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## CONTENTS

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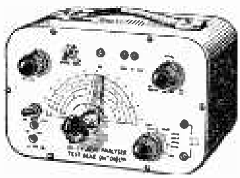

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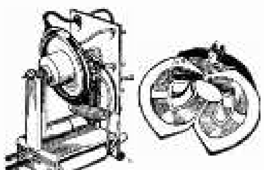

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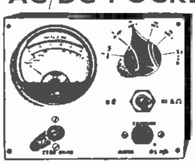

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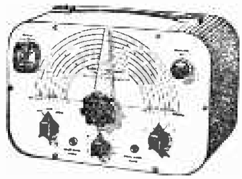

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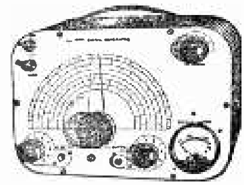

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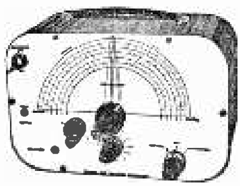

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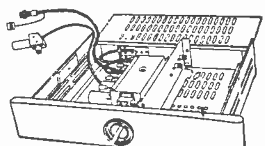

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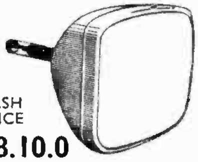

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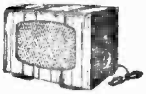

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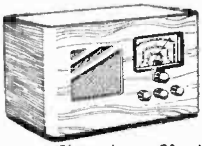

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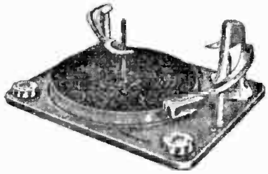

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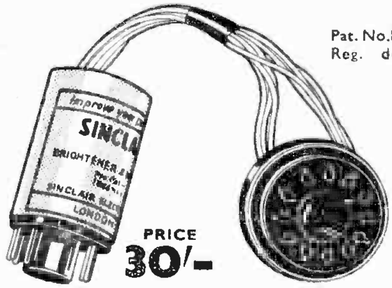

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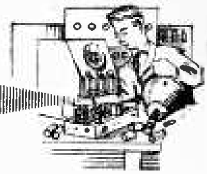
# Practical Television

## & TELEVISION TIMES



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CONTENTS:





# *Fringe Area Reception*

SINCE television began, it has advanced steadily; new techniques have been evolved, new transmitting stations built and the service areas of the existing stations extended. Now nearly all of the British Isles is covered by television and no doubt within the near future the whole country will be able to receive at least one programme. The emphasis now therefore in the development of television as a means of entertainment is being laid upon increased coverage. It is not generally realised that even within the service areas of well-established transmitters there are locations where reception of programmes is difficult or impossible. The difficulties are of course more pronounced on Band III, where signals tend to be limited to a near-optical range, than on Band I. The remedy commonly suggested for improving or obtaining reception is the use of a multi-element aerial, or even two aerials mounted side by side. We receive many letters from readers who have been told that this is the only way to improve reception. The fact is that increasing the number of elements on the aerial may make reception more difficult; as the length of the aerial is increased, so reflection effects tend to become more prominent and, of course, the resulting array is very directional. Thus, the use of a five-element aerial may, depending on circumstances, give better results than the use of a ten-element type. By far the best advice which can be given to viewers living in fringe or "difficult" areas concerns the positioning of the aerial. Moving the aerial, by even a few feet, particularly on Band III can sometimes enable a signal to be received. In general, the aerial should be placed as high as possible, but during initial experiments it may be connected to a length of low-loss coaxial cable and moved around the house (and possibly even the garden) in search of a signal.

Eventually, when a signal is obtained, it may be too weak for perfect operation of the receiver and periodic tearing of the picture may be experienced. The picture, and possibly the sound may be "noisy" and of poor entertainment value. However, it may be possible to improve results by employing a pre-amplifier stage between the aerial and the receiver although if the signal-to-noise ratio is initially below a certain level, there may be no improvement by the addition. In many instances there may be a worthwhile improvement and therefore we have designed a two-band pre-amp which will be featured in our next issue. The unit uses a frame-grid double triode valve in a cascode circuit for low noise and high gain and, in many areas, will prove a valuable addition to existing receivers. The article will include complete constructional details of the pre-amp, together with full alignment data.

*Our next issue, dated June, will be published on May 20th*

# Frame Blocking Oscillator

## A COMPLETE PRACTICAL CIRCUIT

THE part of a receiver which embraces the sync separator and the frame timebase is undoubtedly of most interest to the constructor. The line section is rather too complicated, in view of the inclusion of the line output transformer.

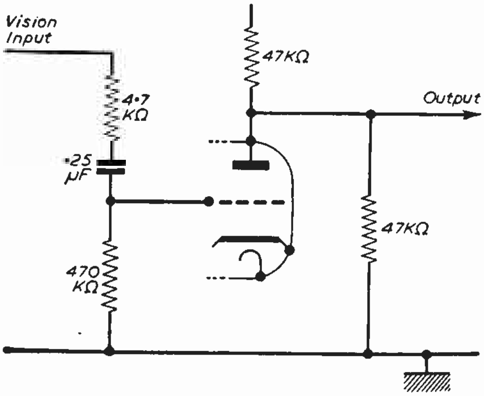



**Fig. 1.—A triode sync separator.**

The conventional sync separator is the saturated pentode, but it is possible to make use of a triode, which may be a separate valve, or one section of a triode-pentode, the other portion of which may be used as the frame output stage or the sound output stage. A circuit recommended by Mullard, and described in one of their Technical Communications publications is shown in Fig. 1 and this may be fed into flywheel synchronising circuits and timebases in the ordinary way.

Many experimenters prefer the multivibrator type of oscillator for their timebases, and whilst these do function fairly easily, they are subject to stray capacity effects, and it is possible to make up two circuits with identical values which will not function in the same manner, simply on account of the layout. On the other hand, the blocking oscillator is practically foolproof, provided that a suitable transformer is employed. This is the only difficulty and care should be taken to use a transformer which is designed for the type of blocking oscillator which is employed. The following description of a frame blocking oscillator is based on information contained in Volume 5, Number 42 of Mullard Technical Communications.

### *The Blocking Oscillator*

A conventional blocking oscillator for use as a frame sawtooth generator is shown in Fig. 2. The important features of this type of circuit are:

(1) A transformer is required.

(2) When the oscillator triggers, a large amplitude pulse is produced, across the transformer, which might, in many cases complicate the design of the synchronising circuit.

(3) The peak current required from the valve when the oscillator triggers is several times greater than with a cathode-coupled multivibrator. A typical value of peak cathode current is between 100 and 200mA.

### *Frame Oscillator Requirements*

The function of the frame oscillator valve is to produce a sawtooth waveform of about 30V amplitude across a capacitor. The valve acts as a switch discharging the capacitor to produce the flyback, and is cut off during the scan allowing the capacitor to re-charge through a high resistance towards a high positive potential. The resulting sawtooth must be sufficiently linear to permit the design of a reasonably simple linearising network in conjunction with the frame output stage.

Equalising pulses are not used in the British 405-line television system, therefore the separated frame synchronising pulses may have different durations on odd and even frames. To prevent this difference affecting the oscillator conduction time, a fast oscillator flyback must be used; a typical value being about 200µs.

To obtain a sufficiently linear sawtooth it is necessary that the initial portion only of the exponential increase of potential across the charging capacitor be utilised. This requires a long time constant changing towards a high potential, a typical value for the capacitor being about 0.1µF.

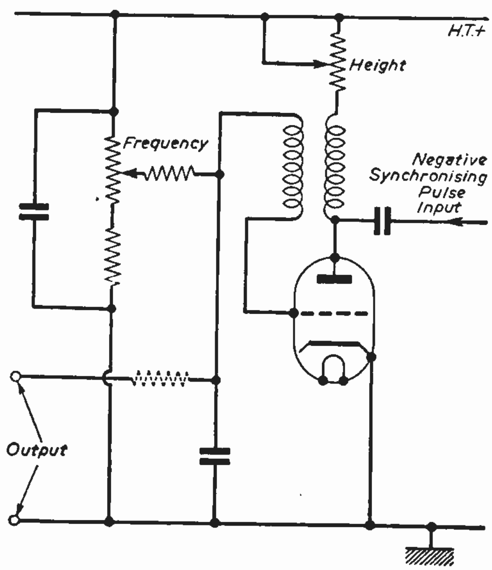



**Fig. 2.—Conventional blocking oscillator.**

### *Design Considerations*

Assuming a value of 0.1µF for the charge capacitor and an oscillator conduction time of 200µs, the peak current required to produce a sawtooth of 30V amplitude is V.C./t, which equals 15mA.

Because the current pulse is not rectangular the peak current in the capacitor will be about twice

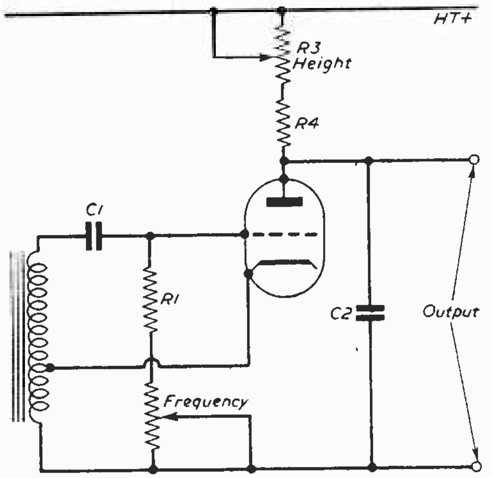



**Fig. 3.—Cathode-coupled blocking oscillator.**

this value. Additional current will be supplied during the flyback period, because a positive-going pulse is produced across the output transformer and fed back to the charge capacitor via the linearising network. The current required from the oscillator is therefore the sum of these currents, and the final value will depend on the feedback circuit, a typical value being about 50mA.

In a blocking oscillator circuit the control grid of the valve is driven very positive (20 to 30V) to achieve this discharge current, and the resulting cathode current (ig+ia) is much higher, because the grid and anode currents are comparable in value.

The output sawtooth waveform may be taken from the anode or the grid circuit. The advantage of utilising the grid circuit waveform is that the grid capacitor is discharged negatively and aims towards a positive potential. The aiming potential is thus effectively increased by the negative excursion which tends to improve the linearity of the waveform.

### *Interaction of Controls*

An important consideration in the design of a frame timebase is the interaction of controls. Adjustment of the linearity controls, for example, changes the shape of the waveform fed back to the oscillator via the linearity network.

It might be expected that the use of the anode waveform would produce less interaction of the controls. In practice, however, the tight coupling between the grid and anode circuits through the transformer prevents any effective buffering action. A circuit technique often used to minimise interaction of controls, is to use a series buffer resistor placed between the oscillator and the output stage (shown dotted in Fig. 2. The amplitude of the drive waveform for such a circuit is much greater (typical value about 80V) due to the attentuation across the buffer resistor arising from the input impedance of the frame output stage. Since the required oscillator output is then much larger the peak valve currents will be correspondingly increased.

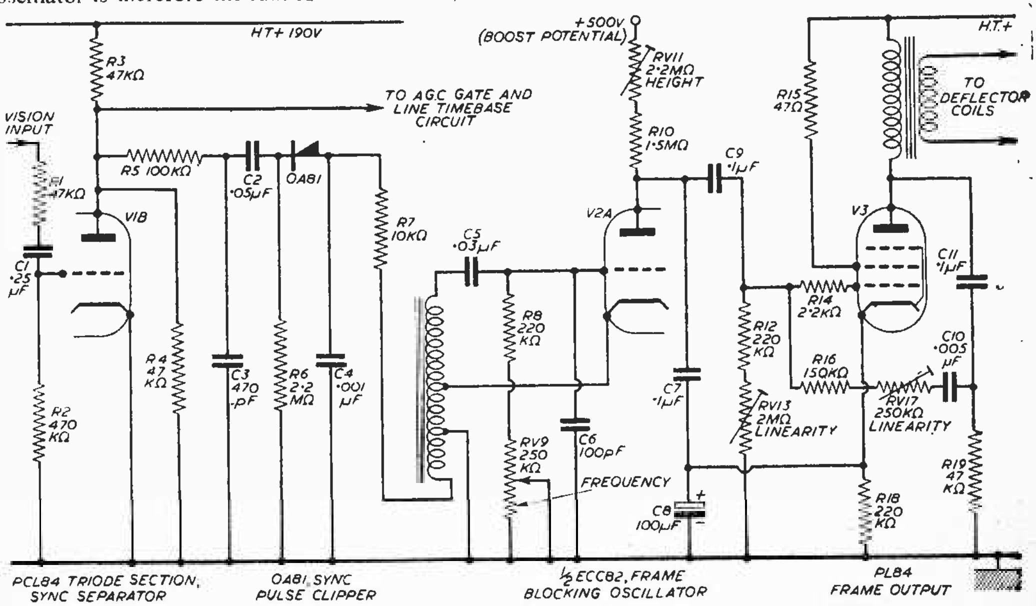



**Fig. 4.—Complete frame timebase.**

A further shortcoming of this circuit technique is the resulting high A.C. impedance at the control grid of the frame output valve and the possibility of hum pick-up.

### *Cathode-Coupled Blocking Oscillator*

As large values of peak cathode current shorten the useful valve life it is advantageous to reduce such currents to a minimum. At the same time the oscillator frequency should be reasonably independent of the other timebase controls. The output, which can be obtained from the free anode of a cathode-coupled blocking oscillator, enables the valve to provide the buffering action without attenuation of the output sawtooth.

The basic circuit of the cathode-coupled blocking oscillator is shown in Fig. 3, the operation being similar to a conventional anode-coupled circuit. The significant difference, apart from the isolation provided by the valve between the output circuit and the frequency determining components R1C1, is that a positive synchronising signal is required because no phase inversion is provided by the transformer. To synchronise the oscillator with a negative-going pulse, a separate winding or overwind must be provided.

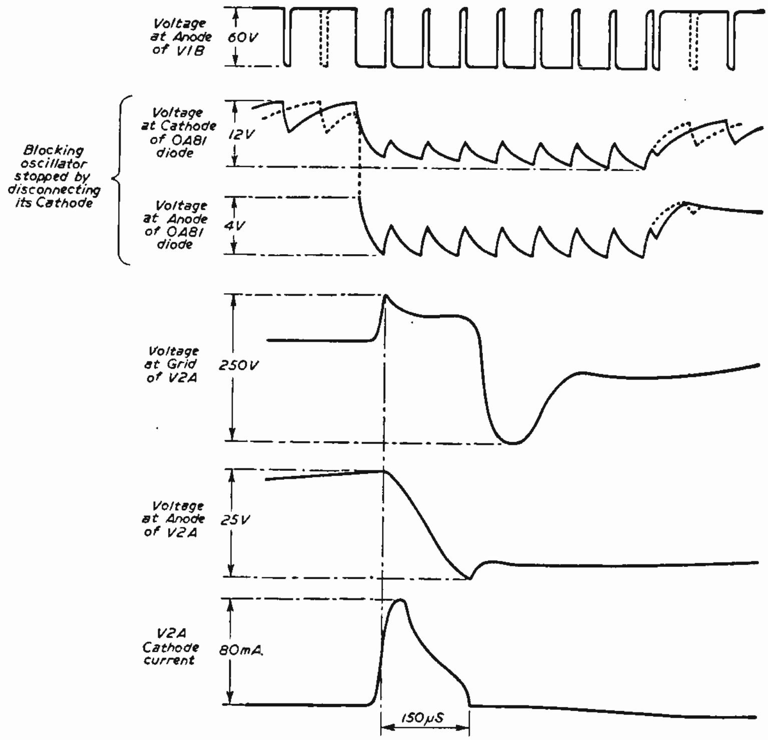



Fig. 5.—Waveforms for Fig. 3.

### *Circuit Description*

A complete frame timebase circuit employing a cathode-coupled blocking oscillator is shown in Fig. 4 and the waveforms occurring in the circuit in Fig. 5. The operation is as follows:

The separated synchronising pulses from the anode of the synchronising pulse separator V1B (½PCL84) are integrated by R5C3. The integrated waveform is A.C. coupled to the self-biased diode (OA81) limiter. The integrated frame pulse causes the diode to conduct and the resulting current pulse, flowing through the transformer, triggers the oscillator. When the oscillator triggers, a pulse, produced across the synchronising winding of the transformer, is fed back to the diode. To reduce the overshoot amplitude, a filter network (R7C4) is interposed between the transformer and the diode.

The oscillator frequency is controlled by variation of the grid time constant (RV9). The output sawtooth, developed across the charge capacitor C7, is taken directly to the grid circuit of a conventional output stage. The boost potential is used as the aiming potential for the charge capacitor to improve the sawtooth linearity since the mean anode potential of the triode is about 100V.

### *Line Timebase Interference*

In an experimental receiver line pulses picked up in the grid circuit tended to cause pairing of the scanning lines. The effect was removed by the addition of capacitor C6.

### *Impulsive Noise*

The stability of the frame synchronisation when the receiver was subjected to severe noise inputs from a controlled noise generator was very satisfactory. Only noise pulses occurring just in front of the frame synchronising pulses can affect the oscillator because at all other times the control grid is well below cutoff and the synchronising input is limited in amplitude.

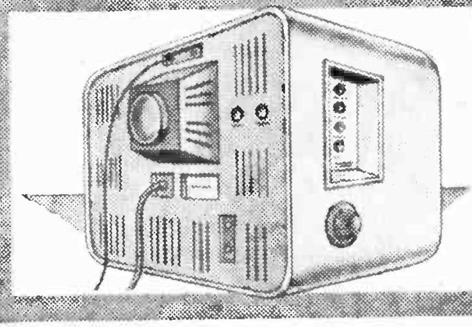
### *Transformer Specification*

*Windings:* 4480 turns (start: grid) tapped at 2500 (cathode) and at 3880 (earth). Finish 4480 (sync).

*Wire:* 40s.w.g. enamelled-copper wire, scramble wound.

*Laminations:* 12 pairs interleaved E and I stampings No. 40, Silcor II as supplied by Magnetic and Electrical Alloys Ltd.

# Servicing Television Receivers



## No. 55—THE PHILIPS 1115U, STELLA ST8314U, etc.

By L. Lawry-Johns

*(Continued from page 346 of the April issue)*

THE previous article dealt with faults in the timebase sections of the above receivers and we now deal with other faults including those in the turret tuners which are fitted to some receivers.

### *Hum Bars*

Sometimes these receivers in common with many others have the symptom of "No picture, screen divided into black and white bars". The symptoms are often reported as lack of height, the raster being visible at the top or bottom half only. In fact, if the brilliance is advanced, the black portion will show up greyish, proving that the height is present and the raster severely shaded. Reversing the mains leads (or two pin plug if fitted) will reverse the area shaded, i.e., the black will now be at the top instead of at the bottom or vice versa. The immediate suspect is the vision detector EB91 (V9) and replacement will nearly always cure the condition. However, there are times when the picture is present but heavily shaded as above. This normally indicates heater-cathode leakage in an EF80 vision circuit valve but other symptoms will almost certainly present themselves since the bias (cathode) resistor or resistors will then be shunting the remainder of the heater chain depending upon the severity of the short and the value of the cathode resistor. For example, if V8 develops a direct heater-cathode short the 180Ω cathode resistor will shunt the heaters of V10, 9, 5 and the CRT. The resistor will overheat and the heaters of the above valves will dim considerably as the effective heater current will be approximately halved. Thus, the picture and sound will fade out, or will not come on at all. In the case of V7, the symptoms will depend upon the setting of the contrast control. With the control towards minimum gain (maximum resistance) the shunting effect on the other heaters will not be too severe and the symptoms will be a severely shaded picture (light and dark areas). As the contrast is advanced, the heaters of V8, 10, 9, 5 and the CRT become shunted and the picture will dim. Fortunately this is not a common fault but it does happen.

