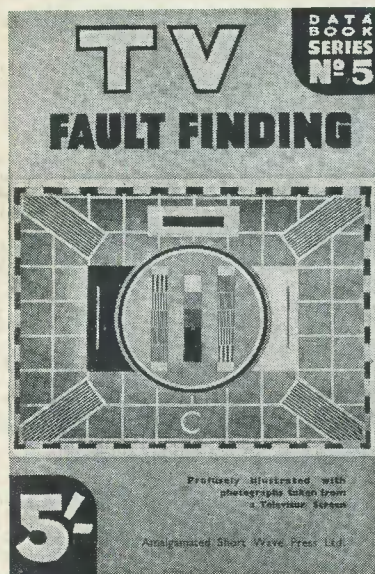


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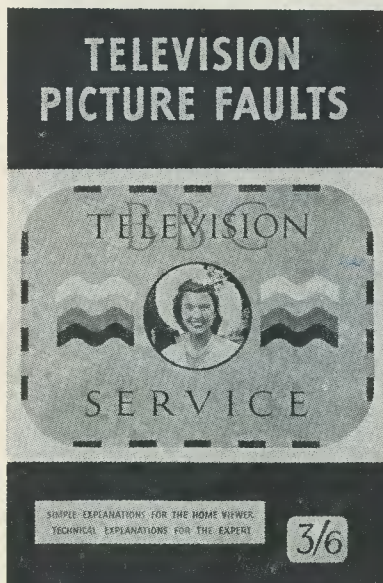
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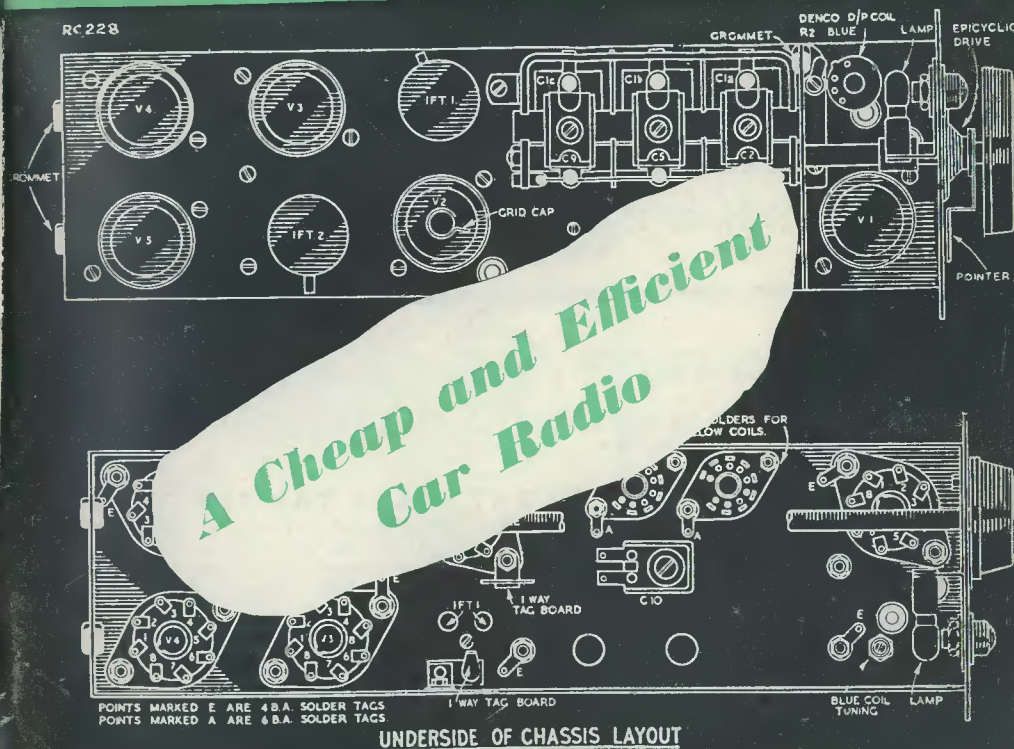
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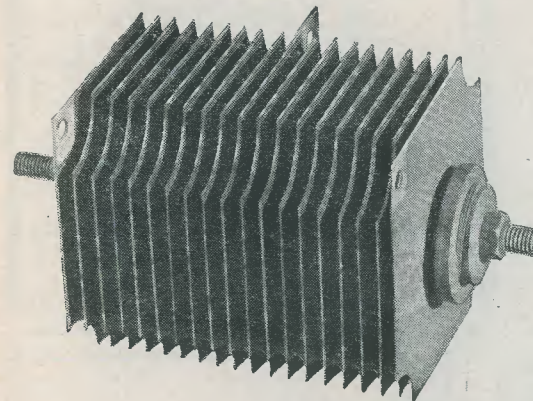
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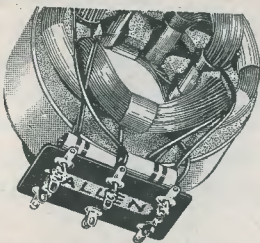
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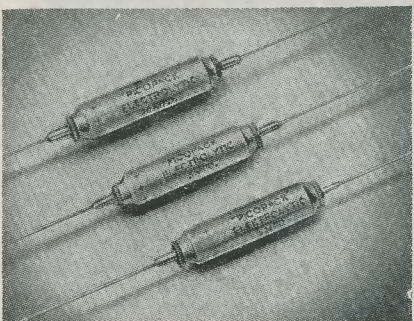
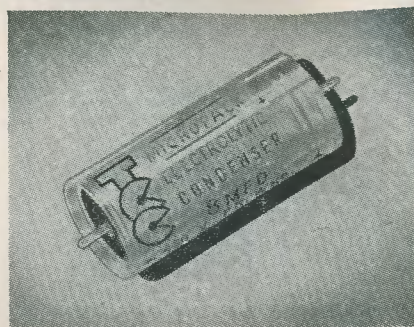
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| 50            | 25   | 1 1/2 in.  | 3/4 in. | CE18C |
| 32            | 150  | 2 1/2 in.  | 1 in.   | CE19F |
| 2             | 200  | 1 1/2 in.  | 1/2 in. | CE31G |
| 8             | 450  | 2 1/2 in.  | 1 in.   | CE19P |

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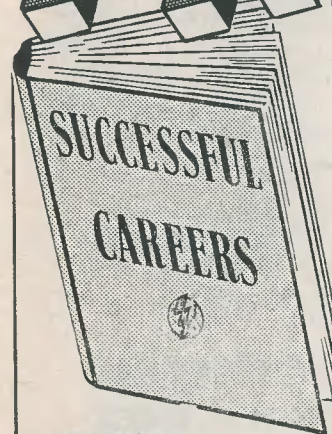
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|-------------------|-----------------|------------|---------|----------|
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| 20                | 12              | 1 1/2 in.  | .34 in. | CE30B    |
| 30                | 15              | 1 1/2 in.  | .43 in. | CE71B    |
| 10                | 25              | 1 1/2 in.  | .34 in. | CE30C    |
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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. 32: Frequency Changer as Source of Negative Bias.

This month's circuit illustrates a principle which, although used occasionally in commercial receivers, is little known in this country. It takes advantage of the fact that a negative voltage is built up at the oscillator grid of a superhet frequency-changer, and it uses this voltage to bias the output valve. Such a circuit is particularly useful in American AC/DC receivers where the HT voltage is limited to approximately 110 volts. When cathode bias is used for the output valve in receivers of this type, the bias voltage built

up across the cathode resistor reduces the effective HT applied to the valve, with the result that the available power output is lowered.

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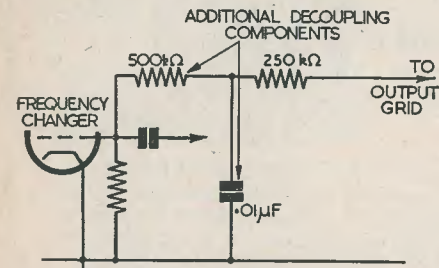
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### Bias Voltage

In Fig. 1 it is assumed that the bias offered by the oscillator is equal to that needed by the output valve. This should be quite easy to arrange in practice, since the value of the oscillator bias can be altered, within limits,

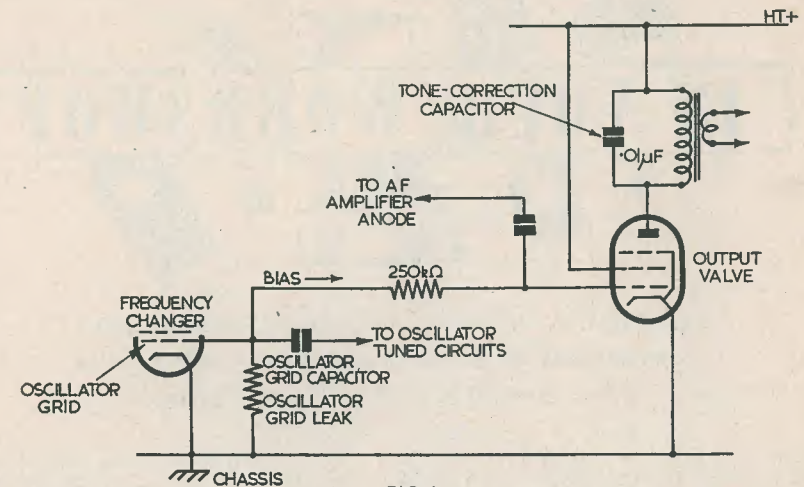


RC 238

up across the cathode resistor reduces the effective HT applied to the valve, with the result that the available power output is lowered.

### Application

In Fig. 1 the circuit is shown applied to any receiver. As may be seen, the cathode of the output valve is taken to chassis, the negative



RC 237

FIG. 1

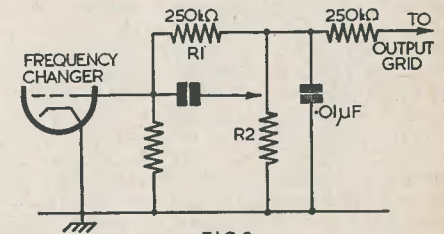
by varying the values of the oscillator grid capacitor or grid leak. If the values chosen do not give a similar voltage on each range of a multi-band receiver, an additional parallel grid leak could be switched in on one band, although it is doubtful if such an arrangement would be necessary when conventional coils are used. The bias voltage can be measured by connecting a milliammeter in the anode circuit of the output valve and comparing the readings obtained with those given by an ordinary grid bias battery of the correct voltage.

In cases where the bias voltage is too high and cannot be lowered sufficiently without upsetting the working of the oscillator, a potentiometer circuit, as shown in Fig. 3 may be used. In this circuit R1 and R2 form the potentiometer. To avoid damping the oscillator grid circuit, R1 should have a value of at least 250 kΩ.

### Further Uses

Although the original purpose of the circuit, that of giving greater output in 110 volt AC/DC receivers, does not necessarily commend itself for use in receivers using British mains voltages, the principle employed still has many applications. Instances of this consist of output biasing in midget battery receivers using low HT voltages, or of supplying a delay voltage for delayed AVC systems.

The circuit should prove especially attractive to designers of AC/DC/Battery receivers, in which the difficulty of obtaining a simple automatic bias circuit is well known.

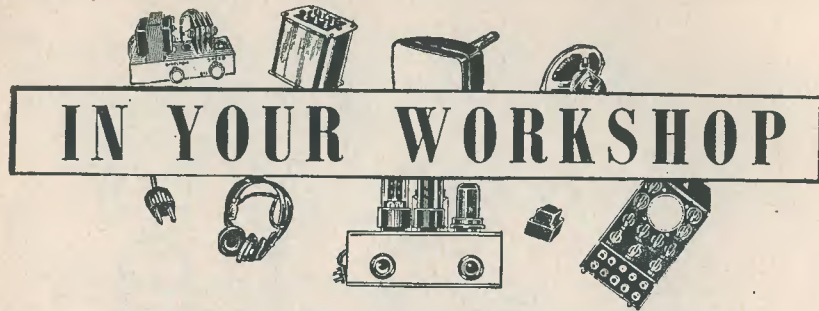


RC 239

FIG. 3

### Disadvantages

Whilst the circuit has many obvious advantages it suffers from the single disadvantage that, on the occasion of the oscillator ceasing to function, the output valve is deprived of its source of bias. It should also be borne in mind that, in a multi-band receiver, the oscillator will stop working for a very short time when the wave-change switch is operated.



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.

I have been asked by several readers in the last few months for any information I might have concerning home-constructed intercom systems. I seem to remember some articles on this subject several years back in the *Radio Constructor* but, as that was quite a time ago, a few brief notes on intercom equipment might not now be out of place in these columns.

**Basic Requirements**

Although amplifying intercom systems may employ all manner of ingenious designs, the usually accepted form is that illustrated in Fig. 1. This shows a master unit fitted with an AF amplifier, and three remote units. When the master unit operator wishes to speak to a remote unit he sets his Talk/Listen switch to Talk. This connects his loudspeaker to the amplifier input and the remote loudspeaker to the amplifier output. The master unit operator then speaks into his loudspeaker, which acts now as a microphone, and the amplified sound is reproduced over the remote loudspeaker. When the Talk/Listen switch is returned to Listen the remote loudspeaker acts as a microphone and any sound picked up by it is reproduced over the master unit loudspeaker.

The Talk/Listen switch is, of course, essential, as it would be impossible to have a loudspeaker connected simultaneously to the input and output terminals of an amplifier without setting up oscillations. (G. A. French gave an ingenious method of overcoming this trouble in *Suggested Circuits* some time ago when he advocated having the Talk/Listen circuits switched continuously at mains frequency; and readers may be interested in experimenting with this scheme).

Fig. 1 also shows three selector switches. These are used by the master unit operator to select either one, two or all three of the remote units.

**The Amplifier**

The amplifier used in an intercom system can be quite straightforward and conventional. Two triodes and an output pentode or triode should give adequate gain for normal purposes. Negative feedback need not be fitted since very high fidelity is not required and it would only increase the cost of the amplifier.

A practical circuit is shown in Fig. 2. This has one or two points of interest. To begin with, it will be seen that the grid input circuit (including the grid leak) to the first valve is screened. This is essential in order to prevent hum. However, whilst it is necessary to screen the microphone transformer and the lead to the first grid, there is rarely any need to screen any of the wiring connected to the microphone transformer primary. A proper microphone transformer should be used, incidentally; a speaker transformer connected "wrong way round" will not always give sufficient step-up.

A further point of interest lies in C3, the coupling capacitor between V1 and V2. A value of 500 pF is shown in the diagram for this component. This low value is deliberately chosen in order to attenuate any hum which may be picked up by the lines to the remote units. If the hum level on any particular installation is low, it may be found possible to increase the value of C3. The low value, however, causes very little loss of intelligibility.

The volume control, R4, is connected in the grid circuit of V2. This is done to facilitate the layout and design of the amplifier chassis

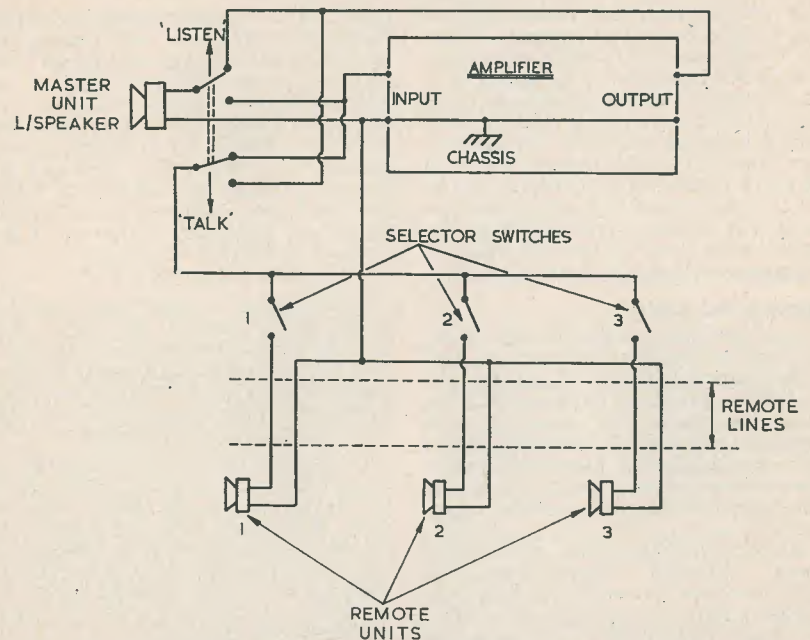
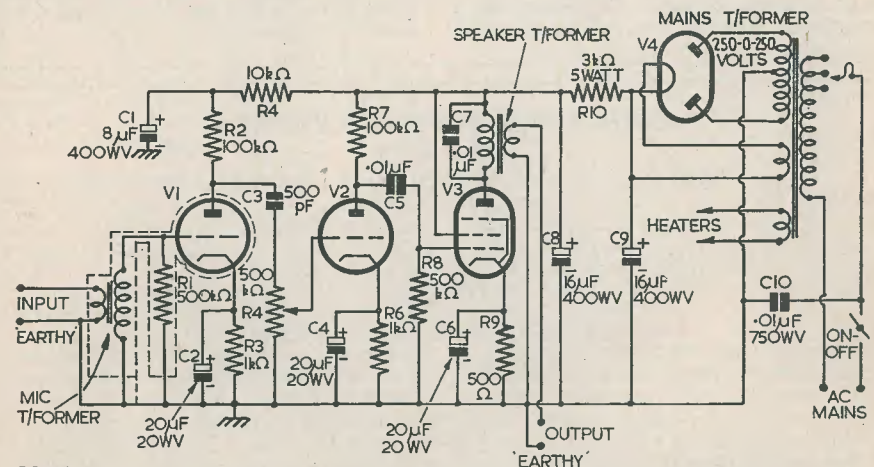


Fig. 1. Basic layout of a typical amplifying intercom system. It should be noted that one terminal of both input and output connections is common to the amplifier chassis, and that switching is carried out in the other, "hot," leads.



