# TRACING TUBE FAULTS

# Practical Television

AND TELEVISION TIMES

SEPTEMBER 1957

1/3

EDITOR: F.J.CAMM

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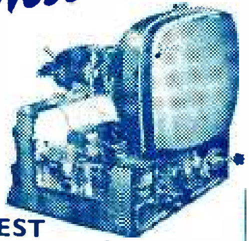

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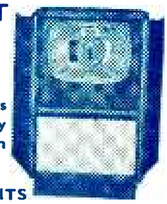

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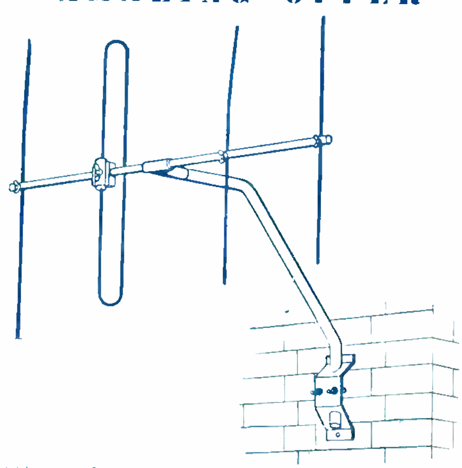

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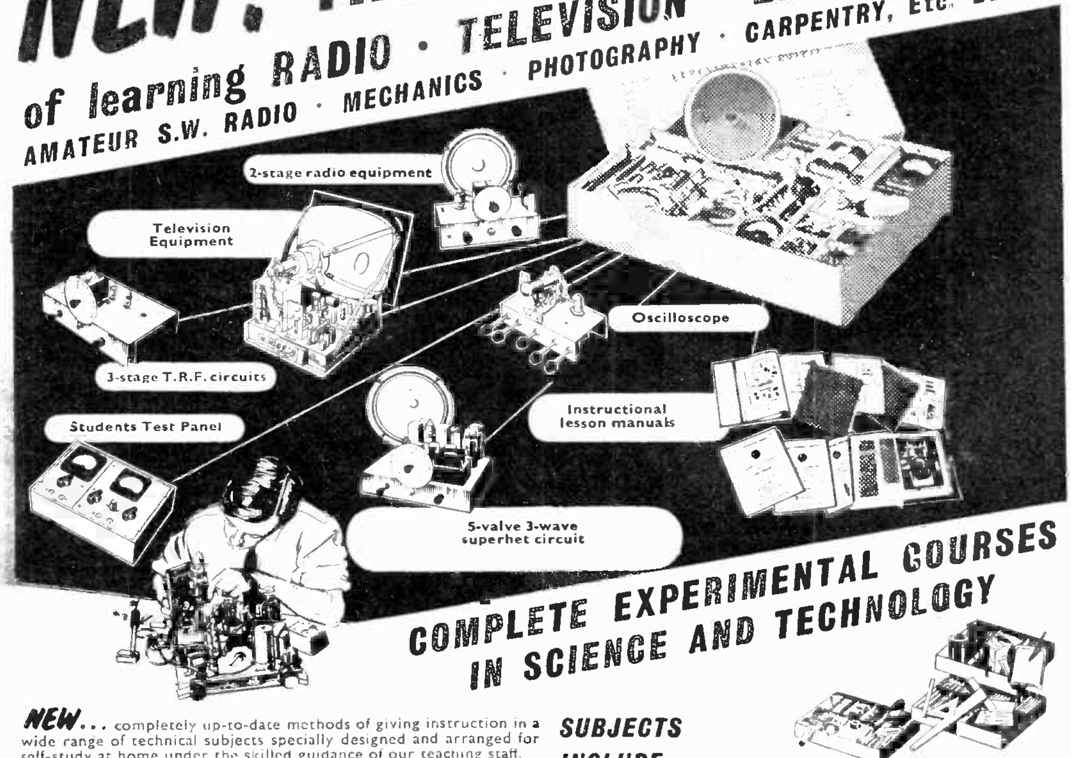


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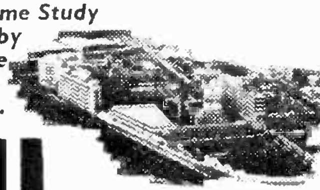

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# Practical Television

## & TELEVISION TIMES

Editor : F. J. CAMM

Vol. 8 No. 86 EVERY MONTH SEPTEMBER, 1957



Editorial and Advertisement Offices :
PRACTICAL TELEVISION
George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.
Phone : Temple Bar 4363.
Telegrams : Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

SUBSCRIPTION RATES
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CONTENTS :





# TELEVIEWS

## *THE NEW TV TUBES*

THE new wide-angle 110-degree picture tube which will be a feature of most American TV receivers for 1958 will not be incorporated in 1958 TV receivers made in this country nor will it be shown at the Radio Show. It is beyond all doubt, however, that such a tube must eventually be made over here. Angles have generally become wider, since 1946. They have progressed from 52 degrees to 65 degrees, 85 degrees and 90 degrees, and now the 110-degree tube has arrived.

It will permit cabinet styling to be shallower, an improvement which has been long overdue. All television receivers today are too deep from back to front to permit attractive cabinet styles. The attempt to hide the length of the tube by allowing it to project into a bulbous extension at the back of the receiver is clumsy. The wide-angle tube, of course, permits of the manufacture of a shorter tube, and it is likely that within the next few years angles will become even flatter. It is understandable that the industry here is not anxious to upset production too frequently. There have been three changes in tube angles since 1946. The 65-degree tube was introduced in 1949, the 85-degree in 1952 and the 90-degree in 1953.

The 110-degree tube is achieved simply by putting more power into the tube enabling a wider deflection of the beam. It is, of course, a major advance, although it will involve other changes in circuitry, particularly in that part which operates the gun.

Another improvement introduced by one American maunfacturer is an ultrasonic remote tuning device which uses no wires. Other manufacturers announce that they will be introducing a similar device.

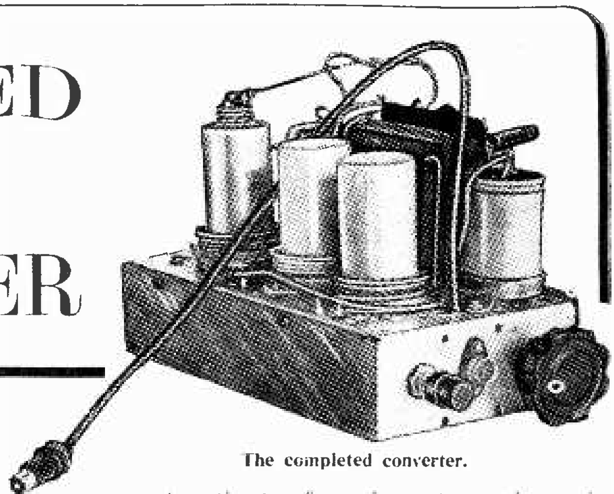
## *THE RADIO SHOW*

THE Radio Show at Earls Court will not exhibit any surprises in the way of technical development. More manufacturers are making use of printed circuits, but the main changes will be in cabinet styles. It is difficult to see where TV under present technique can be improved. The hopes expressed that projection TV would develop have not fructified and no progress has been made towards eliminating its main defect, that side viewing presents a blurred picture. It must be concluded that this system will eventually vanish from the English market. There is no marked change in prices, either one way or the other. The other aspect of the Show, will, we think, provide the attractions which will draw, we hope, record crowds this year, in spite of the credit squeeze and the general economic situation.

We shall be pleased to welcome all readers on our Stand No. 117.—F. J. C.

*Our next issue dated October will be published on September 20th*

# AN IMPROVED RF26 CONVERTER



The completed converter.

INCORPORATING TWO R.F. STAGES WITH A PRE-AMP FOR BAND I FREQUENCIES

By H. Duckworth

BEFORE the I.T.A. began their test transmissions, it was cautiously suggested by some that the older type of sets may not lend themselves to conversion for the new programme frequencies. Their opinion was largely based on the fact that the set under practical working conditions would find itself open to receive two separate transmissions at the same frequency, since the mixer output of a converter would be that of the BBC. The fact that almost any television set worthy of the name is capable of being "input" converted does not prove the speculative opinion to be wrong. Indeed many converted sets receiving an I.T.A. programme may be modestly described as "monitoring" the BBC at one and the same time. A ghost sound is ever present in the background, whilst the picture is patterned. "Grain" content on the picture producing an ant-like backcloth, together with the jagged vertical edges, may accompany the break-through. Viewing under these conditions is hardly acceptable. The writer saw that a remedy lay in more amplification at Band III with a reduction of gain at Band I, i.e., contrast and/or R.F. gain controls on the set. The question of providing an adequate aerial or the need of an input filter, should be left until, with the converter working at its best, a fairly accurate estimate of requirements can be made. In this way expenses are kept at the minimum.

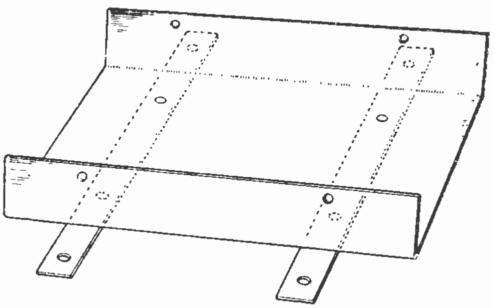


Fig. 4.—Screening base with cabinet securing strips attached.

The R.F. 26/7 unit was selected as being a suitable ex-Government unit on the score of size and price. My six-year-old straight set demanded that the mixer output should be on the Band I frequency. For those who have seen these R.F. units and perhaps admired their construction it may come as a shock to learn that the conversion begins by removing all the components. The task is fairly lengthy but rewarding. Apart from the fact that an extra valve is required, the layout for Band III work can be improved. It was considered that the case of speed and ease of conversion should be sacrificed to ensure stability in operation.

From the circuit it will be seen that the two EF54s are used as R.F. amplifiers, an EC52 as oscillator and an EF50 as mixer. From the aerial input the signal is fed either to the grid coil of the first EF54 or, in the case of Band I, to the grid of the mixer. This valve, in effect, preamplifies the signal, which on the older sets where the gain controls are fully loaded for normal reception, may help towards getting a quieter picture. The power supply is self-contained but other arrangements are described as alternatives. The mains "on-off switch" on the TV set should control the current to the converter, so that the valve heaters come up as the set is switched on. Band III is therefore immediately available at the turn of the wave-band switch. A separate on-off

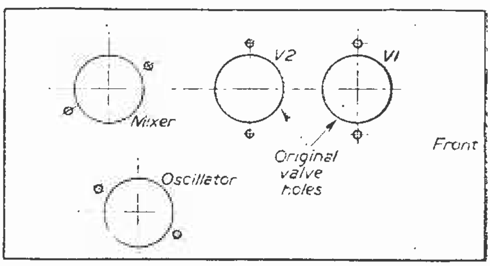



Fig. 5.—Valve positions.

switch usually means an irritating wait for the heaters and the possible risk of leaving the switch at the end of an evening's programmes. The setting up of the converter is simple. A volt and continuity meter should be at hand for testing and checking.

*Construction*

Strip the unit down to the chassis and remove valveholders. For those who are inclined to be hasty I would suggest a measure of restraint. Many parts are needed for the conversion and the remainder, removed in good condition, will make a valuable contribution to the spares box. A set of 0-6 B.A. spanners will help considerably and where a nut proves stubborn, the heat of the soldering iron applied to the varnish coating may enable all components to be recovered in good condition. Cut out the valve space of the oscillator. In the absence of a cutter a small chisel and a half-round file for smoothing down the rough edges, can be used. Drill the front panel to accommodate the wavechange, the aerial input and the 0.20pF trimmer (formely aerial trimmer). The screening can of the unit should be cut to the height of the chassis and whilst the two are held in a vice, two holes each side can be drilled to take the self-threading screws. For those who have not used this type of screw the diameter of the hole through both case and

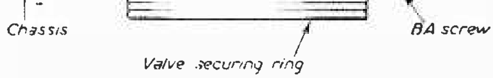
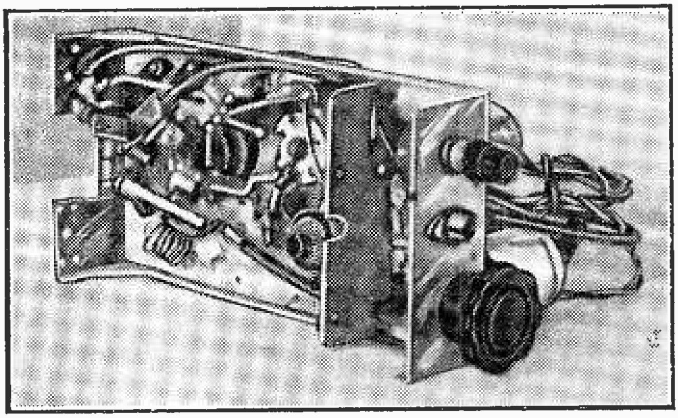



Fig. 3.—Method of fitting cathode "ring."

chassis should be that of the screw. The case is then drilled 1/16in. larger so that the thread will only bite into the chassis.

*R.F. Amplifiers*

The use of a pentode for frequencies approaching 200 Mc/s is unusual. The common practice is to use a triode for this type of work. However, working with a EF54, and that should be taken as the literal sense of assisting it by all practical means to do this exacting task, it has been seen that the valve will provide a useful amount of amplification. The cathode/grid is the critical part of the valve. The design of bringing out the cathode to four separate pins has, in the original circuit, led to the use of four separate decoupling condensers. That was for frequencies of up to 80 Mc/s. The decoupling capacitance required for Band III operation can be better obtained by setting a collar around the base of the valve. It is secured to, but insulated from the chassis by a collar of stiff paper. The cover of a soft-backed exercise book is ideal. Fig. 3 shows the collar set in place around the valve base. A compass



A view of the underside of the chassis.

point pushed through the screw holes from beneath to penetrate the paper will complete the paper collar which, in turn, can be used as a template. The metal screen which held the variable condensers is ideal material from which to cut the metal collar. The screw holes in this should be drilled oversize. With materials cut and paired for the two valves, assembly can begin. Set the paper in place, push through the 6 B.A. screws from beneath. The paper will conveniently cling to the screws. Drop the metal collar over the paper. Set an insulated washer in place before screwing on the nut. Test with an ohmmeter for an open-circuit reading. Bend over the four cathode pins to the collar and solder. The valve screen of V1 should be filed to clear the cathode ring and secured in place. This, incidently, is the only valve base screen required. Replace holders of V3 and V4, setting the oscillator and mixer as shown in Fig. 5. Wire heaters and decouple, using .0005 $\mu$F condensers. A good supply of these condensers will be obtained from stripping the unit. Set L1, L2, L3, L4 in place. Wire the screen and anode components around V1 and V2.

*Oscillator and Mixer Circuits*

The circuit shows the cathodes of each valve are connected in parallel. With the new valve positions the joining wire need be only ½in. Solder components around the mixer valve. Use should be made of the insulated supports for securing the decoupling components. From the oscillator anode, co-axial cable should be lead to the trimmer at the front of the unit. Earth both ends of the outer cable. L2 is a self-supporting coil of s.w.g. 16 and should be soldered directly to pins 4 and 8. Connections to the wave-change switch and aerial input can be dealt with after the preliminary tests have been carried out, for which the power supply must be available.

### *Power Supply*

There are four possible arrangements as shown :—

(1) Heater current (6.3v.) and H.T. from the set.

(2) H.T. from the set
(3) Use of Mains (A.C. rectified H.T.
(4) Transformer A.C. rectified H.T.
} together with 6.3v. heater transformer.

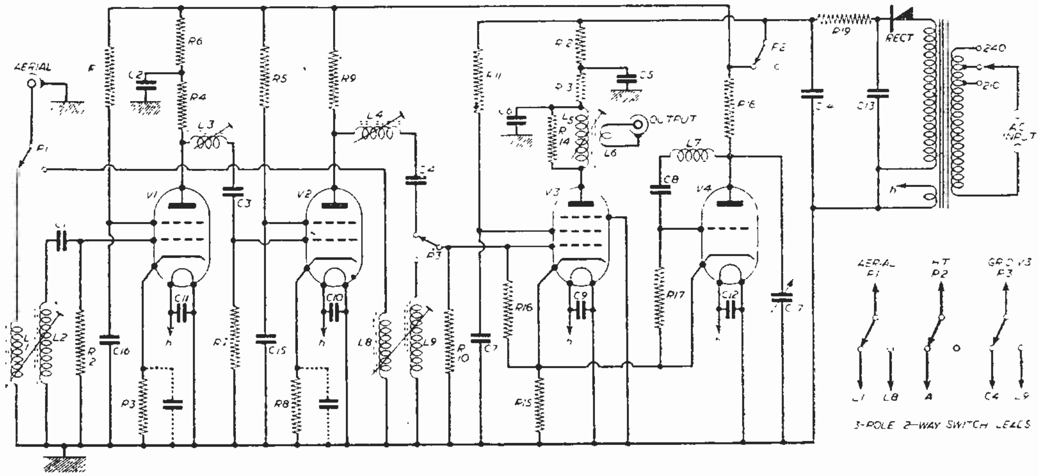
With (1) and (2) the ability of the set to supply an additional 30mA must be assessed. Many of the older sets are working close to their limit on this question of H.T. current. An annoying characteristic of an aging rectifier is that the effect of an extra load does not show a drop in voltage until some later date, when any attempt to reduce the current flow to its former level is unlikely to restore the voltage. It seems a question of the final straw on the camel's back. A new rectifier, however, would solve the problem. If the valves of the set are supplied by a 6.3v. transformer winding, the heaters in the converter may be fed from the same point. If this is considered, a trial should be made, during which a voltmeter across the supply would indicate the effect of the additional load. A drop of not more than half a volt is acceptable. In (3) and (4) the choice is merely one of whether the converter chassis should be isolated from the main's supply. If the set is of the A.C./D.C. type (i.e., where the chassis may be live) an H.T. feed from the set will put the converter in the same class. Beginners are advised to avoid working under such conditions. To further this end, isolating components have been omitted from the circuit. The more experienced will, if they choose to use A.C./D.C. technique, have sufficient knowledge and therefore safety to incorporate the components where necessary. With a two-foot length of co-ax cable from L6, and a suitable input terminal fitted, the one remaining factor is the aerial, from which it is intended to receive the Band III programme.

**COIL DATA**

| | | |
|---|---|---|
| L1 ½ turn | L5 7½ turns | L9 6 turns |
| L2 2½ turns | L6 2 turns | |
| L3 3 turns | L7 5 turns | 16 s.w.g. ¼ inner |
| L4 3 turns | L8 2 turns | diameter |

### *Choice of Aerial*

In a good reception area, the existing H or X aerial may provide a satisfactory signal. In weaker areas the addition of twigs to the Band I array may be sufficient, whilst in parts where the signal is poor a separate aerial will be essential. A glance on the neighbours' chimneys should suggest a suitable array for the district. The writer feels that from the available arrangements as mentioned the most suitable and not necessarily the biggest and most expensive should be chosen. To this end a cut-wire dipole, hung from a picture rail, should provide a signal on which to line-up the converter, in all but poor reception areas. When the alignment is complete, the performance will give an indication as to which type will eventually be required. In this way the expense of getting too elaborate an array is avoided.




**RESISTOR AND CONDENSER VALUES FOR Fig. 1.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R6, 12, 13 | 2.2 K. | R1, 5 | 15 K. | C1, 8 | 4.7 pF. Ceramic | C2, 5, 6, 7, 9, 10, 11, 12 | 500 pF from unit. |
| R4, 9, 10, 14, 18 | 10 K. | R3, 8, 15 | 330 ohms. | C3, 4 | 7.5 pF. Ceramic | C13, 14 | 8μF Electrolytic. |
| R2, 7, 17 | 22 K. | R19 | 2.2 K. 2 watt. | C15, 16 | 50 pF. Ceramic | C17 variable | 0-20 pF. |
| R11, 16 | 100 K. | | | | | | |

Figs. 1 and 2.—Theoretical circuit and switch connections.

*Alignment*

The conversion lends itself to a step-by-step method. Instead of putting the aerial to the input coil of V1, the performance is more easily checked by beginning with the mixer valve and working backwards towards V1. Each step should show an improvement in gain and quality. By "aerial" is meant inner to test point, outer to chassis.

*Procedure*

The gain controls on the set should be put to maximum.

(1) Band I aerial to grid V3.
Tune (L5L6).

The picture should be an improvement on previous performance when controls are reduced. The "pre-amp" has now been aligned, so that now all further tests will be with the Band III aerial.