### *No Vision Signals*

If the sound is in order and the screen illuminates normally as the brilliance is advanced, with no modulation present, check V7, 8, 9, 10 and voltage to pins 8 and 7 of each EF80 valve base. As far as V7 and V8 are concerned a voltage of about 160-180 may be accepted at each pin. The potential at pin 1 of V7 varies with contrast, 2-5V being normal. About 2V should be recorded at pin 1 of V8. Voltages of V10 with no signal applied are, pin 7—160 approximately, 8—135, 1—2·5. A normal signal input will cause the following voltages to be obtained, pin 7—130 to 145, pin 8—100, approximately, pin 1—5, pin 2 (grid) about 3. All these voltages vary according to the signal input, when it is present, as determined by the sensitivity and contrast settings.

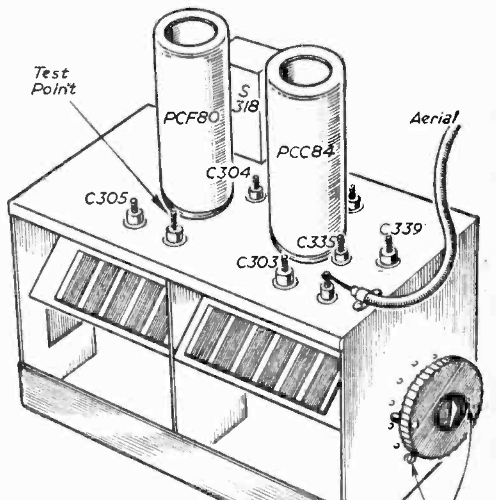



**Fig. 6.—Top view of the turret tuner. (Note the stop screws.)**

Where a voltage reading is very low or absent, check the feed resistor and decoupling capacitor and the valve itself.

### *No Sound Signals (Picture Normal)*

Advance the volume control. If no hum is present, see that the speaker leads are connected and check

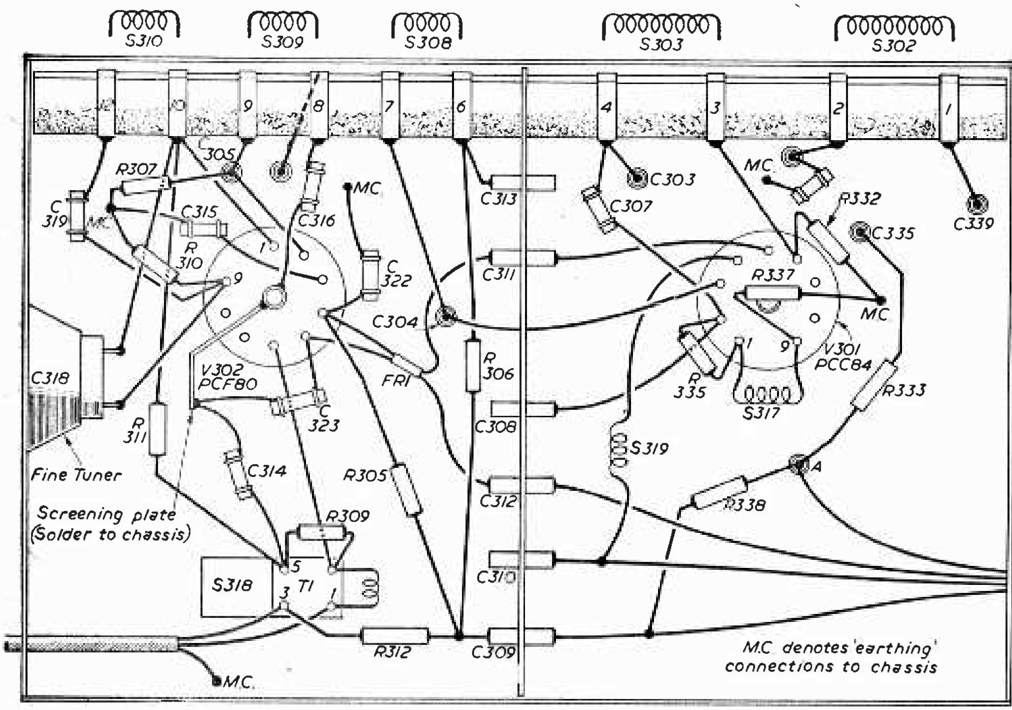



**Fig 7.—Underside of the turret tuner showing position of components.**

PL82 (V6), sound output transformer, C31, R175. If hum is present but not affected by the volume control, check ECL80 (V4) and its 220k anode resistor (R31) to pin 1. Distortion results as this goes high. If the volume does affect the hum level, check back to V5, V4 and V3, examining these valves and the base voltages. Valve V4 has two sections, a triode which functions as an audio amplifier and a pentode which functions as the second sound I.F. amplifier. Voltages to expect are V4, pin 1—48, pin 6, about 130, pin 8 117, pin 3, 3 approximately, V3, pin 7, 150, pin 8, 176.

### *No Sound, No Vision Signals*

The raster is normal when brilliance is advanced. Check V1 and V2 valves having ensured that the aerial input is in order. Check the seating of the coil cans on the front right side, sensitivity control and valve base voltages: V1—pin 1, 2-6, pin 7, 130-175, pin 8, 165-180, V2—pin 7, 170, pin 8, 110.

### *No Signals on Turret-Tuned Models*

Check PCC84 and PCF80 valves and examine resistors R306 and R312. If these resistors are charred, check C313 and C314. A short in the PCF80 can cause R312 to burn out but quite often the associated lead-through capacitor C313 breaks down causing R306 to overheat and burn out. A short in C314 (which is suspended in the wiring) will damage R312. Voltages to be expected are, PCC84—pin 1, 85-140, pin 2, 82-135, pin 3, 170-180, pin 7, 1·3—10, pin 8, as 7; pin 9, as 1; PCF80—pin 1, 55, pin 2, 2·2, pin 3, 120, pin 6, 165.

### *Replacing Components in Tuner*

The position of all components must be maintained. In the case of C313 a replacement decoupling capacitor could be of the disc type soldered from spring tag 6 to the chassis point of C313. Disturbing other components will affect tuning since the circuit stray capacity will be altered and at the frequency employed this has a profound effect on the tuning.

### *Stop Screws*

As supplied, 1446U and kindred models have a turret tuner but the switch has only three positions. When extra coils are to be added or the turret is required to be rotated the rear stop screws must be unscrewed—a flange on the turret is obstructed by the screw on either side to limit rotation. The purpose of this limitation is to enable only the loaded positions to be selected (one Band I, two Band II) thus avoiding confusion to the lay user who may be "lost" by the greater number of blank positions.

### *Trimmers*

All trimmers are securely sealed and these seals must not be broken unless absolutely necessary. The trimmer threads are very coarse and unless properly sealed will quickly move. In addition the threads must have a good contact with chassis and this contact may not be so positive once the sealing is broken, resulting in variation in gain and sometimes complete loss of signals. **Note:** not all

*(Continued on page 419)*

# A Universal Valve Tester

## CHECK HEATER TO CATHODE INSULATION AND EMISSION

By J. Hillman

WITH this tester most valves can be tested for emission, for heater/cathode shorts and for leakages between any two pins. These latter tests are carried out with the valve heaters at normal temperature. Ten valve holders are used; namely British 5, 7 and 9 pin; Mazda and International octal; miniature 7, 8 and 9 pin; large glass 8 and 9 pin. In addition an adaptor can be used for testing any other type of valveholder not covered by this tester including CRT's. The H.T. voltages are applied to both anode and screen, and the emission is registered on the 30mA meter. A switch with six positions controls the H.T. voltage used and the current is limited by a fuse bulb of 40mA in the H.T. negative lead. The grid of the valve under test is normally returned to H.T. negative but on operating a switch a resistance is inserted in series with the grid lead and if grid current is flowing, then the meter reading will alter. The amount of this alteration will give an indication of the "softness" of the valve.

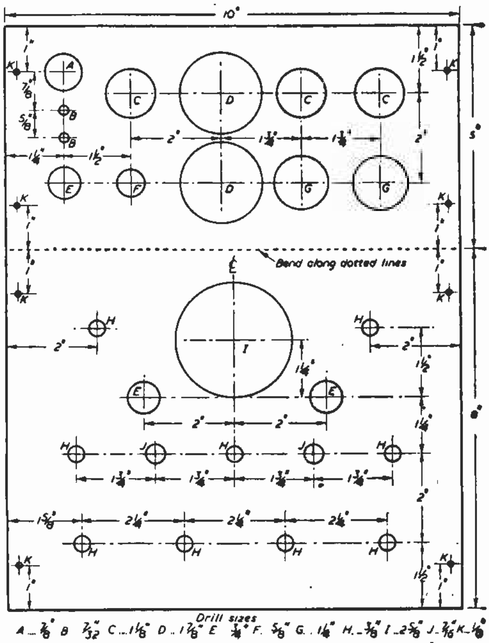



Fig. 1.—Drilling details of metal panel.

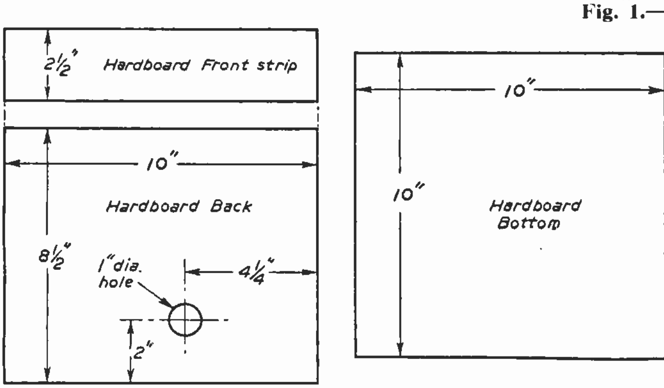



Fig. 2.—Dimensions of the case.

*Heaters*

The heater voltages are selected by a 2-pole, 12-way switch and the voltages are 1, 2, 4, 5, 6, 9, 13, 15, 20, 24, 30 and although the highest voltage is only 30 this is quite sufficient to test 50V valves. It will be noticed that there is no switch for the grid connection to the pins and this is done by using a wander lead with two wander plugs—one going to the grid socket and the other going to one of the pins of the British 9-pin valveholder. The top cap socket is provided with a wander lead also, but with a crocodile clip on one end to enable it to be clipped on to the top cap or side cap of the valve under test. The leakage tests are carried out by means of a neon lamp in series with H.T. negative and the cathode switch. Thus, by using the anode switch in conjunction with the cathode switch, the insulation of any two pins can be tested. This latter test can also be used to check continuity of heaters before proceeding to check emission.

It will be noted that a 1$\mu$F paper condenser is put in parallel with the neon and this eliminates the slight glow caused by capacity of wiring. By using a large capacity, the time taken for it to charge up and discharge through the neon is long enough for all tests to be carried out. Incidentally, this charge and discharge can be used to clear

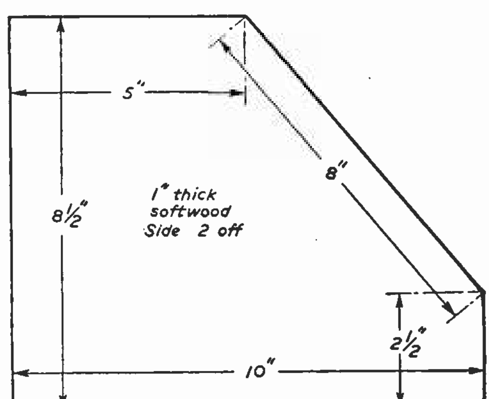



Fig. 3.—Measurements of the sides.

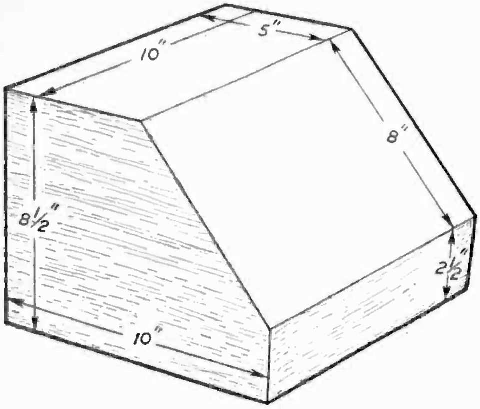



**Fig. 4.—The completed case.**

some insulation faults if left on for some time. The metal panel is earthed by a separate lead and is not connected to the H.T. negative in any way.

### *Construction*

First mark out and cut a piece of aluminium 10in. x 13in. Then mark and centre-punch the holes as shown in Fig. 1. Each hole shown is designated by a letter giving the size of drill to use. The larger hole " I " may be punched out with a cold chisel or a series of holes drilled around and the hole finished off to size with a file. Next, cut out the two sides as in Fig. 3 and bend the metal panel to fit the sides of 5in. and 8in. Having done this, paint the panel with crackle paint or enamel. When the paint is dry, screw the panel to the wooden sides with woodscrews and cut out the hardboard front strip Fig. 2, and glue and pin this to the 2½in. front. To cover the join of metal and hardboard use a black PVC tape. The cabinet should now appear as Fig. 4.

The switches and meter and lampholders are now fitted to the front panel and the valve holders to the top panel. The mains transformer is mounted by screwing it to the inside of one of the wooden sides keeping it near the bottom and to the back. Wire up the valveholders first using coloured PVC wire as follows, pin 1-red; pin 2-yellow; pin 3-green; pin 4-purple; pin 5-black; pin 6-brown; pin 7-white; pin 8-orange; pin 9-pink; top cap-grey. Start with pin 1 of the miniature 9 pin valveholder

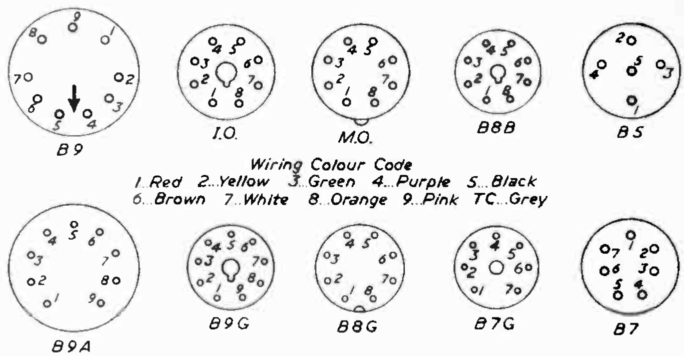



**Fig. 6.—The valve bases and the wiring colour code.**

and continue to pin 1 of the 7 pin holder; pin 1 of the British 9 pin; pin 1 of the 7 pin; the 5 pin then across to pin 1 of the International Octal; on to the Mazda Octal; the large glass 9 pin; the large glass 8 pin; finishing at small glass 8 pin. Similarly with pins 2, 3, 4, 5. With pin 6, of course, the British 5 pin will be bypassed and the lead from pin 6 of the British 7 pin will go to pin 6 of the International Octal valveholder. With pin 7 the same holds true, but when pin 8 is wired up, the wire is taken from pin 8 of the small 9 pin past the 7 pin to the large British 9 pin then across to the Int. Octal on to the Mazda Octal; large glass 9 pin and the two 8 pins. With pin 9, the wires goes from small 9 pin to large 9 pin; large glass 9 pin and finally to the centre spigot of large glass 8 pin. Next measure up the length of wire needed to reach from the mains transformer to the heater voltage switch and remove the switch and wire it up out of the case using colour coded wires and twisting them into one large lead. This makes neater wiring and it is much easier to solder the switch out of the case.

Now wire up the anode, screen, cathode, and two heater switches starting with one contact on each switch and working through the contacts. Then wire up the tenth to the top cap socket. Leave one contact blank before the first contact on each switch. Next wire up the H.T. leads to the rectifier and meter and voltage switch. The metal rectifiers are supported by using a 4B.A. threaded rod and securing

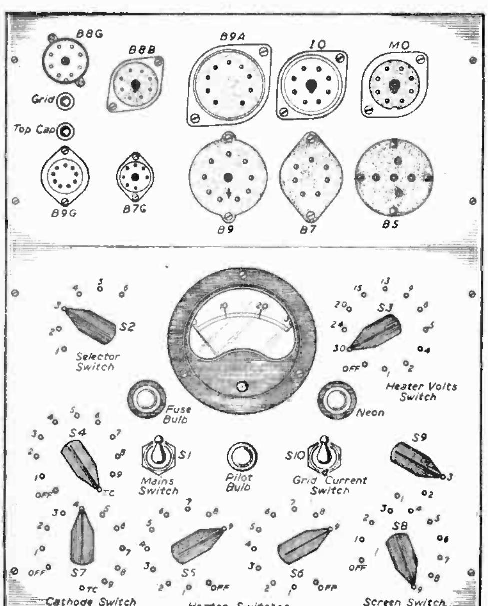



**Fig. 5.—The front panel of the tester.**

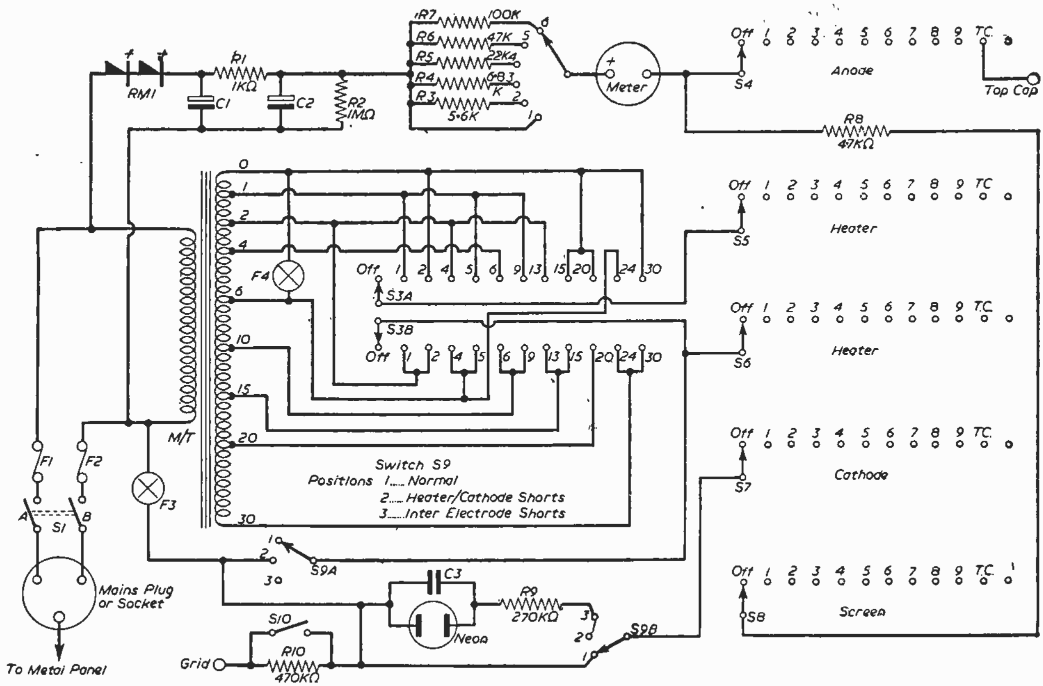



**Fig. 7.—The complete wiring diagram (S9—position 1: normal, position 2: heater to cathode short, position 3: inter-electrode shorts).**

it to the frame of the mains transformer. The block condenser and the electrolytic condenser are screwed down to the wooden side on the opposite side to the mains transformer. Wire up the rest of the switches and lamps and finally the 3 pin mains socket on the back panel.

***Testing***

Put all switches to the off position and switch on the mains switch S1 and check that there is H.T. at the anode and screen switch moving contact.

