A layout should be adopted which will leave the lengths of leads at a fair thing. Just what constitutes a fair thing is rather hard to say, but it should never be necessary to add to the length of lead on the unit as received from the maker. In most cases it will be found desirable to lop the leads by an inch or two and this should be done. Do not leave the leads any longer than necessary.

CROWN COLOUR CODE

AERIAL COIL

A	Green	G	Brown
E	Braid	F	Black

OSCILLATOR COIL

G	Blue	P	Yellow
E	Braid	B	Red

INTERMEDIATES

P	Green	G	Brown
B	Red	F	Black

R.C.S. COLOUR CODE

AERIAL COIL

A	Black	G	White
E	Braid	F	Cut busbar

OSCILLATOR COIL

G	Yellow	P	Red
E	Braid	B	Green

INTERMEDIATES

Lettering embossed in moulded base

RADIOKES COLOR CODE

AERIAL COIL

A	Black	G	White
E	Braid	F	Cut busbar

OSCILLATOR COIL

G	Yellow	P	Red
E	Braid	B	Green

INTERMEDIATES

Lettering embossed in moulded base

The Converter Valve

There are several types of converter valves listed by the valve manufacturers, but owing to the present position of supply and demand, you may find it necessary to take what you can get. Most of the coil brackets are recommended for use with a 6J8G converter valve, but will operate with other types such as the 6K8G, 6A8G, 6A7, 2A7, etc.

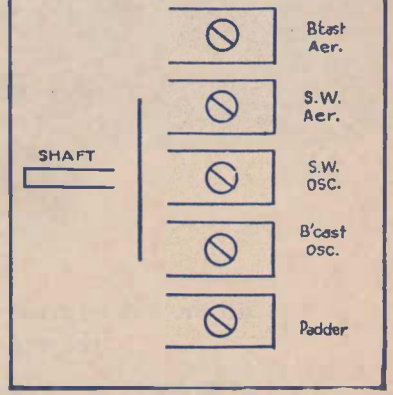
The By-pass Condenser

An important point in getting proper alignment is to have the correct by-passing of the a.v.c. line. This condenser, which is fitted from the "F" of the aerial secondary winding to earth, comprises part of the first tuning circuit, the actual grid return running to the a.v.c. line, As a result this condenser needs to be an efficient one, connected close to the unit and with an effective earthing, for preference directly to the earthing wires of the gang condenser. Efficient earthing is in itself an important factor and should be watched carefully.

It is always preferable to have an independent bias resistor for the converter valve, with its own by-pass condenser, of course. In many cases, however, the cathode of the converter will be tied to the cathode of the intermediate valve and a single resistor and by-pass used for both valves. If instability is encountered in such cases the obvious remedy is to fit independent bias resistors for each valve. Three hundred ohms is a normal value, but is not critical.

Checking Performance

The best check for performance, apart from actually testing for sensitivity, noise level, etc., with a signal generator, is to take a reading of the actual grid current of the oscillator section of the converter valve whilst in operation. But first check the voltages on the various elements and make sure that they agree with the valve maker's ratings. If these are normal, yet results do not appear to be up to expectations, the cathode end of the grid leak (usually 50,000 ohms) is disconnected, and a milliammeter inserted to read the grid current flowing through the grid leak. For the 6J8G the grid current should be around a quarter of a milliamp (250 microamperes), and even at the remote end of the short-wave band the grid current should never fall away to below 100 microamps. It is quite normal to find variations according to dial setting, but the grid current should always be between 100 and 300 microamps.



Trimmer layout for the Crown bracket.

Why Accept Less Very Best?

Now, more than ever, engineers are asking this question. Because they know that ROLA is definitely the best loud speaker and that nothing else is quite as good as ROLA.

ROLA is the only loud speaker with all these outstanding features:

- ★ **Completely Dustproof**
- ★ **Kappa Cones**
- ★ **Permaflex Spiders**
- ★ **Permacentric Construction**
- ★ **Improved Magnetic Circuit**
- ★ **Isocore Transformers**
- ★ **Australian Made Throughout**

All the way up from the raw material, Rola speakers are manufactured under the expert direction of Rola's specialised engineers.

In order to safeguard supplies for the future, Rola undertook the manufacture of magnet winding wires and magnet alloys. Thus is Rola pioneering two new Australian industries.

THE BEST RADIO RECEIVERS USE ROLA, THE WORLD'S FINEST LOUD SPEAKER

. . . . The NEW Rola Price List and

Service is as service does . . .

. . . and if service DOES give a customer entire satisfaction, then it IS service. Real service.

Naturally it is your aim to make your repair facilities as adequate and as efficient as possible . . . in other words, to inspire the complete confidence of your customers. But no matter how well equipped your service section may be, no matter what degree of technical skill you can bring to bear on radio problems — you cannot do a 100% service job unless you replace worn-out valves with Philips.

ALWAYS REPLACE WITH

Philips valves, made in a modern Sydney factory to the world's highest standards of efficiency, are giving unexcelled performance in thousands of receivers throughout the Commonwealth, because the public, educated by Philips advertising over many years, know the importance of thoroughly reliable valves in any set. You'll get more profit from your service work and valve replacement sales if you pin your faith on Philips valves.

PHILIPS VALVES

THERE IS A PHILIPS VALVE FOR EVERY SOCKET OF EVERY RECEIVER

MULLARD BATTERY SET IS SENSITIVE

Ideal for Country Conditions

★

A Set Review by A. G. HULL

★

COUNTRY readers often complain that set manufacturers spend most of their time and energy perfecting their all-electric receivers, and do not pay sufficient attention to the development of really effective sets to operate from batteries.

We have even had letters from our own readers in which they accuse us of showing a preference to the needs of city dwellers and not giving our country cousins a "fair go."

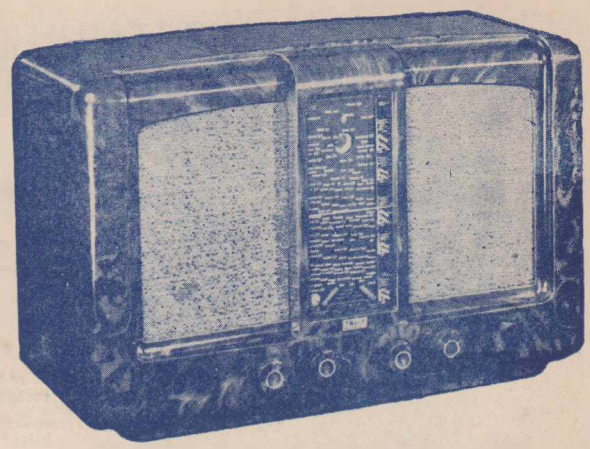
There may be some grounds for the complaints. It is undoubtedly a fact that in many brands of receivers the battery models do not have performance which is comparable with other models of similar specification, but operating from the power supply.

The whole problem is an especially sad one, for it is the country man who needs a set with extreme sensitivity, selectivity and general performance. In the city it is usual to find the set tuned to the local stations which can be received quite effortlessly. On the other hand the listener who is located in the country is often hard-pressed to find sufficient range to bring through to him the mid-day news session, which he is so keen to hear. Newspaper news will be stale by the time it arrives.

★

Latest Mullard battery set release is this five-valve de luxe mantel — known as Model 67.

★



SPECIFICATIONS

Brond: Mullard.

Model: No. 67.

Type: Dual-waver for battery operation.

Coverage: S.W., 16-50 metres; B.C., 540-1600 metres.

Price: £32/10/-, complete with full battery equipment. (Vibrator - powered model, £5/5/- extra.)

Fortunately the complaint does not hold good for all brands of receivers, and one in particular is the latest Mullard model, known as type 67.

It may be remembered that in last month's issue we reviewed the all-electric Mullard receiver and found it was a remarkable performer. When we returned that set we brought up this matter of the performance of battery models, and we're glad we did. The Mullard engineers lost no time in sending up a sample of this battery receiver, with a claim that we would find it equal in performance to their a.c. models of similar type.

Up and down the dial a couple of times while working back in the office one night proved their claim beyond a shadow of doubt.

The Mullard Model 67 is a battery set in a million.

It gives extreme sensitivity and se-

(Continued on page 42)

THE OUTSTANDING "UNIVERSITY" D.C., A.C.-D.C. MULTIMETERS

They are fully described in this issue.

PRE-WAR PRICES

D.C. only, kit of parts:	£4/8/6
Wired and tested:	£4/18/6
A.C./D.C., kit of parts:	£6/15/6
Wired and tested:	£7/10/6

All prices plus tax. Carrying case and test prods are included.

★ Full building instructions, circuit diagrams, etc., are given with every kit of parts. Terms available.

The very latest in multimeters — University 1941, D.C. and A.C./D.C. multimeters. Available either in kit form, ready to build yourself, or completely built and tested. Note the ranges: 0-10, 0-50, 0-250, 0-1,000 volts D.C.; and A.C.: 0-1, 0-10, 0-50, 0-250; M.A.: 0-500; 0-50,000 ohms, with internal battery; 0-1.5 megohms, with external 45-volt battery.

Entirely new...

The UNIVERSITY VOLTOHMETER

A remarkably new, small-sized set checker. You can build it yourself.

Note the ranges —

Voltage: 0-10, 0-50, 0-250, 0-1,000. Ohms: 0-500, 0-50,000. Special zero adjustment for accuracy on ohms scale. Meter, 1,000 ohms per volt. There's quality, grace and accuracy, together with economy, in this sensational new checker.

PRICES:
Kit of parts
£3/15/-
plus tax
Wired and tested
£4/2/6
plus tax

ALL SERVICEMEN'S AND SETBUILDERS' REQUIREMENTS

Being radio engineers and warehousemen, we specialise in **your** requirements. We stock **all** radio replacement parts, including Calstan and Palec test gear, "University" portables, test equipment, radio kits, amplifiers, etc. Before deciding on your next kit get the Radio Equipment price first.

RADIO EQUIPMENT PTY. LTD.

E.S. & A. BANK BUILDING, BROADWAY, N.S.W. (Phones: **M 6391 - M 6392.** **Telegrams: RAQUIP, SYDNEY**

Dear Sirs,—Please send me full details of the University Multimeters and Voltohmeter. At the same time please quote me for.....

NAME .....

ADDRESS .....

TWO HANDY MULTI-METER KITS

More elaborate in design than the "Servi-Meter" described last month, these two "University" kits for multi-meters are manufactured by Radio Equipment Pty. Ltd. of Broadway, Sydney.

UNDOUBTEDLY the most useful of all test instruments for servicing or adjusting radio receivers, or for testing component parts, is a combined voltmeter, milliammeter and ohmmeter, known as a "Multimeter."

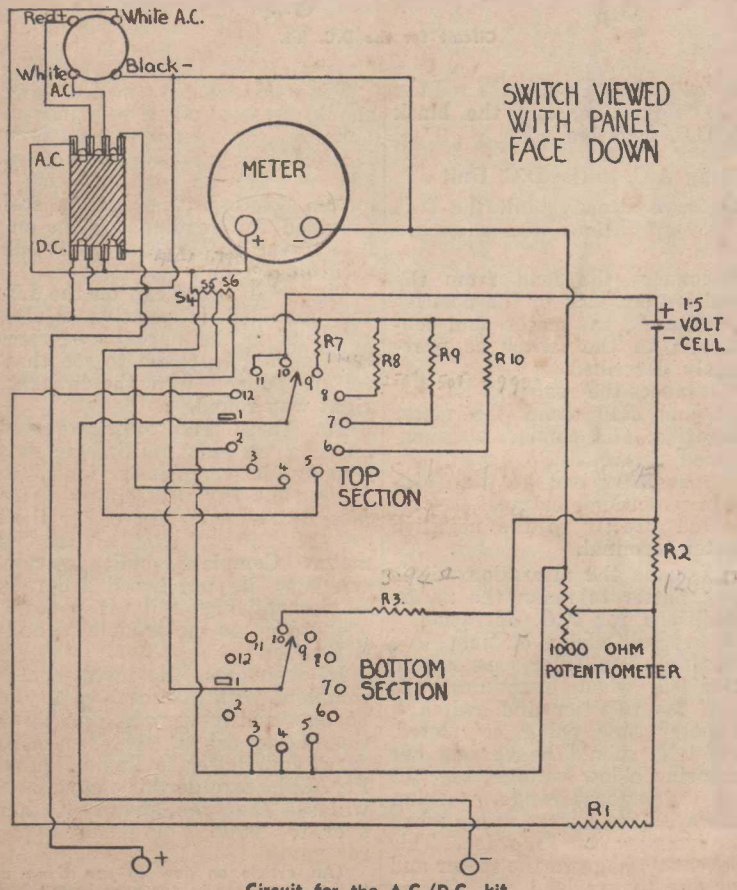
In districts where A.C. power mains are not available, only D.C. voltages are experienced, and a D.C. multimeter is all that is required. For working on A.C. operated receivers, however, the ability to measure A.C. as well as D.C. voltages is very convenient. A simple yet thoroughly efficient multimeter has been designed by our engineering staff, and is available either in kit form, so that you can construct it yourself, or, alternatively, you can purchase it completely built and tested if you prefer to do so. The instrument has been especially designed so that it can be built either as a D.C. or A.C./D.C. unit. This means that you can build the D.C. version now and add the few extra components necessary for the A.C. voltage ranges at a later date, without disfiguring the instrument panel and with a minimum of trouble. The scale of the meter provided is clearly marked with separate ranges for A.C. and D.C. measurements, so that there is no chance of making an incorrect reading.

