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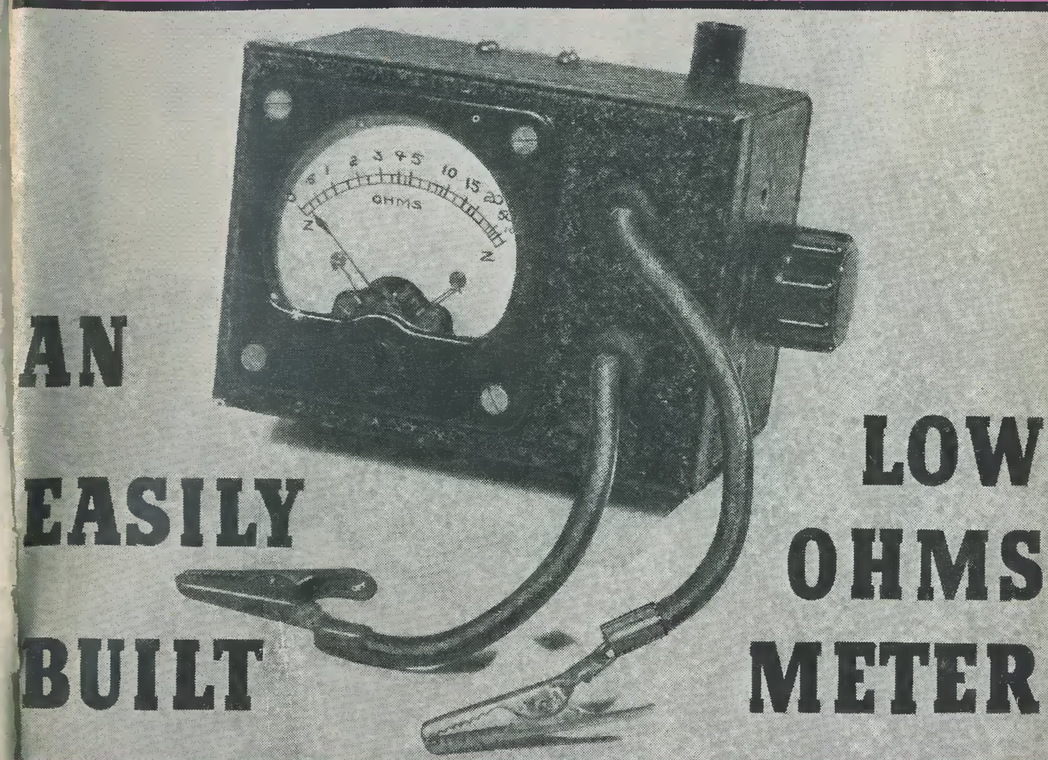
The RADIO CONSTRUCTOR

for the Radio and Television Enthusiast



IN THIS ISSUE . . . ALSO

A BATTERY FOUR · 4-WATT AMPLIFIER · A MIXER PRE-AMPLIFIER · V H F F M FEEDER UNIT, PART 3 · 10 VALVE RADIOGRAM, PART 2 · SWITCHLESS INTERCOM SYSTEM · ANTI-INTERFERENCE AERIALS · THE "MAGNA-VIEW," PART II · In Your Workshop · Radio Miscellany · Query Corner, etc., etc.

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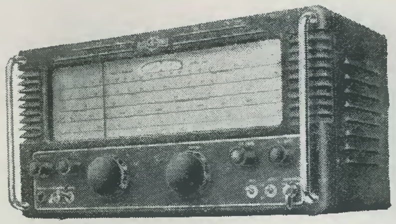

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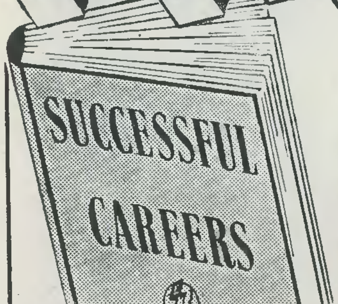

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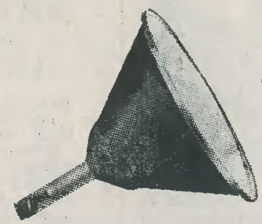

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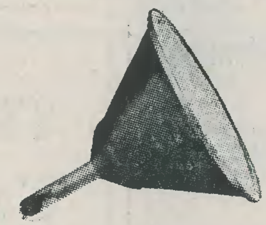

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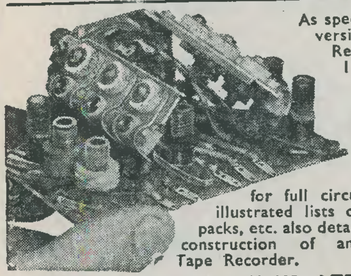

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Edited by C. W. C. OVERLAND, G2ATV

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NOTICES

THE EDITOR invites original contributions on construction of radio subjects. All material used will be paid for. Articles should be typewritten, and photographs should be clear and sharp. Diagrams need not be large or perfectly drawn, as our draughtsmen will redraw in most cases, but relevant information should be included. All Mss must be accompanied by a stamped addressed envelope for reply or return. Each item must bear the sender's name and address.

TRADE NEWS. Manufacturers, publishers, etc., are invited to submit samples or information of new products for review in this section.

ALL CORRESPONDENCE should be addressed to *Radio Constructor*, 57, Maida Vale, Paddington, London, W.9. Telephone CUN. 6518.

A Companion Journal to THE RADIO AMATEUR

Suggested Circuits for the Experimenter

The circuits presented in this series have been designed by G. A. FRENCH specially for the enthusiast who needs only a circuit and the essential relevant data.

No. 25 A SWITCHLESS INTERCOM SYSTEM

One of the greatest disadvantages of amplifying loudspeaker "intercom" systems lies in the necessity of fitting a "Talk-Listen" switch at the "master" position. Without such a switch the amplifier output and input would be linked together, either electrically or over an acoustic path, and the resultant unavoidable feedback would cause oscillation.

This month's circuit illustrates a means of dispensing with the "Talk-Listen" switch whilst, at the same time, allowing simultaneous conversation to be obtained between two points. This is achieved by using two amplifiers, these being switched in and out continually in such a manner that one is operative when the other is not. One of these amplifiers takes its input from one point and drives the loudspeaker at the other, whilst the second amplifier operates in the reverse direction. Assuming a suitable switching frequency, it then follows that speech may be carried both ways and the feedback cannot occur at all.

The system suffers from the disadvantage that the speech appearing at either loudspeaker is "chopped" at the frequency at which switching takes place, with the result that fidelity of reproduction is reduced. Intelligibility, however, need be affected only by a small amount.

The Circuit

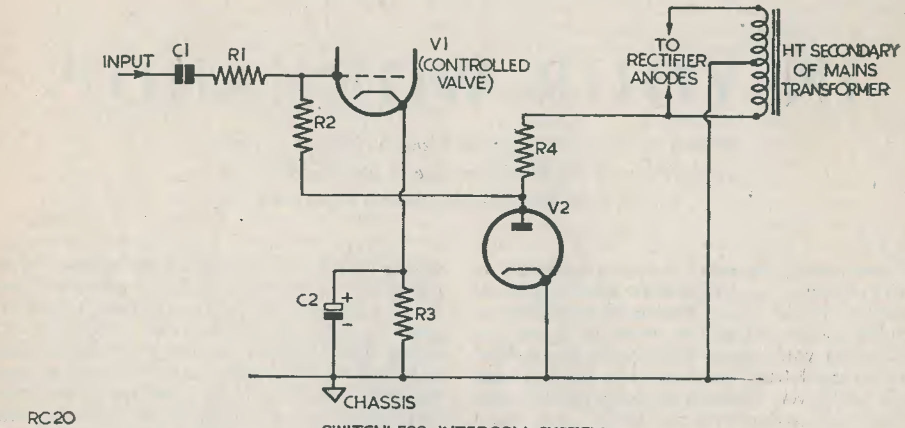
The circuit given here shows one of several ways in which periodic switching of either of the amplifiers may be carried out. The voltage used for switching control has a frequency of 50 c/s and is obtained here from one half of the secondary of the amplifier power pack HT transformer, the centre tap of which is connected, in the normal manner, to chassis. Switching is then accomplished by allowing the alternative voltage from the transformer secondary to vary the grid bias of one of the early valves in the amplifier. This valve is shown in the circuit as V1.

Also included in the circuit is a diode, V2, whose purpose is to prevent positive grid bias being applied to the controlled valve when the switching voltage swings positive with respect to chassis. The resistor R1 is connected between C1 and the grid of V1 in order to prevent this capacitor (and the previous anode or input circuit) from affecting the switching voltage. In practice it will, in many cases, be found possible to reduce the value of this resistor or even to omit it altogether.

Operation

A relatively high AC voltage is used for switching in order to reduce as far as is reasonably possible the time taken for it to pass between zero potential and the negative cut-off point of the controlled valve. The period during which the controlled valve works with an incorrect value of bias is therefore correspondingly short. The controlled valve may consist of either a triode or a pentode (not vari-mu, of course), and its grid base may be shortened, if necessary, by operating it with reduced HT.

Due to its high value, the switching voltage will give an effect approaching that of control by a square wave. It is doubtful, however, whether it would give rise to troublesome harmonics of the switching frequency in the output of the amplifier; although a strong 100 c/s note will almost definitely be found at the anode of the controlled valve. The process of filtering out the switching frequency in the subsequent stages of the amplifier should not raise many problems. It will probably be found that a small-value capacitor (between 100 and 500 pF) connected between the anode of the controlled valve and the following grid will attenuate the unwanted lower frequencies quite adequately.



SWITCHLESS INTERCOM SYSTEM

COMPONENT VALUES

Resistors

R1	500 kΩ
R2	250 kΩ
R3	Normal bias value for V1.
R4	2 MΩ

Capacitors

C1	AF coupling; 0.01 to 0.05 μF.
C2	20 μF, 20 W.V.

Two Amplifiers

The diagram illustrates the arrangement required for one amplifier only. The second amplifier (operating in the reverse direction) will need a similar control circuit. The control voltage of this second amplifier will, of course, need to be so connected that it is in antiphase to that used by the first. A saving may be made by using one power pack for both amplifiers, the switching control voltages being obtained from either end of the common mains transformer secondary.

ROYAL PATRONAGE

H.R.H. THE DUKE OF EDINBURGH K.G.

It is announced from Buckingham Palace that His Royal Highness, the Duke of Edinburgh, K.G., has been very pleased to extend his Patronage to the Incorporated Radio Society of Great Britain.

Although His Royal Highness has lately undertaken a great number of additional responsibilities he will do his utmost to take a personal interest in the Society.

The announcement from Buckingham Palace will give great pleasure to all Members of the Society.

IN YOUR WORKSHOP

In which J. R. D. discusses Problems and Points of Interest connected with the Workshop side of our Hobby based on Letters from Readers and his own experience.

This month, instead of devoting my space to a single subject, as I have done in the past few issues, I should like to deal with a number of smaller points. One or two of these are concerned with topics mentioned in readers' letters, and I trust that these readers will bear with me over the slight delay which has occurred since they wrote to me.

Iron Cores

Adjustable iron-cored coils are used in both commercial and amateur-built equipment more often nowadays than they used to be. This is understandable when one considers the advantages offered by such coils as against their un-cored brethren. The iron-cored coil has the advantages of taking up less space; of enabling adjustments of inductance as well as parallel capacitance to be made (a particularly useful attribute where ganging is concerned); and, after it has been set up to a particular value of inductance, of holding that value over a longer period of time than does the usual compression-type trimmer.

A further application of the iron-cored coil, that of permeability tuning, does not, however, seem to have captured the interest of the amateur to any great extent. Bearing this in mind, it is interesting to note that a few commercial receivers use systems that could be copied fairly easily by the amateur. There was, for instance, a pre-war Continental set, designed on midget lines for medium-wave reception only, which employed quite a simple arrangement for permeability tuning. This receiver had two coils, each approximately half an inch in diameter and three inches long, for signal and oscillator respectively; tuning being effected by moving two iron-dust cores of about the same length in and out of the coils. It is necessary to use long, thin coils such as this in order to obtain a smooth change in inductance as the cores travel in and out.

Obtaining an iron-dust core longer than an inch or so on the amateur market would be difficult; but there should be no objection to joining three or four shorter ones together end-to-end. The cores could be held together with cellophane tape, the whole assembly being wrapped in one or two thicknesses of thin, strong paper, and afterwards shellacked. The movement of the cores could be governed by a cord, pulley and spring arrangement, such as is used for laterally-moving dial indicators. It would be necessary to wind the tuned coil only on the former, aerial coupling and oscillator feedback being obtained by bottom-end capacitor coupling. Alternatively, the coils could be tapped about a fifth of the way up from the earthy end, this providing an aerial connection, or a cathode tap for an electron coupled oscillator.

Short-wave bandspread could be obtained by means of a similar arrangement. In this case, a set of "ganged" cores could travel in unison in and out of inductors having one or two turns only, these latter being connected in series with whichever short-wave coils are selected by the wave-change switch.

Apart from possible permeability tuning systems, iron-dust cores are encountered mainly, of course, in circuits where they are used to adjust the values of various inductors. When they are used in this fashion it is sometimes a little difficult to ensure that they will remain in position after having been set up. This is particularly true when the core has a threaded body and is not mounted to a separate brass adjusting screw. Fixing the core in position by means of varnish, glue or some similar hard-setting compound does more harm than good, as it then becomes impossible to re-adjust the core at a later date.

A preparation for holding iron cores in position and which, if mixed carefully, will not harden with time, can be made by mixing together equal weights of talc, zinc oxide and vaseline. These ingredients may, of course, be obtained from the chemist. It is important to make certain that they are well mixed together; and the best way of doing this consists of lightly heating the vaseline until it is fluid, whereupon the zinc oxide and talc can be added and thoroughly stirred in. When the vaseline has cooled, the resultant compound should be a white, sticky paste.

Suggestion

A reader who was interested in my recent comments on electric guitars, and who wishes to remain anonymous, sends in what he describes as the Craziest Suggestion of the Month. This consists of an electric jew's harp! He claims, rightly enough, that the voltage built up across a pick-up bobbin mounted close to the vibrating centre steel of a jew's harp would be more than sufficient to drive most dance-band amplifiers, and that the effect would certainly be novel and interesting.

I don't think that an electric jew's harp, considered as a novelty only, is too crazy an idea really; especially in the dance-band world where crazy ideas often click! I notice that no-one has, as yet, "electrified" the washboard and thimbles, (if that is the correct term), but, doubtless, this will come.

It must be mentioned that an "instrument" such as an electric jew's harp will be placed in the mouth; whereupon the user would be particularly susceptible to shock unless adequate earthing and insulation were employed. Even the usual 0.01 μF capacitor between mains and amplifier chassis would be enough to give a more than unpleasant tingle.

Battery Oscillators

Another reader, E. L. Hitchcock of Ilford, Essex, has a few words to say anent my recent paragraph on 1.5 volt filament oscillators. Readers may remember that I pointed out that such oscillators would be capable of good frequency stability.

Mr. Hitchcock says that he used to be familiar with an R.C.A. transmitter whose MO employed a circuit arrangement of this type. This happened over five years ago, and so his recollections are not entirely clear.

"I rather fancy that the oscillator was the electron-coupled type you suggest" he carries on, "and the low power output was partly overcome by using two valves in parallel." This was fed to an 807 run at quite low power. The only trouble was filament failure in the small valves, but this was not bad enough to be a serious objection to their use.

"It may interest you to know that, in the particular case I have in mind, the oscillator drove a broadcasting transmitter rated at 7½ kilowatts on frequencies in the 16, 19 and 49 metre bands at various times."

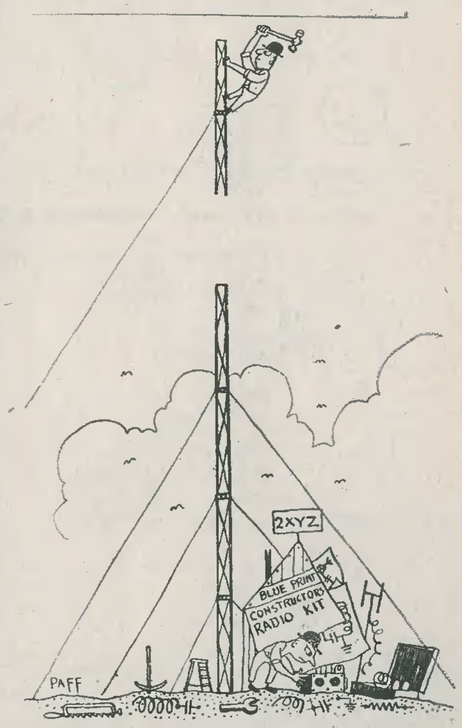
It seems, therefore, that the use of 1.5 volt valves for high-stability oscillators is not impracticable. Filament failures are a limiting factor, however, although they could be overcome by using the more robust 2-volt types; which could still be heated from a stabilised mains supply. Out of two laboratory wavemeters which I have recently encountered, one uses an EF50 with the metal cover removed, whilst the other uses a two-volt valve run off an accumulator, despite the fact that all other supplies (HT etc.) are derived from the mains.

On the other hand, however, the well-known BC221, even though it is designed for portable battery operation, uses 6.3 volt 0.3 amp valves.

Tropical Conditions

I have lately had the opportunity of examining receivers and components which have been working under tropical conditions in Malaya. Although I cannot offer a balanced or representative report, I would like to say that I was most impressed by the very quick rusting of iron and steel. Ordinary tools, for instance, become covered with a coat of rust in a matter of days. Steel chassis are very liable to rust unless properly treated.

I was also impressed by the fate of several wire-ended mica capacitors which had burst open. These were relatively large-value components (about 0.5 μF) and were about eight years old. The heat, presumably, had caused the "innards" to expand, splitting open the outside case along the seam.



"Ease up, Charlie—There's a bit missing from the kit!"

A BATTERY "FOUR"

By A. S. CARPENTER

A fairly powerful receiver with simplicity of operation was required recently for use by an inexperienced operator, who was somewhat advanced in years.

Battery power was the only kind available. At first, an all-dry circuit was envisaged, but this idea was discarded in favour of a 2V type of receiver after consideration of the expense of battery replacements.

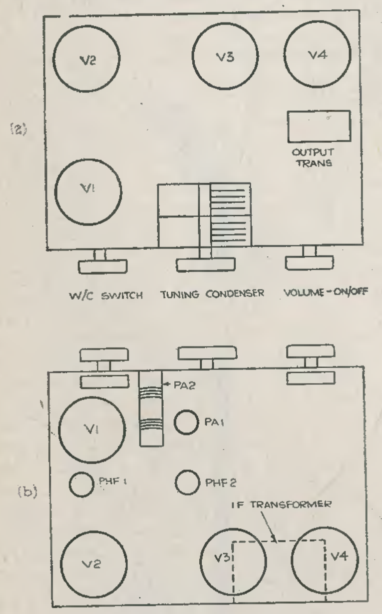


FIG. 2 – POSITIONS OF MAIN COMPONENTS
(a) TOP VIEW
(b) UNDERSIDE VIEW
RC 48

Expense was a prime factor, and the following set was evolved using a WD No. 18 receiver as a basis. This was carefully stripped (the 465 kc/s IFT's being put away and earmarked for future use) and the components re-arranged—with some added—in the form of a "straight" set—HF (VP23), grid-leak detector (VP23), LF (HL23DD) and output pentode (Pen 25), the latter being purchased separately. The HL23DD is a duo-diode triode, but in this set the diodes are not used, the valve acting as an amplifying triode.