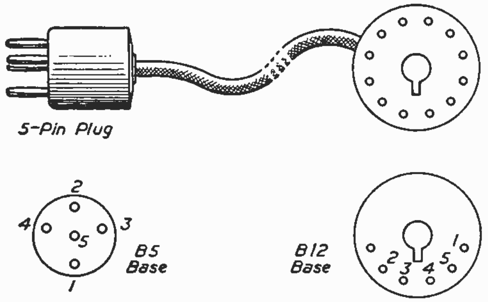



**Fig. 8.—CRT adaptor.**

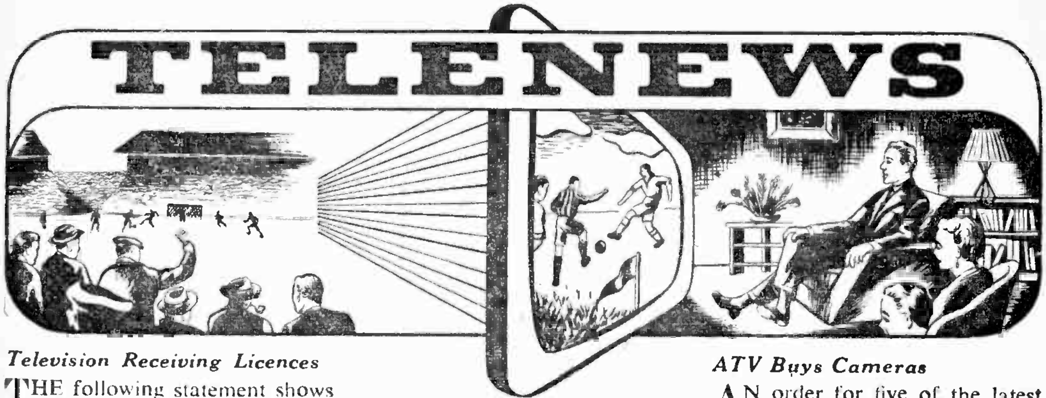
If there is no voltage, then check back at the meter, then S2, the junction R1/R2 and finally at the rectifier. When the H.T. circuit is working, check the heater voltages and mark the switch to correspond. If you have no A.C. meter, check the circuit with a bulb (use a 2·5V bulb for the 1V and 2V positions and a 6V bulb for the 4, 5, 6V then a 12V bulb for the 9 and 13V positions). Use a 24V bulb for the 15, 20 and 24V positions. Now set switch S9 to the inter-electrode short position and

*(Continued on page 432)*

**COMPONENTS LIST**

**Resistors:**
- **R1—1k 1W.**
- **R2—1M ½W.**
- **R3—5·6k 5W.**
- **R4—6·8k 5W.**
- **R5—22k 1W.**
- **R6—47k 1W.**
- **R7—100k 1W.**
- **R8—47k 1W.**
- **R9—270k ½W.**
- **R10—470k ½W.**

**Capacitors:**
- **C1,2 8+8μF 500VW.**
- **C3 — 1μF paper 500VW.**
- **M/T Ellison LT133.**
- **Neon Miniature M.E.S.**
- **F1, F2 — 1A 1¼in. glass.**
- **2 panel-mounting M.E.S. holders.**
- **1 pilot light holder (M.E.S.).**
- **F4 6V 0·3A bulb (M.E.S.).**
- **F3 6V 0·04A bulb (M.E.S.).**
- **Meter 0 to 30mA, all similar.**
- **2 wander plug sockets.**
- **3 wander plugs.**
- **1 crocodile clip.**
- **2 RM1 metal rectifiers.**
- **1 twin fuse holder.**
- **S3 2-pole 12-way switch.**
- **S4, 5, 6, 7 and 8 five 1-pole 12-way switches.**
- **S1 DPST toggle switch.**
- **S2 1-pole 6-way switch.**
- **S9 2-pole 3-way switch.**
- **S10 SPST toggle switch.**
- **Valve Holders: B7G, B9A, B9, B5, B7, B8G, B9G, B8B, 1·0, M.0.**




### *Television Receiving Licences*

THE following statement shows the approximate number of Television Receiving Licences in force at the end of February 1960, in respect of television receiving stations situated within the various Postal Regions of England, Wales. Scotland and Northern Ireland.

| *Region* | *Total* |
|---|---|
| London Postal .. .. .. | 1.797.253 |
| Home Counties .. .. .. | 1.395.472 |
| Midland .. .. .. .. | 1.575.707 |
| North Eastern .. .. .. | 1.690.966 |
| North Western .. .. .. | 1.386.864 |
| South Western .. .. .. | 870.360 |
| Wales and Border Counties .. | 622.350 |
| Total England and Wales .. | 9,338,872 |
| Scotland .. .. .. | 889,585 |
| Northern Ireland .. .. .. | 139,766 |
| Grand Total .. .. .. | 10,368.323 |

### *Westward TV's Studio Site*

WORK on clearing the site for Westward Television's studios at Plymouth has begun. The site, 1¼ acres in extent, fronts on Derry Cross and lies between the Atheneum and the Drake Cinema. When sinking preliminary test holes the contractors unearthed a quantity of human bones which were identified as those of French prisoners of war who were imprisoned here during the Napoleonic Wars. The bones were removed and re-interred. As excavation proceeds further similar finds are expected and local archæological societies will be notified. Plymouth Corporation are the ground landlords.

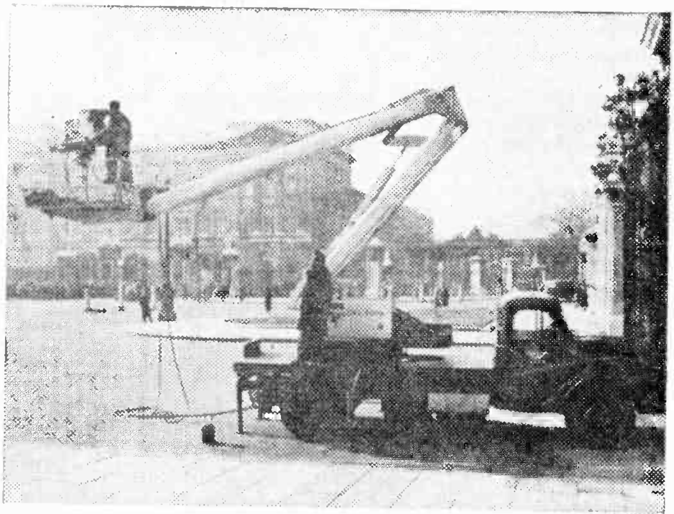
### *Independent TV in the Borders*

THE Independent Television Authority will shortly be inviting applications from new groups wishing to become the programme contractor for its Border area. In this area, the Authority plans to build two transmitting stations. One station will be sited near Carlisle and its coverage area will extend round the Solway Firth from Wigtown to St. Bees Head and will take in the greater part of Kirkcudbrightshire and Dumfriesshire in Scotland, most of Cumberland and a large part of Westmorland. It is hoped to begin programme transmissions from this station early next year. The other station will serve the Tweed area between the Lammermuirs in the north and the Cheviots in the south. It is hoped to begin programme transmissions from this station around the end of 1961. Approximately half a million people live in the areas to be served by these two stations.

### *ATV Buys Cameras*

AN order for five of the latest Mark IV television camera channels has been placed by Associated Television Ltd. with Marconi's Wireless Telegraph Co. Ltd. These five channels will employ the English Electric Valve Company's 4½in. Image-Orthicon pick-up tubes. It is understood that they are for use in Associated Television's Wood Green Studios. A further twenty of these channels are being supplied to other U.K. users, including the BBC and Granada.

In the export field, despite its very recent introduction, the Mark IV has already made a considerable impact, some 65 channels having been ordered by the United States, Canadian,



**This photograph shows a BBC television cameraman checking over his camera equipment outside Buckingham Palace as he prepared his platform ready to start relaying pictures of the scenes there on the announcement of the birth of the Royal baby. The platform is capable of covering a very large area and has proved useful for many outside broadcasts.**

Australian. Danish, Swiss and Italian Broadcasting authorities. One of the main features of the new camera channel is its extreme stability in operation, making virtually unattended operation possible, with a minimum of technical staff.

*Montreux TV Festival*

NEXT year's First International Festival of Television Arts and Sciences in Montreux, Switzerland, may be seen "live" on television screens in Britain and a dozen other European countries linked to Eurovision, including Russia Poland and Czechoslovakia. Mr. C. Gillieron, Administration Office Director of the European Broadcasting Union which co-ordinates Eurovision, announced recently that he has notified all television organisations that the official Swiss Television Service is giving its full support to the Montreux Festival and has asked its fellow E.B.U. members to do the same. The E.B.U. meets in Amsterdam on April 23 for a week's conference and one of the major items on its agenda is the projected Montreux Television Festival.

*Southern TV Figures*

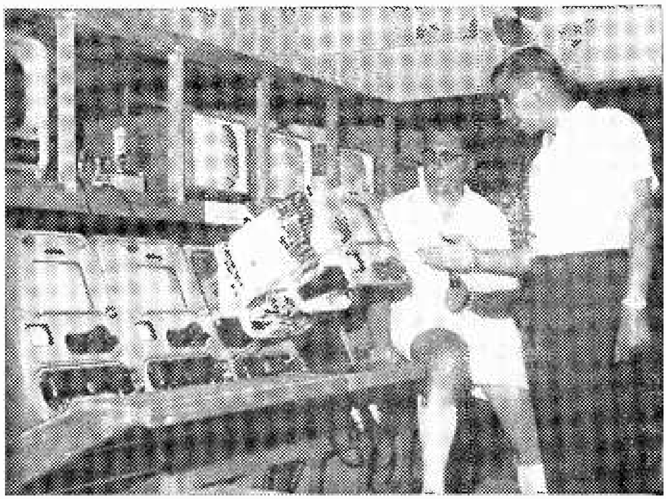
FIGURES recently issued by TAM Ltd. show at mid-February 569,000 homes, or 48 per cent of all households in the area, were able to receive ITV from either the Chillerton Down or the Church Hougham transmitter. Individuals in these ITV homes totalled 1,883,000, or eleven out of every 20 people living in private households in the area.

An analysis of the size of households shows that whereas 50 per cent of all households in the Southern ITV area had three or more persons living in them, 66 per cent of ITV homes were of this size. TAM adds that a survey covering the whole of the newly-defined Southern area is now in progress. The latest TAM estimate of the number of homes in the area capable of receiving Southern ITV programmes is 587,000 as at March 13, 1960.

*TV Advertisements*

BUSY advertising executives can now see a complete TV commercial before a penny has been spent on filming, merely by looking up from their desks. One of the leading advertising agencies is now equipped with an E.M.I. Electronics closed-circuit television and sound system in the basement TV studio of its London offices and receivers are located at key points throughout the six-storey building. Several of the receivers are situated in directors' offices, and another in the agency's private theatre allows communal viewing.

Important points like camera angles, permissible span of movement and suitability of colours for monochrome reproduction, can all be carefully examined and decisions reached in advance. Expensive filming time is then reduced to a minimum.



**Africa's first permanent television service is expected to have a viewing audience of over half a million by the end of the year. Nigerian maintenance and engineering staff are being trained to take over the operation of the service—under a contract awarded by the West Nigerian Government—by Marconi's who were responsible for the supply and installation of the transmitting and studio equipment. This photograth shows the Technical Operations Manager with the Station Manager in the Ibadan Control Room.**

*"Remote Eye" at London Airport*

AN experimental installation of closed circuit television has been completed at London Airport by Marconi's to enable the Authorities to determine whether the control of aircraft parking can be improved. At present a Marshalling Supervisor, situated in the main passenger arrival and departure building, relies on radio-telephony for reports of aircraft parking movements because his view of the parking area is restricted to that portion which lies in front of the building. A closed circuit television system is a possible means of improving control in that it could give the Marshalling Supervisor visual information as to the numbers and disposition of the aircraft. To this end, two BD871 television cameras have been installed at the top of lighting stands, one at either end of a main parking area.

*Special Trucks for TV Tubes*

A NEW fleet of 17 Leyland Steer trucks will shortly be placed in service by London Carriers Ltd., who are to operate a 24-hour service transporting television tubes for Mullard Ltd. The new vehicles, which are to replace a fleet of articulated outfits, will operate between the Mullard factory at Simonstone, near Burnley, and their Sywell distribution store in Northampton.

The new twin-steered six-wheelers have a overall length of 30ft and are fitted with bodies incorporating special roller floors manufactured by Cocker of Southport Ltd. Each body has internal dimensions of 24ft 2in. long, 7ft 6¼in. wide and 9ft 3¼in. high.

Each vehicle will carry 840 television tubes, the tubes being packed in boxes and then in pallets. Each pallet will carry three boxes containing ten tubes.

# Power Supply Circuits for TV

## DESIGN AND OPERATION

By J. Kemp

THE majority of TV owners have A.C. mains, and not always with the optimum amount of receiver protection. A study of many designs particularly home-contructed shows that the cheapest of all protections, the fuse, is by no means standard. There is absolutely no justification for the omission of fuses, whereas there is a great deal to be said in favour of them. When selecting the correct rating normal load figures are desirable, for the more that is known about normal conditions the greater the protection that can be obtained from the "link" in the power supply that is deliberately made weak. Many readers will need no advice or guidance about fuses, but in television ownership and construction, as in all things, there are the interested newcomers who rather than leave out a good point will accept values from similar apparatus. To copy other values is to grade the whole business rather broadly and is risking expensive trouble.

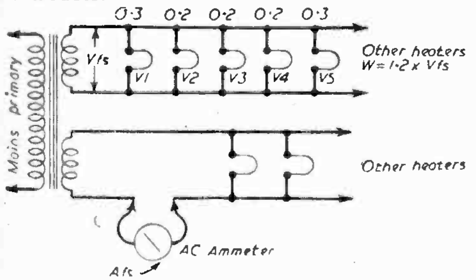



**Fig. 2.—Checking heater currents.**

Fuses, by their very nature and intended usage, are made quite cheaply: it is far better to spend a shilling or two on over-caution than spend pounds for lack of any care at all. Domestic supply fuses cannot protect a receiver, for their ratings must cover loads other than the set itself and consequently such fuses would allow currents that could do much damage to the TV without "breaking".

A good average value for normal protection is given by:

$$R = 1{\cdot}5\,\frac{\left(\frac{ImA \times Vht}{1{,}000} + \frac{Afs \times Vfs}{1}\right)}{Vmi}$$

Where: ImA is total receiver H.T current—milliamperes (Fig. 1) Vht is receiver H.T. (smoothed D.C.) voltage (Fig. 1) Afs is total valve heater currents in a parallel run (Fig. 2) and Vfs is heater voltage of one valve in such parallel runs. Where several secondaries are found and their voltages differ, the respective wattages are added together, but where such separate secondaries have a common voltage then only the value of one need be considered against the total currents of the related windings. Vmi is the mains input voltage.

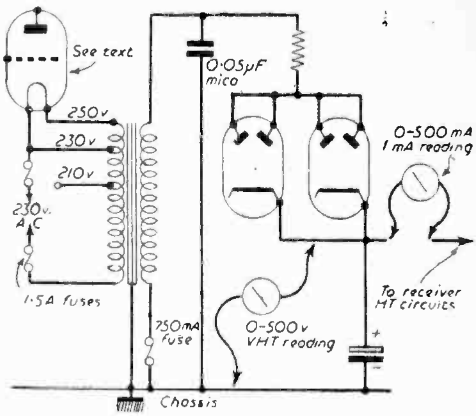



**Fig. 1.—Checking current for load values.**

As beginners are mostly concerned at this point an example may not be amiss. Assuming ImA as 300, Vht as 300, Afs and Vfs as 25 valves with 6·3V 0·3A heaters and a Vmi (mains input volts) value of 250, the resultant rating is 0·8, but this would be carried to 1A in practice and allows for transformer losses involved. As the formula assumes blow-out on 50 per cent overload it should be closely followed for best protection, and in this respect where fractional answers occur discretion should be used in "rounding off" the figure.

### *Series Heaters*

Some receivers, though designed solely for A.C. mains, also employ a type of modified A.C./D.C. technique for valve heaters as in Fig. 3. Where such circuits occur the total wattage is VI where V is the voltage across the entire winding and I is the current in amps. of one valve only. In some cases also shunt resistors may be employed where valves of "odd" current ratings are included in series heater chains. Suppose it is desired to include a 12·5V 0·15A type in a chain of valves of varying heater voltages but identical current ratings (as they should be if no series or parallel ballasts are used). Then the system in Fig. 4 (for 0·3A) would be used and the chain current is that of the valves not shunted, the odd valve rating not being considered as the shunt compensates for the difference. However, if the chain consisted of 0·15A types, and a 0·3A type were inserted, then the system of Fig. 5 would be needed and the chain current then becomes that of the higher-current valve, in this case 0·3A. It will be noted that the "odd" valve is placed to avoid an additional shunt as would be required if the valve were set in an intermediate

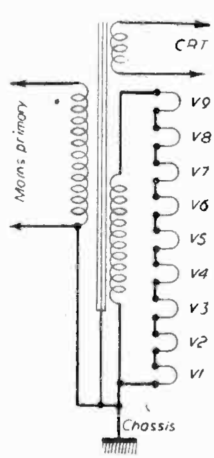



**Fig. 3.—The modified A.C./D.C. circuit for heater supplies.**

position. Where mains transformers have tapped primaries for correct loading, the differences existing between such taps (in typical cases 10 volts; inputs 210-230-250 etc.) can be used (Fig. 1), where practicable for low current loads. An odd valve heater voltage can be supplied by such taps, but no great load should be so imposed, for primary windings are gauged for primary currents. The point is raised as a caution and also concerned is the after-caution necessary for with such "stunts", carelessness can lead to violent shock from the heater of the valve so connected.

Where A.C./D.C. techniques are contemplated (by constructors) the drawbacks of such systems should be overcome or limited. Not the least snag is the possibility of chassis being "live" at full mains potential and a definite hazard to life. The writer is surprised by the attitude of many to any talk of shocks and care to avoid them. Perhaps such attitudes are bred by the apparent inability of A.C. mains to give lethal doses in most cases of contact. However, circumstances vary, as do physical health levels, and survival of shocks may be due entirely to conditions favouring persons involved, which is no guarantee that such will always be the case. Many fatal accidents concern persons that have often received shocks before and when, perhaps, familiarity bred contempt! Take no chances.

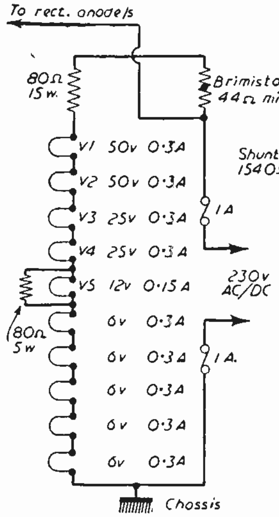



**Fig. 4.—Using "mixed" valves in a chain.**

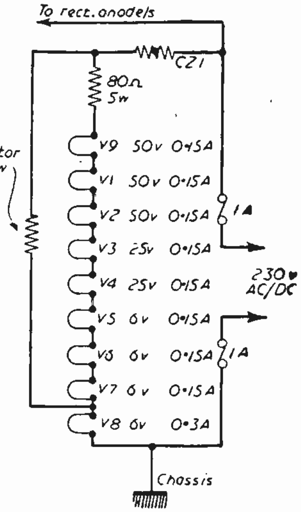



**Fig. 5.—Another modification where only one valve is different.**

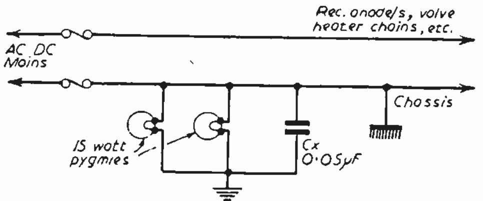



**Fig. 6.—Protecting the chassis on an A.C./D.C. receiver.**

The circuit of Fig. 6 shows a simple arrangement that will give excellent protection against "live" chassis and associated risks. It will enable readers interested to ensure that apparatus can be handled safely, and many constructors must wish to leave a newly-built job open for adjustments, modifications and the like. A true earth is necessary, but as shown it should not be taken to chassis except through the condenser Cx. Two lamps are shown in the circuit, though one will do quite well. Two are in Fig. 6 to allow for the possibility of the chassis not being indicated by reason of lamp failure.