In the D.C. multimeter, there is a blank space provided at the right-hand side of the panel, in which the extra switch required for A.C. volts can be easily fitted when desired, without moving any other parts.

Ranges

The multimeter has four ranges of volts and mills., and three ranges of ohms. The voltage scales are: 0-10v., 0-50v., 0-250v., and 0-1,000v. The mills. ranges are 0-1 mill., 0-10 mills., 0-50 mills., and 0-250 mills. The ohms ranges, 0-500, 0-50,000, and by the use of an additional 45-volt battery, readings of up to one and a half megohms with a small deflection on three megohms, can be obtained. One of the features of this instrument is that a reading of a quarter of an ohm is possible. This allows the resistance of coils, intermediates, valve filaments, etc., to be measured with the utmost ease.

The selection of the desired ranges of volts, milliamps or ohms is achieved by the use of a multiple switch, giving speed and simplicity.



Circuit for the A.C./D.C. kit.

Construction

The selector switch consists of two banks one above the other (in the circuit these are drawn separately to prevent confusion); each bank has one moving arm and twelve fixed contacts. The moving arm connects to the lug which protrudes from the bottom of each wafer when viewed from underneath. The fixed contact immediately above this differs from all the others in that it has a square opening in the middle. Being different, we can use it as a marker lug for wiring the remainder of the switch, and for this purpose we will refer to it as No. 1 contact. It is not connected in either bank. The numbering of the other contacts will be carried out working towards the right-hand side, the meter being face downwards with the terminals for the test leads towards you.

The first step in wiring is to wire up the contacts of the switch which connect together. As will be seen from the circuit, No. 2 on the top bank connects to 3, 4 and 5 on the bottom bank, nearest the panel. The moving arm on the bottom bank connects to No. 3 on the top bank, and 10 and 11 on the top bank connect together. The numbers on these contacts do not correspond to the numbers on the components. Those contacts on the top bank which come close to the frame of the potentiometer should be bent up to prevent any danger of shorts.

The components are numbered according to the order in which they should be assembled, and no difficulty should be experienced in fitting them in their proper places.

There are several precautions to be observed in wiring. They are as follows:—

(1) Make sure you get the correct end of the tapped milliamp shunt (i.e., the combination of S4, S5, S6 and R3) connected to the positive end of the meter

and the taps wired to the switch in their correct sequence.

(2) The resistors R7, R8 and R9 and R10 must also be connected to the switch in correct order.

(3) The wiring should be carried out with 18 S.W.G. tinned copper wire, because of its rigidity and low resistance. If the wires can be kept apart there will be no need to insulate them. Mostly, however, they will need covering with the spaghetti tubing which is provided.

(4) It is extremely important that all soldered joints should be carefully made, particularly those connecting to the shunt resistors for the milliamp ranges. A bad joint may introduce extreme inaccuracies, and in some cases may prevent the meter from operating at all.

(5) After completing the wiring, it is essential that the panel and wiring be thoroughly checked at least once, particular care being paid to the milliamp section, before any attempt is made to use the meter.

The A.C. Version

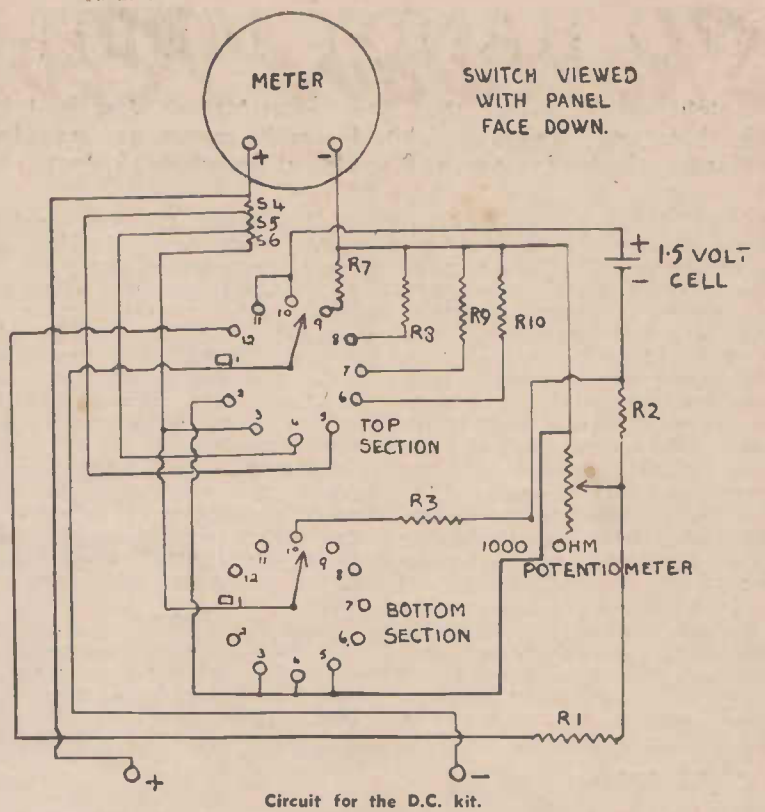
If you are constructing the A.C./D.C. instrument, the ends of the four resistors, R7, R8, R9 and R10, which in the D.C. version are soldered directly to the lug on the negative terminal of the meter, may be conveniently attached to a soldering lug mounted on a short strip of bakelite. The other end of the bakelite strip can then be drilled and mounted on the negative terminal of the meter.

The wiring of the A.C. switch and the rectifier is much more simple than it appears from the circuit diagram.

With the body of the switch towards the left-hand side of the meter, the panel front being face downwards, the four terminals pointing towards the top of the panel are those on the side of the switch marked "A.C." in the circuit diagram. The two top lugs, one on each end, will then be the two which are shown in the circuit connected together and to the positive pin jack of the instrument. The remaining connections may now be made. No difficulty should be experienced in getting them in their correct order.

Great care should be exercised when connecting to the rectifier to prevent overheating by the soldering iron, as this will completely ruin its performance. The leads attached to the rectifier should not be cut short; at the very least one inch should be left to prevent excessive internal heating. On no account must the lugs of the rectifier be directly soldered to, or the iron allowed to come too close when soldering other joints.

The two lugs of the rectifier painted white form the A.C. input, the red lug is the D.C. positive, and the black lug the D.C. negative.



Circuit for the D.C. kit.

Adding A.C. to the D.C. Unit

If you have already built the D.C. meter, the alterations necessary are as follows:—

(1) Disconnect the lead from the positive pin jack to the positive terminal of the meter, and connect it to the switch as previously described.

(2) Disconnect the resistors R7, R8, R9 and R10 from the meter negative, and connect as mentioned previously.

(3) The negative end of the 1000-ohm potentiometer must be connected directly to the negative meter terminal.

Having made the alterations, it is a simple matter to make the necessary additions for A.C. operation.

Check over all wiring at least once before using. Particular care should be exercised when examining the wiring of the rectifier and switch.

The meter now being completed, the first trial should be carried out by measuring a low voltage, say, 2.5 volt, on the highest range, working down towards the lowest range when each is found to be in order. This will prevent damage to the meter and rectifier due to overload.

The two separate scales provided should be used when measuring A.C. voltages. The top one, 0 to 50 volts, is used for any readings taken on the 50-volt, 250-volt or 1000-volt A.C. switch position. The bottom scale is provided for readings taken on the 0 to 10-volt A.C. range, and is marked accordingly.

The small brass cap on the 1.5-volt cell provided is positive, while the zinc can is the negative connection. Care should be taken to see that the cell is clipped into the bracket the right way round.

For those who are interested in building up this multimeter or purchasing it completely built, Radio Equipment Pty. Ltd. offers the complete kit of parts for either the D.C. or A.C./D.C. version of the multimeter. Completely-built instruments can also be purchased from Radio Equipment Pty. Ltd., if you do not wish to go to the trouble of building it yourself.

In each case, the instruments are complete with all best-quality components and test prods. For information as to prices, etc., you can address your letter to Radio Equipment Pty. Ltd., care of this magazine. We will see that the enquiry is handed over to Radio Equipment Pty. Ltd. for you.

(An article on how to use these meters is due to appear in our next issue.)

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY

"Oh wind, if winter comes . . ."

By the time these notes are read we will certainly be well into the Radio winter, and stations that have for many many weeks given us wonderful reception will just be a memory for a few months. I refer to the 13, 16 and now the 19 metre bands. Probably more radio sets have been unfairly abused this year than before, because a greater number of listeners than ever seem to tune to **DJR**, Berlin, and hear Station Ananias in the "news" session at 10 p.m. It is increasingly hard to explain to newcomers to the short-waves that overseas signals "have their moments,' but, being aware of this, we anticipate just how they will behave, and consequently as we reach the autumnal equinox we are ready for this "foolin' " and forget them and choose those countries that will afford us amusement or interest during the long winter evenings. But this absence of stations on the 19-metre band at night has its compensations, for it heralds good day reception. From midnight right through till 6.15 p.m. there is a wealth of good programmes to be heard. London excels, and the choice of transmitters is great. The Europeans absent from the night reception, of course, are also going great guns in the daylight, and most of the new schedules are shown under loggings.

A World-wide Radio Station Devoted to Culture and Education

My listening to overseas stations is so constant and the number checked so numerous that I seldom find time to dwell on any particular one, notwithstanding the many excellent programmes offering, even if the only English heard is at the beginning or end of a session. But, I think, after Daventry my first choice would be **WRUL**. This Boston (U.S.A.) station, operated by the World Radio University, and for no profit, has such high ideals that they are worthy of more than a "tick" on the station list.

Let us take just one extract from the Charter of the Foundation: "To foster, cultivate and encourage the spirit of international understanding, and to promote the enlightenment of individuals throughout the world."

Maybe radio will play its part in bringing about a better and, let us hope, permanent understanding between nations. I have often thought that perhaps had we years ago encouraged a universal language, with radio, which reflects the instant viewpoint, a great number of our differences could and would have been settled in a less gruesome fashion.

One of the surprises of the month was the strength of COCO, Havana, 8700kc, 34.48m, at the unusual hour of 8 p.m. The longest advertisements I have ever heard were put over in English, and it is quite likely had I been a resident of Havana I would have followed the suggestion to obtain a self-propelling pencil absolutely free simply by sending 50 cents to the penman for a beautiful fountain-pen with a two-way pen-point and containing enough ink to write 5,000 words, with a 14-carat safety clip, etc., etc.

Voice Like Roosevelt's

The advertiser, with a voice so remarkably like Roosevelt's, is very convincing. Reference to **CMCK**, Miami, Florida, may confuse some listeners, but this is the call-sign of the broadcast band of **COCO**. Actually there are no short-wave stations in Florida, **WDJM** selling out some time ago.

Another surprise was friend **WNBI**, Boundbrook, 11,890kc, 25.23m, going for his life in foreign languages at 8 p.m. Tricked for a while by this "stranger" who appeared to have jumped the wavelength held until recently by Chungking, I waited a little while only to learn it was **WNBI**.

B.B.C. Error

Seldom does the B.B.C. make a mistake, but in the 9 p.m. news on May 17 the announcer referred to "Mr. Curtin, the Acting Prime Minister of Australia." I wonder whose face was red.

Matinee Reception

The ladies at present certainly have it all over we poor souls who are compelled to slave in the city, when it comes to overseas listening. Daylight reception, although not yet at its peak, is remarkably good, and newcomers to the short-waves are recommended to confine their attentions to the East if the evening is the only time available for exploring the ether on the high-frequency side of their receiver. It is quite possible that on some nights the stations you have heard or heard about, such as London, Berlin, Rome, etc., being received at such good strength of an evening a few weeks ago, may come through with passably good signals, but this time of the year it is safer to tune them, say, from midnight to 6.15 p.m. You will therefore see you are only actually forgetting them for a few hours.