VP23 ≡ ARP12

Circuit

The complete circuit diagram is shown in Fig. 1. HF coupling follows V1, and resistance capacity coupling is employed between V2 and V3. The output valve is parafed.

Volume is controlled by varying the bias on V1, a variable mu HF pentode. Although it is not possible to reach zero, a good range of control is obtainable.

No reaction was used in this particular case, as it was felt that this would thereby simplify operation. To offset any difficulties over selectivity, it was decided to use high grade coils and not too large an aerial.

Coils

Wearite "P" type coils were used. As provision for "Long" and "Medium" had to be made, four coils were required. This particular make was chosen partly because of their comparatively small size, and the only difficulty (if it can be called such) is that a fair amount of wiring is required in conjunction with the wavechange switch, but this proves no handicap providing time and care are taken. The great advantage is that the "long" wave coils are completely out of circuit when receiving "medium" wave transmissions, and vice versa.

Layout

Top and underside layout arrangements are shown in Fig. 2. The chassis measures 8″×6″×2″. The four coils are mounted underneath, close to the wavechange switch. Coil PA2 is fixed to the front flange, pointing inwards, and coil PA1 to the bottom of the chassis, upside down and at right angles to PA2. PHF1 and PHF2 are fixed in the same manner as PA1, but as far apart and as far from the others as possible in order to avoid any interaction. A small 50 pF trimmer is connected across terminals 1 and 2 of each coil for trimming purposes.

The LF transformer is mounted on the rear flange of the chassis and underneath, coming between, and over, the bases of valves 3 and 4. In view of this, it is best not to mount this component until the two valves are wired up.

As will be seen from Fig. 2, the only components appearing on top of the chassis are the valves, twin-gang tuning condenser and the output transformer.

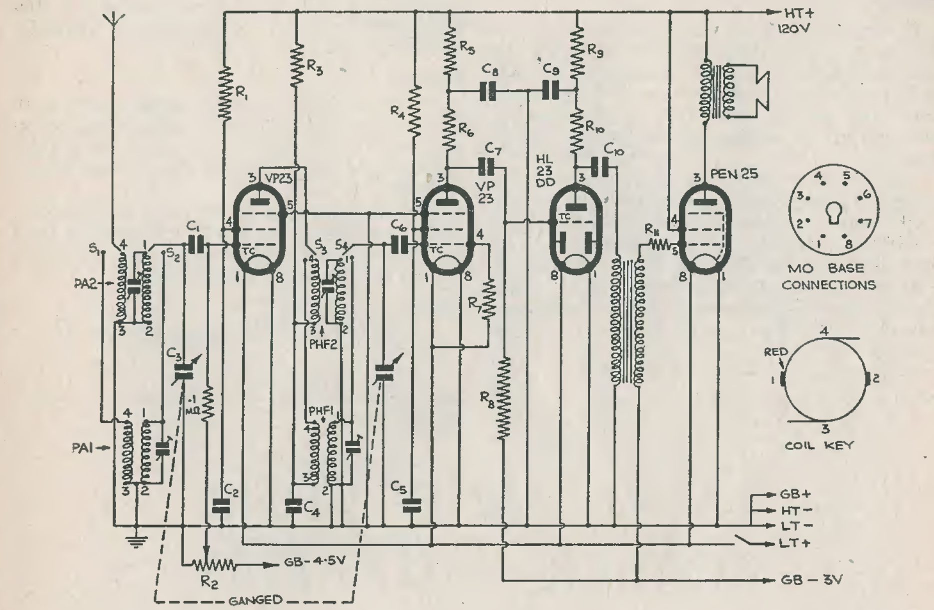


FIG. 1 – THEORETICAL CIRCUIT RC 47

LIST OF COMPONENTS

* *denotes components additional to those contained in the ex-WD No. 18.*

Ex-WD No. 18		C1	100 pF
R1, R6	200 kΩ	C2, C4, C5	0.001 μF
R2*	500 kΩ pot.	C3*	500 pF twin gang
R3	100 kΩ	C6	100 pF
R4	500 kΩ	C7	0.05 μF
R5*	20 kΩ	C8, C9	0.01 μF
R7*	2 MegΩ	C10	0.005 μF
R8	500 kΩ	Four 50 pF trimmers*	
R9	5 kΩ	Parafeed LF transformer*	
R10*	30 kΩ	Tapped output transformer*	
R11	100 kΩ	S1, S2, S3, S4*	4-pole 2-way Yaxley switch
Coils*	Wearite PA1, PA2, PHF1, PHF2		

Wiring

If wires of different colouring are used for the coils and switch, ease of checking the final connections will be greatly facilitated. It is easiest to commence with the filaments, coils and switch, and HT, in that order, finishing up by joining on the battery supply leads.

The " on-off " switch is incorporated in the volume control, and is arranged to switch " off " when volume is at its lowest point.

Resistors are all ¼-W, and the values given were found to be the best after a period of trial and error. With different valves, some trouble from microphony was experienced, but this effect was absent in the completed receiver. A grid stopper was included in the grid circuit of V4 to avoid any parasitic oscillation.

Results

After the usual trimming adjustments were made, and with a short aerial rigged up indoors, output was found to be more than sufficient, so that there was always some power in hand.

Selectivity proved to be quite satisfactory, and the quality from the 8″ PM speaker used by the writer was extremely good. In fact, results far exceeded expectations.

Cost

An overall estimate—approximately £4.

VALVES AND THEIR POWER SUPPLIES

Part 2

By **F. L. BAYLISS** A.M.I.E.T.

DC Receivers

Concurrently with the early AC types discussed in the previous article was produced a range of DC valves, similar in characteristics to the AC types but having comparatively high voltage heaters, all of similar current rating.

Receivers employing these valves were popular around 1930, when comparatively wide areas of the country were still served by DC mains.

Unlike the modern AC/DC receivers, however, many of these early DC sets were designed for DC—and DC only. The writer, who was resident in a DC area in 1933, has distinct memories of radio emporium windows chock full of them. Some were dual types, having the usual rectifier—often metal—and mains dropper; the remainder possessed only the resistor and smoothing pack.

There was little basic difference between the power supply circuits of these sets and those of their modern counterparts, however; occasionally the loudspeaker field winding was the smoothing component, and mains-bridge capacitors were more popular than electrolytics. The mains dropper, usually wound with heavy gauge Eureka wire, was a much more robust and massive affair than the modern vitreous type and seldom gave trouble.

If, therefore, you happen upon a receiver such as these, check it through as you would a modern set—and don't forget the 0.1 μF capacitor from one side of the mains to chassis. How they hum when this component becomes disconnected !

Early 6 Volt Valves

It is probably true to say that the first receivers on sale in this country possessing 6 volt AC mains valves were of American manufacture and imported.

The cabinets of some of these were indeed imposing—built on massive and palatial lines with heavy ornamentation. Ten valves, ten watts and push-pull output shook the floor of many a radio shop in the early 1930's and, indeed, even the late 1920's.

These receivers—and there are many of them still in use—had American valves with UX type bases. There are four common varieties of this base, UX4, UX5, UX6 and UX7; the number refers to the number of valve pins, and the two pins having the greatest diameter are heater connections.

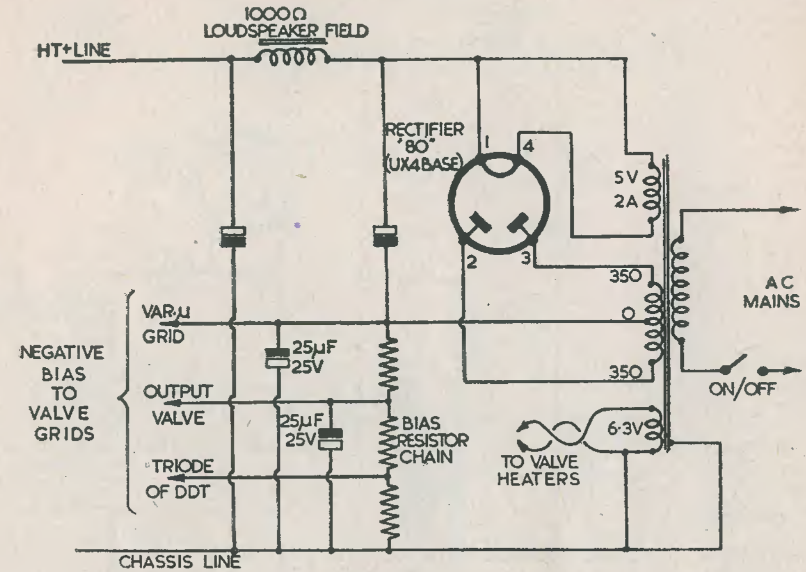


FIG.3

RC43

Many of these valves are still made. If, when servicing such a set, a replacement is required, the popular and reliable Tungsram range distributed by Siemens will probably supply your need.

In any case, almost all of these valves were subsequently duplicated in the international octal range when this base was introduced. It is not too difficult a matter to remove the UX valveholders and fit an international octal in their stead.

The corresponding octal range, however, carry a new and entirely different nomenclature. For instance, the UX4 rectifier " 80 " became the octal 5Z4, the UX6 " 78 " became the popular 6K7.

If you require an octal replacement for a UX valve, consult a current valve handbook. In it, the two types are often bracketed together —or sometimes a cross-reference is given.

Power supply in these receivers was usually as shown in Fig. 3. Bias was sometimes obtained from a bias resistor in the HT– lead, as indicated, and sometimes by individual resistors in the valve cathode leads.

Some of these American companies later commenced manufacture in this country, and one or two are, indeed, in the forefront of British design and manufacture today.

The AC/DC Counterpart

These early American 6.3V AC receivers also had AC/DC counterparts in which the range of high voltage heater valves, also with UX type bases, were ordinarily used in the output stage and power pack, together with similarly rated (current) 6.3V valves in RF and IF stages.

HT was often supplied by a 25Y5 or 25Z5 rectifier, having the two anodes strapped: the output valve was frequently a " 43 " (octal type 25A6) and the heater current almost invariably was supplied via one or more mains dropping resistors located in the receiver itself. (One twenty-year old set—of well-known make—had no less than four such resistors in it). Such resistors were shrouded and unshrouded, wound on porcelain formers, and air-cored on paxolin cross-pieces, in wondrous variety.

Although individual cathode bias was occasionally adopted in these receivers, another quite common method was to strap the grids to chassis and to bias all cathodes positively via a common-to-all resistor, wound on a

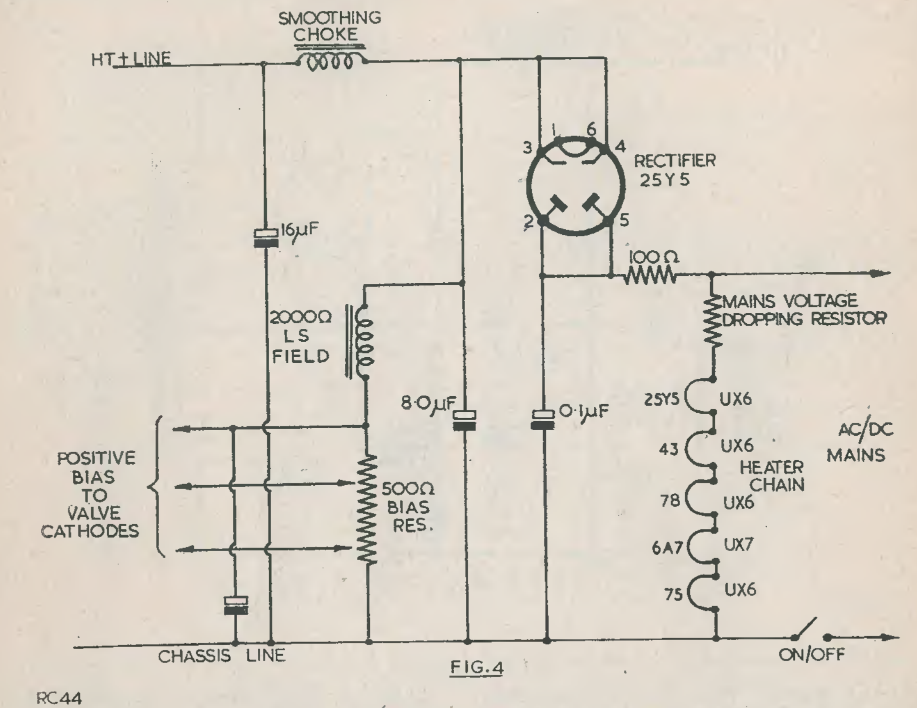


FIG.4

porcelain former and resembling a mains dropper, connected between HT+ and chassis—often in series with the loudspeaker field.

A typical power supply circuit of such a receiver is shown in Fig. 4.

RADIO AMATEUR

CONTENTS FOR DECEMBER

Two Metre Converter. Part 2. Constructional details of a new design.

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T.V.I. The approach from the televisor angle.

Putting Us Over. Publicity for Amateur Radio.

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Strictly for the Beginner. More on starting Transmission.

Workshop Practice, together with our usual Amateur Band, Broadcast Band, VHF News, Club News, Mail Bag, etc., etc.

2.5 Volt AC Types

One further and slightly older American type—now very rarely met with—is a range of AC valves having 2.5V heaters. The writer has handled only one receiver of this type, but it was probably typical. The valve line-up was 2A7 frequency changer (American "Europa") 24A IF amplifier (Hungarian "Tungsram") 2B7 duo-diode-pentode ("Europa") and 2A5 output pentode (marked U.S.A.). Power was supplied by a small 120V secondary mains transformer in a metal rectifier voltage doubler circuit.

Other valves in this series are 2A6 duo-diode-triode, and 2B6 double-triode output. All have UX bases and are difficult to obtain as replacements, except perhaps as odd surplus lines.

They were certainly sure, and it is not proposed to deal further with them except to mention that the heater current in this case was supplied by a 2.5V winding on the transformer. (These valves are still listed, with data, in the valve section of recent editions of the ARRL *Radio Amateurs Handbook*, and some types were in use during the last war.—Ed.).

A 10-VALVE RADIOGRAM

by J. R. DAVIES

PART TWO

—oOo—

Although we mentioned in our last article the reason for using the capacitors C36 and C37 and the resistor R19 in the cathode circuit of V5, (Fig. 1 of last month's issue), we did not explain then the reason for using this particular detector circuit itself.

This we intend to do now. For easy reference the relevant part of the radiogram circuit is reproduced here as Fig. 2. It will be seen that a diode instead of an infinite impedance detector has been employed, this choice having been made after due consideration of the advantages offered by both circuits.

The Detector and Cathode Follower

When a receiver which is intended to offer high quality reproduction is originally envisaged, the question of what type of detector circuit to employ assumes considerable importance. This is due to the fact that, unless due care is taken, distortion will almost inevitably be introduced at this stage. The two most useful circuits for a receiver of this type are given by the diode and the infinite impedance detector. Of the two the infinite impedance detector is, at first sight, the most attractive since it theoretically offers perfect detection and also has an extremely high input impedance, this latter attribute resulting in reduced loading of the last IF transformer. However, the rectified voltage built up across the load of an infinite impedance detector is positive with respect to chassis, thus rendering it useless for AVC purposes; whilst the use of an auxiliary diode for AVC detection once more loads the last IF transformer and straight-

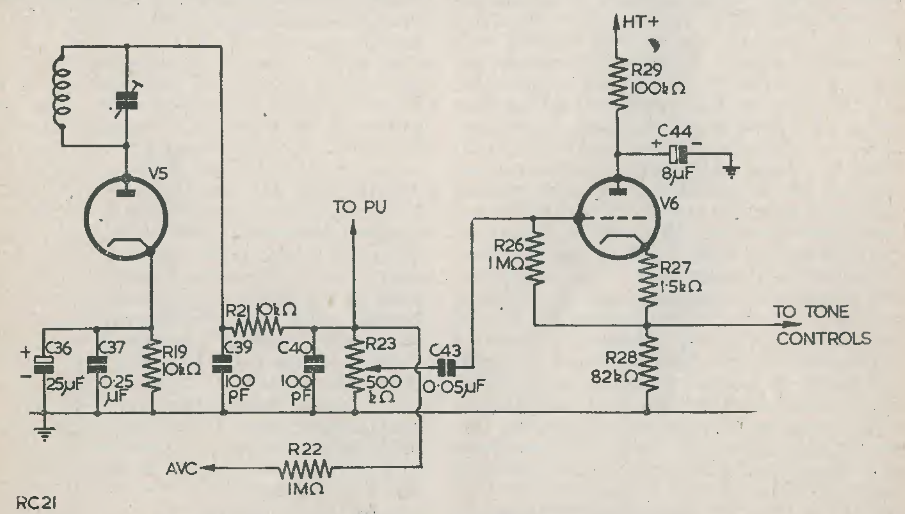


Fig. 2. The detector and cathode follower circuits.

away reduces the advantage given by the very high input impedance. Furthermore, the cathode of an infinite impedance detector has to feed into a load in which the AC and DC impedances are almost inevitably bound to be dissimilar (in the same way as with a diode) and this dissimilarity can introduce distortion.

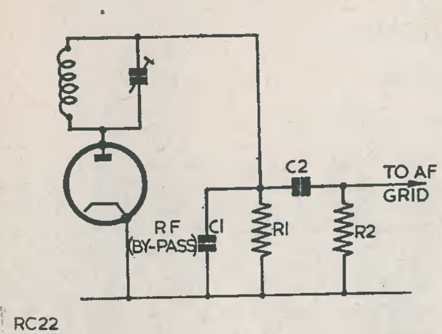


Fig. 3. A conventional diode detector illustrating the AC and DC load impedances mentioned in the text.

This point usually appears to be overlooked when the infinite impedance detector is discussed.

When we come to consider the diode, we find that this also suffers from its own peculiar disadvantages. To begin with, to obtain the greatest efficiency of detection from the diode its plate resistance must be low compared with its load resistance. Although, to ensure this point, it is easily possible to use a high value of load resistance, it also happens that the plate resistance of the diode is, itself, inconstant. Below a certain applied voltage it tends to increase. Thus, when weak signals are being received, the ratio of plate resistance to load resistance may vary; resulting, at the least, in amplitude distortion. This state of affairs may be *very* slightly eased by lowering the plate resistance (in this particular circuit two diodes are connected in parallel), and by using a relatively high load resistance; but by far the best solution consists of ensuring that the applied signals are sufficiently strong to enable the diode to work over that portion of its characteristic in which its plate resistance is sufficiently low to be relatively negligible, (i.e. when compared with its load). The provision of a good signal for rectification is assumed almost automatically in a receiver with high pre-detector amplification (such as occurs in this particular case) and one may assume reasonably safely that the only signals which are not handled at full detector efficiency are those which are so weak that they cannot be received clear of background noise. With this circuit it was found that it was impossible to notice any deterioration in fidelity at all, even on the weakest signals received by the radiogram.

Of far greater importance with the diode detector is the necessity for ensuring that the AC and DC impedances offered by its load are as nearly similar as possible. Fig. 3 shows a simple diode circuit to illustrate what is meant by this statement. In this diagram the capacitor C2 is used to isolate the DC voltages built up across R1 and so enable R2 to function as a grid leak for the following AF amplifier. Unfortunately, C2 also serves to pass both AF and IF voltages, with the result that the DC diode load is represented by R1, whereas the AC load is represented by R1 and R2 in parallel.