Whilst discussing A.C./D.C. drawbacks, the popular negative resistance elements must be included. Former protections against surges consisted, in the main, of barretters, ballast tubes, etc., and such devices usually dropped the surplus voltages in heater strings whilst maintaining constant current over fluctuating voltage values. A modern system is the thermistor, and when these are used the manufacturer's recommendations should be followed. Details are published of operating temperatures and particular note should be made of the minimum value to which each type falls (value of resistance). Allowance should definitely be made for such a minimum working figure and, taking one example, one type starts at 3,000Ω cold and absorbs surges by reason of this. However, as it warms so its resistance drops, but according to maker's data at full operating temperature its resistance when passing 0·3A is 44Ω. If this is not considered then the valve or valves will be under-run by an average of 13V. Fig. 7 shows a typical heater chain, and it will be obvious that A.C./D.C type valves should always be used in such schemes. The resistance RKP represents the cathode resistors of associated valves all in parallel, as they are so far as stresses are concerned. The resultant value is very low as calculation from typical values will prove, and for this reason valve-heater chains are arranged so that the high-voltage heaters "bear the brunt".

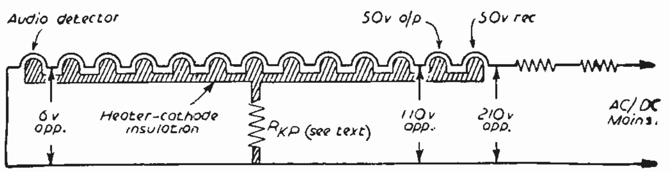



**Fig. 7.—Diagram illustrating heater-cathode insulation.**

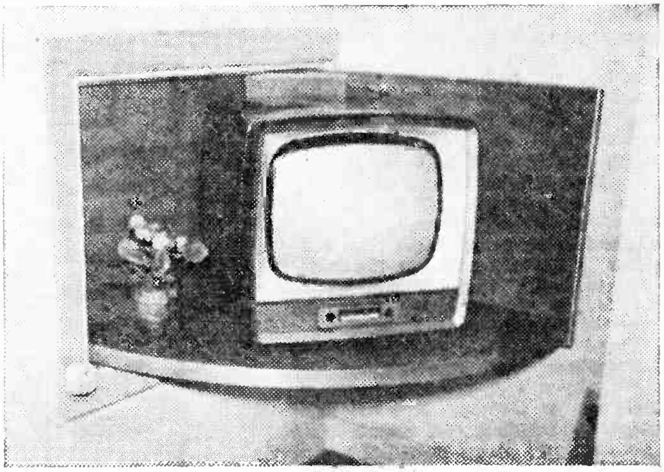
# TELEVISION TURNTABLE

## A NOVEL SPACE-SAVING UNIT

By R. Hawkins

ONE of the problems in a small house is the lack of space, especially adjacent to the fire-place. This area usually houses an armchair, or a television set, but not quite both.

This was overcome in my home by fitting a quadrant turntable into the dividing wall between dining room and lounge. If it is convenient to use only one room, the television is kept in the vacant room and the armchair is placed in the alcove at the fireside. When viewing is desired the armchair is placed in front of the fire and the turntable revolved into the room to the viewing position. After viewing is over, both are returned to their original positions.



**The completed turntable.**

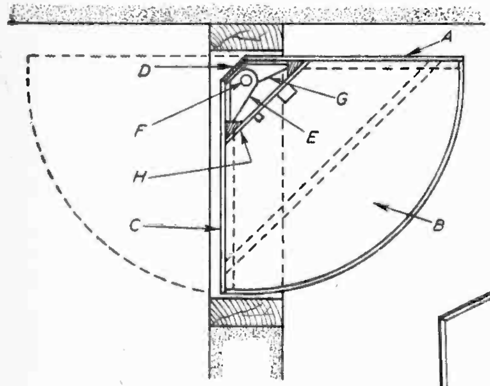



**Fig. 1.—A plan view of the unit.**

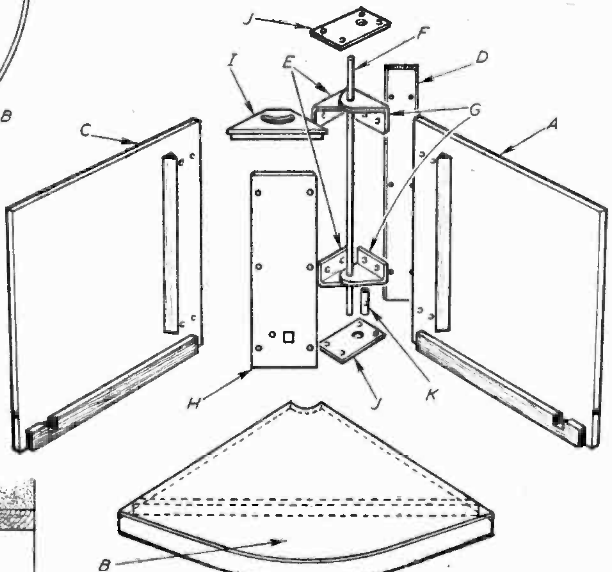



**Fig. 2.—An exploded view.**

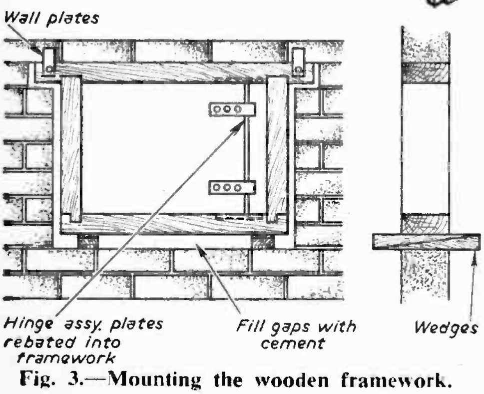



**Fig. 3.—Mounting the wooden framework.**

In Figs. 1 and 2, the doors (a) and (c) were made from $\frac{3}{4}$in. thick oak-faced "Weyroc" edged with a ramin bead. Battens were attached to carry the table top (b), also made from "Weyroc" and ramin bead.

A $\frac{1}{2}$in. diameter M.S. shaft was used as a hinge pin located in two $\frac{1}{4}$in. M.S. plates (j). The hinge brackets (e) and (g) were made from L.A. angle bolted on the doors. A spacer made from $\frac{1}{2}$-1in. dia.

*(Continued on page 432)*

# Aerial Feeder Matching

## USING A COMMON DOWNLEAD WITHOUT A DIPLEXING CIRCUIT

By J. Frith

WITH the increasing coverage of television transmitters on Band III, many amateur constructors find themselves confronted with the problems of design for VHF for the first time, and also with the installation of the more elaborate types of aerial required, in most cases, to deal with the weaker field strength of the Band III transmission. The simple two-element array of dipole and reflector, so often used on Band I, presented no difficulties, as by using almost any type of low-impedance feeder, according to the requirements of the receiver, satisfactory operation of the aerial could be assured. But in the installation of a multi-element array for Band III it is not practical merely to connect aerial to receiver by the first available length of feeder, as quite serious losses may occur by so doing. In addition the aerial system has now to provide two signals of widely different frequencies and more problems arise when it is intended to connect both aerials to a single downlead. However, by the application of some simple theory to the design of the feeder system, these difficulties may easily be overcome and maximum performance of the aerials assured.

### *Matching the Band III Aerial*

As more directors and reflectors are added to the simple half-wave dipole to make a multi-element array, the radiation resistance at the centre of the dipole, about 80Ω in free space, drops sharply. For a four-element array it is of the order of 6 to 8Ω. A feeder constructed to match this impedance would have impossibly close spacing and thus a means of increasing the radiation resistance must be found. The commonest is the so-called folded dipole, almost universally used in aerials for Band III. The folded dipole is fundamentally two half-wave dipoles in parallel, connected together at the ends with the feed taken from the centre of one of them. If the two conductors have the same surface areas (e.g., made from the same diameter tubing) the aerial current divides equally between the two, and the radiation resistance at the feeder terminals is

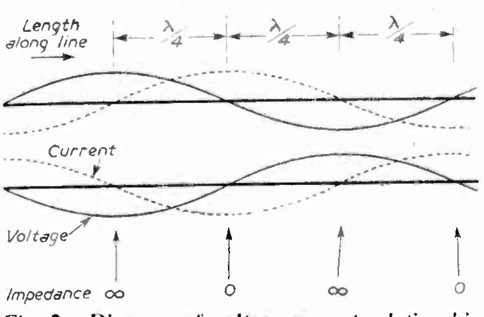


**Fig. 2.—Diagram of voltage-current relationship on a transmission line.**

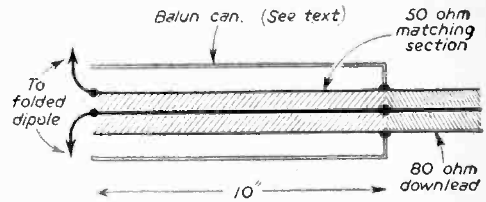


**Fig. 1.—Construction of the Band III matching section.**

multiplied by four. Thus the feeder impedance required to match a four-element folded dipole array is of the order of 30Ω. If 72 or 80Ω cable is used to the receiver, a mismatch will be produced, which, although it may not be very serious, will result in increased losses and reduced efficiency.

The simplest matching device for coaxial cable is the "quarter-wave transformer". This consists of a quarter-wavelength of coaxial line connected between the two impedances it is desired to match. If the two impedances are denoted by Z1 and Z2, then the impedance of the quarter-wavelength section

$$Zc = \sqrt{(Z1.Z2)}$$

If a section of 50Ω cable is used it will provide a match to 31·25 from 80Ω cable, which can then be used for the downlead.

### *The "Balun" Converter*

As the outer conductor of coaxial feeder is earthed at the receiver end, the two halves of the folded dipole will not be balanced equally about their earthed centre point, resulting in distortion of the polar diagram of the aerial and pick-up from the feeder. The conversion of an unbalanced coaxial line for use with a balanced aerial termination is accomplished with a so-called "balun" (balance-to-unbalance) converter. The most practical form is known as the "quarter-wave can", and consists of an additional coaxial screen, a quarter wavelength long, placed around the existing feeder at the aerial end and connected to the outer screen of the feeder at the end farthest from the aerial (see Fig. 1). The end nearest the aerial is coincident with the end of the outer screen of the feeder, but insulated from it. The outer conductor will now effectively be earthed and the two connected to the aerial will be able to move in antiphase with respect to earth—with a folded dipole, its centre point.

A balun converter may easily be constructed using a length of heavy ¼in. coaxial cable from which the centre conductor and polythene dielectric have been removed. The braid screen and outer covering are slipped over the feeder and the end soldered to a bared section of the outer conductor of the feeder. If the converter is used with a quarter-wave matching transformer as well, it will start at the same point, and all three cables must be carefully soldered together as shown in Fig. 1. Great care must be taken not to short the inner conductor to the screens, or to distort the polythene by application of too much heat when soldering the screens themselves. The outer covering of the heavy cable can then be pulled down over the joint and trimmed at the aerial end, making sure that the two braid screens do not touch at this point. The cable ends may then be waterproofed with adhesive, or other suitable compound.

When calculating the length of a quarter-wave the "velocity factor" of the cable must be considered.

$$\text{Velocity factor} = \frac{\text{Velocity of wave in feeder}}{\text{Velocity of wave in free space}}.$$

Or, for any one frequency:—

$$\text{Velocity factor} = \frac{\text{Wavelength in feeder}}{\text{Wavelength in free space}}$$

Thus, to obtain the length of a quarter-wave in a feeder, the natural quarter-wavelength must be multiplied by the velocity factor of the cable used. A round figure for polythene-spaced coaxial cables is 0·66. For Channel 9, a quarter-wavelength in coaxial cable is almost exactly 10in.

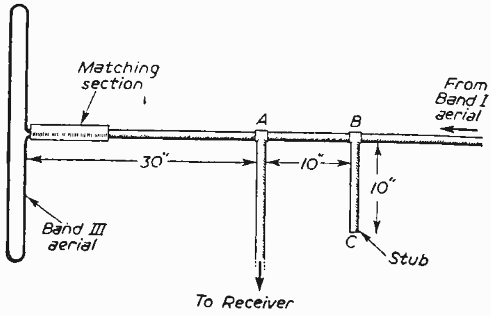



**Fig. 3.—Construction of the complete feeder system for Bands I and III.**

When two feeders from two separate aerials are connected to a single line for connection to the receiver, a device must be used to prevent each aerial, with its own feeder, from interfering with the other. A Band III signal received on its aerial, when passing the junction of the feeder to the Band I aerial, must "see" an infinite impedance in the direction of the Band I aerial, and the same applies conversely to the Band I signal. If this is not so an impedance mismatch will occur at the junction and the signal from each aerial will be mixed with a smaller signal received on the other aerial, resulting in the spoiling of the polar diagrams of both aerials. This problem is solved commercially by the use of a pair of filters incorporated in a "junction box", the filter in the Band I lead being adjusted to reject signals in Band III, and vice versa. The design and construction of such filters is not impossibly difficult for the amateur, but it is possible to effect the same result without using them by attention to the feedlines themselves.

***Stubs***

The principle used is a familiar one at radar frequencies, where it becomes invaluable. On a resonant section of transmission line the impedance (voltage-current ratio) varies sinusoidally along the line. For a perfect line the impedance at points of no current is infinite, and where there is no voltage the impedance is zero (see Fig. 2). Thus, if the line is physically short-circuited at such a point, the operation of the line is unaffected. A quarter-wavelength away, however, the voltage is at its maximum, and there is an infinite impedance. If any point on a feeder is physically short-circuited, thus introducing zero impedance, a quarter-wavelength away the impedance of the line will appear to be infinite to that particular frequency, and a further quarter-wavelength away it will appear to be zero again. Also, if a length of line is terminated in an open-circuit, a quarter-wavelength from the end it will appear to be short-circuited, and so on.

Thus, to produce a reflected open-circuit at any selected point on a feeder, one may instead produce a short-circuit at a distance of one quarter-wavelength from it. But this short-circuit may also be artificially produced, e.g., by connecting to the line a quarter-wavelength of feeder *open*-circuited at its other end. This length is called a stub. In Fig. 3, a stub is seen connected to the Band I feeder a quarter-wavelength away from the junction and a quarter-wavelength long. To a Band signal the open circuit at point C is reflected as a short-circuit at point B, and this short-circuit appears as an open circuit at point A, the feeder junction. Thus, a Band III signal "sees" an infinite impedance along the Band I feeder. If desired, another open quarter-wave stub may be connected a further half wavelength along the line. This, it will be seen, will reinforce the effect of the first.

The construction of the stub is as simple as it looks. To insulate the junction of the inner conductors a short piece of polythene tubing may be used drilled through one side to take the stub and slit lengthwise through the hole to allow it to be slipped over the junction. The polythene from the cable used for the balun converter is most suitable for this purpose. The braiding should then be wrapped around the junction and carefully soldered in position. The completed stub can then be laid along the feeder, encased in a length of sleeving.

To prevent the Band III array from affecting the Band I signals the same principle is applied. Where a folded dipole is used for Band III reception, the ultimate end of the entire Band II feeder system is a short-circuit at the centre of the folded dipole. Thus, if the total length from this point to the feeder junction is made a quarter-wavelength at the Band I frequency, an infinite impedance will appear at the junction as "seen" by the Band I signal. It is sufficiently accurate to regard the velocity factor of the actual folded dipole, considered as a transmission line at Band I frequency, as being unity, so that if the length round one leg of the dipole is subtracted from a natural quarter-wavelength at the Band I frequency, and the remaining length multiplied by the velocity factor of the cable used the length of the feeder required for the Band III aerial is obtained.

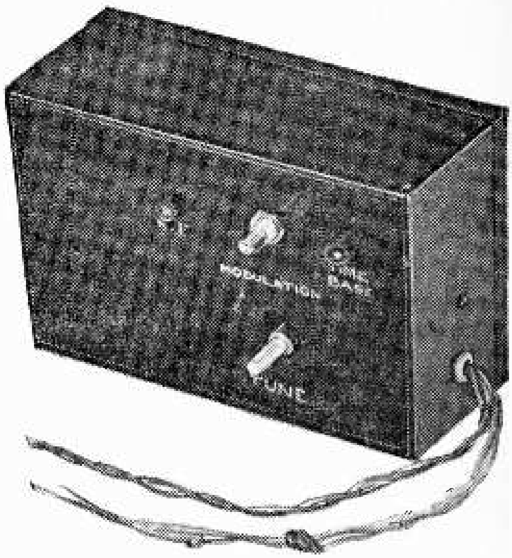
***Testing***

The performance of the junction system is easily tested. With the receiver tuned to Band III the signal strength is observed while the Band I feeder is disconnected from the junction, and also when it is shorted and open-circuited beyond the stub. Absolutely no variation should be seen. When tuned to Band I there should again be no change in signal-strength when the Band III feeder is disconnected and reconnected at the junction.

# I.F. WOBBULATOR

## VISUAL INDICATION OF VISION I.F. RESPONSE CURVES

By D. R. Bowman




MOST experimenters in television are concerned with picture definition, and it can be a tedious business seeking it without suitable equipment. Here is described a cheap and efficient apparatus which, with the aid of an oscilloscope, will enable the constructor to be sure of one factor at least—the important one of "response curve"—in his circuit adjustments.

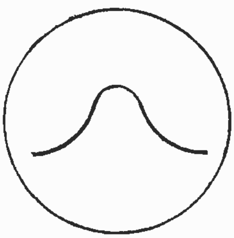


**Fig. 1.—A typical trace for a single tuned circuit.**

### *Principles*

The aim of the designed circuit is to produce an oscillator which can be varied in its frequency so as to sweep through the nominal intermediate frequency of the I.F. amplifier. In order to show the response curve of the receiver on the face of the tube of an oscilloscope, the output of the oscillator is connected to the input of the amplifier, and the voltage developed at the detector is fed to the Y plates of the oscilloscope tube—amplified as necessary. If the timebase generator is set to a low speed—say, 10 sweeps per second—and the oscillator is swept through the I.F. at the same speed, the response curve of the amplifier appears on the screen of the CRT. A moment's consideration will show the reason for this. Away from resonance the amplifier is off tune and only a small voltage is developed at the detector. As the generated frequency approaches the tuning point of the amplifier the detector voltage will increase, and since the spot will have moved (towards the centre of the trace, usually) it will be deflected vertically. At the point of resonance—if a single tuned circuit is taken as the simplest example—maximum voltage is developed at the detector, and the spot on the tube face undergoes maximum deflection. As the generated oscillations increase in frequency, off-tune conditions are again met and the deflection of the spot decreases. A typical trace curve for a single circuit is shown in Fig. 1.

### *Conditions of Design*

Certain conditions have to be met in the design of such a "wobbulator". Firstly, there must be automatic means of sweeping the oscillator frequency through the nominal I.F. of the amplifier. Secondly, this process must repeat at a high enough rate to show an apparently continuous trace on

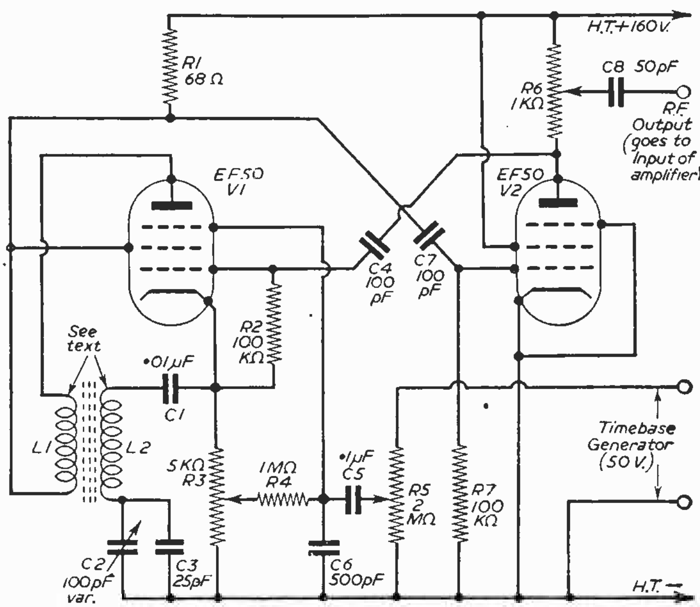



**Fig. 2.—The circuit diagram of the wobbulator.**

the CRT. The third condition is that this must not be done at too high a rate, otherwise the tuned circuits, if highly selective, cannot respond in time and a distorted trace results. Five to ten traces a second is good enough, and with large-bandwidth amplifiers 50 per second will do, though it is really too high a rate of sweep. Fourthly, the oscillator must swing completely through the I.F. and where considerable bandwidths are involved this is a limiting feature of design.