RC236

Fig. 2. Circuit diagram of a practicable intercom amplifier. Unless otherwise stated, all resistors are half-watt and all capacitors 350 working volts. V1 should, preferably, have a top-cap grid and may be the triode section of a 6Q7, VR55, or similar valve. V2 may be a 6J5, V3 a 6V6, and V4 a 5Y3: or suitable equivalents.

since, in this position, the volume control does not need to be heavily screened. There is little likelihood of V1 being overloaded by the small AF inputs fed to the amplifier.

A transformer mains supply is recommended. Although AC/DC circuits are used in some commercial intercom amplifiers, the amateur is advised not to use them as they can introduce quite a lot of trouble. This is mainly due to the fact that the remote lines cannot be connected directly to the amplifier chassis for reasons of safety; and, if they are isolated, are thereupon very liable to introduce hum.

#### Loudspeakers and Lines

Any small loudspeakers may be used in the system, four or five inch models being, generally, the cheapest and best. Surplus moving-coil headphones are not of much use in installations of this type as they make very poor loudspeakers and are, in addition, rather insensitive as microphones. Large loudspeakers are also not recommended because they give "boomy" reproduction when used as microphones.

All the remote lines work at voice-coil impedance. Although screened wire will naturally give best protection against hum when used for the remote lines, it is often possible to use unscreened wire so long as it is kept well away from mains wiring. Lighting flex, or similar wire, is quite heavy enough for short runs.

#### Dip Soldering

I don't know whether it is merely that I like a change now and then, but I must admit

that I always enjoy leaving the workshop bench for a period to start messing around outside with blow-lamps and things like that. In this particular instance I had a number of heavy cable terminations to make, and the best way of doing this was by dip-soldering. My main difficulty lay in finding a container to hold the molten solder. Ordinary tins are fairly satisfactory for this sort of thing, but they are liable to give way at the seams if too much heat is applied. In the end I found a battered enamelled tin mug (a relic of the war!) and this proved excellent.

Dip-soldering is quite easy and is very quick. It is essential, of course, that the work to be soldered is really clean and that it is held in the solder long enough to reach the requisite temperature. I used Baker's Fluid as the flux, dipping the work into the fluid then straightaway into the solder.

It is worth while keeping a short flat wooden stick handy since a scum continually forms on the surface of the solder. (Part of the scum, in my own case, was probably caused by the residue of war-time brew-ups left in the mug!) The stick can then be used to push the scum to one side and then remove it from the solder. If the work picks up any of the scum it may tin poorly.

Care should also be taken to see that the molten solder does not get too hot. The first indication of too high a temperature is given by the formation of a light yellow film of oxide on the surface. If this appears the applied heat should be reduced until the film disappears again.

### EIGHTH ANNUAL ELECTRONICS EXHIBITION

will be held at

**THE COLLEGE OF TECHNOLOGY, MANCHESTER**

during the sessions:

JULY 15TH, 1953 — 12 noon : 10.0 p.m.  
 JULY 16th, 1953 — 10.0 a.m. : 10.0 p.m.  
 JULY 17TH, 1953 — 10.0 a.m. : 10.0 p.m.  
 JULY 18th, 1953 — 10.0 a.m. : 7.0 p.m.  
 JULY 20th, 1953 — 10.0 a.m. : 10.0 p.m.  
 JULY 21st, 1953 — 10.0 a.m. : 9.0 p.m.

PORTIONS OF BOTH THE COMMERCIAL AND THE RESEARCH SECTIONS OF THE EXHIBITION WILL BE DEVOTED TO THE MEDICAL APPLICATIONS OF ELECTRONICS. A SERIES OF LECTURES, ON SUBJECTS ALLIED TO ELECTRONICS, WILL BE PRESENTED.

#### ADMISSION WILL BE BY TICKET ONLY

Make applications (enclosing a stamped addressed envelope) for admission tickets, lecture programmes (available after June 1st) and lecture tickets to the Hon. Secretary: **Mr. W. BIRTWISTLE, 17 Blackwater Street, Rochdale, Lancashire**, or by direct application at the Exhibition Reception Desk. Catalogues (post free 1/6) will be available after July 1st.

## VALVES

### and their Power Supplies

#### PART 9

By F. L. Bayliss A.M.I.E.T.

#### Safety

For the E.H.T. supply to a cathode ray tube in a television the radio frequency oscillator, touched upon in part eight of this series, is a safe and highly convenient device.

Moreover, although ordinarily used mainly for picture tubes, such oscillators are quite suitable for the supply of 2,000 volts or so to an oscillograph tube, when such a tube is used by the constructor, in a television.

For some obscure reason, however, oscillators have never achieved any degree of popularity with such tubes, despite the undeniable advantage offered in respect of safe handling. One can experiment freely with a television containing an E.H.T. oscillator, whereas, with E.H.T. taken from the mains supply considerable risk is always attendant.

Moreover, the oscillator entails very little extra in constructional work, and, when one considers that the cost of the usual E.H.T. transformer is about £2 10s 0d, the total expenditure upon the complete oscillator circuit would show a very considerable saving over the A.C. mains counterpart.

In this part, then, an E.H.T. unit to operate a VCR.97 cathode ray tube will be discussed, and a positive step taken, perhaps, still further to popularize and make safer an already immensely popular tube.

#### Circuit Considerations

One point outstanding in such an E.H.T. oscillator is the much lower output voltage than is usually needed for an ordinary picture tube.

It is usual, and better, to connect the tube deflector plates to the H.T. line, thus using the H.T. voltage as part of the total E.H.T. voltage.

The H.T. voltage to the time base is usually used, and this voltage 400 to 500 volts, may be deducted from the total E.H.T. required to give a remainder that must be supplied by the R.F. oscillator.

Thus, 500V subtracted from the 2,500V required for a VCR.97 leaves 2,000V. This figure allows considerably more latitude in the coil design than would be permissible if the requirement was 6,000V to 7,000V. Such

a coil may easily be wound by the constructor in fact.

With an output of 2,000V, the forward plus inverse voltage will not exceed 5,000: thus, to avoid the bugbear of supplying an accurate 2V or 4V for the rectifier heater from the oscillator coil, the liberty of throwing the pack inverse voltage on to the coil may be taken, and the rectifier heater left free of the E.H.T. system altogether. The rectifier heater or filament may then be supplied by a separate 2V or 4V heater transformer—not specially insulated—or from a suitable tapping upon the valve heater winding of the receiver mains transformer.

#### The Circuit

In Fig. 29 is the circuit successfully used by the writer.

The valve oscillator is a 6V6, but almost any steep slope output pentode or beam tetrode may equally well be used.

The E.H.T. rectifying valve is a VU.120 but, here again, a VU.111 or VU.133 may be used and the filaments supplied with 4 volts instead of 2V.

The current available depends upon several factors—H.T. voltage type of power valve, degree of coil coupling, and so on—but is usually between 100 $\mu$ A and 250 $\mu$ A.

In arranging a resistance load network the over-riding requirement is to keep the load current to as low a value as possible.

In practice, a limit is set by the availability of suitable values of potentiometers for brilliance and focus control, 2.0M $\Omega$  being the largest popular size made—although here and there one may discover a stockist of values larger than this.

With the values shown, the chain current is 134 $\mu$ A, and a negative voltage variation of from—1866 to—2,000 volts available across R<sub>1</sub> as tube grid bias. This adequately caters for the -1 to -100 volts requirement of the VCR.97.

Similarly, the focus anode to cathode potential difference of from 250 to 450 volts is catered for by R<sub>2</sub> (268 volts to the junction with R<sub>2</sub>) and R<sub>3</sub> (a further and variable 268 volts to the junction with R<sub>4</sub>).



The remaining 1,330 volts potential is dropped across R<sub>4</sub>, R<sub>5</sub> and R<sub>6</sub>.

The ratio of resistor values in this chain is approximately correct, whatever the actual values used.

For example, if a 5.0MΩ potentiometer is available for R<sub>3</sub>, R<sub>1</sub> needs to be increased to 2.0MΩ, R<sub>2</sub> to 5.0 MΩ, and R<sub>4</sub> to R<sub>6</sub> to 8.2 MΩ each; the chain current will then be 54 μA.

The set of plates connected to the adjusting screw of C<sub>4</sub>, if connected to chassis, will allow adjustment of C<sub>4</sub> without hand-capacity effect.

Two 0.001 μF capacitors and a 100 kΩ resistor are used for smoothing.

The capacitors may be mica, silver-mica or paper, but should have a working voltage rating of at least 2,500 volts, and preferably 3,000.

Using the potentiometer R<sub>9</sub>, a wide varia-

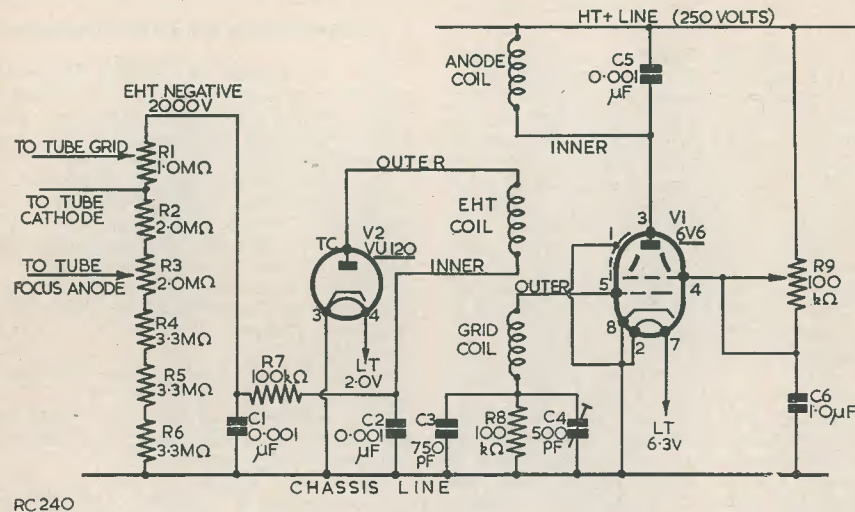


FIG. 29

List of Components

|            |                    |    |                                 |
|------------|--------------------|----|---------------------------------|
| R1         | 1 MΩ carbon pot.   | C3 | 750 pF mica                     |
| R2         | 2 MΩ, ½W           | C4 | 500 pF preset trimmer           |
| R3         | 2 MΩ carbon pot.   | C5 | 0.001 μF mica                   |
| R4, R5, R6 | 3.3 MΩ, ½W         | C6 | 1.0 μF Mansbridge paper         |
| R7         | 100 kΩ, ½W         | V1 | 6V6 (6F6, EL33, etc.)           |
| R8         | 100 kΩ 1W          | V2 | VU120 (VU111, VU133, etc.)      |
| R9         | 100 kΩ carbon pot. |    | International octal valveholder |
| C1, C2     | 0.001 μF 3 kV wkg. |    | Ceramic B4 valveholder          |

In either case, chain current plus average tube beam current will be well below 250 μA\*.

Tuning and Smoothing

Although it is usual to tune the anode coil, such an arrangement puts HT on both sets of trimmer plates and renders tuning hazardous, if not dangerous.

Accordingly a fixed 100 pF mica capacitor is connected across the anode coil, whilst the counterpart in series with the grid coil, C<sub>3</sub> and C<sub>4</sub>, allows a variation of 200 to 250 pF on either side of 0.001 μF.

tion of EHT voltage is possible. Additional smoothing and a lower voltage are also obtainable by increasing R<sub>7</sub> to 0.5 MΩ or even 1.0 MΩ.

R<sub>9</sub> and C<sub>4</sub> should be set to give 2,000 volts EHT at the R<sub>1</sub> end of the load chain, using, if possible an electrostatic voltmeter or an EHT meter reading 0-5,000 volts with a full scale deflection of not more than 200 μA.

A higher voltage may be obtained by increasing the HT supply to the anode of V1 from 250 to 300 volts, although care should be exercised when doing this as the EHT output will rise steeply.

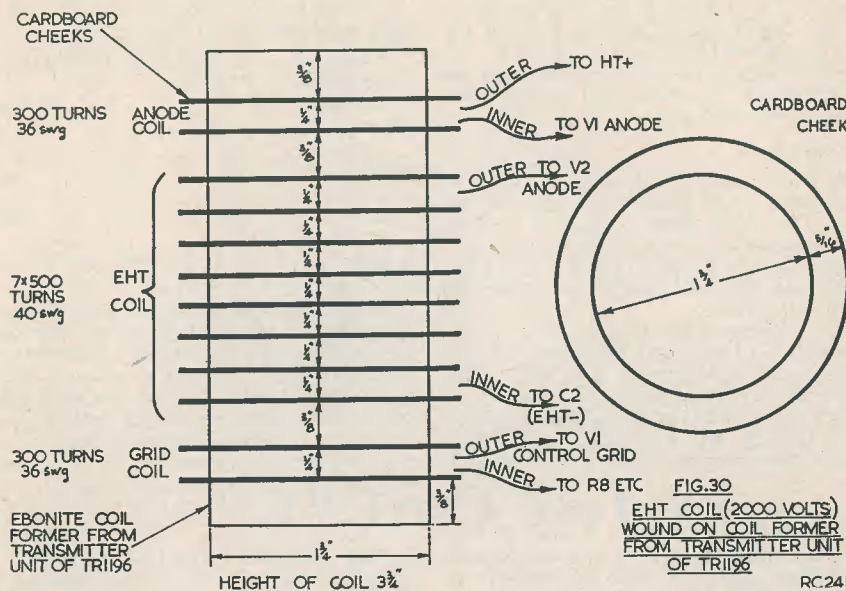


FIG. 30  
EHT COIL (2000 VOLTS)  
WOUND ON COIL FORMER  
FROM TRANSMITTER UNIT  
OF TR1196

RC 241

The Coil

The transmitter unit of the TR1196 contains four sturdy ebonite coil formers, and it is one of these that the writer used in making his own unit.

Twelve cardboard cheeks are cut, coated all over with cellulose cement, and finally cemented into position on the coil former as shown in Fig. 30.

The anode and grid coils are identical. Each consists of 300 turns of 36 swg enamelled wire, wound in the same direction, commencing with the end marked "inner."

The seven sections of the EHT coil are each wound with 500 turns of 40 swg enamelled wire, in one continuous winding, commencing with the end marked "inner" and finishing with "outer."

Each section should be wound evenly, although pile-wound, and a level winding surface should be maintained from the bottom to the top of each section.

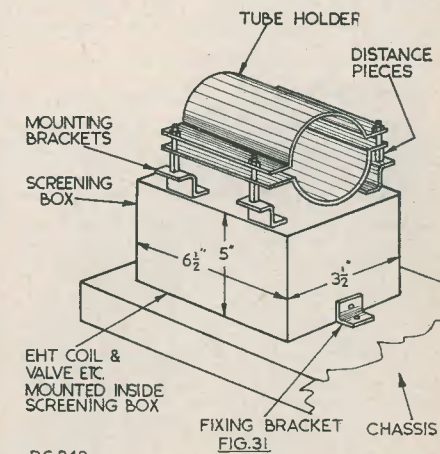
The coil wires should finally be joined to flexible leads, the joints sleeved, and the sleeving and part of the flex securely glued to the coil with cellulose cement before being brought out to the appropriate connections.

The bulkiness of the coil caused no inconvenience—the coil, V1, and the smoothing equipment being eventually accommodated in a screening box, and the box, in turn, being

used as the base mounting for the VRC97. A sketch of the arrangement is shown in Fig. 31.

Alternative Coil Formers

Other types of coil former may be used—bakelite, paxolin, or polystyrene, or even impregnated cardboard—and other diameters



RC 242

down to  $1\frac{1}{4}$ " will be quite suitable, and should need no change in the number of turns per coil given for the  $1\frac{1}{2}$ " former.

There is ample reserve of power, and the only discernible difference will be in the frequency of the oscillations.

#### Valve Rectifiers

The VU120 is a valve of the U21 type, and has a heater rating of 2.0V at approximately 2.0A. The RMS input voltage is 4,500V, and the maximum rectified current 5 mA.

The VU111 is a valve of the V1907 type, and has a similar EHT rating but a filament rated at 4.0V, 1.0A.

The VU133 is similar to the VU111.

The VU120 has a cathode internally connected to the heater pin 3. The VU111 and VU133 are directly heated.

In all these cases, however, the valve will be functioning well within the rated limits,

and only the forward voltage, and not the inverse, will be thrust upon it.

\* Mullard Ltd. give the following data upon tube type ECR60:—

| Val= $V_{a3}$<br>(V) | $-V_g$<br>(V) | $I_a$<br>( $\mu A$ ) | Cut-off<br>Volts |
|----------------------|---------------|----------------------|------------------|
| 2,500                | 15            | 200                  | -40              |
| 2,000                | 9.5           | 200                  | -30              |
| 1,500                | 4             | 200                  | -22              |

Thus, although the higher set of resistor values would throw less strain upon the EHT supply, the average beam current would possibly not exceed 100  $\mu A$ , and this, together with the 134  $\mu A$  chain current through the lower set of resistor values would still be within the capabilities of the circuit.

## Test Card "C"

In the October 1951 issue of this magazine we reported that we had approached the B.B.C., on behalf of our readers and amateur TV enthusiasts in general, for additional showings of Test Card "C" in the evenings. We were not alone in this, for the Editors of other contemporaries had also made their approaches.

Unfortunately, the B.B.C. did not, for various reasons which they gave at the time, feel themselves able to meet these requests. However, since then we, the Editor of *Practical Television*, and other bodies concerned have been plugging away continually.