It can be shown that, to obtain the minimum distortion from a diode detector, the following relationship must be satisfied:—

$$\frac{\text{Diode load impedance to modulation frequency currents}}{\text{Diode load impedance to direct currents}} > \text{Degree of modulation of applied signal}$$

Therefore, even when the usual 3:4 (or lower) resistive AC/DC load ratio found in the average superhet is employed, we still cannot be certain of accurate reproduction of transient or sudden fortissimo passages radiated by the transmitter; particularly when receiving certain Continental stations which may employ a higher percentage of modulation than that used normally by the B.B.C.

A further point of considerable importance lies in the provision of tone control circuits. If these are to be comprehensive they must obviously lie outside the negative feedback loop used by the subsequent AF amplifier. At the same time they cannot be connected directly into the diode detector AF circuits. If, for instance, a tone control circuit were connected across R1 or R2 of Fig. 3, the changing capacitance values given by the circuit would upset the characteristics of the diode load. In addition, they would alter the RF by-pass values and probably cause de-tuning of the IF transformer secondary as well. Further to this is the fact that it is extremely convenient to make R1 or R2 a volume control, and it would prove unworkable (to say the least), to fit, say, a treble-cut tone control immediately after such a component.

If we are to use a diode detector we are therefore faced with the necessity of having a low AC/DC impedance ratio, a useful volume control and provision for tone control circuits,

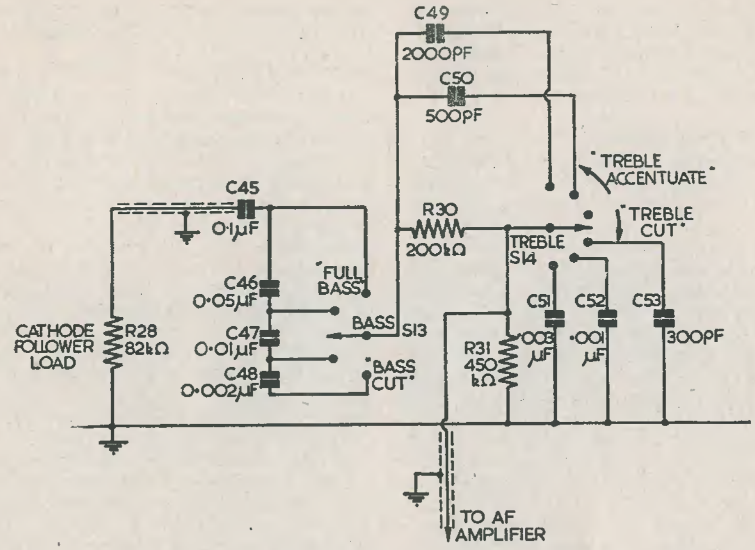


Fig. 4. The tone control circuits.

all within the immediate vicinity of the diode circuit itself. All these requirements have been met at once in this particular receiver by the somewhat unusual method of using a cathode follower immediately after the diode detector. With this circuit, the resistor R2 of Fig. 3 is replaced by the grid-chassis input impedance of the cathode follower, the whole circuit being shown in Fig. 2 where V6 is the cathode follower.

Since the input impedance of V6 approaches infinity, the DC and AC diode loads have an impedance ratio of very nearly unity, thus almost entirely eliminating the biggest disadvantage given by the diode detector. The resistor R1 of Fig. 3 now becomes a volume control (R23 of Fig. 2). It may be noticed that the lead from the volume control to the grid of V6 (including C43) is not shown as being screened. Sufficient screening is provided in practice by taking advantage of the layout, but in such a manner that the capacitance to chassis is negligible.

The tone control circuits are taken from the cathode load of the cathode follower, the impedance of this load being sufficiently low to provide a signal capable of being controlled for bass and treble reproduction without altering the conditions under which the valve itself works. It is also possible, with this circuit, to transfer the AF voltages from the cathode load to the tone control components by means of ordinary screened wiring, without bothering overmuch about losses due to capacitances to chassis.

The Pick-up Filter

It will be noted also that normal screened wiring is employed to transfer the output of the pick-up to the volume control R23, the use of this wire being admissible since the added capacitance given by the wiring is in parallel with that given by the IF bypass capacitor, C40. Referring back to Fig. 1 of last month's article it may be seen that an input filter, C42, R24 and R25, is connected between the pick-up and the radiogram proper. This filter is intended for a crystal pick-up. The pick-up used by the writer was that fitted to the Collaro RC500 auto-changer.

When a magnetic pick-up is used the filter may be removed and a direct connection employed in its place. However, if the magnetic pick-up should be a high-grade instrument the manufacturers will very probably advise the use of an alternative type of filter, and their literature should be studied on this question. The input impedance for "Gram" is 500 kΩ paralleled by slightly less than 200 pF; but the resistance value may be lowered by connecting a shunt resistor between the "Gram" contact of S8 and chassis. When S8 is set to "Long," "Medium," or "Short" this additional resistor will be out of circuit and cannot therefore affect radio reproduction.

The Tone Control Circuits

The tone control circuits used in the radiogram are reproduced in Fig. 4. The controls themselves consist of two switches S13 and S14.

S13 is a four-way switch used to select four different values of capacitance in series with the AF feed to the treble control. The values of the capacitors have been chosen to allow a gradual bass cut as the switch is rotated. It should be pointed out that the "lift" is fairly small and its effect is only fully noticeable when a properly baffled speaker is used. The bass control is intended mainly for gramophone reproduction, where it will be found that it effectively reduces "rumble" and the somewhat annoying bass distortion given by worn records. On "radio," it is usually quite sufficient to set the control to "Full Bass."

The treble control is a little more complex and employs the six-position switch, S14. This switch makes use of the resistors R30 and R31 to provide both treble cut and accentuation. In the two "top" positions (at the "Treble Accentuate" end) accentuation is provided by the capacitors C49 and C50 respectively. The third position is blank, allowing unaltered reproduction to be obtained. The three "bottom" positions apply the progressively increasing values of capacitance offered by C53, C52 and C51 across R31. The effect, as the switch is turned from "Treble Accentuate" to "Treble Cut," is smooth and gradual, allowing a nicely balanced tonal response to be finally obtained.

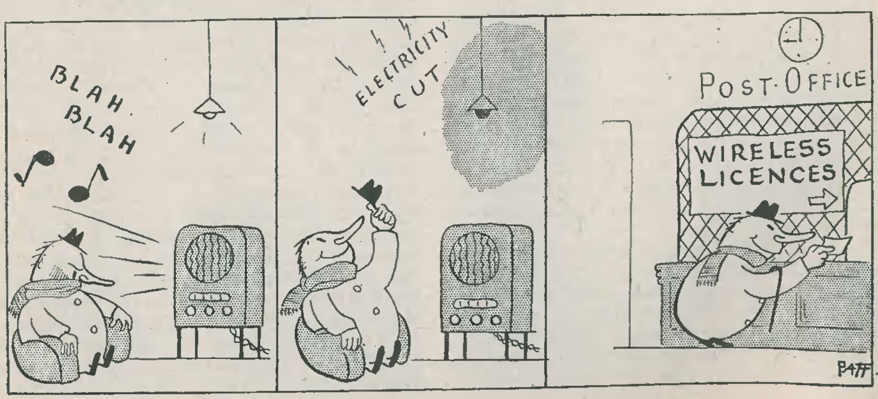
Interconnecting Leads

It would be bad practice to apply the AF output from the radio unit via normal screened wire to the input terminals of the AF amplifier, since the high capacitance inherent in such a lead would upset the results obtained from the tone control circuits. It is therefore necessary to use a screened lead which has a very low capacitance. The writer found that the simplest way of doing this was to use a length of coaxial cable, the outer conductor being, of course, connected to chassis at both ends. A three-foot length of such cable would have a capacitance between inner and outer conductors of less than 50 pF or so and would be almost ideal for the job. Other types of low-capacitance screened wire could be used instead of the coaxial cable should it be so desired.

In the writer's model, the screened wire to the AF amplifier is fitted with a pair of tags at its end, these being coupled to two separate terminals on the amplifier chassis. The other interconnecting leads between the radio chassis and the amplifier are taken to an octal valve adaptor, an appropriate valve-holder being mounted on the amplifier chassis. It should be noted that mains wiring is also taken through this plug and socket, thus enabling the switch on the volume control not only to switch on the two chassis but also to switch the mains to the gramophone motor as well.

(The IF's were wrongly given as 456 kc/s last month. They should be 465 kc/s.—Ed.)

(To be continued)



Mainly for the Beginner

SUPERHET DETECTORS

By **H. E. SMITH G6UH**

Superhet Detectors

The double-diode-triode type of valve is almost universally used as the second detector in domestic receivers, and is more often than not used in Short Wave receivers by home constructors.

For ordinary broadcast reception, the DDT valve is ideal, providing detection, AVC, and one stage of audio amplification. It is a linear device, and will handle large signal inputs. All this is very necessary in order to avoid distortion. But what do we require in SW reception? One thing we need is a sensitive detector, in order to sort out some intelligibility from that weak carrier. It is not entirely necessary that our detector should be linear, nor is it necessary that it shall be capable of handling high signal voltages. Diode detection is the most insensitive method of all, except perhaps for the crystal detector. The crystal is inefficient because it will allow current to flow through it in the reverse

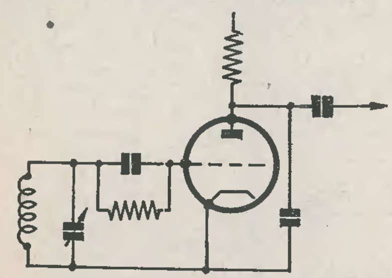


FIG. 1. BASIC LEAKY GRID DETECTOR

RC39

direction. The diode is better than the crystal in this respect, but it still falls short of the ideal detector in that it is relatively insensitive and must be fed with power for optimum operation. It *consumes* power and thus reduces the Q of the tuned circuit, causing a loss of selectivity.

How far is it possible to improve on a system which has come to be recognised as standard practice? There are, in fact, several much better ways of obtaining more sensitive detection, and we shall examine these. The use of a leaky grid detector will improve sensitivity beyond all measure, and although this will overload on strong signals, a manual RF control will put a stop to this occurring.

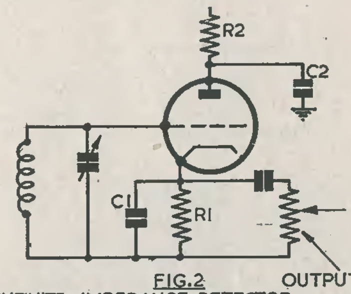


FIG. 2
INFINITE IMPEDANCE DETECTOR

C1–250PF C2–0·5μF C3–0·1μF
R1–150kΩ R2–25kΩ VR–0·25MΩ
VALVE–L77 TYPE

RC40

Another point in favour of the leaky grid detector is that it will also act as the BFO for CW reception, and thus prevent the loss of sensitivity which often occurs when the BFO is switched in, more often than not due to excessive injection.

In the circuit shown in Fig. 1, no method has been shown for obtaining AVC, but this could be obtained by using a small diode of the EA50 type, or even a small metal rectifier such as the WX6. Effective noise suppression can be obtained by using a "follower" type limiter in the anode circuit. The grid coil, of course, tunes to the same frequency as the IF, and the small variable capacitor across it provides a means of obtaining pitch control for CW reception.

Another point in favour of this arrangement is that a regeneration control provides a ready method of obtaining variable IF sensitivity. The leaky grid detector, as does the diode, places a load on the tuned circuit and causes some loss of selectivity, but this is offset by the additional tuned circuit, and the regeneration control.

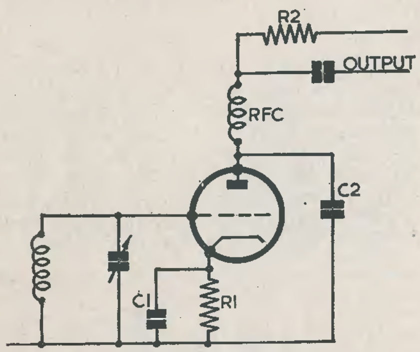


FIG. 3
ANODE BEND DETECTOR
C1—0·5µF MIN C2—·001µF
R1 & R2 ACCORDING TO VALVE TYPE
RC41

Another form of detector which provides more selectivity than the above is the "infinite impedance detector," the circuit of which is shown in Fig. 2. This detector places practically no load on the tuned circuit and has good linearity and a high signal handling capacity. The actual sensitivity however, is little better than the diode, and it does not lend itself so readily to the variations in circuit design that may be obtained with the leaky grid.

Another type is the "anode bend" detector, where the valve is biased almost to cut-off and the application of a signal causes an increase in anode current, and the anode current follows these RF variations in a manner similar to the changes in a diode detector.

The anode bend detector, Fig. 3, is considerably more sensitive than the diode, will handle greater inputs than the leaky grid type, and will not damp the tuned circuit to the same degree as either of these types. However, in spite of all the apparent benefits to be obtained from these last two types, the leaky grid has the vote because of its greater flexibility. Two of the best types of valves to use are the 6AK5 and the Z77, wired as pentodes as shown in Fig. 4.

The cathode tap on the coil should be approximately 1/6th of the way up from the earthy end. With the 50 pF variable capacitor set at approximately half-way in, the grid coil should be carefully tuned to resonance with the IF. This is best done on a signal with the detector in a non-oscillating condition. When the regeneration control is advanced, the detector will oscillate for CW reception and the 50 pF variable can be used as the pitch control.

The audio gain control is, of course, fitted to the following valve, and not in the grid circuit of the detector.

It is hoped, later in this series, to deal with noise suppression as applied to TRF receivers

(*Continued on page 240*)

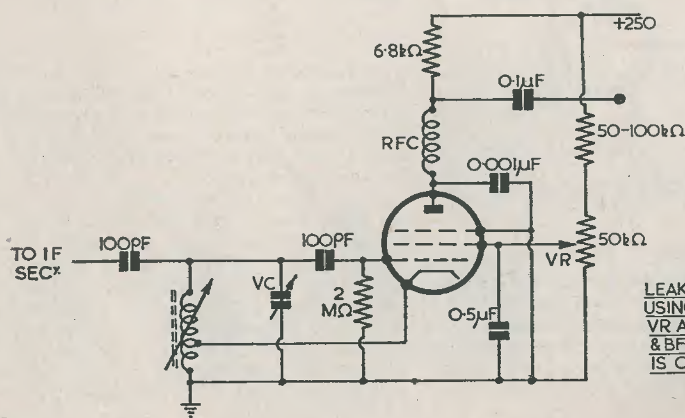


FIG. 4
LEAKY GRID DETECTOR USING Z77 VALVE
VR ACTS AS SENSITIVITY & BFO CONTROL. VC IS CW PITCH CONTROL.
RC42

ANTI-INTERFERENCE AERIALS

By **K. B. PULLIN**

The anti-interference aerial is, as its name implies, a type of aerial designed for minimum pick up of local interference, such as car ignition and other forms of electrical interference. It is already known that the best cure for electrical interference to radio reception is to get at the source of the trouble and fit suppressors to the offending apparatus. In many cases this is not possible, and until legislation is passed making it illegal to operate electrical apparatus or use cars unless fitted with suppression devices, the interference pulses must be minimised by using special aerials, and by the fitting of noise suppressors to our radio and television receivers. It has already been established that peak car ignition interference exists between 60 and 20 Mc/s. These frequencies include the Television bands and some of the SW Broadcast bands. It is on these portions of the SW spectrum that car ignition interference is at its *worst*, but it does, of course, extend from well into the 420 Mc/s. Amateur band to below 1 Mc/s.

Leaving Television, we shall deal only with the Broadcast and Amateur bands. It should be stressed that where severe local interference is being experienced, both from cars and electrical machinery, several important points must be observed.

(1) The aerial must be erected as high as possible.

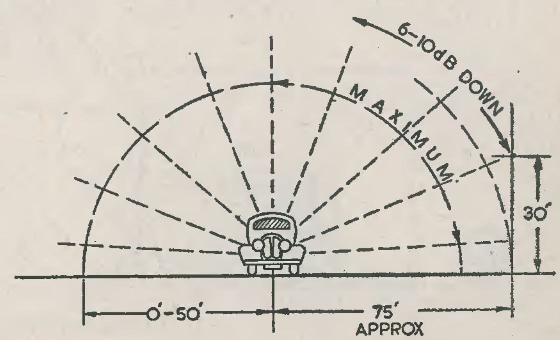
(2) The "lead-in" or "feeder" should be screened or "twisted" in order to ensure that as little as possible of the interfering pulses shall be picked up on the "lead-in."

(3) The aerial should run at right angles to the source of interference and not parallel to it.

(4) Wherever possible, in areas of severe interference, the aerial should be designed to "resonate" on the frequency band most used by the listener. (This may entail erecting two or even three separate aerials).

Taking these points one by one, the first consideration is height. Car ignition and most other forms of interference are usually greatly attenuated at heights of 30 feet or more *above* the source, and at 75 feet or more horizontally (see Fig. 1). We shall deal first of all with a listener on the 10-metre Amateur band, who desires maximum results with a minimum of interference. We will suppose that a main road runs along at the front of the house, and some 100 feet of garden is available at the rear. A 10-metre half-wave dipole is the best aerial to use, with 50 Ω coaxial feeder forming the "down lead." This is shown in Fig. 2,

Fig. 1. Approximate height and distance at which car ignition is greatly attentuated (average case only).



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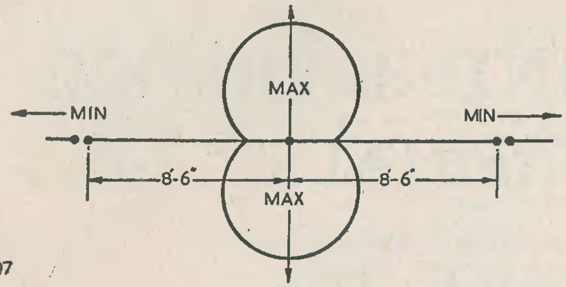

C697

Fig. 2. Showing directional properties of a 10-metre half-wave dipole (plan view or polar diagram).

together with the lobes of maximum reception. It will be apparent that " minimum " reception is in a line with the wire, and it must, therefore, be installed " against " the noise source, rather than for maximum signal from any given area. All four important points, previously given, have now been dealt with. Coaxial feeder has an " inner " and an outer and, referring to the sketch Fig. 3, the " outer " should be connected to the half nearest the house. The feeder should be taken straight down from the aerial and may even be buried in conduit for the rest of its journey to the house.

If the receiver in use is of the " domestic " type, it will probably be designed for use with " high inpedance input." In this case, the 50 Ω feeder cannot be connected directly to it. (Note:— Nearly all types of Communication Receivers are designed for " low impedance " aerial connection, and will thus not require any modification). A simple aerial tuning unit must be constructed in order to couple the 50 Ω feeder to the high impedance input of the receiver. A coil of 8 turns, 1" in diameter, wound with No. 16 Copper Wire, spaced $\frac{1}{16}$" between each turn, and tuned with a 50 to 100 pF variable capacitor is all that is required. This is sketched in Fig. 4, and the unit will only require tuning. Listen to a signal on the receiver, and adjust C1 for maximum. The unit will now need no further adjustment. It will be appreciated that this unit is more in the nature of an " impedance transformer " than a tuning circuit.

