Practical Television

1'6

AND TELEVISION TIMES

JANUARY
1961

How to make attenuators

Contents

ANNOUNCING . . .

THE OFFER OF THE YEAR!

HARVERSON'S SUPER STEREO KIT

The product of a world-renowned manufacturer, this stereo amplifier is composed of a number of compact "ready-built" units, only requiring interconnection. This system has the big advantage of being easily adaptable to fit any cabinet. Each unit is extremely well made from first-grade components, and all valves employed (ECL82, EZ80 range) are genuine Mullard. The comprehensive instructions supplied with each kit make the simple interconnection of units easy even for the novice.

THE KIT COMPRISES . . .

TWO MIDGET AMPLIFIERS each capable of 3W output. The reproduction is good, enabling you to get the best from both your stereo or monaural recordings. Both amplifiers are complete with well-designed output transformers providing perfect matching to standard 3-7Ω loudspeakers, and have remote bass, treble and volume controls. Size 5″ x 2½″ x 3″ high (each amplifier).

CONTROL UNIT, this is a flying panel fitted with three 2-gang potentiometers, enabling the bass, treble and volume controls of each amplifier to be positioned in the most convenient place in your layout. These dual controls are equipped with attractive cream and gold knobs and an escutcheon is provided for the complete panel.

SEPARATE POWER PACK complete with valve rectifier although of midget size (5″ x 2″ x 3¼″ high), provides power for complete amplifier equipment.

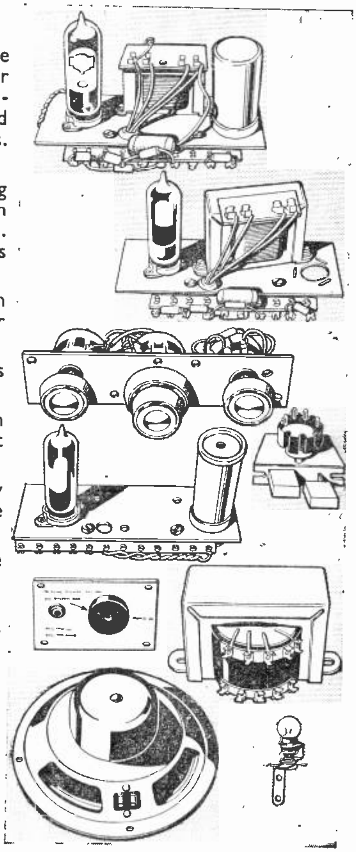
ISOLATED MAINS TRANSFORMER of robust construction is a separate unit and may be mounted independently.

VOLTAGE SELECTION PANEL. Consisting of a panel fitted with the "valve base" type of mains input selector and a channel output socket.

ONE LOUDSPEAKER, a good quality 5-inch speaker, specially selected for this equipment. (**Note:** The second speaker may be purchased from us for an additional 14/6.)

CREAM DOUBLE PUSH BUTTON SWITCH of attractive design gives positive on/off switching action.

INDICATOR LIGHT. This pilot light provides visual indication that the equipment is operating, and is complete with an attractive gold-finished escutcheon.



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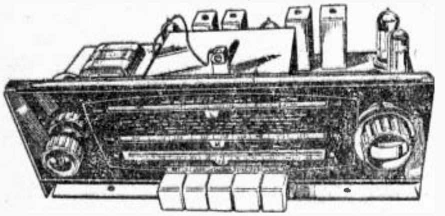

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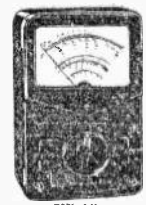

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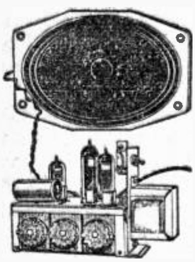

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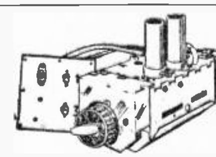

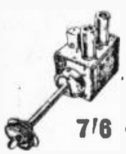

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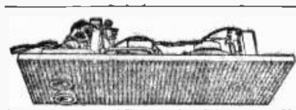

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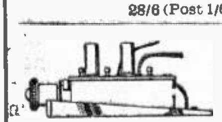

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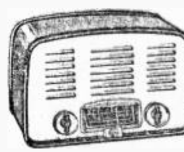

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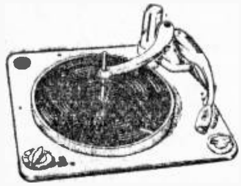

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Practical Television

AND TELEVISION TIMES

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Contents

TV IN INDUSTRY

TO the lay mind, the word "Television" stands only for a medium of mass entertainment and certainly most of us meet TV only in this guise. However, domestic TV now appears to be reaching saturation point and until either new bands (IV and V) are brought into use, or different transmission standards, for both monochrome and colour, are exploited, it seems that TV for entertainment will remain much as it is at present. However, it cannot be said that development of television is not proceeding; in the field of "industrial television"—an all-embracing term—many new uses and techniques are appearing. In fact, such is the importance of TV in industry that an exhibition of industrial photography and television was held at the Royal Albert Hall, London late in November. It is significant to note, that at this exhibition, the stands appeared to be divided almost equally between photographic equipment and television equipment.

In industry, the main use of TV seems to be concerned with observation of areas normally hazardous to personnel—owing to radiation, for example—or with areas which are inaccessible. To judge from the exhibition, another major use of TV is the quick transmission of information from one point to another without ambiguity. This simple transmission of documents such as cheques constitutes a form of information processing similar in principle to the processing of information of punched card and computer techniques. In most computer systems, information must be converted from the symbols which are normally used—letters of the alphabet and figures—into what might be termed "computer language". This procedure is often known as "programming" a computer. It is normally achieved by transcribing the information, using a human operator, on to a number of cards in which holes are punched to represent the information. This transcription is very slow compared with the rate of working of the computer and prevents maximum efficiency being reached. The need has therefore been evident for some time for a machine capable of "reading" directly the information to be processed without the intermediate stage involving punched cards. Such a machine—now in production—was recently shown to members of the press and to achieve recognition of characters it employs a system similar in principle to television. Lines on tally rolls from cash registers are "read" by forming a raster on a CRT and projecting an image of the raster on to the tally roll. The varying amount of light reflected as the light spot moves over the white paper and the dark, inked characters is picked up photo-electrically and gives an output of pulses which can then be analysed, recognised and processed in logical circuits in the same way as the information derived by more conventional methods.

The possibilities for such machines are great and, no doubt, more advanced types will eventually make their appearance. Meanwhile, television will be used more and more in industry both directly and indirectly.

Our next issue, dated February, 1961, will be published on January 20th.

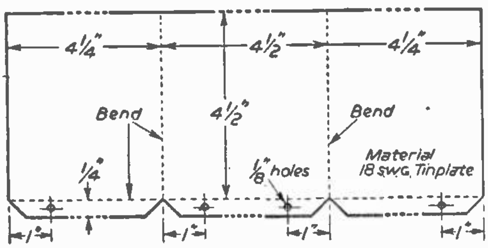
The Practical Television OLYMPIC

ALIGNING THE CIRCUIT

By D. R. Bowman

(Continued from page 168 of the December issue)

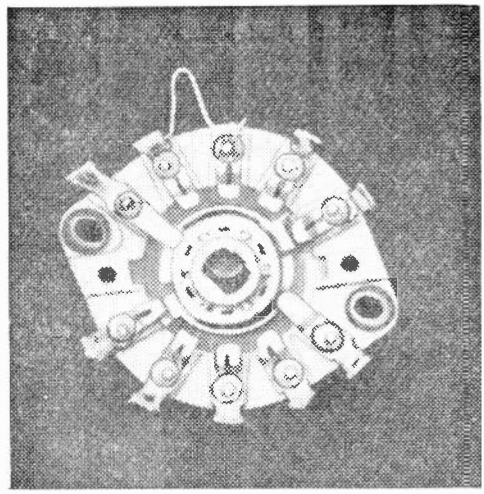
AFTER having carried out the majority of the mechanical construction of the tuner as described last month, the inter-stage screen is now put into position and screwed down, and the wiring continued. The last



Details of Line Output Transfmr Screen

Fig. 10.—The dimensions of the line output transformer screen.

wafer is put into position again with the correct spacers, and the wiring completed. It will be realised that if any mistake is made it may be necessary to take the whole tuner down again. During development this had to be done at least



A view of one of the tuner switch wafers showing the Band III loading inductor.

eight times, but if great care is taken, the constructor should be able to make it correctly at the

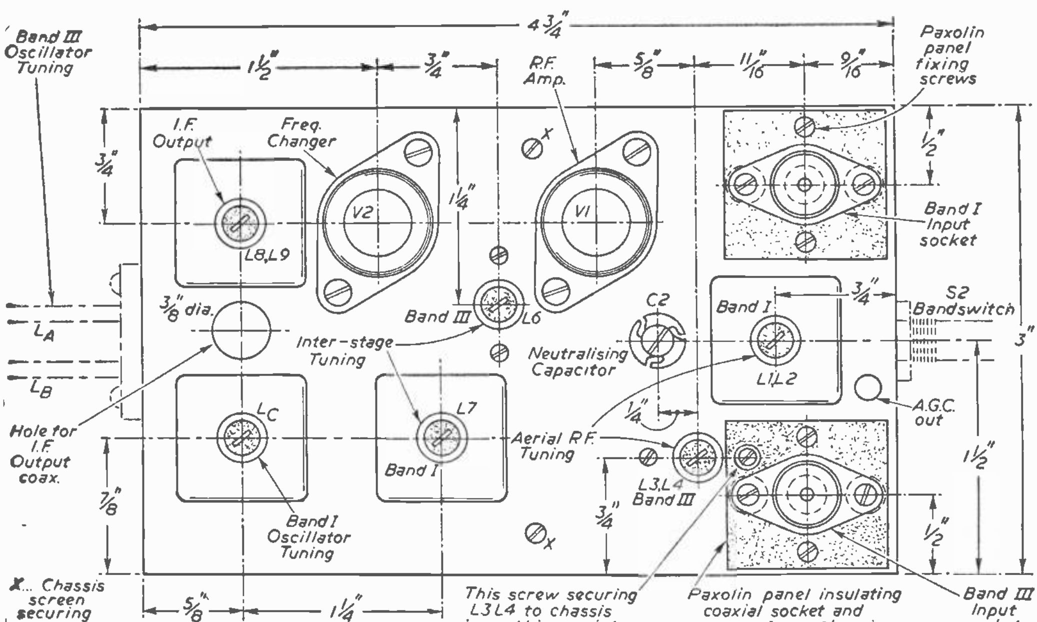


Fig. 11.—The above-chassis layout and dimensions of the tuner chassis.

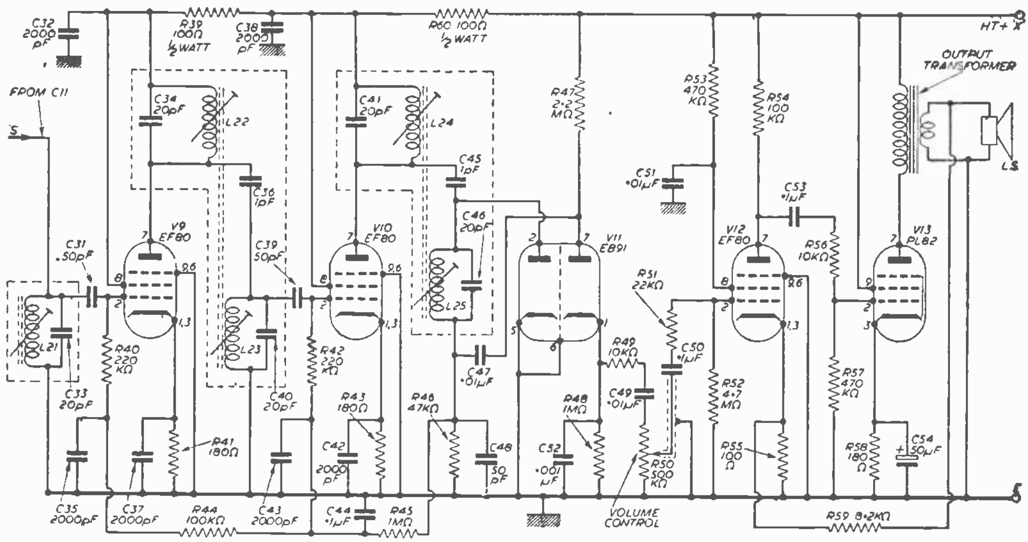


Fig. 12.—The circuit of the sound I.F. amplifier, detector, and amplifier stages.

first attempt. Care and thought and frequent comparison between wiring diagram and circuit diagram during wiring will be rewarded.