Charles Ian Orr-Ewing, O.B.E., M.P., very kindly aided us in our endeavours by approach-

ing the Director General of the B.B.C., Sir Ian Jacob, K.B.E., C.B., and suggesting that Test Card "C" be transmitted for twelve of the fifteen minutes during which it had been agreed, in principle, with the British Radio Equipment Manufacturers' Association to transmit the tuning signal.

Although we have not been officially advised of the matter, it certainly seems, to judge by recent events, that the B.B.C. have taken up this suggestion. We are very grateful to them for the help which the evening Test Card "C" transmission has given us, and trust that they will be able to continue radiating what is, to us, an indispensable signal.

#### THE NEW PHILIPS MAGNETIC TAPE RECORDER

The ELA Department of Philips Electrical Ltd., announce the release on the British market of a new magnetic tape recorder — type EL.3530, a portable twin-track, selling at £77 10s 0d. It is designed for operation on A.C. mains, 50 cycles per second, on voltages between 110 and 245.

Simplicity of design, great ease in operation and quality of reproduction are three of this new recorder's most important features, among many others embodied as a result of Philips' 25 years' experience in the making and marketing of sound reproducing equipment.

The twin-track recording of this new model is for a tape velocity of  $3\frac{1}{2}$  in per second, giving it a tape consumption which is one fourth of that of single-track recorders with a tape velocity of  $7\frac{1}{2}$  in per second. Music and speech reproduction are of the highest quality. The tape length of 600ft, on a 5in diameter reel, affords a recording or play-back time of one hour.

A special advantage of this recorder is that the recording/play-back head is de-magnetized when changing over from recording to play-back, and vice-versa; this further eliminates noise.

A "magic eye," operative only during recording, indicates the recording level by lighting-up immediately the appropriate knob is put in the recording position. The "magic eye" serves also as a warning that the erasing head is switched on.

The play-back amplifier has an output of 2.5 watts, fully sufficient for use in small halls. The built-in loud-speaker ensures clear and true-to-life reproduction over the audio-frequency range. There are output sockets for connection to an extension loudspeaker and to headphones for monitoring purposes. An output is provided on the recorder to enable recordings to be transmitted over lines to an existing amplifying system.

The recorder is supplied with a crystal microphone equipped with a table stand and  $1\frac{1}{2}$  yards of cable. The high sensitivity of this microphone enables it to be used, if necessary, at a considerable distance.

Telephone conversations can be recorded quite easily with this recorder by the use of the Philips Telephone Coil, type EL.3970. This coil needs only to be put under the telephone and connected to the 2 mV, 0.5 Megohm input of the recorder. No connection with the telephone itself is necessary.

## Radio Control Equipment

### PART 6

By RAYMOND F. STOCK

#### Selector Construction

All the selectors used in radio control are alike in their operation, and their construction can be identical except for the number and arrangements of the contact banks and wiper arms.

Fig. 28 shows a view of the 'input' side of a unit suitable for home construction, and sizes can be taken from the scale.

The operating magnet can probably be taken from surplus equipment, in which case the dimensions and arrangement will have to be amended to suit.

If a magnet has to be made the yoke A can be cut down from an old P.O. type relay frame. Bolted to it is the core B, cut from a piece of iron or mild steel rod  $\frac{1}{4}$ " to  $\frac{3}{8}$ " diameter; often a long  $\frac{1}{4}$ " bolt can be used providing there is sufficient plain shank, and in this case the head should be left on to provide a larger area to the pole face, as at C. Cores taken from old relays have this feature.

The armature D is a piece of material as for the yoke, and it is pivoted between lugs left on the yoke with a brass pin E about  $\frac{1}{8}$ " diameter.

The electromagnet is bolted (by a bracket if necessary) to an aluminium base or panel, which supports the ratchet wheel bearing bush. The shape of the panel is immaterial, but will have to be decided by the number of contacts required, since the contact arc is bolted to the other side of the base as described later.

The armature is forked at its free end to take the end of the pawl F, which is pivoted to it by another brass pin. The pawl can be filed up from a scrap of mild steel, or it may be a brass strip having a steel tooth soldered to one end and a brass tube at the other end to take the pivot pin.

A light spring G keeps the pawl in contact with the wheel.

If an electromagnet and pivoted armature are available from another source, the pawl

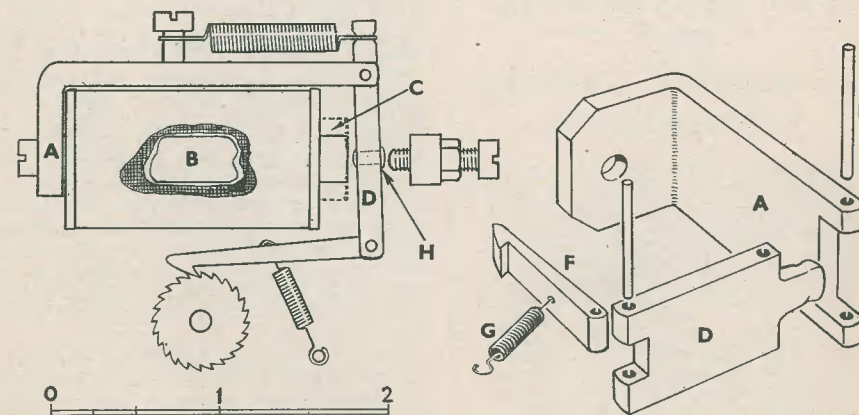
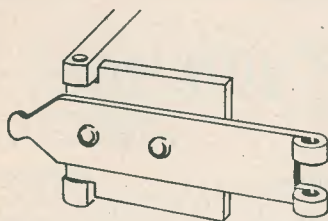


Fig. 28. Construction of the operating mechanism of a selector. Scale—in inches



C29

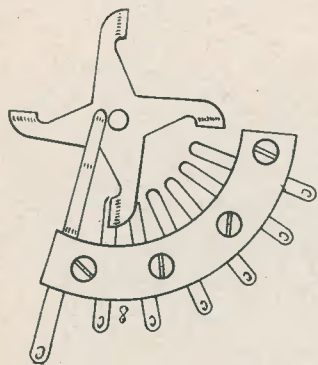
Fig. 29. Alternative armature for selector

and spring may be supported on a false armature of brass or duralumin riveted to the existing one as shown in Fig. 29.

In any case a return spring must be fitted to an extension of the armature at the pivoted end, and is stretched to a 6-BA bolt in the magnet frame.

The forward movement of the armature is limited by the 'anti-residual' rivet H coming into contact with the end of the pole piece; its backward movement, and therefore the stroke, is limited by an adjustable back stop screwed to the base. It can be taken from an old Siemens relay or electric bell, and must be provided with a locknut.

The ratchet wheel may be taken from a clock or spring driven toy, but it is not difficult to cut one from a brass or mild steel disc if a small jeweller's file is used. The number of teeth will depend upon the positions required and is almost always a multiple of them. The stroke of the armature must be kept small, as if the air gap is allowed to become large an impossibly large quantity of power is



C30

Fig. 30. Contact arc and wiper arm

required for the magnet. A movement of  $\frac{1}{32}$ " to  $\frac{1}{16}$ " is suitable; since the pawl has a movement about twice as great as this, the pitch of the teeth must be from  $\frac{1}{16}$ " to  $\frac{1}{8}$ ", and the smaller the better. In order to keep the wheel a reasonable size, between 12 and, perhaps, 48 teeth are desirable. The wheel can be about  $\frac{3}{32}$ " thick, and is soldered to the end of a shaft  $\frac{1}{8}$ " diameter which works in a brass bush riveted or screwed through the aluminium base. The other end of the shaft carries the wiper arm(s) assembly and all the 'output' arrangements are on the reverse side of the base.

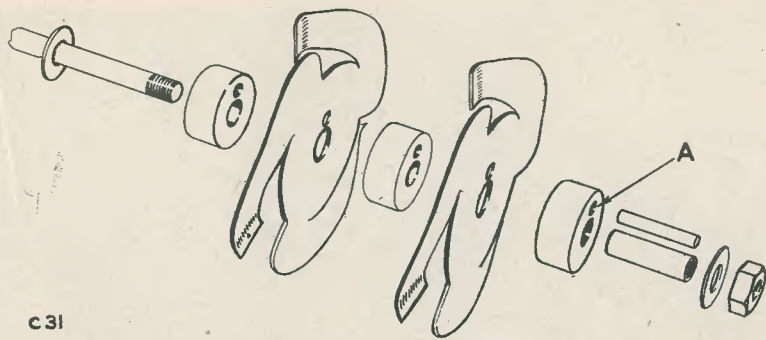
It will be seen that the number of teeth on the wheel must be a multiple of the positions required; the number of static contacts must, of course, be equal to the positions, and consequently the fingers of the wiper arm are always more than one. Thus in this case a 24-tooth wheel has been shown, and in Fig. 30, a view of the other side of the base, is shown a 4-fingered wiper arm and 6 contacts.

The wiper arm is cut with scissors from springy copper foil, and if there is no objection to the frame being live it may be soldered to the shaft with a washer between it and the bush. The static contacts are cut from strips of brass or copper sheet (about 20g.) and clamped between two arcs of perspex or paxolin. Clamping screws pass right through the 'sandwich' and bolt into tapped holes in the base.

An additional springy contact is supported to bear upon the end of the wiper arm shaft to ensure good contact, and each of the copper fingers is bent so that it bears with an even, firm pressure on the contacts.

To adjust the selector the return spring for the armature is tightened until it has just enough power to rotate the assembly from step to step, the armature back-stop being adjusted until the pawl has only sufficient movement to span one tooth pitch. The voltage can now be increased until the magnet has sufficient power to operate positively: it is not possible to predict in advance what power will be necessary to operate a selector unless one has had considerable experience. With a fairly lightly constructed unit, as shown, and with only a single wiper arm, the input may be about 2W and the power handling characteristics sufficient to operate any steering motor.

When a two-pole selector is required to handle perhaps 3A or 4A for main propulsion, its contacts and wiper arms must be correspondingly heavier, and it may require 2A to operate at 6 volts. In the former case, an electromagnet coil wound as described earlier in Fig. 11 will be suitable, but for the two-



C31

Fig. 31. Assembly of multi-way wiper arms. The central tube is fibre

pole motor selector the coil must be made larger by perhaps 25% and the gauge of the wire dropped to 28 swg. Usually the correct results can be obtained by varying the applied voltage.

When a two-pole selector is required the construction of the wiper assembly is as shown in Fig. 31.

Each wiper arm is clamped between insulating discs and, after assembly in register, a hole can be drilled at A with a plastic peg inserted. This locks the wiper arms, the sandwich being clamped up between a washer soldered to the shaft and an end nut screwed onto the shaft threaded for the purpose.

(To be continued)

Each wiper arm is cut with a complete circle at the centre, and a static contact arm bears on this position to make connection.

The 2 arcs of fixed contacts can be built up in 2 layers using 3 insulating arcs between them.

Larger selectors than this are not easy to make, and standard P.O. type units with 11 ways and 4 or more poles are available cheaply at surplus stores.

It may sometimes be necessary to fit a spring detent to prevent reverse action of the ratchet wheel, and in this case a piece of watch spring is arranged to bear on the surface of the wheel as shown in Fig. 20.

## 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 Model Engineer Exhibition

Many of the models entered for "The Model Engineer" Exhibition at the New Royal Horticultural Hall from August 19th to 29th, are worked by electricity, while a major attraction is the water-tank where radio-controlled model yachts and boats will be seen manoeuvring.

Other attractions include a miniature Grand Prix racing track, a steam driven working model roundabout, and passenger-carrying steam locomotives. In the demonstration area all branches of model engineering will be shown.

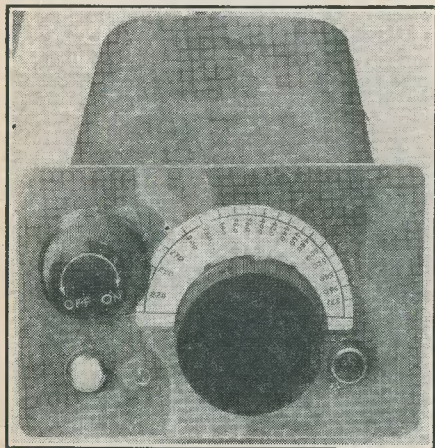
# The INEXPENSIVE

## A CHEAP and EFFICIENT CAR RADIO

By A. Tiel

*We have pleasure in presenting this design for an Efficient, yet Inexpensive Car Radio Receiver. This receiver has been designed in two versions, one using ex-W.D. components and the other built around brand new material. Actually there is not a great deal of difference in the cost of either version, and where the Constructor has not a great deal of experience we should strongly advise him to use new material throughout. We have heard this receiver in operation and were impressed with the performance.*

The writer having recently taken delivery of a new Morris 8 and being interested as a radio amateur in portable transmitting and receiving

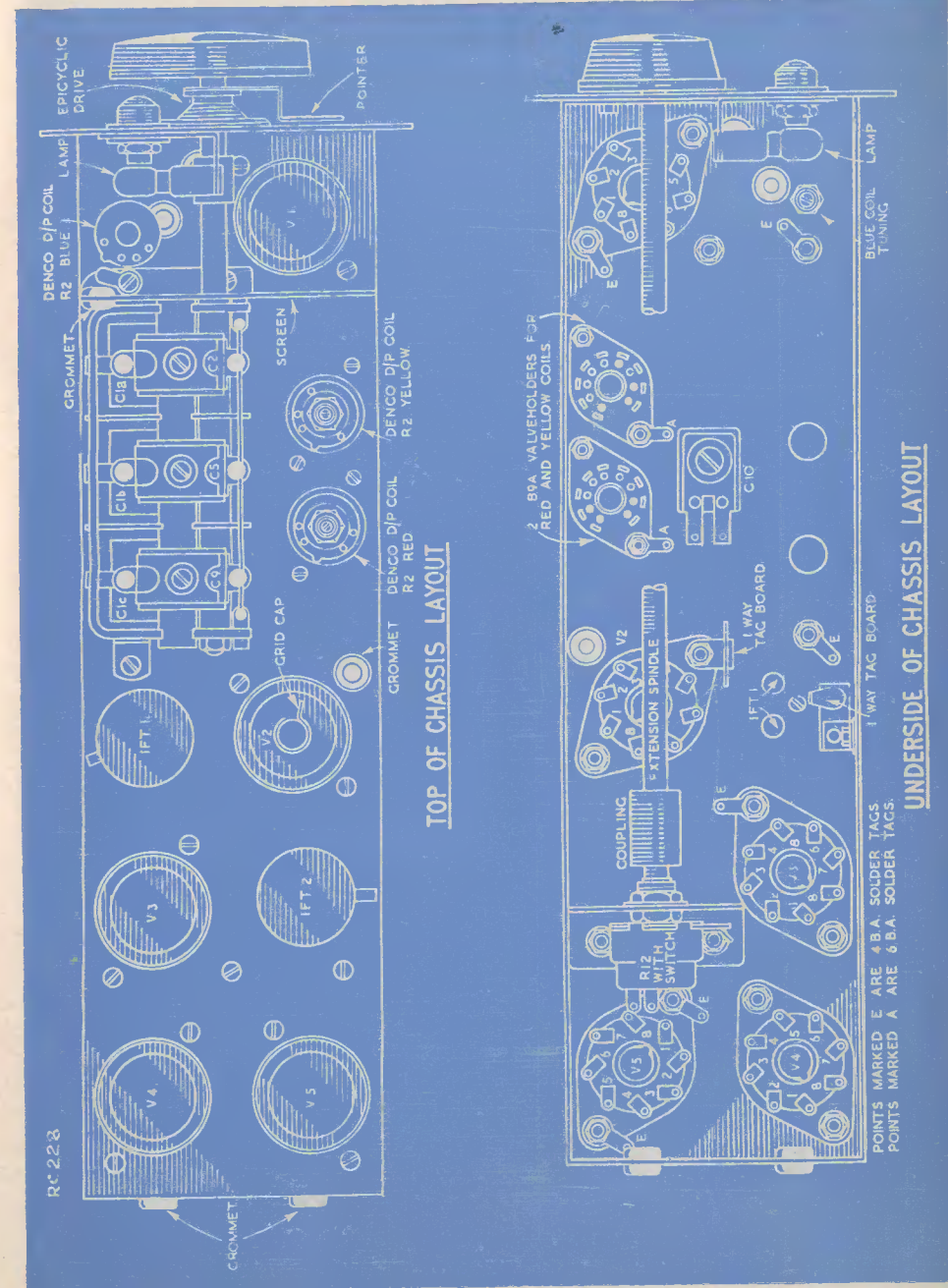


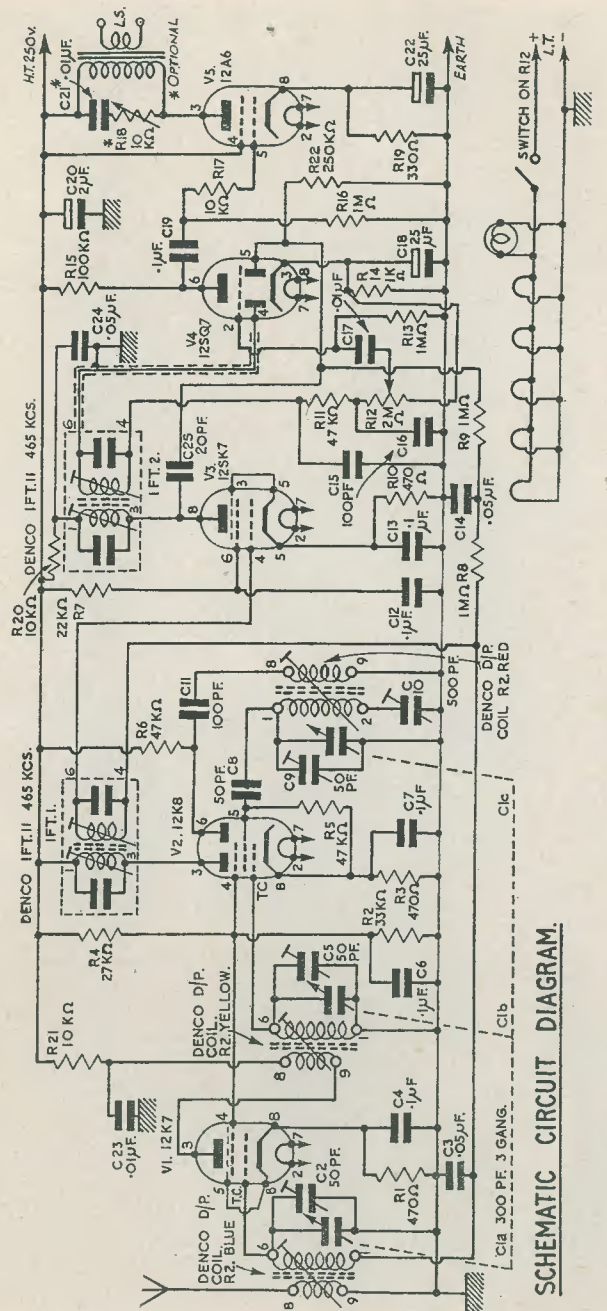
Front view of the receiver made from surplus components

equipment, decided that it would be very pleasant when alone and on long journeys to have installed a broadcast receiver to help pass away the tedious hours on the road. Owing to the high price of the manufactured sets due to the purchase tax, the question of buying one of these was at once discarded. In consequence, the receiver would need to be built keeping the costs as low as possible by omitting the "frills" without loss of efficiency. To meet the first demand the surplus market was obviously the place to visit, as very many of the components which go to make a set can be acquired for a very reasonable outlay.