Another requirement is a good earth connection. This should be as short as possible and of low resistance (i.e. thick wire). Provided that a height of some 30 feet has been obtained for the aerial, and it has been erected at least 75 feet from the main road, the car interference level should now be lessened by well over 50 per cent. This arrangement will also minimise the interference from nearby vacuum cleaners and other electrical apparatus. It must be realised that this aerial resonates on the 10-metre Amateur band, and it is on that band that absolute maximum results will be obtained. It will operate satisfactorily up to

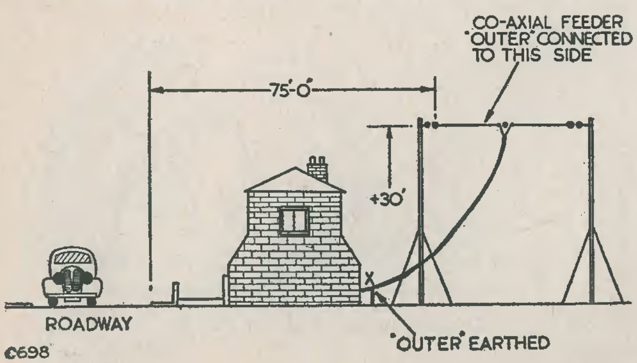

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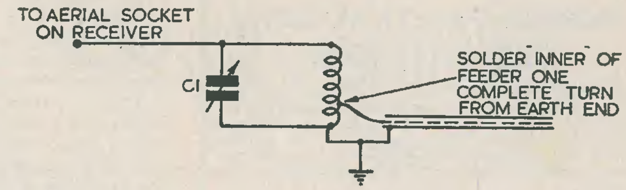
Fig. 3. Arrangement for good discrimination against car ignition interference.

Fig. 4: "Impedance transformer" for use with receiver having high impedance input.



C699

15 or even 20 metres, but will be less efficient. An aerial for the 20 metre band should be exactly twice the length for optimum results, and in this case, the number of turns on the aerial tuning unit should be doubled.

Various types of anti-interference aerials are obtainable commercially, and these are designed to operate over the whole short and medium wave ranges. Some are fitted with a switched transformer at the connection to the receiver to provide a better impedance match over certain ranges of frequencies.

Mains borne interference

It is not generally realised that much of the interference from electrical equipment is introduced into the receiver via the mains lead. Before erecting any special aerial, therefore, it is a good plan to try some simple limiting devices on the mains input. Fitting two 0.01 μF capacitors across the mains, with the centre connection to earth, often effects a surprising improvement.

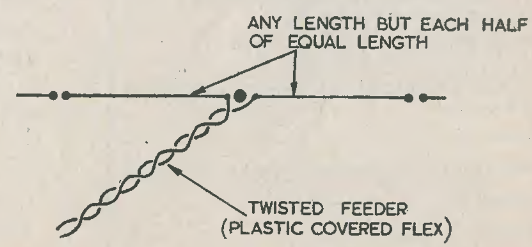
Indoor aerials of all types are particularly prone to pick up interference from the house wiring, and where an indoor aerial is absolutely necessary it is always better to instal this as near to the ridge of the roof as possible, and use a screened down lead, with the screening well earthed.

The " Doublet "

A cheaper, though somewhat less efficient type of noise reducing aerial for the SW broadcast listener, is the " Doublet " shown in Fig. 5. The feeder is plastic-covered flex, quite easily obtainable today. With this arrangement, no transformers are required and the feeder is connected to the aerial and earth sockets of the receiver in the normal manner, and it is immaterial which way round they are connected. The usual earth lead should, of course, be connected to the receiver. For normal short and medium wave reception, the top section may be 30 feet overall, but the length is relatively unimportant provided that each half is of the same leng h. Once again, height is of the greatest importance, and the feeder, being twisted together, is a poor " collector " of RF pulses. (Note:— Plastic covered flex should not be used for VHF work; its losses are too high on frequencies above about 30 Mc/s).

The twisted type of feeder is known as a " balanced " feeder. Balanced feeder is also manufactured as a flat twin wire, not twisted together. Balanced feeder only remains balanced when each wire is spaced exactly the same distance apart and spaced the same distance from any earthed object. For this reason alone, the so-called balanced feeder ceases to be balanced as soon as it enters the house. The phase difference between the two wires is then upset, and the feeder becomes " live " and is liable to act as an aerial. Thus the benefits of using a balanced feeder are often lost and results can be disappointing.

Fig. 5: The doublet. As in Fig. 3, the " end " should point towards the interference.



C700

The interference problem is one which cannot be generalised, and so much depends upon the particular type of interference and upon the location. Special aerials alone will not completely solve the problem. For more complete rejection of noise, the receiver should have a suppressor incorporated, either of the diode or crystal type. Most communications receivers have this incorporated, but with the domestic SW Receiver a modification is recommended, using one of the systems as detailed in various Amateur handbooks. Car ignition (or "pulse type") interference is comparatively simpler to eliminate than brush discharge, or "hash" from electric motors and similar apparatus. This latter is best dealt with at the source.

Mainly for the Beginner . . .

(*Continued from page 236*)

and leaky grid detectors, as this is a problem which appears to be worrying a great number of beginners. One simple method which you can try is reducing the HT on the screen of the audio amplifier or output valve to about 20 or 30 volts. The valve will then limit on peaks of interference. It is better to fit a variable control, as the valve may be cut off on strong signals if not adjusted correctly.

The Editor Invites

articles from readers, of a nature suitable for inclusion in this magazine. Articles submitted for publication should preferably be typewritten, but ordinary writing is acceptable if clearly legible. In any case, double spacing should be used, to allow room for any necessary corrections. Drawings need not be elaborately finished, as they will usually be redrawn by our draughtsmen, but details should be clear. Photographs should preferably be large (half-plate) but in any case the focus must be good. Much useful advice to prospective writers is given in our "Hints for Article Writers," which will be sent free on request.

"THE MAGNA-VIEW"

The Radio Constructor's 16 inch Televisor

PART 11

Revised Sound Noise Limiter

Some effective improvement in the sound section has been made to the noise limiter, the new arrangement of which is shown in the diagram. Reference to the August issue will show that the required modifications are very slight.

New components are given their actual values in the circuit, whilst the remainder are numbered as before. The most noticeable improvement is the complete absence of background when no signal is being received.

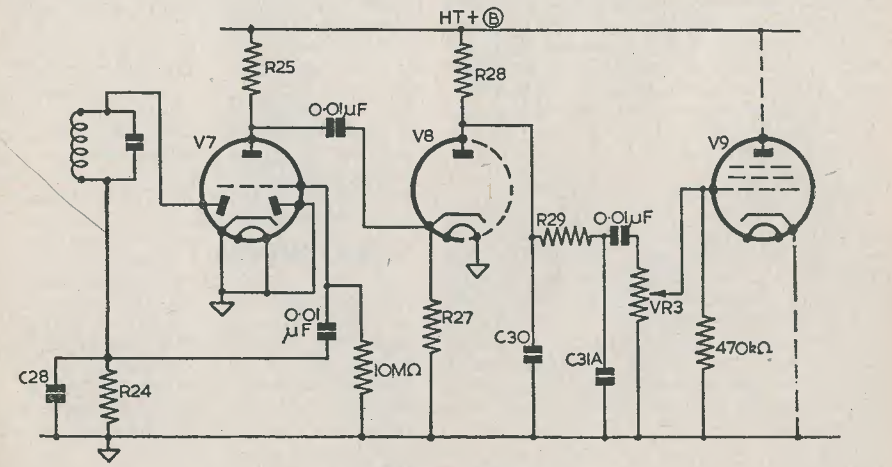
The peak interference clipping remains as efficient, and the volume level is maintained. As very little trouble is incurred, it is undoubtedly a worthwhile modification.

Queries

Quite a few queries have arrived at these offices, and a selection is printed here for the interest of readers.

French without BBC

Probably the most interesting was the vision and sound strip which failed to receive the BBC, but reproduced a French station. Oddly enough, this particular set when in circuit with a signal generator accurately tuned to 45 Mc/s gave out a terrific signal. The answer to this one was, of course, that the coils L2A and L2B were accidentally separated by so great a distance that no coupling was effected and, in consequence, the oscillator section failed to inject into the mixer half of the 12AT7. An average separation between these coils is ¼". No analysis of the French station was carried out, but presumably it was a harmonic sympathetic to the intermediate frequency of the TV strip. The signal generator produced enough signal to bridge the gap, thus distracting the constructor from the real fault.



NEW NOISE LIMITER

RC 34

Coil Connections

Another query, relating to the coils, referred to the correct connections. The lower end of the coils should be taken to the " earthy " points. L1, which has a PVC winding intended for the aerial, is plainly shown in the circuit and the photographs.

Faulty Frame Scan and Drive

One reader was experiencing trouble with the frame scan and failure of the EHT rectifier to heat up until the drive control was well advanced. The answer was found in the fact that the frame blocking transformer had been connected in the reverse sense (primary instead of secondary, and vice versa), and all the controls had been set to compensate for this error. Correcting the connections here immediately solved at once this unfortunate mistake.

Collapsing Line Sync

One point which has arisen, slightly obscure in its origin and one which it is doubtful if many readers would have cured, took the form of collapsing line sync progressively worsening the longer the set was in service. Fortunately, this particular fault was located within reach of the laboratory and so we were able to give the set a really comprehensive examination. This fault is one which may occur in other " Magna-View " chassis built by readers, and is due to varying fluctuations in the Ferroxcube in the line output transformer. A state of oscillation is created, gradually increasing in frequency until it exceeds the normal oscillation frequency of the line multivibrator. When this condition is reached, the line sync has less and less effect. The remedy is to change the component values of R36 and R37. It should be noted that if this change is put into effect, both components must be changed and not either one by itself. R36 becomes 82 kΩ, and R37 becomes 1.5 kΩ.

Fading EHT and Scan

Here is a fault which certainly was troublesome at first. The set concerned functioned very well for about an hour, but then the EHT and scan gradually faded away. This was found to be due to a faulty 6SN7 in the line multivibrator stage. One half of this valve had fairly good emission; the other half suffered from an electrode fault which expressed itself under thermal conditions. Substitution by a new valve provided a complete cure.

Dry Joints

Sad to relate, there were one or two instances of bad soldering destroying sync separation, despite our warnings on this subject. It cannot be over-emphasised that good workmanship is absolutely imperative in any radio, and even more so in a televisor.

Faulty Focusing

Failure to study the text also produced a case of faulty focusing. A 12″ tube was employed for setting up the raster, and a separate power pack was employed to feed a vision and sound strip from a previous effort.

Under these circumstances, apparently the voltages had been properly assessed by the constructor, but unfortunately the series resistor (R42) requirements were overlooked. Thus insufficient current was shunted through the focus coil. Raising the value of this resistor to approximately 1,000 Ω at once cured the trouble.

Poor Brilliance

Poor brilliance on a T901 English Electric tube was due to a de-magnetised ion-trap magnet.

A severe blow to this component was the probable cause, to judge from correspondence on the matter.

Vertical Black Bars

This has already been discussed, and is due to a long lead from the grid of the tube falling within the radiation field of the line output transformer.

Within this category was the complaint from a neighbour of interference to a domestic radio receiver. This can admittedly happen under certain circumstances; again from the line output transformer.

The cure is to make up a suitable shield for the transformer. A most effective and simple device is to secure some perforated zinc and completely enshroud this component. As great a clearance as possible all round is required to avoid fouling the high voltage points, and a piece of polystyrene tubing should be used to carry the EHT lead through the cover when constructed.

Cathode Modulation

A query was received regarding the use of cathode modulation and, although this could be done, no advantageous reason could be seen for revising the entire tube and time base portion of the set. Reasons, good reasons, have already been given on this subject, and your writer is unwilling to interfere with a design that has shown itself to be first-class.

No EHT or Raster

An unusual fault reported from one constructor was complete failure to obtain either EHT or raster. His clue to us, here, was his remark that the line-hold control was completely over to one side of its swing. Here again we must point out that the timebase of the " Magna-View " is so inter-related that a failure in one section is quite likely to disturb the remainder of the circuit.

The line-hold potentiometer was completely broken down in this instance, and a leaky C31 meant that all the recovery volts from the 6U4GT were lost to chassis. Changing these two components effected an immediate cure.

Where possible, do try to check as many components as possible with the instruments available, before using. It will pay in the long run.

Frequency Drift

Frequency drift was also raised as a query. Some effective improvement can be carried out by taking R8 on the vision strip to the choke output on the power pack.

Reference to the circuit will show that it is possible for HT fluctuations to occur as a result of varying requirements on the vision/sound chassis. Taking the supply to R8 from the point suggested above places it largely outside this changing influence.

The Ion-Trap Magnet

One reader, it is feared, does not carefully follow the *Radio Constructor* and our constant efforts to improve minor points in the " Magna-View." This query suggested excessive difficulty in locating the ion-trap magnet.

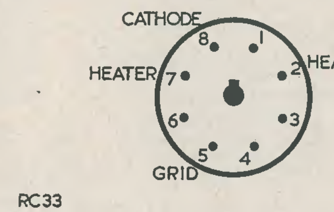
It was known that the available space for this component was small, so we gave details in the November issue of modifications to the focus board which provides an additional half-inch of neck space.

TEST REPORT

The Ferranti TR14/2 Aluminised CRT

We have received one of the above television tubes for test in the " Magna-View " Televisor. It is a 14″ rectangular tube with a particularly well defined resolution, and is very suitable for those requiring a picture slightly smaller than is obtainable from the tubes previously dealt with.

Installation arrangements follow the description given in the September issue of this magazine, with suitable reductions in measurements for this size tube. The supporting front block will be approximately 5″×12½″. The securing straps are simply made shorter, and this can easily be done with the tube in position. The mask construction, etc., will follow the procedure as previously described.



Base connections for the Ferranti TR14/2 CRT

This tube requires a maximum EHT of 12 kV, and the simplest method of arriving at a balance for reduced EHT and scan is to lower the HT rail voltage and also reduce the screen voltage of the 6CD6G. R31 on the timebase should be raised, then, to approximately 22 kΩ, (see June issue). The series resistor circuit shown in conjunction with the power input (same issue) may be amended to about 600 Ω, subject to the efficiency of individual sets.

The scanning angle for the TR14/2 is 65°, which clearly indicates possible over-scanning. However, the above modifications will provide the necessary correction.

The heater is rated for a 4V supply. Connections for the international octal type base are given in the accompanying diagram.

The external coating of the tube should be connected to chassis; this coating also provides the final EHT smoothing (see September issue).

This tube has a 38 mm neck, so that a thin packing of paper should be used when fitting the deflection coils.

"MAGNA VIEW"—*Reprints*

It is with considerable pleasure that we acknowledge the many compliments paid to us on the remarkable quality of this televisor by readers who visited the R.S.G.B. Sixth Annual Amateur Radio Exhibition.

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8in.	18/6	15/–			

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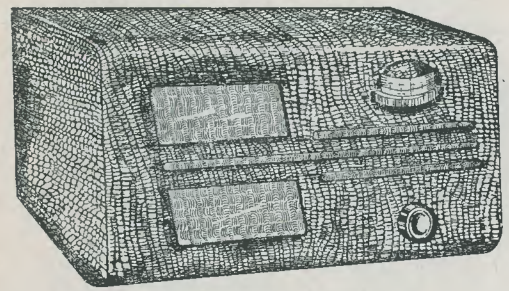

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The usual resistance ranges on universal meters will not read resistances of the order of one ohm, and the current consumption from the battery is always quite high on the lower ranges (some 200 mA is a normal figure).

Due to this high consumption, unless the battery is new the voltage takes some time to stabilise, and the zero reading is continually varying. The circuit shown here overcomes this defect, as the consumption is only 2.5 mA, but it will comfortably read a resistance of a quarter of an ohm. The accuracy of the reading is independent of the state of the battery so long as it is lively enough to allow the zero reading to be reset.

All that is required to calibrate the instrument is one standard resistor of a value equal to the mid-scale reading, in this case 5Ω.

The movement is an ex-WD RF ammeter, which was purchased at very low cost as the thermo-couple was faulty. The latter was removed and the meter connections were wired directly to the terminals on the case. This particular movement had a resistance of 2Ω and a full scale deflection of 2.5 mA.

Ordinary types of movement, such as the 0-1 mA type, can be used, but their internal resistance is usually too high, and it would not be possible to use the printed scale which accompanies this article.

Fig. 1 shows the circuit. It can be seen that the meter is energised by the battery, with the fixed dropping resistor to limit the current in the circuit to the value which will give full scale deflection of the movement. The variable resistor is employed to compensate for ageing of the battery. The resistance to

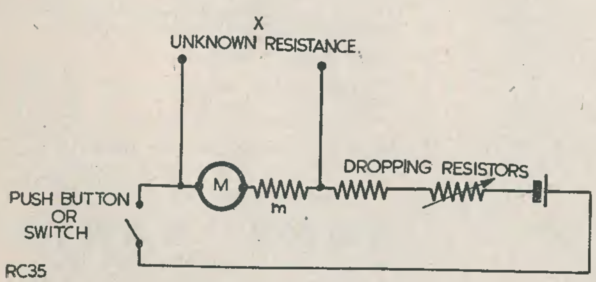
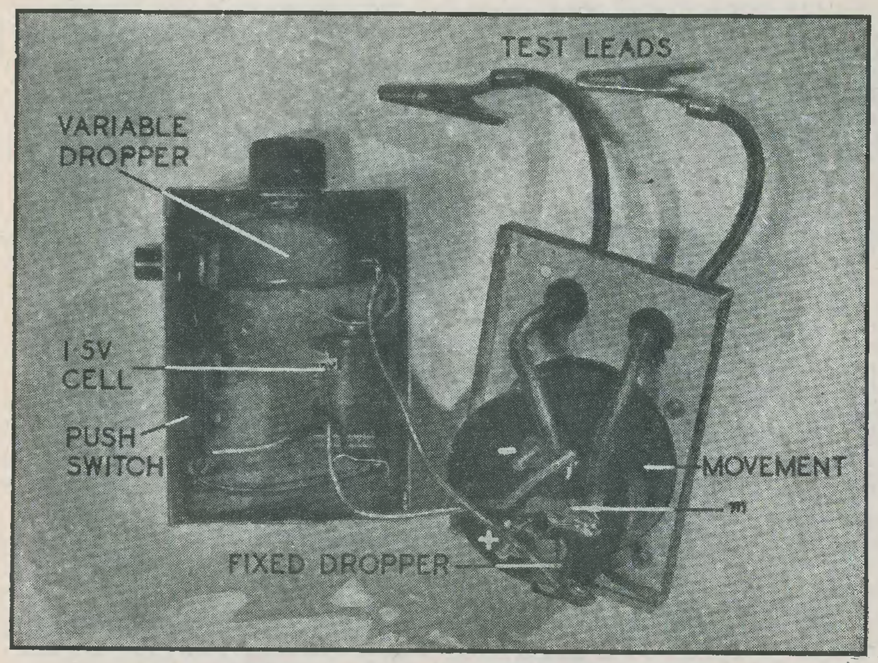


Fig. 1. Theoretical circuit of the Low Ohms Meter.

COMPONENT LIST

- 1 RF Ammeter, 4A, 2¼" square, type 10A/13383
- 1 Fixed dropper, 400 Ω
- 1 Variable dropper, 500 Ω
- 1 1.5V cell
- 1 Standard resistor, 5 Ω



Internal view of the meter, showing layout and wiring of components

be measured is placed across the meter movement and calibration resistor *m*, instead of in series as is more usual. This means that the scale is the normal way round, instead of giving the usual backwards reading, i.e., 0 ohms is at the left of the dial.

Reference to Fig. 2 shows that when a resistance is being measured there are two possible paths for the current, one through the movement and one through the unknown resistance *X*. If *X* is equal in value to the sum of the movement resistance *M* and the calibrating resistance *m*, then the current *I* will divide equally between the two paths and the meter reading will be halved. This is the most simple case to appreciate, and will be followed when calibrating as described later.