The timebase generator of the oscilloscope will produce a linear sawtooth voltage, and if this can be caused to produce a considerable linear variation of oscillator frequency, the problem is solved.

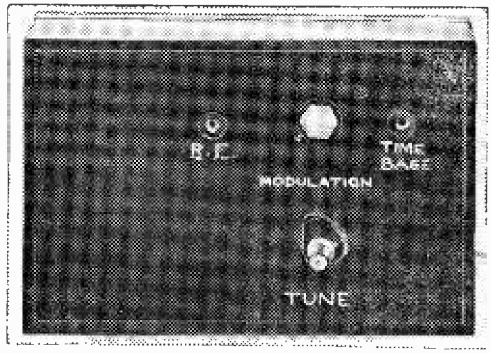
### *Frequency Variation*

The writer tried several methods of varying the oscillator frequency before settling on the present circuit. The normal method, using a "reactance valve", proved to have two faults at the usual television I.F.—it was impossible to achieve a large enough sweep without generating at a low frequency and multiplying up, and also the variation of frequency was not linear with a linear sawtooth voltage. The use of a Miller valve across the oscillator tuned circuit gave a better sweep, but the frequency change was not linear. In both cases four or five valves would have been needed to give reasonable results, because of the correction involved. The mechanical method is attractive—using a motor-driven variable condenser to tune the oscillator—but it is a little unreliable, and does not lend itself well to low speeds of "wobbulation". It is, moreover, not elegant.

### *The Circuit*

The circuit eventually adopted is shown in Fig. 2. Valves V1 and V2 together comprise a multivibrator of low output. It does not give a rectangular waveform because of this, and because of the fact that it is "locked" to a tuned circuit consisting essentially of L2 and C2 in series. (C1 is merely a H.T. blocking condenser.)

The timebase voltage, at about 20-30, is fed to the suppressor grid of V1. The action can be visualised as follows: the actual analysis is complex.




**Front panel.**

Consider the suppressor of V1 very negative; then all the valve current is diverted to the screen and L1 (which is coupled closely to L2) is virtually open-circuited and has no action on the tuned circuit L2/C2 apart from its capacitance. Thus the oscillatory frequency of L2/C2 is almost unaffected by L1. Now if the suppressor becomes positive nearly all of the cathode current goes to the anode and thus flows through L1. This is now an active part of the tuned circuit because of its mutual inductance with L2; the frequency of oscillation therefore changes. Since the degree of effective coupling between L1 and L2 varies with the suppressor grid voltage, the time-base voltage on the suppressor varies the frequency of oscillation.

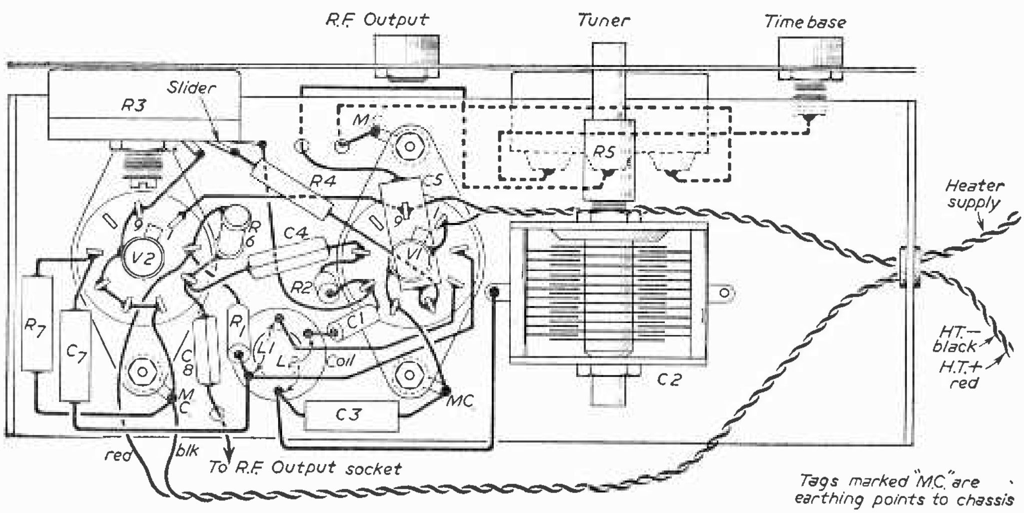



**Fig. 3.—Underchassis wiring details. (Note that C6, wired between the junction of R4 and C5 to chassis, has been omitted for clarity. Resistor R6 is here shown as a fixed resistor but a potentiometer may be used as indicated in Fig. 2.)**

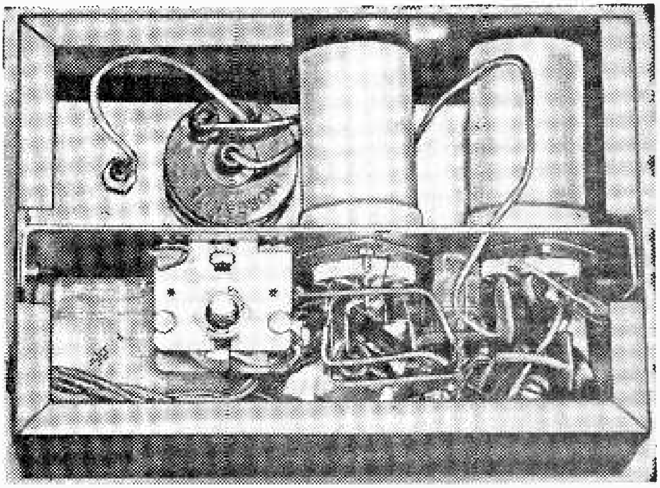
*Construction*

The construction is simple enough and calls for no special precautions other than those usually adopted when circuits have to cope with frequencies of 10-50Mc/s. The components shown should, of course, be of good quality and low loss. All condensers below 500pF in value should be of mica or ceramic manufacture. With the coils L1 and L2, as now described, the fundamental frequency of oscillation is about 8Mc/s, but can be varied to about 14Mc/s. Up to the fifth harmonic can be used effectively, and thus the following ranges are covered:

| | |
|---|---|
| 8-14Mc/s | 32-56Mc/s |
| 16-28Mc/s | 40-90Mc/s |
| 24-42Mc/s | |

If the higher harmonics are not sufficiently prominent the anode resistor of V1 can be increased to, say, 1000Ω.

Coils L1 and L2 both consist of 14 turns of 24s.w.g. enamelled copper wire, close-wound on a 0·4in. Aladdin former with an iron dust core. L2 is wound on top of L1, with an insulating layer of tape (transparent plastic) between. The cathode end of L2 should be directly next to the anode end of L1.



A view of the wiring.

*Adjustment*

Adjustment is simple. First, a meter is inserted in the cathode lead of V1 (i.e., in series with the 5k resistor) and the standing bias on the suppressor is varied until the valve current is minimum. This is not a critical adjustment, and if preferred this control can be omitted, using a 2·2k resistor instead of the 5k in the cathode lead; in this case the suppressor grid lead is returned direct to earth.

Next, setting the variable condenser C2 at about half its travel, adjust the core of L1-L2 until the frequency generated is about 9Mc/s, the sweep control R5 being set to zero. The wobbulator is now ready to use.

The only connection not shown in Fig. 2 is that between the amplifier detector and the oscilloscope. For this, a 10k resistor should be attached to a flex lead; the other end of the resistor is connected to the diode anode or the volume control slider, and the free end of the flex connected to the Y-amplifier input of the oscilloscope. The 10k resistor will avoid instability due to the connection, and if this is not enough, try a screened lead or increase the value, up to 500k if necessary.

*Curve*

It should be noted that the response curve may easily come out "the wrong way up": it depends on which way round the diode detector is connected. Leaky-grid detectors always come out wrong way up. This is no disadvantage.

This instrument will give, with a close coupling between L1 and L2 and an iron core well inserted, as much as 30 per cent frequency deviation. This will give an ample bandwidth even on the lowest frequencies, and more than enough at the modern television I.F.s of 30-40Mc/s.

*Modifications*

With certain EF50 valves, otherwise quite efficient, the gain-bandwidth product is not sufficient for the maintenance of oscillations above about 8Mc/s with the specified valves of anode resistor, namely 68ohms and 1,000ohms. This situation becomes worse if stray circuit capacitances become relatively large.

To ensure oscillation, the 1,000ohm resistance in V2 anode should be substituted by a small choke. An item which has proved satisfactory consists of 60 turns of 30s.w.g. enamelled copper wire, close-wound on a former 3/16in. in diameter.

It should be noted that an attempt to increase loop gain by increasing anode resistor valves is of no use: it diminishes the frequency at which oscillation can be maintained. Beyond a certain point, multivibrator action begins, in which the tuned circuit in the cathode circuit of V1 plays a minor part; this is, of course, not the condition required.

*Choke*

The inductance of the choke should be such that together with the circuit capacitances of V2, its natural frequency of oscillation is much higher than that of the V1 cathode tuned circuit. If the inductance is 14μH the circuit capacitance 10pF, this condition is realised. However, if circuit capacitance is about 25pF resonance can occur in the V2 anode circuit at some setting of the tuning condenser, very large gain results and V1 is overloaded resulting in an effect similar to squegging. If in doubt therefore, it is better to reduce the size of the V2 anode choke.

# A "Printed" Aerial Filte

## A PRINTED CIRCUIT DESIGN FOR HOME CONSTRUCTION

By R.

SEVERAL kinds of interference commonly affect the reception of television pictures. They include the following, apart from ignition noise and mains-borne interference from brush-fed motors:

(a) Signals received at, or within, 3Mc/s of the intermediate frequency of the receiver,

(b) Signals received near the signal-frequency,

(c) "Image" signals from external sources,

(d) I.F. harmonics, produced at the detector, being fed back to earlier stages,

(e) Oscillator harmonics generated in the receiver itself.

### Elimination

Strictly speaking, there should be no difficulty in eliminating all these sources of interference. Good filtering and screening of the receiver itself is, in any case, necessary to remove the last two in the list—and perhaps decoupling more than screening. Reception via the aerial of interfering signals is dependent on several factors. One of the more important is that no attempt is usually made to overcome the lack of "balance" that exists between aerial and coaxial feeder. As a result, the coaxial lead itself acts as an aerial and although it is very inefficient at picking up television frequencies, whether Band I or Band III, it is liable to receive a good deal of short-wave energy. Moreover, the lead comes down from the aerial through a region where—especially in towns—other television receivers are working and are generating as a rule a good deal of radiated energy.

While the use of suitably-proportioned balance-to-unbalance transformers ("baluns") could be used, it is normally much simpler to dispense with this complication and use other means of overcoming the trouble.

### Trap Circuits

If a single local source of radiation is the cause of "patterning" on the received picture, a common device is to include somewhere in the lead—and as near as possible to the receiver—a simple trap circuit. Three possible arrangements are shown in Fig. 1.

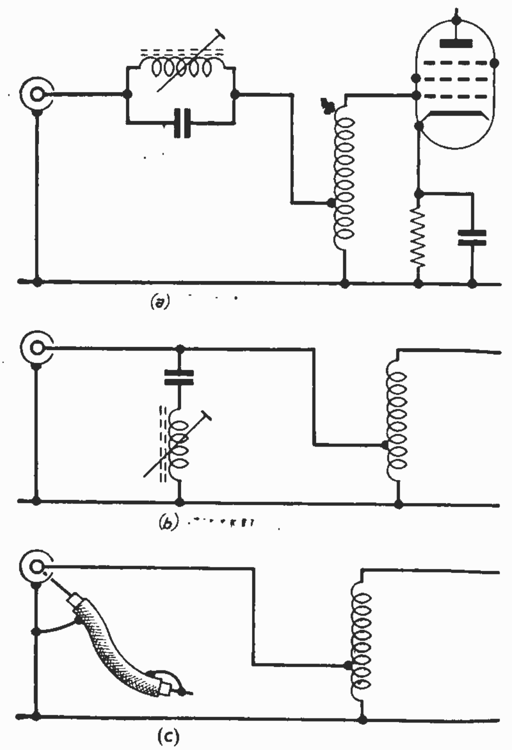
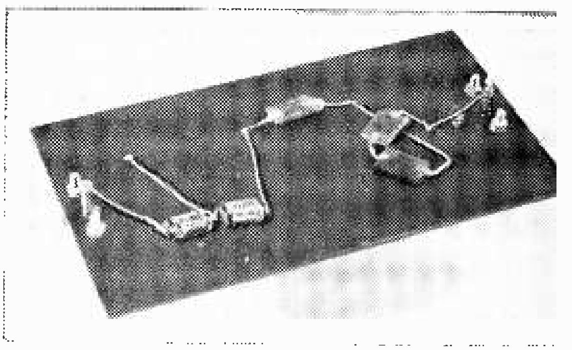



Fig. 1(a).—Rejector circuit.
(b).—Acceptor Circuit.
(c).—Short-circuited transmission line (a special case of the acceptor circuit).



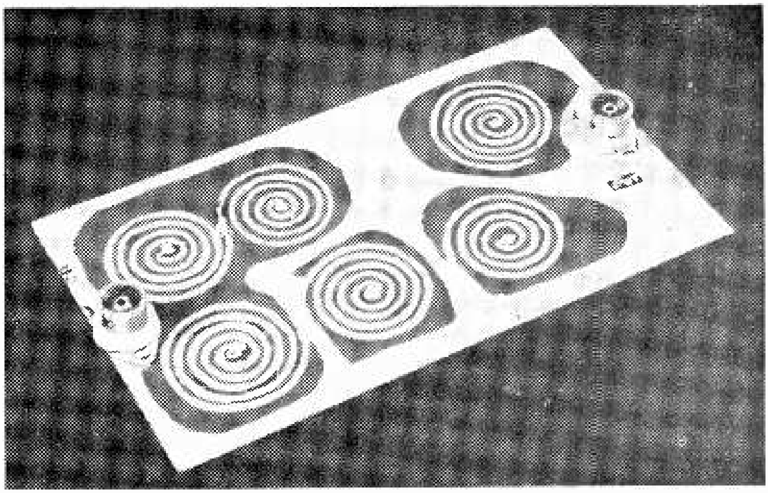
**The reverse side of the printed board. The series/para combinations of condensers used to achieve the necess values of capacity can be clearly seen.**

Usually about 30dB attenuation of an interfering frequency is aimed at, and although the arrangements shown in Figs. 1(a) and (b) are sometimes used, only Fig. 1(c) will give this degree of attenuation in normal circumstances.

Where several different interfering frequencies may exist, none of these circuits is satisfactory. This is usually the case—the considerable bandwidth of the vision I.F. amplifier allows for many different frequencies to enter the amplifier. Under these conditions it is very difficult to remove unwanted frequencies by simple trap circuits, largely because the addition of extra traps affects those already fitted. The alignment is very tricky and the difficulty increases geometrically as the number of traps increases.

# Unit

Archer



The complete "printed" filter unit.

### *Printed Filter*

The best method is the use of a suitable wave filter, and here is described the construction of such a filter using printed circuit techniques. The recent arrival on the "home experimenter" market of 'do-it-yourself' printed circuit kits makes this feasible—although the amateur needs only to be able to obtain the copper-clad insulating board as the chemicals needed are freely obtainable and very cheap.

The wave filter is a combination of inductances and capacitances so chosen that, when inserted in a circuit between a generator and a load, very great attenuation of certain frequency bands occurs with negligible effects on other ranges of frequency. If the calculations have been successful, a very abrupt transition occurs between the wanted and unwanted frequencies.

### *Matching*

There are three types of filter in general use: the low-pass, the high-pass and the band-pass. Here we are concerned with a high-pass filter — one which eliminates all frequencies below 41Mc/s and transmits, with little loss, all frequencies above this.

Any filter must be designed for definite input and output impedances. The filter described here is only suitable for inclusion in a coaxial line of 75Ω nominal impedance.

Wave filters normally incorporate both end sections and intermediate sections. The former are concerned chiefly with the achievement of the correct input and output impedances; the intermediate sections supplement the attenuation given by the end sections, allow for very great attenuation at certain frequencies, and ensure more uniform attenuation over the whole range.

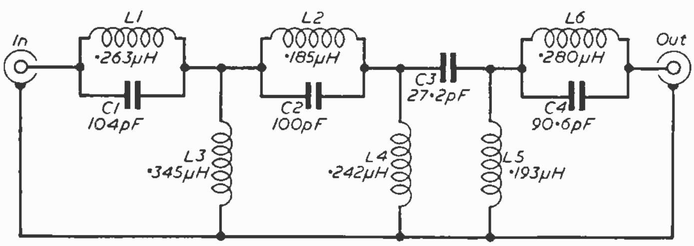



Fig. 2.—The theoretical circuit of the filter.

### *"π" or "T" Types*

Filters may be either π type or T type. This means, roughly, either of rejector or acceptor type. For this design, the π type has been chosen, because the self-capacitances of the coils affect the behaviour less, in that the condensers added in the design are in parallel with coil self capacitances. The theoretical circuit is shown in Fig. 2. Although one end is labelled "**In**" and the other "**Out**" they are in fact interchangeable with no effect on performance.

Two possible methods of construction offer themselves as attractive alternatives. The printed circuit system has the advantage of simplicity of execution, a minimum of capacitance between input and output ends and reduction of coupling between the inductances. The alternative, of using coils wound on small formers, enables more accurate adjustment, especially of the very sharp edge of the transmission band. However, this makes alignment rather more difficult. For those who prefer not to use printed circuits, details of the

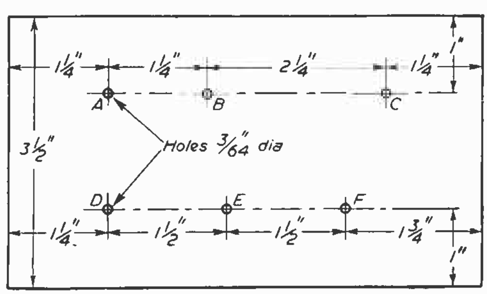



Fig. 3.—Marking out the board.

coils will be given and of an alignment method. It should be noted that in this case screening of the whole unit will probably be required.

### *Construction*

The copper-clad boards supplied with the 'do-it-yourself' kit measure about 3½in. x 6in. and this is a convenient size to use. The first thing to do is to clean the board with kitchen scouring powder, so that the copper is clean and bright. Then a line is drawn with a soft pencil 1in. from each long edge of the board, right across it. Marking out and drilling is then completed as in Fig. 3.

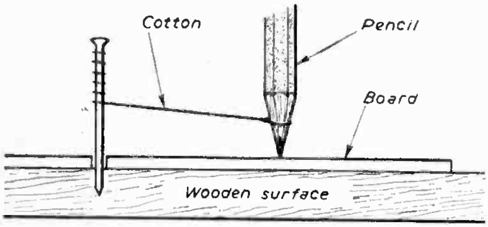



**Fig. 4.—Marking out the coils.**

A brass pin of normal size (1in. long) is required, and it should be examined under a hand lens to ensure that its diameter is just a shade under 1/32in. (i.e. 22s.w.g.).

A length of No. 40 Machine Twist is attached to this pin by a knot and is secured to the metal firmly with a touch of waterproof cement. When this is thoroughly dry the cotton is cut off to a length of about 2in. and a small loop about ⅛in. diameter is tied at the end, to take a pencil point.