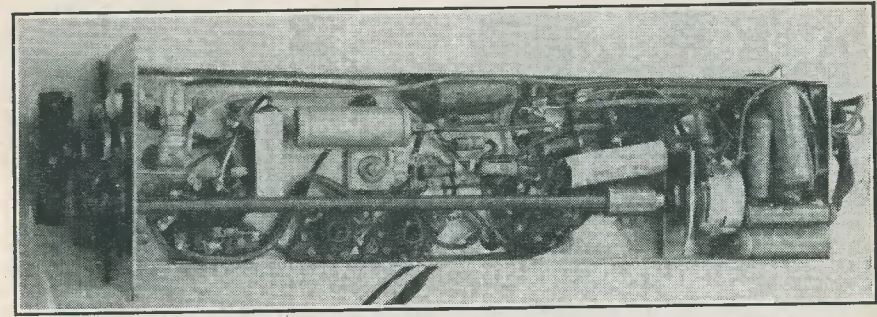
To make it compact, keep down cost, and to minimise switching, it was decided that only the medium waveband coils be fitted. This proved quite satisfactory, as it was found that very few drivers, when on the road, listened to the long or shortwave programmes, the "Light" and "Home" programmes being more satisfactory from the point of view of maintaining good reception.

The next question was where to house the set, as obviously it should be located within a comfortable distance of the driver's hand. It was found that on pulling out the grille in the centre of the dash, a hole approximately  $4\frac{1}{4} \times 3\frac{1}{8}$  had been cut from the metal frame





*Circuit diagram of the version using ex-W-D components. The circuit of the all new version, together with components list is given on pages 634-635*



*Under-chassis view of the surplus version.*

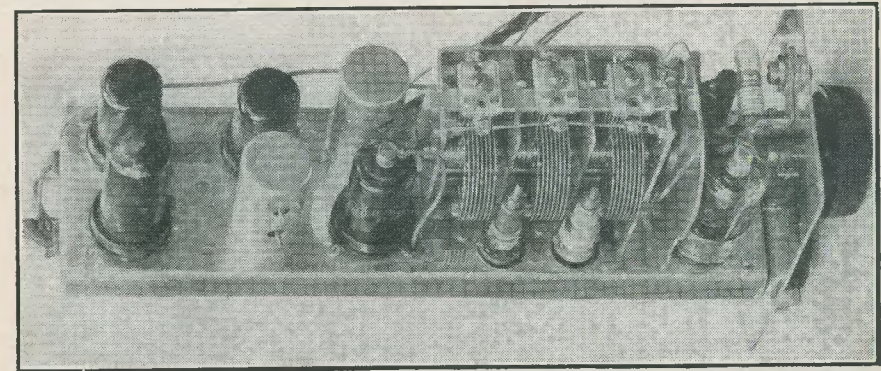
in order to facilitate wiring of the various controls. This looked to be an ideal position, as by moving one or two of the wires in the rear a clear depth of 11" was available. Also, to the left of this, below the glove box, was a circular hole of some 18" diameter just above the lower tray, which suggested a suitable position for the loudspeaker. Alternatively, the latter could be mounted behind the glove box lid, having first removed the medallion and fitted an expanded metal grille in its place.

Next the power supply. As very many excellent small surplus converters are still available, a type 104 12V input, 6V 3Amp/250V 100mA output was selected at a cost of 7/6 the same being completely smoothed and boxed. This particular one was chosen because the writer required other supplies for transmitting gear, but a much smaller type with

just a 250V 50mA output would have been quite satisfactory. This unit was then mounted under the car bonnet, fed from the accumulator through a switch in the car and the outputs brought out to a small perspex terminal strip fitted under the dash. On this strip were also mounted a pair of leads from the car battery to sockets supplying current for the valve heaters.

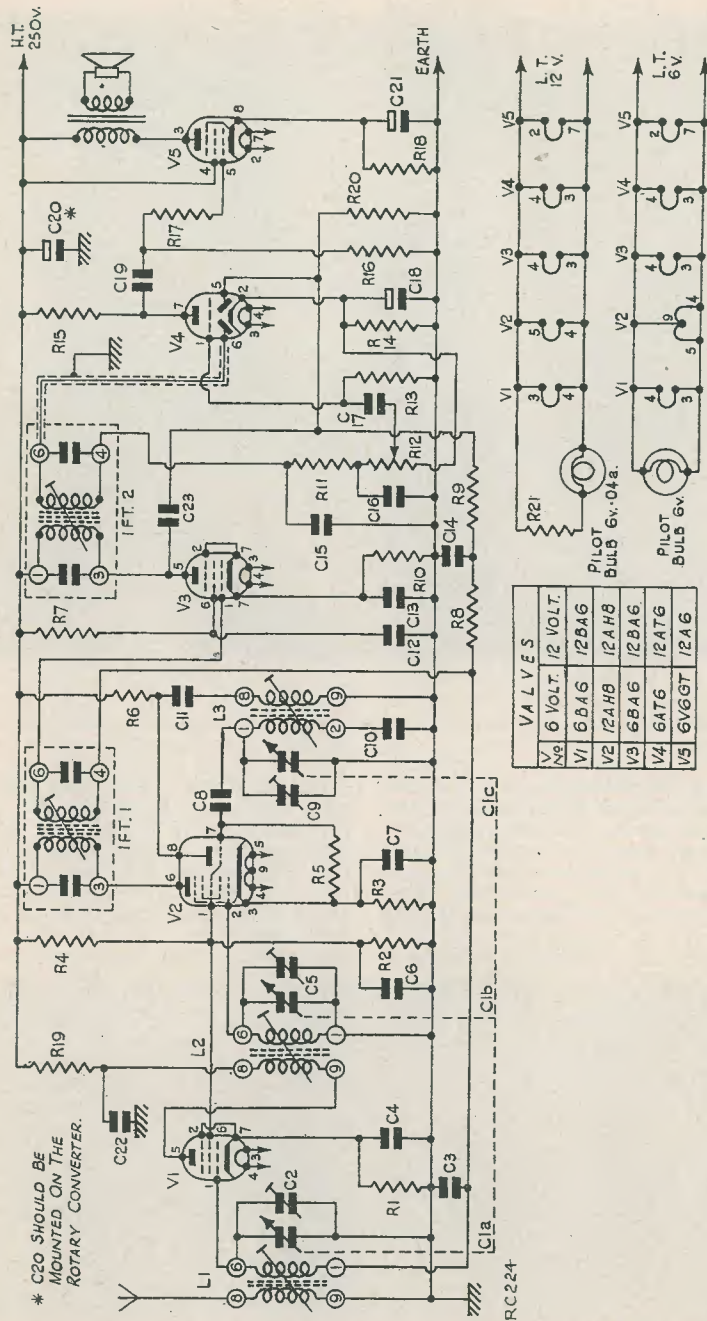
The aerial consisted of about 20-ft. of V.I.R. cable stretched under the car chassis and wound over and between the copper brake tubing to support it, this being fed in to the car through a hole in the scuttle to a socket secured under the dash. Later a roof whip aerial was fitted for comparative results. The whole was then wired up, the little set giving quite pleasing results for a very reasonably outlay.

Now a few words for those car drivers who



*Above-chassis view of the surplus version*





The "Inexpensive" Car Radio—All new version Circuit Diagram

| VALVES |                    |
|--------|--------------------|
| V No   | 6 VOLT. / 12 VOLT. |
| V1     | 6B7G / 12BA6       |
| V2     | 12AH8 / 12AH8      |
| V3     | 6BA6 / 12BA6       |
| V4     | 6AT6 / 12AT6       |
| V5     | 6V6GT / 12A6       |

## PARTS LIST, CAR RADIO USING NEW COMPONENTS

## Resistors

|                   |   |
|-------------------|---|
| R1, 3, 10         | 470 $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS   |
| R2                | 33 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS  |
| R4                | 27 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS  |
| R5, 11            | 47 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS  |
| R6                | 47 k $\Omega$ , 1W, Dubilier type BTB               |
| R7                | 22 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS  |
| R8, 9, 13, 16, 12 | 1 M $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS   |
| R14               | 1 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS   |
| R15               | 100 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS |
| R17               | 10 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS  |
| R18               | 330 $\Omega$ , 1W, Dubilier type BWF                |
| R19               | 10 k $\Omega$ , 1W, Dubilier type BTB               |
| R20               | 270 k $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS |
| R21               | 150 $\Omega$ , $\frac{1}{4}$ W, Dubilier type BTS   |

## Condensers

|                      |  |
|----------------------|--|
| C1a, b, c            | 300 pF 3-gang variable, J.B. or Denco (Clacton) Ltd. |
| C2, 5, 9             | 3-30 pF concentric trimmers                          |
| C3, 14, 15           | 0.05 $\mu$ F, 350V DCW, Dubilier type 460            |
| C4, 6, 7, 12, 13, 19 | 0.1 $\mu$ F, 350V DCW Dubilier type 460              |
| C8                   | 50 pF silver mica $\pm$ 20% Dubilier type S635       |
| C10                  | 350 pF silver mica, $\pm$ 10%, Dubilier type S635    |

|             |  |
|-------------|--|
| C11, 15, 16 | 100 pF silver mica, $\pm$ 20% Dubilier type S635 |
| C17, 22     | 0.01 $\mu$ F, 1000V DCW, Dubilier type 460       |
| C18, 21     | 25 $\mu$ F 25V DCW, Dubilier type BR             |
| C20         | 2 to 8 $\mu$ F, 350V DCW, Dubilier type BR       |

## Coils

|    |  |
|----|--|
| L1 | Denco (Clacton) Ltd. type D/P, Range 2, Blue   |
| L2 | Denco (Clacton) Ltd. type D/P, Range 2, Yellow |
| L3 | Denco (Clacton) Ltd. type D/P, Range 2, Red    |

IF Transformers, Denco (Clacton) Ltd. type IFT11.

## Valves

All Brimar. According to car battery—see circuit diagram.

## Miscellaneous

Case, chassis, panels, Denco (Clacton) Ltd.  
 Valveholders, to suit valves used.  
 Slow motion drive (epicyclic), extension spindle and coupler, dial lamp holder, knobs, single mounting tag strips, screened sleeving, single pushback wire, sleeving, solder, screws, nuts and washers.

This also applies to the piece of aluminium carrying the volume control. Lastly mark out and drill the front panel as per sketch.

Should the facilities not be available for this metal work, Denco (Clacton) Ltd. are supplying two types of chassis and cabinet. One is drilled for surplus valves as described in the *Motor*, with a radius on the corners of cabinet for fitting to the Morris 8, and the other is drilled for new Brimar valves and has a black steel cabinet with square corners suitable for any make of car.

The Morris cabinet is in aluminium, as is the original.

Next mount all components on the chassis, leaving the volume control until most of the wiring has been completed. Commence wiring the heater circuit using flex or a twisted pair of insulated wires. Earth pin No. 1 on all valveholders when using the surplus valves. Bias circuits can then be wired up, except those for the 12SQ7, and 12A6 valves. These should be left until all other wiring is completed, the components being of such size that they would

be in the way of other wiring if connected. From then on it is a matter of choice how to proceed. The writer wired each circuit separately, commencing at the RF stage and finishing at the output stage.

For calibration purposes a piece of white card was cut to 1 $\frac{1}{2}$ " radius, covered by a piece of clear perspex of the same size. This was slid behind the epicyclic drive and secured to the panel by two screws. A pointer was then added which moved over 180°. A bicycle spoke filed to a knife edge makes an excellent rigid pointer. The epicyclic drive and two indicator lamps were then mounted on the front panel, and the panel was then carefully fitted to the chassis so that the spindle of the three gang condenser was in line with the spindle of the drive. Before finally bolting this together, slide the coupler over the condenser spindle with the panel in position; no binding or springing should take place, and both spindles should easily enter the coupling.

(To be continued next month)

# The "UNIVERSAL" Large Screen

## AC/DC Televisor

Part 3. Described by A. S. Torrance, A.M.I.P.R.E., A.M.T.S.

(By kind permission of IKOPATENTS LTD)

### Assembly of Components

For convenience in working, and at the same time to avoid damaging these fragile parts, it is advisable to remove the CRT fixing straps (G).

The chassis may now be assembled either way up with greater safety and comfort.

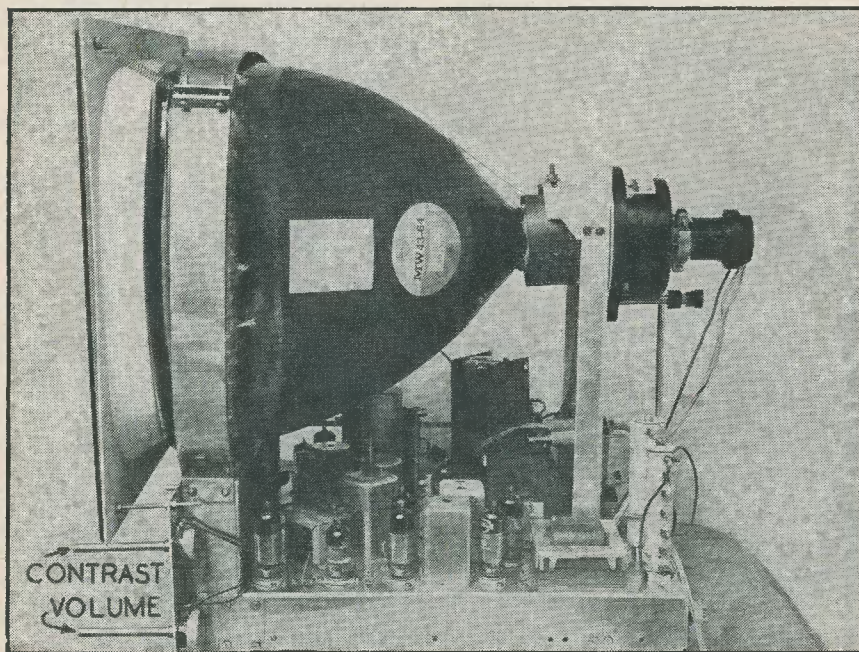
### Power Pack Choke

Undo the fixing bolts and slip off the lamination frame on the side where the connecting

wires are to be found. The choke is placed in the position shown in the photograph, and the frame bolted back under the chassis. The bolts should be well tightened to stop any subsequent vibration of the laminations.

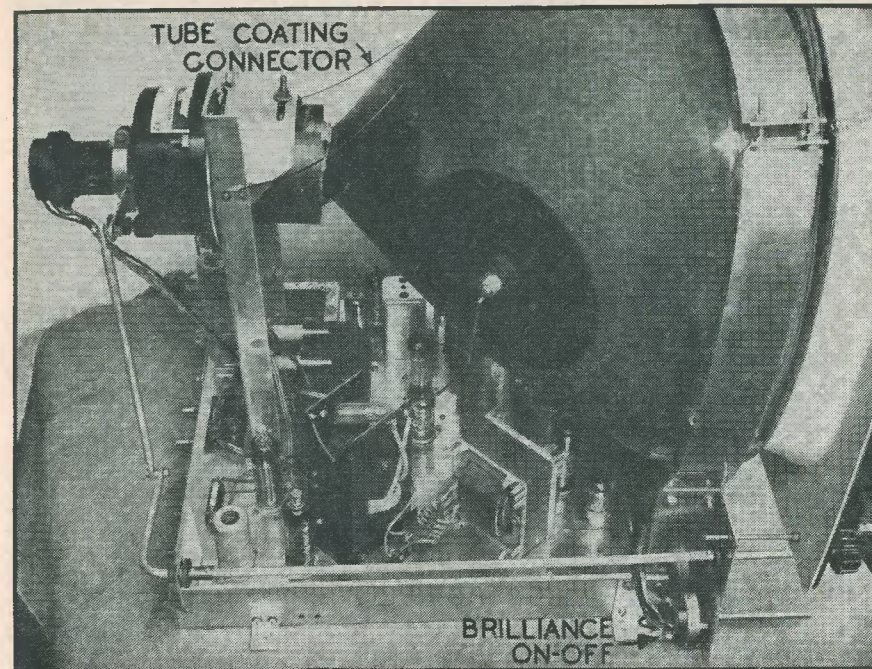
### Rectifier 14A/342

Make two simple "L" brackets, high enough for the rectifier to clear the top of the chassis, and bolt into position over the air space provided. The feet of these brackets turn inwards,



Left-hand side of chassis, showing smoothing choke

636



Right-hand side of chassis

and the connection plates of the rectifier are placed underneath.