(2) Band III aerial to grid V3. Adjust oscillator trimmer for sound and vision. On a weak signal only sound may be obtained. If neither picture nor sound, L8 may need adjustment to provide the correct frequency range of the oscillator. Set trimmer to mid-position and insert each in turn iron and brass slugs into the coil. The slug may be held by wax to the tip of the screwdriver. If an insulated tuning rod is available it should, of course, be used, although the shaft of the screwdriver has little consequence in this form of test. The slug, moved slowly, should provide normal sound and vision, vision on sound ("brrrr" in the loudspeaker), sound on vision (severe picture disturbance) or a peculiar effect of sound alone with the slight slug movement giving some form of modulation of the raster without any part of picture being recognised. Any one of these forms will prove the oscillator to be working. In case of intermittent breaks in performance rock the E.C.52 in its holder to provide better pin contact Whichever case is heard or seen, leave the slug in position by resting it within the coils. Move the aerial to grid of V2. Tune L4. The signal will be stronger and easier to work with. Returning to the possible results, if picture and sound cannot be obtained simultaneously the oscillator is working *below* the signal frequency instead of *above* it. The iron slug should therefore be withdrawn or if a brass slug is in the coil it should be inserted deeper, until the picture and sound are obtained. The turns given for L8 should cover all the Band III channels so that a brass slug ought to be in the coil. According to the extent, so turns are to be removed. Begin and continue with ½ turn. After each removal, use the trimmer to secure a picture. If the result is negative then again insert brass. The depth will be less. As the final adjustment is approached the brass slug will be effective ¼in. from the coil. Set the trimmer midway and open or close the turns of the coil, until picture and sound are obtained. This setting up of the oscillator can be quite instructive and satisfying to one who has had little experience in this field.

(3) Aerial to L1. Adjust L2, L3. It should now be necessary to reduce contrast. This applies particularly to those who have used a Band III aerial of commercial pattern. Where the test has been made on a wire-dipole, an estimate of aerial requirements can be made. Incidentally, the wire-dipole should be now moved to different parts of the room. A movement of as little as 6in. can give an amazing difference in signal strength. Having found the best position, reduce the set controls and compensate with brilliance. If good definition can be got with a quiet picture, then twigs on an existing Band I aerial would suffice; a picture with grain, demanding high gain from the set, indicates the need of a three- to seven-element aerial. In all cases a diplexer should be used before the converter input. Final coil adjustments on a testcard transmission will provide the necessary picture quality.

*Band I/Band III Switch*

The requirements are:—

Band I. Aerial input to L8.
H.T. to V3.
Grid V3 to L9.

Band III. Aerial input to L1.
H.T. to all valves
C4 to grid V3.

A 3-pole 2-way switch is adequate for these tasks. (L1, L2) (L8, L9) should be attached to the metal screen across V1. In the photograph they were removed for clarity. Switch connections to coils should be done in co-axial cable.

The mains input to the converter should be through the on-off switch of the set. This may be done when a permanent position in or on the set has been decided. An internal fixing to the cabinet is suggested as being the neat and convenient method. Two strips of metal secured to the unit screening base by means of screws or preferably rivets, and drilled to take short, stout wood screws as shown in Fig. 4. With the converter fitted to the top or sides of the cabinet, the fret should be cut to give access to the controls. In the case of small table sets, it may be that the interior of the cabinet will not accommodate the converter.

# TRACING TUBE FAULTS

HOW TO TELL WHETHER IT IS THE CIRCUIT OF THE TUBE WHICH IS CAUSING TROUBLE

By H. Peters

THE following notes have been compiled as a guide to the symptoms shown by faulty tubes, with simple proofs which can be applied. They do not supersede the articles published already on the cause and cure of various tube faults (although for completeness these have been touched upon) and are arranged in order of likelihood. To provide a quick reference each fault section covers the cause, symptom, proof, and cure, in that order.

### *Low Emission*

Caused by the crusting up of the emissive surface of the cathode, deterioration of the fluorescent screen, a partly shorted heater, gas in the tube, or a combination of any of these, this common fault is normally obvious by a lack of brightness of the picture.

Any attempt to increase brightness or contrast will flatten the picture and rapidly turn it negative, even though the interference limiter is off. This state may be preceded by a positive picture with "glistening" highlights—for example, faces appear to have perspiring foreheads and cheeks. The fault can come slowly upon the tube taking many months, when it is difficult to notice the difference from night to night, or it can appear suddenly whilst in use or especially after a long period of idleness such as a holiday.

Focusing will remain good, apart from "oyster-shell" distortion, which gives the spot a halo set to one side, but more contrast will be needed to produce a viewable picture.

Proof usually follows switching off, when the spot persists longer than usual and may swell up to give an image of the decayed cathode. This latter can also be produced by connecting the tube up without the focus magnet and scancoils and by reducing the EHT by half. A spot of light the size of an orange will be seen, and if the cathode is decayed this spot will look rather like the moon seen through a telescope, full of dark blotches and craters.

More positive proof can be gained by using a microammeter inserted in the cathode lead, and the little ex-W.D. 500 micro-amp movements owned by most amateurs are ideal for the job. A healthy tube will fully deflect one of these meters, whilst a low one will barely move the pointer.

About 20 to 50 micro-amps is the usual reading for a normal picture and any tube which gives this reading should be capable of a viewable picture unless some other fault is present.

The meter will, however, give an indication of the state of the cathode by measuring its current, which is what we are interested in at the moment. It can also be used to align the ion trap magnet accurately and to measure the various currents taken by the individual electrodes.

The cure for low emission is to over-run the heater (and consequently melt the encrusted cathode surface) either for a short period with the valve taking grid current, called reactivation; or else permanently whilst the set is running, called boosting.

Although neither method is permanent or wholly satisfactory, if they enable the useful life of a tube to be extended a few months they are economic.

Not all tubes respond to treatment, but the two cases most likely to succeed are (a) where the heater has been under-run in the set, e.g., a 2-volt tube which has been wired up with inadequate flex and which only has 1.8 volts on the pins, and (b) the tube which starts off very dull, but which brightens up later in the evening.

Partly shorted heaters must be treated with great respect, as these are likely to go open when excessive voltage is applied.

In reactivation the raising of the heater voltage is done slowly and nominal value can be almost doubled.

In boosting this is not possible due to the tendency of heaters to fracture with the switching-on surge. A good general value of boost volts is +30%, whilst +50% represents the safety limit. When fitting a boost transformer it is always advisable to use one which deals with heater cathode shorts as well, as the over-running of the heater is likely to cause this fault to occur.

Four important "red herrings" should be ruled out before a tube is discarded:—

### 1. *Ion Trap Magnet*

If this has slipped from its position round the neck of the tube almost exactly the same symptoms as low emission result. Although it is a simple matter to readjust, it is still quite useful to be able to diagnose the difference as seen on a picture. The picture on a faulty tube will stay still when the brightness is turned up, whilst a displaced ion trap magnet will cause the picture to turn over slightly at the point where it flattens out prior to turning negative.

Ion trap magnets should be adjusted for maximum brightness of the picture, and never used to centre the picture at the expense of brightness. One type has a habit of breaking its fibre strap, but can still be used by closing up the two arms until it clamps stiffly on the tube neck, and by taping it well over after adjustment.

### 2. *Interference Limiter*

A picture which readily goes negative with increase of contrast can well be due to a fault in the interference limiter circuit. This is usually biased to invert all interference peaks above a certain level, and this is accomplished by backing off the conducting point of a diode by a potential divider from H.T. to chassis. A fault in this divider network will cause the picture to be limited similarly to a low emission tube, but can be proved otherwise by turning up the brightness control, which should have no effect on the limiting action.

### 3. *Video Detector/Amplifier*

An insipid grey picture but with a good control of brightness can be due to a fault in the video amplifier, which may have a faulty load resistor or even be low emission. Faulty germanium diode vision detectors can also produce this fault, accompanied by streaking and poor definition.

### 4. *EHT Rectifier*

A low EHT rectifier can easily be distinguished by advancing the brightness control, which will cause the picture to swell up, defocus and disappear, going darker in the middle first. Readers who are in the habit of checking EHT with an insulated screwdriver will notice that at this stage an A.C. spark can be drawn off the rectifier anode, as usual, but that the cathode shows no sign of life at all. An extremely low EHT rectifier will give no light on the screen at all, and under these conditions a flash of light can sometimes be produced by suddenly advancing the brightness control from resting at minimum for a good two minutes. This is a particularly useful test to make when the rectifier is sealed in the line output transformer.

### *Note on Projection Tubes*

A fairly safe way of assessing the condition of a projection tube is to examine its face when cold. A well-used tube, candidate for replacement, will have a rectangular patch of brownish discoloration burnt on it by the raster. Some idea of the drop in light value due to this can be obtained by refitting the tube at a slight angle to its original position so that the raster illuminates part of the unburned patch, and by comparing the two areas.

### *Heater Cathode Leakage*

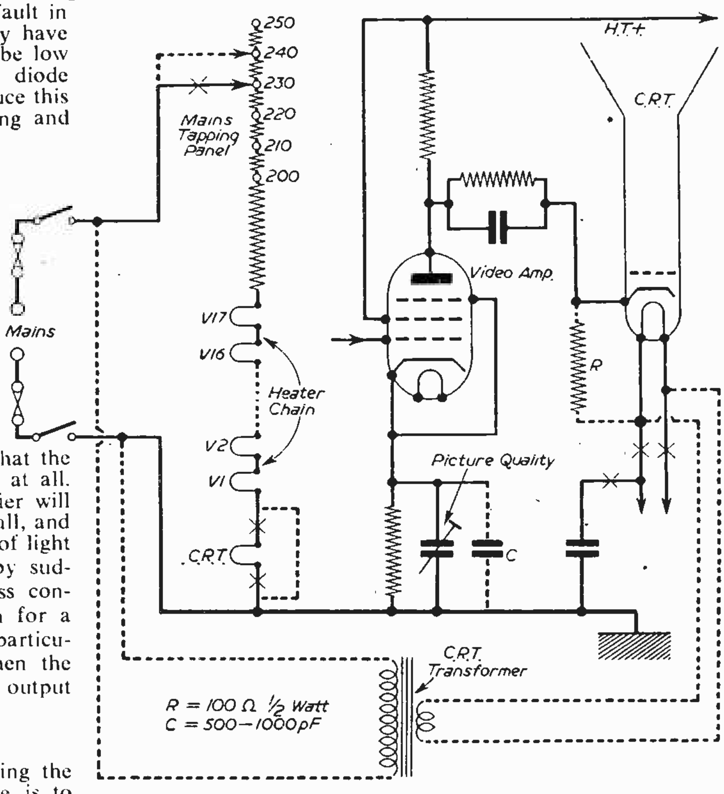
This particular fault has been widely written about already possibly because it is curable, enabling the tube to be used to its natural end.

Caused by a breakdown of the insulation between heater and cathode, it normally has no effect on grid-modulated tubes—which suggests an obvious but rather cumbersome cure.

The normal symptoms are of intermittent bars of streaking or smearing, sometimes accompanied by the picture jumping about ½in. to the right and going a little bit brighter. At the beginning this usually takes about ½ hour to come on.

Eventually the streaking will spread right up the screen and may then be present when first switching on.

These symptoms will only be seen on tubes with transformer-fed heaters, where the heater winding is not tied down anywhere (except perhaps to the cathode itself by a 100K resistor) and the streaking is due to the extra capacity the heater transformer shunts across the video output.




*Existing wiring removed at 'X'* *Additional wiring shown thus --------*

**Typical video, C.R.T. and heater circuit showing wiring changes when fitting C.R.T. isolating and boosting transformers.**

Where the heater is tied to the chassis, such as in A.C./D.C. sets, the symptoms will be of uncontrollable brightness, which may even collapse the EHT supply and remove the raster.

Another exception is in modern sets where a cathode follower is provided behind the video amplifier. In this case leakage greater than 20K ohms will be hardly noticed, but a dead short will manifest itself in a surprising number of ways, according to the set design.

The writer has experienced the following symtoms in such cases: Red-hot anode in video amplifier and/or cathode follower, with anode and cathode loads to match.

Burnt out vision detector crystal and burnt out grid and cathode bias resistors in video amplifier.

Apparently noisy brightness control.

Most of the damage in such cases has been traced to a collapse of the A.G.C. system, which has caused the video detector to "run away."

To prove heater cathode leakage, the simplest method is to tap the tube neck very gently and see if the fault varies. Tapping usually makes it permanently "on" or "off."

In very intermittent cases a 20 K ohm resistor touched across between heater and cathode, and grid and cathode in turn, will enable you to see which of the faults you have thus stimulated most resembles the one you are trying to diagnose.

The cure for this trouble is of course a low capacity isolating transformer, which will reduce the streaking caused by the mains transformer capacity to a negligible amount, and enable the tube to run with the heater and cathode strapped.

In A.C./D.C. sets run off A.C., or in "A.C. only" sets with a small transformer supplying the tube heater, a mains driven primary winding is essential, but where the mains transformer providing the heater supply is of generous proportions a plug-in 1 to 1 ratio type, such as the "Nuray," can be used.

No hard and fast rules can be laid down for the fitting of transformers, each model presenting its own variations, but these are good guiding principles:—

1. Mount transformer on the woodwork in preference to the chassis as this will reduce the capacity to laminations. Connect it to the tube heater by short free-spaced leads (old coaxial inner is ideal). Keep the transformer away from the tube neck to avoid a bent raster.

2. Connect the mains primary to the set side of the "on-off" switch—usually between chassis and a suitable point on the mains dropper.

3. Remove all wiring to the heater pins on the tube, including components used to shape the video response. Link one side of the heaters to the cathode by a 100-ohm ½-watt resistor (not critical) so as to make the fault permanently "on."

4. Advance the picture quality control usually found in the cathode of the video amplifier to offset the effect of the extra capacity introduced by the isolating transformer. If necessary add between 500pF and 1,000pF across the control.

5. On A.C./D.C. sets where the tube completes the chain, the heater wires, having been removed from the pins, should be shorted together and taped off. Then alter the heater chain voltage tap to the position correct for 10 volts higher.

### *Grid Cathode Shorts*

Grid cathode shorts usually occur some time after the tube has been in use, and can be caused by the grid supports sagging, thus letting it touch the cathode, or by "dust" in the gun, which lodges between grid and cathode.

The symptoms, which can easily be intermittent (taking hours of running to produce), are either uncontrollable brilliance, or (if the EHT regulation happens to be poor) no EHT or raster and a blue glow in the EHT rectifier.

To prove grid-cathode shorts, disconnect the lead to the grid and meter the free pin. If a voltage is read, leakage exists, a good tube giving no reading. A further check is to vary the contrast control and hence the cathode potential and observe that the grid voltage varies in sympathy.

To cure this condition in a tetrode tube the grid and cathode can be permanently strapped together and the first anode used as the grid, making the tube a triode. This modification gives the tube a longer grid base and more video drive is therefore needed. Focusing also will be more astigmatic. Triode tubes are more awkward, but those with sagging support wires may be cured by turning the tube upside down on its mount and allowing the sag to straighten out. Dust may be burnt off by the use of a high A.C. voltage between grid and cathode (try the EY51 anode) with the tube cold. This, however, can be a "do or die" operation, with a risk of losing the tube.

### *Ion Burn*

Uncommon nowadays, this defect is due to impurities within the tube getting caught up in the electron stream, and being relatively heavy, bombard the fluorescent screen to destruction. Sluggish compared with the electrons, they are harder to deflect and this property is used to prevent them burning the tube face.

By angling the gun and deflecting the electron beam towards the screen by a small magnet the ions, as the heavy particles are called, bombard the side wall of the tube where they do no harm.

The general symptom of ion burn is a dark patch in the middle of the screen about the size of an orange. This is usually seen on non-ion trap tubes, and although ion trap tubes ought to be immune from the fault they do suffer if the ion trap magnet is displaced or broken, when burning may appear as above, or as corner shading, or (as has been seen recently on some 17in. tubes) like a large rectangular frame with diagonals and a circle in the middle—a sort of ghostly test card C.

Ion burn cannot be cured, but its annoyance can be reduced by ensuring good high EHT and by checking that the ion trap magnet (if fitted) is set to the position of maximum picture brightness.

No useful purpose can be served by fitting an ion trap magnet to a non-ion trap tube, except to help picture centring.

### *Grid Emission (or Secondary Emission)*

Sometimes caused by cathode particles falling on the grid, the appearance of grid emission is a faint unmodulated raster which cannot be reduced by brightness or contrast controls, and which is usually offsest from the actual picture upon which it is incurably superimposed. Proof is obtained by removing the cathode wire from its pin.

(*Concluded on page* 62)

# A Low-Loss Loft Aerial

DETAILS OF AN EASILY-ERECTED AND EFFICIENT SCHEME

By C. A. Oldroyd

HURRIEDLY erected indoor aerials are generally poor performers; but there are exceptions. Referring to Mr. Sim's letter (P.T., July, 1953), he tells us about a Vee indoor aerial made up from rusty fencing wire. It worked very well, receiving Holme Moss over a distance which is considered to call for a multi-array. Having to fix up an indoor aerial as quickly as possible, I decided to try a Vee type. In days gone by radio constructors laid great stress upon "low-loss" construction, and this was applied to the aerial described.

Two ⅜in. outside diameter copper tubes, 4ft. 8in. long (for Holme Moss) form the "rods": one end of each tube was flattened in the vice for a distance of about two inches. The mounting was a piece of paxolin, about ½in. thick, see Fig. 1. After marking out the vertical centre line of the panel, two parallel lines, each ¼in. from the centre line, were scribed; they indicate the ½in. gap between the rods. Clearance holes for 3/16in. bolts were drilled in the rod ends. On the centre line, near the bottom of the panel, a ⅛in. hole was drilled; from this hole lines thirty degrees to the centre line were marked out; they mark the centre lines of the rods.

If the rods are now placed on the panel, centre lines of rods coinciding with the marked lines, the rods are slid up and down till their inner edges touch the ½in. gap lines. Then the holes for the 3/16in. bolts are marked out on the panel. As indicated in Fig. 1, the outer tips of the rods are tinned, so that the coax leads can be easily soldered to the rods. Finally, a fine sawcut was made from the panel edge to the ⅛in. hole; this gives us an air gap between rods, and also prevents a bridge of flux forming when soldering.

A wood block was fixed to the back of the panel, a long ¼in. bolt passes through a clearance hole in this block and two cut-down steel brackets. This arrangement allows the whole assembly to be tilted to any desired angle, as indicated by the arrow. The steel brackets are mounted on a plank long enough to span three loft floor joints; in this way we can try the aerial in different positions and at different angles, as shown in Fig. 2.

Our loft is large, but—unfortunately—not very high at the centre; access is by a small trap door designed for slim people only. After inspecting the loft interior, I did not like the idea of crawling about on the beams; maybe bringing down

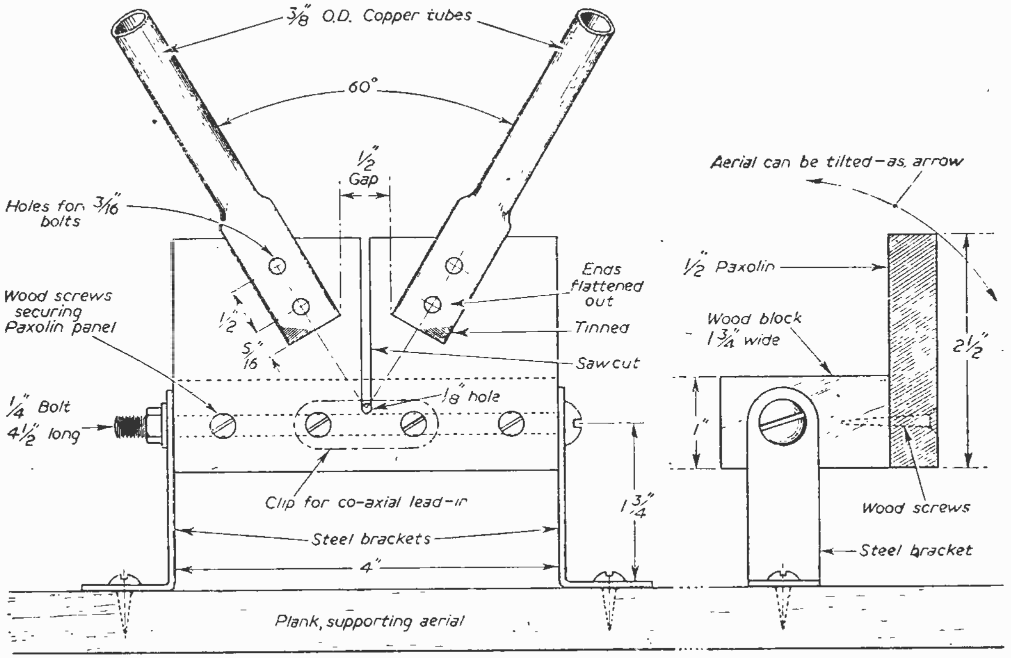



**Fig. 1.—General details of the Loft Aerial.**

part of the ceiling when putting my foot off the beam! The aerial described can be taken to pieces, after a trial assembly to see that bolts pass easily through the clearance holes in rods

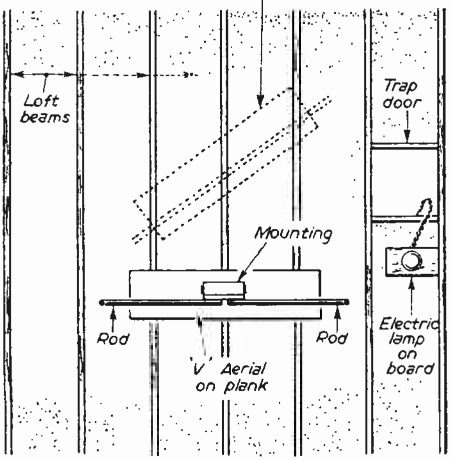



**Fig. 2.—Suggested Mounting details.**

and panel, and re-assembled without entering the loft itself, the constructor standing on a stepladder placed under the trapdoor opening. To provide plenty of light, a lampholder was mounted on a small board, and fitted with a lamp. Stand this board against the wall, at an angle of about 45 degrees. If a three-pin socket is also mounted on this board, and wired to the mains together with the lamp, we have a handy source of current for our soldering iron when soldering the coax leads to the rod ends. As shown in Fig. 3, the Vee should face the transmitter, to obtain maximum gain.