### *Marking the Coils*

The copper-clad board, drilled with holes as shown in Fig. 3 is placed on a wooden surface. The pin with cotton attached is pushed through a hole into the wood so that it is firmly held. A soft (4B) pencil point is put through the prepared loop in the cotton and marking off the coil can begin. The idea is to keep the cotton uniformly tight while winding it on to the pin, meanwhile marking out the coil. The winding-up is done until the pencil point comes to within about ⅛in. of the pin and the end of the coil is fashioned as shown in Fig. 5, so as to obtain a definite point where the coil begins. Counting from the centre the turns for each coil are as follows:—

| Coil Centre | No. of Turns | Approximate maximum outer diameter |
|---|---|---|
| A | 4½ | 0·65in. |
| B | 4¼ | 0·6in. |
| C | 4¾ | 0·675in. |
| D | 5 | 0·7in. |
| E | 4⅓ | 0·65in. |
| F | 4 | 0·6in. |

The figures for the outer diameter are given to afford a check on the dimensions of the spiral; if markedly more or less than this, a pin of different diameter or other cotton should be chosen.

### *"Resist" Paint*

When the spiral coils are marked in pencil they have to be covered with the 'resist ink', which consists of black cellulose paint. With care, and the use of a fine brush, a steady enough line can be painted over the top of the pencil line already marked out. The thickness of the paint line is so arranged as to give, roughly, a spacing between turns equal to the width of the line, or a little over.

When dry, the paint line can be tidied up with the point of a penknife blade if any major inaccuracies have occurred in drawing. More of the copper is now covered with the cellulose paint so that not only is there sufficient copper left, after etching, to give low R.F. resistance to the 'chassis' but also some screening is afforded between coils. Reference to the illustration will indicate the sort of result to be achieved. It is advisable at this stage also to allow for holes to be etched to take coaxial sockets for input and output. The 'chassis' must not be brought too close to the coils.

### *Cleaning*

When the board is completely dry and the paint hard it should be washed thoroughly in hot detergent solution. Grease from the fingers may otherwise cause uneven etching. It is then placed in the etching solution, which is a strong solution of ferric chloride in water, and after about half an hour the copper not covered by the 'resist' will have been etched away.

The cellulose paint can now be scrubbed off with kitchen scouring powder. Cellulose 'thinners' are unnecessary for a small job like this, and are very dangerous if inhalation of the vapour occurs. For best results at this stage the remaining copper should be silver-plated. Methods of doing this have been published in PRACTICAL TELEVISION.

### *Other Components*

The capacitors used may be ceramic or silver-mica. The important thing is that they should be of 5 per cent. tolerance or better. Best results will be achieved if facilities exist for accurate capacitance measurement, when values can be selected from the constructor's stock to the nearest 1 per cent. The difficulty exists that the edge of the pass band is very close to the sound frequency of Channel 1, and so London viewers may find that some attenuation of 41·5Mc/s occurs, unless care is taken in selecting capacitances. If this happens, C2 and C3 should be varied a little each way (say 3 to 5pF) until the desired attenuation characteristic is achieved. The illustration of the reverse side of the unit shows how in the prototype series or parallel connection of capacitors is used—this was because higher accuracy was thus obtainable. The characteristic obtained with the prototype is shown in Fig. 6, and it will be seen from this that the usual I.F. range of 34-49Mc/s is severely attenuated.

Even this filter gives no protection against 'image' (second-channel) interference which may occur by picking up the radiation from FM receiver oscillators. Only reasonably good selectivity ahead of the I.F. amplifier can prevent this. An interference signal within a megacycle or two of the desired signal is likewise not affected except that Channel I viewers see and hear no trace of signals below about 40Mc/s.

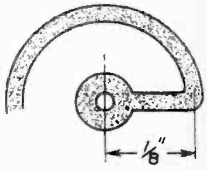



**Fig. 5.—Details of the coil centres.**

### *The Filter using Conventional Coils*

For those who prefer to make up the unit using conventional coils, the following notes will be useful.

All coils except L3 (which has 4 turns) consist of 3½ turns of 30s.w.g. enamelled copper wire, close wound on a former ¼in. in diameter. A VHF type (purple-coded) iron dust slug is provided for each.

To set the coils to the required inductance by adjustment of the core, a 100pF capacitor (1 or 2per cent accuracy) is placed across the probe terminals of a valve voltmeter. Using the shortest possible connector leads the valve voltmeter is attached across each inductance in turn. A signal generator is coupled very loosely indeed to each coil—the 'high output' terminal is best used if one is provided, and a short lead from it put 2 or 3in. away from the coil concerned.

The signal generator is set to the appropriate frequency, from the following table, and the core of the inductance in question is adjusted to resonance. This is repeated for each coil in turn, and on completion the unit is ready for use as soon as connections have been soldered up.

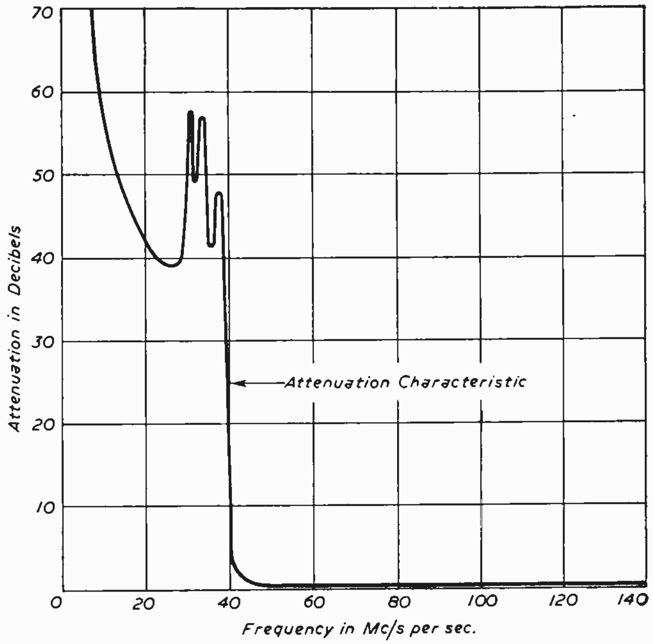



**Fig. 6.—The attenuation characteristic of the filter.**

**TABLE OF FREQUENCIES**

(loading capacitance of 100pF)

| | |
|---|---|
| L1 0·263μH—31·1Mc/s | L2 0·185μH—37·0Mc/s |
| L3 0·345μH—27·0Mc/s | L4 0·242μH—32·2Mc/s |
| L5 0·193μH—36·25Mc/s | L6 0·280μH—30·0Mc/s |

It should be noted that the filter must be connected as near as possible to the input socket of the receiver. Its efficiency if used properly is very great, but if a long length of coaxial cable joins the unit to the receiver unwanted signals can be picked up on this length and fed straight into the receiver.

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## SERVICING TELEVISION RECEIVERS

*(Continued from page 400)*

trimmers have a chassis contact, however, and extra connections should not be made until the circuit is checked.

### *Fitting a Turret Tuner to Band I Models*

When it is desired to fit a tuner unit, the possibility of using V2 as an additional I.F. amplifier may be considered as this system bestows a useful extra gain which in some areas may be essential. The majority of tuners have a two-plug system; an R.F. plug to replace V1 and an I.F. plug or adaptor to replace V2. It is not difficult to rearrange the wiring so that all tuner connections are made to the R.F. plug, thereby enabling V2 to be retained. To do this, proceed as follows: disconnect V2 base pins 1 and 3 from chassis and connect a lead from these pins to the corresponding pins on the base of V1 (or take to chassis through a 150Ω resistor shunted by a 0·005μF capacitor). Disconnect pins 2 and 8. Connect a 100Ω resistor from pin 2 to chassis (pin 6 or 9). Connect a 100k resistor from H.T. to pin 8 with a 0·005μF to chassis. Disconnect pin 7 of V1 base and wire a lead from this pin to pin 2 of the V2 base. Now rewire the R.F. plug as follows: H.T. to pin 8 (i.e. H.T. supply lead to tuner is derived from pin 8 of the R.F. plug); tuner heater leads to pins 4 and 5 removing the link if fitted; I.F. output (coaxial), inner to pin 7, outer to pin 6 or 9.

If a gain control lead is fitted (white) to pin 1 or 3 do not alter it but if pins 1 and 3 of V2 base have been connected to the corresponding pins of the V1 base, short the 82Ω resistors (2) to prevent feedback (these resistors are not decoupled).

The voltage (mains) adjustment carousel should be rotated to the next lower position to provide the extra heater current. The tuner requires 16V and as only V1 has been removed this leaves approximately 12V "to find".

# A Remote Controller

## SIMPLE VOLUME AND MAINS CONTROL

By M. James

THIS remote controller was originally built for a television in the author's bedroom, where it was felt that a means was needed to control the sound level and "on/off" switch from the viewing position in bed. It could, however, be installed in any room and would greatly benefit cripples and the disabled.

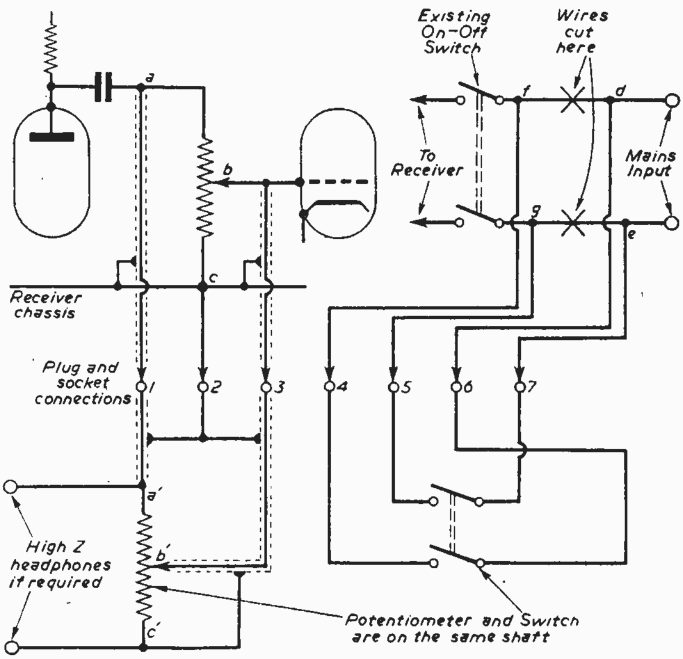



Fig. 1.—The circuit diagram.

### The Circuit

The volume control on most receivers is as shown in the diagram, with the signal level on the control grid of the valve being varied by means of a potentiometer, earthed at one end, and connected, via a condenser, to the anode of the preceding valve. The controller consists of a potentiometer of the same value as that in the receiver, connected (via the screened cable) in parallel with the original volume control, and a switch in series with the receiver on/off switch.

### Construction

First the volume and on/off control is located in the receiver, and the circuitry around the former checked to make sure it is as described above. An octal socket is then mounted at a suitable place on the back of the receiver, so that the remote controller can be detached when not required.

Two screened wires are then taken from points (a) and (b) to pins 1 and 3 on the socket, while the outer screening is connected to pin 2. Next, the mains wire is cut just before the switch, and wires are run from (d) and (e) to pins 6 and 7 respectively. From (f) and (g) wires are taken to pins 4 and 5.

To make the connection between the receiver and remote controller, any type of cable may be used, provided that the leads carrying any signal are adequately screened. In the original, the author used a five core cable, with one lead screened and a length of television coaxial cable.

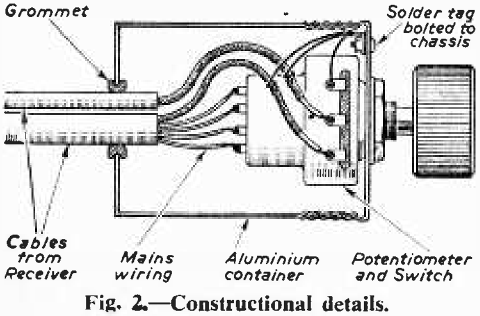



Fig. 2.—Constructional details.

The appropriate connections are made with the cable to an octal plug, and it is better if a method of gripping the cable is employed to remove strain from the actual joints. Also the wires should be colour coded.

To house the combined volume on/off switch for the controller, a small aluminium container (originally purchased filled with tablets) measuring 2in. x 1½in. was used. This provided screening for the whole assembly and is easily held in the hand.

A fairly large hole is drilled, or cut in the bottom of the container and fitted with a rubber grommet to allow access for the cable, and the volume control is fitted in the centre of the lid. The wires are then brought in through the bottom, and connections are made to the potentiometer and switch; point (a) going to (a') etc., also a solder tag is bolted to the side of the container and a wire taken from it to the outer screening of the signal leads. Check the wiring, screw down the lid and seal it if necessary, and fit a knob to the shaft, and the controller is ready for use, after plugging in at the back of the receiver. If it is required to remove the controller, a plug should be fitted instead, with the pins to the mains switch shorted out.

The on/off switch on the receiver should be in the "on" position, and the volume control at about its mid-point. The set can then be switched on, or off, and its volume varied from the viewing position.

*If the receiver is of the A.C./D.C. type, where the chassis is connected to one side of the mains supply, it should be made certain before operating the controller, that the chassis is not live.*

# Measuring Low Resistance

## PRINCIPLES AND PRACTICAL CIRCUITS

By J. S. Kendall

THE measurement of values of resistance of the order of 1Ω with any degree of accuracy is a problem unless special instruments are available. Stray resistance becomes very important—for example a pair of leads can measure 0·01Ω. This resistance can be neglected when making measurements of the order of 10Ω but 0·01Ω is 1 per cent of 1Ω and 10 per cent of 0·1Ω and therefore when making measurements of very low resistance the error introduced by lead resistance may not be neglected. In fact, it may be necessary to deduct the lead resistance from the final reading.

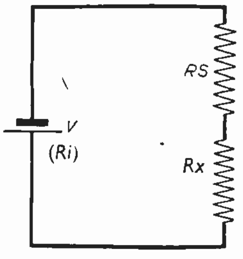


Fig. 1.—Series circuit.

### *Principles*

A basic method of measuring the resistance of a coil is shown in Fig. 1. Rs is a known standard resistor and Rx is the unknown resistor. The circuit therefore is of the simple series type with the same current flowing through Rs, Rx and Ri which represents the internal resistance of the battery.

Let the current in the circuit be Ia. Therefore applying Ohm's Law to Rs.

$I = Ers/Rs$

where Ers is the P.D. across Rs.

Applying Ohms Law to Rx,

$I = Erx/Rx$.

where Erx is the P.D. across Rx

Therefore $Ers/Rs = Erx/Rx$

Therefore $Rx = \frac{Rs \times Erx}{Ers}$

For clarity, suppose a coil were being measured. The standard resistance used is 3Ω, the voltage across the standard is 2·1 and that across the coil is 0·8. Then from the formula given above

$Rx = \frac{3 \times 0{\cdot}8}{2{\cdot}1} = \frac{24}{21} = 1\ 1/7$

We must now determine the accuracy of the reading. If the lead joining the standard resistance to the coil were included in the circuit across which the voltage drops were measured, then the reading will be inaccurate. The accuracy of the standard resistor must also be considered; it may be a 1 per cent type which means that its actual value is within ± 1 per cent of the value printed on it. The meter reading may be within ± 3 per cent. These errors may be considered negligible, but if the resistor was, say, a 5 per cent type the total error might be as much as ± 8 per cent. For coils and the like, a reading correct within 10 per cent is adequate but, on the other hand, if the resistor was intended for use as a shunt on a meter, a more accurate reading would have to be made. Two or three sets of different readings could be taken with different standards, each as accurate as possible, and the arithmetical mean or average value calculated.

### *Parts*

After considering the basic principles involved in the measurement of low resistance, we may now consider the design of a suitable unit. Three good quality parts are required, which should not be obtained from the junk box: a set of three standard resistors (1, 3 and 10Ω); the wafer switch, which must have a very low, and constant, contact resistance and the terminals. It is likely that a double-pole, double-throw toggle switch of good quality is available, but it should be checked that the contact resistance is low and does not vary at all. The terminals are difficult to clean but when once in use will maintain a low contact resistance to the wires but only as long as they are not moved. New terminals have low resistance and therefore require no cleaning before use.

The mounting of the parts can be left to the constructor, and most parts can be fixed to a suitable panel, the material of which is not at all critical. The toggle switch should have solder tags, not terminals, and then the three standard resistors can be wired between the tags of the wafer switch and the appropriate tag of the toggle switch. The lead from the battery is also taken direct to this same solder tag. The housing can be made to suit the panel or the panel to suit the housing. A suitable container may be made from a cigar box, if available, or a metal box.

For general use, the resistors can be 1, 3 and 10Ω. Other values can be chosen, but it is not recommended that a standard of more than 100Ω be used, in which case a set of five standards is recommended: 1, 3, 10, 30 and 100Ω. The tolerance should be 1 per cent.

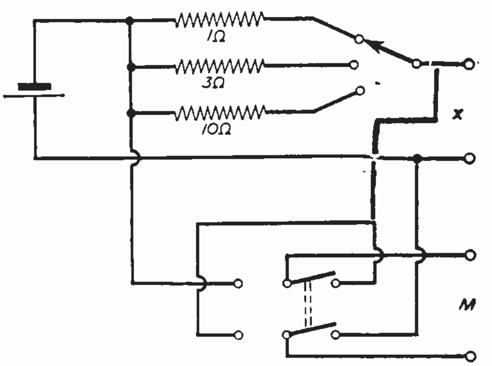


Fig. 2.—A practical circuit.

### *Lead Resistance*

Lead errors should be taken into consideration if necessary. The resistance may be measured directly by shorting the leads together at their far end and the value measured may be deducted from the final measurement.

If a direct reading meter is preferred, a simple unit may be constructed, provided that a sensitive meter of 1mA f.s.d. is available (or any meter of 10Ω or higher internal resistance with an f.s.d. of 0·1mA or lower). For example, of a 10mA meter of exactly 10Ω resistance were available, this would be suitable but the 10Ω scale resistor (Fig. 4) would not be required. Again, a 10mA meter that could be made up to 10Ω would be suitable. On the other hand, matters would be simplified considerably if a meter of 100Ω and 1mA f.s.d. were available and it would be possible to obtain a more accurate overall standard for the 1Ω range. Of course, a 0·1mA meter of 1,000Ω would be even better—and more costly.

If a 10Ω meter were used a 1·1Ω resistor would have to be obtained for the 1Ω range. Such a value is more difficult to obtain than a 1Ω standard. The parts of these meters are specialised but generally dealers are willing to order them or they may be purchased direct by post.

### *Final Circuit*

In the circuit in Fig. 3, as in the circuit in Fig. 1, the current throughout the circuit is the same, but the total meter deflection will depend on the setting of the variable resistor Rv. In use, this is adjusted so that the meter reads full scale deflection. Any resistor which is then placed across the "unknown" terminals is then in parallel with the meter and will shunt away part of the current, e.g. if the standard resistance is 10Ω and a 10Ω resistor is placed in circuit across the terminals, then the meter reading will drop by a half. A meter having a long scale may be calibrated to give more readings than a small one but it is not recommended that too many points be drawn on the scale or it will be too crowded. Values between calibration marks can be estimated by eye. The centre of the scale will be open, half deflection being given by a resistor equal to the standard. Rs in parallel with the meter forms the standard, usually 10 or 1Ω. Note that they form these resistances in parallel, so that both must be higher than these values, unless one is so high that it can be ignored, e.g. a meter of 1,000Ω can be ignored as it would only cause less than 1 per cent error with a 10Ω resistor in parallel, and under 0·1 per cent error with a 1Ω resistor in parallel. If the meter is of 10Ω, then the resistance for the 10Ω range would have to be ignored. Again with a meter of 100Ω, the standard in parallel for the 10Ω range would be 11Ω and for the 1Ω range the error owing to the meter could be ignored as it would not exceed 1 per cent.

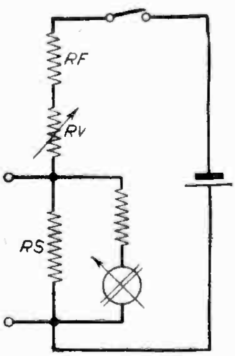



**Fig. 3.—Principle of "shunt" type meter.**

Do not be tempted to calibrate to a very high accuracy—1 per cent deflection is 1/1000 of the standard; 9 per cent is 1/10; 91 per cent is ten times and 99 per cent is 100 times. If possible should be used for calibration. It is best to calibrate the higher scale and assume that the lower would follow the same markings.