### Condensers

C48-C52 and C39-C43, together with the 60/100  $\mu$ F, are now mounted with clips on top of the chassis, as shown.

### Frame Blocking Oscillator Transformer

Mounted under the chassis, as shown.

### HT and Heater Droppers

Mounted on top of the chassis, at the rear.

### Tag Strips

Carefully count the number of tags on each strip, and bolt underneath in their correct positions. The tag part of the bolt fixing, in each case, is required for chassis contacts and should not be removed. In addition to those shown in the heater point-to-point diagram, one 2-way strip is required for the frame transformer—see photo.

### Rear Controls and Aerial Socket

Cut a piece of perspex, plastic, paxolin or other suitable insulating material to cover the entire length of the rear end of the chassis. This may well be made of a greater depth than is shown in the photograph, thus affording more protection against contact with the fuseholders.

Drill clearance holes for the control bushes and aerial socket. Bolt the latter into position with countersunk headed bolts. Slide the material over the bushes and secure into position with the potentiometer nuts. The spindles may then be cut shorter, leaving sufficient length for the knobs. These latter must be of the type having deep-seating grub screws.

This procedure effectively protects the operator from contact with the chassis when making adjustments. Note that the bushes for the focus mechanism are also insulated.

### Front Controls

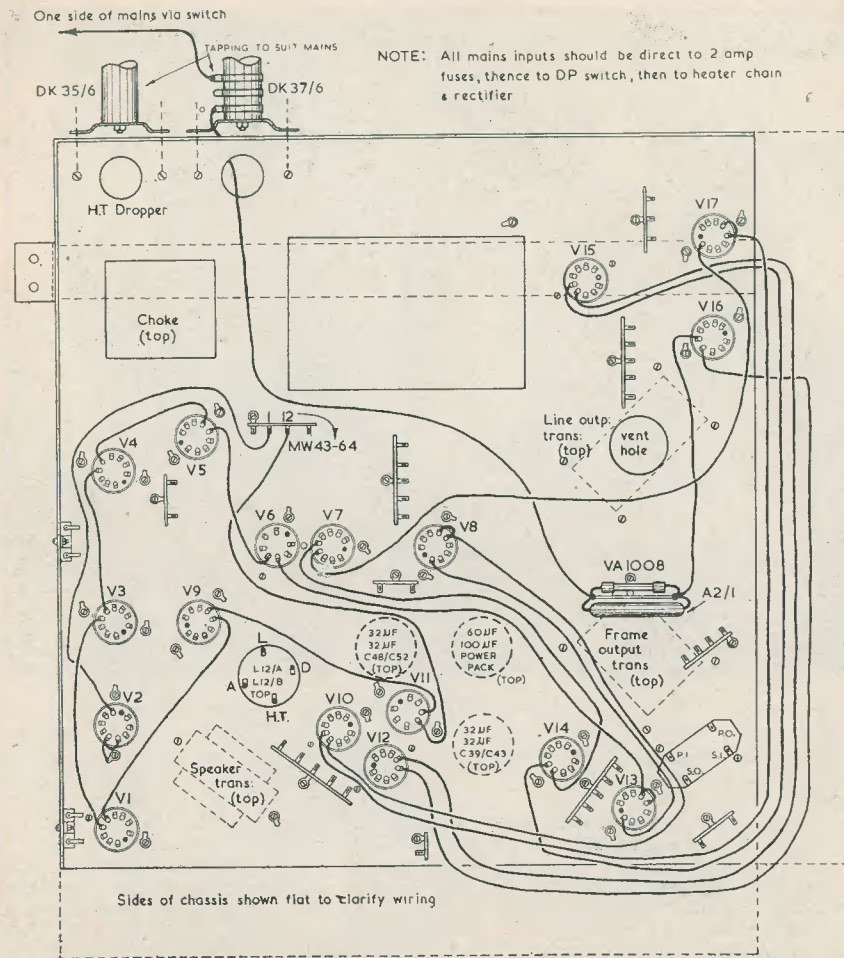
Instal in position as shown. It is advisable to attach the engraved knobs before wiring—this will assist the constructor in avoiding any possibility of crossing the connecting wires.

### Line Output Transformer

This component should not be mounted at this stage—it has delicate wiring, and during the wiring-up procedure may be subjected to considerable handling, with subsequent damage.

Instal Valveholders, selecting the appropriate type for each valve as specified in the heater





UNDERSIDE OF CHASSIS SHOWING HEATER CHAIN WIRING & DISPOSITION OF TAG STRIPS, VALVE LOCATIONS, ETC

TV 017

chain diagram, and parts list. This is important. It must be understood that some valves are carrying VHF signals, and any losses incurred through faulty or poor quality holders will inevitably destroy the high definition capable of resolution by the "Universal" television.

The VA1008 and the A2/1 may now be soldered in parallel and in their allocated position.

#### The Heater Chain Wiring

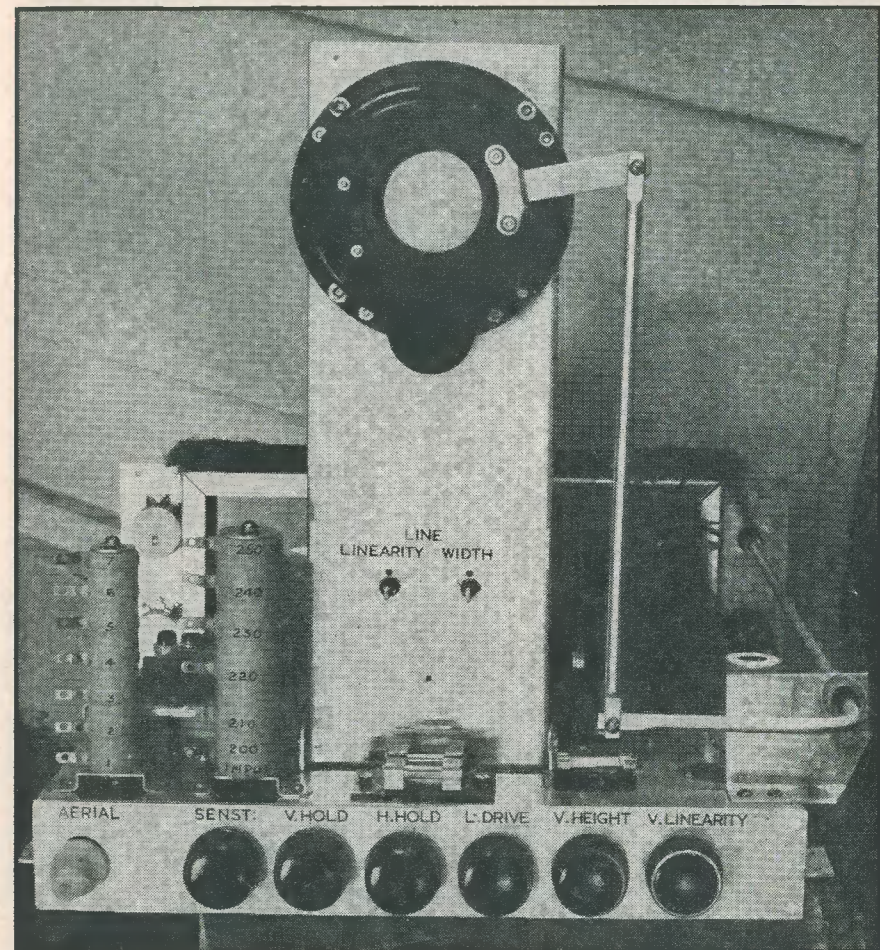
Careful study should now be made of the

under-chassis point-to-point wiring diagram of the heater chain.

**DO NOT DEVIATE FROM THE LAYOUT GIVEN.**

This has been carefully devised to give maximum stability and freedom from parasitic oscillation, sometimes present in series-heater arrangements.

Commence, then, at V2. The first connection will be pins 4 and 5 (joined externally) to chassis. Proceed through the chain exactly as shown. Good quality PVC or tinned copper



Rear view, showing rear controls and insulating mounting panel

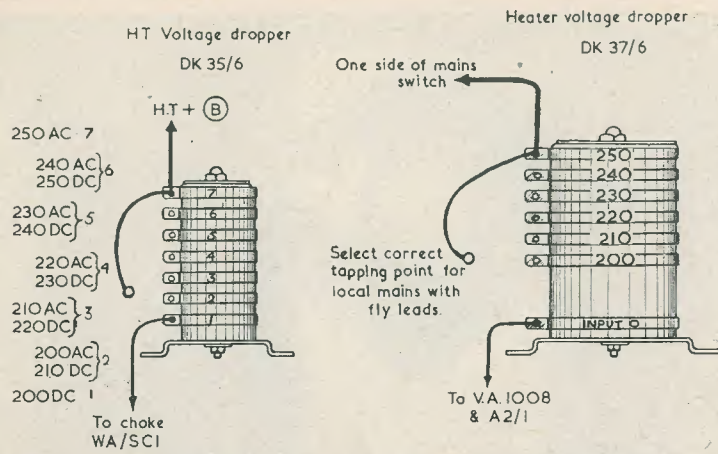
and sleeving must be used. Do not use push-back type wire. Maximum insulation is imperative.

Note the tag strip provided for eventual heater supply to the MW43-64. Flexible leads will be required for this, and will be added later.

C66, C67 and C68 are not shown in the point-to-point diagram, but should be soldered into position now (see heater chain section of circuit).

#### Testing the Chain for Insulation

Make a temporary "short" across the CRT heater tag strip (shown as 1.12. MW43-64). Insert all the valves with the exception of V2. With a continuity meter check the chain right through from the DK37/6 heater dropper to pin 9 of V2. There must be continuity—the actual resistance reading obtained will be fairly high due to the heater dropper and A2/1.



DETAILS OF VOLTAGE DROPPER TAPPING POINTS

Sizes emphasised for clarity

TV17/5

**Test Circuit to Chassis**

THERE MUST BE ABSOLUTELY NO CONTINUITY, WITH V2 REMOVED, TO CHASSIS.

Remember that the heater chain is completely across the full mains input, and any mistake or fault resulting in a short circuit at any part of the chain will throw the entire mains across the filaments of perhaps just a few of the valves.

Remove the temporary "short" acting for the CRT, and all the valves, at the conclusion of the test.

THE ABOVE TEST SHOULD BE CARRIED OUT AT FREQUENT INTERVALS DURING THE WIRING, IN ORDER TO MAKE CERTAIN THAT NO INADVERTENT CONNECTION HAS BEEN MADE.

**Identification of Controls**

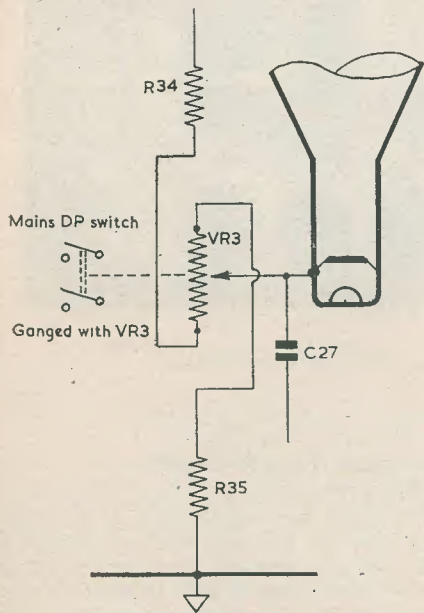
In order to enable the constructor to easily identify the function of the controls as shown in the circuit diagram, the following list is given:—

- |                     |                |
|---------------------|----------------|
| VR1 Sensitivity     | VR2 Contrast   |
| VR3 Brilliance      | VR4 Volume     |
| VR5 Height          | VR6 Frame Hold |
| VR7 Frame Linearity | VR8 Line Drive |
| VR9 Line Hold       |                |

**Component List**

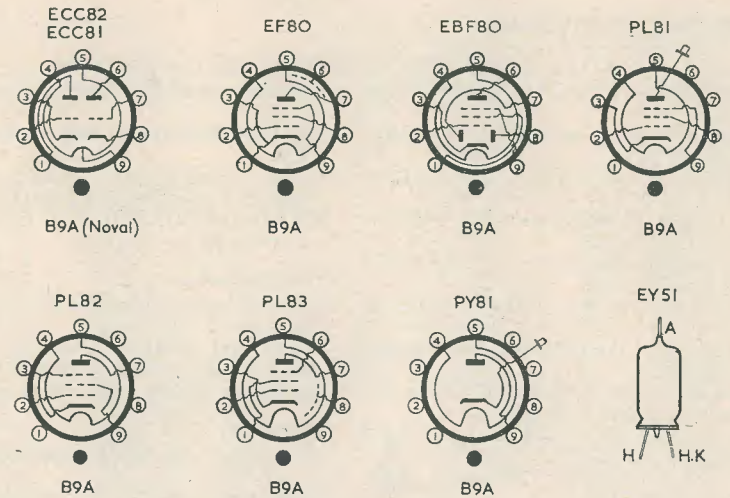
The list of components given is an exact copy of those contained in the prototype receiver, and it is very important that it should be adhered to.

To construct a 17" television on one small chassis, careful selection of components with reasonable physical dimensions is necessary.



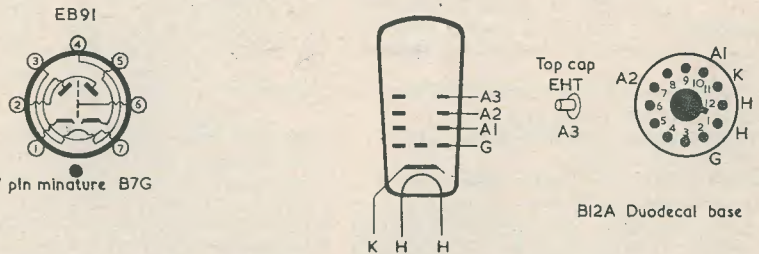
CIRCUIT TO ELIMINATE SPOT

TV17/8



NOTE: V7 ON CIRCUIT DIAGRAM IS SHOWN INCORRECTLY, THE ABOVE IS CORRECT. WHEN WIRING, PIN 6 IS CONNECTED TO PIN 3 EXTERNALLY

TELEVISION TUBE MW43-64



TV17/6

Valve Bases and connections used in the "Universal"

Any deviation from the list is likely to cause crowding somewhere in the assembly.

**Residual Spot Cancellation**

An alternative arrangement is shown for cancelling out the residual spot left on the screen when switching off. This is an unconventional circuit. The brilliance is at maximum

when the control is in the fully left position. At this point the switch is then at "Off."

This circuit is arbitrary, but is recommended by your writer. Either of the methods shown may be selected without incurring any further expense. The Dubilier switch is interchangeable.

To be continued—  
Complete component list appears overleaf

**The Index to Vol. 6 is now being prepared**

Make sure of your copy by sending a stamped, addressed envelope marked "R. C. Index" in top left hand corner.