This simple aerial worked very well, at a distance of about sixty miles from Holme Moss,

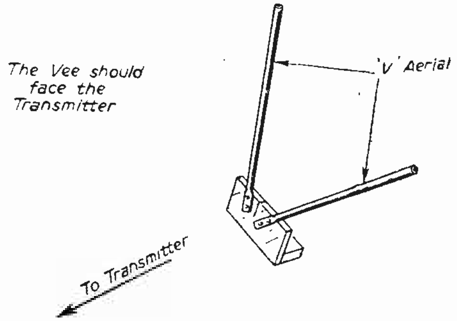



**Fig. 3.—It is important to position the aerial correctly.**

and brought in a fair signal, feeding a G.E.C. T.R.F. A.C./D.C. receiver, not a fringe model. To receive the Band III transmissions, a converter advertised in this magazine was obtained; this unit acts as a two-stage amplifier on Band I as well. Surprisingly good was the reception of the Band III transmissions on this Vee aerial, using the above converter, so it was obviously worth while to make the best possible job of an indoor aerial

## TRACING TUBE FAULTS

(*Continued from page* 60)

which should make no difference to this raster. This fault can occasionally be cured by tapping the tube neck gently, but fortunately it usually occurs within the guarantee period.

### *A1 Leaks*

Faults due to the A1 electrode vary greatly and are fortunately rare. The symptoms can be no picture (or even no EHT) or a weak under-contrasted picture with plenty of brightness. Proof can be obtained as for grid-cathode shorts, by removing the wire from the pin and trying to read a voltage on the pin. A microammeter inserted in the tube cathode lead, or for that matter in the A1 lead itself will sometimes give a clue to the trouble. The A1 current is normally very small, in the order of 50 microamps, but will rise in the absence of EHT on the final anode.

Curing by flashover (see grid cathode) is not without risk, but the tube can sometimes be run by attaching a 1MΩ resistor and flylead to the A1 pin and tapping round the tube base and H.T. until a picture is obtained, when the wiring is made permanent.

### *Open Cathode*

An annoying fault which comes suddenly and leaves the tube blank, and without a vestige of cathode current. The only cure is to try to break down the heater-cathode insulation with a high voltage, and then fit an isolating transformer, but success is rare and not without risk.

### *Soft Tube*

A tube which has air in it or "soft" tube can usually be identified by the following symptoms: No picture, purple flashings around the electrodes in the gun, and a white milky edge around the metallic "getter" mark. In its early stages the symptoms sometimes produce a peculiar brightness control action. Having set the control for a normal picture the raster gets brighter and brighter over many minutes until it is impossible to watch. Turn the control back for a normal picture and this then fades out slowly. This action can go on all evening without settling down. Replacement is the only cure.

### *Dry Joint Base*

Many of the foregoing symptoms can be suggested by unsoldered pins on the base. Always check this before discarding a tube.

### *Boosting on D.C. Mains*

Boosting on D.C. mains where a heater transformer cannot be fitted is best done by a wire-wound resistor of adequate wattage wired between the top side of the C.R.T. heater and the mains voltage dropper. A typical value is 4,700 ohm 10 watt which will boost a 6.3 volt tube to 7.5 volts approximately. The tube must be at the bottom of the heater chain.

# PICTURE TUBE REPLACEMENTS

By M. W. Kirby

*This Article Gives Some Pointers to Viewers Wishing to Adapt Their Sets for One Reason or Another to Take a Different Type of Tube from the Original.*

AS the cathode-ray tube is the most expensive item in a television receiver it is of importance that when the tube becomes faulty it should be replaced as cheaply as possible. Sometimes there is one to hand which although the same size has different electrical characteristics, or if being replaced by a "reconditioned tube" it might be that the exact replacement type is not available. It might also be desired to fit a tube of more recent type of which the characteristics are dissimilar to the original and requires adapting the set to take the tube.

It should be remembered that a cathode-ray tube represents a real danger in inexperienced hands, and precautions should be taken against the danger of implosion at all times when the tube is uncovered. The scope of this article is for fitting tubes of the same size and not fitting tubes of larger size than the original. This may be dealt with in a subsequent article.

The first consideration when examining the possibility of substitution is to determine the amount of space in the cabinet or chassis, as although the vast majority of popular tubes can be adapted electrically it is often the mechanical aspects which render them unsuitable for replacement. This is best done either by trial or by comparison of the dimensions in published data on the respective tubes. Assuming the tube can be made to fit the next thing to consider is the electrical work to be done. Firstly, some idea of how the heater voltage can be obtained should be investigated.

## *Heater Supply*

If the heaters require the same voltage and current the base can be connected up straight away without any further work, but if the requirement is different, decide whether or not the tube is to be fed from a transformer, if so either a completely new transformer supplying the correct voltage can be fitted or a supplementary transformer (if the voltage required is higher) can be connected in series with the original to give the required voltage. Be sure the windings are in phase and if not reverse one of the windings. If the C.R.T. heater is connected in series with the valve chain as in all A.C./D.C. sets, there is the alternative of either fitting a transformer as above and shorting out the old heater leads with a resistor as described below, or adapting the heater chain to give the required current. The first step is to rewire the heater so that one side is common to earth. Do this, if it is not already so wired, by shorting out the heater leads and insulating them from earth. Trace the valve that has one side of its heater common to earth, disconnect the earth lead and connect to the valve pin a lead which connects to the tube base heater pin. The other side of the tube heater is returned to earth. It is sometimes desirable, especially if the valve concerned is in the R.F. strip to connect across the tube heaters a .01 $\mu$F condenser, as raising the valve above earth may introduce some instability.

Once this has been done consider the current requirements. If the tube requires a greater current a resistor R1 should be wired from the mains switch to the tube heater connection that is not joined to earth (Fig. 4). This resistor must be connected to the mains as, if it were connected to the voltage control resistor, it would be possible that, due to the heavier current flowing in the circuit, it would burn it out, apart from upsetting the voltage drop. If the current consumption of the tube is less than the valve chain supplies a resistor R2 must be connected across the tube heater. We can now calculate the value of resistor required. Using Ohms Law we have:

$$R1 = \frac{I1 - I2}{E1}$$

Where:
I1 Current required by tube.
I2 Current flowing in circuit.

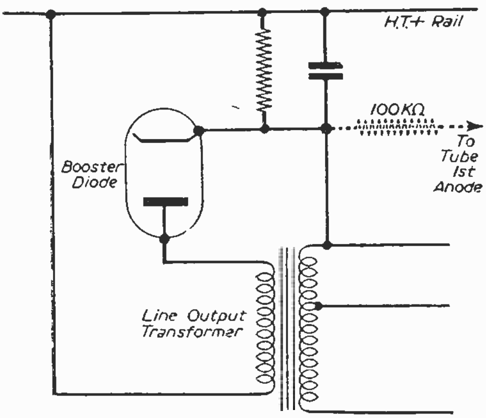



Fig. 1.—Method of obtaining first anode voltage.

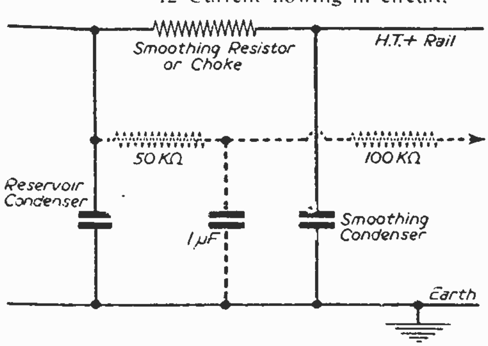



Fig. 2.—Method of obtaining first anode voltage for sets without booster diode.

$$R2 = \frac{E2}{I2 - I1}$$

E1 Difference between supply voltage and tube voltage.
E2 Tube voltage.

The wattage is calculated from:
For R1 Watts $= E1 \times (I1 - I2)$.
For R2 Watts $= E2 \times (I1 - I2)$.

In the case of R2 always use a good quality resistor rated at least twice the calculated wattage as in the event of this failing by going high or open circuit it will cause excessive voltage to appear across the tube with the danger of burning out the heater. Should the tube have the same current requirements but at a different voltage it is sufficient to adjust to the different voltage by varying the mains voltage adjustment to suit the difference in voltage required.

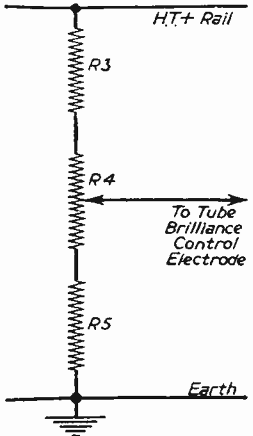



Fig. 3. This is the normal circuit for a brilliance control network across the H.T. supply.

## EHT Supply

Having obtained the heater voltage, connect up the cathode grid and EHT. In spite of much that is said about EHT, in practice a change of 20 per cent. or more can be tolerated without a great loss in brilliance, and if the tube being fitted is a modern one it will probably be better than the original in spite of having low EHT voltage. If the tube being fitted is a tetrode and is replacing a triode it is necessary to provide a first anode voltage. In sets using a booster diode it is best taken from the cathode of this, through a 100 K resistor to the tube pin. If the set has no booster diode the circuit shown in Fig. 2 may be used. The diode connection of Fig. 1 is preferable as this gives quite a useful gain over the H.T. rail. Switch on the set and allow to warm up. If the bias values for the two tubes are similar the brilliance control will work satisfactorily, but if not the trouble is due to the bias, then the resistor network will require adjustment. If the tube is grid modulated the cathode bias should be altered and vice versa, as this will avoid altering the video output circuit. The bias is usually obtained by some variation of the circuit shown in Fig. 3 which consists of a potentiometer network across the H.T. supply. If the voltage is too great increase the value of R3. If too low increase the value of R5. The same effect will be obtained by reducing the value of R5 in the first case and R3 in the second. Increasing the values is to be preferred as care must be taken not to overload the network when reducing the total resistance in circuit due to the heavier current flowing.

In some circuits the total resistance must be kept constant, as any alteration will upset some part of a stage drawing current from part of the network used for the brilliance control. If this is the case it only means that any increase in one leg of the network must be reflected by a similar decrease in the other, i.e., if R3 is increased in value by, say, 50,000 ohms then R5 must be reduced by this amount. If a tube is fitted that requires an ion trap this should be fitted as follows. Turn brilliance control to maximum, fit magnet over neck of tube with the arrow pointing towards the face of the tube. Switch on and adjust for maximum brilliance. This should place the magnet so that it is diametrically opposite the tilt of the gun away from the centre. If not, but is on the same side as the tilt, the magnet is the wrong way round and should be removed and replaced with the other side towards the face and readjusted. Tighten in this position for the moment. If no brilliance is experienced when fitting the magnet the fault is either in the bias or the EHT supply. Correct the bias by shorting out the grid and cathode with a short piece of wire and try rotating the magnet up and down the neck of the tube. Check the voltage on the first anode to make sure that it lies between 180-450 volts. Next test the EHT. Remove the EHT lead from the tube and draw a spark from chassis to about ¼in. If a rich healthy spark results there is EHT present. Try drawing a spark from the tube anode. This should be much weaker, but should get richer as the brilliance control is advanced, showing that the tube is drawing current. (If the cathode and grid are shorted this will not apply, but it is a useful test.) Next, connect the lead to the tube and try drawing a spark from the EHT terminal on the tube to earth with a well-insulated screwdriver. If a good spark exists the trouble is not EHT regulation, and the magnet

(*Concluded on page 68*)

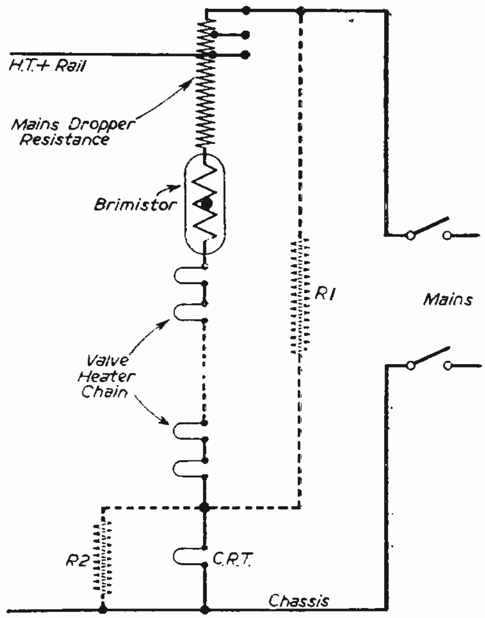
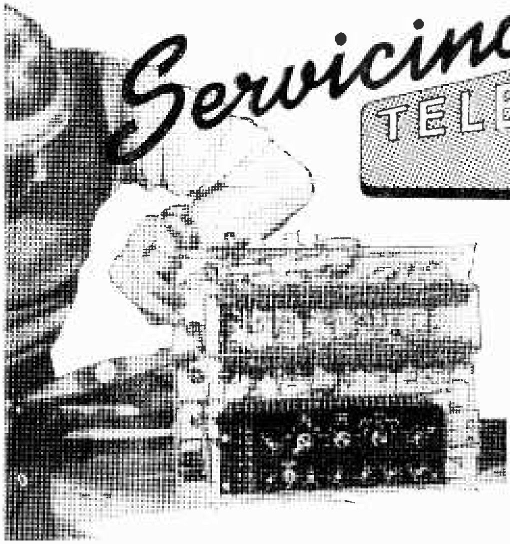



Fig. 4.—Adapting series heater chains to give required currents.

# Servicing TELEVISION RECEIVERS



## No. 32.—THE SOBELL TS17 AND T346

By L. Lawry-Johns

(*Continued from page 14, August issue*)

THE positive voltage obtained from the contrast control cancels the negative bias derived from the sync separator. the V8 clamping diode preventing the line from becoming positive should the positive voltage exceed the negative under any conditions. The resulting bias is smoothed by a further network before application to the V3 vision and sound I.F. amplifier. It may be noticed that under high signal conditions advancing the sensitivity beyond a certain point reduces the sound. This is due to the fact that the A.G.C. system operates on a common sound and vision valve and in addition the A.V.C. circuit also comes into operation. affecting the V8 sound amplifier only. The two systems are not mutually compensating.

Separation of the sync pulses is carried out by the V7 pentode section. The line pulses are coupled by a 10 pF capacitor to the anode of the triode section (pin 1) from the pentode anode (pin 6).

The triode section forms part of the line multivibrator in conjunction with the PL81 (VII).

The frame pulses are derived from the anode circuit of V7 pentode being integrated by R55 and C73. An interlace filter (MR2) effectively removes any remaining line pulses to enable correct synchronisation of the frame oscillator to be achieved.

### *The Frame Timebase*

An ECL80 valve (V10) is employed, the triode section as a blocking oscillator, the pentode as the frame amplifier-output. T5 is the blocking oscillator transformer, T6 the output coupling to the frame scanning coils.

It should be noted that the vertical hold circuit includes a series resistor which may be shorted out should the characteristics of the ECL80 change so as to necessitate operating the control set to one end of its travel.

This feature incidentally is also incorporated in the Horizontal Hold circuit.

The Height control varies the H.T. applied to the anode of the triode section and this H.T. is derived via a 39 KΩ resistor from the boosted H.T. line from the line output transformer. The saw-tooth output of the frame oscillator is coupled from the grid winding of the blocking transformer to the control grid (pin 9) of the pentode section, via a .1 μF capacitor. A 10 KΩ grid stopper and a 1.8 MΩ grid leak complete the control grid circuit. A feedback circuit derived from the pentode anode feeds back a proportion of the output voltage to the grid circuit to linearise the frame scan, the amount of feedback being determined by the frame linearity control.

### *The Line Timebase*

As previously mentioned the line oscillations are generated in a multivibrator circuit formed by V7(B) and V11. The high oscillatory voltages at V11 anode being used by the line putput transformer to provide the line scanning stroke, suitably damped and added to by V13 (PY81), as well as being stepped up by an overwind to supply the EHT rectifier V12 (EY51). Width is varied by the position of the three-point tap and linearity (left to right width relationship) by L8.

### *Power Supplies*

A PY82 H.T. rectifier V14, is used in a conventional circuit, the surge limiter (R117) being a 35 ohm 5-watt resistor wired in series with the valve cathode. The main smoothing capacitor has 100 and 200 μF sections wired on either side of the smoothing choke. The valve heaters are in one chain, the tube heater being " next to chassis."

So far, the general circuit outline has been described and a few hints on handling given. This month the various common faults and their generally effective cures will be dealt with. However, there is one point of interest which we would mention and which can prove to be a time saver. It concerns replacing the tube in the TS17. As mentioned earlier. the front viewing glass is easily removable for cleaning. Once removed, however, it will be seen that the tube clamp is accessible, and once the tube base socket and ion trap magnet have been removed from the rear of the tube. the front clamp may be loosened and the tube removed from the front, without removing the chassis. There are no snags attached to this operation. and tube renewal can be effected in a matter of minutes. Another simple modification which overcomes a frequent objection can be made to the turret tuner. The objection is to the number of turns. or " clicks," which have to be made when tuning from Band I to Band III. Assuming the receiver is in use in the London area (Channels 1 and 9) a switch over from one programme to another necessitates quite a few turns of the channel selector. Now it is quite a simple matter to remove the Channel 9 coils and clip them into the Channel 13 position, i.e., next to Channel 1. The advantages of this are too obvious to require comment, but a word of caution is necessary. Assuming the receiver is in use in the Midland area (Channels 4 and 8), it must not be assumed that the Channel 8 coils can be inserted into either the Channel 3 or Channel 5 clips. The tuning provisions are different for the Band I (1-5) and Band III (6-13) coil positions. Thus, if a straight switch-over is required, place the BBC coils into the Channel 1 position and the I.T.A. coils into the Channel 13, if the receiver is used on any other than the Channel 1 areas. In later receivers this system has been adopted, the switch positions being marked in three positions only, one Band I (BBC), and two Band III (ITA).

Whilst on the subject of the tuner unit, the usual minor troubles most often encountered may be discussed. The symptom of persistent fading which can be remedied only by actuating the tuner switch is quite common and in the majority of cases can be cleared by cleaning the studs and springs with a good switch cleaner or by applying a solvent such as C.T.C. or Thawpit, taking care to apply a thin film of vaseline afterwards. This latter is most important and must not be omitted.

The symptom described must not be confused with that which obtains when the oscillator coil is out of alignment, causing the signals to be obtained with the switch turned just "off the click." When satisfactory reception cannot be obtained at the desired switch position, it being necessary to turn the switch either a little before or a little after the proper position, remove the switch and fine tuner, set switch correctly and fine tuner to the mid-position. Insert a suitable trimming tool through the hole provided and reset the coil core to maximum sound.

We are often asked what steps are necessary to overcome the fault(?) condition whereby the I.T.A. signals are weak and only the sound or the vision can be tuned, but not both. The answer is invariably that the applied signal is too weak and an improvement is necessary at the aerial end. If a good signal is known to be present, the PCC84 valve should be checked, preferably by substitution. It is good economics to keep a few known efficient valves as standbys, and in the case of these receivers a PCC84, PCF80, ECL80, EF80 and a PL81 form a good "insurance." A PY82 and a PY81 can be added to make the list almost complete, the EBF80 and PCL83 of the sound stages being omitted as there is less likelihood of confusion if one of these should fail. Still referring to the tuner unit, another "weak link" exists in the form of a 1KΩ (1,000 ohms) resistor which is occasionally brushed by the rotation of the turret. This can eventually lead to an H.T. short to chassis, charring this resistor (R7) and causing the 470Ω H.T. feed resistor to burn out. The 1KΩ resistor is mounted in the tuner unit behind the centre "biscuit" of the turret.

The 470Ω resistor is fitted under the main chassis, being located by tracing the blue lead from the tuner to it.

Replacement of both resistors generally restores operation, provided, of course, that the 1KΩ is mounted in a position which permits free movement of the drum.