The anode resistor (R11) to the oscillator valve is large, and it will be seen from the wiring diagram that it lies in between the rods which carry the switch wafer. Care should be taken that adequate insulation is used so that no accidental

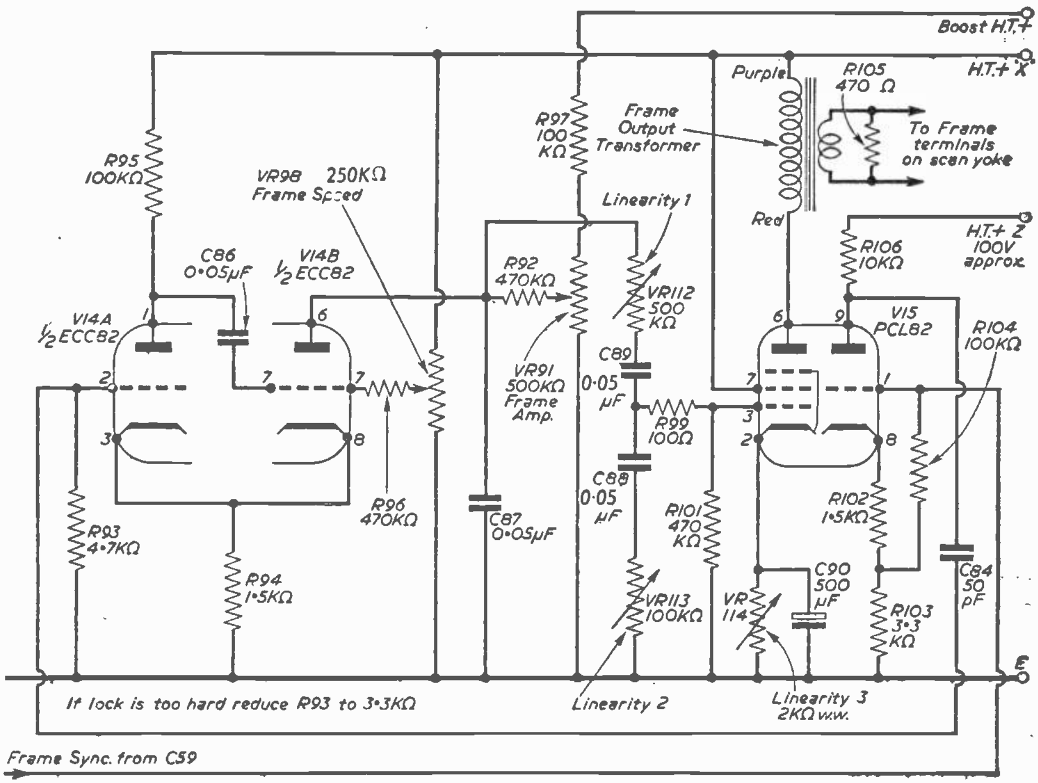


Fig. 13.—The frame multivibrator and output circuits.

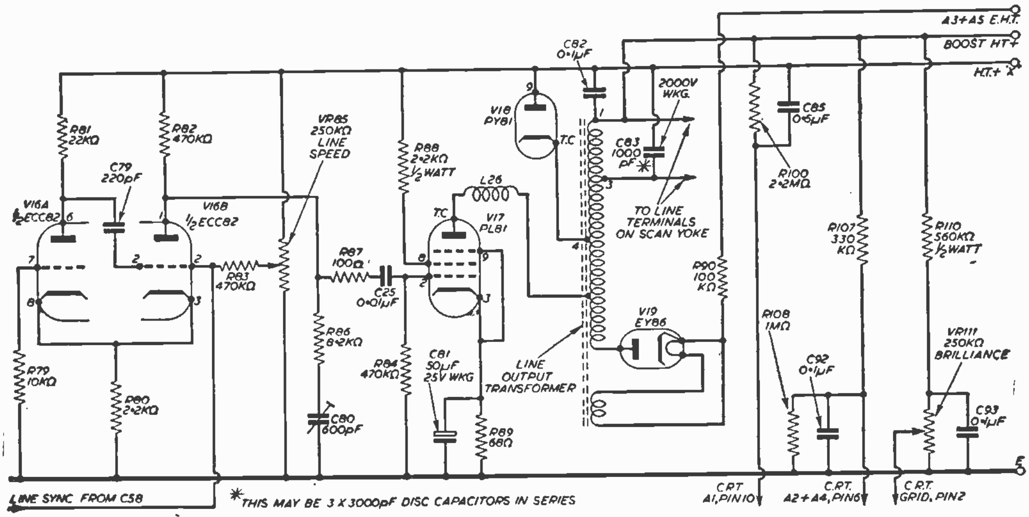


Fig. 14.—The line multivibrator and output circuits.

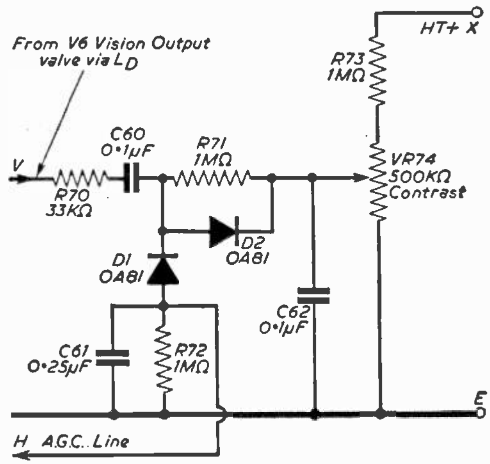
short-circuit may deprive the oscillator of its H.T. supply.

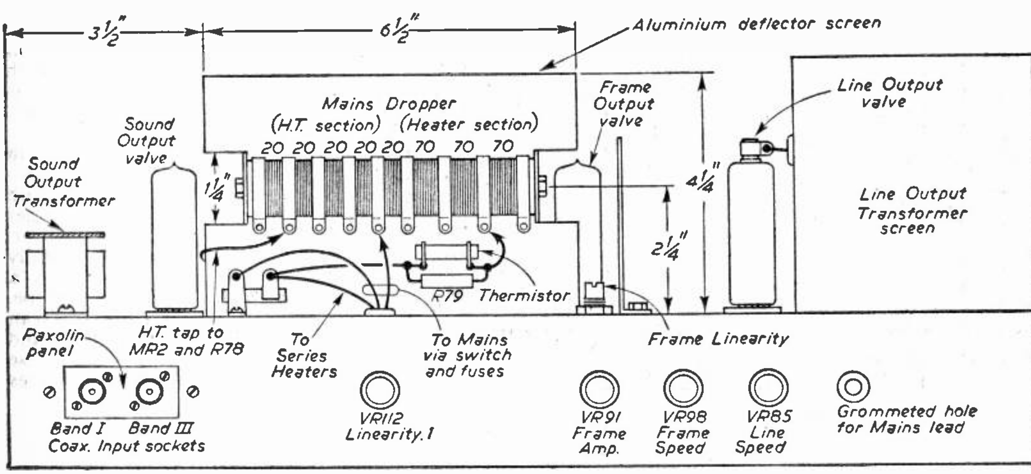
The inter-stage screen must, of course, be cut away to clear the small components on the base of the PCC89. This is best carried out by trial and error, care being taken not to cut away so much material that screening is impaired. In wiring it is important to keep the second anode of the PCC89 "out of sight" of its cathode capacitor. C4 may be used, properly positioned, to assist in this screening. C67, C68, the heater decoupling capacitors, may also be positioned so as to fill up any holes in the inter-stage screen.

The oscillator wafer should be wedged firmly to the shaft to ensure constancy of its position

Fig. 15 (Right).—The delayed AGC circuits.

Fig. 16 (Below).—A rear view of the chassis showing the mains dropping resistor and its heat-deflecting shield.





when rotated. This is achieved by inserting a fine needle between wafer and shaft, and tapping it lightly into position. The excess can then be broken off.

It may be noted here that R1 and R2 together afford the AGC delay potential to the grid of V1, the PCC89. The total value is 14·7M, but if a 15M resistor is available it may be used instead by itself. Condenser C4 in particular must be soldered into position with the absolute minimum length of leads. It is really preferable to use two 500pF capacitors in parallel to minimise the inductance between the grid of the second triode and chassis, provided lead length can be reduced. However, the 1.000pF capacitor specified is of very suitable physical construction and no difficulty has been met with it.

The mains-dropping resistor is located at the back of the chassis and is contained in a mounting made from a piece of polished aluminium bent to shape. This acts as a heat reflector and deflector to assist in keeping the chassis cool. It has not been found necessary in the prototype receiver to provide any fine tuning control, even for Band III because care has been taken to minimise "drift". If however, the chassis rises in temperature to any great degree some drift may be expected, and proper precautions need to be taken for ventilation. Unfortunately the valves themselves generate most of the heat produced, but the use of the new silicon rectifiers for the H.T. removes one source of unwanted heat.

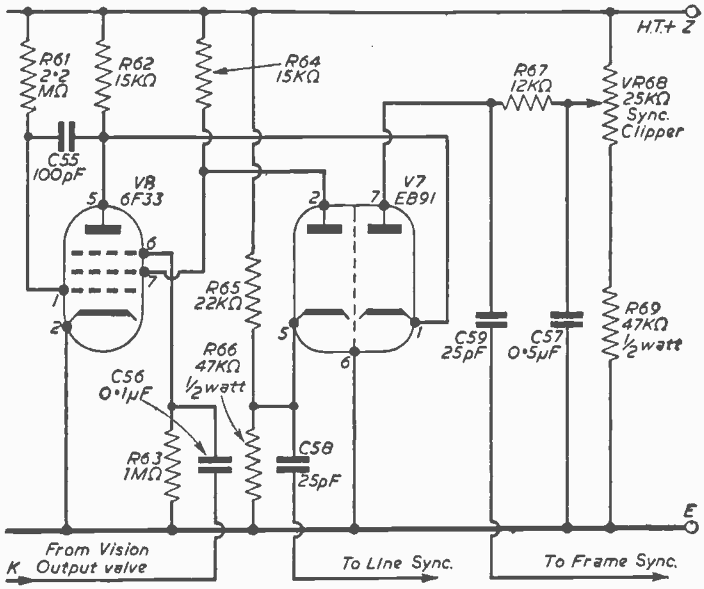
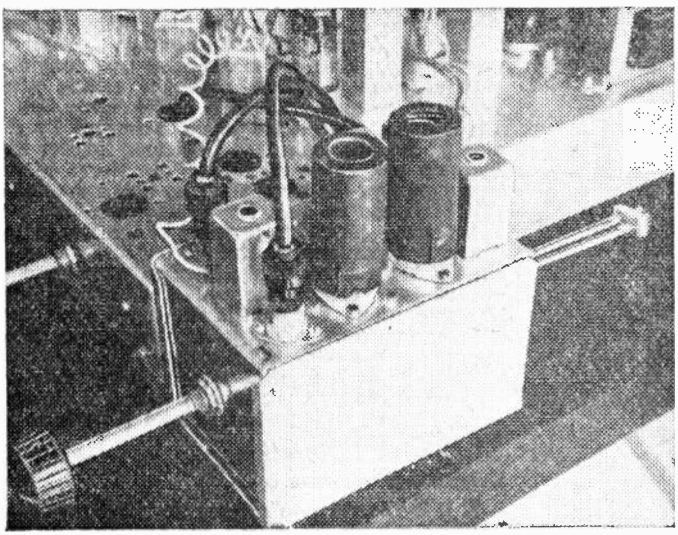


Fig. 17.—The sync separator and clipper circuits.