The evenings afford some fine recreation, and Singapore, Hongkong, Delhi, Burma, Chungking, Saigon, Tokyo, Moscow, Manila and Shanghai offer a varied programme that can be heard at a volume and with such clarity as to be surprising.

Brief Mention

Peru is being heard again in New Zealand and **OAX5C** in Ica and **OAX4J**. Lima are reported by Mr. Hal Johns, of Nelson.

Two more Daventry transmitters appear to be on regular duty — **GRV**, 12,040kc, 24.92m, and **GRS**, 7065kc, 42.49m. See loggings for details.

Berlin is putting over a fine signal on **DXD**, 10,544kc, 28.45m, from 7.50 a.m. to 4 p.m.

Rome is now using regularly the transmitter heard for so long up till 7 a.m. some weeks ago. It is **2RO-18**, 9760kc, 30.74m. See loggings.

Dr. Gaden advises hearing the seldom-reported Canadians, **CRCX**, Toronto, 6090kc, 49.26m, and **CFRX**, Toronto, 6070kc, 49.42m. He also mentions that, in addition to **XGOY**, Chungking, being on 5950kc, 50.42m, he thinks they were on approximately 52 metres. (Somebody is there, but who?—Ed.)

Radio Suisse (**HER-3**) is being heard at great strength between 2.40 and 3.37 p.m.

KGEI, 31.02m, closes at 6 and opens up a few minutes later with English announcement followed by one-string guitar, then Chinese session from Chinatown, San Francisco, till 7 p.m.

VERIFICATION FROM RADIO CONGO BELGE

Was truly delighted to get a confirmation under date of December 26 from Le Chef du Service de l'Information, Leopoldville, Congo Belge, to my report of November 2 last year.

In a letter thanking me for my report was enclosed a very nicely-printed folder giving the schedule of **Radio Congo Belge** (absolutely no reference to **OPM**) and a sheet of Congo Belge postage stamps. With correspondence from this part of the world so intermittent, I am deeply appreciative of the fine gesture. My Pelman training took me back to those good old school days when I did follow philately.

The MONTH'S LOGGINGS

ALL TIMES ARE AUSTRALIAN EASTERN STANDARD

Where known, schedules are shown, but listeners must remember overseas stations reserve the right to make alterations without notice.
With the rapid improvement in daylight reception, which has not yet reached its peak, more and more stations will be heard for a longer period.

AUSTRALIA AND OCEANIA

VLQ-8, Sydney 17,800kc, 16.85m
Session discontinued.

VLQ-3, Sydney 15,315kc, 19.59m
Session to North America now an **VLQ,** 31.2, from 1.25 a.m.

VLQ-7, Sydney 11,880kc, 25.25m
Trans. IV. to South-east Asia, 11.10 p.m. to 12.40 a.m.
Trans. V.(a) to Mexico: 12.50 a.m. to 1.15 a.m.

VLQ-2, Sydney 11,870kc, 25.27m
Trans. II. to North-east Asia, 9.40 p.m. to 10.15 p.m. Trans. IV.(a) to A.I.F., North Africa and Palestine, 11.15 p.m. to 11.45 p.m. Trans. X. to North America (West), 3.55 p.m. to 4.40 p.m. Trans. X.(a) to A.I.F., 5 to 5.30 p.m.

VLR-7, Lyndhurst 11,840kc, 25.33m
Replaced by **VLR-8.**

VLR-8, Lyndhurst 11,760kc, 25.51m
Schedule: Relays A.B.C. National programmes on week days from 6.30 a.m. to 10.15 a.m., noon to 6.15 p.m., and on Sundays from 6.45 a.m. to 2 p.m., 3 p.m. to 6.15 p.m.
This wavelength nicely in the clear (Deppeler). Tone and quality something to be proud of (Hallett).

VLQ-5, Sydney 9680kc, 30.99m
Trans. III. to North America (East), 9.20 p.m. to 10.05 p.m. Trans. VI. to South Africa, 5.10 to 5.45 a.m.; also on **VLLW-2.**

VLQ, Sydney 9615kc, 31.2m
Trans. I. to New Caledonia and French Oceania, 6.25 p.m. to 7.25 p.m. Trans. III.(a) to Latin America, 10.15 p.m. to 10.45 p.m. Trans. V. to North America (West), 1.25 a.m. to 2.10 a.m. Trans. VI. to British Isles, 4.10 a.m. to 4.45 a.m.

VLW-2, Wanneroo 9560kc, 31.38m
From 9 p.m. to 12.45 a.m., National programme. Trans. IV. to South-east Asia, 11.10 p.m. to 12.40 a.m. Trans. VII. to South Africa, 5.10 a.m. to 5.45 a.m. Also on **VLQ-5,** 30.99m.

Fiji:
VPD-2, Suva 9535kc. 31.46m
Schedule: 7-8 p.m. except Sunday.
Splendid news service at 7 pm. French session 3 to 3.30 p.m.

New Caledonia:
FK8AA, Noumea 6130kc, 48.94m
Schedule: 5.30 to 6.30 p.m.
On closing, plays "Marseillaise," "God Save the King" and "The Star-Spangled Banner."

AFRICA

Abyssinia:
12AA, Addis Ababa 9650kc, 31.09m
Schedule unknown, but heard around 5 a.m. Would like reports on this station.—Ed.

Algeria:
TPZ, Algiers 12,120kc, 24.76m
Schedule: 5.30 p.m. to 6.15 p.m.
Fair 6 p.m. (Nelson, Rogers).

TPZ-2, Algiers 8960kc, 33.48m
Schedule: 4 a.m. to 9 a.m.
Fair 6 p.m. (Nelson, Muller).

Belgian Congo:
OPM, Leopoldville 10,140kc, 29.59m
Schedule: 4.55 a.m. to 5.45 a.m.
See reference under "Notes From My Diary."

Egypt:
SUX, Cairo 7865kc, 38.15m
Schedule: 4.30 a.m. to 6.30 a.m.
Still fair at 6 a.m. (Nelson).

French Equatorial Africa:
FZI, Brazzaville 11,965kc, 25.06m
Schedule: 6-7 a.m., 4-4.30 p.m.

Gabon:
FHK, Libreville 9320kc, 32.18m
Schedule: 7 to 9.15 a.m.

French Morocco:
CNR, Rabat 12,831kc, 23.38m
Good strength at 6 a.m. (Cushen).

French West Africa:
Senegal:
FGA, Dakar 9405kc, 31.90m
Would like reports.—Ed.

Gold Coast:
British West Africa:
ZOY, Accra 4915kc, 61.04m
English session at 4 a.m.

South Africa:
Kenya:
VQ7LO, Nairobi 6083kc, 49.31m
Schedule: 2.15 a.m. to 5.15 a.m. News at 2.30 and 4.
Generally an excellent signal.

ZRH, Pretoria 6007kc, 49.94m
Heard around 3.30 a.m.

ZNB, Mafeking 5900kc, 50.95m
Heard at 3.30 a.m.

Rhodesia:
THE POST OFFICE STATION, Salisbury 7317kc, 41m
Schedule: 2 a.m. to 6 a.m. Relays Daventry at 4 a.m. Closes with "God Save the King."

Portuguese East Africa:
Mozambique:
CR7BE, Lourenco Marques . 9710kc, 30.9m
Schedule: 5 to 7 a.m. except Mondays. News 5.55.
Fair signal.

Portuguese West Africa:
Angola:
CR6AA, Lobita 7614kc, 39.39m
Fair signal on Sundays at 5.30 a.m.

Natal:
ZRO, Durban 9750kc, 30.75m
Closes at 7 a.m. after B.B.C. News.

Spanish Morocco:
Radio Falange, Tangiers 7090kc, 42.31m
Schedule: 6 to 8 a.m. All Spanish.
R6 at 7 o.m. (Taylor).

WITH THE REPORTERS

I thank the following for reports this month:—

Wm. Bantow, Edithvale, Vic.
A. T. Cushen, Invercargill, N.Z.
L. Edel, Rose Bay, Sydney.
A. L. Flegg, Melbourne, Vic.
Dr. K. B. Gaden, Wallumbilla, Q.
H. I. Johns, Nelson, N.Z.
K. B. Mitchelhill, Muswellbrook, N.S.W.
G. Muller, Newtown, Sydney.
S. I. Nelson, Cairns, Q.
M. Rogers, Hunter's Hill, Sydney.
E. E. Seward, Marrickville, Sydney.
P. L. Smith, Dunnsborough, W.A.
E. J. Stanke, Mt. Gambier, S.A.

Send in reports as fast as you hear anything unusual.

Madagascar:
RADIO TANANARIVE, Tananarive 6063kc, 49.48m
Heard weakly after midnight. Female announcer.

AMERICA

Central:
Costa Rica:
TIPG, San Jose 9620kc, 31.19m
Schedule: 10 p.m. to midnight.
Loudest of the Central Americans.

TILS, San Jose 6165kc, 48.66m
Schedule: Opens at 10 p.m.

TIGPH, San Jose 5910kc, 50.72m
Schedule: 10 to 11 p.m., 3 to 4 a.m., 9 a.m. to 1 p.m.
Slogan is "Radio Alma Tica."

El Salvador:
YSPA, San Salvador 10,400kc, 28.55m
Schedule: 11.10 p.m. to midnight; 4-6 a.m.; 9.30 a.m. to 2.30 p.m.

Guatemala:
TGWA, Guatemala City 15,170kc, 19.77m
Monday mornings from 5.30 a.m. to 8.15 a.m.

TGWA, Guatemala City 9685kc, 30.98m
Heard from 2 p.m. to 2.45 p.m. (Rogers). Excellent (Johns).

TGWB, Guatemala City 6480kc, 46.30m
Just audible at 3 p.m., closing (Gaden).

TGQA, Quezaltenango 6400kc, 46.88m
Excellent Sunday afternoons at 4.30 p.m.

TG-2, Guatemala City 6200kc, 48.39m
Closes at 6.04 p.m. Improves from 3.45 p.m. Strong signal, but noise high at closing (Gaden).

British Honduras:
ZIK-2, Belize 10,600kc, 28.30m
Schedule: Wednesday, Friday and Sunday, 4 to 4.30 a.m., 11.30 to 11.50 a.m.

Nicaragua:
YNPR, Managua 8580kc, 34.97m
Good signals at 11 p.m. (Cushen).

Panama:
HP5A, Panama City 11,700kc, 25.64m
Schedule: 2 p.m. to 3 p.m., 10 p.m. to midnight.

HP5J, Panama City 9607kc, 31.22m
Schedule: 10 p.m. till midnight.

North:
KGEI, 'Frisco 15,330kc, 19.56m
Schedule: 10.15 a.m. to 3 p.m. News, 10.45 a.m.
Best signal from mid-day; closes after News at 2.55 p.m. (Rogers).

WGEA, Schenectady 15,330kc, 19.56m
Schedule: 1.15 a.m. to 8 a.m. News, 3.45 a.m.

WNBI, Boundbrook 11,890kc, 25.23m
1 p.m. to 3 p.m. and heard again at 8 p.m. in foreign languages.—Ed.

WBOS, Boston 11,870kc, 25.26m
Schedule: 7 a.m. to 2 p.m. News, 9 a.m.
Strong at 9.30 a.m. (Bantow).

WRUL, Boston 11,790kc. 25.45m
Schedule: 4 a.m. to 8 a.m. (News 6.30 a.m.)

WRUW, Boston 11,730kc, 25.58m
Schedule: 8.15 a.m. to 12.30 p.m. (News 8.15 p.m.).
Strong at 9.15 a.m. with Slovac programme (Bantow).

WLWO, Cincinnati 11,710kc, 25.62m
Schedule: 8 a.m. to 10.45 a.m. News, 8.30 and 9.25 a.m.

KGEI, 'Frisco 9670kc, 31.02m
Schedule: 4 p.m. to 6 p.m. (News 4 p.m. and 5.55 p.m.); 10 p.m. to 3.10 a.m. (News 10.30 p.m., 12.30 a.m., 1.30 a.m., 3 a.m.).
Opens again a few minutes after 6, and, till 7 o'clock gives programme from Chinatown in 'Frisco (Nelson).

WRCA, Boundbrook 9670kc, 31.02m
Schedule: 6 a.m. to 3 p.m.
Now appears to close at 3, thank goodness.—Ed.