A fault which leads to some confusion is variation of brilliance. The symptoms are that the mean level of brightness will suddenly decrease, initially leading one to believe that the signal strength has fallen due perhaps to an aerial fault

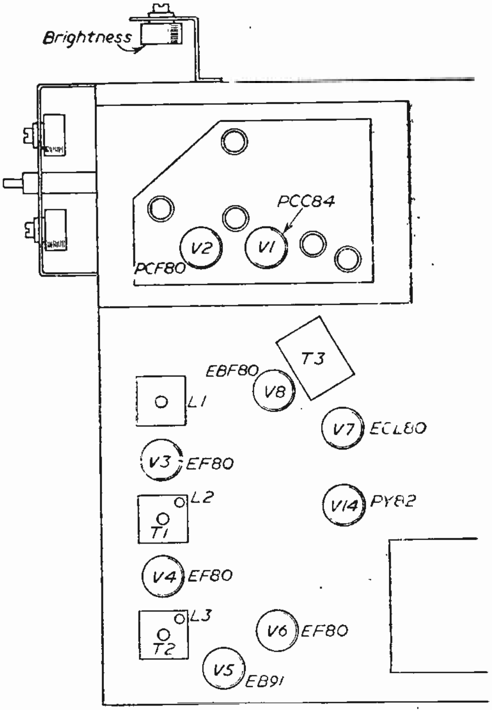



**Fig. 6.—Positions of the valves on the H.F. side.**

or something similar. However, if the brilliance is advanced to maximum it will be noted that the usual raster lines are either unobtainable or very faint as opposed to the usual "white screen." A measurement of C.R.T. grid volts will show that only 50 v. can be recorded at maximum brilliance setting. The usual snag is that as soon as a reading is taken normal conditions return, the grid voltage goes up and the raster is completely controllable from a high level illumination to black-out. The frame fly-back suppression capacitor (.1μF) connected to the junction of the tube grid series resistors 22KΩ and 470KΩ may be responsible, and disconnection will prove this. However, it may be found that the 470KΩ must be replaced before normal reliable conditions are restored. The components mentioned may be located by tracing the grid lead from tag 2 of the base socket (C.R.T.) to the 22KΩ (red, red, orange). The 470KΩ is coloured yellow, violet, yellow and normal conditions can temporarily be restored by short-circuiting this resistor with a short lead. This is probably the best course when the family are tapping their feet! This is one of the instances where one of the short leads, terminated at each end with a crocodile clip, as advocated by F. E. Apps in one of his recent articles, proves of high value.

### *Line Timebase Faults*

The condition most likely to be encountered is that of NO PICTURE, NO RASTER, NO E.H.T., the usual line timebase whistle being absent. The first check to make is on the PL81. Substitution is the best check. If a new valve fails to restore normal conditions, check the 8.2KΩ screen dropping resistor which may be found to be burned or open circuit. If the resistor is burned, don't replace the PL81 until it has been tested, since a short in the valve may have caused the resistor to fail.

If the PL81 circuit is in order, check the ECL80 V7 (part line oscillator) and the PY81. The line output transformer is a less likely but still quite possible suspect. In this connection it may be mentioned that a line output transformer defect is difficult to detect with normal instruments, a short circuited turn being sufficient to cause excessive damping.

Where the line timebase whistle is audible, check the EY51 heater; the too obvious conclusion, that because the heater is not glowing the valve must be gone, may be correct after all! Just to be on the safe side, however, remove the tube anode cap to see if this action results in any activity at either end of EY51.

| CONTROLS |
|---|
| **Sensitivity 5 KΩ (Lin.).** |
| **Contrast 500 KΩ (Lin.)** |
| **Horizontal Hold 100 KΩ (Lin.)** |
| **Volume 500 KΩ (Log.) D.P. Switch.** |
| **Vertical Hold 50 KΩ (Lin.)** |
| **Frame Lin. 50 KΩ (Lin.)** |
| **Height 100 KΩ (Lin.)** |
| **Brightness 50 KΩ (Lin.)** |

If, with the tube lead off, a good spark is obtained at the single wire end of the EY51 but the heater is still out, it is quite in order to replace it.

| SOBELL TS17 VALVE LINE-UP |
|---|
| **V1—PCC84 R.F. Amp.** |
| **V2—PCF80 Freq. changer.** |
| **V3—EF80 Common I.F. Amp.** |
| **V4—EF80 Vision I.F. Amp.** |
| **V5—EB91 Vision Det./Limiter.** |
| **V6—EF80 Video Amp.** |
| **V7—ECL80 Sync Sep./Line Osc.** |
| **V8—EBF80 Sound I.F. Amp/Det./Clamp.** |
| **V9—PCL83 Sound A.F. and Output.** |
| **V10—ECL80 Frame Osc./Output.** |
| **V11—PL81 Line Output.** |
| **V12—EY51 EHT Rectifier.** |
| **V13—PY81 Efficiency Diode.** |
| **V14—PY82 H.T. Rectifier.** |
| **C.R.T. MW43/64 (TS17).** |
| **C.R.T. MW36/44 (T346).** |

The line output transformer, PL81 and PY81 (the EY51, of course, being mounted on the transformer) are located on the right side of the chassis in the perforated screening box. The lid is removed once the fairly large brass screw is released. When tracing a fault of low efficiency, poor width, poor E.H.T. regulation, etc., do not forget to check the V7 triode section anode resistors 330KΩ and 100KΩ as well as the 470KΩ grid leak resistor of the PL81. Poor E.H.T. regulation means that the brilliance fails as the control is advanced beyond a certain point, the raster becoming blurred and large before finally failing altogether.

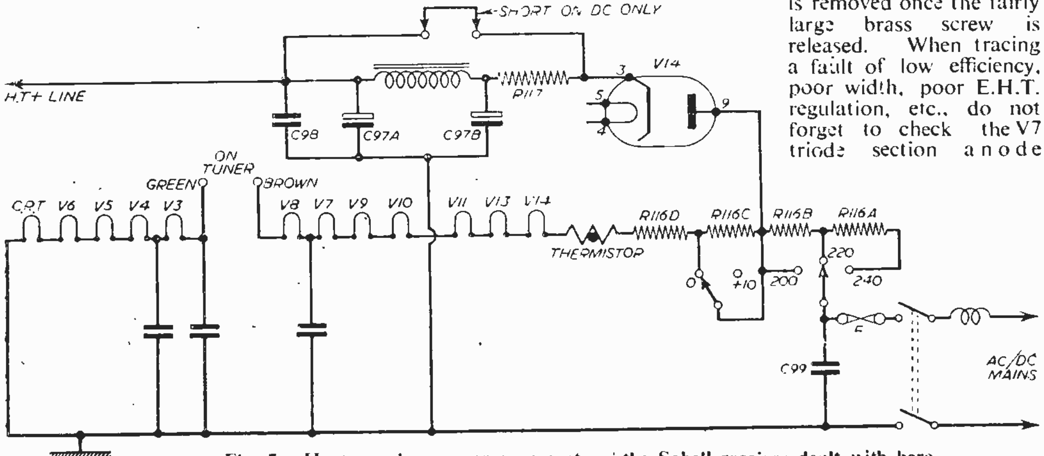



**Fig. 5.—Heater and power arrangements of the Sobell receiver dealt with here.**

If inspection reveals that the EY51 heater is glowing healthily even though the picture fails due to lack of E.H.T., it is virtually certain that this valve (the EY51) needs replacing. Sometimes the symptoms are of variation of brilliance depending upon the white picture content, the weather chart for instance producing a very blurred picture, perhaps blacking out altogether. Incidentally, flutter caused by aircraft in the vicinity causes intolerable variation and only a reduction in brilliance will enable a picture to be held at all.

These symptoms, of course, are applicable to any receiver and not only to those which are the subject of this article.

*Frame Timebase*

A rather peculiar fault encountered several times on these receivers shows as an extended frame scan accompanied by inability to lock the picture vertically. Put in other words, the height is excessive and the picture rolls at high speed. This has been found to be due to a short-circuit in the 820KΩ resistor which is wired in series with the VERTICAL HOLD control. This is exactly the opposite to what is usually encountered, the fault usually being that the reistor "goes high," causing loss of hold and slightly reduced height.

The V10 ECL80 itself can be held responsible for numerous frame timebase faults, including loss of hold, height and distorted frame scanning, the latter varying from severe cramping at the bottom of the raster to nothing more than a pair—perhaps only one white line across the centre of the picture, the latter being otherwise normal.

In the event of valve replacement not curing severe frame distortion, check the 100μF (12VDC) electrolytic capacitor wired from pin 3 of the valve base to chassis.

*Sound Section*

When distortion of the sound signals is experienced, the 4.7MΩ (yellow, violet, green) resistor, which is the H.T. feed resistor to the WX6 noise limiter, should be suspected. This resistor and the small metal rectifier are mounted close to the PCL83 valve base. It is good practice to replace the resistor with one of ½ watt rating to prevent a repetition of the distortion at a later date. The WX6 itself is often responsible for noisy sound, but undoubtedly the volume control itself (500KΩ DP switch) is the most frequent offender in this direction, accurate diagnosis presenting no difficulty, however, since the slightest touch creates the most unearthly noise. This noise is worsened when the PCL83 tends to be microphonic, and between the two of them the net effect must be heard to be believed!

*Blown Fuse*

When the fuse fails repeatedly, it is sometimes difficult to ascertain the cause. If the fuse failure is intermittent, perhaps days elapsing before another one goes, suspect the PY82.

If it blows as soon as the set warms up, however, try another PL81, and if this does not stop it, have the PY82 and PY81 tested. After these steps it will be necessary to check the H.T. line for shorts, observe the valve heaters as they warm up (for signs of a few lighting up brightly, indicating a heater-cathode short in one) and generally examine the chassis for obvious signs of overloading.

## REPLACING PICTURE TUBES

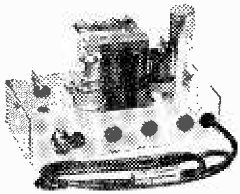
*(Continued from page 64)*

should be rotated for maximum brilliance. Should none be obtained it is reasonable to suspect faulty tube. If an EHT meter is available an ion trap is simple to adjust, and should be carried out as follows. Connect the meter to tube anode with the EHT lead connected. Advance the brilliance control until a fall in voltage is experienced. Set volume control at the point where the voltage just begins to fall. Adjust ion trap in usual way.

Once a raster has been obtained adjust the focus control to a point of maximum sharpness. If a sharp raster cannot be obtained it will be necessary to make some adjustments to the focusing mechanism. If the focusing is by means of permanent magnets try the effect of screwing them nearer together or farther apart ; also the effect of moving the assembly up and down the neck of the tube. If focus cannot be obtained it will be necessary to replace the magnets. If focus is effected by a combination of permanent and electro-magnets the following procedure should be adopted. Set the permanent magnets to give as sharp a raster as possible, then adjust the resistance network as in the case of the brilliance control to either increase or decrease the current flowing through the coil, but be careful not to exceed the current rating for the coils. It is better to fit stronger magnets than burn out the focus coil. Once focus is obtained it is worth while readjusting the ion trap as the focusing will probably have altered its setting.

The only trouble likely to be encountered now is that due to a lower deflection sensitivity the timebases do not give sufficient power to fill the screen. It is as well to compare the published figures before starting the conversion, as to increase the outputs of the timebases can be somewhat complex, and instructions are outside the scope of this article. As a general guide any variation of over 60 per cent. means that the tube is unsuitable. Also the voltage required to modulate the tube should be considered, as if a 100 per cent. increase is required it may be that the present video stage will not give the extra voltage without alteration. For the same reason the interference limiter may have to be readjusted to avoid clipping the signal when the tube is being fully modulated.

The above procedure may at first appear to be rather formidable, but if the job is tackled methodically no trouble should be encountered. In general, it is more likely to be successful if a tetrode is replacing a triode than the other way about. In the writer's experience the only tube which cannot be replaced by other makes are those round ones made by Emiscope, but these are usually ruled out at the start on account of size alone.



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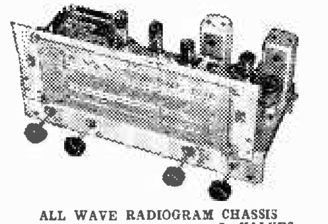

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| 16+16/450 v. T.C.C. | 5 6 | 60+100/350 v. | 11/6 |
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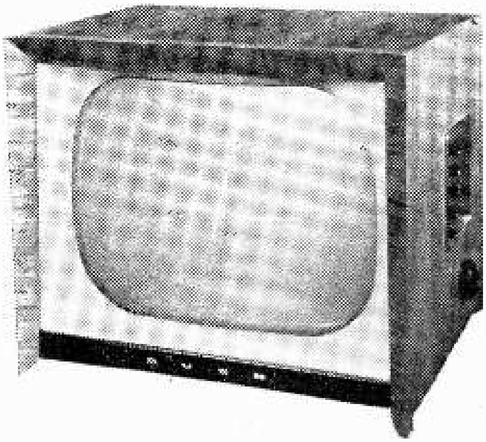
# TV at Earls Court

## A PRELIMINARY REVIEW OF SOME OF THE EXHIBITS AT THIS YEAR'S RADIO AND TELEVISION SHOW

AS the opening date of the Radio Show draws nearer, more and more details of the exhibits are being released. As is usual with the show, however, certain manufacturers prefer to withhold certain information in the desire to steal a march on their competitors, as a result of which we are kept in the dark regarding any startling development which may eventually be released. However, from the information so far received, there appears to be little which is actually new at this year's show, and the majority of exhibits will look and perform very much like those of last year. One of the foremost circuit developments is, of course, the use of printed circuitry, and whilst, at the time of writing, no complete receiver appears to be made entirely on a printed circuit chassis, Pam (Radio & Television) Ltd., who were the first manufacturers to produce a printed circuit television set in this country, now introduce a complete range of TV sets—all using printed circuit chassis. However, the R.F. portion of these receivers still utilises the "wired" technique, and only the time-bases are on the printed circuits. No doubt other firms will also be producing printed circuit units in their receivers, but this technique does not seem to have reached the proportions which were anticipated at last year's show.

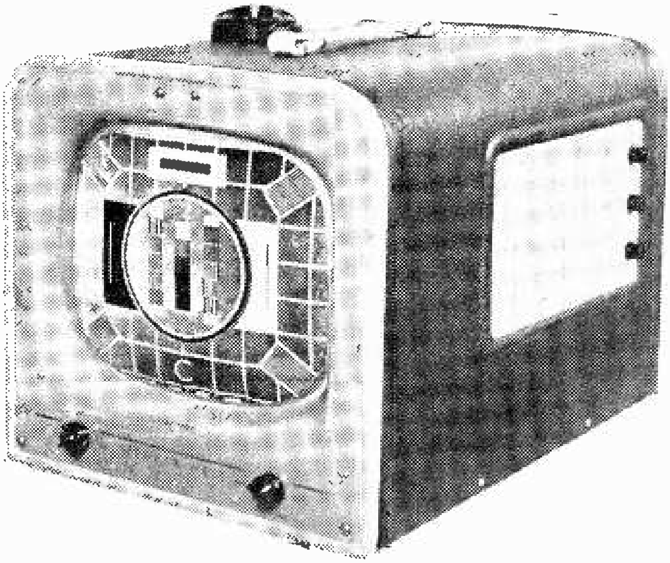
Easy-to-get-at pre-sets are found on this Invicta and Pam receivers.



Modern design in table models is typified by this Bush receiver.

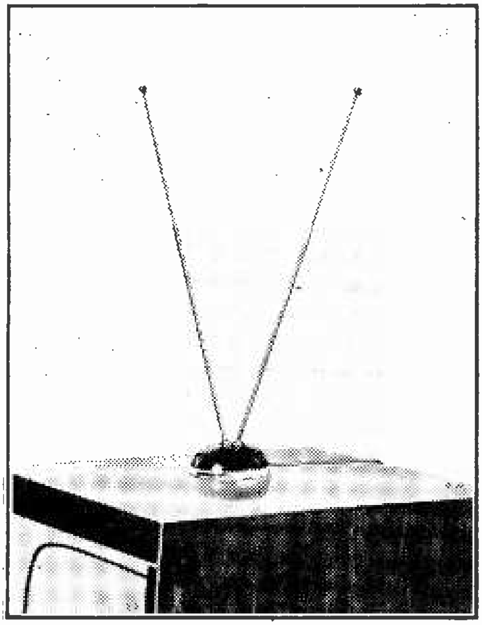
### *Reduced Size*

The most interesting development, from the pictures which we have seen, is the tendency in table models to reduce the overall size of the cabinet, whilst using larger tubes. Thus 17 and even 21 inch tubes are being used, but the cabinet sizes are very little, if at all, larger than the 12 and 14 inch cabinets of previous years. This has been accomplished in most cases by making the



A portable by Spencer-West with magnifying front.

tube front fill the entire front of the cabinet, and also by the use of the rectangular tube. The loudspeaker is still, in the majority of cases, of the elliptical type, and is placed at the side of the cabinet instead of beneath the tube, and in many cases, as typified by the illustration of the Bush receiver on page 71, the controls have also been removed to the side. This thus provides the viewer with a much larger picture and removes from him the difficulty of having to find accommodation for a larger set. Unfortunately, however, from the technical point of view, this increase in size which is now available by the use of larger tubes has not resulted in the manufacturers providing the viewer with improved sound quality. There appears to be still the 8in. elliptical speaker as a maximum size, and the



The "Golden-V" aerial for all bands—by Belling & Lee.

simple direct-fed pentode output stage, and yet the quality of reproduction on the wavelengths used for television is capable of so much better use. We hope, by the time the show opens, to see that some manufacturer has provided a push-pull output stage, with a really high-quality speaker, although this will call, of course, for a console cabinet. This question of quality seems to be avoided by the manufacturers, and yet there is a terrific demand for "hi-fi" equipment for the reproduction of gramophone records. On the V.H.F. sets used in sound radio there also appears to be very little carried out in the way of doing justice to the high-quality which is available, V.H.F. bands being included in small table models with no attempt at wide-band quality reproduction.

*Pre-sets*

The illustration on the left of page 71 shows an Invicta model and this, with the other models by the same manufacturing concern, has what might be regarded by many viewers as a welcome return to an old practice. This is the placing on the front panel of certain pre-set controls. Readers will remember that at one time the controls were all on the front, then certain of them were removed to the rear "out of the way," whilst in some cases a small lid or panel was used to cover them until they needed adjustment. The four small controls are for vertical and horizontal hold, contrast and sensitivity, and many viewers find it helps to have these handy to adjust from time to time to compensate for valve wear and tear and varying atmospheric conditions.

*Portables*

In the region of the smaller sets there is the portable, and a very good example of these is the Spencer-West model shown at the foot of page 71. This particular model is for use on either A.C. or D.C. mains, but not for batteries, and weighs only 17lb. This, too, uses the printed circuit in its construction, and has automatic picture control and noise suppression circuits. The tube used in this receiver, as is more or less now in general use, is of the aluminised type and it would appear that this type of tube has now won the battle between aluminised or ion trap. A feature on this Spencer-West model, which we have not seen before incorporated in a complete receiver, is the use of a magnifying front to provide an apparently larger picture with the employment of a small tube. There appears to be no large-scale development of the room-to-room portable which at one time was thought possible.

*Aerials*

In the realm of the accessory the aerial has probably undergone the greatest development. The illustration on the left shows the "Golden V" by Belling & Lee. This is an "in the room aerial" which can be used on any channel in Bands I, II or III with either vertical or horizontal polarisation. It has adjustable elements which can be extended and set at any angle to give the best possible results, and its directional properties help to eliminate double images or "ghosts." It has a non-slip base and is finished in black and genuine gold plate. It has been purposely made to be more efficient in Band III than on Band I, as it has been found in practice that this band is the most difficult to receive. At 2 guineas this represents a very good buy.

# TV I.F. Transformers

THE QUALITY OF A RECEIVED PICTURE IS VITALLY DEPENDENT ON THE R.F. COUPLINGS. SOME DETAILS ARE GIVEN HERE FOR AMATEURS WHO WISH TO WIND THEIR OWN I.F. TRANSFORMERS By T. Usher

THERE must be many serious amateurs who have thought of winding their own I.F. transformers, but who have decided, on second thoughts, to follow some coil winding details from a published TV set design. These details are, however, invariably those for winding coils to be employed in stagger-tuned circuits, and there are none for band-pass coupled transformers, but while most amateur TV set constructor designs use these stagger-tuned circuits, the coupled circuit interstage coupling in one of its variations enjoys a greater popularity in commercial practice today. Possibly the amateur believes that single coils stagger-tuned are the easiest to handle, but coupled circuits are not only within the average amateur's ability to employ, they have several important advantages over the former. One advantage of coupled circuits is that only one single lining up frequency is required instead of the several required when lining up the single coils to their different frequencies. Another considerable advantage is that it is possible to obtain a higher stage gain with them by some 50 per cent., or even more if the Q of one circuit is higher than the other and the coupling is correctly adjusted. It will be seen that the making of one's own coupled circuit coils, a feat which is by no means difficult providing a little patience is exercised, is well worth while.