Within the mains dropper mount is also situated the surge limiting thermistor, which is suitable for 0·3A valves. This is paralleled by a 500Ω 10W resistor to enable the warming-up period to be shortened. The surge on switching on does not exceed 0·38A on the heater chain, and this causes no trouble.

The silicon rectifier for H.T. supplies are said by the manufacturers not to require parallel resistors to equalise peak inverse voltages. Nevertheless these have been incorporated as a safety precaution, and are made of ½W rating to minimise temperature rise. They are yellow in colour and do not radiate heat well. **In no circumstances must less than 20Ω appear between the mains lead and these rectifiers, or the charging current into C66 will damage them when the set is switched on.** With this precaution, mains voltages as low as 190 will give full performance with this receiver.

In order to minimise rise in temperature of the valves no valve screens are specified at all with the exception of the two tuner valves and the sound detector. The EF80 valves do not really need screens since they have a screen inside the valve envelope. Valveholders designed for a can are used in both vision and sound I.F. amplifiers however, because the skirt of the holder gives



A view of the completed tuner.

(Continued on page 216)

SERVICING TUNERS

THE MECHANICS AND THEORY OF MODERN TURRET TUNERS

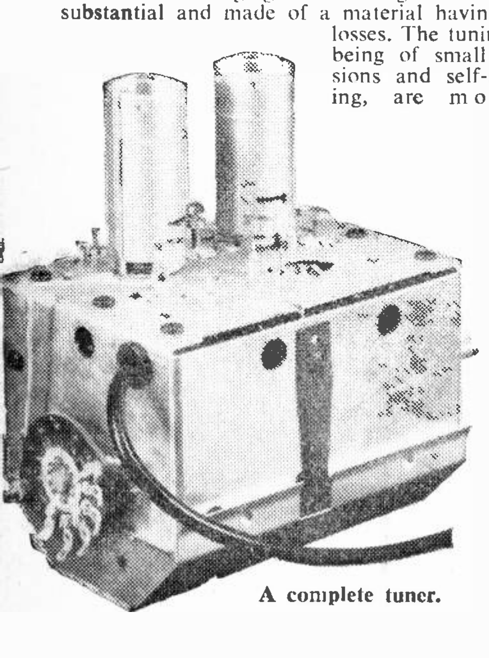
By G. J. King

SINCE the advent of television in Band III, from about 1954, all television receivers have featured some method of selecting stations in Bands I and III. Several methods of channel selection have been used, and these include tuners with pre-set tuning over two or three channels, usually two channels in Band III and one in Band I, with a two or three position rotary switch for channel selection. G.E.C. receivers of early Band III years employed such a method of channel selection. Ferranti receivers were also made with a similar two position switch for band changing. In the Band I position the set is pre-tuned internally to a BBC channel, while in Band III position a continuously variable permeability tuner is switched into circuit. This operates over the whole of Band III. Combinations of these ideas were also adopted with different makes and models.

Multi-channel Tuners

The most popular method of station selection today is provided by the so-called multi-channel tuner. This is made in two forms: the well-known turret tuner and the switch tuner, such as is used extensively in Pye receivers. The turret tuner, as is well known, consists of a rotatable drum or turret carrying a maximum of twelve pairs of coil biscuits around its periphery. When the turret is rotated on its shaft by means of the channel selector knob, the contacts on the coils corresponding to the required channel locate on strips of spring metal folded into loops. Contact is then secured between the required coils and the tuner circuits.

The basis of the switch tuner, as would be expected, is a 12-position rotary switch. The switch is made up of a bank of switch wafers each having a rotor made in the form of one or more contacts, and a stator comprising a ring of low-loss material —in which the rotor operates—and bearing around its periphery 12 contacts. The switch wafers are rather like those employed in ordinary broadcast receivers for changing the wavelength, but are more substantial and made of a material having lower losses. The tuning coils, being of small dimensions and self-supporting, are mounted directly on the wafers between adjacent tags. It is thus possible to alter the inductance of the total circuit in increments corresponding to adjacent channels by turning the rotary switch.



A complete tuner.

Servicing the Turret Tuner

The mechanical construction of a Cyldon turret tuner (which is typical of most tuners of this kind) is shown in Fig. 1. This exploded diagram clearly reveals the turret which bears the pairs of coil biscuits. The side panel assembly carries the spring metal contacts which bear upon the contact studs of the coils. The turret proper is held in position in the chassis of the tuner under spring pressure by means of the front and rear spindle support springs. The turret is divided into two sections by a centre disc. This is suitably shaped around its edge to allow the small roller of the locator spring and wheel assembly to provide positive location of each channel position under spring pressure. The dividing disc also screens the aerial coil (L1) side of the turret from the R.F. and oscillator coil (L3, L4 and L5) side to avoid interaction and instability.

In common with most multi-channel tuners, the turret tuner of the type under discussion incorporates a fine-tuning control to permit the user to counter slight drift of the oscillator frequency and also establish optimum oscillator setting after changing channel. The fine-tuning comprises a variable capacitor (C14) which is formed by the stud of the fine tuner, the condenser bracket and the cam and sleeve assembly. The sleeve of the cam slips over the turret shaft, so that a dual control knob can be used for channel selection and fine tuning. Alteration in value of the fine-tuning capacitor is achieved by variation of dielectric constant brought about by the insulated cam entering the air-gap between the condenser bracket and fine-tuner stud. The cam is so shaped as to provide a progressive increase or decrease in capacitance over a very small range. The cam and sleeve assembly is held under spring pressure against the condenser bracket by means of the condenser tension spring which is held in position by the turret spindle.

Connections

If it is necessary to remove the tuner from the receiver cabinet or chassis for servicing, all the wires connected to it must be disconnected, but *not* before making an easily read sketch of their positions on the various tags and a note of their colours. For certain troubles, it may be necessary to return the tuner to the makers for servicing and it is virtually impossible to be sure of the wiring otherwise after two or three weeks.

If necessary, the tuner can be dismantled to the stage shown in Fig. 1 without disturbing the circuit on the chassis assembly. It is, indeed, most important to avoid disturbing the wiring and position of the components as the self-capacitance of the circuit generally was taken into account during the alignment of the tuner, and it is not a simple matter for the experimenter to undertake realignment and hope to secure the best results.

The bottom screen and side screen of the tuner are both simply clipped into position and are fairly easily removed. The side panel assembly is held in position by two screws, while the fine tuning assembly can be dismantled by first removing the two screws securing the condenser bracket. The turret assembly can be removed by disengaging the two spindle support springs and allowing the turret to fall from the bottom of the chassis assembly.

Wedge Springs

The aerial coil assembly and mixer coil assembly are located in grooves in the centre disc of the turret assembly and are held firmly in position by means of spring metal clips fitted to the two outside plates. In some tuners, the available coil space is not fully occupied, and the blank positions wedge springs are used to take the place of the coil biscuits and to hold the coils which are used firmly against each other. Thus, if additional channels are required it is first necessary to remove the wedge springs and then introduce the required coils. It must be observed that two coils are required for each channel, and that they must both correspond to the channel to which it is required to tune. There is never much success in using a coil of a different channel and hoping to secure optimum tuning of the required channel by altering the number of turns or the spacing between the turns. Similarly, it is essential to ensure that the coils used are, in fact, designed for the particular make of tuner in which they are to be used. The coils also differ between tuners of the same make but different model. The tuner oscillator frequency and I.F. combination have a major bearing on the exact type of coils required.

Each coil contains a tuning slug made either of brass or of iron dust, and these are held firm in the coil formers by the slug locating springs pressing against their threads. The slug in the oscillator coil corresponding to the channel to which the tuner is switched is accessible for adjustment through a hole in the facing side of the chassis assembly, slightly below and to the right-hand side of the fine tuner when viewing from the front.

Oscillator Slug Adjustment

Generally, the hole in the front of the tuner coincides with a hole in the front of the receiver cabinet, often beneath the channel selector knob, which first has to be removed. Thus, to adjust the oscillator slug it is rarely required to remove the turret tuner. If the fine tuning control falls short of the centre of its travel for optimum tuning of vision and sound of all channels, the fine tuning

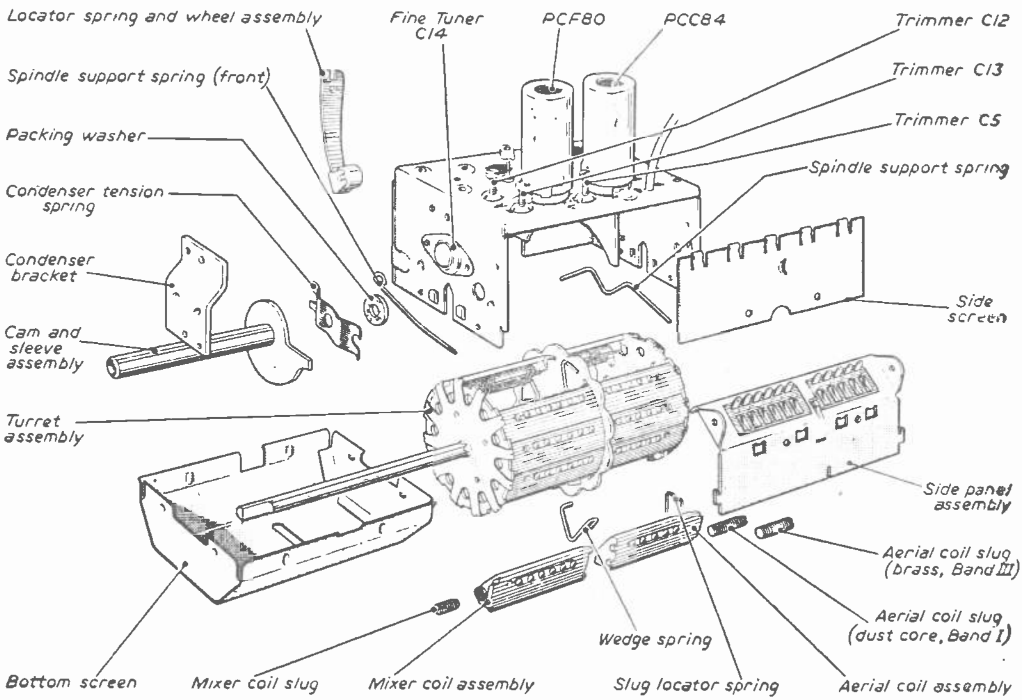


Fig. 1.—The construction of a typical turret tuner.