WCBX, New York 9650kc, 31.09m
Schedule: 7 to 9 a.m. News at 7 and 8.45.

WLWO, Cincinnati 9590kc, 31.28m
Schedule: 11 a.m. to 3 p.m.

WGEA, Schenectody 9550kc, 31.41m
Schedule: 8.15 a.m. to 11.15 a.m.

WGEO, Schenectady 9530kc, 31.48m
Schedule: 5 a.m. to 7.45 a.m., 8 a.m. to 2 p.m. (News 6.55 to 8.25 a.m.)

WCBX, New York 6170kc, 48.62m
Good at 2.33 (Johns).
WNBI, Boundbrook 6100kc, 49.18m
Poor when closing at 4 p.m. (Goden).
WCAB, Philadelphia 6060kc, 49.5m
Heard at 4 p.m.
WRUW, Boston 6040kc, 49.65m
Schedule: 9.15 a.m. to 11.15 a.m. (Morse code practice at 10 a.m., but signal may fade.—Ed.)

Mexica:
XEQQ, Mexico City 9680kc, 30.99m
Schedule: 11 p.m. to 2 a.m.
XEWW, Mexico City 9503kc, 31.57m
Between 2 and 4 p.m., excellent (Rogers).

South:
Argentine:
LRX, Buenos Aires 9660kc, 31.06m
(Quite good at 9.15 p.m. (Edel).

Bolivia:
CP-5, La Paz 6200kc, 48.39m
Heard at 10 p.m. (Goden).

Ecuador:
HCJB, Quito 12,460kc, 24.08m
Schedule: Noon to 1.10 p.m., 9.55 p.m. to 11 p.m.
Weak at night (Nelson).
HCQR, Quito 5975kc, 50.21m
Quite good at midnight (Goden).

Chile:
CB-1180, Santiago 11,980kc, 25.04m
Weak at 2 p.m. (Johns).
R4 at 9.30 p.m. (Nelson).
CB-1170, Santiago 11,700kc, 25.64m
R8 when closing (Cushen, Johns).

Colambia:
HJCT, Bogota 9630kc, 31.15m
Closes weakly at 2.30 p.m. (Gaden).
HJFK, Pereira 6090kc, 49.20m
Heard in afternoons and sometimes till 5 p.m. on Sundays.

Peru:
OAX5C, Ica 9430kc, 31.82m
Fair signals at 2.40 p.m. (Johns).
OAX4J, Lima 9340kc, 32.12m
Fair at 2 p.m. (Johns).

THE EAST

Burma:
XYZ, Rangoon 6007kc, 49.94m
Schedule: 9.45 p.m. to 1 a.m., except Sundays. News at 12.30 a.m.
English session commences at 11.30 p.m.
XZZ, —— 3490kc, 86.00m
In porallel with **XYZ.**

China:
XOZ, Chengtu 15,510kc, 19.34m
Can be heard some nights from 9 p.m.
XGOX, Chungking 15,200kc, 19.74m
Schedule: 10-11.5 a.m.; 2.30-6.5 p.m. English news at 5.20 p.m.
Now Turkey has gone, afternoon session good (Gaden).
FFZ, Shanghai 12,090kc, 24.83m
Schedule: 8 p.m.-1 a.m. News 10 p.m.
XGRS, Shanghai 12,015kc, 24.97m
Schedule: 7 p.m. to 1 a.m.
"The Voice of Europe." News 9.30 p.m. and 11.15 p.m.
XIRS, Shanghai 11,980kc, 25.02m
Splendid from about 10 to 10.45 p.m. in English and Itolian.
XMHA, Shanghai 11,853kc, 25.31m
Schedule: 7 p.m. to 1 a.m. News, 9 p.m. and 11.15 p.m.
XGOK, Canton 11,605kc, 25.75m
Strong each night. News at 10.30 p.m.
XOZS, —— 10,040kc, 29.88m
Heard at 9.10 p.m. Good signals.
XGOA, Chungking 9720kc, 30.85m
Fair at 11.15 p.m. (Bantow).
XGOY, Chungking 9635kc, 31.14m
Schedule: Midnight to 2 a.m. News at midnight and 1 a.m.
XGOY, Chungking 9500kc, 31.58m
5 a.m. to 7.20 a.m. in Chinese.
XPSA, Kweiyang 8484kc, 35.36m
Schedule: 9 p.m. to 1 a.m.
XPSA, Kweiyang 6980kc, 42.98m
Excellent signals at 9 p.m. (Cushen).
XGOY, Chungking 5950kc, 50.42m
10.45 p.m. to 11.55 p.m.

Portuguese China:
CRY-9, Macao 6080kc, 49.34m
Schedule: 10.30 p.m. to 1 a.m.
Now being heard on nights in addition to Mondays and with improved quality.

Thai:
HSP5, Bangkok 11,715kc, 25.61m
Schedule: 10.50 p.m. to 1 a.m. except Mondays. News, 11.45 p.m.

Dutch East Indies:
PMA, Bandoeng 19,380kc, 15.48m
Schedule: 10.15 to 11.15 p.m. News, 10.45.
YDB, Soerabaya 15,315kc, 19.59m
Schedule: 1.30 to 5 p.m.; Sundays, from 10.30.
Fair at 3 p.m. (Nelson).
YDC, Bandoeng 15,150kc, 19.80m
Schedule: 8.30 to 10.30 a.m., 1.30 to 5 p.m., 7.30 p.m. to 1.30 a.m.
PLJ, Bandoeng 14,630kc, 20.51m
Schedule: 7.30 p.m. to 3 a.m.
PLP, Bandoeng 11,000kc, 27.27m
Schedule: Same os **YDC.**
Good at 9.30 p.m. (Flegg).
PMN, Bandoeng 10,260kc, 29.24m
Schedule: Same as **YDC.**
Good at 9.30 p.m. (Flegg).
YDB, Bandoeng 9550kc, 31.41m
Schedule: 7.30 p.m. to 1.30 a.m.
YDA, Tandjongpriok 7250kc, 41.38m
YDX, Medan 7220kc, 41.55m
Excellent from 9 p.m.
PMY, Bandoeng 5145kc, 58.3m
Schedule: 7.30 p.m. ta 1.30 a.m.
YDF, Soerabaya 4960kc, 60.48m
Fair towards midnight.
YDE-2, Solo 4810kc, 62.37m
YDA, Tandjongpriok 3040kc, 98.68m
Schedule: 7.30 p.m. to 1.30 a.m.

French Inda-China:
Radio Saigan, Saigon 11,780kc, 25.47m
Schedule: 8.40 p.m. to 2 a.m. News, 8.45 p.m., 1.45 p.m.
Excellent nightly (Flegg).
Radio Saigon, Saigon 6180kc, 48.54m
Schedule: 8.40 p.m. to 2 a.m.
Very loud signal.

Hong Kong:
ZBW 9525kc, 31.49m
Schedule: 8 p.m. to 1 a.m. Relays B.B.C. News at 11 p.m.

India:
VUD-3, Delhi 15,290kc, 19.62m
Schedule: Noon to 3 p.m. (News at 1.20 p.m.); 4.30 p.m. to 6.30 p.m. (News at 6 p.m.).
VUD-4, Delhi 11,830kc, 25.36m
Schedule: 9.30 p.m. to 3.20 a.m.
News, 10.30 p.m., 1.50 a.m., 3.15 a.m.
VUD-2, Delhi 9590kc, 31.28m
Schedule: 9.30 to 2 a.m. News, 10.30 p.m., 1.50 a.m.
VUD-2, Delhi 7290kc, 41.15m
Opens 9.30 p.m. Same programme as **VUD-4,** 25.36. News 10.30.
Heard Delhi at 3.30 p.m., 19/5/41 (Gaden).
VUM-2, ... 7270kc, 41.27m
Heard at 9.30 p.m. (P. L. Smith).
VUB-2, Bombay 7240kc, 41.44m
Good around 10.30 p.m.
VUC-2, Calcutta 7210kc, 41.61m
Fair about 10.30 p.m.

Japan:
(Tokyo considered source of supply unless otherwise mentioned)
JLU-4 .... 17,795kc, 16.86m
9 a.m. to 10.30 a.m., 11 a.m. to 1 p.m.
JZK 15,160kc, 19.79m
1 a.m. to 2.55 a.m. (News, 1.45 a.m.). 3 a.m. to 4.30 a.m. (News, 4 a.m.). 1.30 p.m. to 4 p.m. (News, 2.55 p.m.). 4.30 to 6.30 p.m. (News, 4.35 p.m.).

NEW STATIONS

RADIO DENMARK, Copenhogen, 9680kc, 30.99m: Mr. Edel, of Rose Bay, tells me he hos been hearing this stotion for some time. They onnounce, "You hear Rodio Denmark." Best transmission seems to be from 3.30 to 3.45 p.m.

UNCONNU, 9749kc, 30.77m: This Free French station is heard every morning from about 5.30. It closes sharp at 6 a.m. UNCONNU, French for "unknown," seems an appropriate but nevertheless unsatisfying call-sign for the station friend Muller and I have chosed for many moons.

XIRS, Shanghai, 11,980kc, 25.02m: Heard last month just after we had gone to press. Signol has improved and now can be classed as good. English ond Italian is used and, of course, is pro-Axis in outlook.

RADIO LEVANT, Beyrouth, 8030kc, 37.36m.: Schedule: 3 p.m. to 3.30 p.m. These particulars are taken from "Internationol Short-wave Radio" (April). Beyrouth, or Beirut, is in Lebanon, Syria. (Listeners should keep a sharp lookout, as it may be possible to hear **RADIO LEVANT** during the winter.—Ed.)

JLG-4, —— 15,105kc, 19.86m
5 a.m. to 8.30 a.m. (News, 8 a.m.). 9 a.m. to 10.30 a.m.; 11 a.m. to 1 p.m. (News, 11.05 a.m.).
JVZ, —— 11,815kc, 25.39m
7 p.m. to 9 p.m.; 9 p.m. to 12.30 a.m. (News, 11.25 p.m.).
JZJ 11,800kc, 25.42m
1 a.m. to 2.55 a.m. (News, 1.45 a.m.). 3 a.m. to 4.30 a.m. (News, 4 a.m.). 5 a.m. to 8.30 a.m. (News, 8 a.m.). 1.30 p.m. to 4 p.m. (News, 2.55 p.m.). 7 p.m. to 8 p.m. For Australia and New Zealand: 8.30 p.m. to 9.25 p.m. (News, 8.35 p.m.). 9.30 p.m. to 12.30 a.m.

JVW-3 .... 11,720kc, 25.6m
Schedule: 7 a.m. to 8.30 a.m. (Physical exercises, 7 to 7.20.)
JIB, Formosa 10,530kc, 28.48m
Opens at 8.30.
JDY 9920kc, 30.23m
No particulars of schedule.
Fair signal, poor quality. Heard nightly.
JIE-2, Taiwan 9695kc, 30.96m
Schedule: 11 p.m. to 1.30 a.m.; News at 12.15 a.m.
JVW-2, —— 9674kc, 31.01m
Schedule: 6.45 p.m. to 11.30 p.m.
Fair nightly (Beattie).
JZI 9535kc, 31.46m
Schedule: 1.30 to 4 p.m.; 4.30 to 6.30 p.m.; 1 a.m. to 2.55 a.m.; 3 a.m. to 4.30 a.m.; 9 to 10.30 a.m.
JLG-2, —— 9505kc, 31.57m
Schedule: 5 a.m. to 8.30 a.m.
News at 7.30 a.m., but lot of interference (Gaden). (Most likely **XGOY,** on 31.58, the trouble.—Ed.)
JVW 7257kc, 41.34m
Schedule: 5 a.m. to 8.30 a.m.; News ot 6.5 a.m.
JLT 6190kc, 48.47m
No particulars, but believe same schedule as **JVW.** Fair at 7.15 a.m.
MTCY, Hsinking 15,330kc, 19.56m
Heard special test from 8.30 to 9.30 p.m. Languoges used, English and Italian. Signal R8, Q5 (Nelson).
MTCY, Hsinking 9545kc, 31.43m
Opens at 7 a.m. Signals only fair (Cushen, Johns). News at 7.5; closes at 7.50.—Ed.
MTCY, Hsinking 6030kc, 49.73m
Heard from 9.30 p.m. (Rogers).