## Universal Televisor

### LIST OF COMPONENTS USED IN THE PROTOTYPE

|   |  |
|---|--|
| Deflection Coils—WA/DCA1—Denco (Clacton) Ltd.   | Top Cap for PL81—Lasky's (Harrow Road) Ltd.  |
| Line Output Transformer—WA/LOT1—Denco (Clacton) Ltd.  | Top Cap for PY81—Lasky's (Harrow Road) Ltd.  |
| Power Pack Choke—WA/SC1—Denco (Clacton) Ltd.  | Heater Chain Dropper—DK37/6—J. L. Goldsman Ltd., distributed by Amplion.             |
| Frame Output Transformer—WA/FMA1—Denco (Clacton) Ltd.   | HT Dropper—DK35/6—J. L. Goldsman Ltd., distributed by Amplion.                       |
| Frame Blocking Transformer—WA/FBT1—Denco (Clacton) Ltd.   | <b>Miscellaneous</b>   |
| Width Control—WA/WC1—Denco (Clacton) Ltd.   | Resistors across deflection coils—Supplied by maker.                                 |
| Line Linearity Control—WA/LC1—Denco (Clacton) Ltd.  | Spring steel, brass, or phosphor-bronze wire for connecting tube coating to chassis. |
| Vision/Sound Coils—"Universal" TV—Denco (Clacton) Ltd.  | Tag Strips—Solder Tags—Nuts and screws.  |
| Correction Chokes 1-2-3—"Universal" TV—Denco (Clacton) Ltd.   | <b>Valves</b>  |
| Chassis and Structure—"Universal" TV—Denco (Clacton) Ltd.   | All Mullard—See heater chain circuit.  |
| Focus Mechanism—"Universal" TV—Denco (Clacton) Ltd.   | <b>Condensers.</b> All T.C.C. Available complete and boxed.                          |
| Cans for L4-L5, L7-L8—"Universal" TV—Denco (Clacton) Ltd.   | C1, 1000pF, CTH310 C35, 47pF, 101SMP   |
| Cabinet—"Universal" TV—Lasky's (Harrow Road) Ltd.   | C2, 1000pF, CTH310 C36, 0.01μF, 543  |
| Perspex—"Universal" TV—Lasky's (Harrow Road) Ltd.   | C3, 1000pF, CTH310 C37, 220pF, SCT14   |
| Escutcheon (White)—"Universal" TV—Lasky's (Harrow Road) Ltd.  | C4, 47pF, 101SNP C38, 200pF, SCT14   |
| Duomag Focaliser—FD12/4—Elac.   | C5, 10pF, 101SNP C39, 32μF, CE27LE†  |
| 5" Speaker—5/45—Elac.   | C6, 1000pF, CTH310 C40, 0.01μF, 543  |
| Speaker Transformer—18009—Elac.   | C7, 47pF, 101SMP C41, 0.01μF, 543  |
| Ion Trap Magnet—IT9—Elac.   | C8, 22pF, 101SMP, Finish "C" C42, 50μF, CE32B  |
| Rear Control Knobs—5x1" with deep seating grub screws—(Uncles Bliss) Lasky's (Harrow Road) Ltd.   | C9, 47pF, 101SMP C43, 32μF, CE27LE†  |
| Valveholders—See heater chain—Mc'Murdo.   | C10, 1000pF, CTH310 C44, 0.01μF, 543   |
| Aerial Connector—AA/3UB—Mc'Murdo.   | C11, 1000pF, CTH310 C45, 0.1μF, 343  |
| Aerial Socket—B3/US—Mc'Murdo.   | C12, 47pF, 101SMP C46, 0.1μF, 343  |
| Power Pack Rectifier—14A/342—Westinghouse.  | C13, Supplied with coil C47, 0.01μF, 543   |
| ¼" Felt for packing—See tube mounting—Lasky's (Harrow Road) Ltd.  | C14, 1000pF, CTH310 C48, 32μF, CE27LE†   |
| Double Fuseholder—2A fuses—Lasky's (Harrow Road) Ltd.   | C15, 1000pF, CTH310 C49, 0.5μF, 500CP915   |
| Single Fuseholder—250mA fuses—Lasky's (Harrow Road) Ltd.  | C16, 47pF, 101SMP C50, 0.05μF, 343   |
| Knobs for Front—with deep seating grub screws—Brilliance, Volume, Contrast, Focus. See text for "On/Off" methods—(Uncles, Bliss), Lasky's (Harrow Road), Ltd. | C17, 1000pF, CTH310 C51, 100μF, CE61C  |
| Insulated Bushes for Focus Mechanism—"Universal" TV—Denco (Clacton) Ltd.  | C18, Supplied with coil C52, 32μF, CE27LE†   |
| Half Links for Focus Mechanism—"Universal" TV—Denco (Clacton) Ltd.  | C19, 1000pF, CTH310 C53, 0.05μF, 343   |
| Top Cap for MW43-64—Lasky's (Harrow Road) Ltd.  | C20, 47pF, 101SMP C54, 0.02μF, 543   |
|   | C21, 10pF, 101SMP C55, 0.05μF, 543   |
|   | C22, 0.05μF, 343 C56, 0.01μF, 543  |
|   | C23, 8μF, CE11L C57, 0.02μF, 543   |
|   | C24, 1000pF, CTH310 C58, 3300pF, CTH315  |
|   | C25, 2200pF, CTH310 C59, 0.005μF, 543  |
|   | C26, 0.1μF, 343 C60, 82pF, SCT2  |
|   | C27, 0.1μF, 343 C61, 82pF, SCT2  |
|   | C28, 0.1μF, 743 C62, 680pF, 601SMP   |
|   | C29, 10,000pF, CTH422 C63, 400pF, 501SMB   |
|   | C30, 1000pF, CTH310 C64, 0.5μF, CP915  |
|   | C31, Supplied with coil C65, 47pF, SCT1  |
|   | C32, 1000pF, CTH310 C66, 1000pF, CTH310  |
|   | C33, Supplied with coil C67, 10,000pF, CTH422  |
|   | C34, 0.01μF, 543 C68, 1000pF, CTH310   |
|   | 3 Clips for Top Mounted Condensers.  |
|   | 2 Side-fixing Clips for C51, C23.  |

Power Pack Condensers.  
60/100μF, CE37LE

NOTE.—32μF is C52. The un-marked condenser between R56 and chassis in the circuit diagram is C45.

The condenser across the line deflection coils is provided by the makers.

\*=Same Can. †=Same Can.

Resistors. All Dubilier, available complete and boxed.

|                |                |
|----------------|----------------|
| R1, 4.7kΩ BTS  | R20, 1.5kΩ BTS |
| R2, 33Ω BWF2   | R21, 4.7MΩ BTS |
| R3, 100Ω BTS   | R22, 5.1kΩ BTS |
| R4, 4.7kΩ BTS  | R23, 22kΩ BTS  |
| R5, 1.5kΩ BTS  | R24, 10kΩ BTB* |
| R6, 2.7kΩ BTS  | R25, 10kΩ BTB* |
| R7, 22kΩ BTS   | R26, 22kΩ BTS  |
| R8, 680Ω BTS   | R27, 47kΩ BWF2 |
| R9, 10kΩ BTS   | R28, 220kΩ BTS |
| R10, 2.7kΩ BTS | R29, 5.1kΩ BTS |
| R11, 150Ω BTS  | R30, 3.3MΩ BTS |
| R12, 6.8kΩ BTS | R31, 33kΩ BTS  |
| R13, 1.5kΩ BTS | R32, 1MΩ BTS   |
| R14, 1.5kΩ BTS | R33, 3.3kΩ BTS |
| R15, 2.7kΩ BTS | R34, 220kΩ BTS |
| R16, 33Ω BWF2  | R35, 22kΩ BTS  |
| R17, 100Ω BTS  | R36, 2.2MΩ BTS |
| R18, 150Ω BTS  | R37, 470kΩ BTS |
| R19, 3.9kΩ BTS | R38, 22kΩ BTS  |

|                |                |
|----------------|----------------|
| R39, 1.5kΩ BTS | R57, 33kΩ BTS  |
| R40, 150Ω BTS  | R58, 220kΩ BTS |
| R41, 100kΩ BTS | R59, 10kΩ BTS  |
| R42, 220kΩ BTS | R60, 22kΩ BTB  |
| R43, 10MΩ BTS  | R61, 390Ω BTS  |
| R44, 2.2MΩ BTS | R62, 47kΩ BTS  |
| R45, 1MΩ BTS   | R63, 2.2MΩ BTS |
| R46, 33kΩ BTS  | R64, 3.3MΩ BTS |
| R47, 10kΩ BTS  | R65, 4.7kΩ BTB |
| R48, 100Ω BTS  | R66, 47Ω BWF2  |
| R49, 10kΩ BTS  | R67, 1MΩ BTS   |
| R50, 1.5kΩ BTS | R68, 220kΩ BTS |
| R51, 270Ω BTS  | R69, 22kΩ BTS  |
| R52, 220kΩ BTS | R70, 82kΩ BTS  |
| R53, 10kΩ BTS  | R71, 47kΩ BTS  |
| R54, 470kΩ BTS | R72, 1.5kΩ BTS |
| R55, 10kΩ BTS  | R73, 330Ω BTS  |
| R56, 100kΩ BTS | R74, 82kΩ BTB  |

\*=Or one 4.7kΩ 2W R850

Heater-Chain Series Resistor, 750Ω 2N. A2/1. Varite Resistor, VA1008, (Mullard) (In Parallel).

|                |               |
|----------------|---------------|
| VR1, 25kΩ CB   | VR6, 100kΩ CB |
| VR2, 2.5kΩ CA  | VR7, 100kΩ CB |
| VR3, 100kΩ CB  | VR8, 100kΩ CB |
| VR4, 500kΩ CJS | VR9, 100kΩ CB |
| VR5, 2MΩ CB    |               |

Resistors across deflection coils supplied by maker.

## Second National Handicraft and Hobbies Exhibition

The inaugural Handicrafts and Hobbies Exhibition in 1952 at Central Hall, Westminster, conceived primarily for a vast public interested in seeing and purchasing British handicraft materials, attracted nearly 50,000 visitors from all parts of the country. With preliminary arrangements well in hand, it is confidently anticipated that at least double the number of visitors will flock to Central Hall during September 17th to 30th. Admission price is one shilling.

A wide and varied range of interests is catered for by 125 Exhibitors covering:—Marquetry; Modelling; Artificial Jewellery; Weaving and Spinning; Woodwork and Carpentry; Basketry; Book-binding; Leatherwork; Toy-making; Embroidery; Knitting; Home-decorating; Wireless; Television; Stamp-collecting; Gardening; Preserve-making; Sweet-making; Pottery-throwing; Glass-blowing; Model Railways and Model Ships.

## STOP PRESS—Test Card "C"

We have now received the text of Sir Ian Jacob's reply to Mr. Charles Ian Orr Ewing, M.P.

This gives the information that the approach of the British Radio Equipment Manufacturers' Association for extended radiation of the Tuning Signals was made jointly with The Radio and Television Retailers' Association Ltd.

At the discussion, the B.B.C. suggested that it would be more convenient for everyone concerned if, instead of extending the duration of the clock tuning signal, this was to be preceded by a ten-

minute period of Test Card "C" accompanied by a tone signal. This was agreed.

The necessary apparatus has now been delivered and installed, and is in operation. In future, it is the B.B.C.'s intention to precede every period of programme transmission by about a quarter-of-an-hour of "lining-up" signals. These will normally consist of the trade Test Card and tone for ten minutes, followed by four minutes of the Clock caption and music.

In addition the B.B.C. will fill the gap (normally about 45 minutes) between the end of the afternoon transmissions and the start of Children's Television by radiating Test Card "C" and tone.

## Radio Miscellany

Old Timers of the crystal set era will remember Wood's metal (50% Bismuth, 25% Lead and 12½% each of Tin and Cadmium). In 1923-26 it was widely used for mounting crystals in their brass cups as its melting point (66 to 70 degrees Centigrade) was unlikely to damage the crystal. In those days one could buy it at practically every wireless shop, although in recent years even the best radio suppliers have not stocked it. It had a minor burst of popularity in post-war years for use in thermal fuses but as far as I could discover it was still only obtainable from suppliers of laboratory materials etc., or from the Old Timers' junk boxes. By decreasing the amount of cadmium to 11% and bringing the tin up to 14%, an alloy with a melting temperature as low as 50°C. is obtainable, and this can be brought still lower by the addition of mercury.

Those who have been lucky enough to have a little low temperature solder in hand, have been sparing in their use of it. Not because it was expensive but because it was such a nuisance to replenish one's stock. It is therefore of great interest to see that Multicore are marketing a handy pack in the form of a card on which is wound approximately a 5 feet ribbon of "melt with a match" solder containing its own non-corrosive flux.

It retails at a shilling. It will be most useful on a Field Day or when joining aerial wires on a roof when you cannot take a soldering iron. Spliced wires are best joined by binding the solder-tape around the joint and heating with a naked flame.

It can, of course, be equally well used in the workshop with a warmish iron, and is especially suitable for fine wiring and delicate components which are always liable to injury if the heat from a high temperature iron is applied to them too long. A sample recently tested gave strong and electrically sound joints, with the ease the makers claim for it. On behalf of constructors I particularly welcome this re-appearance of a readily obtainable low temperature solder, and the thermal fuse experimenter will find it is just what the doctor ordered. The tape can easily be cut into wire-like strips and if necessary, beaten out to a

fine gauge. Such safety fuses often take the form of two strips of springy brass, the tips of which are held together by a film of low temperature solder. Upon overload the solder melts and the circuit is broken as the contacts spring apart. It will be found in practice that the contacts break apart before the melting point is reached. All fusible metals go "pasty" before the melting point is reached, and thus weaken the circuit-breaking contact.

### Aluminium and All That

Talking of solder reminds me that I am often asked about the soldering of aluminium, either by heat or paste.

The latter can be dismissed quite simply. Certainly none of the soldering pastes I have heard of are any good at all for electrical connections, and none of those I have tried have any mechanical strength worth mentioning. They are useful, however, for stopping small holes and odd jobs of that nature.

Of other methods there have been recent developments in the ultrasonic soldering of aluminium and its alloys which are claimed to work very satisfactorily. It is apparently done by applying sound vibrations at some 20,000 c/s when a firm job is said to result. I have not seen any specimens of the work nor any exact details of what happens. Maybe the oxidised surface film is broken down, or alternatively the solder might grip on minute irregularities in the metal rather than provide a true fusion.

While the uses of the ultrasonic system is claimed to be becoming more widely recognised industrially any form of aluminium soldering iron for home use still appears to be a long way off. Nevertheless it's a pleasing thought that one day we shall be running a seam along a couple of sheets of ali with a vibratory soldering gun!

### Odds and Ends

Following my comments of a couple of months ago, I have been surprised at the number of readers who have written to say they would prefer to have stereoscopic rather than colour TV. Unless some new optical system is developed I cannot imagine that stereoscopic TV will have much attraction

for more than a few. At present it would need a couple of extra pockets in the TV cabinet—one to hold the tinted spectacles and the other for the packets of head-ache powders!

A recent development has been the deaf aid adaptor which enables the user to listen to broadcast programmes at will. It is but a step to the built-in radio unit which will form a combined portable and deaf-aid.

It starts one wondering what the license position will be. At present a fixed address license covers the occasional use elsewhere of a portable set. It could well be argued that any use of a deaf-aid as a radio receiver must necessarily be occasional—on the occasions when it is not being used as a deaf-aid!

The recent press prominence given to the radio taxi dispute brings home how extensive the use of radio has become in the taxi and car hire business. No doubt most readers have heard of instances of instructions being radioed to a driver who, on arriving at the address given, finds that a rival firm have nipped in and already picked up the passenger. No doubt some of these cases are the result of genuine mistakes but many have a flavour of a new line of "piracy."

Perhaps some enterprising firm will introduce scrambled speech to confound would-be hi-jackers!

## Centre Tap talks WOOD'S METAL ~ about ~THIS AND THAT

### Sun Spotting

The next sun-spot cycle is being suggested as a subject for amateur mass observation on a world wide scale. We have certainly to learn much of the effects of sun-spots on radio communications but such an effort would probably serve better as a full-dress rehearsal for other forms of observation, rather than learning much more of their nature. We already know much of their effects, but some of the tricks they have been reported as playing (such as tripping relays etc.), are quite unaccountable. It is not the effect of the phenonema but the causes which remain such a mystery.

There is, of course, much still to be learned of the sun itself. When one first seriously ponders on its nature, a realisation that former vague and school-boyish ideas of it being a fiery mass some 92,000,000 miles away which, although it has passed the prime of its lum-

inosity is likely to go on without noticeable loss of intensity for tens of thousands of years more, is somewhat naive. Even its minor aspects require a life-time's study and of its composition we can only hazard guesses.

Made of the best coal it would give barely a millionth part of the energy emitted and would finish up as a cinder in less than six thousand years. Yet a study of fossil remains clearly indicate there has been no appreciable fall in its radiated energy over thousands of years.

Its nature must remain completely unknown to us until we have learned a lot more about the radio-active elements. If the sun was composed of solid uranium it would generate only a third of the energy it emits!

As the maximum effect of sun-spots occurs between 4 to 6 metres (sometimes reaching nearly 100,000 times greater level than the normal receiver noise) it is likely that there will be considerable disturbance of British TV reception. Perhaps that way we shall get as much mass observation, or rather the lack of it, that we want! The most probable effects will be high noise level and complete fade-outs. Even then people will probably blame their receivers!

It is surprising how many viewers look for faults in their sets when the trouble is at the transmitting end. There must inevitably be camera faults etc., and I often wonder how many viewers at the first sign of trouble leap up and tinker with the controls. Oddly

enough the B.B.C. don't seem to think it necessary to tell viewers that the trouble was their end until any old time up to a couple of hours later.

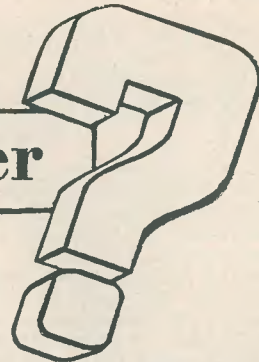
### Puzzle Corner

I suppose a good number of readers keep a Scrap Book of sorts. I have had one for a good many years which I irregularly keep. It contains numerous circuits, details of unusual and continental valves, component literature, formulae for quick drying paints, polarity testing and home-made wax polishes, etc. When it gets too voluminous one has to wade through and turn out all the out-of-date gen. It was in the process of "stripping" mine some months back that I came across the entry "No. 3 size."

This entry was obviously made years ago; as far as I could judge somewhere about 1939. For months I was puzzled as to what it  
(continued on page 647)

## Query Corner

A Radio Constructor service  
for Readers



### Frame Non-Linearity

I have built a television receiver according to the information given in your booklet entitled *Inexpensive Television*. The result was very good and I have but one criticism: the linearity of the frame timebase is poor, the picture being badly cramped at the bottom. Most of the components associated with the frame timebase have been changed without producing any reasonable degree of improvement. Have you any suggestions?

K. Knowles, Harrow

Many hundreds, or possibly several thousands, of these televisions have been made to date, and in the main the results appear to be most satisfactory. However, from time to time a complaint of poor frame linearity is received, a fault which has defied all the corrective efforts of the constructor. In some cases the root of the trouble can be traced to insufficient HT supply voltage to the timebase unit. If scan distortions are to be avoided a voltage of at least 450V is required and best results are usually obtained with a supply of between 500 and 600V. It will be appreciated that the higher the EHT voltage applied to the cathode ray tube the lower will be its deflection sensitivity and the greater will be the output required from the timebases. Sometimes, the poor linearity can be attributed to a faulty valve or leaky capacitor, and such points can be readily checked by making substitutions.