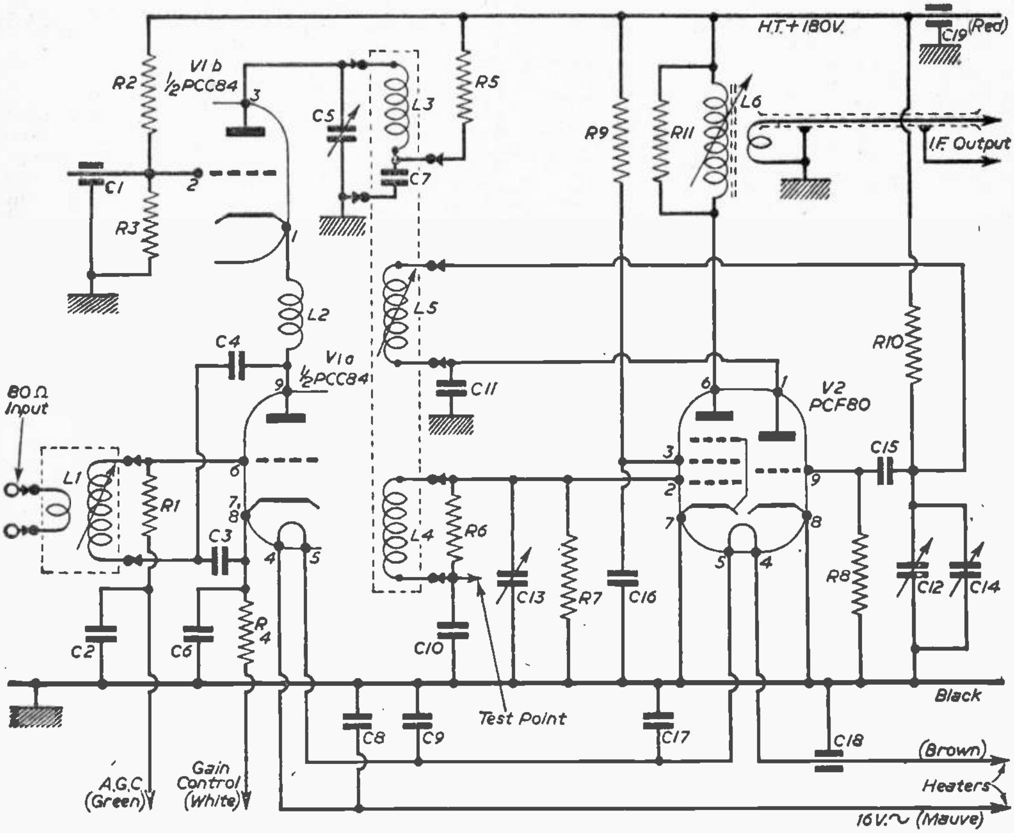


Fig. 2.—The circuit of the tuner illustrated on page 185.

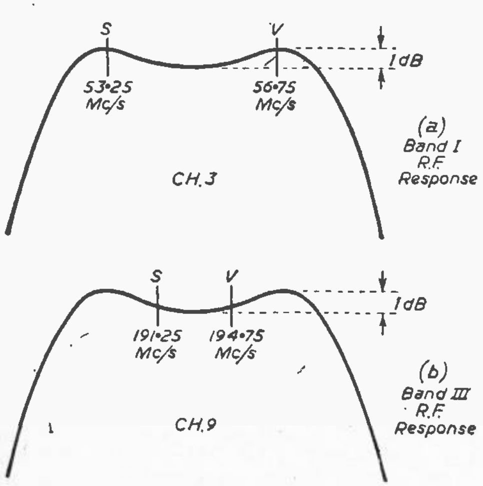


Fig. 3.—Response curves of the R.F. stage of a tuner on Bands I and III.

control should be adjusted to its mid-position and the oscillator slug should be adjusted very carefully for maximum sound consistent with minimum sound interference on vision.

Adjustment must be carried out with a slim non-metallic trimming tool, and a plastic knitting needle shaped to form a screwdriver is ideal for performing this adjustment. Care should be taken to avoid unscrewing the core too far out of the coil former, as it may disengage the thread and locator spring and fall from the former into the inside of the tuner unit.

Aerial Coil

The slug in the aerial coil former rarely requires similar adjustment, and in most tuners it is not usually possible to adjust this slug while the set is working. In any event, the tuning of this circuit is very broad and in normal signal strength areas it is difficult to establish an optimum tuning point.

Several small trimmers, such as C5, C12 and C13 in the unit under consideration, are located in various parts of the circuit and accessible from the top of the chassis. These are *not* for general adjustment, but are included for standardising the stray capacitances and to aid in the initial alignment at the factory.

(To be continued)

FAULT-FINDING WITH A SIGNAL GENERATOR

COMPREHENSIVE GUIDE TO TEST PROCEDURE

By L. E. Higgs

SIGNAL-GENERATORS are second only in importance to the multi-range test-meter when used for TV fault-finding. Much has been written on the construction and features of test oscillators for the amateur, but little on the essential quick check tests used to localise a defective stage in a receiver.

The tests explained in this article are intended as a guide for the home constructor and the techniques and refinements of R.F. measurement will not be found. The author has endeavoured to show how to perform the various tests and how to analyse the results obtained.

These tests are based on a typical 13 channel superhet TV, the standard design of which has settled down over the last five years. Quite likely a number of sets will be found to vary slightly. When this is so, the equivalent points can be chosen to correspond and the results interpreted accordingly.

It is suggested that familiarity with the signal generator can best be built up by working through these tests on a TV in good running order and notice taken of the results. These observations will help the user in future to recognise and appreciate differences in performance when a fault exists, and speed the tracing of the faulty stage.

Signal generators (or test oscillators) vary enormously in price and complexity, but they all supply the following services:—

1 An accurately tuned unmodulated radio frequency (CW).

2 An optional internal modulation to the above. (Modulated CW).

3 An adjustable audible frequency tone voltage (A.F.).

4 Control of the output of 1 and 2 to a very small amount. (Attenuator). The attenuator on the cheaper instruments is often far from accurate but provided it effectively cuts down the output to a very small degree that is all that is required. Crystal checks, output metering and other refinements are not required here and the maker's handbook will explain these points.

The tests are listed in the tables under the headings of "Sound" and "Vision", and are used in conjunction with the given test points. It is assumed that a normal raster is obtainable and that the vision or sound is missing, else very weak; or alternatively both are missing or weak together. Another assumption is that the receiver has been working satisfactorily up to the moment of failure and that the I.F. and R.F. tuning adjustments have not been thrown out of alignment. If it is known that realignment is needed, then reference must be made to the maker's alignment instructions as no rule of thumb can be applied to this tricky operation that will give good results on all sets. Never try to save time or money by attempting to adjust tuned circuits without the proper information. The cans of a TV chassis all look alike, even to an expert unfamiliar with that receiver and there is no certainty which is which. All receivers have their own peculiarities of adjustment, dampers, etc., without which only a rough approximation can be obtained, so better still do not touch them. It is most unlikely that a receiver will suddenly cease operating because the alignment went off tune.

Connect a termination unit as shown in Fig. 1. The purpose of this is to match the output lead approximately and to block off the H.T. when connecting from anodes and chassis. This lead should be used for all tests. Remember that most TV chassis are connected to mains and so connect the plug correctly before starting.

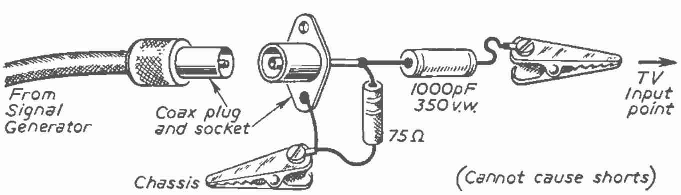


Fig. 1.—A signal generator connector which is safe for injecting signals at points carrying H.T. and at valve grids.

Sound Section

The method used is to work back from the speaker, stage by stage, injecting a suitable signal and when hearing the expected output tone from the speaker move back another stage until a point is reached where no signal is received. It can then be assumed that the defect is between the last two test points. As the signal is applied nearer and nearer to the aerial when working back, the output volume increases as more gain is used.

Test Point 1. (See page 188).

Identify the grid of the sound output valve from circuit or valve information. Apply the full output from the signal generator A.F. socket to the grid and chassis and when a moderate sound is heard in the speaker move to the next test point.

Test Point 2.

Apply the A.F. leads between the top of the volume control and earth. (Take care not to foul the mains connections on the rear of the volume control.) The normal output is now much louder and the A.F. could be reduced. The volume control operates and should now be kept turned up.

Test Point 3.

Find the sound intermediate frequency of your particular receiver. Tune it in on the manual tune knob and ensure that the correct range on the signal generator is selected. Feed in the full output of the generator when switched to modu
to the sound I.F. valve anode and ch
point is about 200V positive and so
when connecting and later when discon

Table of Test Points and Results

SOUND TESTS

Test point	Input type	Location	Normal result	Fault result	Remarks
1	Strong A.F.	Output valve grid and chassis.	Loud volume.	No sound shows output stage fault.	Volume control ineffective.
2	Reduced A.F.	Top of volume control and earth.	Very loud volume.	No output shows A.F. stage fault.	Volume control effective—turn up full.
3	Strong mod. CW sound I.F.	I.F. valve anode via capacitor and earth.	Moderate volume.	No output shows detector stage fault.	Weaker output due to sig. gen. mismatch. Oscillator clip now H.T.+.
4	Reduced sound I.F. mod. CW.	I.F. valve control grid and earth.	Loud volume.	No output shows I.F. stage fault.	
5	Weaker sound I.F. mod. CW.	Common I.F. valve control grid and earth.	Very loud volume.	No output shows common I.F. stage fault.	Some effects on screen— weak bars.
6	Very weak sound I.F. mod. CW.	Mixer grid from test point top of tuner, or coil proximity.	Very loud sound. Disturbed raster.	No output shows mixer stage fault.	Channel fine tuner should not affect signal.
7	Weak sound signal frequency.	As above if accessible.	Very loud sound. Disturbed raster.	No output shows oscillator fault.	Channel fine tuner will need resetting for maximum sound. Sig. gen. must be accurate.
8	CW signal ± or the sound I.F.	Proximity injection mixer or direct on osc. coil (with aerial fitted).	Sig. gen. "tunes" in sound. Proves local osc. faulty.	No output shows combined mixer oscillator defect. (L.C. valve).	Heterodyning when TV fine tuner is altered proves local osc. is running satisfactorily.
9	Sound signal frequency.	Direct into aerial socket.	Loud sound tuned by turret fine tuner.	Weak sound, grain on screen rushing background.	Faulty R.F. (cascode) stage. Contrast and sensitivity to be turned up.

VISION TESTS

Test point	Input type	Location	Normal result	Fault result	Remarks
10	Strong A.F.	Cathode pin of picture tube.	Weak horizontal rolling bars.	Blank raster shows tube circuit fault.	Adjust brilliance for weak illumination. Apply A.F. via capacitor.
11	Reduced A.F.	Video valve grid.	Strong horizontal rolling bars.	Blank raster shows video amplifier fault.	Vision limiter to be kept down.
12	Strong vision I.F. mod. CW.	Anode, vision I.F. valve via capacitor.	Weak horizontal rolling bars.	Blank raster shows faulty vision detector or detector circuit.	Injection point 200V+ above earth.
13	Reduced vision I.F. mod. CW.	Grid vision I.F. valve.	Strong horizontal rolling bars.	Blank raster shows faulty vision I.F. valve circuit.	Contrast turned up full.
14	Weak vision I.F. mod. CW.	Grid common I.F. valve.	Very strong horizontal rolling bars.	Blank raster shows fault in common I.F. stage.	Contrast and sensitivity up full. Possibly slight sound breakthrough.
15	Weak vision I.F. mod. CW.	Grid mixer valve if accessible.	Very strong horizontal rolling bars	Blank raster shows faulty mixer stage.	Full contrast and sensitivity.
16	Strong CW vision I.F. ± signal frequency.	Proximity injection to oscillator coil.	For suspect stopped local osc. Tune channel from sig. gen.	Stations "tuned" in by sig. gen. Prove local oscillator stopped or faulty.	Aerial to be connected.
17	Weak vision signal.	Direct in aerial socket.	Tuned by turret tuner (fine) strong.	Weak, grainy or no result shows R.F. stage fault.	Full contrast and sensitivity.
18	Strong A.F.	Grid vertical output valve.	Raised irregular raster of criss-cross lines.	No raising or disturbance of the thin bright horizontal line—vertical output stage faulty.	For use with "no vertical" faults—a thin bright horizontal line.

moderate volume should be obtained and it may be necessary to adjust the tuning of the signal generator very slightly to produce a maximum output. Do not alter the tuning again once this is done until the remainder of the sound tests are completed.

Test Point 4.

Connect the signal generator output to the sound I.F. valve grid and chassis. A great increase in sound should be heard and the attenuator can be used to reduce the signal to prevent overloading. Contrast and volume must be kept full on.

Test Point 5.