Malaya:
ZHP-1, Singapore 9700kc, 30.92m
Schedule: 7.40 p.m. to 12.40 a.m.; News, 9 p.m. and 11 p.m.
ZHP-3, Singapore 7250kc, 41.38m
Schedule: 7.40 a.m. to 12.40 a.m. French and Malay.
ZHP-2, Singapore 6175kc, 48.62m
On parallel with **ZHP-1.**
ZHJ, Penang 6090kc, 49.26m
Relays B.B.C. at 9 p.m. Consider better than **ZHP-2** (Gaden).

Philippines:
(Manila, unless otherwise stated)
KZRH 9640kc, 31.12m
Schedule: 7.30 a.m. to 9.30 a.m. (News 8.15 a.m.); 6 p.m. to 2 a.m. (News 10.30 p.m.).
Very strong at night (Mitchellhill).
KZRM 9570kc, 31.35m
Schedule: 6.45 p.m. to 1.30 a.m. News, 8.35, 10.45 and 11.45 p.m., also 12.45 a.m.
Can be heard opening at 7.45 a.m.
KZIB 9500kc, 31.58m
Only fair from 8.30 p.m. onwards.
KZRF 6140kc, 48.86m
Fairly strong at 9.15 p.m. (Bantow).
KZRC, Cebu 6100kc, 49.18m
Very strong at 11 p.m.
KZIB 6060kc, 49.50m
Noise spoils this otherwise loud signal.

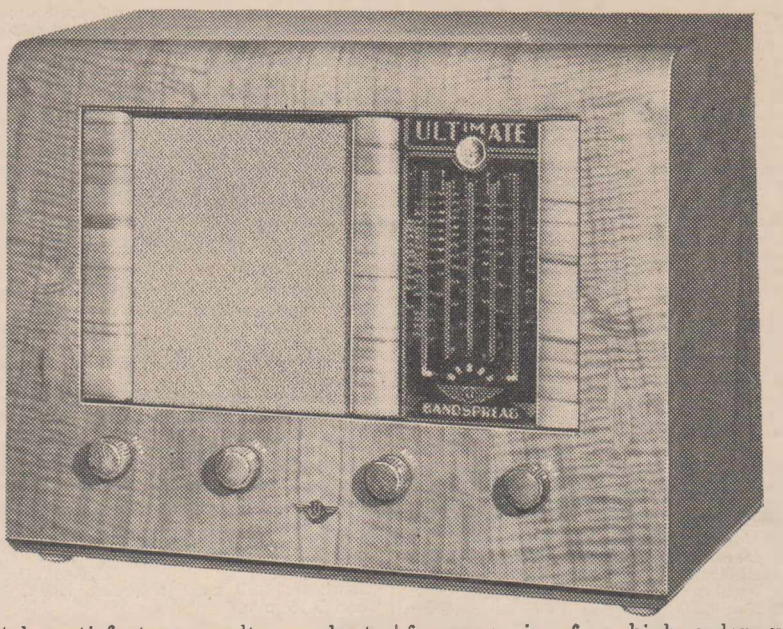
GREAT BRITAIN

"This Is London Calling"

E.T., Eastern Transmission; P.T., Pacific Transmission; Am.T., American Transmission; Af.T., African Transmission; Eur., European Transmission; Home, Home Service. News: P.T., 4.15 p.m., 6 p.m.; E.T., 9.00 p.m., 11 p.m., 2 a.m.; Af.T., 4.00 a.m., 6.45 a.m.; Am.T., 8.45 a.m, 10.00 a.m., 10.45 a.m., 2.30 p.m.; Eur.T., 6.00 p.m., 11.30 p.m., 8 a.m.; Home, 3.00 a.m., 6 a.m. Talks: P.T., 4 p.m., 4.30 p.m.; E.T., 9.15 p.m., 2.15 a.m. Newsreel: P.T., 5 p.m., 1.30 p.m.
GSV 17,810kc, 16.84m
E.T., 8.55 p.m. to 2.30 a.m.
GSP 15,310kc, 19.60m
P.T., 5.30 p.m. to 6.15 p.m.; Af.T., 5.30 a.m. to 8 a.m.
GSI 15,260kc, 19.66m
P.T., 2.57 to 6.15 p.m.; E.T., 8.55 to 11.30 p.m.; Af.T.. 2.55 a.m. to 5 a.m.

Latest Ultimates Feature Band-Spreading

Makes Short-waves Even More Effective



IT has always been a pleasure to review the performance of Ultimate receivers. Every Ultimate we have ever handled has been a good performer. The latest model of the Ultimates is another beauty, too.

Known as the Ultimate bandspread models the latest range of these fine receivers is fitted with full bandspread. Instead of attempting to cover the whole of the short wavelengths, the tuning is confined to the main shortwave broadcasting bands, so that each of these is spread right across a full swing of the dial. Tuning on the shortwaves is just as easy as on the broadcast band. With ordinary dual-wave receivers the tuning on the shortwaves is critical and many listeners miss more shortwave stations than they hear, simply because they tune right across them in a fraction of a turn of the dial control knob. Bandspread puts an end to all such difficulties and even a child can be sure of getting completely satisfactory results on shortwaves.

As might be expected of an Ultimate, the general standard of performance is of a high order, with extreme sensitivity and selectivity on the shortwaves, so that the addition of the band-spreading feature really means something in the matter of station getting. It might well be an idea for Ultimate to adopt a motto to indicate: "If a shortwave station can be received you'll get it easiest on an Ultimate."

A number of models are available with the band-spread feature, the particular model tested by us being a powerful job listed as a nine-valver, the magic eye tuning indicator being included.

This job has a highly efficient r.f. stage, a 6K8G convertor, an intermediate stage at 460 kc., and a powerful audio end with 6V6G beam power valves in push-pull. As might be expected, this audio end gives excellent tone, tons of volume and is quite free of hum.

Coverage

There may be some who will feel that something is being lost when the shortwave tuning covers only the actual broadcast station bands, from 16 to 17½ metres, 19 to 20, 24 to 26 and 30 to 32.

There are large gaps of the shortwaves which are not tuned at all.

We have no hesitation is reassuring those who may have doubts on this point.

At the present time the gaps are occupied only by commercial morse stations and no worth-while shortwave programmes are lost. The ad-

(Continued on page 41)

GSF 15,140kc, 19.82m
E.T., 8.55 p.m. to 2.30 a.m.; Af.T., 2.55 a.m. to 5.15 a.m., 6.45 a.m. to 8a.m.; P.T., 5,30 to 6.15 p.m.; 2.55 a.m. to 8 a.m.

GRV 12,040kc, 24.92m
Eur., 2.55 a.m. to 4.15 a.m. (News at 4 a.m.).

GSE 11,860kc, 25.29m
Eur., 8.55 p.m. ta 2.30 a.m.

GSN 11,820kc, 25.38m
Eur., 8.40 p.m. ta 1.30 a.m.

GSD 11,750kc, 25.53m
P.T., 2.57 p.m. ta 6.15 p.m.; E.T., 11.45 p.m. ta 2.30 a.m.; Af.T., 2.55 a.m. ta 8 a.m.; Am.T., 8.20 a.m. ta 2.35 p.m.

GRX 9690kc, 30.96m
Eur., 2.55 a.m. to 8.30 a.m., 8.40 a.m. to 12.30 p.m. (Spanish and Portuguese), 6 p.m. ta 8 p.m. News, 8 a.m. and 6 p.m.

GRY 9600kc, 31.25m
P.T., 2.57 p.m. to 5 p.m.; Af.T., 2.55 a.m. to 8 a.m.; Am.T.. 8.20 a.m. to 2.35 p.m.

GSC 9580kc, 31.32m
Am.T., 8.25 to 2.35 p.m.

GSB 9510kc, 31.55m
P.T., 2.57 p.m. to 6.15 p.m.

GRU 9430kc, 31.75m
E.T., 11.45 p.m.to 2.30 a.m. News, 2 a.m.

GSW 7230kc, 41.49m

GRT 7150kc, 41.96m

GRS 7065kc, 42.49m
Home, 2.30 p.m. to 6 p.m. News, 4 p.m.

GRR 6075kc, 49.38m
Home, 2 a.m. to 8 a.m. News, 3 a.m., 6 a.m. and 8.45 a.m.

GSA 6050kc, 49.59m
Eur., 2.30 p.m. to 8 p.m., 2.55 a.m. to 9 a.m.
News, 6 p.m. and 8 a.m.
Good at 4 p.m. and 8 a.m. (Gaden).

EUROPE

France:
(Of course, Nazi controlled)

PARIS MONDIAL 15,240kc, 19.68m
Heard irregularly.

PARIS MONDIAL 11,840kc, 25.33m
Schedule: 1 a.m. to 7.30 a.m.; occasionally from 2.15 to 2.30 p.m.

"Y" 9520kc, 31.51m
Schedule: 7.50 a.m. to 2 p.m. News, 11.30 a.m. to 1.30 p.m. At 1.50 listen to Gertie in "Hot Off the Wire."

Germany:
"Station Ananias," despite references to Bremen, Hamburg, etc., is counted as coming from Berlin.
Lord "Haw-Haw": **DJW**, 31.09m; **DJQ**, 19.63m, and **DXM**, 41.27m.

DJH 17,845kc, 16 81m
Schedule: 5.30 p.m. to 2 a.m. News, 7.30 p.m. and 10 p.m.
Erratic.

DJE 17,764kc, 16.89m
Schedule: 5.30 p.m. to 11 p.m. News, 7.30 p.m.
As usual, in winter, erratic also.

DZG 15,360kc, 19.53m
Heard at midnight (Muller).

DJR 15,340kc, 19.56m
Schedule: 3 p.m. to 2 a.m. News 5 p.m. and 10 p.m.
Erratic. Some nights signal is splendid, but it is often 10.30 or 11 before good.

DJQ 15,280kc, 19.63m
Schedule: 4.30 p.m. to 2 a.m. News, 5 p.m., 10 p.m. and midnight.

DJB 15,200kc, 19.74m
Schedule: 7.50 a.m. to noon. News, 9 a.m. and 11.30 a.m.

DJL 15,100kc, 19.85m
Schedule: 1.40 a.m. to 3.15 a.m. News, 2.15 a.m.

DXH 14,460kc, 20.75m
Irregular; sometimes fair at 7 a.m.

DZE 12,130kc, 24.73m
Heard opening with an R9 signal at 1 a.m.

DJP 11,855kc, 25.31m
Schedule: 6 p.m. to 2 a.m. News 10 p.m.
Excellent at 10 p.m. Good at 4 and 6 p.m.

DJD 11,770kc, 25.49m
Schedule: 1.40 to 7.25 a.m. News, 2.15, 5.15 and 7.15 a.m. Talk at 3.30 a.m.
7.50 a.m. ta 2.05 p.m.

DXB-2 .... 11,740kc, 25.55m
Very good at 11 p.m. Opens at 11 with N.B.C. service.
DXP 49.75m
Schedule: Noon to 4 p.m. News, 1.30 and 3 p.m.
DZD 10,544kc, 28.45m
Schedule: 7.50 a.m. to 4 p.m. News, 1.30 p.m. and 3 p.m.
DZA 10,087kc, 29.75m
Strong at 5.30 to 6.30 a.m.
DZB 10,040kc, 29.86m
Excellent at 6.30 a.m. (Rogers).
DJX 9675kc, 31.01m
Schedule: 1.40 to 7.25 a.m. News, 2.15 and 7.15 a.m. Talk. 3.30 a.m. and 6.45 a.m.
DJW 9650kc, 31.09m
Schedule: 3 p.m. to 2 a.m. News, 5 p.m., 10 p.m. and midnight.
Good in afternoon (all reporters).
DXB 9610kc, 31.22m
Not heard lately.
DJA 9560kc, 31.38m
Schedule: 2.30 a.m. to 6 a.m. News, 2.30, 3.30 and 5.30 a.m.
DJN 9540kc, 31.45m
Not heard lately.
DXM 7270kc, 41.27m
Schedule: 6 a.m. to 8 a.m. News, 6.30 a.m. and 7.30 a.m. by Lord Haw-Haw.
DJC 6020kc, 49.84m
Schedule: 3.40 to 7.25 a.m. News, 5.15 and 7.15 a.m.
Excellent signal at 7.15.

Holland:
PCV, Amsterdam 18,070kc, 16.6m
Can be logged when noise abates. Much better after midnight (Nelson).
PCJ-2, Huizen 15,220kc, 19.71m
Opens at 9.30 p.m. Like **PCV,** better after midnight (Nelson).