The most common form of coupled circuit uses mutual inductance coupling between the primary and secondary coils which are placed in the grid and anode circuits respectively of the I.F. valve. Top capacity coupling in addition to mutual inductance has been used but it is very unusual to use it deliberately.

### *Stage Gain*

The gain obtainable for a given bandwidth which is taken as 2.7 Mc/s usually (that is the limit of the BBC transmission) depends primarily on the value of the valve mutual conductance and the circuit capacities associated with the valve. With coupled circuits the gain depends also on the coupling factor, as can be seen in the well known formula for the stage gain of a single valve with a bandwidth :—

$$\text{Stage Gain} = Gm\sqrt{Rp\ Rs}\left(\frac{k\sqrt{Qp\ Qs}}{1 + k^2\ Qp^2\ Qs^2}\right)$$

Where Gm = value mutual conductance
k = coupling coefficient = 1/Q for critical coupling
Rp = Primary circuit impedance
Rs = Secondary circuit impedance
Qp = Primary circuit ($=\omega Ci/Rp$)
Qs = Secondary circuit ($=\omega Co/Rs$)
Ci = Total Primary circuit capacity
Co = Total Secondary circuit capacity
$\omega = 2\pi f$

In the majority of cases in practice the Q values are equal, that is Qp = Qs. In this case the formula above is simplified and becomes :—

$$\text{Stage Gain} = Gm\sqrt{Rp\ Rs}\left(\frac{kQ}{1 + k^2\ Q^2}\right)$$

It should be appreciated that the primary and secondary Q values of the transformer, unlike ordinary radio circuits where they are made as high as possible, depend not so much on the coil dynamic resistance but on the circuit capacity. Each of the coils is deliberately damped heavily by resistances in parallel with its windings of almost invariably much lower resistance than its dynamic impedance at resonance. In the absence of any damping resistances a high Q value would be achieved, and a Q of 150 for the coil alone can easily occur. With high intermediate frequencies the valve input resistance contributes to the coil damping and has to be allowed for in the choice of damping resistance value. Valve makers quote a figure of grid input resistance at one particular frequency, and it is possible to derive the input resistance at any other frequency by using the approximation that the input resistance is inversely proportional to frequency.

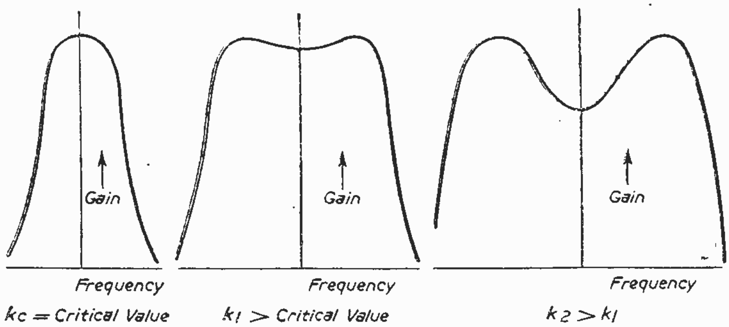



**Fig. 1.—The single response curve, and those formed by band-pass or staggered tuning.**

### *Coupling Factor*

For those not familiar with coupled circuits it should be explained that when the transformer primary and secondary Q's are equal it is possible to vary the amplitude versus frequency response of the stage by increasing the coupling between the coils from what is known as critical to greater values. At a coupling value below critical a reduced stage gain and bandwidth result and consequently this degree of coupling is never used. At the critical coupling value a single peaked response occurs still and maximum amplification is obtained at the resonant frequency to which both the primary and secondary will have been tuned. As the coupling is increased beyond this value two humps appear in the amplification versus frequency response curve and these are equally spaced from the centre. A dip occurs also in the centre which corresponds to the resonant frequency. The height of these humps, however, remains the same as that of the single peak in the critical coupling case. If the coupling is increased even more, these humps in the response curve move farther and farther apart, and at the same time the dip in the centre increases. (Fig. 1.)

It is unusual to have the coupling increased beyond the point where the dip in the centre is greater than —2 db or 80 per cent. of the maximum amplitude, because of the difficulty of subsequent correction to give a flat top in the overall response curve. Also with this condition the transient response is liable to be poor, so that a sharp black outline on the picture is liable to be followed by a white outline and vice versa.

The coupling factor needed to obtain the desired bandwidth with mutual inductance coupling will depend on the primary and secondary Q. This in turn depends on the circuit capacity.

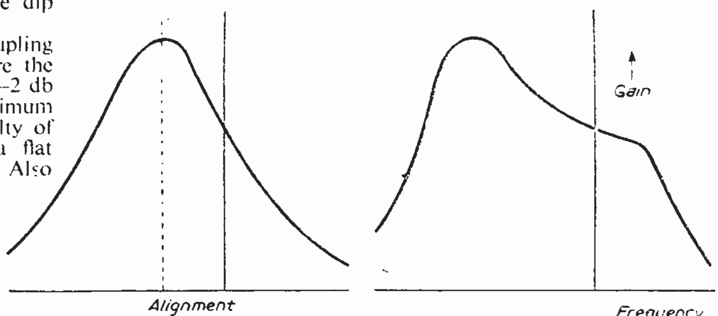
If by any chance the primary and secondary are not tuned to exactly the same frequency, the effect is similar to overcoupling ; the amplitude of the humps remains unchanged.

*Unequal Q Circuits*

A higher stage gain can be obtained with the transformer primary and secondary Q of different values by making, for instance, the primary twice the secondary. When the transformer is so adjusted the stage gain increases as the ratio of the primary and secondary Q increases, until in the limit when one winding has infinite Q the stage gain is increased in the ratio of 2 to 1.4 for equal Q circuits.

Circuits with unequal Q ratio are similar to equal Q circuits in their behaviour as the coupling is increased, but the height of the humps in the response curve does not remain constant but changes with an increase of coupling. A response similar to the critically-coupled case is obtained with these circuits when the coupling is increased to give what is called transitional coupling which gives the flattest response. Under these conditions of coupling the response beyond the limits of the pass-band falls off more rapidly than in critical coupling with equal Q circuits. This is sometimes an advantage in providing a little extra relativity.

A disadvantage of the unequal Q circuits is the somewhat greater difficulty which arises during alignment, particularly at the higher intermediate frequencies.



**Figs. 5 and 6.—Further response curves as described in the text.**

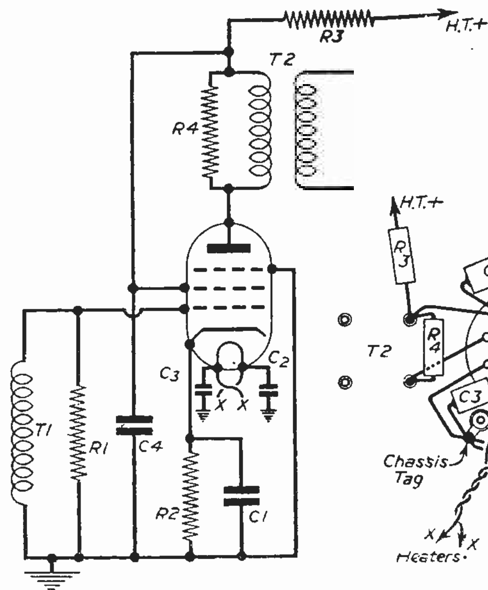
*Bandwidth and Capacity*

In the gain formulæ, the gain for a given bandwidth is dependent not only on the circuit coupling, but also on the circuit capacities which reduce the gain and must therefore be kept to a minimum. Having selected a suitable valve for its high (Gm/total capacity) ratio, every effort must then be made to keep down the stray capacities of its associated circuit. Of course, for other reasons, the valve anode and grid leads are kept as short as possible. The circuit layout can be considered satisfactory only if a reasonable value of stage gain is obtained. Having wired up the circuit, the damping resistances to obtain the primary and secondary coil Q values for the desired bandwidth are then dependent on the valve grid input capacity, coil capacity, valveholder, wiring stray capacity, and the anode capacity.

TA

9/32in. iron-cored former, w

| Turns | 10 | 12 | 14 | 1 |
|---|---|---|---|---|
| Inductance (pH) | 1.7 | 2.2 | 2.74 | 3 |



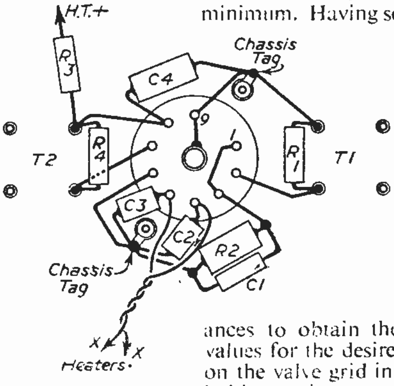



Fig. 2.—A typical Noval based valve I.F. stage.

A fairly typical layout for a Noval based I.F. valve is given in Fig. 2, with the theoretical circuit alongside.

Using an EF80 valve some average values which were measured in this circuit were 9pF for the primary circuit of which the valve anode-earth capacity contributed 3.3 pF, and for the secondary circuit 14 pF of which the valve grid-earth capacity was 7.5 pF as obtained from the valve maker's figures. These values may serve as a guide and a starting point for experimental work.

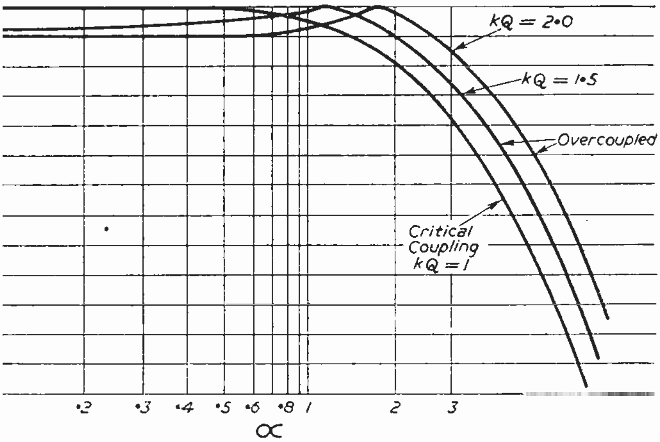



Fig. 3.—Curves showing response.

## *Stage Design*

Suppose we wish to work out the damping resistances for an I.F. valve stage working at 35 Mc/s mid-band frequency in a circuit similar to the one in the sketch. The bandwidth required is, say, 2.7 Mc/s for a −2 db loss of performance. Coupling is to be made critical (kQ=1). First the transformer Q must be determined, and we shall choose equal Q circuits for this purpose. Then we use published curves of tuned circuit selectivity called Universal Selectivity Curves. These are reproduced here, and show the circuit response in terms of a circuit constant ∝ which is the Q × $\left(\frac{\text{off tune frequency}}{\text{resonant frequency}}\right)$

.E I.
d with 30 s.w.g. enam.

| | | | | | | |
|---|---|---|---|---|---|---|
| 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 3.8 | 4.4 | 5.0 | 5.5 | 6.1 | 6.6 | 7.2 |

From the curve we find that a drop of −2 db (approximately 80 per cent. of response) corresponds to an ∝ of 1.2. This gives a Q value of (1.2 × 35/2.7)=15.6.

The damping resistance required on the primary is $(15.6/2\pi \times 35 \times 9 \times 10^{-6})$ or 7.9 kΩ, and for the secondary is $(15.6/2\pi \times 35 \times 14 \times 10^{-6})$ or 5.1 kΩ. In practice an 8.2 kΩ and a 5.6 kΩ resistance would be used.

The effects of the damping imposed by the anode impedance and the grid input impedance have been ignored as they are usually very high by comparison with the damping resistances. The grid input impedance may not always be neglected, particularly at the higher frequencies, and the value of the damping resistance must then be adjusted to take account of this.

With the above values of damping resistance, the stage gain becomes $\frac{7.4}{2}\sqrt{(5.6 \times 8.2)}$ or 25, using an EF80 valve with a Gm of 7.4 mA/v.

## *Coil Winding*

The experimental procedure is to wind the coils for the primary on a "cut and try" basis. The above values of circuit capacity may serve as a guide to the probable tuning capacities. The number of turns to give the required inductance to resonate at the I.F. chosen may be obtained from published tables of coil turns and frequency for different iron-cored formers. For obvious reasons it is advisable to wind on too many turns rather than too few. Iron dust cores are almost invariably used for tuning, and these should be screwed half-way into the former. Then with the primary and secondary coils connected in the circuit, one coil is damped heavily (with say a 500 ohm resistor) while the other coil is tuned. The turns are then removed from this coil until the coil resonates. The other coil is then dealt with likewise.

The mutual inductance required can be obtained from the correct axial spacing of the coils, from an overwinding on either the primary or secondary, or from an interlinked extension (bifilar fashion) of both the primary and secondary coils. The first method is most tedious to carry out experimentally, depending as it does on the adjustment of the positions of the ends of the two windings to each other. The overwinding scheme is probably the most popular commercially, but has a snag in that in varying the tuning of the coil over which the coupling is wound varies the mutual inductance and hence the coupling. Consequently the overwinding turns then have to be adjusted. To minimise the effect the iron core should be at the end of the winding remote from the overwinding. The third method, particularly with a third dust core for the coupling winding has some advantage for the amateur, as there is less effect from tuning the primary and secondary on the coupling. A long coil former must, of course, be used, or two separate coil formers.

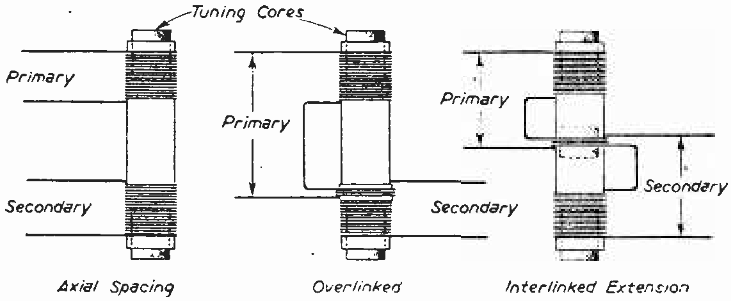



Fig. 4.—Details of I.F. windings.

To some extent the choice of coupling method is dependent on the I.F. used. With the older lower frequencies of 13 Mc/s or so, it may not be possible to obtain sufficient coupling unless an overwinding is used. At the higher frequencies it is much easier to obtain adequate coupling by any of the above methods. In fact, with an overwinding only a turn or so will be needed, compared with as many as 16 turns for critical coupling in a typical I.F. stage at 13 Mc/s.

The type of coil former selected will depend on the method of screening the stages. Where the whole stage is screened, separate unscreened coil formers may be used ; these may be either long coil formers accommodating both primary and secondary coils or separate coil formers side by side. However, care must be taken where the coil formers are side by side to allow for the coupling which will exist between the coils by making the coupling winding assist the mutual inductance from this effect, or the coils must be spaced so that the effect is negligible.

The coil formers themselves need not be of low loss material and a phenolic resin former is quite satisfactory since the coils are, of course, heavily damped anyway.

The choice of wire for the coils is mainly based on convenience. Where a large number of turns are wound on, as are necessary for the lower frequencies such as 16 Mc/s, gauge 36 s.w.g. enamel covered wire with the turns side by side would be used. The whole winding is then secured by a polystrene or cement varnish. For the overwinding a layer of cellulose tape or waxed paper is placed over one end of the winding, and the coupling winding is wound on top. This is then treated in the same way. At frequencies of 35 Mc/s the wire size can be increased to gauge 30 s.w.g. enamel and then likewise dealt with. (Table 1.)

### *Distortion of the Response Curve*

The arrangement of the coil connections should be such that the adjacent ends of the primary and secondary are what is known as "earthy." This, in conjunction with the short valve anode and grid leads, reduces to a minimum any capacitive coupling between the windings. This unwanted coupling present would produce some distortion of the resonance curve. The effect could then only be cured by some retuning after the original alignment to restore the symmetrical response. This may be difficult to do without a wobbulator.

Another cause of distortion of the resonance curve of the I.F. stage after correct alignment to the I.F. is the effect of the anode to grid capacity of the valve. Although this is very small, for instance, .007 pF in the case of the EF80 valve, it is often sufficient, particularly at 35 Mc/s, to produce feedback. This feedback will then produce an asymmetrical response curve of the stage.

The input resistance of the valve is given by $Rg = \frac{Go^2 + Bo^2}{Gm\ Bo\ (\omega Cga)}$ where Bo is the anode circuit susceptance, Go is the anode circuit conductance. Cga=anode to grid capacity. Gm=mutual conductance.

When the anode circuit is capacitive, then the grid input impedance is negative and this results in negative feedback which results in a decrease in gain. When the anode circuit is inductive a positive grid impedance results. This produces a positive feedback, giving an increase in gain. With the I.F. transformer primary in the anode circuit these conditions are obtained when the frequency is respectively higher and lower than the intermediate frequency. For a single tuned circuit in the anode, this gives the response shown, which obviously corresponds to a shift of the resonant frequency. The extent of the frequency shift depends on the magnitude of the anode to grid capacity. (Fig. 5.)

For the case where the transformer primary is in the anode circuit, the mechanism of the feedback is a little more complex because of the reflected impedance of the secondary into the primary. However, the final result is much the same and a distorted resonance curve is obtained. Where overcoupling is used, humps appear unequally displaced from the centre frequency and of unequal height. To avoid this effect the impedance of the grid-circuit is made not more than about 10 times the minimum value of grid input impedance. (Fig. 6.)

In the case of circuits critically coupled, the minimum grid input resistance is given by :

$$Rg = \frac{2}{Gm\ (\omega Cga)\ Rd}$$

where Rd is the transformer dynamic impedance.

A point to be taken note of is that where the response curve of a stage is taken by putting a signal generator from the valve grid to earth, the low output impedance of the generator reduces very considerably the grid input impedance.

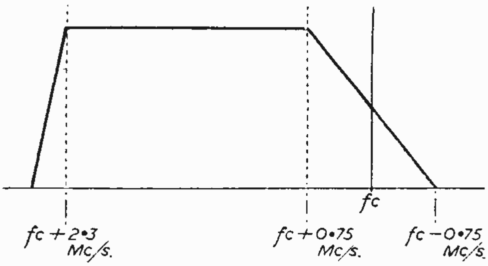



**Fig. 7.—The correct response curve which should be aimed at.**

Under these conditions the effect of the anode-grid capacity cannot be observed. Unless one is aware of this possibility, response tests taken in this way on the I.F. stages may be misleading.

### *I.F. Amplifier Response*

An I.F. amplifier generally employs a mixture of degrees of couplings. A combination of critically coupled and overcoupled circuits can be used to give the required overall bandwidth of the amplifier as a whole. A typical scheme uses critically coupled transformers for all stages, except for the last, which employs overcoupling between the final I.F. stage and the demodulator diode.

Another scheme often seen is a mixture of overcoupled and critically coupled transformers with a single tuned circuit to fill in the trough in the response curve, so giving finally a flat response curve. In deciding on the amplifier response, it is necessary to take into account the response of the front end of the receiver where a turret tuner or single station circuit may be employed. It may well be found necessary to modify the I.F. amplifier response to suit it in order to give the overall bandwidth desired.

# Scanning & Synchronisation

1.—FUNDAMENTALS

By G. K. Fairfield

THE electron-beam of a cathode-ray tube can be swept across the screen face either electrostatically, that is by means of a potential applied between two plates situated on either side of the beam, or electromagnetically by means of a magnetic field set up by the passage of current through coils also disposed about the beam axis. Whilst the former method is employed for the small deflection-angle tubes used in oscilloscope work, much too high a scanning potential would be needed if this method were to be adopted for television tubes. Consequently, e.m. deflection of the beam is utilised and the problem revolves around the creation of a linear magnetic field transversely across the tube neck and causing this field to increase linearly with time as the beam crosses the screen.

*In this, the first of a series dealing with the principles and practice of scanning and synchronisation circuits, it is intended to look a little into the theory of electromagnetic (e.m.) scanning as it affects the design of television circuitry.*

A sketch of the field required is shown in Fig. 1, which also shows how the coils are disposed about the tube neck. The deflection will be at right-angles, both to the direction of magnetic field and current through the coils (Fig. 2). The field-producing current (i) is shown in diagramatic form in Fig. 3. With no current flowing the spot is stationary at the screen centre and as (i) increases to a maximum value of + I amp., the spot is deflected to the right-hand edge of the screen. The current then rapidly reduces, passes through zero, and builds up to a maximum value, − I amp., in the reverse direction, whilst the spot flies rapidly to the extreme left-hand edge of the screen (the retrace period). The current then decays linearly to zero and one complete scanning cycle has been performed. It will be seen later that this view of the scanning cycle, i.e., commencing and finishing at the screen centre, has much to commend it when discussing efficiency-diode circuits, although it will be appreciated that after the first half-cycle of a repetitive scan we can commence to talk about a sawtooth waveform, disposed on either side of a zero-current axis (Fig. 4).