Move back again to the grid of the common I.F. stage with the signal generator tuning untouched but again reduce the input to a very weak amount to give the equivalent sound as before. There may be some disturbance of the raster now if the input is too high but this is not abnormal.

Test Point 6.

This point is often nearly inaccessible as it may be in the turret. It is better to leave this test than to disrupt the wiring or turret coils if this is the case. Sometimes a test terminal is provided on top of the turret. Otherwise connect the chassis clip of the signal generator to chassis and clip the input clip as close to the mixer coil as possible. A metallic contact is not always needed, this is proximity injection and the signal generator may need to be turned down even with this improvised injection.

Test Point 7.

Keep the connections as in Test Point 6 and change the tuning of the signal generator to the sound signal frequency of the channel selected on the TV turret. With a weak input a strong sound output should be received if the local oscillator is working, or at the correct frequency. The fine tuner on the set should now operate. If no output can be obtained then the local oscillator may have ceased and the next test will prove this.

Test Point 8.

Tune the signal generator to the sound signal frequency minus the intermediate frequency of the sound; e.g. for channel 1, 41·5Mc/s and a sound I.F. of 38·15Mc/s ∴ 41·5−38·15=3·35Mc/s. Inject this CW signal into the local oscillator coil by clipping direct on to the winding and at a high strength. If the sound can be tuned in from the signal generator this time, then it proves that the oscillator section of the frequency changer has stopped. The aerial must be connected during this test. If proximity injection is tried and severe sound heterodyning produced, then it indicates that the local oscillator is still operating.

Test Point 9.

Insert the signal generator output direct into the aerial socket and tune to the signal sound that the TV channel is set to. With a strong input but a pin and earth or grid. An output of bars shows that the CRT circuit is sound.

Test Point 11.

This test checks the video stage. Reduced A.F. should be used and the limiter (vision) be kept turned off.

Test Point 12.

Switch to the vision centre I.F. frequency on modulated CW and use a strong input. A rolling bar output confirms that the detector is all right. Remember this point is at H.T. above earth.

Test Point 13.

This tests the vision I.F. valve. Reduced input must be used here and contrast and sensitivity kept full on. The AGC circuits will otherwise mask the gain variation.

Test Point 14.

Reduce the signal generator's output again at this point as a tone breakthrough on the sound is normal with too high an input level. Severe breakthrough can also mean that the generator is off-tune or that the TV rejector may be out of alignment. Do not attempt to adjust the tuned circuits however but continued with the tests. Alignment, if wrong, can be attended to when the fault has been cleared.

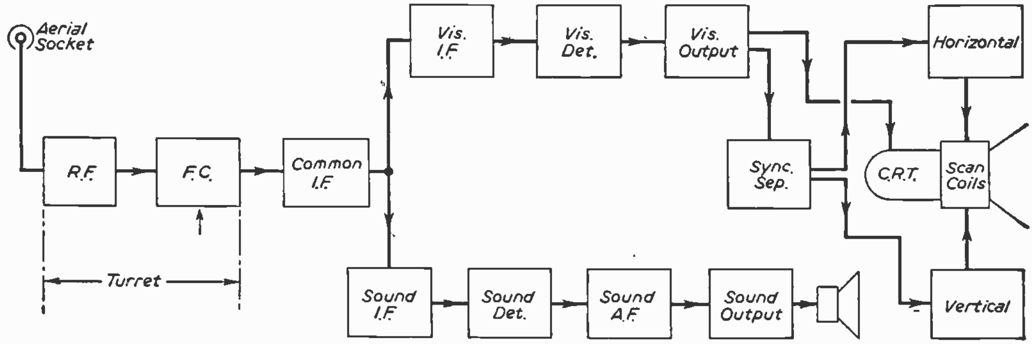


Fig. 2.—Points in TV receivers at which test signals may be injected. (Use this diagram in conjunction with the table of test points.)

weak output sound, tunable now by the fine tuner, a fault is indicated in the R.F. stage—usually the cascode circuit. The weak result is often accompanied by rushing background and grain.

Vision Sections

The procedure here is similar to that used in the sound sections. Instead of using the speaker as an indication of output, the video modulation of the screen raster is observed. In complete vision alignments an output meter is used. This is properly the method of stage gain tests and measurement. In our case however, we are interested in a quick run through check to find a stage that has ceased functioning and a visual estimate is sufficient. The vision circuit is easily overloaded and care must be taken to avoid "swamping". Do this by keeping the input as low as possible to give a well contrasted output. The output will appear as horizontal rows of black and white bars across the screen when modulated CW or A.F. is fed in. Usually eight bars appear for 400c/s modulation.

Test Point 10.

Inject strong A.F. directly into the tube cathode

Test Point 15.

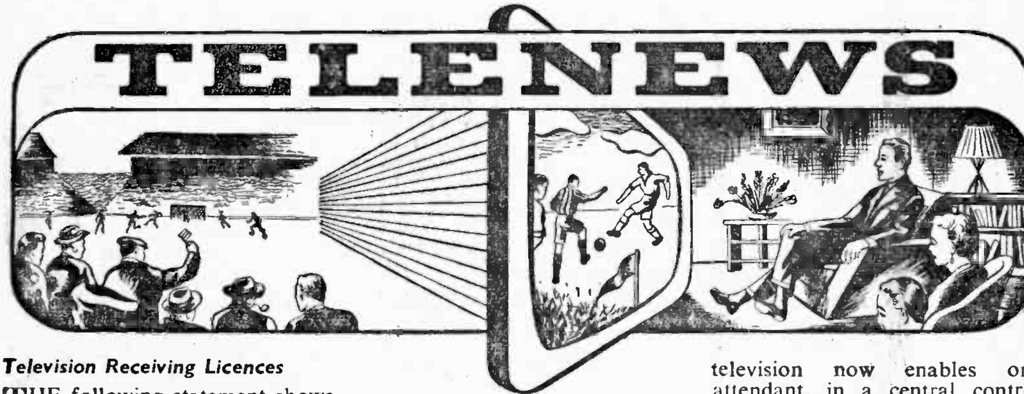
As with the sound Test Point 6 this point may be inaccessible. With proximity injection an increase in input may be needed to produce an output. Avoid pulling the oscillator circuit about.

Test Point 16.

This test, like the sound equivalent is only needed for suspect failure of the local oscillator. Use strong CW and vary the signal generator output around the signal vision frequency minus the vision I.F.; e.g. for channel 1, 45Mc/s−35Mc/s= 10Mc/s (assuming a standard I.F. of vision 35Mc/s).

It should be mentioned here that normally the TV local oscillator is in nearly all cases above the signal frequency so the same result is possible for both vision and sound with an injected CW of 70Mc/s. This may be tried, but many signal generators do not cover this high range, in which case there is no option but to use the lower, stronger minus frequency. The aerial should be connected for this test. Production of the channel picture and sound, tuned from the signal generator indicates a faulty local oscillator.

(Continued on page 202)



Television Receiving Licences

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

Region	*Total*
London Postal	1,880,898
Home Counties	1,497,651
Midland	1,661,424
North Eastern	1,773,080
North Western	1,445,616
South Western	920,593
Wales and Border Counties	660,157
Total England and Wales	9,839,419
Scotland	970,031
Northern Ireland	153,367
Grand Total	10,962,867

Television Appointments

MR. N. T. ATKINSON, formerly head of Ekco Television Development, has been appointed to the post of Chief of Television and Radio Development. Mr. Atkinson has been concerned with the development of Ekco television receivers since 1938 and in his new position he will be directly responsible to executive director and chief engineer Mr. A. J. Brunker. Mr. E. W. Maynard, formerly in charge of export television development, succeeds Mr. Atkinson as head of Television Development.

New Canadian TV Stations

THE two 18kW sound transmitters for each of the two new commercial TV stations in Montreal are being supplied by Marconi. One outlet is French, while the English outlet is owned by the Canadian Marconi Company. The order, received through Canadian Marconi Company, is to the value of £200,000.

Both stations' transmitter facilities will be housed in the same building on top of the picturesque Mount Royal mountain in the heart of Montreal. The vision equipment consists of 4kW BD366 transmitters driving 18kW amplifiers (BD369), and the sound equipment consists of 1kW transmitters (BD317) with 10kW amplifiers (BD360). The transmitters are suitable for colour television.

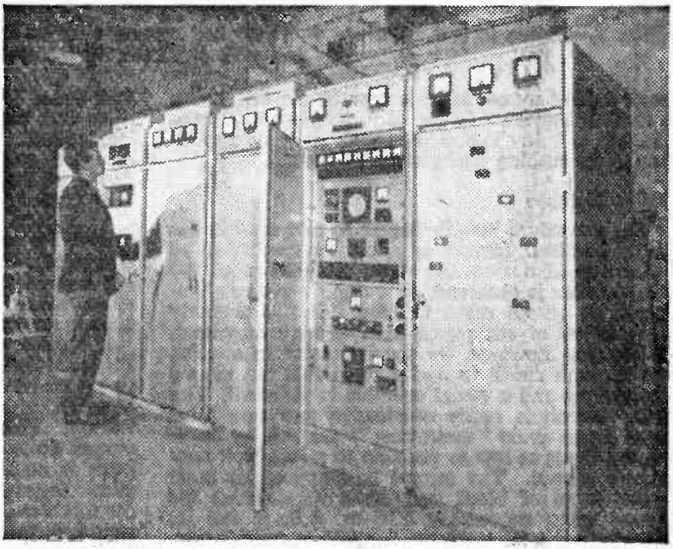
The new stations are expected to go on the air early in 1961.

Remote Control by Television

THE man who reads the meters in Britain's newest gasworks at Sunderland no longer has to leave his chair. Closed-circuit television now enables one attendant, in a central control room at the gasworks, to take all the necessary operational readings from meters, gauges and other instruments situated in different parts of the building.

The system, installed by Pye TVT Limited's Industrial Division, works on 625 lines and has five TV cameras strategically positioned throughout the gasworks to send pictures to an 8½in. screen in the control room. Using a five-way camera switching unit, the attendant can bring to the screen pictures from any one of the cameras. The camera is then directed by remote control on to any instrument which the attendant wishes to read.

Closed-circuit television enables



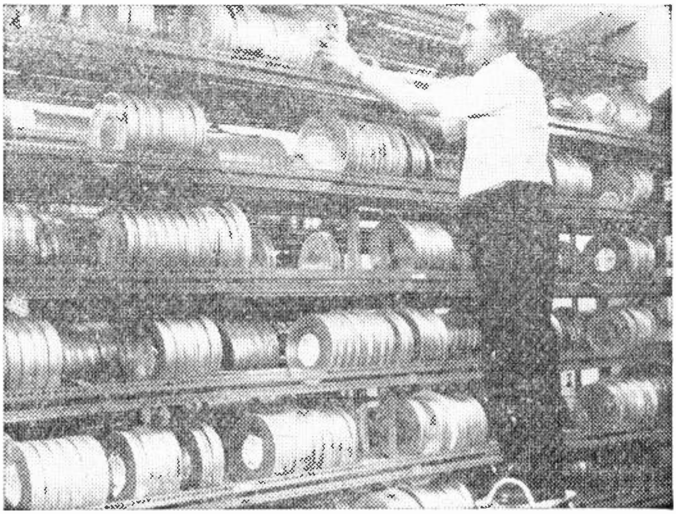
The 18kW vision transmitter being supplied for TV stations, by Marconi.

routine hourly checks on all important instruments to be made in a matter of minutes, and makes it unnecessary for an attendant to patrol the gasworks at regular intervals.

British Electronic Component Expansion

BRITAIN'S radio and electronic component industry, with exports last year exceeding £11 million, and now running at the rate of £1 million a month, aims at increasing this figure considerably when, from May 30th to June 2nd next year, for the first time at Olympia, London, it holds its 17th Radio and Electronic Component Show.

The Component Show has grown too big for Grosvenor House, Park Lane, London, where it has been held for many years, and in its home at Olympia it will be three to four times its previous size.