Portugal:
CSW-6, Lisbon 11,040kc, 27.17m
Schedule: 3 a.m. to 6.45 a.m.
Very good at 5 a.m. Best at 6 a.m.
CSW-7, Lisbon 9740kc, 30.8m
Schedule: 6.50 to 9 a.m. Talks: On Wednesday, Friday and Sunday from 6.50 a.m. to 7.30 a.m.
CS2WD, Portugal 6200kc, 48.38m
Schedule: 6 to 9 a.m.

Rumania:
Radio Bucharest 9245kc, 32.45m
Fair at 5 a.m.

Russia:
("This is Radio Centre, Moscow, calling")
RW-96 .... 19.47m
Schedule: 8 p.m. to midnight.
Only fair at present.—Ed.
RW-96 .... 15,180kc, 19.76m
Schedule: 2 p.m. to 5.30 p.m., midnight to 3.30 a.m. News, 1 a.m.
RWG 14,720kc, 20.38m
Irregular.
RNE 12,000kc, 25.00m
Schedule: Noon to 6 p.m., physical jerks; 12.30 and at 1.20 p.m., 10 p.m. to 11 p.m. News, 10.30 p.m.
RAL/RVG 11,645kc, 25.77m
Irregular.
RW-15, Khabarovsk 9565kc, 31.36m
Schedule: 6 p.m. to midnight.
Back again and therefore bad luck for **KZRM.** Plenty of music.
RW-96 .... 9520kc, 31.51m
Schedule: 12.30 p.m. to 1 p.m. (English). 10 p.m. to 8 a.m.
News, 4.30 and 6 a.m.
RKD 8035kc, 37.33m
Closes at 7 a.m. (Cushen).
RW-15, Khabarovsk 6115kc, 49.06m
Fairly strong at 7 p.m. (Bantow).
RW-96 .. .. 6061kc, 49.5m
Midnight to 8 a.m. News, 6 a.m.
RV-59 .... 6030kc, 49.75m
Irregular.
RW-96, Moscow 6000kc, 50.00m
Irregular.
RV-15, Khabarovsk 4273kc, 70.2m
Very fair signal.

Spain:
EAQ, Madrid 9860kc, 30.43m
Good in mornings.
Radio Espagna, San Sebastian, .7210kc. 41.6m
Fair at 6.30 a.m.
EAJ-9, Malaga 7170kc, 41.75m
Good at 6.30 a.m.
EAJ22, Oviedo 7140kc, 42.02m
This new Spanish station is heard around 6.30, but fades out just after chimes are heard at 7 a.m.
Radio Malaga, Malaga 7120kc, 42.1m
Heard at fair strength at 6.30 a.m.

Switzerland:
HBH, Geneva 18,480kc, 16.23m
Schedule: 11.45 p.m. Fridays to 1.10 a.m. Saturdays. Mostly English, little French. News 12.5 a.m., 11.45 p.m. Mondays to 1.10 a.m. Tuesdays, Italian. German and French.
HBJ, Geneva 14,535kc, 20.65m
First Sunday in the month. 3.45 p.m. to 5.10 p.m.
HBO, Geneva 11,420kc, 26.31m
Same remarks as **HBJ.** Fair signal.
Very good on June 2.
HER-3, Schwarzenburg 6165kc, 48.66m
Schedule: 2.40 p.m. to 3.37 p.m. Good signal. 3.30 a.m. to 7.05 a.m. Splendid signal.

SCANDINAVIA

Denmark:
RADIO DENMARK, Copenhogen
9680kc, 30.99m
Heard from 3.30 to 3.45 p.m. Station announces "You hear Radio Denmark" (Edel).

Finland:
OFE. Lahti 11,780kc, 25.47m
Schedule: 1.30 a.m. to 8 a.m. (News, 4.15 and 7.15 a.m.); 3.30 p.m. to 6 p.m.
OFD, Lahti 9500kc, 31.58m
Schedule: 1.30 a.m. to 8 a.m. News, 4.15 and 7.15 a.m.

Norway:
LKQ, Oslo 11,735kc, 25.57m
Schedule: 3.05 to 6 p.m.; 1.30 to 7.30 a.m.

Sweden:
SBT, Stockholm 15,150kc, 19.8m
Schedule: 6 p.m. Sundays to 7 a.m. Mondays. Daily: 3.56 a.m. to 7.15 a.m.
SBP, Stockholm 11,710kc, 25.63m
Schedule: 3.56 a.m. to 7.15 a.m.; 4.40 pm. to 6 p.m. (Sundays, 6 p.m. to 7 a.m. Mondays).
SBO, Stockholm 6060kc, 49.46m
Schedule: 7.18 a.m. to 8 a.m. News, 7.20 a.m.

MISCELLANEOUS

Azores:
CT2AJ, Ponta Delgada 4002kc, 75.00m
Schedule is believed to be: Thursdays and Sundays, 11 p.m. to 1 a.m.
Heard call-sign at 11 p.m. (Taylor). (See reference under "New Stations."—Ed.)

Arabia:
ZNR, Aden 12,110kc, 24.76m
Poor at 3.30 a.m. (Byard). R5 (Cushen).

Canada:
CJRO, Winnipeg 6150kc, 48.78m
Heard till 3.30 p.m. on occasions (Cushen).
CRCX, Toronto 6090kc, 49.26m
Quite good at 4 p.m. (Gaden).
CKFX, Vancouver 6080kc, 49.34m
Schedule: 12.30 p.m. to 6 p.m. (Sundays to 7.30 p.m.).
Heard regularly 4.45 to 5 p.m.
CFRX, Toronto 6070kc, 49.42m
Still going at 4.15 p.m. (Gaden).
CJCX, Sydney, Nova Scotia 6010kc, 49.92m
Heard faintly at 10 p.m. (Rogers).
RADIO CANADA, Quebec 6160kc, 48.70m
Good from 9.30 p.m. till 10 p.m., then **TILS** opens and upsets things (Cushen, Bantow).

Greece:
SVM, Athens 9935kc, 30.196m
SVM, Athens 7075kc, 42.4m

Iraq:
HNF, Baghdad 9770kc, 30.69m
Heard testing around 3.35 to 4 p.m. (Hallett).

Iran (Persia):
EPB, Teheran 15,100kc, 19.85m
Now and again between 8 and 8.30 p.m.
EQB, Teheran 6155kc, 48.74m
Schedule is: 11.45 p.m. to 6 a.m. News 4.30 a.m.
Good station (Rogers).

Syria:
RADIO FRANCAIS, Libre D'Orient
9045kc, 33.17m
R5 opening at 3 a.m.

Newfoundland:
VONG, St. John's 9475kc, 31.68m
Schedule: 11.30 p.m. to 3.30 a.m.
VONH, St. John's 5970kc, 50.25m
Schedule: 7.30 a.m. to 12.30 p.m.

Turkey:
TAP, Ankara 9465kc, 31.70m
Schedule is: Midnight to 6.30 a.m. News at 4.15, and on Sundays English at 5.50. Excellent signals. Splendid dance records Now giving news in English at 8.10 on Sundays and 8.20 week-days (Rogers).
Heard well in N.Z. (Johns).

Location Unknown:
"Christian Peace Movement," 9440kc, 31.76m
Between 5.45 and 6 a.m. Not reported this month.

Location Unknown:
EUROPEAN REVOLUTIONARY STATION
9658kc, 31.06m
Heard from 7 to 7.20 a.m. This anti-Fascist station announces they are on 31.2m and schedule is: 3 a.m., 5 a.m., 7 a.m., 9 a.m., 10 a.m. and 3 p.m. Both 7 a.m. and 3 p.m. sessions are heard at good strength (Edel, Gaden, Muller).
UNCONNU 30.77m
This is the name of my Free French station that closes at 6 a.m. The location, as the name of the station implies, is unknown.

WEST INDIES

Cuba:
Havana unless otherwise mentioned
COCY 11,460kc, 26.17m
Schedule: 11 a.m.-2.55 p.m.; 9.45 p.m. to midnight.
Fair at 7 a.m. and 10 p.m. (Nelson).
COCM 9835kc, 30.51m
Schedule: 11 p.m. to 3 p.m.
Fair morning or night (Nelson). Weak at 3 p.m. in N.Z. (Johns).
COBC 9360kc, 32.04m
"El Progresso Cubano." Fair at 11.10 p.m. and also in mornings.
COCY, Havana 9230kc, 32.46m
Very good when closing at 3 p.m. (Gaden).
COCX 9200kc, 32.61m
Heard well nightly from 11 (Rogers).
COBZ 9030kc, 33.32m
Closes at 4 p.m.; English announcement. Fair signal (Johns).
COCQ 8850kc, 33.90m
Schedule: 9.45 p.m. to midnight.
Gives religious service at 11 p.m., English and Spanish. Good signal (Nelson).
COCO 8700kc, 34.48m
Schedule: 10.30 p.m. to 3 p.m. next day.
One of the best Cubans. Heard some nights from 8 p.m. with advertisements in English and refers to **CMCK,** Miami, Florida.
COJK, Camaguey 8665kc, 34.62m
Good till 9 a.m.; good at 3 p.m.; closes at 3.30 p.m. (Gaden, Rogers).
COHI, Santa Clara 6455kc, 46.48m
Schedule: 9.45 to midnight.
Also heard at 3 p.m. Good (Gaden).
COCQ 6375kc, 47.06m
Good between 9.45 p.m. and midnight. Heard R max. when closing at 4 p.m. (Gaden).
COCW 6324kc, 47.47m
Improving from 9.30 p.m. (Rogers).

Haiti:
HH3W, Port-au-Prince 9883kc, 30.35m
R7 at 5.45 a.m. (Byard).

Dominican Republic:
HIIN, Trujillo City 12,486kc, 24.03m
Heard weakly some nights at 10 p.m. (Nelson).
HI2G, Trujillo City 9295kc, 32.28m
Occasionally heard at 2.30 p.m. (Gaden).
HI3U, Santiago 6020kc, 49.43m
Opens faintly just after 10 p.m.
HIIJ, San Pedro de Macoris 5970kc, 50.25m
Closes at 3 p.m. with march (Cushen).

Martinique:
RADIO MARTINIQUE, Forte-de-France
9705kc, 30.92m
Can be heard weakly at 8.30 a.m. (Gaden).

SUBSTITUTE VALVES

(Continued from page 14)

supply is not a series arrangement as in A.C./D.C. circuits.

59—2A5—Change socket (medium 6 pin).

2A6—75—2.5/6v. transformer.

2A7—6A7—2.5/6v. transformer.

2B7—6B7—2.5/6v. transformer.

5Z3—83V—To be used only when the plate voltage does not exceed 375 R.M.S. per plate and the maximum current required 175 mA.

55—85—2.5/6v. transformer.

6K7 —6K7GT—In some cases it may be **6K7G** necessary to lengthen the grid lead to the top cap.

41—41—Provided filament current is not important, this substitution will be satisfactory.

56—57—Medium 6-pin socket. Connect as triode. (Screen and supp. grids tied to plate). Alter grid lead from socket to top cap.

76—6J7G—Octal socket. Connect as triode (screen and supp. grids tied to plate). Alter grid lead from socket to top cap.

E424—6J7G—4v. to 6v. transformer. Octal socket. Screen and supp. grids tied to plate. Grid lead connected to top cap of valve instead of at the socket. This substitution is dependent upon circuit arrangements and function of the E424 in any specific apparatus.

E406N—45—1.0 ohm resistor in series with filament (to carry 1.5 amp. bias resistor 1500 ohms, 36.0 mA, -56v.). Differences in power output and distortion may be expected because of output transformer "load impedance" requirements; in the case of E406N it is 2500 ohms, and for type 45, 4600 ohms. This may or may not be of importance, depending upon the nature of the apparatus the E406N is used in.

A209—30—No change required.

A409—30—33.3 ohm resistor in series with filament (to carry 60 mA).

A609—01A—4.0 ohm resistor in series with filament (to carry 0.25 A) or type 30 with 66.6 ohm resistor in series with filament (to carry 60 mA).

A642G—32—66.6 ohm resistor in series with filament (to carry 60 mA). Change plate lead on top to grid lead. Screen grid voltage 67.5 maximum.

A442G—32—33.3 ohm resistor in series with filament (to carry 60 mA). Change plate lead on top to grid lead. Screen grid voltage 67.5 maximum.

B217G—30—In transformer coupled stages with 135 volts on the plate, it will be necessary to increase the bias to -9 volts (Class A conditions).

B262G—32—Change plate lead on top to grid lead. Screen grid voltage 67.5 maximum.

B255G—34—Change plate lead on top to grid lead. Screen grid voltage 67.5 maximum.