Take another case: if *X* had been 1 Ω resistance, and $M+m$ is 5 Ω, then five times as much current will flow through the 1Ω resistance as will flow through the other path. Another way of putting it is that the movement current is only one sixth that of the total current. This leads us to the formula:

$$\text{Meter I} = \frac{X}{X+M+m} \times \text{FSD}$$

From this the table given was worked out. Thus, given the centre point of the scale being accurate, the rest can be worked out. If the correct movement is used it is not necessary to calculate this or use the table, as the scale given can be used.

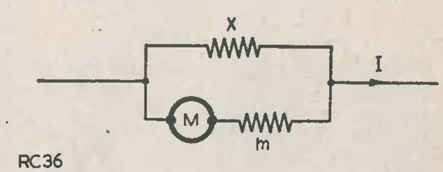


Fig. 2. Showing current paths through movement and shunt

Although the unknown resistance changes the resistance of the energising circuit, the change in the current is so small that the effect can be ignored. If the same circuit were set to measure 50 Ω mid-scale, there would be some inaccuracy.

Also, the battery and dropping resistors are across the movement, and therefore affect the higher resistance readings. Fortunately, the resistance of the droppers is high compared with the meter reading, and this effect is also negligible. Because of this, slight changes in the dropping resistance to compensate for the battery voltage do not affect the scale reading.

Table giving meter readings for various values of resistance

R Ω	*% full-scale reading*	*Meter reading*
0.25	4.75	0.12mA
0.5	9.1	0.23
0.75	13.1	0.33
1.0	16.7	0.42
1.5	23.1	0.58
2.0	28.8	0.71
2.5	33.3	0.83
3.0	37.5	0.94
3.5	41.2	1.03
4.0	44.4	1.11
4.5	47.3	1.19
5.0	50.0	1.25
6.0	54.6	1.37
7.0	58.3	1.46
8.0	61.6	1.54
9.0	64.3	1.61
10.0	66.6	1.67
12.5	71.4	1.79
15.0	75.0	1.88
17.5	77.7	1.95
20.0	80.0	2.0
30.0	85.7	2.14
40.0	88.8	2.25
50.0	90.8	2.28
75.0	93.8	2.35
100.0	95.2	2.38

Fitting of the paper scale to the movement is not difficult, provided care is taken. Here are a few hints:—

The best glue is ordinary office glue. You will also need a pair of tweezers and a fine screwdriver.

Get a flat board or a piece of paper to work on. Failure to do this will invariably result in losing a screw, or getting the works full of iron filings. It is incredible where these come from, and once in the works they are extremely difficult to remove.

Touching the pointer or giving it a slight bend will do no harm, but do not accidentally give it a " bash " on the tip when replacing the scale. This often proves fatal.

Remove the scale by undoing the two fixing screws, but don't drop them in the works. If you do, beware of damaging the hairspring; shake them out, but don't try to pick them out. Whilst removing the scale, set the pointer as near to the centre as possible by means of the zero set.

Glue on the new scale, and re-assemble. Hold the screws in place with the tweezers whilst starting the threads.

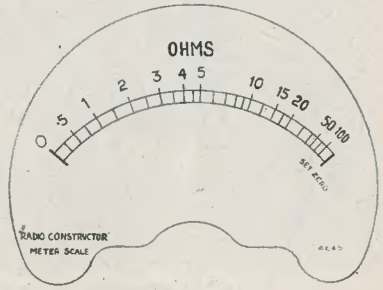


Fig. 3. This scale may be cut out and pasted on to suitable meter movements as described in the text.

When putting on the cover, don't force it. Sometimes the zero screw on the cover *does* locate properly the first time ! Put the screws in the cover and then check that the zero setting screw is working properly in both directions.

Connect up the instrument and adjust the dropping resistor until full scale deflection is obtained. Connect the standard resistor and adjust the movement series resistor until the correct scale reading is indicated. This series resistor will have a value of some 3 Ω only, and can be made from Eureka or even fine copper wire. Some four feet of 38 swg enamelled copper would do, or some three inches of the same gauge Eureka.

The instrument is now ready for use.

QUERY CORNER

A "Radio Constructor" Service for Readers

A Mixer Pre-Amplifier

I have a microphone and a record player which are together located some 10 ft. from the amplifier and speaker system. I wish to construct a mixer unit which will enable me to fade from one to the other whilst at the same time giving some small degree of amplification. Can you please recommend a circuit of such a unit?

D. Craig, Gosport.

Our recent description of a mixer unit suitable for use at the input of a power amplifier has led several of our readers to request a circuit diagram of a combined mixer and pre-amplifier which is suitable for use at the remote end of the signal input cable. The arrangement where the record player is mounted in a separate cabinet away from that which houses the main amplifier and speaker system appeals to many quality enthusiasts because it eliminates mechanical feedback between the speaker and the gramophone pickup. This type of feedback can be responsible for the blurring of the louder passages of speech and music, an effect which can mar the reproduction of an otherwise perfect amplifier system.

There are, however, two pitfalls which may beset those who have had no previous experience in the use of pre-amplifiers. The first concerns the choice of output impedance for the amplifier. As a generalisation it is fair to state that if the top note response of the amplifier is to be maintained, its output impedance must be reduced as the capacitance across the output terminals is increased. This capacitance is largely due to the screened cable which carries the signal from the pre-amplifier to the main amplifier. The capacitance of this cable is often in shunt with the load resistance of the last valve in the pre-amplifier and, as the capacitative reactance decreases as the signal frequency increases, so the gain of the valve is reduced at the higher frequencies. It is therefore important that the pre-amplifier should present a low output impedance to the screened cable.

The second pitfall mentioned earlier concerns hum. A prolific source of hum in pre-amplifiers which derive their HT and LT supplies from the parent amplifier is inductive coupling between the LT leads and the screened signal-carrying lead in the multi-way cable used to couple the two units. We believe that the best way of overcoming this trouble is to supply the valve heaters in the pre-amplifier from a separate LT transformer. Generally, the HT requirements of the extra unit are so small that they can be easily met by the power pack in the main amplifier.

In designing the amplifier circuit shown in Fig. 1, particular attention has been paid to the points mentioned above. Two input channels are catered for; one has a high sensitivity and is suitable for handling the output from the microphone, whilst the other has a lower sensitivity and is therefore suitable for use in the gramophone pickup circuit. Reference to the circuit diagram shows that the high gain input channel is fed into a low

Query Corner

RULES

(1) A nominal fee of 2/6 will be made for each query.

(2) Queries on any subject relating to technical radio or electrical matters will be accepted, though it will not be possible to provide complete circuit diagrams, for the more complex receivers, transmitters and the like.

(3) Complete circuits of equipment may be submitted to us before construction is commenced. This will ensure that component values are correct and that the circuit is theoretically sound.

(4) All queries will receive critical scrutiny and replies will be as comprehensive as possible.

(5) Correspondence to be addressed to " Query Corner," Radio Constructor 57 Maida Vale, Paddington, London, W.9.

(6) A selection of those queries with a more general interest will be reproduced in these pages each month.

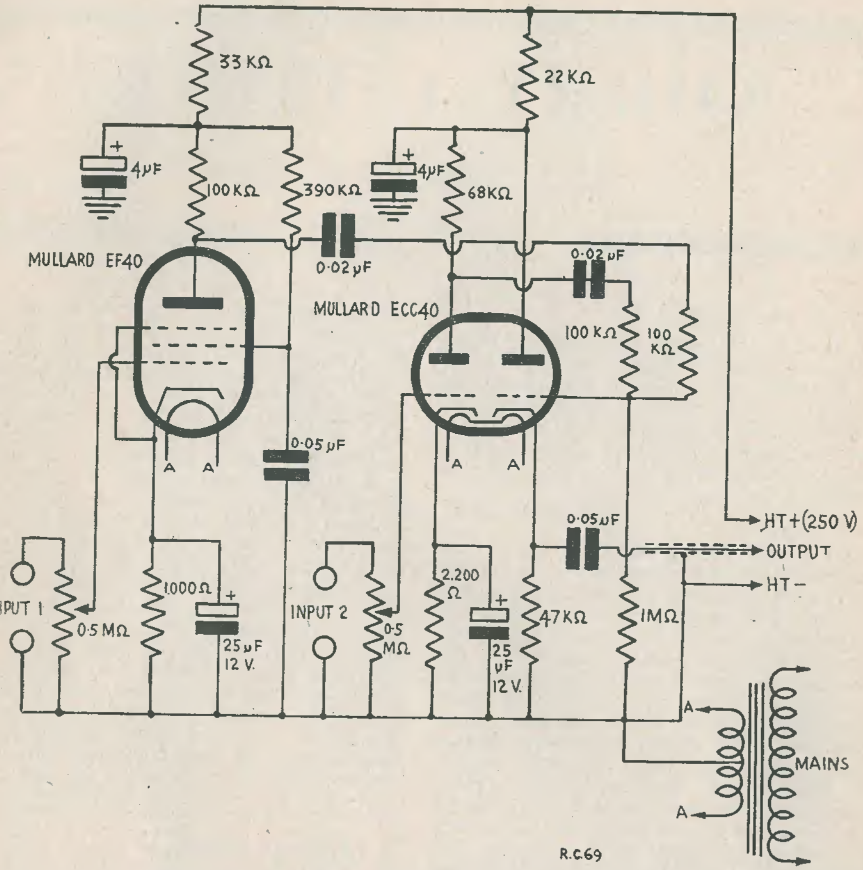


Fig. 1. Circuit diagram of the Mixer Pre-Amplifier. The HT is taken from the main amplifier, the drain being 5 mA.

noise pentode which is operating as a resistance-capacitance coupled amplifier. The output of this stage is fed into the input of one half of a double triode which is arranged as a cathode follower. The low gain input channel is fed into the other half of this valve which functions as a straightforward amplifier. The output of this section is also fed to the cathode follower. The signal level in the two channels can be separately adjusted by means of independent volume controls, it being possible to take the signal from either channel or to fade from one to the other. The output impedance of the pre-amplifier is in the region of 700 ohms, a figure which is sufficiently low to prevent any attenuation of the upper signal frequencies. The secret of this low output impedance lies, of course, in the use of the cathode follower output stage. The output impedance of this type of circuit is approximately equal to the reciprocal of the mutual conductance of the valve.

To prevent any inter-action between the two channels, stopper resistors are included in the signal leads before these become common at the input of the cathode follower. Freedom from HT hum is ensured by the provision of ample decoupling. For reasons already given, the LT supply is derived from a small mains transformer which has a centre-tapped 6.3V 1A winding. The construction of the pre-amplifier is a job which should present no difficulties. A rectangular chassis should be employed with the two valves arranged in positions similar to those shown on the circuit diagram. The mains transformer should be located at the output end of the chassis, together with the four-way plug and socket used to connect the unit with the main amplifier. Screened cable should be used for the input and output signal connections, the input leads being kept as short as possible, whilst within reason the output lead may be as long as required.

Secondary Resistance

I have a mains transformer which has a 250–0–250V secondary winding. Upon measuring the resistance of the two halves of the secondary I was surprised to find quite an appreciable difference in reading. Does this indicate that one half of the winding has some shorted turns?

B. Marsden, Lincoln.

It is quite usual to find a difference in resistance between the two halves of a centre-tapped secondary winding. This difference is due to the fact that one half of the winding is placed nearer the transformer core than the other half, and is therefore wound on a slightly smaller diameter. This means that less wire will be used for a given number of turns, and hence the resistance of the inner section will be lower than that of the outer section. Both sections will, however, have the same number of turns and will provide the same output voltage.

To test for shorted turns on a mains transformer, it should be connected to the mains supply and allowed to run entirely off load for an hour or so. After this time there should be no detectable change in its temperature. A number of shorted turns will result in a substantial rise in temperature even when the transformer is operated off load.

AC/DC Receiver

Is it important when installing an AC/DC radio or television receiver to ensure that the mains plug is inserted in such a way that the chassis of the set is at earth potential?

K. Barr, Glasgow.

It is always considered to be good practice to connect the mains to an AC/DC set in such a way that the chassis is at earth potential. No matter how good is the insulation provided by the cabinet of the set, there is always the possibility that the user may accidentally come in contact with the chassis, possibly via one of the knob fixing screws or a chassis retaining bolt. There are small neon test prods on the market which are invaluable to the service man for detecting live chassis, the tiny neon lamp lighting when the probe contacts a live part. For a receiver which is often moved from room to room a small indicating neon can with advantage be permanently installed on the back of the set. The neon is connected from the chassis to the external earth socket, and will give immediate indication should the chassis be connected to the live side of the mains.

THESE MINIATURES CAN BE OF GREAT ASSISTANCE TO THE AMATEUR

Brimar 1AC6 — Heptode Frequency Changer

The need for economy in current has, up to now, prevented battery frequency changers from giving a performance approaching that of a mains valve. Research into new types of filament coating has culminated in the 1AC6 which not only gives a higher performance, but a considerable decrease in current consumption as well.

The oscillator section of this valve requires only 30 volts of H.T. at 1.6 mA and operates up to 30 Mc/s without difficulty. The grid and anode connections of this section are separate from the other, and a normal tuned anode or tuned grid oscillator circuit with feed-back coil may be used.

With an anode current of 0.7 mA and a screen current of 0.15 mA the conversion conductance is 0.325 mA/V, and the filament is rated at 1.4 volts, 50 mA.

If you intend to build a battery shortwave or portable receiver, the inclusion of the 1AC6 is well worth considering.

Brimar 6AK6 — Output Pentode

Constructors of car-radios and mobile equipment will be pleased to learn that this valve is now made in this country. With its heater rated at only 0.15 Amp at 6.3 volts, it is hard to believe that 1 watt output can be obtained with only 180 volts H.T. The 6AK6 is quite capable of this, however, and consuming 15 mA from the HT. supply, brings to a close the day when the power output stage has always to be associated with heavy consumption.

Brimar 6BW7 — Television R.F. Pentode

The 6BW7 is a standard 6.3 volts, 0.3 Amp noval-based miniature pentode with a phenomenally high mutual conductance. With a 180 volt H.T. supply, the slope is 9.0 mA/V, so that a high stage gain can be obtained. Produced primarily for R.F. and I.F. amplifier service in T.V. Receivers, great care has been taken to maintain a high input impedance to prevent excessive damping of the tuned circuits. The cathode is connected to two of the base pins, so that two connections can be made to earth. This lowers the impedance in the cathode circuit at high frequencies and so helps to raise the input impedance.

12BH7 — Double Triode

Another television type, this valve is intended for the dual function of frame oscillator and frame output in the time-base. Because of the high peak current requirements of such service, it has been necessary to raise the heater power, so that this valve is rated at 12.6 volts, 0.3 Amp. Being on a Noval-base, however, there is a spare pin to which the centre of the heater can be attached, so that an additional rating of 6.3 volts, 0.6 Amp is available when required.

Further information on the types mentioned above may be obtained on application to Messrs. Standard Telephones and Cables Limited, Publicity Department, Foots Cray, Sidcup, Kent, who will be pleased to send a Broadsheet containing characteristics of their valves to any interested readers.

QUALITY FEEDER UNIT

for the

VHF FM PROGRAMME

by G. BLUNDELL

PART 3

Coil Details

These are all fairly straightforward, with the exception of the discriminator coil over which particular care must be taken. In every case, the spacing between the windings on any one former must be rigidly adhered to, as this affects the coupling between the circuits. All the tuning condensers must be small enough to mount inside the screening cans, and must be mounted level with the winding that they tune. Wiring the tuning condensers underneath the chassis instead of in the cans will result in uncontrollable instability.

The condensers with a TC part number were not included in the original parts list, and these must also be obtained. Note carefully that *all* condensers with TC numbers *must* be silvered mica types, and not stacked mica or ceramic. This is necessary to ensure stability of the capacitance.

Instability which would be caused by coupling along the heater line is prevented by a combination of chokes and condensers. This is cheaper and more effective than the use of condensers only. The chokes are wound on a mandrel which is afterward withdrawn.

The oscillator and mixer coils are also wound on a mandrel, but in opposite directions. The coupling winding of the aerial coil consists of one turn only, but it must be wound as closely as possible on top of the grid winding L1.

In order to control the stray capacitances inside the IF coils, the opposite ends of the windings are made "hot," i.e., connecting to a grid or anode. The base connections of the coils should, therefore, be carefully followed.

The hardest coil to wind is the spaced bifilar winding L7B. This form of winding is necessary in order to keep the winding exactly balanced. Lack of balance results in distortion. If there is no spacing between the windings, the stray capacitance becomes too high.

The coil (L7B) consists of two 8-turn windings, interwound with, but spaced from, each other. This spacing is achieved by introducing 32 swg enamelled wire between the other wires. Four wires must therefore be wound at one time. The coil is covered with distrene varnish and then the spacing wires are removed. With care and patience a neat job can be made of this coil. The finished length of it should be approximately $\frac{7}{16}$". TC8 is the coupling condenser, with a value of 47 pF.

All coils should be covered with distrene varnish to prevent the turns becoming displaced. The writer's method of anchoring the winding is to use a small piece of card measuring $\frac{3}{8}$"×$\frac{1}{8}$". Wind the start of the winding around this, and then wind the turns on top of this card, fixing the finish of the winding under the other end of the card.

The coil formers and screening cans may be obtained from Webb's Radio, 14 Soho Street, London, W.1. The large can is the type normally used for 465 kc/s IF's, and is 1½" square by 2⅜" high.

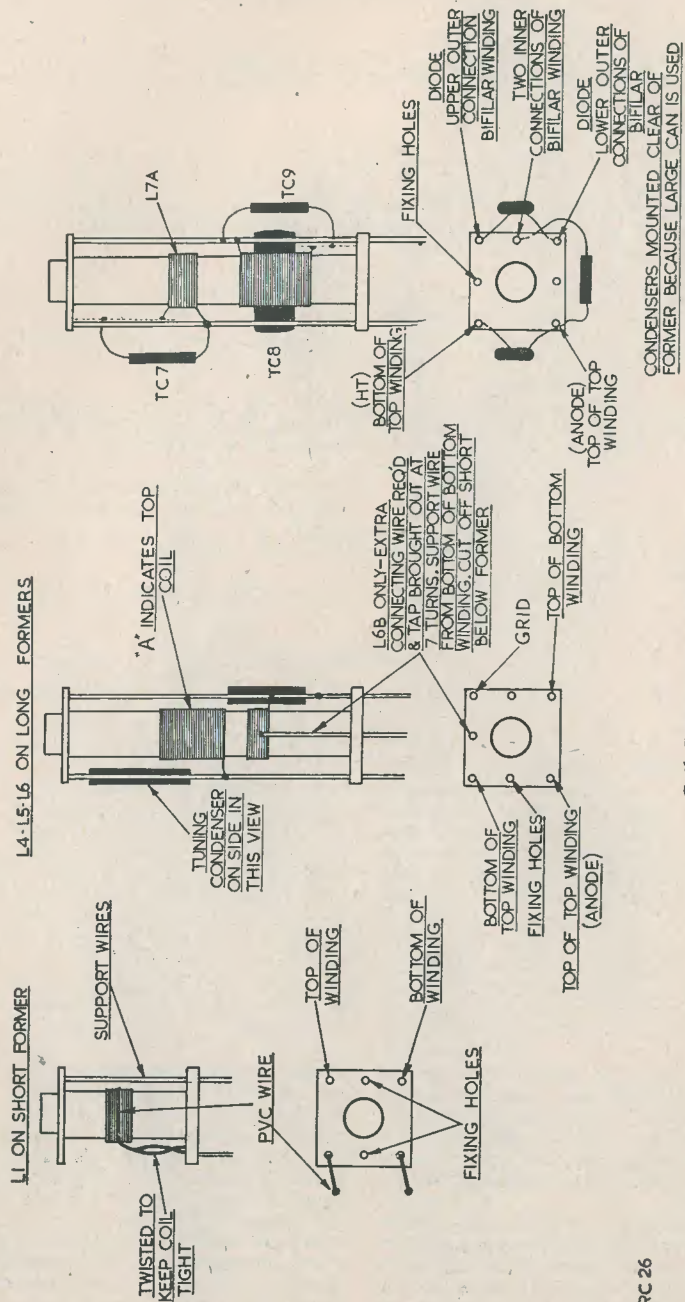
All the windings on formers are wound in the same direction. The views of the coils shown in the sketches are from the side and the base.