The new ATV film library, where millions of feet of film are stored on racks made by the Dexion group.

Marconi Underwater TV Helps Fish and Hydraulic Research in Scotland

RECENTLY ordered by the North of Scotland Hydro-Electric Board, a Marconi-Siebe, Gorman underwater TV camera will be used for research into fish and hydraulic problems on Scottish lochs. Among other things the camera will inspect the huge fish screens which guard the turbine intakes and prevent smolt (young salmon between one and three years old) from being swept into the turbines. The job of inspecting these screens—which also guide the migrating fish into the fish passes and hence to the sea—was previously done by divers.

The camera will also be used to study fish behaviour in the fish passes and to inspect the tunnels linking the dams and power stations. Engineers will therefore be able to report on the condition of the tunnels without dewatering, a costly job in men and materials.

The Hydro-Electric Board have already carried out satisfactory tests with underwater TV equipment, using the camera to inspect fish screens which may be 120ft below the surface. The 14in. monitor supplied with the camera was found to give better pictures than a diver could see in murky water.

When in general use the Marconi equipment will be taken from loch to loch all over Scotland for these on-the-spot investigations.

BBC Television and V.H.F. Sound Station at Radnorshire

THE BBC has placed a contract with Ernest Deacon Ltd., Kington, Herefordshire, for the construction of the building for the new television and V.H.F. sound broadcasting station at Llandrindod Wells, Radnorshire.

This is one of several low-power stations which the BBC is building to extend and improve the coverage of its television and VHF sound services.

The Llandrindod Wells station will bring BBC television within reach of some 12,000 people in Central Wales, and it is hoped to complete it during the summer of 1961.

Canada Buys British Instrument Landing System

THROUGH Pye Canada Ltd., Pye Telecommunications Ltd. have received a contract from the Royal Canadian Air Force for the supply of a Pye Instrument Landing System for installation at the R.C.A.F. Airfield, Trenton, Ontario.

Pye I.L.S., incorporating a directional localiser, operate as an internationally specified approach aid at many civil airfields and it is used by the Royal Air Force. It is the primary guidance element in the pilot-less landing of V-bombers. Over 100 Pye installations are now in use throughout the world. This is the first installation of British I.L.S. on the other side of the Atlantic.

TV Cameras for Mexico

TELEVICENTRO, Mexico's television organisation, has ordered three complete television camera channels from E.M.I. Electronics Ltd. The units, which were delivered immediately the order was finalised, will replace existing United States equipment. They are the first British 4½in. Image Orthicon cameras to be imported into Mexico.

Each channel comprises a camera, control units, power supply unit, picture and waveform monitors, control console and ancillary equipment.

E.M.I. Electronics' television equipment has already been exported to Canada, U.S.A., Norway, Poland, Italy, Switzerland, Hungary, Australia and China.

A mobile demonstration unit has recently toured Europe, showing the company's Image Orthicon camera to leading television organisations. As a result, several further enquiries have already been received.

Oscilloscope Faults

IMPROVING THE CIRCUITRY AND ELIMINATING HUM

By W. Cleland

A TEST instrument has to be reliable if it is to be of any use for checking, so any internal faults of an oscilloscope have to be cleared up before it is used, and oscilloscopes require to be particularly free from spurious effects. The types of oscilloscope used in servicing TV and radio sets are simple when compared with the advanced instruments that have been developed for research purposes, but it would be unwise to assume that even a simple oscilloscope can be hastily planned and constructed without encountering any snags. The amateur who carries out such a project without making preliminary experiments is likely to find that the completed oscilloscope is almost unusable because of the trace being marred by hum pick-up, cross-talk, astigmatism, unsatisfactory focusing, mains fluctuations, and other effects.

Mains Transformer

The first thing to be considered is 50c/s magnetic hum from the mains transformer. Some cathode ray tubes are particularly affected. For example a VCR97 without a mu-metal shield is slightly affected by the magnetic field of a mains transformer when situated as much as a yard away. This suggests the building of a separate power supply connected to the oscilloscope by a cable. The main difficulty here is conveying the EHT supply, taking account of insulation requirements and the risk of shock. This can be overcome by the use of a suitable cable and plugs, and this method is used in some large oscilloscopes. It is also possible, of course, to house the EHT unit inside the oscilloscope while keeping the main power supply separate.

Usually, however, it is considered that a separate power supply is too cumbrous, especially in small oscilloscopes, intended to be portable. By careful positioning of the mains transformer, or balancing of the fields of two or more transformers, together with the use of a mu-metal shield on the cathode-ray tube, it is possible to make the oscilloscope compact without having the trace spoilt by the unwanted magnetic deflection.

50 c/s Hum

The effect of 50c/s hum when the timebase generator is running at a high frequency may be to thicken the trace, and so can be mistaken for poor focusing or for astigmatism.

When the horizontal deflection is switched off, it should be possible to obtain a small sharply-focused spot. Unwanted magnetic deflection will elongate the spot, but astigmatism can have the same effect along either the X or Y axis. If there is also a slight 50c/s ripple voltage on the plates, this may combine with the magnetic deflection to produce a tiny hysteresis loop, resulting from hysteresis in the laminations of the mains transformer.

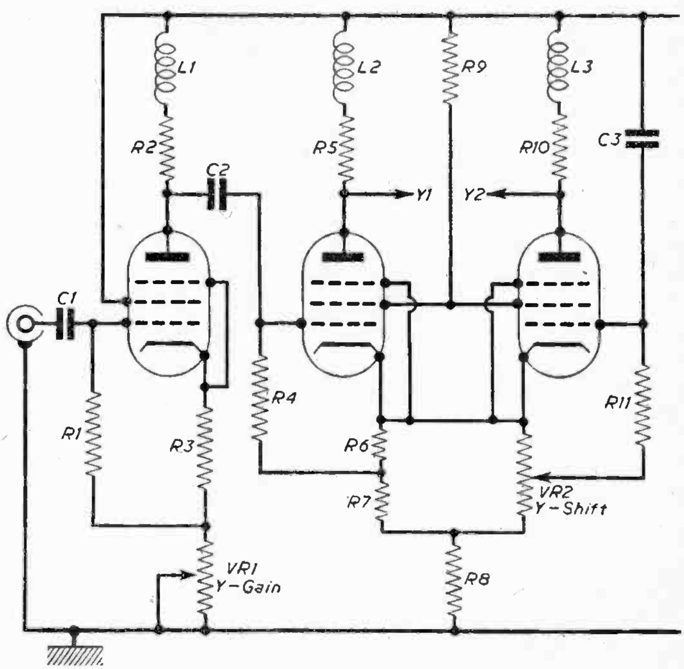


Fig. 1.—The Y-amplifier of a small oscilloscope.

The test for deflection due to magnetic hum is to rotate the cathode ray tube by itself. If the spurious deflection is due to magnetic hum it will remain stationary, while if in reality it is due to ripple on the plates, it will rotate with the tube. If both are present there will, of course, be some change with rotation, and it will be necessary first to eliminate the ripple voltage before the test can give distinct evidence of magnetic deflection.

Hum Voltages

To a complete beginner, spurious deflections can be a mystery because the deflections may be caused by a number of simultaneous causes, all of which have to be cleared up before the oscilloscope can be a success. However, with practice and experiment, the sources of the troubles can be tracked down.

The input of any sensitive high impedance apparatus has to be screened to prevent hum pick-up, especially when, as in the case of an oscilloscope, it is connected to the mains. Screening involves increased capacitances and so diminishes the high frequency response, but it can only be avoided by using low resistances, which is not usually practicable. Quite often the gain control in the Y-amplifier alters the cathode feedback on the first valve, so that reducing the gain increases the input impedance. Thus the amplifier remains sensitive to hum even at minimum gain, because the high input impedance means that a correspondingly higher hum voltage can be picked up at the input. A finger placed on the input connection gives full-screen hum deflection. Inputs must therefore be either from low impedance sources or else screened ones, if hum pick-up is not to be troublesome. In addition, leads should not be longer than necessary.

"Mains Jump"

Hum can also be introduced inside the amplifier itself. Push-pull or symmetrical deflection assists in cancelling this out, and makes less smoothing necessary in the H.T. supply. If hum arises within the amplifier it may be necessary to increase decoupling arrangements. Decoupling is less effective against "mains jumps". The mains voltage is subject to random fluctuations as the consumer load varies, and the result can be a jumpiness in the trace, which might easily be attributed wrongly to switch contacts or to a faulty potentiometer, although such possibilities cannot be overlooked.

The best way to deal with "mains jumps" is to use symmetrical valve arrangements. In fact, many oscilloscopes use symmetrical arrangements throughout, i.e. two valves in each stage. This is not, however, absolutely necessary. A single valve input stage followed by a symmetrical output stage is satisfactory, providing both coupling capacitors of the output stage are connected towards the H.T. + line, as shown in Fig. 1. This ensures that mains fluctuations, as represented in the H.T. voltage, will affect both valves equally and so will have no effect upon the trace.

Usually the amplification is too small for noise to be troublesome, but in a cathode-follower probe stage preceding the input of an oscilloscope, using a valve that was probably defective in this respect, a considerable amount of noise originated. This differs from other displays in being completely fortuitous, and appears on the screen as a jostling population of spikes with no particular frequency or amplitude.

Astigmatism

One feature of hum is that cancellations can occur if it arises from two or three different sources. One source might be an EHT supply of the mains type with insufficient smoothing; another hum pick-up in the amplifier from inadequate decoupling. When one source of hum is removed it may thus be found that hum deflection on the screen is worsened, and it is necessary to deal with all the probable sources of hum at the same time, and to find which have the most effect.

Slight residual hum, thickening a higher frequency trace, could be mistaken for poor focusing, so care should be taken to ensure that a sharp spot can be obtained. If the spot is elongated when hum troubles have been eradicated it will be due to astigmatism, caused by the mean voltages of the plates and final anode being different. The remedy is to adjust the voltage of the final anode relative to the mains voltages of the plates until a perfectly round spot is obtained. The type of shift system used should, if possible, be one which does not vary the mean voltage of the plates, i.e. the

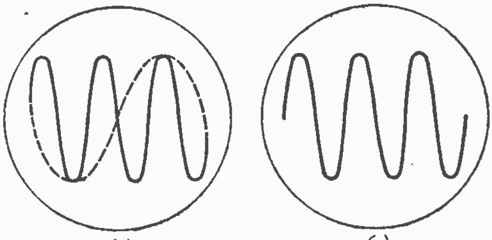


Fig. 2.—Oscilloscope traces with sinusoidal input.

voltage on one plate of the pair in question should rise by the same amount as the other falls.

This is sometimes done by using ganged potentiometers for the shift controls, or if the output stage is of the self-balancing symmetrical type, using two valves with direct coupling to the C.R.T. plates. A single potentiometer, controlling one grid, will give the same result, one anode rising in voltage by the same amount as the other falls.

If the shift controls are to work satisfactorily, the capacitors incorporated must be of good quality. Besides preventing the shift controls from functioning properly, leakage reduces the time constant, and may cause distortion.

A capacitor can be tested by placing it in series with a neon lamp and a 22k limiting resistor across an H.T. supply. The interval between flashes depends upon the difference in voltage between the striking and extinction potentials of the neon lamp, and also upon the capacitance value multiplied by the leakage resistance of the capacitor. A small capacitance can be expected to have a higher leakage resistance, making the interval between flashes about the same as for a larger capacitance of the same working voltage and construction, although the flashes will be weaker. However, we are really concerned with coupling capacitors of, say, 0·25μF, and with good ones, the time between flashes should be counted in minutes rather than seconds.