### *Batteries*

The instrument will draw a maximum current of some 100mA so that the batteries do not need to be large in capacity. The voltage should be about 4½ although a 6V battery may be used to allow for a deterioration of 2V which may be eliminated

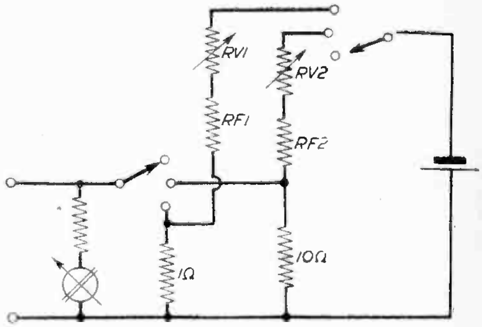
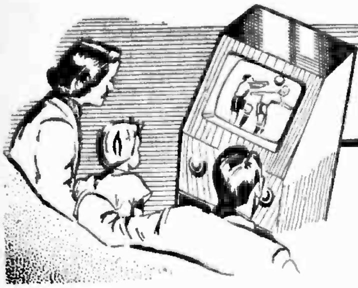



**Fig. 4.—Final circuit developed from Fig. 3.**

by the use of Rv1 and Rv2. For the 1Ω range a 20Ω variable may be used, and for the 10Ω range a variable of about 200Ω. These values are not critical and even values of 50Ω and 500Ω would be suitable. The remainder of the required resistance is made up by the fixed resistors Rf1 and Rf2 which should be calculated to be about 20 per cent higher than the resistance which is required with the full 20Ω or 200Ω in circuit. Never rely on the variable resistance alone for the full resistance of the circuit or the meter may be burnt out when adjustments are made. When a 4·5V battery is used the values would be 30Ω and 300Ω: for a 6V battery 50Ω and 500Ω would serve. For convenience of purchase, preferred values must be used and not those calculated. Thus, resistors of 33Ω and 330Ω for the 4·5V battery (47Ω or 470Ω for 6V) would be required with a tolerance of 2( or 10 per cent. The resistor should have a rating of 2W to avoid drift in resistance value while the meter is being used.

The lead resistance may have to be taken into account and can be measured direct by shorting the leads together and the value deducted from a total resistance reading.



# UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

**By Iconos**

### *Off-Beat*

THERE is plenty of publicity for teenagers these days. They are the pampered class, the target of novelists, newspapers, playwrights, film producers and television—especially television. I do not say that television exactly glorifies them—indeed, both BBC and ITV take pride in seeking out the most unsavoury teenage boys and girls and encouraging them to reveal their way of life *ad nauseum*. There are plenty of normal and healthy teenagers. But I suppose these normals are "squares" and therefore undramatic in the eyes of some of the crew-cut TV producers. Residents of Brighton were embarrassed by A.R's *Living for Kicks*, a skilfully-made documentary programme with Daniel Farson as interviewer. This was scarcely the right material for family circle viewing! This feature probably obtained good TAM ratings and therefore more stones will be pulled back in more towns to reveal the lower form of insect and human life. Unsavoury subjects at the theatre, music hall and cinema attract large audiences—but of a type that is transient. The displacement of these places of entertainment by supermarkets in many towns is an inevitable consequence. Let us hope that the BBC and ITA do not fall into the same trap. It would take very large supermarkets to displace Lime Grove and Wembley TV studios!

### *Colour TV*

COLOUR TV! The very mention of it sends an apprehensive shudder down the backs of the members of the appropriate Committees of the Government, BBC, television contractors and other interested parties. Colour TV has been a niggling ache to them, and it is getting worse. Even after its introduction, troubles are bound to persist for a long time. Sooner or later, someone will have to make a decision on when it will be introduced, and what system of transmission will be used at the studios, transmitters and receivers. The BBC have been carrying out practical tests for some time at very great cost but with encouraging results. There are two or three colour systems which fulfil the requisites of the American N.T.S.C. standards. Demonstrations have been excellent—it makes black and white television flat and uninteresting by comparison. However, the increased costs of all transmission and receiving equipment, its maintenance and operation and finally, the large increase in scenic costume and similar costs, all mount up to delay the taking of decisions. How bitterly many British manufacturers and others regret the hasty re-adoption of the 405 line standard after the war! Just a little delay and some trivial compensation for pre-war TV set owners who could prove that their sets still worked, would have enabled a fresh start to be made—possibly on 625 lines. However, that is all over and done with—but nobody wants a repetition of this kind of mistake when colour is introduced.

### *Three-colour or Two-colour TV?*

MOST modern systems of colour photography are based on a combination of three colours—yellow, cyan (a shade of blue-green) and magenta. With films or still transparencies, these three primary colour components of a scene are filtered into their respective photographic emulsions if three separate negatives are used (as in the original Technicolor 3-strip system) or self-filtered in three layers of photographic emulsion on the same base (as with Eastman Colour). A

**Francis Coudrill operates "Hank", his puppet, and his 16mm sound and picture camera for a TV feature.**

similar kind of filtering is necessary in colour television. For really acceptable results on a large cinema screen, a three-colour system is considered to be essential for films: although quite good results have been obtained on film with two-colour processes by Technicolor — comparatively recent improvements upon the earlier two-colour systems of Prizmacolor, Kinemacolor and others. Of course, the fidelity of a two-colour system is less than those using three colours, but the costs and complications are very considerably reduced. The BBC are reputed to be experimenting with a two-colour system. If they find just the right combination of filters which will give reasonably consistent results without too much degradation, they might have a solution which is within the financial resources of TV programme companies and individual viewers. Three-colour TV costs more than three times black-and-white TV at both receiving and transmitting ends. Those who doubt the potentialities of a two-colour system should take a look at some of the excellent results attained with the earliest Technicolor films. A two-colour system was used by Technicolor more recently on the Olympic Games film made at Wembley about eight years ago.

### *"China Doll"*

The steadily increasing skill of ABC-TV's production department and technicians becomes apparent with every play in their *Armchair Theatre* series. Many of them are now produced and recorded on Ampex tape at ABC's new production centre at Teddington. Glossy technical qualities, first-rate lighting, imaginative set designs and first-class direction are their characteristics. It is a pity that the plays themselves sometimes fall below these high standards. *China Doll*, for instance, was a beautifully acted, superbly directed production of a dreary story about a middle-aged wife, neglected by her husband, who falls in love with a young, good-looking car salesman. The wife was very well played by Ursula Howells, who has not been seen on television for some time. Hugh Burden was the harassed husband, and Tom Gerard, a newcomer in his second TV play, was convincing as the handsome salesman. But, like many other recent plays on both BBC and ITV channels, it was a pretty dreary and depressing affair. Almost the same remarks applied to the BBC's production of *The Fanatics*, Miles Malleson's play of the roaring twenties. The transmission of this play, which attracted and shocked large theatre audiences of that period, is now calmly put on in a Sunday evening programme by the BBC. The high technical qualities in this case can be credited to the BBC's Birmingham studio, with production by Terence Dudley.

### *Master Controls*

How complicated can master control systems become ? There seems to be no limit. TWW is now operating a small temporary local news and interview studio in Bristol, the vision output of which can be injected into the coaxial line bringing the network programmes from London to TWW's master control at the Pontcanna Studios, Cardiff. This can be operated by remote control in Cardiff. The same will apply for the output from the very large stage now being built by TWW at Bristol. The programme switching in Anglia's beautifully engineered master control at Norwich is now automatically carried out by a steadily-moving punched tape. The output of the new Southern Television Studio at Dover is sent via London to Southampton Master Control, where it is switched into the local and network programmes and sent back to the Dover ITA transmitter as well as Chillerton Down transmitter. The Dover Studio picture therefore travels over 400 miles of coaxial lines and radio links to get to its local transmitter, five or six miles distant!

### *Hancock Back Again*

Tony Hancock and Sydney James, their writers, Ray Galton and Alan Simpson, and their producer, Duncan Wood, have set such a high standard of character comedy entertainment that it must be difficult to maintain the pace and quality. The new series of *Hancock's Half Hour* began with an amusing little story of Hancock's cold in the head that was good but not quite up to form. The second episode, the adventures of the lugubrious Tony in the East Cheam Public library, was right back in top class again. Magnetic Videotape recording was used, which seemed to give better photographic qualities than previous episodes. The Crazy Gang returned to *Sunday Night at the London Palladium* — to the theatre where they first teamed up 28 years ago. Their united ages are said to add up to an astronomical figure, but the rather unkind camera work and lighting seemed to multiply that figure by two! Nevertheless, their robust humour provoked a lot of laughs and Bud Flanagan, the star clown, was in very good form.

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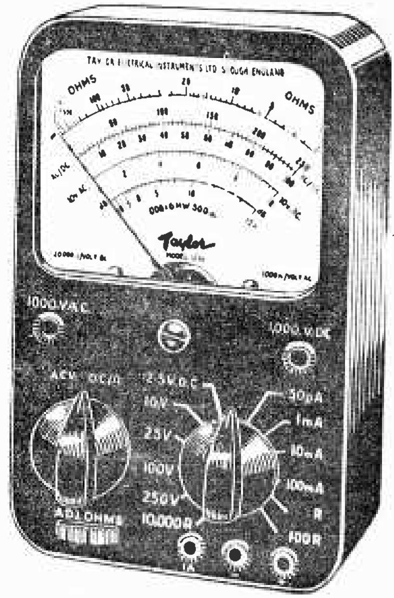


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# An important announcement for users of Mullard products

On the 19th January 1960 injunctions were granted by the High Court of Justice, Chancery Division, to Mullard Ltd. restraining Bentley Acoustic Corporation Ltd. from:

1 **Infringing the "Mullard" trade mark.**

2 **Passing off as valves of Mullard Ltd., valves not manufactured by Mullard Ltd.**

3 **Selling or offering for sale in connection with the "Mullard" name, valves not manufactured by Mullard Ltd.**

4 **Applying the "Mullard" name to valves so as to pass off inferior valves as of the quality marketed by Mullard Ltd. under the "Mullard" trade mark.**

Bentley Acoustic Corporation Ltd. were also ordered to pay agreed sums in respect of damages and **costs.**

*This action was brought by Mullard Ltd. in the interests of the users of their products, and the Company wish to give notice that it is their intention to take action against any persons or companies who infringe their trade marks.*

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# Trade News

## NEW PRODUCTS AND DEVELOPMENTS

### *AERIALS*

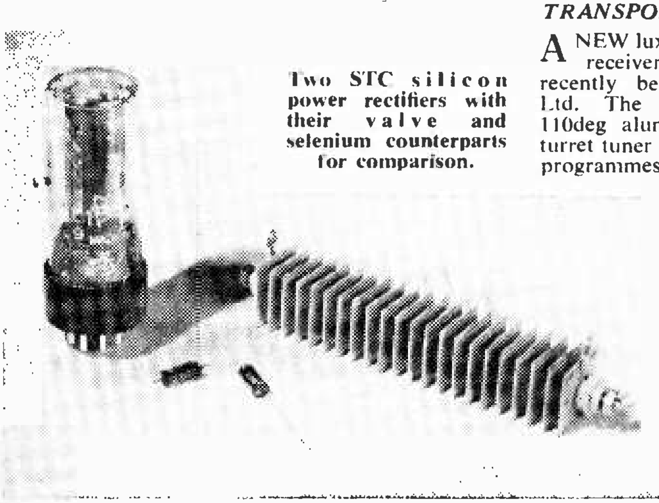
TWO new television aerials have been introduced by Wolsey Electronics Ltd. They are the Wolsey Loft Twin Super and the Wolsey Straight Three. The first is basically the same as the Twin Super Room Model but plastic covering is not used and a new type of rigid locking multi-plane ball joint has been affixed to the base. The Straight Three has a conventional Band I three element design. It is of standard gauge and quality and not a junior or light weight model. *(Wolsey Electronics Ltd., Cray Avenue, St. Mary Cray, Orpington, Kent.)*

### *TWO NEW TV SETS*

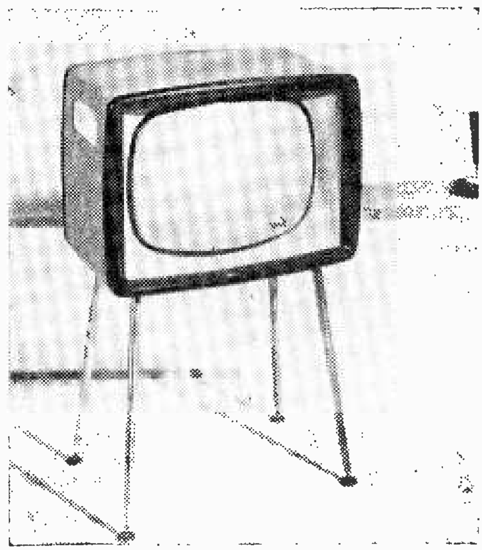
TWO new television receivers have been introduced by Stella Radio and Television Co. Ltd. They are the ST. 1017U 17in. and the ST. 1011U 21in. both fitted with a 110deg cathode ray tube and selling at 64 guineas and 79 guineas (tax paid) respectively. There is also a fringe version (ST. 2017U) of the 17in. set which sells at 68 guineas (tax paid). In both models the controls are set in a recessed side panel. The speaker at the opposite side of the set, also recessed, is conveniently angled towards the viewer. These two recesses make excellent hand-holds for carrying the receiver from room to room. A highlight of both models is a push-button on/off switch which enables the volume control to be pre-set. *(Stella Radio and Television Co., Ltd., Astra House, 121-123 Shaftesbury Avenue, London, W.C.2.)*

### *STC SILICON RECTIFIERS*

A NEW SenTerCel rectifier for the television industry has now been introduced by Standard Telephones and Cables Limited. Produced on specially-designed plant at the Company's Rectifier Division at Harlow, the new unit may be used to replace the valve and the selenium rectifier from the high tension supply circuits of all TV receivers. Known as the FST1/4, the unit is a silicon semiconductor type with properties which make it especially suitable for compact receivers incorporating 110deg deflection cathode ray tubes. Two of the FST1/4 silicon rectifiers are necessary on 200/240V mains. For further information write to *Standard Telephones and Cables Ltd., Connaught House, Aldwych, London, W.C.2.*



**Two STC silicon power rectifiers with their valve and selenium counterparts for comparison.**



**The Dynatron "Envoy" Model TV45.**

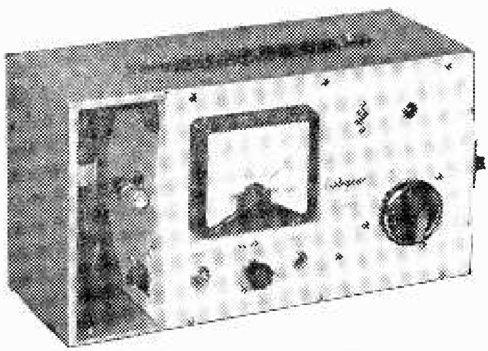
### *TRANSPORTABLE TV*

A NEW luxury styled 17in. transportable television receiver, to be known as the "Envoy", has recently been announced by Dynatron Radio Ltd. The Envoy incorporates a new 17in. 110deg aluminised tube. It has a 12 position turret tuner with coils fitted to cover ITA and BBC programmes, appropriate to the area in which the receiver is likely to be used. All 12 positions on the turret can be pre-tuned to cover any of the 13 channels which are allocated to television. Highly sensitive circuits counteract fading and, in areas of good reception, a telescopic aerial is provided as an optional extra. Frame fly-back suppression is provided to give increased latitude in the adjustment of viewing controls. An adjustable vision interference limiter prevents interference pulses exceeding peak white level on the screen. High quality sound is obtained by the use of two side-facing 7in. x 4in. elliptical loudspeakers.

Two versions of the Envoy are available: Model TV45 for use in good reception areas, price 68 guineas; and Model TV45F which incorporates fly-wheel synchronisation for use in fringe areas. Both versions are housed in a wooden cabinet covered in pig-skin vynide, which is washable and highly durable. *(Dynatron Radio Ltd., Maidenhead, Berks.)*

### *LABGEAR INSTRUMENT*

THE Labgear Signal Strength Meter now includes Bands I, II and III having a frequency range covering channels 1-5, 8-12 and FM. Another



**The Labgear Signal Strength Meter.**

feature is a 4in. meter on which the signal intensity is directly calibrated. A 20dB attenuator pad is also supplied which, when fitted, multiplies the scale reading by 10 times so giving a coverage of from 10$\mu$V to 10mV. *(Labgear Ltd., Willow Place, Cambridge.)*

### *SCREWDRIVERS*

A NEW leaflet entitled " Screwdriver Know-how " has been produced by Stanley Works (G.B.) Ltd., and is designed for the general user and contains illustrated notes on the choice, use and care of screwdrivers. The full range of Stanley screwdrivers is described and a table of correct drilling sizes for holes for wood screws is also included. Inquiries should be made to the *Home Sales Department, Stanley Works (G.B.) Ltd., Rutland Road, Sheffield 3.*

### *INDICATOR LAMPS*

AN illustrated leaflet describing new types of " Acru " neon indicator lamps is now available. The lamps illustrated include types for M.E.S., M.C.C., S.B.C. and S.E.S. fittings. Festoon lamps are also produced which have low striking voltages. Certain of the lamps are available in fluorescent green as well as neon. Such devices form ideal indicator lamps for home-constructed electronic equipment and have the advantage of being economical in power consumption. Some types also give an indication of the applied voltage. The leaflet is available from *The Acru Electric Tool Manufacturing Co. Ltd., Demmings Road, Councillor Lane, Cheadle, Cheshire.*

### *HEATHKIT CATALOGUE*

THE latest catalogue produced by Daystrom Ltd. includes eight new kits. Copies of the catalogue may be obtained from *Daystrom Ltd., Gloucester.*

## VALVE TESTER

*(Continued from page 403)*

set anode switch to position 1 and cathode switch to position 1 when the neon lamp should light. Then check the rest of the switch positions to make sure that the markings on the switches correspond with the valve pin positions. If possible use old valves to check that all circuits are working properly before using the tester normally. For all diodes, use S2 and position 6 and the meter should read about 3mA for full emission. Rectifiers use position 4 when the meter should read about 11mA. All valves are listed in a separate sheet giving switch positions and emission readings. For heater/cathode shorts the switch S9 is put to position 2 when no reading on the meter indicates no short. Cathode ray tubes can also be checked by making up an adaptor as shown in Fig. 8 using a 5 pin plug and plugging into the British 5 pin base on the tester, the other end of the lead connects to 12 pin CRT holder.

In operating the tester always put the switches to "off" when finishing especially the heater switches, and check the various switches after setting them before switching on the mains switch to ensure the correct voltages are applied to the heaters.

## TELEVISION TURNTABLE

*(Continued from page 408)*

M.S. tube (k) was used under the lower angle bracket to gain the correct clearance between the doors and the frame. The cover (h) was made from oak-faced ply and covers the aerial and electricity supply. These were brought down the wall and in through the slot in part (i).

The brick work was removed carefully and a lintel 5in. x 4in. fitted with wall plates as shown in Fig. 3. The framework of 5in x 2in. timber was assembled and at the same time the hinge pin, plates and hinge brackets, and spacer tube were fitted.

After cementing the gaps and plastering completed an architrave as on door of the room was fitted.

The turntable should be assembled in the framework before starting on the wall. Then, after fitting the framework to the wall, the turntable is reassembled.

To finish the turntable a clear varnish was used on the oak-faced ply, i.e. the insides of the doors and the table top. The reverse side of the doors and framework were painted to match the existing woodwork in each room.