However, in stubborn cases it is probably better to use a slightly different frame amplifier circuit, and the one about to be described can be recommended to all those who wish to obtain a near perfect vertical scan. The arrangement differs from the original largely in the method of phase splitting, and it has the advantage that a linearity control is provided. The output from the transistor used as a frame oscillator is a negative going sawtooth, and this waveform is applied to the

grid of the first half of the double triode. The anode of this valve carries a positive going sawtooth, a fraction of which is fed to the grid of the second half of the valve. Consequently, the anode of this section carries a negative going voltage which is substantially equal in amplitude but opposite in phase to that on the first anode. The degree of equality of these two voltages is dependent upon the values of the two arms of the dividing network between the two anodes. In certain cases, some improvement may be obtained by adjusting the balance by varying R1. The linearising circuit consists simply of an adjustable R-C combination across the anode of the first valve. This has the effect of correcting for any distortion which may be introduced by the curvature of the valve characteristic.

### Extending CR Tube life

I have read with interest articles on the subject of rejuvenating television tubes, as the tube in my receiver is now giving a very dim picture. Would you recommend that I have the tube reactivated in an effort to prolong its life?

D. Sayers, London

An appreciable extension in the life of a television tube can be obtained when the only fault which the tube has developed is low cathode emission. This increase in life can be obtained in one of two ways, by a process known as cathode reactivation or by simply raising the heater voltage of the tube. In many ways the results of the two techniques are the same in that they bring to the working surface of the cathode more electron emissive material. However, to avoid waste of time and money it is necessary to be able to recognise a tube which will respond to treatment. The visible symptoms of poor cathode emission are a dim picture which lacks any highlights and has a tendency for the flyback lines to appear on the picture when the controls are set for

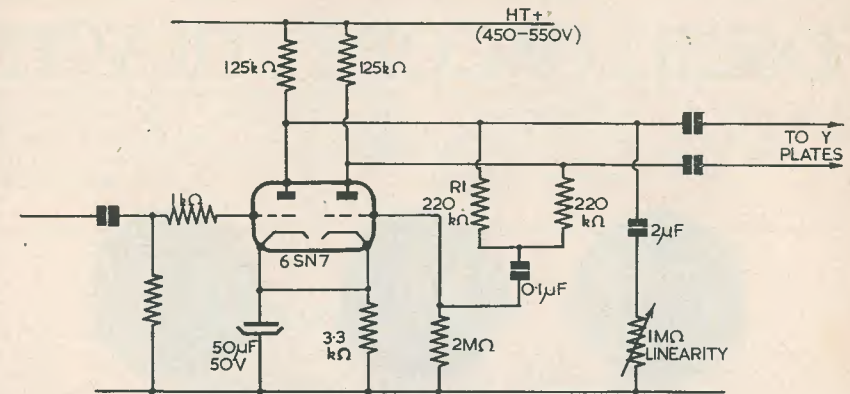


FIG. 1

IMPROVED FRAME TIMEBASE AMPLIFIER-UNMARKED  
COMPONENT VALUES REMAIN UNCHANGED

RC 251

the best results. Now, providing the tube has no other faults in the form of poor inter-electrode insulation, a damaged screen or impaired vacuum, rejuvenation can be attempted. A tube which has a poor vacuum is recognised by poor focus, and there is little to be gained by any effort to extend its life.

Having decided whether it is worthwhile to attempt to improve the cathode emission, the choice lies between reactivating it or merely increasing its heater voltage. Of the two methods, the writer favours the latter as it appears to provide the most consistent improvement on tests made on a number of tubes. It is important that the heater voltage is not increased by more than is necessary and if it is done progressively in steps the maximum life can be coaxed from the tube. Increases of 12%, 25% and 33% have been found to give the best all round results, and the only problem which remains is to decide how to obtain the additional voltage. Perhaps the most convenient method is to add a few more turns around the core of the mains transformer. Most of the larger transformers are wound to 4 or 5 turns per volt so that to obtain, for example, another half volt, two turns must be added. The extra turns are joined in series with the existing tube heater supply source, but care is necessary to connect the two voltages in the correct phase. If the additional winding is connected in antiphase then the resulting heater voltage will be reduced. Having connected up the windings, the voltage should be checked with an accurate AC voltmeter. A simple check to determine how many turns per volt are used on the mains transformer can be made by adding a

test winding of, say, 4 turns and then measuring the voltage across it.

If space does not permit the addition of a winding as discussed above, the increased heater voltage must be derived from a separate transformer. This is not usually an expensive proposition, and quite often a good quality 3 or 4 watt output transformer can be pressed into service. The primary is connected to the mains and the voltage measured across the secondary. The secondary is then unwound and the number of turns noted. This indicates the turns required when rewinding to provide the tube heater voltage. Whilst doing this job it is worth while adding the extra tapping points to provide the percentage increases already quoted. This will enable further periods of extended life to be obtained after the first increase has become ineffective.

Normally there is little danger of damaging the tube heater by small voltage increases, but in time the heater-to-cathode insulation may break down. Anyway, it may be possible to extend the tube life by a year or more, but if only a few extra months are obtained the effort will have been worth while.

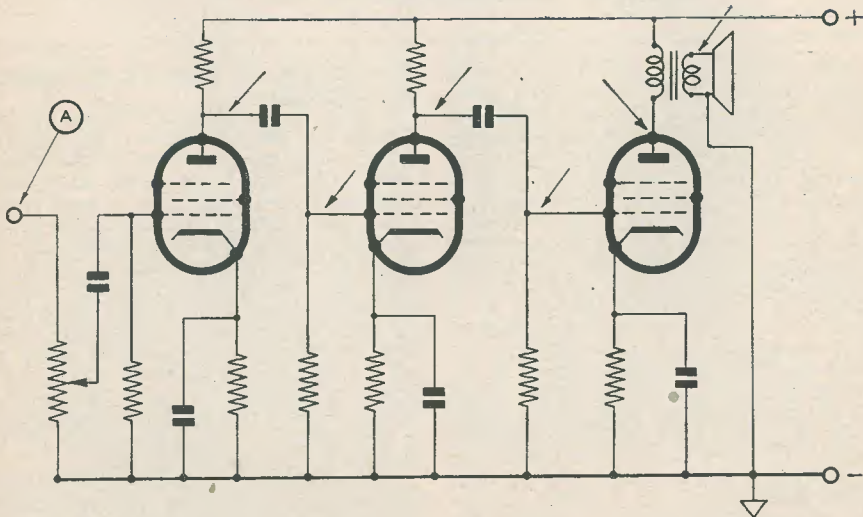
### Radio Miscellany — (Continued from page 645)

referred to, and why it was there, until finally I gave it up as one of the unsolved mysteries.

Last week I found out what it was, or to be more strictly correct, re-discovered it. It is the basis of an extremely useful hint and I wonder how many readers know what it is. The answer will appear in this column next month and in the meantime here is a clue. *Its uses extend beyond the universal*. That should make it easy.

# OSCILLOSCOPE TRACES

by A.B.



BASIC AF AMPLIFIER SHOWING OSCILLOSCOPE TEST POINTS

RC245

## No. 2. The oscilloscope as a means of checking distortion in AF amplifiers.

A reasonably pure sine wave input voltage is essential for this particular method, which is one of several systems used. If an audio signal generator is not to hand, the heater winding of a mains transformer could be used. A potentiometer should be connected across the heater winding in order that the voltage to the amplifier can be varied.

A waveform as shown in A is quite suitable but, due to its small amplitude, it would have to be applied to the CRT plates via the oscilloscope amplifier. Care must be taken to ensure that the oscilloscope amplifier does not distort this waveform, by keeping the gain as low as possible, consistent with a comfortable size picture on the screen.

The signal voltage at the anode of a stage should be an enlarged version of A, if no distortion is present. B, however, shows the effect of incorrect biasing or slight overloading. If this occurs the input voltage to the stage should be reduced. Really severe overloading is shown in C, where considerable grid rectification is taking place.

The technique with multi-stage amplifiers is to work through the circuit from stage to stage until a noticeable departure from the input waveform is observed.

When carrying out these checks the leads from the test point to the oscilloscope should be kept as short as possible, otherwise the amplifier may oscillate.

# Transistors—The Crystal Comes Back Again

By T. W. Dresser

In the course of the last four or five years there have appeared in the technical press references to a mysterious device called a Transistor, which, if the claims made for it are substantiated, may very well spell the doom of the valve for many purposes ultimately; as far as receiver and low power uses are concerned, anyway. That the claims made are far from wild ones can be judged from the fact that, recently, a television receiver was exhibited in New York which used nothing but Transistors throughout; not one single valve other than the picture tube was employed! At the same time a finger ring radio, using two transistors, was shown, which was no greater in size than an ordinary signet ring. This question of size, quite apart from their other advantages, is of immense importance today when miniaturisation, particularly for aircraft and military purposes, is becoming an essential thing, and the fact that twenty or more transistors take up no more space than one valve is a big factor in their development.

Coming down to basic facts, the transistor is simply a Germanium crystal used as a valve, though with certain important differences due to their differing characteristics. Just as a triode valve has three electrodes, so also has a transistor, but whereas in the valve free electrons *in vacuo* are utilised for the operation, the transfer of electrons in the transistor is based upon a totally different conception, which is not particularly easy to follow.

The block schematics of a contact type and a junction transistor are given in Fig. 1, the three elements in the first named corresponding to the cathode, grid and anode of a triode

valve and functioning in much the same way, though not necessarily with the same results as, for reasons which will be explained later, transistors require circuits designed specifically to suit their own characteristics. Nevertheless, transistors can be used successfully in multi-vibrators, amplifiers for RF and LF work, oscillator circuits and in many other places where valves would normally be used. An instance of transistor technique is given in Fig. 2, which is the diagram of a small LF amplifier using a standard contact type transistor and which can be built into a case measuring 2" x 1.5" x 1.5". The amplifier has a response curve sensibly flat from 20 cycles to 20,000 and a voltage gain of 50 when working into the correct output impedance. The maximum input voltage of such an amplifier is 0.1 RMS, and the maximum permissible output slightly less than 5 volts RMS, and the instrument functions from a 30 volt deaf-aid battery with a total current drain of 2 mA. Output noise level, with no input signal and the input terminals open, is 0.015 volts RMS, or approximately 50 db below the maximum signal output. It will be readily seen that this circuit is not so very different to that of a single triode valve LF amplifier if the base is regarded as the cathode, the emitter as the grid and the collector as the anode, and many experimenters have used transistors successfully in modified valve circuits.

At the moment there are two types of transistors available, the contact and the junction or N-P-N types. The former is merely a thin slice of Germanium, cut from a single crystal, and having two catwhisker

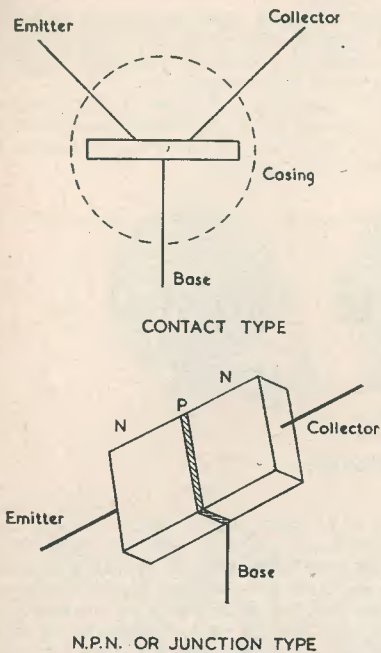


FIG. 1

RC.243.

wires in close proximity in contact with its surface, the whole being enclosed in the form of a small bead. The crystal is mounted on a base of a non-rectifying character. One such unit will have a gain of approximately 20 db, a life of about seventy thousand hours, and will function well from a low voltage source of power with a consumption of one or two mA. The junction type, a later development, is a much improved version, consisting of two sections of normal Germanium, as used in the contact type, with a small piece of P Germanium inserted between them. Stated briefly, the P Germanium is deficient in elect-

rons (although it is not a positron) and therefore electrons from the emitter rush to make up the deficiency, and so, compared with the contact type, there is a considerably greater electron flow and consequently a much greater gain, of 50 db or so. The characteristics of this type are very stable and the life, as far as has been ascertained at present, verges on infinity.

In Fig. 3 the schematics of three oscillator circuits are shown, principally to indicate the flexibility of many transistor arrangements. In 3a the quartz crystal is connected in the base circuit, in 3b in the collector branch and in 3c in the emitter arm. All will function equally well and are the subject of patents granted the Radio Corporation of America. These and many other circuits have already been proved, but that there is much still to learn about transistors is evident from a recent issue of the Bell System Technical Journal, which points out that to secure optimum performance from the device it should be treated as a "dual." Circuits are duals when voltage in one behaves like current in the other, and as transistors and valves are duals in this respect it leads to considerable complication if the maximum performance is required. For instance, what would be a parallel tuned circuit for a valve must become series tuned for a transistor and where an inductance may be called for in a valve circuit a resistor would serve the same purpose in a transistor arrangement, and so on. In time, however, these circuits, like those of valves, will become standardised and familiar and no longer something to puzzle over. By that time, too, no doubt the price will be sufficiently low to put them into everybody's hands. Those the writer obtained from the U.S.A. some days ago cost almost as much as a midget receiver!

What is the future of transistors? That is difficult to forecast. Undoubtedly they will replace valves for many purposes; their minute size, tremendously long life and small power requirements make them ideal for such uses as built-in cable amplifiers, aircraft radio and radar and in many other places where reliability, weight and size count heavily. It is equally certain they will find a number of applications in television receivers and in communications equipment. On the whole it would be foolhardy to say where their usefulness will end as new methods, new uses and new circuits are coming from the laboratories each day, and it may well be that a revolutionary turn which would enable them to be used for any purpose where valves are now used, even including transmission, may be announced.

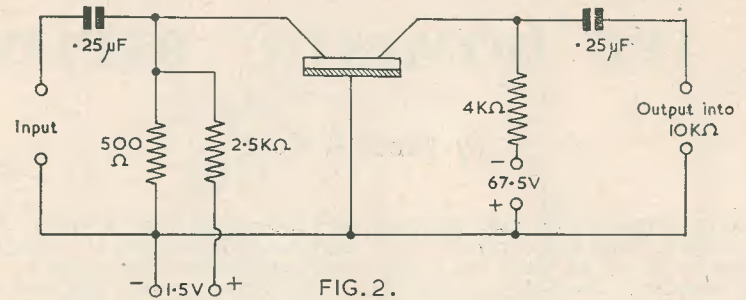


FIG. 2.

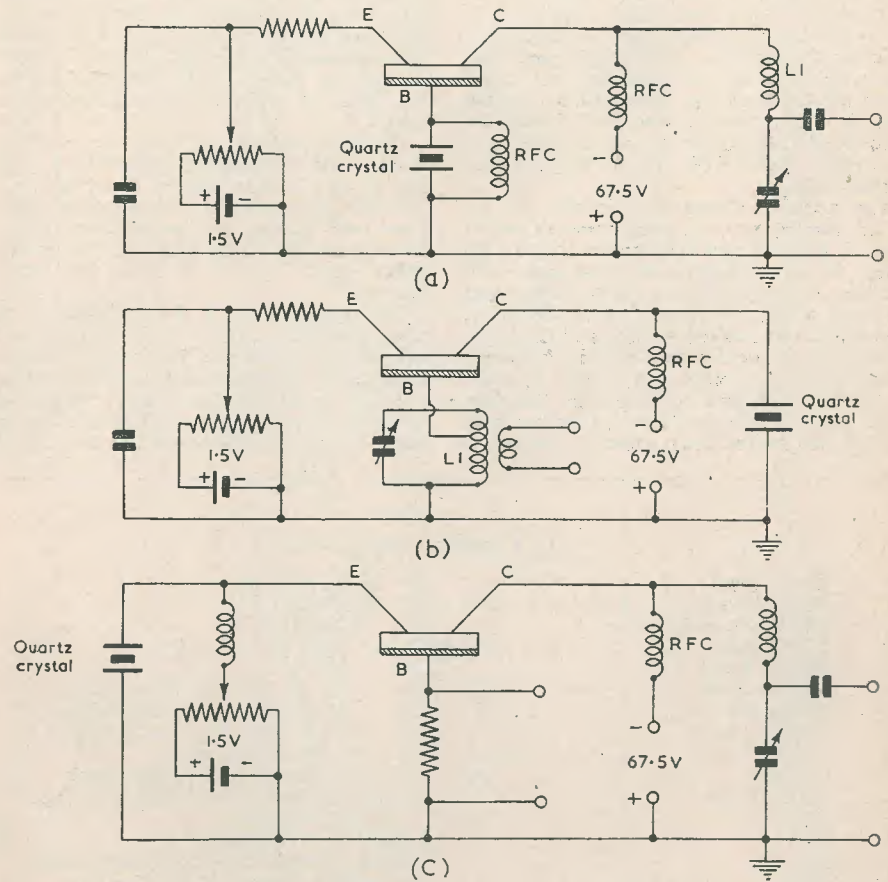


FIG. 3.

RC.244.

### Radio Amateur—July

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- Simple Top Band Transmitter—More 1155 Modifications—Amateur Radio in Portugal—Simple Dual Range Ohmmeter—Aerial Patterns, Folded Quarter Waves—(continued)—Strictly for the Beginner—Doublers and Buffers—Amateur, Broadcast and VHF Commentaries—S.W.B.C. Station Lift—Club News, etc.





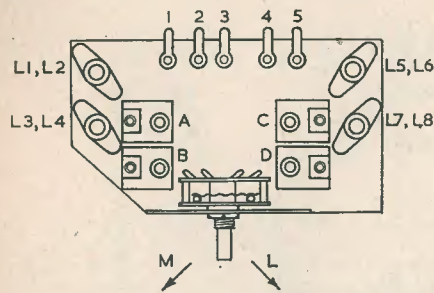


FIG. 2.