### Scanning Coil Considerations

The field produced by the scanning current will be proportional to the ampere-turns of the coil used and at first sight it would seem advisable to make the coils as large as possible in order to reduce the current requirements to a minimum. Apart from physical space limita-

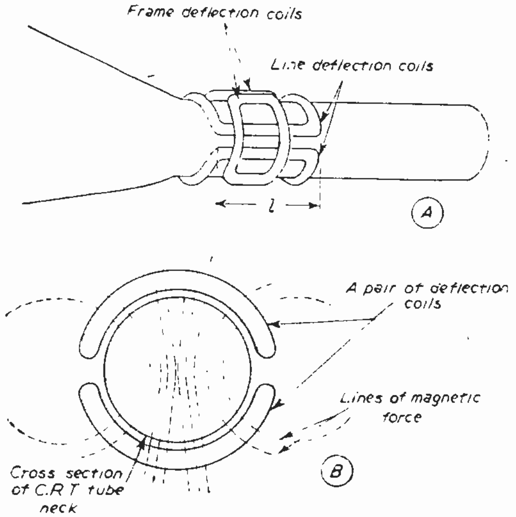



Fig. 1.—E.M. deflection coils and field across C.R. tube neck.

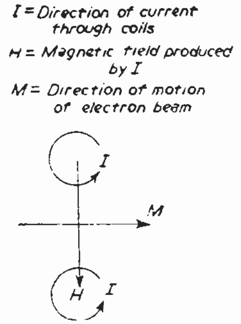



Fig. 2 (right).—Relationship between current, field, and motion of electron beam.

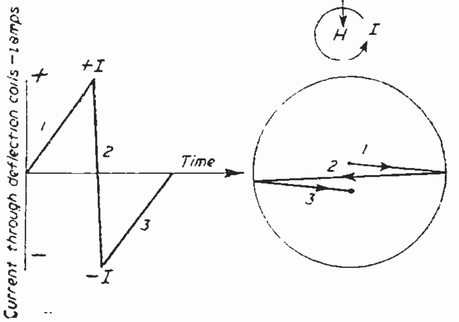



Fig. 3.—Variation of scanning current and movement of spot across tube face.

tions, considerations of the peak potential developed across the line coils limits the inductance value to around 10 mH. During the rapid retrace period tr (about 7$\mu$S) a potential of $\frac{L.2I}{tr}$ volts will be established across the coils and for a peak-to-peak scanning current of, say, 1 ampere, given 10 mH coils, then this potential reaches a value of some $1\frac{1}{2}$ kV, which is a quite large enough insulation problem to be handled!

This situation is not present with the frame coils as the retrace period is at least 100 times as long, and high impedance, low current coils are possible. These present their own difficulties, as will be seen later and as a general rule the $\frac{L}{R}$ ratio of the coils will be found to be similar for both line and frame coils, at around $\frac{L}{R} = 1$, where L is measured in mH and R in ohms. Thus at line frequencies the coils will behave as an almost pure inductance, whilst at the much lower frame repetition rate the coils can be considered as a resistive load. This is an important difference and explains the entirely different approach to the design of the two scanning circuits.

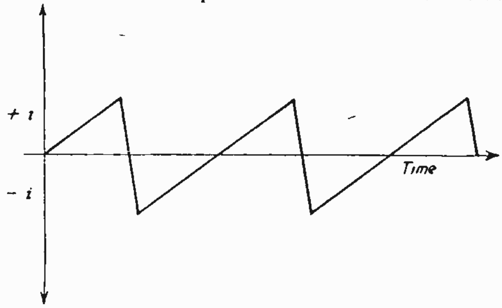



**Fig. 4.—Sawtooth scanning current.**

### *Scanning Power Required*

Ideally, the electron-beam having almost negligible mass, should require expenditure of negligible energy in order to deflect it across the screen. Unfortunately owing in part to the dissimilar lengths of the scan and retrace times and the necessity for linear scanning, and partly due to the resistance of the coils, a fair proportion of the receiver input power is expended in moving this "weightless" beam.

This is particularly serious in the case of the line scan generator and to take a practical example, let a set of deflection coils be used having an inductance of 10 mH and requiring a sawtooth current of 1 ampere (p-p) in order fully to scan the tube. Then during one scan period the energy required will be $\frac{1}{2}.L.I^2$ or 5 millijoules. This energy must be rapidly dissipated during the retrace period and supplied afresh during the next cycle so that the total power lost as heat will be:—

No. of scan periods/sec. $\times$ Energy $\doteq 405 \times 25 \times .005 = 50$ watts.

Fortunately a more efficient form of scanning circuit is possible at line frequency with which it is possible to store some of this energy, otherwise dissipated during the retrace period, and release it during the subsequent scan period. This is the efficiency-diode system and will be considered in some detail later on in this series.

The same arrangement cannot be used for the frame circuit as it implies that the L/R time constant be large in relation to the scanning period and, as has already been pointed out, the L/R values are similar for both sets of coils whilst the frame scanning period is so very much longer. Due to the smaller repetition rate (50 c/s) and smaller scanning-angle required for frame deflection the problem is not severe and a much lower efficiency can be tolerated.

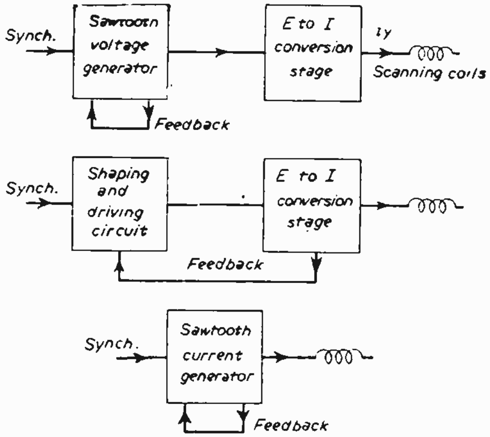



**Fig. 5.—Methods of sawtooth current generation.**

### *Methods of Sawtooth Current Generation*

Turning now to the production of the scanning waveform. Fundamentally three classes of circuitry are possible and these are illustrated in Fig. 5. In the first a linear sawtooth potential is produced from a circuit, such as a multivibrator or blocking oscillator, having internal positive feedback, and fed to a stage designed to convert a potential variation into an identically-shaped current one, i.e., an E to I conversion stage.

(*To be continued*)

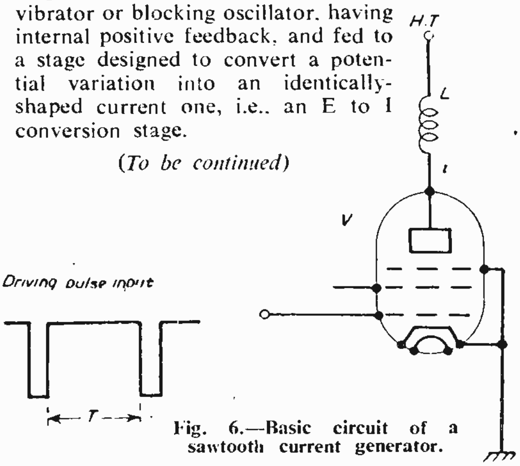



**Fig. 6.—Basic circuit of a sawtooth current generator.**

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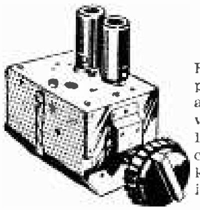

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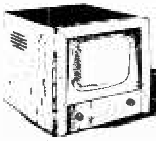

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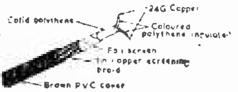


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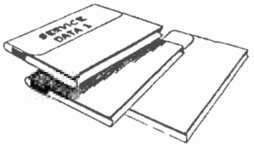


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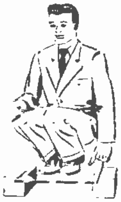

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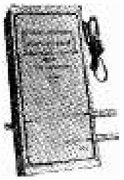

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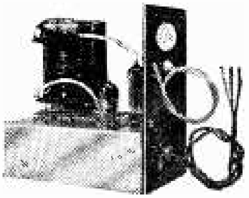

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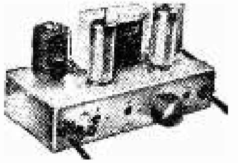

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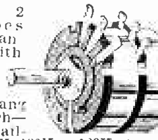

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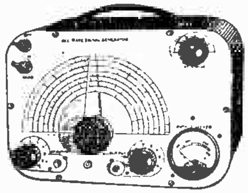

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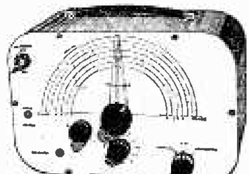

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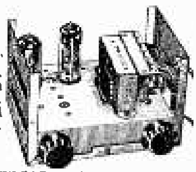

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# Aerial Matching and Mismatching

## HOW IT AFFECTS RECEPTION IN "FRINGE" AND LOW SIGNAL STRENGTH AREAS

By A. F. E. Sonn

*(Continued from page 16 August issue)*

ALTHOUGH an aerial has been correctly matched to the television receiver, mismatching can still occur if an incorrect method of attenuation is used. When using an attenuator it is necessary that the system used should present to the feeder the correct impedance, attenuate the signal, and have an output impedance that matches the set. There are two different methods used for attenuators (see Fig. 6 (a) and (b)). Fig. 6 (a) shows a PI network. Here R1 is the impedance presented to the input, R2 and R3 form a potential divider and R3 is the output impedance. Values of resistance are worked out as follows:

$$R1 = Z\left(\frac{N+1}{N-1}\right)$$

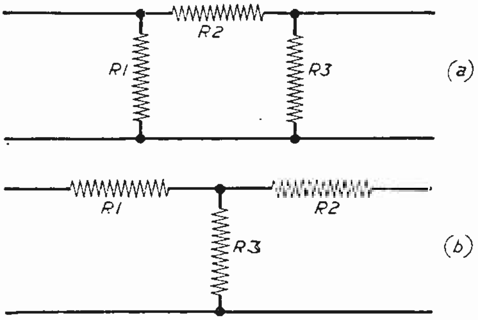



**Fig. 6.—Two methods used for attenuators.**

where Z equals characteristic impedance of feeder and N equals the attenuation ratio required. Thus if Z=70 ohms and attenuation required is 10 to 1 then

$$R1 = 70\left(\frac{10+1}{10-1}\right) = 70 \times \frac{11}{9} = \frac{770}{9} = 85.5 \text{ ohms.}$$

$$R2 = Z\left(\frac{N^2-1}{2N}\right)$$

$$= 70\left(\frac{100-1}{20}\right) = 70 \times \frac{99}{20} = \frac{6930}{20} = 346.5 \text{ ohms.}$$

R3 is the same as R1. The values worked out are not very critical and the nearest preferred standard value can be used. Fig. 6 (b) shows the other method of attenuation, called the T network. Here R1 and R2 are the same value and their resistance is

$$R1 \text{ and } R2 = Z\left(\frac{N-1}{N+1}\right)$$

$$R3 = Z\left(\frac{2N}{N^2-1}\right)$$

If it is desired to have a variable amount of attenuation, further stages can be added (see Fig. 7). There are three stages of attenuation where if, at point A, the attenuation was 10 to 1, then at point B it would be 100 to 1, and at point C 1,000 to 1. It will be noticed that here the output impedance for the first stage is also the input impedance of the second stage and so on.

The reader will have probably noticed that attenuation ratios are quoted as so many dB's down, so perhaps it is as well to give an idea of what this means.

### *Decibels*

Decibels are ratios and not quantities, and if one states that a voltage is 10 dB's up or down, it means that it is with relation to some other voltage. If, however, one is talking about loss or gain, it implies that the output is 10 dB's up or down compared with the input. A simple method of computing decibels as ratios is as follows. If you take as a standard 6 dB, this is approximately a ratio of 2 to 1, and 20 dB a ratio of 10 to 1. Suppose for instance in an attenuator the required attenuation was 26 dB. Then in two stages we could have a ratio of 2 to 1 and 10 to 1; this would give a ratio of 20 to 1 (multiplied) and this in dB's down would be be 6 dB and 20 dB which would give 26 dB (added). Thus one can see that while ratios are either multiplied or divided, according to whether they are gain or loss, decibels are added or subtracted. A list of decibels and equivalent ratios is given on the right.

| dB's | Ratio |
|---|---|
| 1 | 1.12 |
| 3 | 1.5 approx. |
| 6 | 2.0 approx. |
| 10 | 3.2 approx. |
| 20 | 10 |
| 40 | 100 |
| 60 | 1,000 |
| 80 | 10,000 |

**A list of decibels and equivalent ratios.**

### *Gain of Aerials*

The relative gain of an aerial is the ratio of microvolts passed to the aerial terminal of the receiver as compared with that of a simple dipole. For instance, the gain of an H-type dipole is between 3 and 5 dB; in other words, it will offer to the receiver about 1.5 times the signal of a simple dipole. Now an H-type dipole will, owing to its reflector, reduce signal pick-up from the opposite direction of the signal. This is about 10 times down relative to the forward gain, or 20 dB. Thus if the forward gain is 4 dB and the backward gain is reduced by 5 dB, the whole aerial has 9 dB between forward and backward gain. Manufacturers of aerials quote these figures in their specifications, and it is worth while to notice them when a new aerial is decided upon.

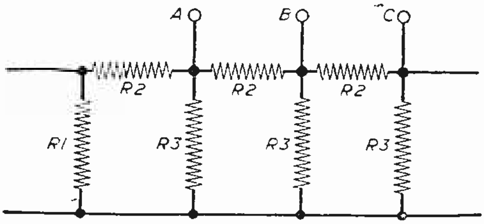



**Fig. 7.—If it is desired to have a variable amount of attenuation further stages can be added as shown.**

### *Mounting of Aerials*

On frequencies used on Band III, interference can have a greater effect than on Band I. Therefore if mounting a Band I and a Band III aerial, see that the Band III is on top of the other.

# CORRESPONDENCE

**The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).**

## *A DOOR-KNOB KILO-VOLTER*

SIR,—Further to your article, "Making a Kilo-volter," page 525 in the June issue, I have, in the dim, distant past, made use of a very similar idea. Instead of the brass door knobs I used 2 ½in. ball-bearings for the spark gap. The idea was, when using the SG voltmeter, the actual electrodes would not come into contact with the chassis or tube supports, causing damage perhaps, to either the rectifier or associated components. Another little tip, when using the instrument the left hand should be in the pocket or somewhere out of the way, as any slightly damp material would track the EHT over from the thumb to chassis shown in picture on the cover. If the limiting resistor is fitted, Fig. 2, the unit can be safely used on any type of EHT unit, even on the R.F. or anode side as well as the rectified side, so we are catering for the R.F. flyback and mains produced EHT. Calibration should be carried out using an electrostatic meter or a known voltage—do not rely on the figures quoted by manufacturers, or if this is done, allow a margin of error.—J. BROWN (Penryn).

**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.**

## *R.F. 26 UNIT*

SIR,—Mr. Treeby and others may be interested in the following details of the R.F. 26 Unit.

It was one of four plug-in "front ends" used with receivers Rx. 1355 and Rx. 3582 for the GEE system. From the front we have the tuned R.F. amplifier, mixer and L.O.

R.F.24 : 20-30 Mc/s five preset frequencies.
R.F.25 : 40-50 Mc/s five preset frequencies.
R.V.26 : 50-65 Mc/s continuously variable.
R.F.27 : 65-80 Mc/s continuously variable.

R.F.24 had a Hartley oscillator, the rest using a Colpitts circuit.

The original I.F. output was 7.5 Mc/s, the bandwidth was designed to be 6 db down 1/2 Mc/s either side of the tuned frequency.—I. D. SAVAGE (N.W.6).

## *RHOMBIC AERIALS*

SIR,—Having been associated with various experiments with rhombic aerials for TV reception, I was very interested in your article on this subject in the July issue of PRACTICAL TELEVISION. But one point occurs to me, however, which will be obvious to anyone who has worked on this type of aerial, but may not be so obvious to the newcomer.

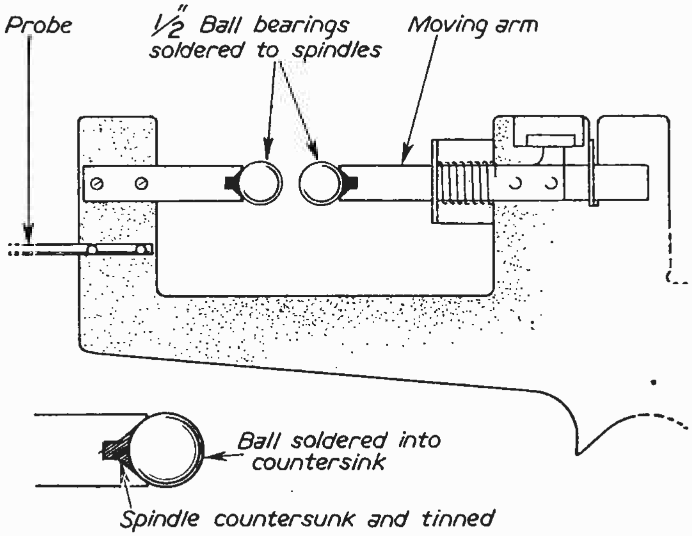
No mention was made in the article of *vertical* rhombics, though these are necessary in areas where the TV transmission is vertically polarised (e.g., Kirk o' Shotts). They are, of course, similar in every way to the horizontal variety, and may, in fact, be easier to erect in many cases, since they require less ground area. On the other hand, a fairly tall mast or pole is required to take the apex of the diamond (and incidentally this can be made of metal without having any appreciable effect on the operation of the aerial).

In conclusion, I should like to confirm that this type of aerial is well worth consideration, as it can be comparatively inexpensive yet capable of extremely good results, provided one is prepared to do a bit of messing about in order to get the best out of it.—RODNEY W. T. HORNE (GM3KJA) (Hawick).

## *"BEGINNER'S GUIDE TO TELEVISION"*

SIR,—As a newcomer to television I should like to know whether you are proposing to republish F. J. Camm's series entitled "Beginner's Guide to Television." I took up radio three years ago as a result of reading his "Beginner's Guide to Radio." It was so simply written that it appealed to me as a green amateur without very much mathematical knowledge and I have since designed and built quite a number of successful receivers as a result. I was unable to obtain the issues containing the earlier articles. —E. T. W. (Lewes).

[*We shall in due course republish the series of articles to which you refer in book form.*—ED.]




**Mr. Brown's suggestion for the improved Kilo-volt tester.**

## C.R.T. ISOLATION TRANSFORMER

**Type A.** Low leakage windings. Ratio 1 : 1.25 giving a 25% boost on secondary.
2 v., **10/6** ; 4 v., **10/6** ; 6.3 v., **10/6** ; 10.8 v., **10/6** ; 13.3 v., **10/6.**
Ditto with mains primaries, **12/6** each.
**Type B.** Mains input 220/240 volts. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. Low capacity, suitable for most Cathode Ray Tubes. With Tag Panel, **21/-** each.
**Type C.** Low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 220/240 volts. Output 2-2¼-2½-2¾-3 volts at 2 amps. With Tag Panel, **17/6** each.
**NOTE.**—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

**TRIMMERS Ceramic.** 30, 50, 70 pf., **9d.** 100 pf., 150 pf., **1/3** ; 250 pf., **1/6** ; 500 pf., 750 pf., **1/9.**
**RESISTORS. All values.** 10 ohms to 10 meg., ¼ w., **4d.** ; ½ w., **6d.** ; 1 w., **8d.** ; 2 w., **1/-.**
**HIGH STABILITY.** ½ w., 1%, **2/-.** Preferred values 100 ohms to 10 meg.