KF1J—1K5G—Change plate lead on top to grid lead. Adjust screen grid voltage to 67.5 volts. Fit shield can around tube. Octal socket.

KF-J—1K5G—Change plate lead on top to grid lead. Adjust screen grid voltage to 67.5 volts depending upon what the tube is used as, i.e., detector, resistance-coupled amplifier, etc. This substitution may be unsatisfactory if KF1 is used as autodyne first detector in a superhet. It should then be changed for 1C7G and new oscillator coil fitted and voltages adjusted. Octal socket. May require a shield can.

KF4—1K5G—Octal socket. See also remarks for KF1 as autodyne detector in superhets. Maximum screen grid voltage 67.5.

KBC1—1B5—Change socket (small 6-pin). May require shield can.

C243N—KL4G—Octal socket.

AZ3 — 6X5GT/EZ3 — 4v. to 6v. transformer. This is only O.K. provided the maximum current required by the apparatus does not exceed 70 mA. If this current is exceeded, a 5V4G should be used, which necessitates a 4v. to 5v. transformer and a change of socket from P to octal type.
The cathode of 5V4G is connected directly to the heater, where, as in the AZ3, it is separately connected. In most cases this is of no importonce, but the circuit should be examined to make sure of this.

EZ3—6X5GT/EZ3—This is O.K. provided the maximum current required by the apparatus does not exceed 70 mA.

TRADE NOTES

Rola Data Available

Available to all readers is a leaflet just released by Rola, giving abridged specifications of the full range of Rola speakers, also the new price list for all models.

An interesting section deals with repair work, giving the prices charged for the various replacement and adjustment work which can be carried out by the various Rola service depots.

The Rola range of speakers is comprehensive, covering from the smallest speaker on the Australian market, up to the new high-fidelity G12 permagnetic, listing at 11 guineas. The smallest is the K5, which has a four-inch cone and about five-inch overall width, with particularly shallow depth. It lists at 26/3.

The leaflet contains much valuable data, and readers are advised to make sure they get a copy by writing to Rola at 116 Clarence Street.

Recently appointed as Managing Director of The Clyde Engineering Co. Ltd., Granville, Mr. D. J. Nolan brings to this old-established firm many years of practical experience.

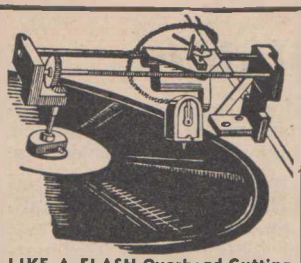
LEVENSON'S WIRELESS

Wholesale, Retail. Wholesale, Retail.

Games, Hobbies, Novelties, and Slot Machine Specialists.

226c PITT STREET, SYDNEY

Everything from A to Z in Radio at Sane Profit Prices.
'Phones: M 2525 and M 2526-7. Goods forwarded C.O.D. Post or Rail. (C.O.D. Mail within N.S.W. only. Not Interstate). We welcome Prepaid Telegrams and Long-Distance 'Phone Calls.



LIKE-A-FLASH Overhead Cutting Head and Cutting Gear £5/5/-.

HOME RECORDING

MAKE YOUR OWN RECORDINGS. Cutting head and overhead cutting unit complete, £6/6/-. Plain Records, 2/11, 3/11, 4/11, 5/11. Cutting Needles, 2/-. Aluminium discs, 1/-, 1/6. Special price in trade lots.

Little Jim's Mate BATTERY SET. In neat cabinet, with 'phones and all batteries. £3/16/5. Ready for use. Charts, 6d.

Fixed CRYSTAL DETECTORS, 2/6, 3/6. Semi-fixed Crystal Detectors, 2/6, 5/6 6/6. Rubber Headphone Pads, 2/6.

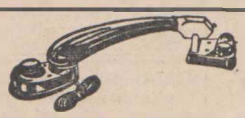
Pick-up Heads. Fit and suit all tone arms and gramophones. For operating gramophone through radio. 15/-, 19/6 each.

Reconditioned Hygrade 'phones, 15/-, 17/6, 20/-. Headphones—12/6, 15/-, 17/6, 21/-. Ericsson's Professional 4,000-ohm 'phones, 47/6.

Radio and other Publications Learn Morse, 1/-. Radio Dictionary, 1/-. Beginners' Radio Book, 1/-. Everyman's Radio Book, 5/6. The Television and Short-wave Handbook, 5/6.

"PRESTO" THE MAGIC BOX The most Amazing Trick — Just out

"Presto"— the grandest, most alluring and outstanding little trick ever introduced. 2/9, post free. Special quantity price.



COSMOCORD CRYSTAL TYPE BRITISH BUILT AND DESIGNED GRAMOPHONE PICK-UP DE LUXE, with volume control built in as illustrated, 59/6.

AMPLION British built Gramo-Radio Pick-up with volume control. Moulded bakelite tone arm. List Price 37/6 Now 32/6.

Just landed! B.G.E. MICROPHONES. Table model. As good in performance as £6/6/- types. NOW 45/. Complete with Volume Control.

SPECIAL! SPECIAL!
Cosmocord Crystol Pickup
British monufacture
84/-
Now 49/6
Special price to traders, lots of 6 or more

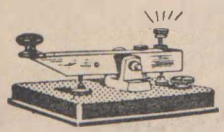
VALVES. MADE IN U.S.A.

Type	Price	Type	Price
57	10/6	85	12/6
58	10/6	6D6	11/-
38	12/9	6C6	11/-
32	11/3	6A7	11/9
2A5	10/6	1D8-Gt	24/3
2B7	14/-	42	12/-
27	11/9	2A7	13/6
6E5	5/-	71A	11/9
19	13/6	47	13/3
5K3	8/9	75	11/-
6J7	11/3	1A7G	15/-
2B7	10/-	30	11/-
6H6	12/9	80	9/6

VALVES AT SANE PROFIT PRICES. ALL GUARANTEED.

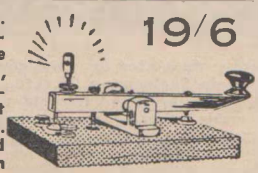
New 227 Valves, 5/9; used, 3/6. New 4XP, 5/-; S215, 5/-; MH4, 2/6. 38, 78, used 5/6. Raytheon B.H. Rectifier, new, 15/-; DU10, 5/-; 2A6, 35, used, 5/6. Used 224, 5/6. 610RC, 610XP, new, 6/6. Used 42, 5/6. New 41MRC, ML4, 3/-. 44SU Rectifier, 5/-. PM22, new, 7/6. Used 1C6, 6A7, 6A8, 6B7, 6U7, 6F6, 6F7, 6L7, 6/6. Used 57, 58, 59, 6/6; 201A, 3/6; A409, 6/6; A615, E406; E452, 6/6. Used PM6, PM5B, A609, 6/6. Used 6J7, 6J8, AL2, EK2, 2B7, 226, 5/6. New PM12, PM2A, 18/-. Let's know your valve wants.

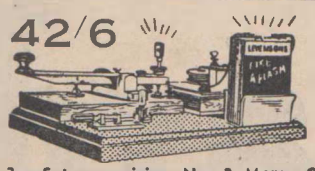
Cone Speaker Units. Leading makes. Were up to 35/-. Now 7/6 and 10/6.



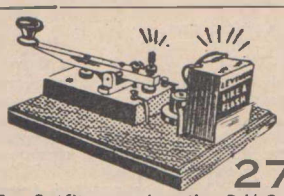
No. 1. — Adjustable Morse Code Key, with long or short tapper arms, splendidly made and finished. Strong reliable heavy plated fittings mounted on bakelite moulded base, 12/6.

No. 2.—P.M.G. Type adjustable Morse Code Key, strong and reliable; will last a lifetime. Heavy plated fittings on thick solid wooden base. Perfect action.

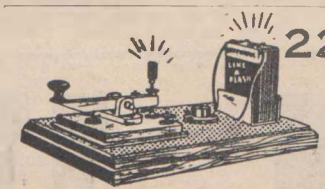




No. 3.—Set comprising No. 2 Morse Code Key P.M.G. Type, with light. Professional De Luxe Buzzer Battery. Throw-over Switch for buzzer or light. Use as required. Mounted on baseboard. Complete.



No. 5.—Outfit comprises the P.M.G. No. 2 Morse Code Key, with adjustable buzzer and battery all mounted on a stained baseboard, ready for immediate operation. Battery included.



No. 6.—A real good little outfit which incorporates the No. 1 adjustable Morse Code Key, in moulded bakelite base, with a smart little adjustable buzzer all complete to operate. Junior model, 13/6.

Rough Gunmetal Castings of Model Planes

•

Write for Full List

Rough-cast Propellor, with space for clock mounting in hub; length, 11," and stand 5/6
Rough-cast Ashtray, with mounting standard; diameter 4" 3/9
Rough-cast tear-drop shaped Ashtray, with mounting standard; length, 6" 3/6
Rough-cast Circular Concave Ashtray, with mounting standard, diameter 4¼" 3/9
Rough-cast Model Planes. Need little filing and finishing.
Comet, 3/-; Spitfire, 2/6; Hurricane, 2/6; large Fairey Battle 4/-; Hudson, 2/6; large, 6/9; large Flying Boat, 12/6; Skua, 3/9; Wirraway, 2/9, 3/-, 4/-; Anson, 2/6; Curtis, 2/9; Douglas, 3/-.
Chromed Ribbed Spun Metal Ashtry with standard (curved or straight) for mounting Plane Model; diameter, 6"; height, 1¾" 6/-
Chromed Hurrican, Lockheed, Spitfire or Wirraway Plane Model mounted on tear-drop shaped Ashtray 22/6

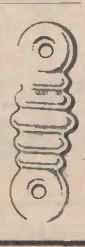
PLEASE ADD SUFFICIENT POSTAGE

Large-size Hydrometers, 3/.

Nickel-cased two-reading Low and High Voltage Meters, 4/6.

Nest of 4-in-1 Metal or Bakelite Fountain-pen-size SCREWDRIVERS, 2/6.

Radio Amateur Call Book. 1938 copy, 5/-.



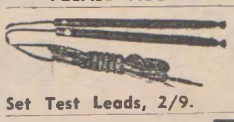
No. 102 — "Like-a-Flash" adjustable Buzzer. 4/6. Bakelite Case High Pitched.

Special price trade lots.

At left: PYREX TYPE INSULATORS. 3" barrel type, 1/-. Pyrex, 4," 3/6; 5½," 6/6; 7½," 30/-.

Ormond Slow Motion Front Panel 2-action Vernier Dial, 8/6.

P.M.G. type Heavy Brass FITTING SOUNDERS 35/-



Set Test Leads, 2/9.

Three - Reading Pocket Meters. 0 to 8, 0 to 180 volts, 0 to 30 M/A. 10/6.

Police Patrol Multi-Strand Rubber-covered Aerial. Needs no separate lead - in. 50ft., 2/6; 100ft., 5/-.
Man - o'- war Heavy Duty Insulated Aerial, multi-strand wires, 50 ft., 5/-; 100 ft., 10/-.

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

V.P. (Williamstown, Vic.) asks about "magic' tuning control and gramophone pick-ups.

A.—These devices are actually small transmitters, and as such are frowned upon by the radio inspectors, and we do not care to describe them in our columns. Operated as intended, they should have a range of only fifty feet or so, but we wouldn't be at all surprised if somebody managed to get one to feed into the power supply and make every radio set in the district take that programme, whether desired or not. Usually a 6A8 or similar frequency chonger is used as an oscillator, modulated by the output of the pick-up. The output is radiated by a short aerial and actually picked up as an r.f. signal by the set in the same way as ordinary broadcast signals are picked up. Our tip is to leave well alone. It's easy enough to get into trouble in more profitable ways!

* * *

"Country Lass" (Mudgee) enquires about work in radio factories.

A.—You wouldn't have the slightest trouble to get a job in a radio factory, but we doubt if your radio knowledge would be any great help in this direction for a start. We expect you would have to do process work, and no particular technical knowledge is required. After a time you would doubtless manage to impress the boss with your ability and get ahead. We doubt if there are any female employees doing laboratory work or final testing, but we can't see any reason why not. Let us have further details of your knowledge and some idea of the salary you would require and we'll do what we can to put you in touch with the right people.

* * *

V.H.McN. (Longreach, Q.) wants a sensitive household receiver and suggested the use of the auto-radio circuit from a recent issue, but with two stages of intermediate amplification.