RC.250

Layout and tag connections of the Osmor TRF Quality Coilpack

correction be needed in the reader's model, it may be advantageous to insert a  $0.002\mu\text{F}$  or higher value condenser in parallel across the speaker transformer primary. Trial and error will provide the answer here. The only controls on the original model were—Audio Gain/Reaction, Tuning and Wavechange.

The power pack is entirely conventional,

the point most worthy of mention being the mains transformer itself. This was an Ellison, Type MT 162, which is available from Solidas, Ltd., who advertise in this magazine. This transformer was found to be ideal for this receiver, small and compact, totally enclosed and delivering adequate voltage. It works very well with the small 5Y3 rectifier—and the whole pack occupies very little space indeed.

Various voltage points as measured with an AVO Model 40 meter are given in the circuit diagram. The voltages were read with the controls set at minimum, under no signal conditions, and were taken with the meter set on the 480 volt range. Cathode voltages were measured on range 12 of the meter.

The receiver when completed gave a very good account of itself and the results were most pleasing. Constructed on a chassis measuring some  $10'' \times 5'' \times 2\frac{1}{4}''$ , it fitted neatly into a small wooden cabinet purchased for a few shillings from a local dealer. Performance was excellent, selectivity and gain being of a high order, which was no doubt largely due to the efficiency of the coil pack. The writer would like to place on record the help and assistance of Osmor Radio Products, Ltd, of Borough Hill, Croydon, Surrey.

## A Tuning Meter

By C. B. Raithby, G8GI

The circuit of Fig. 1 shows a useful tuning meter system that has several advantages. Firstly, the meter reads forwards with signal increase without the need for a complicated network; secondly, it gives high quality from the detector and it only requires an ordinary 0-1mA meter.

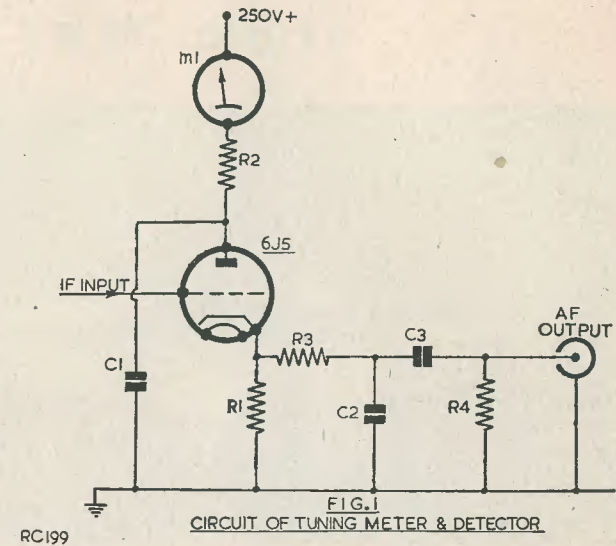
The meter M1 is in the anode circuit of a 6J5 valve used as an infinite impedance detector. The condenser C1 is limited to  $0.1\mu\text{F}$ , as the charging current of anything larger might have a disastrous effect on the meter.

Fig. 2 shows a block diagram of the receiver in which the circuit is used. It is a superhet with one RF stage and three IF stages at 1.6 Mc/s. Like all infinite impedance detectors, a fairly large input is needed for good quality, and is particularly required in this circuit to obtain good meter deflection. Two IF stages at 465 kc/s would, no doubt, be entirely satisfactory.

From Fig. 2 it can be seen that AVC voltage is applied to the RF, FC and first two IF valves, but not to the last IF stage which

### List of Components for Fig. 1

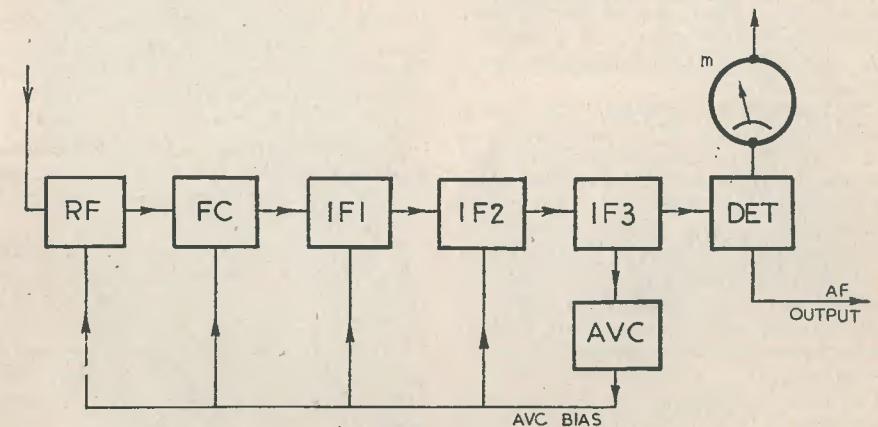
- C1  $0.1\mu\text{F}$
- C2  $150\text{pF}$
- C3  $0.1\mu\text{F}$
- M1 0-1mA
- R1  $56\text{k}\Omega \frac{1}{2}\text{W}$
- R2  $33\text{k}\Omega \frac{1}{2}\text{W}$
- R3  $22\text{k}\Omega \frac{1}{2}\text{W}$
- R4  $5 \text{Meg}\Omega \frac{1}{2}\text{W}$



has fixed bias. The AVC voltage is obtained from the anode of the third IF valve via a separate diode valve.

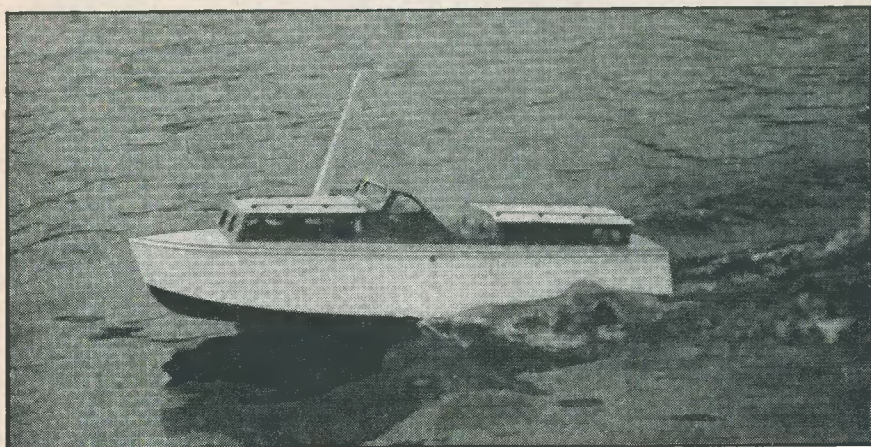
With this receiver, using a small outside aerial, Droitwich gives a reading of 1mA, North Regional 0.9mA and 3.5 Mc/s amateurs up to 0.8 mA depending upon conditions.

The meter can, of course, be used as an "S" meter. Unlike many circuits it is not dependent upon AVC action. This means that, provided a suitable RF and/or IF gain control is fitted to avoid overloading, the meter will still operate with AVC off and actually show carrier strength variations.

FIG. 2  
BLOCK DIAGRAM OF THE RECEIVER

RC200

## Trade News



Those readers who are following the series of articles on Radio Control Equipment will be interested in the smart craft shown in the illustration. The "Wavemaster" Model Cabin Cruiser, as it is called, is particularly suited to the radio enthusiast, who as a general rule is not skilled in the art of model making, for it is supplied as a complete kit of ready shaped parts which need only trimming and fitting together. The only tools and materials required for its construction are a hammer, knife, small file, glasspaper and glue—nails are provided in the kit.

The boat itself is of substantial size, having a length of 34", beam of 11", and a freeboard of 4". This provides ample room for power plant and radio control gear, without being too large for easy transport. The makers recommend an internal combustion engine of from 3.5 to 8 cc, but there is no reason why an electric motor could not be substituted, speed thereby being sacrificed in favour of more complete control, e.g., two forward speeds, reverse and stop positions being quite easily arranged.

The kit is manufactured by Hammersmith Model Makers Ltd., 92 Holland Park Avenue, London, and is supplied with full-size plans and easy-to-follow instructions. The retail price is £3 9s 0d.

Further information and advice on suitable power plants and radio control equipment for the "Wavemaster," and also about the kit itself, is available on request from Mr. J. Carter, 101 High Street, Harlesden, London, N.W.10., who kindly sent us the above information.

Allen Components Ltd., Lower Richmond Road, Richmond, Surrey. This firm has submitted to us for test with the "Magna-View" samples of their new Castellated Yokes which employ Mullard Ferro-cube foundations.

These represent probably the most advanced method of securing rectilinear scanning without the so often attendant de-focusing at the picture edges.

Formed geometrically around the Ferro-cube formers, the windings are placed into slots moulded in them and so accurately produce a correctly shaped picture.

This firm must have spent considerable research on these coils to have overcome the often present drawbacks with castellated yokes, that is excessive frame scan, restricted line output, with oscillation effects present on the left-hand side. The coils we had behaved perfectly on test.

## Trade News—continued

Mullard Ltd. HAVE VERY KINDLY CONSENTED TO EXHIBIT ON THEIR STAND AT THE FORTHCOMING NATIONAL RADIO SHOW A COMPLETE CHASSIS OF THE "UNIVERSAL" LARGE SCREEN AC/DC TELEVISOR NOW CURRENTLY BEING DESCRIBED IN THIS MAGAZINE. READERS WHO ARE INTENDING TO VISIT THIS EXHIBITION SHOULD CERTAINLY MAKE A POINT OF SEEING THIS EXCELLENT RECEIVER.

The General Electric Co. Ltd., announce a new low noise voltage amplifying pentode in the Osram Z729. This is a low microphony, low hum, voltage amplifying pentode of all-glass construction on a B9A (Noval) base. A stage gain of the order of 180 is obtainable.

Also released is the 305 barretter, which is a hydrogen-filled current regulator designed primarily for the protection of series-connected television receiver heater circuits using 0.3A valves. This barretter ensures that the current is maintained within 5% of its nominal value of 0.3A for a voltage drop across the barretter

of 40-90 volts. The tapped resistor for the HT circuit will normally still be required.

Stop Press. See advertisement in this issue Radio Servicing Company, address is now 82 South Ealing Road, London W5.

**Metal Rectifiers.** 250V 60mA H/W 6/6; 250V 250mA H/W 12/6; 12-24V 3A H/W 4/6; 12/24V 3A F/W 12/-; 12-24V 4A F/W 14/-.

**Polystyrene B7G Holder** with Can, set of 4, 6/-.

**Earphones.** 4000Ω 12/6 per pair.

**IT4, IR5, IS5, 3S4,** set of 4, 32/-.

**Linecord.** .3A. 3-way 60-70Ω p. foot, 1/9 per yard.

**Co-Ax Cable.** 70-80Ω per foot, 1/- per yard.

**Radio Cabinet.** Size 12 x 7 x 5 inch in Walnut (wood) or brown (Bakelite) complete with punched chassis, Dial (Med. and Longwave) backplate, drum drive and pointer, £17/6.

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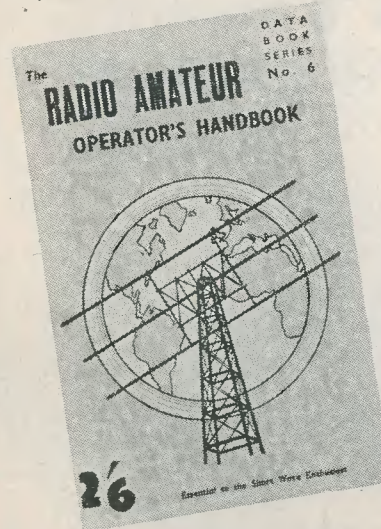
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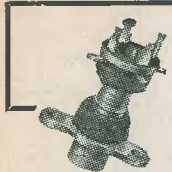
It contains all those details of information which the transmitter and SWL constantly require.

Right up-to-the-minute Amateur Band Prefix lists, both alphabetically and by country, Zone Boundaries, Call Areas, Mileage Tables, QSL Bureaux, "Q" and "Z" Codes, WWV Skeds, and much other information, as well as a selection of maps of DX areas.

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DATA PUBLICATIONS 57 MAIDA VALE LONDON W9

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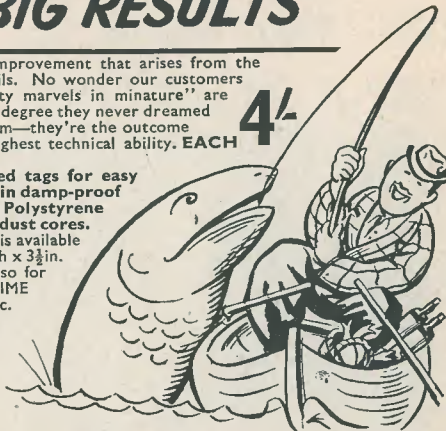
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2/3 each

**ANTENNA ROD SECTIONS**  
Steel, sprayed khaki. Each rod 12in long, 1/4in diam. Any number can be fitted together. 2/6 per doz. 6/- three doz. POST FREE.

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For VCR97. 45/-.

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Strong wood construction, finished in attractive cream covering, with carrying handle and two chrome plated locks fitted. Hinged lid. Internal dimensions: 15in long, 10in wide, 7in high. Soiled condition. LASKY'S PRICE 25/- Carriage 5/- extra.

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With all valves.  
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New aspect ratio.

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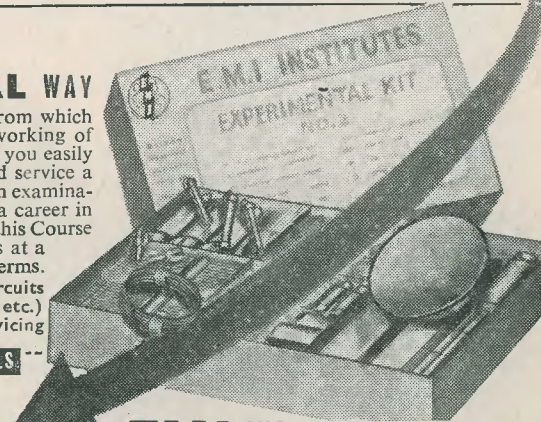
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PREMIER model Tape Recorder for sale complete with Ronette ball-type crystal microphone, spares, record and erase heads, 2 valves and oscillator coil. £25 or near offer. Anersley, 46 Lawrence Avenue, London, E.12.

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ADVANCE Signal Generator Model E2 for sale. New, unused and perfect. Complete with accessories and instructions. Offers above £20. Rice, 68 Vernon Drive, Stanmore, Middx.

TEST Set 73 converted scope £9; R1132 complete 65/-; Atkins Valve Tester £9. Carriage paid. Bryant, 26 West Street, Cromer, Norfolk.

MODIFIED 1355 for Alexandra Palace and RF25 for sale. Good picture. All wave coil pack, new. The lot £2/5. Box No. C129.

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AERIALITE 63A Holme Moss aerial for sale, complete, £4 carriage free. K. Murray, 8 Manor Road, Longbenton, Newcastle-upon-Tyne, 7.

PREMIER Magnetic 9" TV, working, complete, spare set valves, no cabinet, £18. Also over 200 various valves, new and Ex-Govt; Radio and TV components. SAE for details, S.W. London. Box No. C132.

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(continued on page 663)

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Tube in case at £5.12.6 Set.

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

RF24 25/-, RF25 25/-, RF26 59/6, RF27 59/6.

CATHODE RAY TUBES

VCR97. Guaranteed full picture 40/-, carriage 2/-.

VCR517. Guaranteed full picture 40/-, with Mu-Metal 3BP1 Suitable for scopes 25/-, carriage 3/-.

Screen. Mu-Metal Screens 10/-, 6" Enlargers 17/6.

PYE 45 Mc/s STRIP. Type 3583 Units. Size 15"x8"x2".

Complete with 45 mc/s Pye Strip, 12 valves, 10 EF50, EB34 and EA50, volume controls and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5, carriage paid.

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 79/6. Plus 7/6 carriage.

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This Tube replaces the VCR97 and VCR517 without alteration and gives a full Blue and White picture. BRAND NEW in original crates, 45/-, plus 2/- carriage.

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Attractive "Coronation-1953" designs now available from G6MN Castlemount Worksp Notts

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| 1R5  | 7/9 | 6F6g  | 8/6 | 6SA7 | 7/6 | 6V6g  | 8/6 |
| 1S5  | 7/9 | 6F12  | 7/6 | 6SG7 | 6/6 | 6V6gt | 8/6 |
| 1T4  | 7/9 | 6G6   | 5/9 | 6SK7 | 6/9 | 8D3   | 7/6 |
| 1S4  | 7/9 | 6J5g  | 4/6 | 6SN7 | 8/6 | 12AT7 | 7/9 |
| 3S4  | 7/9 | 6K7g  | 4/6 | 6SQ7 | 7/6 | 12AX7 | 5/9 |
| 3V4  | 7/9 | 6K7   | 6/6 | 6X4  | 8/6 | 57    | 6/9 |
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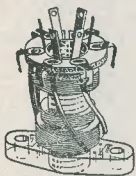
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## SMALL ADVERTISEMENTS

(continued from page 661)

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(continued on page 664)

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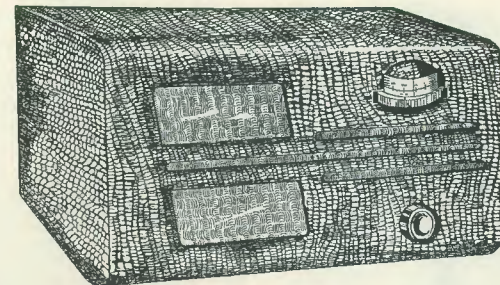
(continued from page 663)

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