**WIRE-WOUND RESISTORS** 25 ohms—10,000 ohms: 5 watt **1/3** ; 10 watt **1/6** ; 15 watt **2/-**
15,000 ohms—50,000 ohms, 5 w., **1/9** ; 10 w., **2/3.**

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**FERROVOICE 1,200ft. Plastic Tape 25/-**
**SCOTCH BOY 1,200ft. Plastic Tape 27/-**

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**L.F. CHOKES** 15-10 H. 60/65 mA., **5/-** ; 10 H. 80 mA., **8/6** ; 10 H. 150 mA., **12/6.**
**MAINS TRANS.** 350-0-350, 80 mA., 6.3 v. tapped 4 v. 4 a., 5 v. tapped 4 v. 2 a., ditto 250-0-250, **21/-.** Bargain 300-0-300 65 mA., 6 v. 4 a., 4 v. 2 a., **15/-.**
**HEATER TRANS.** Tapped prim., 200/250 v., 6.3 v. 1½ amp., **7/6** ; tapped sec. 2, 4, 6.3 v., 1½ amp., **8/6** ; prim. 230 v. Sec. 6.3 v. 3 amp., **10/6.**
**ALADDIN FORMERS** and core, ¼in., **8d.** ; ⅜in., **10d.** 0.3in. **FORMERS 5937/8** and **Cans TV1/2.** ⅝in. sq. x 2in. and ⅜in. sq. x 1⅜in., **2/-** ea., with cores.
**TYANA.**—Midget Soldering Iron. 200/220 v. or 230/250 v., **16/9.** **Solon** Instrument Iron, **24/-.**
**MAINS DROPPERS.** 3in. x 1½in. Adj. Sliders, .3 amp. 750 ohms, **4/3.** .2 amp., 1,000 ohms, **4/3.**
**LINE CORD.** .3 amp., 60 ohms per foot, .2 amp., 100 ohms per foot, 2-way, **6d.** per foot, 3-way, **7d.** per foot.
**LOUDSPEAKER, P.M. 3 OHM.** 2¼in. square, **17/6.** 5in. Goodmans, **17/6.** 7in. x 4in. Goodmans, **21/-.** 3½in. square, Elac., **21/-.** 8in. Elac., **22/6.** 6½in. Goodmans, **18/6.** 10in. R. & A., **30/-.** TSL Tweeter, LSH75, **8/6.** 12in. Plessey, **30/-.** 8in. M.E. 2.5k field, tapped O.P. transf., **24/6.**
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**HIGH RESISTANCE PHONES.** 4,000 ohms, **16/6** pr.
**MIKE TRANSF.** Ratio 50 : 1, **3/9** ea. ; 100 : 1, **10/6.**
**SWITCH CLEANER** Fluid, squirt spout, **4/3** tin.
**TWIN GANG TUNING CONDENSERS.** 365 pf. miniature 1in. x 1½in. x 1⅝in., **10/-** .0005 Standard size with trimmers, **9/-** ; less trimmers, **8/-** ; midget **7/6** ; standard .0005 mfd. 3-gang, **7/6.**
**SPEAKER FRET.** Expanded Metal Silver, 15¾in. x 9½in., **2/-** each ; 14¼in. x 12in., **3/-** ea.
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| 3S4 | 8/6 | 6SN7 | 8/6 | ECC84 | 12/6 | MU14 | 10/6 |
| 3V4 | 8/6 | 6V6G | 7/6 | ECF80 | 10/6 | PCC84 | 12/6 |
| 5U4 | 8/6 | 6V6GT | 8/6 | ECF82 | 10/6 | PCF80 | 10/6 |
| 5Y3 | 8/6 | 6X4 | 7/6 | ECH42 | 10/6 | PCF82 | 10/6 |
| 5Z4 | 10/6 | 6X5 | 7/6 | ECL80 | 8/6 | PCL82 | 10/6 |
| 6AM6 | 8/6 | 7S7 | 8/6 | ECL82 | 12/6 | PL81 | 11/6 |
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| 6BE6 | 7/6 | 12AH8 | 10/6 | EF41 | 10/6 | PY80 | 10/6 |
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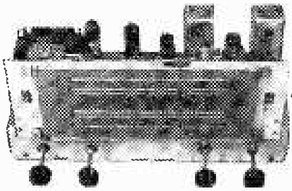
| 6BW6 | 8/6 | 12AU7 | 10/6 | Equip. | | PY82 | 10/6 |
| 6BW7 | 8/6 | 12AX7 | 10/6 | EF50 | 8/6 | SP61 | 5/6 |
| 6CH6 | 10/6 | 12BE6 | 10/6 | Sylv. | | UBC41 | 8/6 |
| 6D6 | 7/6 | 12BH7 | 10/6 | EF80 | 10/6 | UCH42 | 8/6 |
| 6F6 | 7/6 | 12K7 | 8/6 | EF92 | 5/6 | UF41 | 8/6 |
| 6H6 | 3/6 | 12Q7 | 8/6 | EL32 | 5/6 | UL41 | 8/6 |
| 6J5 | 6/6 | 35Z4 | 10/6 | EL84 | 10/6 | UY41 | 8/6 |
| 6J6 | 7/6 | 80 | 8/6 | EY51 | 11/6 | U22 | 10/6 |
| 6J7 | 8/6 | 954 | 1/6 | EZ40 | 10/6 | U25 | 11/6 |
| 6K6 | 6/6 | EA50 | 1/6 | EZ81 | 11/6 | X79 | 10/6 |
| 6K7 | 5/6 | EABC80 | 8/6 | | | | |



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12 month guarantee.
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**Designed to play 16, 33, 45, 78 r.p.m. Records, 7in., 10in., 12in. Lightweight Xtal pick-up, turnover head, two separate sapphire styli, for Standard and L.P., each plays 2,000 records. Voltage 200/250 A.C.**

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As ABOVE less POWER PACK. Requires 200 v. 20 mA. H.T. 6.3 v. .6 a. L.T. **£2.5.0.**
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**JASON F.M. TUNER COIL SET. 26/-.** H.F. coil, aerial coil, Oscillator coil, two I.F. transformers 10.7 Mc/s. Detector transformer and heater choke. Circuit book using four 6AM6, **3/-.** J.B. Chassis and Dial, **19/6.**
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**CONDENSERS.** New stock. .001 mfd. 7 kV. T.C.C., **5/6** ; Ditto, 20 kV., **9/6** ; 100 pf. to 500 pf. **Micas 6d.** ; Tubular 500 v. .001 to .01 mfd., **9d.** ; .05, .1, **1/-** ; .25, **1/6** ; .5/350 v., **1/9** ; .1/350 v., **9d.** ; .1/500 v., **1/3** ; .1 mfd., 2,000 volts, **4/-.**
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Screw Base Type 512, 8/500 v., **3/-** ; 16/500 v., **4/-.**
**SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGES.** K3/25 2 kV., **5/-** ; K3/40 3.2 kV., **7/-** ; K3/45, 3.6 kV., **7/6** ; K3/50 4 kV., **8/-** ; K3/100 8 kV., **14/6.** **MAINS TYPE CONTACT COOLED** 250 v. 50 mA., **8/6** ; 250 v. 85 mA., **9/6.**
**COILS** Wearite, "P" type, **3/-** each. Osmor Midget "Q" type adj. dust core, **4/-** each. All ranges.
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**T.R.F. COILS** A/HF, **7/-** pair. **H.F. CHOKES, 2/6.**

**ALUMINIUM CHASSIS.** 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes. 2¼in. sides, 7 x 4in., **4/6** ; 9 x 6in., **5/9** ; 11 x 7in., **6/9** ; 13 x 9in., **8/6** ; 14 x 11in., **10/6** ; 15 x 14in., **12/6** ; 18 x 16 x 3in., **16/6.**

**FULL WAVE BRIDGE SELENIUM RECTIFIERS.** 2, 6 or 12 v. 1½ amp., **8/9** ; 2 a., **11/3** ; 4 a., **17/6.**
**CHARGER TRANSFORMERS.** Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amp., **13/6** ; 2 amp., **15/6** ; 4 amp., **21/-.**
**VALVE** and **T.V. TUBE** equivalent books, **5/-.**
**TOGGLE SWITCHES.** S.P. **2/-.** D.P. **3/6.** D.P.D.T. **4/-.**
**WAVECHANGE SWITCHES.**
5 p. 4-way 2 wafer, long spindle ... ... **6/6**
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**VALVEHOLDERS.** Pax. Int. Oct., **4d.** EF50, EA50, **6d.** B12A, CRT, **1/3.** Eng. and Amer. 4, 5, 6, 7, and 9 pin, **1/-.** **MOULDED** Mazda and Int. Oct., **6d.** B7G, B8A, B8G, B9A, **9d.**, B7G with can, **1/6.** VCR97, **2/6.** B9A with can, **2/6.** **CERAMIC** EF50, B7G, B9A, Int. Oct., **1/-.** B7G with can, **1/9.**
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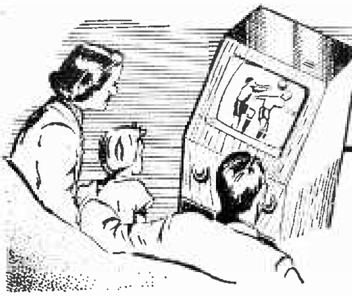

# UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

**By Iconos**

## THE MODERN ANNOUNCER

THE BBC must have had terrific luck in finding the earliest of their TV announcers, because very few of the newer people in the game manage to hit the right key of address; many are too familiar (particularly on I.T.V.), some are too wooden (occasionally on the BBC) and the odd one now and again becomes over-confident and careless. That stealer of the limelight in parlour games, Gilbert Harding, is certainly a very big television personality: but the careless manner he adopted when interviewing important old-time stars in *Goodbye Gaiety* embarrassed viewers and confused the interviewees. Hughie Green is a good performer, always sure of himself in various parlour games, but sometimes annoys with his confidential asides and winks at the viewers.

## MAKE-UP

SOME announcers will not under any circumstances allow themselves to be made-up. A few faces require little or no make-up, even with image orthicon cameras—but, not many. When an American film star, Forrest Tucker, compèring a BBC cabaret programme, boasted that he refused to allow the make-up man to cover up the bronze he had acquired in the South of France, he was being disrespectful to the viewers, to say the least. His face came out almost black, full of creases and shiny with perspiration. This spoiled a performance which was otherwise excellent. I.T.-News have always been well served by their newsreaders in the studio, but have not been lucky with their outside interviewers, male or female. Most of them could do with a few lessons in deportment, smarter clothes, a hair-do or a shave.

The BBC newsreaders, until recently, were wooden, pompous and slightly depressing to look at. They are now suddenly much better, the spark of life occasionally lighting their eyes and putting over their personalities. Peter Haigh and Derek Bond are an ideal combination, especially on *Picture Parade*, when they even seem to make the trailers of bad films seem good. On the other hand, on I.T.V., Peter West, good announcer though he is, somehow manages to make good film trailers seem bad in *Box Office*. Perhaps, in this case, the excerpts of films selected are poor or there is too much emphasis on stars going into the foyers of cinemas at premières. This trailer business is quite a gamble for the film people. Apart from the kind of presentation their film excerpts get, the quality of reproduction of sound and picture is sometimes quite appalling. When presented badly, they seem to warn the viewer *not* to see the film!

## TECHNICAL COMPETITION

I HAVE the feeling that the BBC-TV is going to go ahead technically. There is a lot of new equipment being installed at Shepherds Bush and elsewhere: new type cameras, new type film scanners, new tele-recorders, better lighting equipment and a multitude of new accessories. Their provincial outside broadcast units are very well equipped, too, and are already able to turn out such excellent live documentaries as the visit to the Forth Bridge (which included some excellent helicopter shots). The I.T.V. companies will, in due course, replace some of their present equipment; but it hasn't been installed long. TV studio equip-

**The Mullard Mobile Experimental Unit—a comprehensively equipped laboratory on wheels—has just embarked for the Continent. Purpose of the visit is to check, under field conditions, the results of work on A.G.C. systems for 625 line TV receivers carried out recently in the Mullard Research Laboratories. The spacious interior of the Mobile Experimental Unit can be seen in the illustration above.**

ment reaches the age of obsolescence in an alarmingly short time. On the other hand, I have seen many well-maintained commercial TV receivers which compare very favourably for quality of results with the 1957 models. Neither give pictures which compare with those on the closed-circuit sets at the TV Studios' control rooms. Band width limitations, principally on the receivers, are responsible for most of this loss of quality, a situation which is aggravated by producers and art directors who fail to recognise this limitation. In trying to put over too great a range of tones, they often only succeed in mushing up the results for most commercial receivers.

## "THE LASS OF RICHMOND HILL"

A FEW years ago, Regency plays achieved considerable popularity on stage and screen. The Prince Regent has been represented by different authors and producers in a variety of characters. Mostly, he has been pictured as the gross and corpulent First Gentleman of Europe; gambler, spendthrift, vain and arrogant. A few refer to the great influence he wielded over that art and architecture of the period, which gave us so many buildings which delight the eye in London and elsewhere to-day. W. P. Lipscombe's *The Lass of Richmond Hill* revealed quite a different facet in the life of the Regent; his life at the age of 23, when he was gay and handsome and a popular hero of the people. The story is based upon the events which followed his secret marriage to Mrs. Fitzherbert, a union which could not be recognised by the State, because she was a Catholic.

Jeannette Sterke, who is now one of our finest TV actresses, portrayed Mrs. Fitzherbert with great sincerity and dignity, entirely capturing the sympathy of the viewers—as did Tony Britton, who gave a performance of great charm as George, Prince of Wales, the Regent. The technical values of this TV play were superlative—as they usually are when produced by Rudolph Cartier. Mr. Cartier insists upon a first-class cast, which in this case included Marius Goring as Sheridan, George Woodbridge as George III, and Lucie Mannheim as Queen Charlotte, in addition to Jeannette Sterke and Tony Britton, already mentioned. Cartier's productions always possess the gloss of the real professional touch which make them quite outstanding—not to be missed.

## PLAYBACK

ON the other hand, the BBC-TV maintains its lead in major presentation innovations, of the kind which delights the technically-minded viewer. Take, for instance, the recent TV presentation of Puccini's opera *Madame Butterfly*. George Foa, the producer, decided to use two casts—one to provide the visual effect on the stage and the other to provide the sound. The actors synchronised their lip movements and actions to the playback of the singing and music, thus enabling the best possible results to be obtained respectively on the pictorial and the sound sides. Now this was in itself not a startlingly new technique. It has been done in musical films in the cinema for years; and the BBC have tinkered with the idea on one or two previous occasions. In *Madame Butterfly*, however, the playback method was carried out with great strength and conviction, and the result was a complete success. I have been amused and entertained by the clever use of playback in the Jack Jackson Show on I.T.V.; but it has been left to the BBC-TV to put on a memorable production which proves that playback has a place in the TV presentation of more serious programmes.

## CONDUCTORS AS STOOGES

THE television orchestra conductor on comedy shows, often dragged into sketches and cross-talks, doesn't always make the grade. Eric Winstone, for instance, is a first-class dance band conductor with a tip-top band. But he is obviously ill at ease in coping with dialogue and cross-talk with comedians and others in Holiday Night. Bringing the conductor into the act is a procedure that should be undertaken with great caution: there are not many Eric Robinsons about. Of course, with the show bands such as Billy Cotton's the function of the conductor is rather different: he *is* the show, not the conductor of an accompanying orchestra. I never tire of watching the robust performances of this fine showman, of marvelling at the expert work of his musical arrangers, his dialogue writers and his other assistants with dances, decor and wardrobe.

## WIMBLEDON FORTNIGHT

I AM inclined to think that the BBC won the television championship at Wimbledon—but only just! The TV coverage of the world-famous Wimbledon fortnight was on a truly grand scale. There were about 16 assorted TV cameras plus numerous 16mm. and 35mm. film cameras in use by the army of over 100 BBC and I.T.V. technicians. The chief difference in the respective presentations was the emphasis by the BBC on close shots and mid-shots, whereas I.T.V. preferred to make more use of long shots, giving full views of the courts. Commentaries on both channels were good, particularly Fred Perry on I.T.V. But the handling of the visuals is the most important single factor in outside broadcasts of this type, and it was obvious that the BBC producer had the advantage of superior camera equipment and a greater variety of camera angles.

## IRISH TV

AFTER Scotland and the Isle of Wight TV areas comes Ireland. Various television promoters are competing for the concession to operate commercial television in the Dublin area. The Irish Broadcasting Company Ltd., which has a capital of £100,000, has been registered by a group of American financiers who have offered to build and equip an Irish TV station at an estimated cost of £400,000. Also interested in the concession is a syndicate connected with the Pye Company. The Irish Government is considering the various proposals, but is unlikely to agree to the formation of a TV organisation with majority financial control outside the country. It will be interesting to see whether the group that wins the concession will join in with the British Commercial Network for special star programmes.

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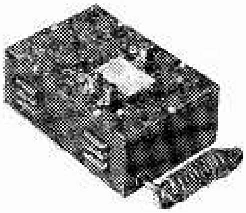

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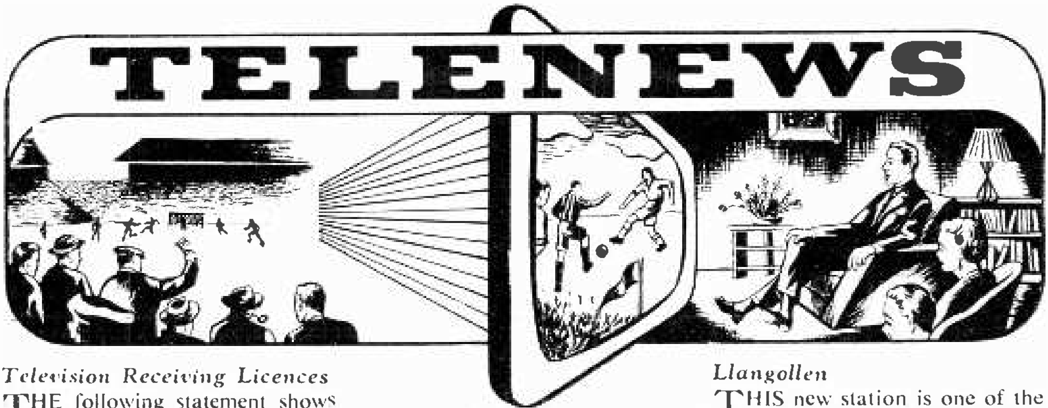



### *Television Receiving Licences*

THE following statement shows the approximate number of Television Receiving Licences in force at the end of June, 1957, in respect of receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

| *Region* | |
|---|---|
| London Postal ... ... ... | 1,489,649 |
| Home Counties ... ... | 853,392 |
| Midland ... ... ... | 1,183,333 |
| North Eastern ... ... ... | 1,126,291 |
| North Western ... ... | 1,017,352 |
| South Western ... ... ... | 527,371 |
| Wales and Border Counties ... | 403,645 |
| Total England and Wales ... | 6,601,033 |
| Scotland ... ... ... | 500,921 |
| Northern Ireland ... ... | 67,555 |
| Grand Total ... ... ... | 7,169,509 |

### *Winter Hill I.T.V. Watched by 795,000 Homes*

MORE than 2,720,000 viewers in 795,000 homes were able to receive independent television from Winter Hill recently, according to Television Audience Measurement Limited.

This compares with 270,000 homes able to receive I.T.A. programmes from the transmitter when it opened twelve months previously.

### *TV Aids Cancer Research*

A NEW closed circuit TV plant permits immediate comparative data of chemical activity within live normal and cancer cells. The National Institutes of Health, Bethesda, Md. report that this is the result of the development of a new ultra-violet-sensitive TV camera tube which is undergoing examination.

### *Electronic Computer Exhibition, 1958*

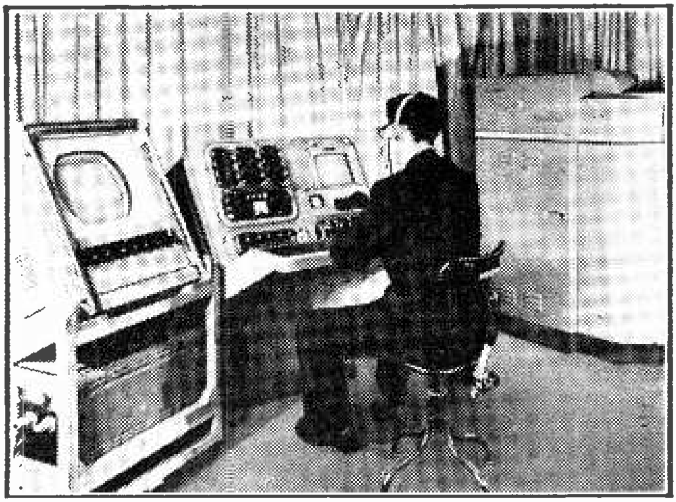
THE Electronic Computer Exhibition is to be held at Olympia from November 28th to December 4th, 1958. It is the first exhibition of its kind in Great Britain and is being sponsored by a joint committee of the Radio Communication and Electronic Engineering Association and the Office Appliance and Business Equipment Trades Association. Most of the leading firms will exhibit.

### *British Institute Convention*

THE Convention of the British Institution of Radio Engineers took place in Cambridge on June 26th to July 1st, when automatic machine tool control by electronic equipment, electronic stimulators or analogue computers, office machinery and information processing and electronics in automation were discussed.