Table of Coil Details

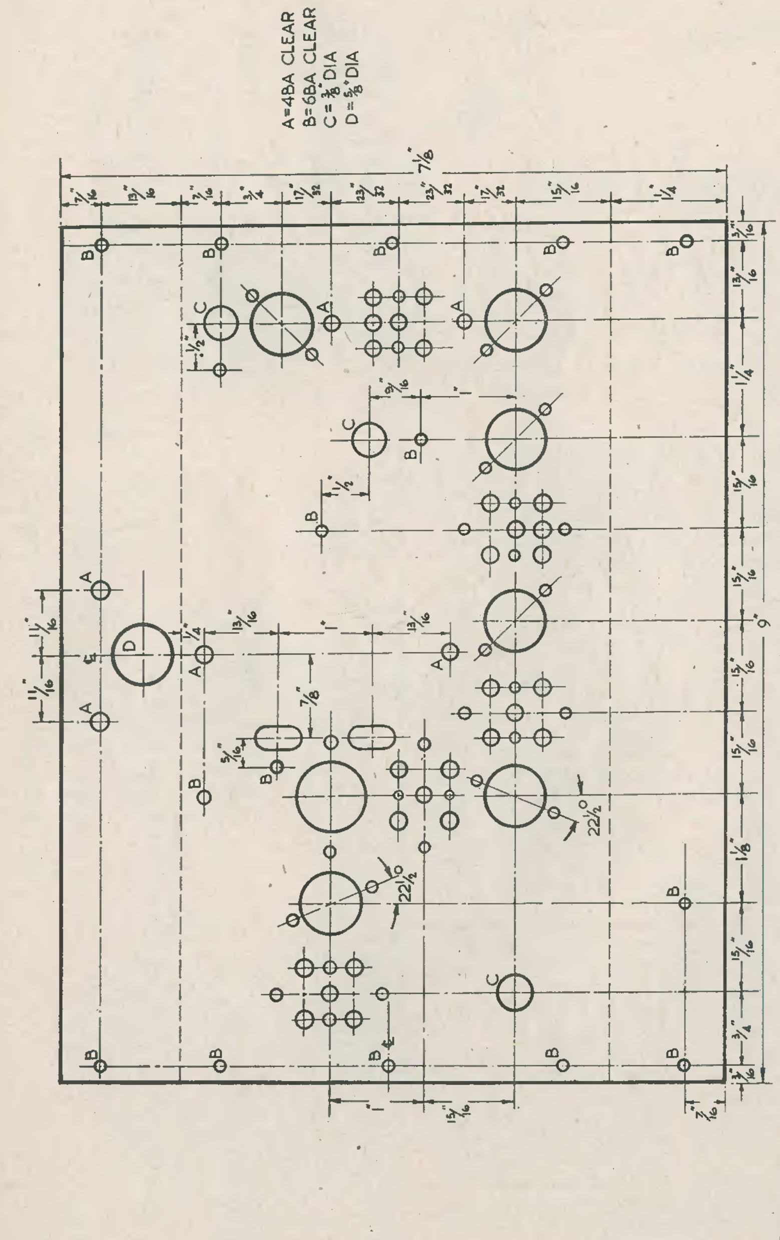
Formers and Cans
1 Short former ¾" sq. base × 1.4" high (Aladdin) with short screening can.
4 Long formers ¾" sq. base × 2¼" high (Aladdin) with 3 long screening cans.
1 Large screening can 1½" sq. × 2⅜" high.

COIL	*No.*	*TURNS*	*GAUGE*
Aerial	L1 L1A	4 1	28 DSC 22 PVC
Mixer Grid	L2	5	18 swg Tinned Copper wound on $\frac{5}{16}$" mandrel. Coil length $\frac{7}{16}$".
Oscillator	L3	4	18 swg Tinned Copper wound in opposite direction to L2, same mandrel, coil length $\frac{5}{16}$".
Heater Chokes	L8 L9 L10 L11	20	22 swg PVC wound on ⅛" mandrel.

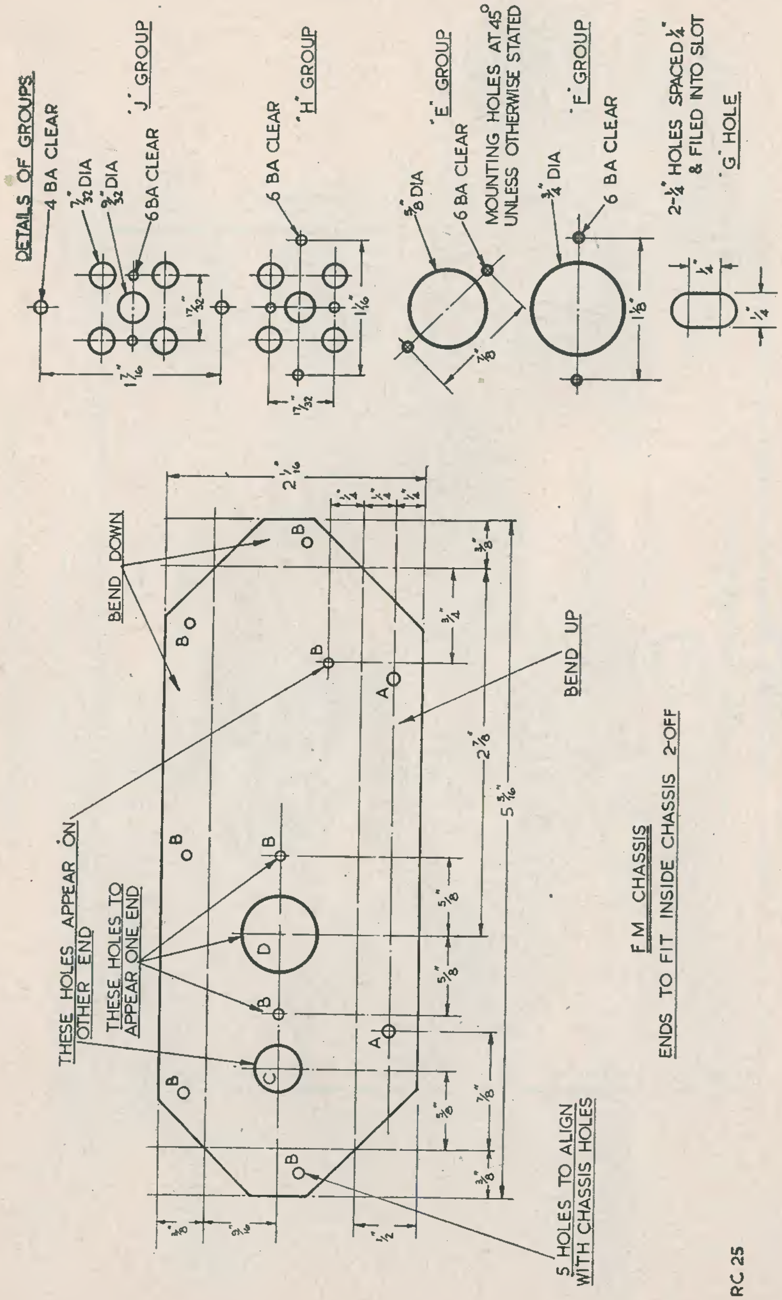
COIL	*No.*	*TURNS*	*GAUGE*	*TC No.*	*CAPce S.Mica*	*SPACING*	*DETAILS*
IFT1	L4A L4B	13 13	28 DSC 28 DSC	TC1 TC2	33 pF 33 pF	$\frac{9}{32}$"	
IFT2	L5A L5B	25 13	28 DSC 28 DSC	TC3 TC4	10 pF 33 pF	$\frac{9}{32}$"	
IFT3	L6A L6B	25 14	28 DSC 28 DSC	TC5 TC6	10 pF 33 pF	$\frac{9}{32}$"	Tap, 7 turns
Disc.	L7A L7B	8 16	28 DSC 32 DSC	TC7 TC9	68 pF 15 pF	$\frac{13}{32}$"	see text



Coil Construction and Wiring



V H F Feeder Unit—Main Chassis Dimensions



VHF FM Feeder Unit—Further Dimension Details

from our Mailbag

Pair of Midgets

Dear Sir,

. . . . .At the same time, I take the opportunity to express (if I am permitted) some remarks about a very interesting article on midget superhet by E. N. Bradley in the October issue of *Radio Constructor*.

On p.90, column 2, line 6 it is stated that AVC can be applied to the first two valves. The valve employed as an IF amplifier is an EF42 which is a "straight" pentode with short grid base. I would dare to suggest (if AVC is contemplated) the use of a different type of valve such as the 6BA6. This valve has a B7G base and fairly high mutual conductance (4.4 mA/V) as well as variable-mu characteristics. This is only a suggestion and I am far from expressing any criticism whatsoever of the existing circuit.

A. Bohdanowicz, Grad.I.E.E., (London, W.5)

Can Anyone Help ?

Dear Sir,

I am trying, unsuccessfully so far, to obtain some technical data on the Marconi CR100. Can you help me at all ?—

W. M. ROBINSON, 2 Kimberley Road, Cambridge.

Home-made Tags

Dear Sir,

The enclosed solder tags are made from a cocoa tin, cut with a pair of scissors. Soldering is made a pleasure when using them, and dry joints are out of the question.—

R. A. POOLE (Newark, Notts).

(*The samples were quite neatly made, and from personal experience there is no doubt that such tags are quite efficient, and do solder readily.—Ed.*).

"Ma" Raymond

Dear Sir,

Centre Tap refers to Lisle Street, and "Ma" Raymond in particular, in his Radio Miscellany, December issue. This famous thoroughfare holds a reputation which is almost world-wide, and it is to the credit of the many radio dealers there that it has acquired renown as a hunting ground for the radio fraternity. Let me hasten to add that I refer only to radio apparatus, and not to certain other forms of relaxation which one is told can be obtained for money almost anywhere along the road. As a focal point for radio bargains, Lisle Street must surely be one of London's Famous Places, after all this time.

The battle which raged between "Ma" Raymond and the equally well-known Will Day will go down in history—in a purely business sense they seemed always to be at each other's throats, determined to put each other out of business by their ruthless slashing of prices. As for "Ma" herself, she was I believe an American—her accent certainly gave one that impression. I fancy she might have served some time at sea, judging by the flowery language she could use ! I could not agree more with Centre Tap when he says that she could treat a customer to a stream of eloquence that took his breath away, yet despite this attribute she had a heart of gold and displayed it on many occasions. She was a shrewd woman, able to weigh up a person with a single glance. *She* knew whom she could harangue, and if the recipient of her invective dared to clash with her, she was not incapable of inflicting physical violence upon him.

I was a schoolboy in those days, but I well remember two incidents. The first was when she was kind enough to give ear to my plea for a valve, the cheapest she could sell me. She took one look at me, and presumably decided I was a deserving case. Two Dutch bright emitters were thrust into my hand —"Take 'em home, lad, and Gawd help you if you don't make 'em work!" she told me. The price ? Not a penny would she accept. Some months later when buying a sheet of ebonite there, I dared to point out that a corner was chipped. My reward on that occasion was enough blasphemy to fill a book, a clump on the ear, and an attempt to assist my hurried exit by a kick in the pants. The venom in her eyes, and the sting of her hand, are as clear now as the day it happened. No doubt about it, she was quite a character.—

Yours sincerely,

W. E. THOMPSON (St. Leonards-on-Sea).

RADIO MISCELLANY

CENTRE TAP *talks about*

VALVES — UNIT CONSTRUCTION — SERVICING

Much has been written about the useful life of valves, and the rule of the thumb dictum—1,000 hours before the performance is markedly impaired—is still generally accepted. Tests usually prove that the emission falls away gradually at first, followed by a faster decline which eventually slows down. Like old soldiers, they simply fade away. All the same, it is no uncommon thing to find valves still in regular use after having given several thousand hours of useful service. In fact, this is what may normally be expected if one is not too fussy about good performance.

Less has been said of toughness to rough handling. Most of us have, at some time or the other, dropped one, or more commonly still let one roll off the table or work-bench. Unless the glass actually fractures they do not, like the early valves, appear to suffer. Modern electrode assembly is far more accurate and rigid than in the earlier types. In fact, the microphonic tube today is something of a rarity. Oddly enough I came across one the other day—a miniature, too. Unluckily for me it was of U.S. manufacture so I am left holding the baby, or rather I would have been if I hadn't found another use for it in a valve voltmeter where the microphony doesn't matter so much, and it can sing its head off for all I care.

Not So Fragile

The practice of handling valves with an exaggerated gentleness is no doubt a heritage from the days when they were much more fragile than the modern product. Pre-war, in one particular make, the glass envelope regularly came adrift from the cap if one attempted to move the valve from the holder without first gently prising it away at the underside of the base. I believe the trouble was due to shrinkage of the adhesive after it had been run warm. As far as I know it never occurred with unused valves of that make. It still happens with modern valves, of course, if you happen to be the type who is unlucky enough to be ham-fisted. It is difficult to see how anyone can be dim enough to try to remove a valve by tugging at the glass envelope, but it does happen. In nearly every bit of ex-W.D. gear you find at least one loose-topped valve.

In the early days many valves had pressed metal around the caps, and I remember once restoring to perfect condition a valve which had the cap wrenched right off. I felt wonderfully proud of myself until some time later when I visited a valve factory and saw how easily they were assembled by hand—once you got the knack of it. At that time the production of seven pin valves had actually started. My repair had been a mere triode, but I was handicapped by shorter lengths of wire, although by way of compensation I had cut away about a ¼″ from the top of the base. It took me about thirty minutes to get the wires through. The girls there were managing seven wires per base and doing them three or four a minute !

By Letter Post

Although I should be the last to advocate the careless handling of them in transit, valves are far more robust than is generally believed. Most modern types are well able to withstand shock treatment without suffering electrode displacement. I remember some twenty years ago seeing a G.E.C. film on valve manufacturing processes. It concluded with scenes of packing cases, filled with the normal cartons used for marketing, being heaved overboard from a low flying aircraft. After this they were checked. It seemed an odd procedure, but was intended to emphasise that even the distribution of the valves received the same careful planning as was given them in all stages of manufacture.

I suppose I should have forgotten all about this film except for a recent incident. I sent for a couple of attractively-priced ex-W.D. tubes. They came by return of post—wrapped in a sheet of newsprint covered with thin card. Being of the B7G type they entered my QTH by way of the letter box, so the least of the buffeting they suffered was to be bounced on the doormat. I straightaway put them on test and found them to be perfect. Incidentally, I later sent for a couple more and they, too, arrived safely, but this time the retailer concerned must have been in a more cautious mood. He put in a second sheet of newsprint!

Such recklessness (with valves, not newsprint) would, a few years ago, have been regarded as sheer craziness.

Simplification

Some years back I described a chassis which I called the " free-deck." Although it has not been widely marketed, many constructors have used similar designs of their own fashioning. Years ago, when receiver design was simpler and the constructor built up a " fresh " circuit every other week, it was recognised that the LF and power stages of every set were inevitably unchanged whatever variations one chose to make in the other stages. Why, then, pull them down only to re-assemble the same thing all over again ? Consequently the thoughtful constructor built the audio and power stages as a separate unit.

Section construction (I can think of no better name) has remained with us in some form or the other ever since, and I have seen several instances where it has been adopted by VHF fans even on simple converters. After all, the mixer and oscillator section remains unaltered whatever arrangement or number of valves you choose to precede it. At least one popular home-built TV receiver is also designed on these lines.

It seems we shall have to elaborate on the idea and evolve a side-by-side-twin-free-deck-chassis; unless Mr. Turner (of whom I have not recently had any news) has devised any further improvements to chassis construction, beyond his detachable holes, which might be incorporated in it.

After Sales Service

We used to hear a lot about alleged profiteering by radio repairers and there is no doubt it was fairly prevalent during the War and the early post-War years. Not that even then the less scrupulous dealer was to blame for it all. Spare parts had a mysterious way of disappearing into the black market, where a high price was demanded from repairers who had been held up for them for months and simply had to have them at any price.

To-day we more frequently hear of high charges made for TV repairs, and recently a neighbour, a level-headed business man, complained to me that he had been " gypped " over the repair of his TV. "Just a little thing which probably only cost a copper or two and I was presented with a bill for a fiver " he averred. As I knew the dealer concerned, I decided to make a few discreet enquiries.

Personally I have had a little experience of TV repair work, and I know only too well just how long it can take to track down some faults—and also something of the inaccessibility of many components ! Resistors and capacitors can change value disconcertingly after warming up, and labour costs are not cheap. With one or two cases I have known it would have been cheaper to strip out the faulty stage and re-wire it with new components.

With this particular case there was nothing like that. It was simply a faulty line transformer, quickly diagnosed. The replacement cost £3 5s. 0d.—far too much I know, but the manufacturer, not the retailer, was to blame for that. True, it was an old pattern, but set manufacturers have a duty to carry adequate spares for discontinued models. When you add to that the cost of collection and delivery, time spent in replacement and checking, office work and postage etc., it showed no profit for the dealer. If he had not supplied the set and had an After-Sales Reputation to maintain, the customer's bill would have been quite a bit heavier. This, of course, is obvious. You can't make a living out of cost price repairs. But it only goes to show that, even when a sensible type of customer has a repair done at virtually cost price, there is always the danger that he gets an idea (especially if the fault quickly follows an earlier breakdown, and the bill is high) that he has been taken for a ride.

Tailpiece

In these days of high speed, one's natural surprise at reading accounts of " visits " to the Radio Show which appear in print days before the Show opens is somewhat blunted. Nevertheless, one technical journal has managed this particular feat on more than one occasion. Now a columnist finds cause for joy in discovering that some of the firms whose success in radio was founded, in his opinion, on the constructors' market, made a come-back at the R.S.G.B. Exhibition. Maybe he, too, possesses occult powers. By my reckoning it appeared about a fortnight before the Show opened. Perhaps he was reporting last years event—just about eleven more months and ten more days too late !

Of course, he might blame the poor printer. Our own printers dropped a pie for me in this column last month. I wrote about "markers " (for locating the two-meter band) -instead of which it read as if I was commending readers to keep a sharp eye on the " markets." I hope nobody thought I was referring to fat-stock prices !

A 4-WATT AMPLIFIER

By **K. R. PIPER**

In a recent article entitled "Why go Hi-fi," I decried the constant search after wide frequency response as an essential of quality amplifiers, and it is intended that this shall be the first of a series of articles describing equipment which will, if given a chance, prove my point that quality is more a matter of balanced response than of wide frequency range response.

The amplifier to be described first is a simple enough job, comprising only two valves, an EF37 voltage amplifier and a 6V6 output stage. It gives an output at 4 watts of quite decent quality, certainly better than is achieved in most radiograms nowadays.