The Amplifier

Parasitic oscillation occasionally gives trouble in oscilloscopes. High frequency oscillation builds up negative bias and can stop itself momentarily until enough of this charge has leaked away via the grid resistance of the valve. The interruption may be at an audio frequency and the bias variation has a saw-tooth waveform. The trouble is overcome by earthing the amplifier circuit to the

Fault	Characteristics	Cure
Effect of transformer field	*50c/s deflection, unaffected by rotating C.R.T.*	*Careful positioning of mains transformer mu-metal shield on C.R.T.*
Hum voltages	*50 c/s deflections which rotate with C.R.T.*	*Improve smoothing, screening and decoupling*
"Cross-talk"	*Closed loop on screen*	
R.F. pick-up from E H T unit	*High-frequency ripple on trace*	
H.F. oscillation	*Deflection at interruption frequency*	*One-point earthing, grid-stoppers short connections*
Noise	*Random deflections*	*Replace faulty component*
"Mains Jump"	*Jumpiness of trace*	*Symmetrical valve and coupling arrangements*
Astigmatism	*Spot elongated in X or Y direction*	*Adjust mean potentials of plates relative to final anode*
Poor focusing	*At optimum adjustment of focus and brightness small spot or sharp trace still not obtained*	*Increase smoothing of E H T. Increase E H T voltage. Eradication of spurious deflections*
Flyback visible	*Return trace superimposed on forward trace*	*Flyback suppression circuit, or increase of speed of flyback*
Leaky capacitors	*Shift controls unsatisfactory*	*Replace with capacitors of high insulation resistance*

chassis at one point only, and by including grid stopper resistances of about 100Ω. Long connections or loops in the wiring are also to be avoided.

Cross-talk from the timebase generator to the amplifier produces a closed loop on the screen, since the X and spurious Y deflections are then of the same origin and therefore the same frequency. The steps taken to counteract it are: improved screening between the Y-amplifier and timebase generator, increased decoupling of the Y-amplifier from the H.T. supply line, and sometimes capacitive balancing of the stray capacitances between the X and Y plates.

If an R.F. EHT supply is used, similar measures may have to be taken to keep the R.F. wave out of the amplifier, and an R.F. filter can be included in the H.T. lead to the EHT unit. Pick-up from the R.F. EHT supply is easily recognised by the presence of a high frequency ripple on the C.R.T. trace. It may also be possible to pick up R.F. on loops in the wiring, and therefore long connections are to be avoided.

Focusing

Good focusing depends upon a well-smoothed EHT supply, and this is most easily obtained using an R.F. unit. The grid bias to the cathode ray tube is decoupled to avoid any residual ripple between grid and cathode. Focusing becomes sharper as the EHT voltage is raised, and a brighter trace is obtained, but the sweep voltages required are increased proportionately, so an EHT of 1kV is regarded as suitable in a small portable oscilloscope without post-deflection acceleration, and this enables full-screen deflection to be obtained without making the H.T. voltage required for the output stages unusually high.

In normal applications the horizontal sweep represents a linear time scale of milliseconds or microseconds, and is a saw-tooth voltage provided by the time base generator. The screen pattern is completed by flyback. At low sweep frequencies the portion of the sweep cycle spent in flyback is so small that it is practically invisible, but at high sweep frequencies where it may become as much as a quarter of the sweep cycle, it becomes noticeable, and may be an undesirable or confusing addition to the display (Fig. 2). It is often possible to include a circuit for blanking flyback by driving the C.R.T. grid more negative during flyback, or less negative during the forward trace period. In the latter case, the flyback suppression may affect the brightness of parts of the trace, and it may be preferred to make the use of the flyback suppression circuit optional by including a switch to turn it off or on as required. It is then possible to see quite clearly which part of the trace is flyback and which is not.

Owing to lack of space, the series "Line Oscillators and Sync Circuits" has been held over and will be continued next month.

EHT Generation

By G. K. Fairfield

No. 2—THE USE OF TRANSISTORS

LAST month the use of thermionic valve circuits for EHT production was described. Transistors may also be used for this purpose and possess a number of advantages that valves lack; such as, high efficiency of conversion and their ability to operate from a much lower value of supply voltage. For this latter reason they lend themselves to incorporation in EHT supply units for portable use.

Efficiency of Conversion

The improved efficiency of conversion from a low voltage to the several thousands of volts that are required for cathode ray tube work arises from the fact that a transistor acts as an extremely effec-

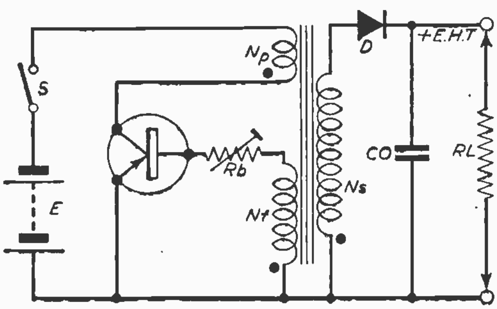


Fig. 1.—A ringing-choke circuit.

tive switch. A thermionic valve when passing its maximum permissible current has a minimum anode voltage of about 50 or so. The transistor, on the other hand, has a minimum potential in the current saturating condition of the order of millivolts. Consequently the ratio of its "on" to "off" voltage can be very much greater than the valve and very low power dissipation occurs in the "on" or conducting condition.

To use the transistor as a switch in EHT supply circuits two methods are possible. The first of these is very similar to the "ringing-choke" method described previously and is capable of providing a large value of EHT at high conversion efficiency.

The second method uses a pair of transistors acting as an inductive multivibrator and is used where rather larger amounts of output power are needed together with extremely good regulation.

Ringing-Choke Circuit

A typical self-oscillating circuit is shown in Fig. 1. The transistor has one winding, Np, of a transformer included in its collector circuit and a feedback winding, Nf, connected in the base circuit such that an increase in a collector current results in increased base drive.

The switch (S) is made and the transistor begins to draw current. A rising current flows through the primary winding Np whilst a constant current flows to the base of the transistor because of the feedback action from Np to Nf. This continues as long as the collector current is smaller than the product of transistor current gain (β) times the base current flowing

As soon as the collector current exceeds this value, the voltage across the transformer windings reverses and a state of resonance occurs, i.e. ringing of the transformer with its stray capacity takes place.

The energy stored in the primary is then transferred to the EHT secondary winding and the rectifier D conducts to allow Co to charge up to a high value. As soon as Co is fully charged then the diode is cut-off as the transistor conducts once more. The action is similar to that of the blocking oscillator used in a television timebase, the frequency of oscillation being governed by the transformer primary inductance.

By controlling the amount of base current with the resistance value of Rb then the amount of oscillatory power transferred to the storage capacitor Co can be adjusted. The value of EHT generated depends on the H.T. supply voltage E and the transformer ratio Ns/Np.

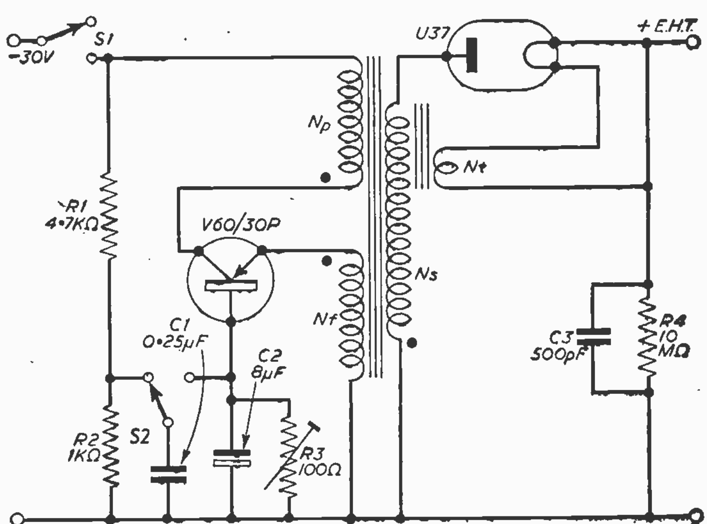


Fig. 2a.—A circuit capable of providing 5kV.

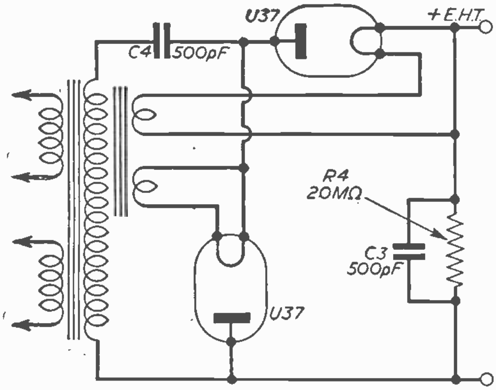
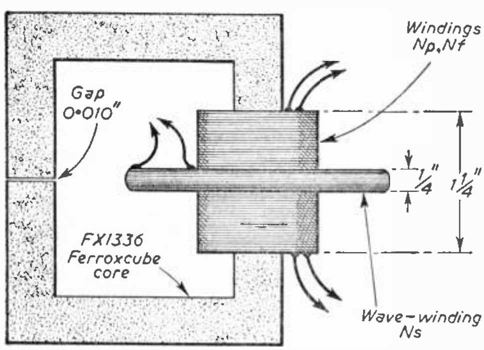


Fig. 2b (above).—This voltage-doubling rectifier circuit gives 10kV.

Fig. 3 (below).—The transformer for the ringing-choke circuit (Fig. 2a).



Practical Circuit

A circuit capable of providing 5kV of EHT at output currents up to 2mA is shown in Fig. 2a. If a voltage doubling rectifier circuit is used then 10kV may be obtained at a load current of 1mA as shown by the alternative connections of Fig. 2b.

The input voltage is only 30V so that this arrangement can be made very suitable for a portable EHT unit.

One feature not present with thermionic valve circuits is the difficulty of initiating oscillations upon switch-on. As the transistor contains no slow-heating filament then very little initial current variations are present to start the circuit into a state of oscillation. Consequently a starting circuit is necessary to provide the initial transient and in Fig. 2a this is obtained by charging capacitor C1 to about 1V with switch S2 in position shown and to discharge this capacitance via the base circuit of the transistor when S2 is thrown in the opposite direction. S2 thus acts as a "starting" switch and may be ganged to the supply switch such that the action of switching on the oscillator will be to make S1 a fraction of a second before S2 when oscillation will commence.

The efficiency of this circuit is fairly high. of the order of 60 per cent to 70 per cent, and since the oscillation frequency will be about 10kc/s then a small value of smoothing capacitance is required for C3.

The transistor used is a V60/30P and is capable of withstanding a peak collector voltage of 60V. This is necessary since the voltage across the collector winding of the transformer reverses when the transistor is switched off and the peak collector voltage rises to almost double the supply voltage. Care must be taken always to connect a load resistance across the output terminals to absorb the supply current. If this is not done then the voltage across the collector-base terminals of the transistor may rise above the permitted maximum value (60V) of the transistor and it will be damaged. A fixed resistor of 10M or 20M (for 5kV and 10kV respectively) may be connected across C3 for this purpose.

A diagram of the transformer is shown in Fig. 3. The core consists of two Mullard ferrite U-core type FX1336 with a gap of 0·01in. paper in each limb of the core.

WINDING DATA FOR FIG. 3

Winding	No. of turns and wire gauge
Np	35 turns of 0·040 enamelled copper wire.
Nf	7 turns of 0·0124 enamelled copper wire.
Interleave	two turns of 0·002in. polythene tape between windings Np and Nf and over Nf.
Ns	4,900 turns of 0·0048 enamelled and single-silk copper wire.

	A	B	C	D	E	F
Wavewound gears (Douglas wavewinding machine).	44	29	32	48	60	80

By the addition of a further winding on the transformer core it is possible to control the regulation of the EHT supply so that the output voltage remains constant as the load current alters.