### *Llangollen*

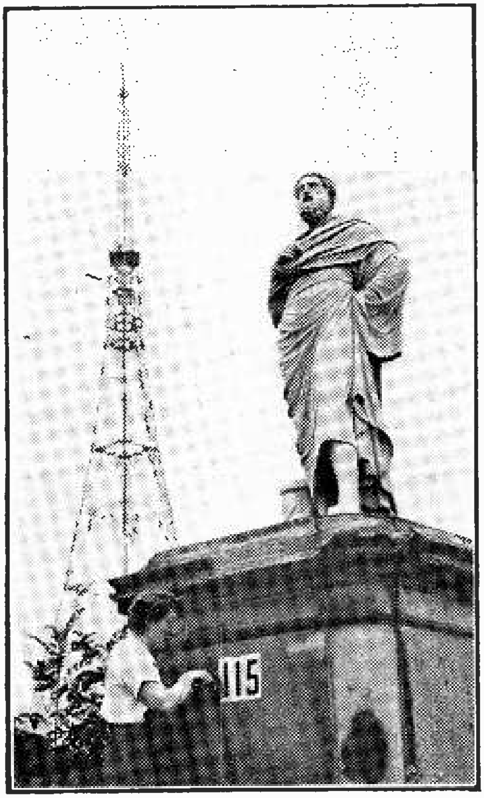
THIS new station is one of the six further V.H.F. stations which, as announced earlier, the BBC is building in the second stage of its plan to provide nation-wide coverage of the sound programmes on V.H.F. It was originally intended that Llangollen should transmit only the Welsh Home Service programmes, but it is now planned to make it a three-programme station. Listeners with V.H.F. receivers will thus be able to receive the Light and Third Programmes as well as the Welsh Home Service at equal strength from the one station and will be able to use simpler aerial installations than would otherwise have been required. The Welsh Home Service will be transmitted on 93.3 Mc/s, the Light



The Marconi Three-Vidicon Colour Telecine was demonstrated in public for the first time in June. The illustration above shows the complete colour telecine channel, including a Colour Monitor, the Operating Console and the Pedestal.

Programme on 88.9 Mc/s and the Third Programme on 91.1 Mc/s, each with an effective radiated power of 6kW. Transmissions will be horizontally polarised as at other V.H.F. sound broadcasting stations, which means that receiving aerials must be fixed horizontally.

The auction, which consisted of the largest collection of impressionist paintings ever to come up for sale in London, attracted a very large number of people, many of whom were unable to get into the main saleroom. These people were accommodated in adjoining rooms. In addition to following the proceedings on the existing loudspeaker system, they were able to see the paintings on television screens, and bid from these rooms. A director of the firm, present in each room, relayed bids by telephone to clerks in the main saleroom.



The Crystal Palace, which has such close associations with television, was recently the scene of an auction at which many of the various statues which were to be found in the grounds were disposed of. Many of these are by unknown sculptors and the origin of many is unknown. One of these is seen above, with the television mast in the background.

### *£200,000 Auction on Television*

A SALE of paintings worth over £200,000 was recently seen on television.

Pye closed circuit television linked the main saleroom at Sotheby's with other rooms in the building. A TV camera installed in front of the auctioneer, Mr. Peter Wilson, relayed pictures of the paintings as they were offered for sale, to TV receivers in the other rooms.

### *Television for Traffic Control*

BRITAIN'S first permanent installation for traffic control is to be set up in the Market Square at Durham.

The Minister of Transport and Civil Aviation, Mr. Harold Watkinson, has informed the Durham County Council that he approves of the television scheme and will make a contribution towards its cost.

At present a policeman stationed in the Market Square is required to control traffic which he cannot see. The object of the new installation is to give him a clear picture of the traffic on two of the approaches to the square.

Traffic entering the square by the Framwellgate and Elvet Bridges can only pass in one direction at a time. The constable controlling the traffic lights on the bridges from his police box in the square cannot see the number of vehicles waiting and must also estimate the time needed to clear each line of traffic between the square and the bridges.

The television cameras which are now to be installed at each bridge will transmit a picture of the actual traffic conditions to a screen in the control box and will help the constable to reduce delays to traffic to a minimum. He will also see the kind of traffic waiting and make allowance for heavy, slow-moving vehicles. In addition, the television will enable him to see whether vehicles parked nearby are interfering with the flow of traffic.

This new method of traffic control was tried out successfully in Durham in August, 1956, and is now to be installed permanently.

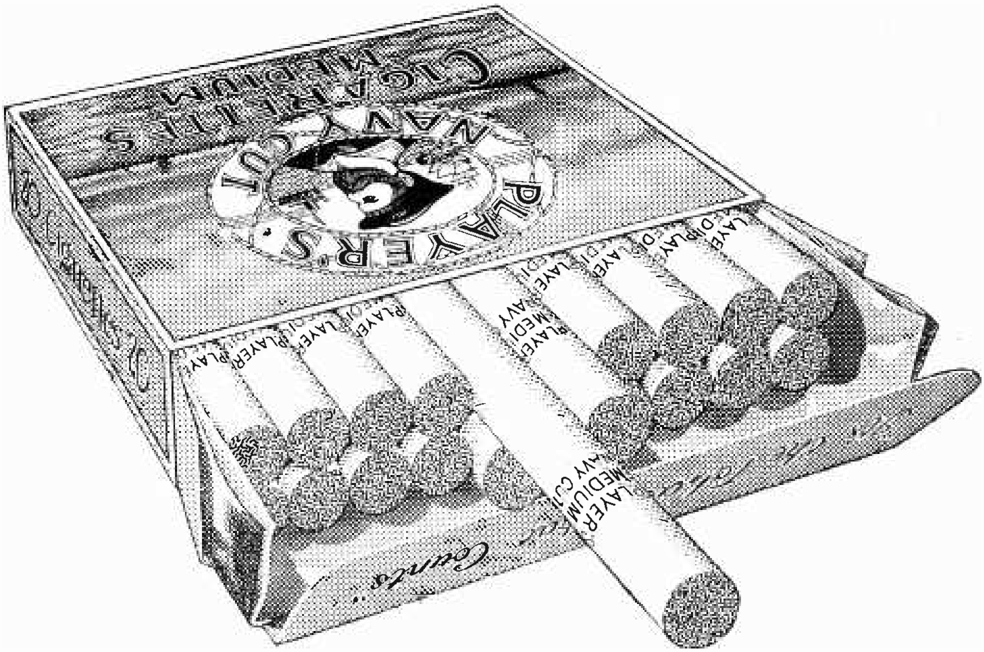
### *I.T.A. Service for Southern England*

THE Independent Television Authority has invited applications for the provision of programmes from the first of its 1958 stations—at Chillerton Down, in the Isle of Wight, designed to extend I.T.A. programmes to more than two million people in southern England. The service area is roughly a half-circle, stretching along its base from Weymouth through Ventnor to Brighton, and reaching to Newbury in the north. Lying in the service area will be Hampshire and the Isle of Wight, almost the whole of Dorset, West Sussex, the south-eastern parts of Wiltshire and the south-western parts of Surrey.

Further stations in the south-west and south-east will be needed before the whole of southern England is covered. The Authority has not yet sought approval for these stations, which are not likely to come into operation until late 1959 or 1960.

With the opening of its seventh transmitting station in the Isle of Wight, probably in the late spring of next year, the authority will have made its services available in areas with a total population of about forty millions, or 80 per cent. of the United Kingdom, within about thirty months of its first transmissions from Croydon in September, 1955.

# I always say please to Player's




**PLAYER'S ALWAYS MEANS PLEASURE FOR ME**

[NCC 154DD]

# 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. 91 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.*

## PHILLIPS 1700A

**I have one of the above projection receivers using a directional plastic screen which I have cleaned, front and back, with industrial methylated spirit and chamois leather. This has left some marks on the plastic which, when seen on the picture, look exactly like water marks in paper. I have been unable to remove these, both with more spirit and with warm water and a detergent. I should be glad to know if you can say what caused the marks to appear, whether it is possible to remove them, and, if not, what is a new screen likely to cost.—F. B. Singleton (Wrexham).**

We do not think that you will be able to remove the marks which have been caused by the chemical action of the spirit. Several advertisements have appeared in quite recent issues of PRACTICAL TELEVISION offering projection units complete or in parts and we have no doubt that one of these advertisers will be able to supply a viewing screen at a very reasonable cost.

## PHILLIPS 563A

**I have recently had trouble with this set and found the electrolytic condensers faulty. I renewed these and while I had the set out I had the four timebase valves tested and renewed. I have not been able to obtain a picture of sufficient width to fill the screen for a couple of years, but when the RCH35 and EL38 were brand new and set still out of the cabinet I was able to fill the whole tube.**

**The trouble seems to be lack of sync when the pot R138 is turned clockwise for maximum width. R120 does not have any effect. If the R138 is narrowed to obtain a picture half an inch less than either side, the picture is perfect. I have renewed both sync valves EB91 and EF50.**

**The fault appears as horizontal bars of about a quarter of an inch deep the full height of the picture which assumes an all-over grey appearance. This is accompanied by high pitched hissing from the speaker. The picture or rather the grey bars have a brilliant vertical row of spots at the left hand side.**

**I think I should mention that I converted this set for I.T.V. with Teletron converter Mark I. Due to breakthrough of BBC, I had to make oscillator condenser 12$\mu$F a variable 25$\mu$F one and then use a frequency some Mc/s off BBC wavelength and adjust converter to this frequency. This was necessary as my I.T.V. aerial is in visible line with and at a distance of one mile from Palace transmitter. (Sound rejector adjusted also).—S. E. Attwell (S.E.21).**

We would advise you to check R119 for correct value and, if this is within tolerance, R85. Under some circumstances slight leakage through C100 can give similar effects. It is essential for C112 to be in good order and we assume this was checked with the other electrolytics. We also assume that the H.T. rectifier is in order, H.T. voltage at C113 being 335VDC.

## MARCONI VT63DA

**This has a fault in height. I have tried several ways to cure it but have failed. The picture is perfect in tone with ample scope for brightness and contrast. The height control is now fully extended, but picture still creeps up at the bottom to about 1in. I have replaced V10, V9, also resistor around height control and deflection coils but to no good. This has been happening now for six months and must admit defect is now very noticeable.—A. E. Peacock (Northfleet).**

We would advise you to check or replace the 2.2meg.$\Omega$ resistor wired from pin 9 of V10 to junction of .1$\mu$F capacitors (two) and 4.7meg$\Omega$ resistor. Also check the latter if the 2.2M$\Omega$ is in order.

The H.T. metal rectifier must also be in good order and the mains selector tappings accurately set.

## ULTRA VT917

**The frame flyback lines are visible even with the brightness and contrast controls set at a low level. The contrast control itself will resolve these even when the brightness control is set at minimum. Linearity and resolution are good.**

**The U25 seems to need frequent replacement due to heater-cathode short. I notice also a slight electrical leakage to the metal clamp of the line output transformer.**

**One of the 20D1's, situated in front of and in line with the rear tube support lights up brilliantly when switched on from cold, although I believe this has always been so.**

**The C.R.T., a new replacement seven months ago, was a little over six months old when the fault became noticeable, and gives the appearance, by its lack of edge, of low emission.—W. J. Handy (Birmingham).**

We would advise you to replace the .04$\mu$F frame flyback damping capacitor, which is wired from one side of the frame output transformer to the centre contact of the brilliance control. It is actually located beneath the chassis between the 20L1 and 10F1 valve bases. If the capacitor is in order, check the video amplifier anode load resistors which are two 8.2kΩ in parallel. Check video amplifier valve base voltages, anode 150v., cathode 4v. If necessary, supply tube heater with a separate 12.6 volt transformer, removing existing heater leads and joining these together with a 40 ohm 5 watt resistor. This will restore normal picture "attack."

### *EKCO T231*

**Sixteen months ago I bought an Ekco T231 set. Recently the picture almost faded completely. The local engineer said the tube had gone, but he never even took the back off. However, two valves seemed to be going to me, U301 which I had tested and was found to be done, and U25 which is soldered in. I renewed U301 and the picture improved considerably. What I would like to know is, could the valve U25 be the cause of the trouble and is it a straightforward soldering job or not?—John Hewitson (Carlisle).**

Replacing the U25 valve is a straightforward job if you work with a clean iron capable of quickly melting the solder in the retaining cups. Avoid sharp bends on the lead-out wires and nicely round off the soldered blobs or corona will result. It it is faulty the picture will get bigger and darker as the brightness control is advanced. Before replacing the tube, check the setting of the ion trap magnet on the neck of the tube, which should be set for maximum brightness. Quite a number of these tubes have recently failed which is probably why your engineer was so sure of his diagnosis, but a good proportion respond to 25 per cent heater boost.

### *PYE LU51*

**A new tube was fitted three months ago. The trouble now is lack of contrast even with brilliance control at minimum, picture can only be reasonably seen in a dark room. If contrast or brilliance is advanced picture goes flat with prominent flyback lines. I have changed R14A and R16A in brilliance network but no effect. PZ30 valve has been changed, also all valves in vision section, but no improvement.—J. A. Box (Loughton).**

We are inclined to suspect that the 2μF electrolytic capacitor associated with the video coupling to the C.R.T. cathode is defective. This is located under the chassis, on the rear end of the long tag panel.

### *PYE V14*

**I get no picture when switched on. If I do get a picture it fades at once. Also the brilliance control, if I touch this to advance I lose the picture altogether. The brilliance control has got to be at neutral to get a picture at all, but of course not for long, about 10 seconds and then it pulls sideways and disappears. I have changed the PCF80 (V24) (V21) (V5), still the same. So I tried to get chassis out. Knobs and outer rings, four fixing bolts; chassis will not come out, so I undid eight screws at back, two at each corner; released top clips and still no go. Could you please put me right here, also V1 at left hand. Is ECC82 the right valve here?—E. Johnson (E.9).**

One of the most likely causes of your trouble is a low EY86 EHT rectifier, which is in the can at the top right hand side and can be reached without unboxing.

Other faults giving rise to similar symptoms are a displaced ion trap magnet and a heater-cathode (or grid-cathode) leakage on the C.R.T.

To unbox the V14 remove cardboard back, lay set on its face, undo four large bolts through the cabinet feet and withdraw the wooden frame off the set. There is no need to remove knobs or plastic front.

### *PLESSY CHASSIS*

**The set is four years old, working on a boosted Mazda CRM123 tube.**

**Very erratic locking on both holds. Locks slightly better when contrast well advanced. ECL80's O.K. Plenty of whistle from line oscillator. Left-hand ECL80 (looking from back) appears to be overheating. Knowledge of TV servicing limited. I am getting service data sent. Would appreciate help.—B. G. McGuinness (Co. Durham).**

We would advise you to check the 250μF capacitor associated with the video amplifer cathode circuit. The video amplifier (10F1) is mounted in the centre of the chassis. A 220Ω resistor is wired from pins 5 and 7 to a 180Ω resistor, the 250μF is wired across this latter resistor, i.e. from the junction to chassis. Also check the 2.2MΩ resistor connected to pin 8 of V9 (ECL80). This is mounted directly behind the video amplifier. A further check can be made upon the 16μF capacitor which is one section of the 32 × 16μF capacitor can mounted behind the metal rectifier under the chassis. If this is open circuit, the whole fault condition would be explained.

### *MURPHY 12in., V.202C*

**This was bought second-hand. In the shop this gave a perfect picture, but has been very poor at home.**

**The main fault is that it is impossible to get a bright, sharp picture. Increasing the brilliance or contrast results in the picture "blowing out" and disappearing. To get any kind of reasonable focus the controls have to be kept so low that in daylight the picture is too dim.**

**Increasing the controls sometimes brings on an arcing noise, with bright lines across the upper half of the tube face.**

**At rare intervals, about every two or three weeks, there is a sharp "crack" and the picture becomes perfect. This noise appears to come from the tube, although I can't be too sure of this. Then, after a few minutes, the same noise occurs and the picture goes poor again, and out of focus.**

**More recently, the EL38 has been flashing inside, and this produces a momentary loss of picture, but with no improvement when the picture returns.**

**I have had to disconnect the Visconal as this**

(*Continued on page* 97)

## SETS & COMPONENTS

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(Continued from page 95)

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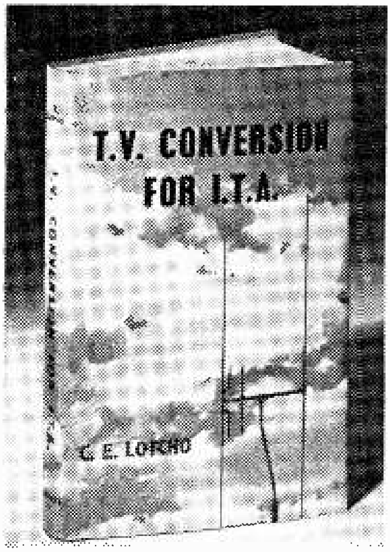


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NEWNES

**went faulty a while ago, resulting in no picture. The picture returned with this out of circuit.**

**The EHT rectifier is a U25, and the C.R.T. is a CRM123.—Christopher J. Taylor (Northwich).**

The trouble could be caused by a faulty U25 valve, which we suggest you replace. When doing this it pays to first discharge the EHT and to solder, with a good iron, making nice round blobs on the joints, otherwise flashing and "frying" will take place. Quite a number of these sets are working well without the EHT condenser, as the capacity of the C.R.T. to chassis is quite substantial and assists in the EHT smoothing.

## *COSSOR 916*

**I boosted tube on your information quite good, except for going very negative when turning up contrast; thank you. Trouble with set now is no picture at all. Heaters O.K. As I have no instruments except for cheap Pifco meter I rough checked EHT on tube with insulated driver. No spark even when cap touched with screwdriver. I am a complete novice but still hope you may be able to help me. Sound is quite good.—J. S. Bruin (Nottingham).**

You should continue with your screwdriver spark test. If there is no spark at the tube anode, remove the lid of the right side can and examine SU61 EHT rectifier. If it doesn't glow, check for spark at single wire end. If there is a good spark, replace the SU61. If there is no spark, check for H.T. at the top cap of the 185BT. If a reading can be obtained have the 185BT and 7Y4 valves tested. Also observe that *both* heaters of the 6SN7 valve light up. If no results can be obtained, check the continuity of the line output transformer from the 7Y4 cathode ($8\mu F$ capacitor) to 185BT top cap and SU61 single wire end.

## *BUSH TV24*

**The first symptom of the trouble was no sound or vision, although there was a raster with controllable brightness. I suspected a valve and got them tested, renewing an EF80, but when I put them all back in their bases the heaters were not glowing at all in any of them, including the EHT section. I've checked the fuses and they are all right. I've noticed that the chassis is alive by a neon tester screwdriver. Before I got the valves tested all the heaters were glowing all right. I've had the valves tested again and are O.K. Could you give me some idea where to look for the trouble and where the faulty components are, if any. Do you think it could be the line transformer.—A. Bryan (Wavertree).**

There is obviously an open circuit somewhere in the chain of heaters, but we are not sure whether the *top deck* valves have been tested or disturbed at all.

We would advise you to reverse the mains leads in order to remove the mains potential from the chassis and then proceed to check through the heater chain with the neon tester. Start from the on/off switch and fuse to the mains dropper resistor to the PZ30 and thence through the valve heater sequence through the right side plug to the lower chassis and C.R.T. base to chassis.

## *EKCO T217*

**This recently developed a frame timebase fault, the picture collapsing into one with horizontal band.**

**I have replaced V12 (20L1) and V13 (10P13), the results disappointing and an increase in height of about two inches. My supply voltage is 230. I happened to try the set on a 200 volt supply, without any alteration to the mains adjustment and the set worked perfectly except for a slight reduction in contrast.**

**I suspect the small rectifier associated with the frame circuit, but am unable to replace it as it bears no identification mark.—R. Young (Sheffield, 10).**

The correct interlace rectifier for your T217 is the SenTerCel Q3/4 coded orange yellow. This is hardly likely to cause your shortage of height as a full size raster should be obtained with this rectifier removed, though it will not lock. Two common causes of this fault are the blocking oscillator transformer and the $500\mu F$ bias condenser on the output valve, but if your set works on a reduced mains input your fault could also be in the mains smoothing.

## *MURPHY V178C*

**Sound perfect, but no raster with brilliance control turned right up. Spark from anode of EL38 valve and anode of EY51, but heaters of EY51 not alight. Line output transformer replaced with new one, new EY51 fitted, EL38 and U281 booster valve tests perfect. As I have no service sheet for this set, I hope you can advise me what components can cause this fault, have also tried with Metrosil condenser disconnected, also with lead to anode of tube disconnected.—G. Taylor (East Ham).**

One of the most likely causes of no EHT is the $8\mu F$ electrolytic condenser wired positive to earth from the bottom of the line linearity control to chassis.

Useful measurements around the circuit are: 236 volts on the PL38 screen: negative 35 volts on the cathode. The spark on the anode EY51 should be about ¾in. long, and on the cathode should be heard rather than seen.

The EY51 can be tested with a 4.5 volt flat cell, which should light it, and if well insulated can be used in lieu of the transformer winding to try and resolve a raster.

## QUERIES COUPON

This coupon is available until SEPTEMBER 21st, 1957 and must accompany all Queries sent in accord with the notice on page 93.

PRACTICAL TELEVISION, SEPTEMBER, 1957

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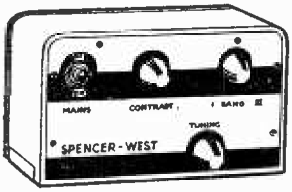


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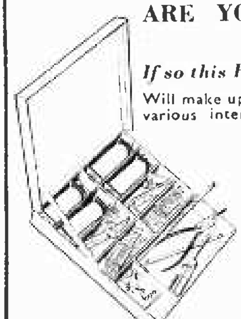

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