The circuit Fig. 1 calls for a few comments, although it is fairly conventional. Working through the amplifier, the first thing which will be queried is the input system, particularly the feed condenser C1. This has a value of only 0.001 μF; this is to obtain a certain amount of apparent top lift, although actually it cuts the bass. Aurally the effects are similar. Next the RC network from anode to grid on V1; this is a simple but very effective method of applying NFB which also introduces a certain amount of tone correction; its fitment is entirely optional and can be left out completely, but better results can be expected with it fitted. The condenser must be a very good MICA type as the slightest DC leakage will produce the most shocking results.

The adjustment of this network is fairly simple. With R1 set for max. gain and the tone control R3 backed right off to have minimum effect, the 0.5 MΩ pot. R2 is adjusted until the reproduction is most natural and then left. Volume will go down as the correct point is approached, but as there is no actual "dip" and then a rise again it is possible to pass the optimum point, when volume will

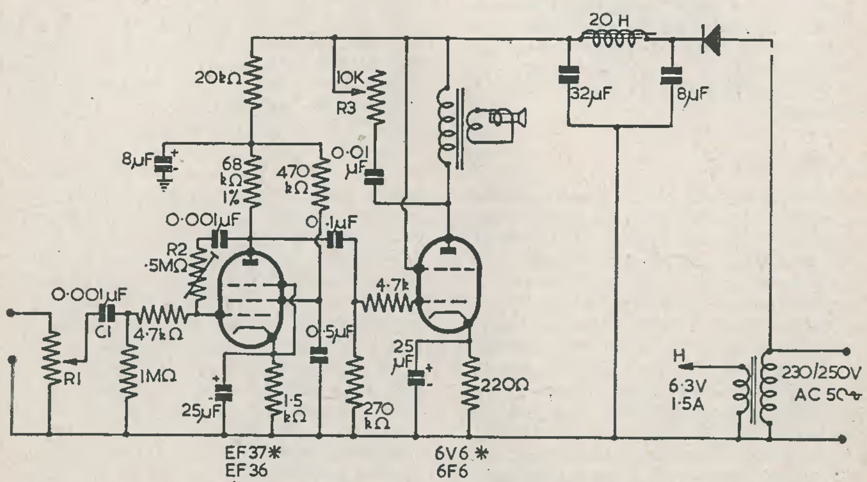


FIG. 1
THE 4 WATT AC AMPLIFIER * PREFERRED TYPES

continue to drop and reproduction will become woolly.

The volume control R1 should be of a value to match the pick-up in use; as most pick-ups seem to be unmarked, a value of 10kΩ is suggested as a starting point for most moving iron types, remembering that a transformer is still needed for the low impedance type. For crystal pick-ups a good figure would be 5 MΩ, but as pots with such a high value are hard to come by, a 2 MΩ may be used with a resistor in series with the pick-up for matching purposes.

As no isolated HT winding is used on the transformer, the chassis is alive to earth and must be treated as cautiously as a universal set.

The rectifier can be any HT type capable of handling 60 mA or more.

Universal Working

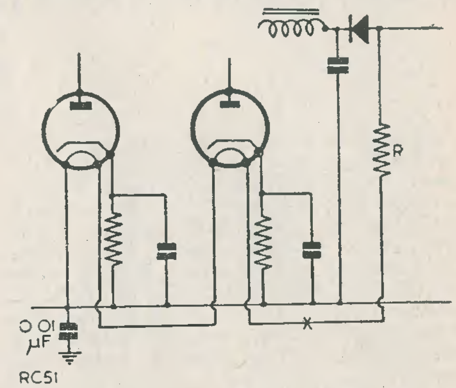
The set can be used on DC with very little modification. The output valve must be changed and two alternatives are available.

If an EF36 or EF37 is used in the first stage, a CL33 is used as the output valve; these have 0.2A heaters.

If a 6J7 is used in the first stage, a 25L6 should be used as the output valve; as these have 0.3A heaters. I have used all of these line-ups and no circuit changes are needed except, of course, for the heater line.

The transformer is done away with and the heaters connected in series, and a suitable resistor added as in Fig. 2 for 0.3A working. The value of R=766Ω for 230V working, and for 0.2A valves=1150Ω. It is also worth while adding a Brimistor at the point X; your dealer will supply the appropriate type. This will prevent any surge of current reaching the heaters when switching on.

In the above notes I have omitted to say why the 68kΩ anode load of V1 is a 1% type. This is so because this load must be accurately maintained and free from noise; the cracked carbon 1% types do this job nicely and, although the value may be altered slightly, a 1% type should still be used here. I would recommend keeping within 5% of the stated value, but 10% can still give excellent results. Using 25L6 in the output stage, adjust bias to 300Ω.



Showing wiring of heaters of the 4-Watt Amplifier for AC/DC operation

WARNING

Enquiries have been received at these offices from constructors who have attempted Large Screen conversion, the circuitry of which was published elsewhere.

It should be fully understood that constructors must not attempt a hybrid circuit incorporating, perhaps, a mixture of several designs, unless they are fully qualified to do so. The line output transformer generally specified can, under certain conditions such as high rail voltage (see June issue), give rise to a highly dangerous EHT potential.

This magazine can accept no responsibility for designs published elsewhere, or for our own designs which have in any way been modified by the constructor.

CONTROL BOXES FOR SURPLUS GEAR

By **P. TURNER**

Quite a lot of the surplus radar gear which has been disposed of was housed in ' slide on ' cases of generally similar pattern. Typical examples are the Type 62 and 62a Indicator Units and the Type 64 Modulator Unit. The construction of these pieces of equipment takes the form of a front panel about 10″ wide by 12″ high, fixed to a chassis of the same width and about 18″ or 20″ in length. The complete chassis and panel slides into a sheet metal casing, leaving only the front panel exposed.

Such equipment, while providing many good components, is nevertheless a little restricted in the use of the carcase and case for housing ordinary, as distinct from Radar, equipment. This is due to the facts that

(*a*) if the front panel must accommodate a 6″ cathode ray tube, there is little room for the controls necessary on a comprehensive oscillograph.

(*b*) it is often difficult to make use of the rear portions of the chassis, because if the controls are to be on the front panel a foot or more of wire exists between the control and the circuit it is serving.

While this is immaterial at DC and low frequencies, at radio frequencies it is always inefficient and often quite impossible.

In order to get round this difficulty I have used a method of applying control which allows the switches, potentiometers and suchlike to be situated as close to the circuits as possible while still allowing the original slide on casing to be used.

The method was suggested by the wide use made in the Services of ' control boxes.' These are often quite small and yet may control complicated equipments. The extension of this method which I have used consists of placing the necessary switches, potentiometers and other controls in a small sheet metal case, about one inch deep, and attaching this by means of a pair of slides to the outside of the main casing. The electrical connection to the parts inside the main casing is made by means of a short cable form, made up of the wires running from the various controls and terminating in a plug made from an old valve base, or a proper plug as made to fit a standard valve holder. This plug is put through a small hole in the side of the main casing and is pushed into a valve holder on the chassis, to the pins of which the connections are made in such order as to put the controls in the proper circuits. If one plug will not give a large enough number of connections, then two plugs and sockets may be used.

The method of assembly is quite simple.

(1) Put the chassis into the case.

(2) Put the plug (old valve base) through the prepared hole and into the proper socket.

(3) Slide the control box into its slides.

The result is neat and professional in appearance. It allows casings to be kept on apparatus which otherwise might be used without a case. This makes for a greater measure of SAFETY in the operation of equipment. Remember that if you get hold of it properly, 200 volts can kill as swiftly and as surely as 2000 volts. And being dead is so permanent, too.

These control boxes are fairly easy to make and the use of them gives that rapid ease of assembly and removal which makes good equipment a joy to service. If the box is made from sheet metal about one sixteenth of an inch thick there is no need to rivet or bolt at the corners. The small dimensions ensure that the box is stiff enough if it is just bent to the form of a box and used as it is. Needless to say, the controls work just as well when the case is off, if they are plugged in, so that servicing and adjustment can be carried out with all parts accessible and working if necessary.

Aluminium is probably the easiest material to use, but tin plate is very good and has the merit of being capable of having soldered seams. This is a very great advantage when screening is necessary between controls. It also has the merit of being available free in the form of the humble fruit or tomato can. A large tin when shorn of the rims and seam and opened out provides a sheet of high quality tin plate (it *has* to be high quality for food packing), about $4\frac{1}{2}'' \times 12\frac{1}{2}''$. This can easily be cut by a pair of stout scissors (cautiously abstracted from the kitchen drawer) and being already tinned is child's play to solder for the corner seams. A ' lid ' fitted to the back of the box and soldered makes it stiff enough, and may be cut a little longer than the box to provide the sliding tongues.

The method is very flexible in operation and can easily be adapted to other circumstances. It is possible to fit switch boxes, terminal boxes and control boxes of all kinds to the top, sides and back of almost any equipment, thus greatly extending the usefulness of some of the otherwise not so useful cases. Figure one shows how it is applied.

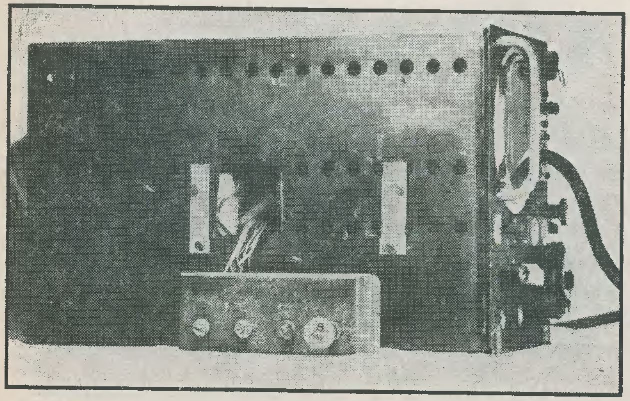


Fig. 1. A completed control box plugged in and ready to be slid into position. The slides are made of two thicknesses of metal, the under one 'L' shaped, the upper one rectangular. The instrument is a 62 Unit converted to an oscillograph.

BOOK REVIEW

DATA AND CIRCUITS OF MODERN RECEIVING AND AMPLIFYING VALVES. (Philips Technical Library, Book IIIa). Compiled and edited by N. S. Markus and J. Otte. 480 pages, 505 illustrations. Price 40s. Distributed in England by Cleaver-Hume Press Ltd., 42a South Audley Street, London, W.1.

This is the latest addition to the series of books in the Philips Technical Library, compiled by members of the staff in the laboratories of N. V. Philips' Gloeilampenfabrieken at Eindhoven. Two other works from this source were reviewed in the May 1952 issue of this journal. This present volume is fully in keeping with the high standard one has come to expect from this team of experts.

In a sense, it could be called a catalogue of several valve types, but in all fairness to the authors and publishers the term should be qualified by emphasizing that this is no ordinary catalogue. Indeed, it would be difficult to imagine how else, or where, one could obtain such extensive information as is given for each valve described.

Although there seems to be stress on the fact that the valves are produced in the Netherlands, it is as well perhaps to point out that valves with similar titles are available from British manufacturers, and the characteristics are, of course, alike. Thus, the Rimlock type to which a large part of the book is devoted is the same as the British B8A, that is, an eight-pin glass base with a locating projection on the metal shield. The Noval-based valves also have British counterparts in the B9A series.

The method of dealing with each type of valve is to show a photograph, about actual size (in many cases there is also an accompanying X-ray photograph showing internal construction), give a detailed description of the uses and application in circuits, follow this with extensive data covering typical characteristics, operating characteristics, and limiting values, and conclude with a series of graphs showing characteristic curves for different operating conditions. In many cases the tables of characteristics occupy several pages, and the amount of information they contain is extremely useful. The graphs are particularly clear and informative. It was noticed that in the case of the ECH42 frequency-changer, no less than fourteen sets of curves are displayed, covering every application to which the valve can be put.

Each series of valves is dealt with in separate sections of the book, and a series of receiver circuits designed around the valves in the section concerned is given. These range from a simple four-valve battery receiver to a fifteen-valve quality receiver for A.C. mains. Amplifiers and F.M. receivers are also included. Each of these designs is given much technical description, and useful tables of measured values. In some cases, the design and construction of I.F. transformers applicable to particular circuits is described.

A valve of unusual interest is the type EQ80, a new type described as an Enneode. It has seven grids, some of which are internally connected, and the electrode assembly is thereby accommodated on a Noval (B9A) base. This valve, for which there does not yet appear to be a British equivalent, has been specially developed for use as detector and amplitude limiter in F.M. receiver circuits, and some simplification of circuitry is achieved by its use.

There appears to be an error in the numbering of the curves for the EZ41 rectifier, page 120. Curves 1 and 3 seem to be reversed, for one would expect a higher output voltage when using a higher value of reservoir capacitance, even though the anode series resistor needs to be higher for a larger capacitor.

It is confidently stated that having regard for the wealth of information it contains, this book is offered at a reasonable price. No less pleasing is the binding of blue linen and gold lettering to match other volumes in the series, and the clear type-face employed.

Trade Reviews

and News

New Multicore products for specific uses.

In addition to the standard range of 6 tin/lead alloys in 9 gauges and variety of packings already available to manufacturers and the trade, MULTICORE SOLDERS LIMITED announce the introduction of many new products, each designed for specific uses.

Prominent among these are the following, extra details of which are readily available from the manufacturers.

At the special request of trade friends Multicore Solders are now producing, in large quantities, an economy pack for Television Engineers. Packed in the yellow and black Multicore carton is a 1 lb. reel of 50/50 alloy 18 S.W.G. containing approximately 167 feet of Ersin Multicore Solder, retailing at 15/– under catalogue ref, R.5018.

Ersin and Arax Liquid Fluxes, hitherto only manufactured by special request, are now generally available in a variety of packings. Liquid fluxes are particularly recommended for dipping purposes and other processes where it is not convenient to use Ersin and Arax Multicore Solders. A 10 oz. tin of Ersin Liquid Flux retails at 6/–.

Ersin Multicore Solder which has for many years been supplied to manufacturers in gauges to 22 S.W.G. is now supplied to special order on ½ lb. reels in even gauges between 24 and 34 S.W.G. Comparitive lengths per pound for 60/40 alloy are approximately 98 ft. of 16 S.W.G., and 5,040 ft. of 34 S.W.G. All gauges, even to 34 S.W.G. contain 3 cores of flux.

For electronic heating methods and other soldering operations, Ersin or Arax Multicore Solder is now made in the form of slugs and pellets. They are available in a wide range of sizes in all standard tin/lead alloys.

Butt-jointed solder rings made from Ersin or Arax Multicore Solder or solid wire can also be supplied and are claimed to be more economical to purchase than stamped washers. Among the specifications of Ersin Multicore Solder Rings which are already being manufactured are ¼″, 5/16″, 13/32″ and ½″ diameter rings. Other sizes are made to special order.

With the co-operation of Johnson Matthey of Hatton Garden, Ersin Multicore Solder is now available in Comsol alloy. This tin/lead/silver solder has a melting point of nearly 300°C which is 113°C above the melting of the usual tin/lead alloys.

Ersin Multicore Comsol solder is normally supplied in 16 S.W.G. and is intended for soldering processes where components are likely to be subjected to excessive working temperatures. Projector lamps, some types of electric motors, etc., are examples. It is believed that Comsol may also be suitable for use on radio and electrical equipment being subjected to sub-zero temperatures, although research into this is at present still proceeding.

Generally, this new product will be supplied direct to manufactures, the price being slightly less than that charged for Er in Multicore 60/40 alloy.

Manufacturers are invited to write for samples of any of the new lines or to consult the Technical Service Department of Multicore Solders Limited on any problem in connection with soldering.

Allen Components, Ltd., Lower Richmond Road, London.

The above firm have forwarded to us for test in the " Magna-View " their most recent version of the DC300 Deflection Coils.

These show a marked improvement on the earlier versions, producing a rectilinear picture with excellent focusing over the entire screen area.

The amount of scan obtained from this equipment would suggest that if a 20″ tube should become available to the constructor, it is unlikely that there would be any difficulty in achieving a full picture.

We congratulate Allen Components on their progressive efforts to obtain still further efficiency from their products.

Messrs. J. Bull and Sons, 246 High Street, Harlesden, London, N.W.10.

An instrument of real use to the radio-man and kindred workers is the Neon Tester. One of these, the type 400, was recently sent to us for test by the above firm, and has been used by us on many pieces of equipment.

Some of the possible applications are: AC or DC ? — Finding the live conductor — Leakages — Continuity — Condensers — Fuse tests with live mains — Potential tests on running motors and dynamos.

Constructors of the " Magna-View " will find this instrument particularly useful, especially so where the mains rectifier circuits are employed. A circuit for the installation of neon polarity to establish relationship of the chassis to mains negative was under consideration, but the possession of the Neon 400 has rendered this plan unnecessary and wasteful.

Two seconds of testing and any doubts are removed: indeed, an entire house could be covered very quickly, with the advantage that in every socket likely to be used for any AC/DC equipment the pin polarities would be known.

Made in the style of a fountain pen, the instrument may be permanently carried around without any inconvenience. The price is 11s. 3d., and a small pamphlet is included which gives instructions for carrying out tests. In our opinion, a very useful implement.

The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.1 announce that commercially made masks are now available for the 6901A television tube, and they may be ordered from the dealer with the CRT. These masks are well designed and enable the constructor to obtain the greatest picture size from the tube. They are recessed in the front to take safety glass, and are easily adaptable for the " Magna-View," maintaining the dust-proof design which is a feature of this televisor.

Alexander Equipment Ltd., Child's Place, London, S.W.5 have sent us for review samples of their "Decal" transfers. The set consists of 6 sheets of panel markings and names suitable for any electronic apparatus, contained in a stiff folder. The transfers are well protected against handling before use, and full instructions are included for their application. The list of words and symbols is exceptionally complete, and a goodly number of letters are included so that, should a particular word not be available, it may easily be made up.

There are also a number of numbers (!) and Greek letters, as well as mathematical signs and such useful items as μF, μsec, μA, mA, Mc/s and so on. Altogether, we think well worth the sum of 4s. 9d. plus 3d. postage

The Editor and Staff

wish all our readers a very Merry Christmas and a Happy and Prosperous New Year

THE WATT-HOUR METER

By **T.H.R.**

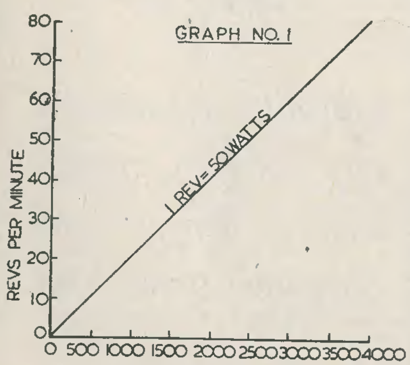
Notes on its use as a Test Instrument

Few amateurs possess a watt-hour meter (though most have them in their houses—the property of the Electricity Undertaking), but the possession of such an instrument can be a great asset in the planned economy of electricity consumption. At the present time, owing to changeover of types, many second-hand meters have found their way into the surplus market, the cost varying between ten and thirty shillings.

This article sets out to describe some of the ways in which the watt-hour meter may be used to ascertain the running costs of various electrical appliances, and includes two graphs to minimise arithmetic.

Application

On a D.C. mains circuit where Ohm's Law applies, Volts and Amps can be measured, and Power and Work readily calculated. In A.C. circuits, however, to find the Power (which multiplied by time equals Work) the product Volts × Amps has to be multiplied by the Power Factor of the particular load, a factor which is often unknown. The Watt-Hour meter, however, measures the actual Work Done, from which can be directly determined the running cost; the kilowatt-hour being the " Unit " of Work charged for by the Electricity Undertaking.