# Letters to the Editor

*The Editor does not necessarily agree with the opinions expressed by his correspondents.*

***SPECIAL NOTE: Will readers please note that we are unable to supply Service Sheets or Circuits of ex-Government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.***

## *BARKHAUSEN EFFECT*

SIR,—I was interested to read in your March issue about a reader who had hum bars on his screen, as I have had a similar effect, but in my case on the vertical scan. I also have found it impossible to remove the trouble and wonder whether any reader has helped Mr. Baddely and would perhaps be able to help me. The effect is one which, I believe, has been termed the Barkhausen effect, but I am not sure about this. It gives rise to a series of dark parallel lines running straight up the screen, from one side of the picture to the other. There are about 10 of these lines, which my wife has described as "Regency stripes". I thought at first they might have been due to the lead from the sync separator to the tube base, and I accordingly made this of very thin wire, then a piece of coaxial, but to no avail. Can it be due to any internal scanning coil effect or defect? Perhaps I may have the assistance of some reader who has experienced a similar fault. — G. J. WILDF (Stanmore).

## *COLOUR TV*

SIR,—The idea mooted by one G. Humberston in a recent issue would, I feel sure, find a most ready market amongst the general public. I cannot agree with the editorial footnote to this reader's letter, that there are already enough controls to adjust. Some time ago I had the pleasure of visiting a television studio and was intrigued by a set which was being used for monitoring. This was provided with controls, not the least interesting of which were, I was informed, known as "shading controls". These appeared to darken or lighten the upper or lower sections of a picture, or the right or left as desired, and I have seen many transmissions at home on which I would have been glad to have the control at hand. I do not think there can be too many controls, although they should, in the main, be out of reach. How lucky is the viewer or experimenter who has these controls available, as many of the pictures may be improved by this means, and added to the colour arrangement referred to, I am sure would prove most valuable.—F. de CERE (Hounslow).

## *SAFE MODIFICATIONS*

SIR,—I was most interested in the information in your April issue, under the above heading, and in view of the recent excitement which has been caused in the paraffin fire world, I think it is high time a review was made of all domestic equipment which is on the market, and which is a source of danger. It is not the first time I have read of TV sets bursting into flames, or people being killed whilst using a set. The tests to be applied to paraffin heaters are to be revised, but the makers and others say that this is not really necessary, as they have been on the market for years and this hullabaloo has only just come up. The same could be said for TV and radio sets which have a 'live' chassis, etc. Surely, there must be some standard of safety which should be adhered to with any apparatus which is plugged into the mains, be it A.C. or D.C., and it should not be necessary for the user to have to think before he does anything with or to the set. I would suggest that the first and most important thing is that it should be made imperative for the set maker to fit a mains isolating transformer. I know this would not work with a D.C. set, but there are now so few areas with D.C. that this could be ignored.—I. COBB (Manchester).

## *VALVE TYPES*

SIR,—I recently wrote to you concerning a fault in my Sobell receiver, and you suggested that I had a certain valve checked as this was probably the cause of the trouble. I removed the back and looked for the valve only to find that there was no such type in the set. I went very carefully over the entire chassis and, not being an enthusiast with valve lists, I went to my dealer who had had the set before and asked him if he knew the valve you mentioned. He looked up a service manual and told me where to find the valve, but on looking there was another valve in this position. When I taxed him, he told me he looked up his records and the valve was the cause of the trouble originally and had been replaced, but as he did not have one of the originals in stock he had used a replacement from another maker. I am sure he did the right thing, but many readers may be faced with the same difficulty, and I think that where such substitutions are made the dealer would do well to pin a card inside the cabinet giving details of such a modification—the same as the Services do with their equipment. It would also be a good plan for the dealer or the owner to fit one of these cards and to record the dates of all servicing or other troubles.—F. J. RINGE (Hampstead).

# Your PROBLEMS Solved

*Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 440 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.*

### MARCONI VC152

**The picture on my 21in. set will not stop rolling and I lose about ⅛in. of the picture at the bottom. I do not have a service sheet for this set.—S. Stanray (Westcliff-on-Sea).**

Your letter indicates that the picture can be made to roll downwards or upwards with the hold control but cannot be locked. This indicates lack of sync pulses or at least weakened sync pulses. You should therefore suspect the interlace diode (small metal rectifier) associated with the LN152 (ECL80) frame timebase valve, also the shunt 2·2M resistor. The LN152 should also be replaced as this may be causing the cramping at the bottom. If you cannot obtain a service sheet for the VC152 from one of our advertisers, obtain a sheet on the VC69 DAM which applies except for the tube type and focus circuit.

### BUSH TV62

**The fault on my television set displays the following symptoms. No raster, no H.T. boost. The sound is normal and the line whistle can be heard. A ¼in. arc can be drawn from the EHT but it is not very "fat". The tube, AW36-21, and valves PL81, ECC82, PY81, EY86 and PY82 (2) all tested and found o.k. except that the rectifiers are down a little. I have a circuit of the timebase unit.—G. Kaye (Edgbaston, Birmingham).**

You do not say whether the EY86 lights up normally or not or whether the EHT was tested at the EY86 anode or the CRT cap. Also we are not sure of what is meant by H.T. boost. In view of this we would advise you to ensure first that the ion trap magnet is correctly aligned, that the EY86 does light up (if it does the boosted H.T. line must be in order). If it does not, remove the EHT clip from the CRT and note the effect. If the EY86 does not light up at all, check the 140pF width capacitor, the 3·3k resistor to pin 8 of the PL81 and the 1μF boost capacitor. Also check H.T. electrolytics.

### FERGUSON 988T

**Superimposed on the left hand side of the picture there appear three dark grey vertical lines each about ½in. wide and the same distance apart, which do not alter by any adjustment of the contrast control. The tube is a rebuilt one giving a very good picture in every other respect.—J. Taylor (Letchworth, Herts.).**

You should check the 0·01μF capacitor wired from pin 2 of the CRT base socket to chassis. This is probably open-circuited.

### G.E.C. TV1746

**The trouble on my set is sound on vision on Band I and Band III. I have tried the oscillator trimmer, etc., and also sound rejector on L22 but cannot remedy the fault. I have also tried attenuating the signal without result.—T. Pearson (Salford 6).**

You should first check the 16+32μF electrolytic capacitor which decouples the H.T. of the sound A.F. and output stages. If this is in order, check by shunting a test capacitor (say 16μF) across each tag to chassis in turn. Check the H.T. decoupling 0·001μF, and the decoupling capacitors generally. We assume the beehive type rotary capacitors in the centre of the I.F. chassis have not been disturbed.

### PHILIPS 1236U-15

**There is no EHT. The sound is good. I have had all the valves tested and they are O.K. I have had the EHT transformer out and it appears O.K. for continuity in the windings, the EY51 does not light up. I have tested the filament.—S. Pilling (Islington, N.7).**

You should not suspect the transformer at this stage. If the PY80 and PL81 valves are in order, check H.T. to pin 8 of the PL81 (assuming there is no line whistle at all). If there is no H.T. present, check 6·8k resistor from H.T. to line blocking oscillator transformer and continuity of this winding. If there is a line whistle suspect EY51, EHT smoothing capacitor (on other side of transformer—disconnect top end) or tube (remove anode clip from tube).

### ENGLISH ELECTRIC T30365

**This set is giving good sound and picture but when it has been on for any length of time the picture will fade out, sometimes returning of its own accord. If the picture does not return I turn the brightness control on the front of the set and the picture will be O.K. for half an hour or so, but eventually fade out again. Also when the picture is present there are wide shadow lines similar to a venetian blind moving up and down at the back of the picture. I have replaced PL83 but it has made no difference. The sound is perfect.—A. Harper (Pontypridd).**

You should check tuner valves PCC84 and PCF80 and the base connections of the EF80 valves. Also check the tuner switch contacts. The tube could be at fault, but this is less likely. The venetian blind effect is due to the reception of interfering signals, which the tuner is incapable of rejecting.

### ARGOSY 21K40

**My set, which is 18 months old, is needing constant adjustment of the line controls. The line**

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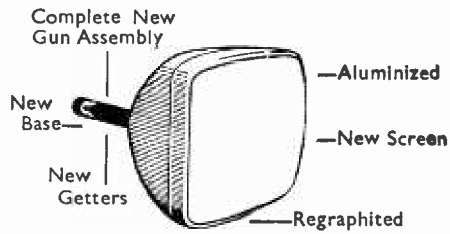


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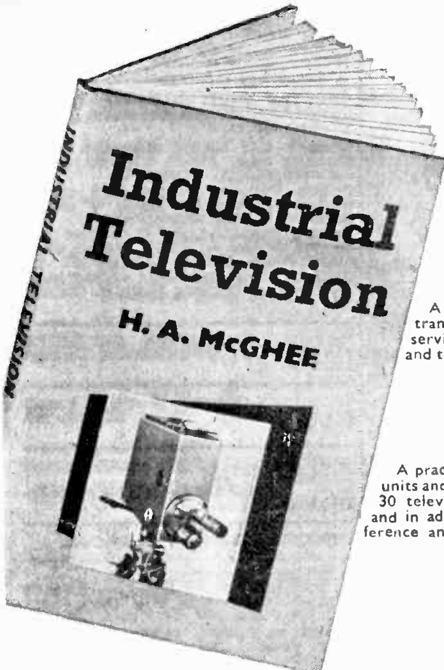


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**hold is very erratic, sometimes requiring many adjustments of the line hold control a dozen or so times during an evening and then it will hold good for several evenings with no bother. The picture is otherwise perfect. When it starts to slip, only the top third of the picture is affected and then after some seconds the whole picture has a shuttering effect with a change of line whistle which, if left, diminishes to a lower pitch in two or three stages till it is of very much lower frequency. I have tried substituting valves, sync separator, interlace diode, removing EHT connection with no effect. I have been wondering if it could be some of the smaller components associated with the valve V7B.—W. Barthwick (Liverpool 6).**

The 21K40 differs in many respects from the 17K40. The line oscillator, for example, is an ECC82 and it is this valve which should be replaced and whose associated components should be checked.

### *MURPHY V150/B*

**I recently acquired the above set on the understanding that the sound was working but no picture. When I first switched on there was good sound and a raster, but no picture. After about half an hour smoke came out of the back and the set completely cut out. I tried the set again the following evening—no smoke this time—but sound and raster are still working. — A. Anderson (Coventry, Warwicks.).**

Without some further details we cannot give a specific reply, but suggest you check for charred components around the base of the valves in the sound I.F. stage. Replace any resistors burned out and their decoupling condensers, and also check the valve concerned for inter-electrode shorts.

### *DOVER TRANSMITTER*

**I have a Band III convertor tuned to Channel 9 London ITV. Will this converter tune to the new Dover transmitter which opened in December? I was unable to pick up the low power transmissions which were radiated for tests, not even sound. A few people I know picked up these test transmissions with the aerial still pointed in the direction of the London transmitter. Will I have to alter the coils for reception?—F. W. Angus (Canterbury).**

You will have to unscrew the dust iron cores slightly to receive Channel 10, not however the I.F. output coil which remains tuned to the existing Band I channel. There is therefore three adjustments to make, the aerial, R.F. and oscillator coil cores, the latter, of course, being the most important and most critical.

### *STELLA ST6417U*

**The above set has run almost trouble free for 5 years, but as the tube was "low" I decided to renew it. My dealer supplied the MW43/69 instead of MW43/64 as he said it was a later tube and direct equivalent. Since fitting the tube the set suffers badly from a fault which did not exist before. Defocusing on peak white. When the contrast control is only slightly on it is a fair but "watery" picture. The slightest advance of the control makes peak white lettering, etc., blurred. As I assumed this was a tube fault I notified the dealer and he was good enough to let me try a further new tube, but with identical results. I have an average knowledge of television and have delved into all the accepted cures for this fault but have had no success. Valves replaced include EY51, PL81, PY81 and EF80 (video amp). I have noticed that some new sets display this fault but not quite so badly as mine.—S. H. Sedle (Kidderminster, Worcs.).**

We are inclined to suspect the video amplifier anode circuit decoupling capacitor which may well be open-circuited. The focus magnet may be defective but this is less likely.

### *AMBASSADOR TV5*

**I have been trying to repair the above set. There is no audible line whistle and no EHT. Before the screen went blank there were multiple horizontal pictures on it. I checked V14 20P1 by substitution with a known good valve. I renewed R79 and C56, checked R74, 76, 77, 78 and 83, C53, 54 and 55, had V15 U281 tested. I have finally renewed the line output transformer without much improvement. I have checked for line sync pulse at V11 anode with signal tracer and can hear it quite clearly. I checked C51 by substitution. The heater in the EY51 does glow faintly. I can draw a small spark from cathode and one about ¼in. long from anode. There is still no line whistle. The EY51 heater glows the most with R79 set at minimum resistance. All I can obtain on the screen is a round patch of light on the bottom half extending just above half way. The H.T. output from metal rectifier is 250V. I have part of the complete circuit in February 1957 issue. In the component values, R76 is 270k, but when I checked this I found it was a 27k. Is this the correct value? Disconnecting EHT lead from tube does not improve matters.—G. V. Walker (Bilston, Staffs.).**

We think that perhaps the insulation of the U281 heater winding on the mains transformer has partially broken down. Is it possible for you to check this witn a megger? R76 is 270Ω (not 270k or 27k). Try the effect of putting a 270Ω across the existing R76.

### *FERRANTI 17T6*

**At the moment there is a 6in. black band across the centre of the picture, with a loud hum on the sound and distortion. I have replaced ECL80 frame output valve without result, and also checked the tube for faults. The picture is normal except for the black bar. I have had trouble with the turret tuner, but believe this is in order. I have been unable to obtain a maintenance sheet.—R. Hartley (Romford).**

The fault is due to a heater-cathode short in the EF80 sound and vision I.F. amplifier (V3) next to the rear left side sensitivity control, or to a similar defect in the PCC84 tuner unit valve.

### *PETO SCOTT 1722*

**I have recently renewed the line output transformer and PY32 and EY86 valves but I am having trouble with EY80 repeatedly burning out. I have had three in three months. The first two were not new but the last was a new one. It lasted just four weeks.—C. Cooper (Basildon).**

Check the width control to see if this is working. If it is not, check it and the series 22pF (12kV) capacitor to the PY81 cathode. There is an EHT regulator (line drive) control which is a 100k variable with a 0·1μF capacitor wired across it (check both), also the 270pF to chassis in the PL81 control grid circuit.

### *ALBA 321*

**The picture on this set has failed completely and the EHT rectifier tends to light brighter than normal. I pushed a piece of cardboard between the earthing clip which earths the coating round the tube. This restored the brightness to the tube face in a rough way but could not resolve a picture but could still control its brightness strength by the contrast control.—J. Davis (Nottingham).**

We would advise you to replace the EY51 valve, restore the earthing clip and if the effect continues, suspect an internal short in the tube itself.

### *ULTRA N84*

**I believe this is a fringe model. I wish to fit a Cyldon tuner E/16/L but am not quite sure which valves to take out to plug in the tuner. Would it be in order to fix it to the chassis despite the maker's instructions to fit it to the cabinet?—H. Hall (Cheltenham, Glos.).**

There is no reason why the tuner should not directly connect to the chassis. In fact, it is essential for the two units to be well bonded together. The R.F. amplifier is the front left 6F1, the frequency changer is the second 6F1. The power plug of the Cyldon plugs into the R.F. socket, the I.F. plug into the frequency changer socket.

### *FERRANTI 14H3*

**The first problem is serious overheating of the line output valve PL81, which becomes almost red hot after a few minutes. When I remove anode cap of either PL81 or PY81 it cools immediately to normal. The EHT transformer had short to heater winding of EY51, but otherwise no faults, but I have ordered a new one.**

**Could you give me wiring details for transformer also which one of two leads on the transformer tag board should go to PL81 and PY81? There is also a frame fault, causing fold-over at bottom and loss of height; height control is at limit.—G. Callin (Stirlingshire, Scotland).**

Check 1·8kΩ resistor to pin 8 of the PL81. The heater winding of the EY51 could be hand wound with well-insulated wire, such as coaxial inner.

The L.O.T. should be numbered as follows: 6 to PL81 anode top cap; 5 to PY81 cathode top cap; 3 to scan coils, 0·5μF capacitor, 4·1MΩ resistor (to pin 10 of CRT), 15kΩ to 33kΩ (height circuit); 2 to resistors to horizontal holds; 1 to 22kΩ resistor to 4·7kΩ and PL81 control grid.

### *EKCO TP308*

**Can you tell me the cause of the screech on the tuner of the above set? The 30L1 and 30C1 have been substituted three times with brand new valves but this still persists. This happens after an hour or two.—V. Jeremy (Merthyr Tydfil).**

Sound I.F. instability is the usual cause of your trouble, and the makers' cure is to replace the 0·001μF which decouples the anode and screen of the 30F5, first sound I.F. valve. This component should be replaced by one of another type, but in exactly the same place.

### *INVICTA 120T*

**The line hold on this set has been giving me trouble for some time. The control is turned fully clockwise. Any heavy interference pulses, or change of programmes make the picture break up into horizontal lines. I have to disconnect the aerial and then replace it to obtain the picture.—F. R. Knight (Lowestoft, Suffolk).**

You will probably find that the ECL80 valve next to the line output section (just to the left of the tube) needs replacement. There is a preset horizontal hold beneath the chassis which could be reset, but replacement of the ECL80 will probably restore normal operation.

### *HMV 1814*

**Can an Emiscope 3/16in. tube be fitted to the above receiver? The original tube Emiscope 3/31 has worn out and I have the 3/16in. tube complete with scanning coils and focus assembly. How do I reduce the EHT to a suitable value for the 3/16in. tube?—W. G. Denny (Ashford, Kent).**

The EHT can be reduced by wiring a 0·001μF capacitor across the line scanning coils. This does however increase the width which may or may not be reduced by the width control. You may find it necessary to increase the resistance (94ohms) in the N152 (P181) cathode circuit (at present two 47ohm in series) to about 150ohms.

### *PETO SCOTT T124*

**With a turret tuner added, the sound is perfect on Band I and III but there is no picture. I have tested the tube in another set and it is all right. The line output valve EL38 was flashing over and eventually went o.c. I substituted a new one but, after a while, this began arcing internally. I wired another valve in place of EL38 without making anode connection but this one did not burn out. The line whistle could be heard very faintly. The EHT spark is very small, about 1/32in. Could you suggest what to test? I have circuit only but no values of components.—P. A. Skepper (St. Helens, Lancs.).**

The flashing in the EL38 probably denotes an internally shorted EY51 or a short associated with the line output transformer or scanning coils.

### *BUSH 24C*

**The width control is at maximum and the picture is about ½in. short of each side. The line linearity does not seem to work properly—H. Partridge (Cradley, Staffs.).**

The symptoms denote a failing valve. Check the PL81, the PY81 and the PY82 all on the left side of the main deck.

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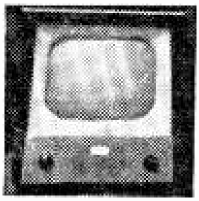

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| 6F6G | 7/6 | 12Q7 | 6/6 | EF92 | 5/6 | UCH42 | 10/6 |
| 6H6 | 3/6 | 35L6 | 9/6 | EL32 | 5/6 | UF41 | 9/6 |
| 6J5 | 5/6 | 35Z4 | 7/6 | EL84 | 8/6 | UL41 | 9/6 |
| 6J6 | 5/6 | 80 | 10/6 | EM81 | 9/6 | UY41 | 8/6 |
| 6J7G | 6/6 | 807 | 5/6 | EZ40 | 7/6 | U22 | 8/6 |
| 6K6GT | 6/6 | 954 | 1/6 | EZ80 | 7/6 | VR105 | 8/6 |
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**Argosy:** T3. **Decca:** D14. **Defiant:** TR1453T. **Regentone:** 14T. **RGD:** 6014T.

**Marconi:** VT63DA.

**Baird:** 2014, 2017, 2114, 2117.

**Cossor:** 930 & T, 931, 933-4-5, 937, 938 & A. & F. 939 & A & F, 943T, 946.

**H.M.V.** 1824 & A, 1825 & A, 1826 & A, 1827 & A, 1829 & A, 1865, 1869.

**Marconi:** VT68DA, VT69DA.

**Sobell:** TS17, T.346.

**Ferguson:** 306T, 308T.
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**MIDGET SUPERHET PORTABLE** 6" x 4" x 1½" 6 transistors, printed circuit. Ferrite aerial. All parts and cabinet. £11.19.6.
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