A.—The idea sounds all right, but we feel a little doubtful about the noise level, especially with two i.f. stages and the vibrator. With batteries you can get away with it, but with high-gain a.c. type valves there might be a chance that the overall noise level would be too high to allow the set to be operated at maximum sensitivity. With a view to getting less noise and a more effective signal we would feel inclined to suggest a straight battery set with plenty of audio gain. However, if you have the charging facilities, you could give the circuit a try and, if the worst comes to the worst, you can easily bridge over the second intermediate if not required. Special attention may be needed to shield the vibrator and take other steps to keep the noise level down. Don't overlook the advantages to be gained from a really efficient outdoor aerial.

* * *

T.M. (Campsie) asks whether our experimental sets are for sale.

A.—No, we do not sell sets or build them to order. We leave work of that kind to our advertisers, who will be pleased to quote you. There should be no doubt about the set being properly built and capable of giving performance up to the standard of the original. We always cut down our sets after they have been photographed.

* * *

J.L.P. (Katoomba) wants to know why we now specify only the 6J8G converter valve whereas a few months ago the only type specified was the 6K8G. He enquires whether there is much difference in the performance of these valves and whether the two types are interchangeable.

A.—The reason for the standardisation on the 6J8G was simply that the coil manufacturers got together and decided to recommend it. Previously we had a personal preference for the 6K8G. However, since changing over we also have found that the 6K8G is perfectly satisfactory in every way. We doubt if there is any noticeable difference in performance. In most cases the valves can be changed without results being affected in ony way. Theoretically, there is considerable difrence in the characteristics of the two types, but in actual practice there are compensating effects which balance out.

* * *

R.E.M. (Gulgang) asks if tubular condensers are likely to be damaged if the pigtail leads are cut short.

A.—It is not advisable to cut the pigtails so short that undue heat will reach the inside of the condenser when it is being soldered into position. It is also inefficient to leave the full length of pigtail. Much will depend on the particular circumstances prevoiling, the position of the terminals, etc., but a handy length is about half an inch, which should allow you to moke an effective connection without any chance of the heat from the soldering iron melting the internal connection between the pigtail and the foil.

ULTIMATE BAND SPREAD

(Continued from page 37)

vantage of having the band-spread tuning far outweighs the loss of the useless wave-lengths in between.

In addition to the assistance of the band-spreading there are several features to make the latest Ultimates a pleasure to operate. For one thing, the dial action is superbly smooth, and is provided with flywheel action, so that a slight spin on the knob will send the pointer right from one end of the dial to the other. Another wonderful assistance on shortwaves is the accuracy of the calibration. If you expect to hear a station on 16.7 metres you just tune the Ultimate to that wavelength and there you'll find the station.

Still another feature which makes for easy tuning is the efficiency of the magic eye. With most sets the magic eye is o.k. on the broadcast band but is not sufficiently sensitive to give a satisfactory indication on shortwaves. Keen attention to this detail by the engineers responsible for the design of the Ultimate, however, has resulted in its operation being just as effective on the shortwaves as on the broadcast.

Construction

All of the above remarks deal with the operation of the set and the charm which seems to be built into these Ultimates. Actually there is no secret about this charm. It comes from within. It is the direct result of careful design, the use of good components and perfect workmanship in their assembly. The calibration, for example, and the way it is maintained, is only possible with a receiver equipped with trimmer condensers which will maintain their capacity throughout a wide range of variations of temperature and humidity. In the Ultimate they are of special ceramic construction. This is just an example of the thoroughness which is typical of Ultimate receivers.

Further Details

Full specifications, pamphlets, and other details of all the Ultimate models can be obtained by writing direct to the distributors, George Brown and Co. Pty. Ltd of 267 Clarence Street, Sydney, mentioning "Radio World." Ultimates are available for either a.c. or battery power.

E.H.G. (Caulfield, Vic.) wants to know whether we consider that a pair of 6V6G valves can give better quality reproduction than a pair of triodes.

A.—Modern arrangements of push-pull 6V6G type beam power valves are capable of being designed to give excellent tonal quality, especially those using resistance-caupled phase-changers, with inverse feedback. Properly designed, such an amplifier can handle practically the whole of the spectrum of audio frequencies without appreciable discrimination. Inverse feedback, such as used in our compensated acoustic circuits, will bring the level of harmonic distortion to a percentage which should make it indistinguishable to even a trained ear. Of course, it is also possible to obtain similar performance from an amplifier using triode valves, but valves of this type are not readily available at present.

* * *

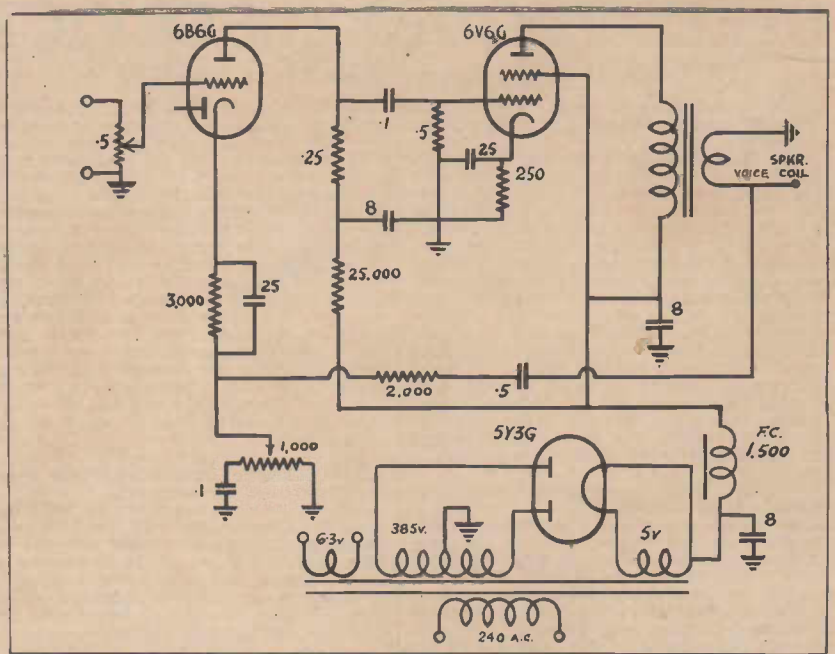
B.P.C. (Rockdale) enquires about intermediate transformers.

A.—We would advise the permeability-tuned transformers, and we think that you would find they were really the most efficient if you could make an accurate check of both gain and selectivity. It's easy enough to get either of these two features, but to get both calls for increased efficiency. We do not expect the difference to be staggering, however, and it isn't likely to mean the difference between a station coming in at a whisper and roaring in at full loud-speaker strength.

* * *

A.R.G. (Clovelly) has been trying his hand at electric spot-welding, using a radio transformer.

A.—The whole trouble is simply that the filament winding is designed to deliver a current of about four or five amperes, whereas when doing the welding in the way you mention you have practically a short-circuit, and the current drain would run up to fifty or a hundred amperes. At least, it should run up in this way, but, owing to the gauge of wire used for the winding being so small, the internal resistance is sufficient to cause a heavy voltage drop at the heavy current. It would not be advisable to attempt to connect the various filament windings in parallel, as they may not have exactly the same voltage. You might manage to get away with the two 2½-volt windings in parallel, but don't attempt to put the other winding in parallel. Even at the best you would still be far below the required current rating for serious work. We suggest that a suitable transformer for the job would be well worth its cost.



In response to several requests we publish above an alternative circuit for the "Porto-Gram," featuring acoustic compensation but no volume expansion.

MULLARD MODEL 67

(Continued from page 29)

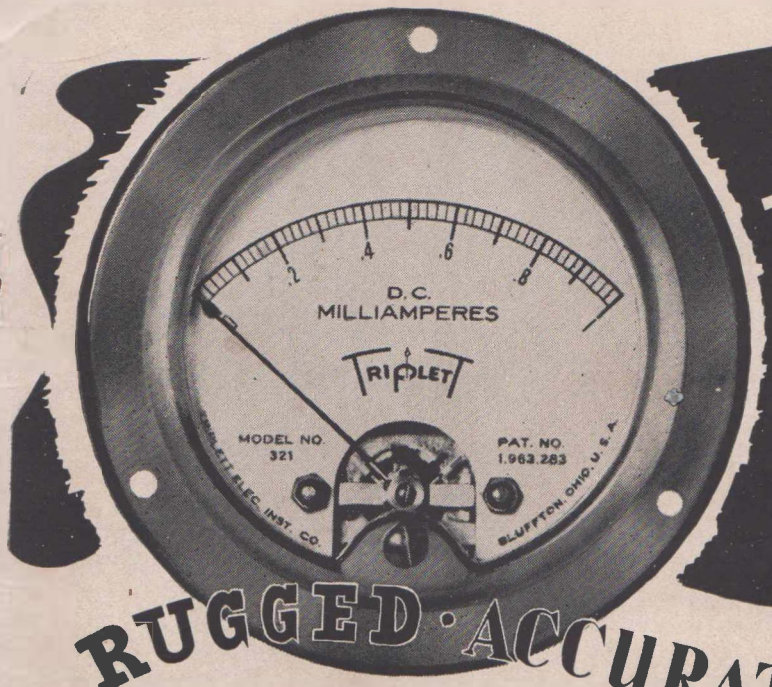
lectivity, yet is not at all extravagant, either in initial cost or upkeep.

Five valves are employed, all of the rugged two-volt series. The circuit employed is not by any means a trick one, following out accepted good practice by using an r.f. stage ahead of the converter valve, with a three-gang tuning condenser. Keen attention has been paid to every minor detail having any bearing on efficiency, however, and the extraordinary performance is the result.

The Mullard model 67 is a dual-waver, with the short-wave band covering from 16 to 50 metres. For the short-wave tuning the dial has each of the short-wave broadcasting bands divided up into lettered squares. This idea is a great help to short-wave listening as it allows the operator to take a logging record of each station heard, making it a simple matter to know exactly whereabouts on the dial to find that same station when it is next required.

Altogether this Mullard battery set is a splendid performer and an excellent proposition.

Further details can be obtained by writing to Mullard (Australia) Pty. Ltd., at 367-371 Kent Street, Sydney.



Model 321 D.C., actual size

TRIPLETT
Precision Built INSTRUMENTS

RUGGED · ACCURATE · DURABLE

. . . built in many types and sizes!

Triplett instruments have established a new standard of quality in the field. Precisian accuracy at law cost, simplicity with extreme ruggedness and bridge type construction are features that evidence the most approved engineering practice.

Magnets of laminated canstruction have each lamination exactly gauged after hardening, thus assuring accurate printed scale characteristics. This is one reason accuracy of scales, when not hand-drawn, can be as low as 1%.

Triplett's exclusive method of maintoining absolute uniform pole piece accuracy supplants the more expensive milled soft iron type, and is far superior to those formed of saft iron. Cast magnets of cobalt and other alloys are used in some of the larger and more sensitive Triplett instruments and relays.

D.C. Instruments are the D'Arsonval type with an extra light moving coil and reinforced parts. A.C. instruments are the movable iron repulsion type; are air damped and have light moving parts. Both A.C. and D.C. have selected sapphire jewel bearings and highly polished pivots; white enamelled metal dials and moulded zero adjusters. Accuracy within 2% except rectifier type instruments which carry a 5% guarantee. Instruments supplied with pointer stops.

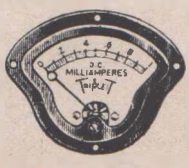
THERMO AMMETER

High Frequency Accuracy 2%

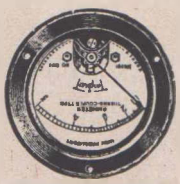
Triplett Therma Ammeters correspand in size, etc., ta corresponding D.C. models. All have maulded cases. Have external couples which withstand 50% averload cannected to meter with 2-foot leads. Couples are easily replaced when necessary. Internal couples to order. External couples only, for any model.

The Model 321, 3-inch dial, illustrated above, is available in 5 and 2 inch dials designated Madels 521 and 221.

Typical "321" ranges are: 0-1, 0-10, 0-50, 0-100, 0-250, 0-500, 0-1000 Milliamperes.



529-D.C. 539-A.C.



Thermo Ammeter

W. G. WATSON & CO. PTY. LTD.

Head Office: 279 CLARENCE ST., SYDNEY. Phone: M 4331 (6 lines). Newcastle Branch: King & Bolton Sts., Newcastle

Branches at Melbourne, Adelaide, Hobart, Launceston and Perth

Distributors of "WATRIC" Products

Printed by the Bridge Printery, 117 Reservoir St., Sydney, N.S.W., for the proprietor of the "Australasian Radio World," 117 Reservoir St., Sydney.