C766

Procedure

Two different operations are possible with the watt-hour meter:—

1. *DETERMINATION OF RATE OF POWER* (*VA × Power Factor = Watts*)

Through a window in the front of the meter can be seen a horizontal disc, which revolves at the rate of 1 Rev./min. for every 5 watts of power consumed. From this relationship the two graphs have been prepared. Graph No. 1 shows Watts against Revs./min. and may be used for loads greater than 100 watts. For smaller loads, Graph No. 2 is more convenient, and gives Watts against the time in seconds taken by one revolution of the disc.

Rate of Power consumption of any piece of equipment, wireless sets, motors, etc. can speedily be determined by this method, and the running costs calculated.

2. *DETERMINATION OF WORK DONE*

This figure is read directly from the dials, subtracting the initial reading from the final one, and is simply an integration of Power with respect to Time. The advantage of the integrating dials is the ability to assess the average consumption of appliances controlled thermostatically. For example, the meter may be left in circuit for a week with, say, an immersion heater, and the relative costs of continuous thermostatic control and intermittent switching ascertained.

Mounting

It is essential that the meter should be vertical, and this is best done by fixing it on a ½" plywood bracket, as shown in the photograph. A mains input lead of power cable should be provided, and the load connection sockets can be screwed directly to the metal plate which covers the meter terminal block. In the instrument shown, 5 amp. and 15 amp sockets are provided, other fittings being available by means of adaptors. The mains earth wire should be taken to a screw on the cover plate, and connected to the earth terminals of the sockets. Four rubber feet complete the construction.

Meters of different amp. ratings are available, and these rates should not be exceeded.

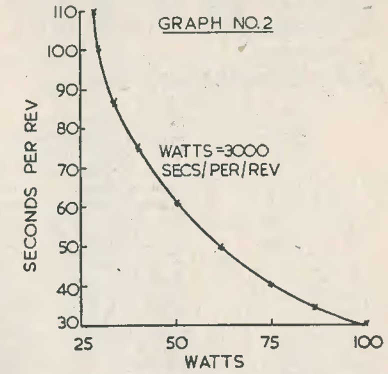
Graphs

In most surplus meters, the discs revolve 1,200 times per kW/hour, and the graphs have been prepared on this basis. If the figure is different (as shown on the front panel), the graphs will have to be re-drawn, as follows:—

Graph No. 1 should be plotted from the formula

1 Rev./min.=60,000R watts.

where R=No. of Revs. per kW/hour.



C767

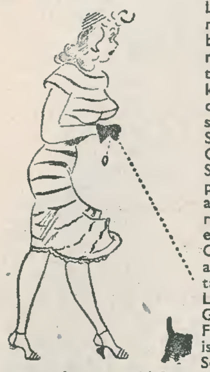
Graph No. 2 is based on

Secs./Rev.=A/watts

where A=3,600,000/Revs. per kW/hour.

When completed, the graphs may be stuck on the back of the bracket, and covered with transparent sellotape.

Is Your Slip Showing?



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FOR SALE Eddystone Model 680 15 valves, new condition. Today's price £106, will sell for £55, bargain. Heavysege, 45 Broadway Avenue, Wallasey, Cheshire. Phone 6780.

FOR SALE *Radio Constructor* Vol. 1 to Vol. 5 inclusive. New condition. Offers. Hurst, Higher Drive, Dawlish, Devon.

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LORAN INDICATOR UNIT for sale, with 5CP1 tube, less valves and components. As specified for *Wireless World* Oscilloscope, £1.15.0d. Modified 1355 with RF24 unit, complete, working, London vision £2. Also *Wireless World* for 1948, 1949 and 1950. *Radio Craft* for 1948. *Radio Electronics* for 1949, 1950. *Radio Constructor* Vol. 1, 2, 3, 4. What offers? Crees, 6 Northolt Gardens, Greenford, Middx.

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FOR SALE Class C Wavemeter in good condition, original price 18/- unmodified. Also 1154B Tx, new valves, £3, write F. Smallwood, 7 Reservoir Road, Southgate, London, N.14.

(Continued on page 271)

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G.E.C. 1 m/a. Meter Rect. ...	**11/6d.**

RECEIVER R1355. As specified for *Inexpensive Television.* Complete with 8 valves VR65 and 1 each 5U4G, VU120, VR92. Only **55/-d.** carriage 7/6d. Brand New in original Case.

RF24 **25/-d.**, RF25 **25/-d.**, RF26 **59/6d.**, RF27 **59/6d.** Owing to limited quantities, these Units supplied only with R1355's.

CATHODE RAY TUBES.
VCR97. Guaranteed full picture **40/-d.**, carriage 5/-d.
VCR517. Guaranteed full picture **40/-d.** carriage 5/-d.
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INDICATOR UNIT TYPE 182A. This unit contains VCR517 Cathode Ray 6" Tube, complete with Mu-metal screen, 3 EF50, 4 SP61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of Resistors and Condensers. Suitable either for basis of Television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing case at **79/6d.** Plus 7/6d. carr.

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All components for Wide Angle 16 ins. Televisor in stock. Sold in Kit form or separately.

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ALL RESISTORS ¼ TO 1 WATT ...	3d. each
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WATCH FOR OUR NEW F.M. RECEIVER KIT

ANY CIRCUIT SUPPLIED—2/6

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SPECIAL VALVE OFFER

6SH7 METAL TUBES slightly soiled ex-equipment, 4 for **9/6, 27/6** doz. All guaranteed. 3D6, 3/6. 1SD2, 1LN5GT, 1LD5GT, 6AC7M, 6C4, 6C5GT, 6J5GT, 6J7G, 6K7GT, 6N7GT 9002, 9003, VS110A, **6/6.** 6AG5, 6F8, 6G6G, 6X5GT, W77, **7/6.** 1R5, 1S5, 1T4, 6L7, 6J7M, 6SG7M, 6F6G 6R7GT, **8/6.** 5Z4M, 5Z4G, 6V6G, MU12/14, 12AT7, 12AU7, 12AX7, DLS10, **9/6.** 6F7, 6SN7GT, 6SQ7M, 6V6M, 6J6, **10/6.** 6AQ5, 6Q7GT, **11/6.** 7A3 (PenA4), KT66, 12SQ7GT, 6K8G, **12/6.** 6K8M, **15/–**

MISCELLANEOUS. Ceramic Valveholders EF50, 807, **1/–** *ea.* **10/–***doz.* Wafer Switches 4 bank, each bank 2P 4W (Total 8P 4W) **4/6** *ea.* **45/–** *doz.* 10K 10W W/W Pots **7/6** *ea.* Double circuit jack plugs and sockets **2/6** *pr.* **24/–** *doz.*

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Aerial Coupling Units Type G. ref ZA 0843. Containing large inductances, variable transmitter, type condensers, 0–1 thermo-coupled ammeter 2" indicator light, etc. with controls brought out to front panel 15 x 11". Contained in metal box 15 x 11 x 15" deep, with 2½" hinge lid, complete with circuit. These are in brand new condition, apart from external scratches, etc. to the case. Price **29/–.** *Carriage* **7/6.**

Aerial Coupling Unit contains variometer 2" round thermo-ammeter reading 0-350 m.a. Contained in aluminium box 5 x 5 x 5" with a 5 x 5 x 1" lid. Complete with carrying strap **8/6.** *Post* **1/9.**

Moving Coil Microphone or Speaker with 6 ohm coil, 1½" drill heavy duty permanent magnet 1" x 2½" dia. as stripped from American equipment. **4/6.** *Post* **1/3**

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VALVES. Clearance of surplus and salvage stocks. 35Z5, PM25, EY51, ECL80, at **11/9;** 5U4G, 5Y3, EF41, EF80, 6V6 at **10/9;** 5Z4, 6K7, EF91, EL91, 10F1, EF50, UCH42, SP4 at **8/9;** 3D6, 77, KT8, SP41, at **6/9;** 1A5, UF41, UY41, 12SJ7, 12SH7, 12SK7, TT11, OZ4A at **5/9;** 4D1, 6C5, PEN383, VP133, LP2, AR6 at **3/9.** Many others.

TRANSFORMERS. Mains (salvage) 260-0-260, 6.3v, 3A, 6.3v 2A. Tapped for 250, 210, 110v. **12/6,** *post* **2/–**

Standard O.P. transformers to match all normal O.P. valves to 2-5 ohm speech coil. **2/9,** *post* **1/6**

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MINIATURE moving coil 'phone speakers. 40-60 ohms impedance. Ideal extension speaker, or quality microphone **2/9,** *post* **9d**

Stamp for complete catalogue C.W.O. or C.O.D.

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Money back guarantee **G RA 6677**

Small Advertisements—*cont.*

(Continued from p. 269)

WANTED Instruction book or blue print for Telefunken 10 valve Kreigsmarine S.W. Receiver, Type E5175 1/38. Any "gen" on this set appreciated. Naylor, The Bungalow, Dudley Street, Morecambe, Lancs.

WANTED URGENTLY R107 Receiver in good condition. Box. No. B217.

WANTED 0-V-1 receiver, must cover 20 metres. ISWL/G5201, 5 Burn's Street, Nelson, Lancs.

WANTED Three valve battery short wave receiver for invalid, complete with plug in coils if possible. D. Wright, 358 Worting Road, Basingstoke, Hants.

FOR SALE—Ham giving up. Transmitter for sale consisting of 6L6-807 R.F. Unit, three stage amplifier-modulator, 500v, 350v, 250v power packs. With valves, £20 the lot. Matthews, 14 Emmanuel Road, Sutton Coldfield, Warks.

WANTED BC946 or BC1206 as new, or in good condition. Offers to Bloor, 109 Wilslow Road, Rusholme, Manchester.

FOR SALE *Modern Practical Radio and Television* (Caxton), three volumes, latest edition, mint condition 35/–. Also RSGB Bulletins, 7 other bound volumes of radio magazines. SAE for details. Box No. B195.

COMMUNICATION EQUIPMENT for sale, quitting hobby. EF54 Preselector, 4 switched bands, 32 mcs to 1.6 mcs continuous coverage, black crackle case, louvred, to match S640 Receiver, calibrated Eddystone full vision dial, slow motion drive. Controls, On/Off, RF Gain, Aerial/Rx change over, Wave change switch, pilot light. Power taken from Rx. £4. Frequency Meter, home constructed, cabinet same as above, 5 valves, 400 cycles audio modulator (switched), 100 kcs Xtal standard, ECO circuit switched to cover amateur and broadcast bands. Eddystone full vision dial, slow motion drive, voltage regulated, bandspread and zero controls, voltage stabilised. Separate power supply not included. £7. Aerial Tuner Unit, covers 32 Mcs to 1.6 mcs in 4 switched bands, 100 per cent condition, £2. Headphones, LR 10/6. 8" Rola Speaker in black crackle metal cabinet to match S640, perfect. £2. Box No. B220.

COMMUNICATION RECEIVER for sale. 12 valve double superhet consisting of an Eddystone S640, fully modified per recent issues of *SWN*, the whole contained in original cabinet with add on unit. EF54 RF stage, ECH35 Mixer, EF39 IF's (1.6 Mcs) into 6K8 Mixer (465 kcs), EF39 IF, into 6Q7 into 6J5 audio into 6V6 output stage. Xtal filter permanently switched in. Voltage stabilised, Audio Filter, Aerial compensator, RF Gain, IF Gain, second oscillator controlled (tuning) from front panel, Tone control, 1.6 mcs and 465 kcs regen controls on panel, sensitivity control. BFO at 465. 1.6 Mcs rejector circuit in aerial input. A very fine communication Rx, terrific selectivity and gain, this Rx has everything — including an Eddystone 'S' Meter. First class working order, tip top performance. £55 or offers. Box No. B221.

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RADIO COMPONENTS—Valves new and surplus, stamp for bargains list to Beever, 3 Minstead Avenue, Lower Edge, Elland, Yorks.

A VALVE WITH MANY USES! Brand new 2C34/RK34, 10 watts dissipation, suitable Push-pull output valve in amplifier, develop 16 watts at 250 mcs. See December's article on use as rectifier. Only 2/– each or six for 10/6d. Ceramic holders 1/– each. Add postage. ELECTRONIX, 220B Canterbury Street, Gillingham, Kent.

(Continued on p. 272)

TRANSFORMERS.—Manufactured to our specification, and fully guaranteed. Normal Primaries. 425 v.-0-425 v. 200 ma., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3a., 0–2–4–6.3 v. 2 a ONLY **72/6.** 425 v.–0–425 v. 200 ma., 6.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a. ONLY **50/–.** 350 v. –0–350 v. 160 ma., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a. ONLY **42/6.** 250 v. –0–250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a. ONLY **32/6.** The above are fully shrouded, upright mounting. Universal Mounting 350 v.–0–350 v. 80 ma., 0–4–6.3 v. 4 a., 0–4–5 v. 2 a. ONLY **18/6.** Top shrouded, drop through 260 v.–0–260 v. 70 ma., 6.3 v. 3 a. 5 v. 2 a., ONLY **16/6.** The following are upright mounting. EHT for VCR97 Tube, 2,500 v. 5 ma., 2 v.–0–2 v. 1.1 a., 2 v.–0–2 v. 2 a. ONLY **37/6.** EHT 5,500 v. 5ma., 2 v. 1 a., 2 v. 1 a. ONLY **72/6.** EHT 7,000 v. 5 ma., 4 v. 1 a. ONLY **82/6.**

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TRANSFORMERS.—Ex W.D. and Admiralty, built to more than 50 per cent. safety factor, with normal A.C. Mains Primaries. All Brand New and Unused. 300 v.–0–300 v. 200 ma., 5 v. 3 a., 6.3 v. 5 a., C.T., 20 v. 750 ma., 70 v. 100 ma. Weight 12 lb. ONLY **42/6** (postage, etc., 2/6). 330 v. -0–330 v. 100 ma., 4 v. 3 a. Weight 7 lb. ONLY **22/6** (postage, 1/6). L.T. 5 v. –0–5 v. 5 a., 5 v.–0–5 v. 5 a., 5 v.–0–5 v. 5 a. By using combination of windings will give various voltages at high current. Weight 11 lb. ONLY **35/–** (postage etc., 2/6). L.T. 6.3 v. 7.7 a., 4.2 v. 2.5 a., 4 v. 1 a. ONLY **19/6** (postage, 1/6). EHT 1,400 v. 2 ma., 520 v. 10 ma., 300 v. 10 ma., 2 v. 1.5 a. ONLY **21/–** (postage, 1/6). Cash with order, please, and print name and address clearly. Amounts given for carriage refer to inland only.

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Valves to suit available.

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For frequency checking of Transformers and Receivers. Provision for phones. Battery Operated. Easily adapted for mains by using 3-6J5 valves. Housed in attractive cabinet with red panel indicator light. Size 7½"x 5½"x 5" Circuit 1/– extra.

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THREE IN ONE TRANSFORMERS. **7/–** each plus Postage 1/6.

Use as p/p Modulation Transf. P/P 211's to single 211-100 watts. Makes Ideal Output Transformer P/P 6L6 to 807's to match High Impedance Relay Speakers, or,

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Worm drive, heavy duty contacts. Former length 6¼ x 1½" dia. Mounted on assembly with cast end-plates. Dim.: Overall ht. 4⅜" length less spindle 7⅞", spindle 2 x ½". Resistance 7.5 ohms 4 amps.
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E67	International Octal	Ceramic	1/– each
H889	International Octal	Moulded	9d. each
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THE IDEAL MICROPHONE FOR RECORDING. ROTHERMEL XTAL 2D56 **£2.19.6** *POST FREE*

The outstanding LMS2 Miniature Coil Pack 3 Band Superhet Unit. Single Hole Fixing, **38/6** *POST FREE*

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DEAL COMPONENT COMPANY
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Small Advertisements—*cont.*

(*Continued from p.* 271)

REPRINT Converting the TR1196 Receiver. Full details on converting this unit, which may be purchased quite cheaply, into a very sensitive all-wave receiver. 6d. post free. All the above from A.S.W.P., 57 Maida Vale, London, W9.

CAR RADIOS, Transreceivers, spares. Different types for disposal. Stamp for details. Brown, 40 Stamshaw Road, Portsmouth, Hants.

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OSMOR — for efficient coils, coilpacks etc. Send 5d. stamp for FREE circuits and lists. Dept. RCC, Osmor Radio Products Ltd., Borough Hill, Croydon, Surrey. Tel. Croydon 5148/9.

ATTRACTIVE QSL's at reasonable prices also Club headings, samples. A. Rowe, Printer and Stationer, 101 Fawnbrake Avenue, Herne Hill, London, S.E.24.

WALNUT Radiogram and Television cabinets. Stamp for details. R. Shaw, 69 Fairlop Road, Leytonstone, London, E.11.

I.P.R.E. PUBLICATIONS. 5,500 Alignment Peaks for superhets 5/9. Sample copy *The Practical Radio Engineer* 2/–. Membership-examination particulars 1/–. Syllabus of TV and radio courses free and post free. Secretary, I.P.R.E., 20 Fairfield Road, London, N.8.

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METALWORK. All types cabinets, chassis, racks, etc. to your own specifications. Philpott's Metalworks, Ltd. (Dept. R.C.), Chapman Street, Loughborough.

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BOOKBINDING. Volumes of *Radio Constructor* and *Radio Amateur* fully bound, imitation leather, gold lettering. 7s. 6d. post free. Prices for other publications on application. Jerome Alcock, CHEADLE, Stoke-on-Trent.

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BLUEPRINTS. High Gain 10 Metre Converter, with a de-luxe circuit comprising EF91 RF stage, ECC91 double triode mixer and oscillator, FF92 IF amplifier, with stabilised voltage supply via a 7475. 1s. 8d. post free with full instructions.

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TV Fault Finding compiled by 'The Radio Constructor'. **5s. 0d.** Postage 4d.

Inexpensive Television for the Home Constructor. **2s. 6d..** Postage 2d.

The De Luxe Home Built Televisor and Radiogram by W. I. Flack. **6s. 6d.** Postage 4d.

Television Servicing Manual by E. Bradley. **4s. 6d.** Postage 4d.

Thermonic Valve Circuits by E. Williams. **21s. 0d.** Postage 9d.

Foundations of Wireless by M. G. Scroggie. **12s. 6d.** Postage 9d.

The Radio Amateur's Handbook by the A.R.R.L. **30s. 0d.** Postage 1s. 0d.

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(*a*) Loss or damage to installation (including in the case of Television Sets the Cathode Ray Tube) by Fire, Explosion, Lightning, Theft or Accidental External Means at any private dwelling house.

(*b*) (*i*) Legal Liability for bodily injury to Third Parties or damage to their property arising out of the breakage or collapse of the Aerial Fittings or Mast, or through any defect in the Set. Indemnity £10,000 any one accident.

(*ii*) Damage to your property or that of your landlord arising out of the breakage or collapse of the Aerial Fittings or Mast, but not exceeding £500.

The cost of Cover (*a*) is 5/– a year for Sets worth £50 or less, and for Sets valued at more than £50 the cost is in proportion. Cover (*b*) (*i*) and (*ii*) costs only 2/6d. a year if taken with Cover (*a*), or 5/– if taken alone.

Why not BE PRUDENT AND INSURE your installation—it is well worth while AT THE VERY LOW COST INVOLVED. If you will complete and return this form to the Corporation's Office at the above address, a proposal will be submitted for completion.

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(If Lady, state Mrs. or Miss) ....
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