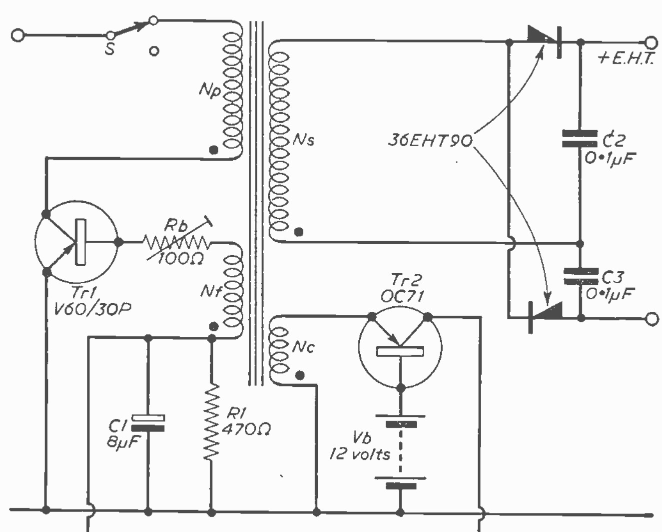


Fig. 4a.—This shows a circuit of a stabilised EHT source.

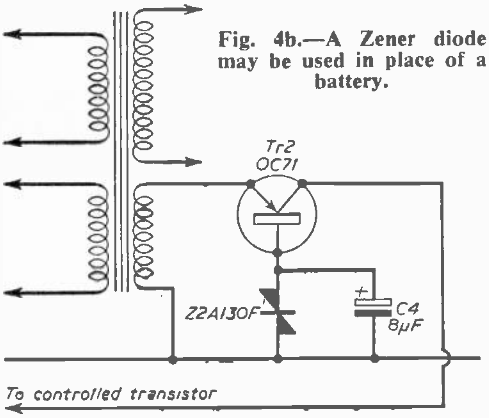


Fig. 4b.—A Zener diode may be used in place of a battery.

Referring to Fig. 4a, a second transistor Tr2 is added with its emitter connected to the fourth winding Nc. A battery Vb is connected between base and ground as shown.

The collector current of the transistor is applied to Tr1 as a controlling bias and is proportional to the difference between the fixed voltage Vb and the peak voltage developed across Nc. As more current is drawn from the EHT output terminals, so the output voltage tends to fall and hence the voltage Vc.

This causes Tr2 to pass more collector current, which in turn allows Tr1 to conduct further during its conducting half cycle. This additional current through the transformer primary, Np, is transferred to the EHT winding and compensated for the increased current drawn by the load. Similarly if the load current fails then Tr2 conducts less and a smaller current is supplied to the EHT load by Tr1.

The battery Vb may be replaced by a voltage reference or Zener diode chosen for the operating voltage required as shown in Fig. 4b.

The effect of improvement in regulation is shown in Fig. 5 which shows the variation in supply voltage as the load current is varied.

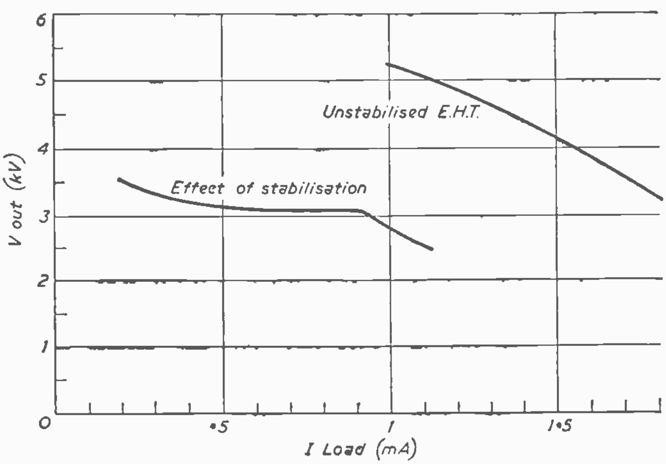


Fig. 5 (above).—The regulation curves for the stabilised EHT circuit.

Inductive Multivibrator

The second form of EHT converter is shown in Fig. 6. This requires two transistors connected to individual feedback windings such that the turning off of one transistor will initiate the turning on of the second and vice-versa, thus constituting a multivibrator action. This may be explained as follows:—

Referring to Fig. 6, let transistor Tr1 be conducting and Tr2 non-conducting. The primary current through winding P1 will rise linearly and a constant voltage induced in the feedback windings F1 and F2. The polarities of these induced voltages will be such as to maintain conduction of sequences Tr1, while keeping Tr2 cut-off.

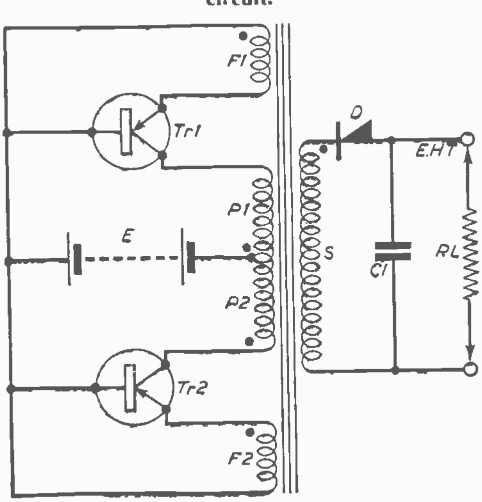
Eventually so much current will be flowing in P1 that the transformer core will begin to saturate. When this occurs the inductance of its windings will fall and the primary current will increase rapidly. When this reaches a value of β times the base current then the feedback voltage will begin to fall. The fall in collector current, which then occurs, will result in reversal of the polarity of the feedback voltage and Tr1 will be rapidly cut off whilst Tr2 is turned on.

A square wave is developed across the promary windings which can be increased by transformer action for subsequent rectification and use as EHT supply voltage.

If the secondary (EHT) winding Ns has a fixed load across it then a constant load current will be imposed on the rising inductive load.

(To be continued)

Fig. 6 (below).—An inductance multivibrator circuit.



How to make AERIAL ATTENUATORS

"T", "π" AND SPLITTER CIRCUITS

By N. Mears

IT frequently happens that the aerial signal, if fed direct to the input terminals of a television receiver, overloads the R.F. frequency changer or the I.F. valves, or produces two much "drive" at the cathode ray tube. With more modern receivers effective automatic gain control is usually provided and the problem is not so severe. However, there are many occasions when too much aerial signal is not a good thing, and this is especially true when—for the purpose of cutting out "ghosts" or reducing interference—a high-gain aerial has to be used well within the service area of a transmitter. It will be realised that if an aerial is picking up interfering signals from a direction, not that of the transmitter, an improvement will be obtained by greater directivity, but this may well reduce the interference and increase the signal, even to the point of annoyance!

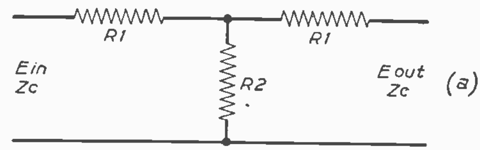
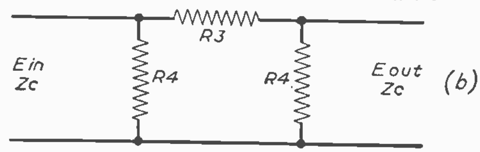
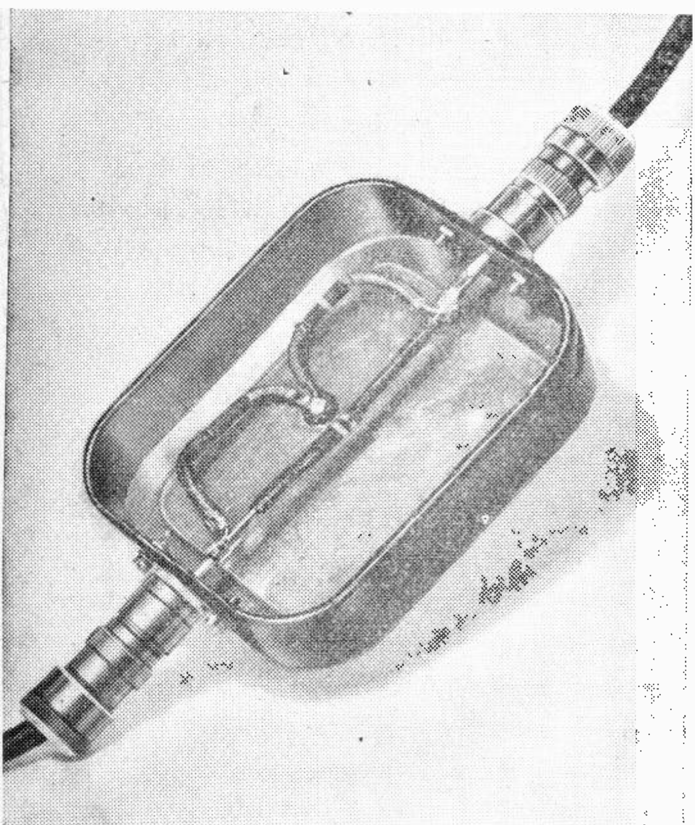


Fig. 1a (above).—T-section attenuator.
Fig. 1b (below).—π-section attenuator.





Left.—This clearly shows the simplicity of an attenuator.

Interference Problem

The problem then simplifies itself to that of reducing the voltage available at the receiver input and with it a much reduced interference signal. To do this effectively, however, certain conditions must be fulfilled.

Unwanted Effects

First, serious mis-match must not be introduced between feeder and input terminals, because not only will this reduce the amount of power transferred from the aerial to the input circuits (the object of the exercise) but will cause more than one unwanted effect.

The first of these is an increase in noise level. Nowadays the need is fully recognised, in designing a television receiver, to arrange for the input matching to be for minimum noise rather than for maximum signal. This is especially the case where Band III is concerned, and when Bands IV and V come into use the requirement will be equally exacting, if not more so.

The second undesirable effect is that of loss of resolution. A simple qualitative analysis will show how this may occur. If the mis-match between feeder and input exceeds a certain quantity, an appreciable amount of energy will be reflected back from the input terminals and will travel back to the aerial. If the aerial is accurately matched to the feeder, this will be absorbed and nobody will be the worse—except perhaps a neighbour who receives a delayed signal as well as the desired one and whose picture may thus conceivably be impaired. Of course this is unlikely to be serious unless perhaps his aerial is only a few feet away from the radiating one.

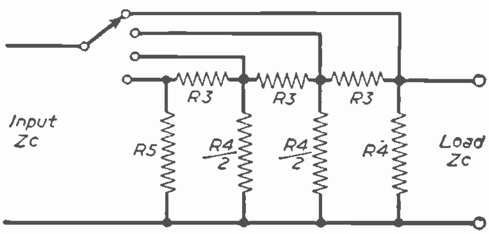


Fig. 2.—π-section ladder attenuator.

The more likely case is the effect on the reader's receiver. If the match between feeder and aerial is exact, no reflection takes place at the aerial. This condition is seldom achieved except where a plain dipole is used. Where directors and reflectors are involved there is usually some mis-match in commercial practice. This will involve a further partial reflection, and the re-reflected signal will travel again down the coaxial cable and arrive at the input terminals once more. Further reflection at this point and at the aerial can be neglected because by now the reflected signal will be much weakened.

The total length of coaxial cable so far traversed by the signal may now be 180ft. Although normally by now it will be much weaker than the signal which has not suffered reflection at all, if severe mis-match occurs it may produce a visible signal on the tube face. If it does, it will be delayed about $\frac{1}{3}\mu$sec and resolution of the 2·5Mc/s and 3Mc/s bars in Test Card C will be impaired, perhaps lost altogether.

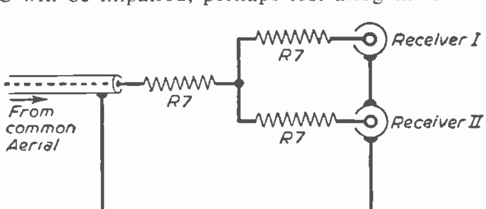


Fig. 3.—"Splitter" circuit for an aerial common to two receivers.

A further effect will be that of changing the damping imposed by the aerial on the input circuits. In correct design, the natural damping caused by the total input resistance of the R.F. valve and its circuits, is just about doubled. Where mis-match occurs the damping will be increased or decreased. If the former, noise will increase; if the latter, phase distortion, or reduction of bandwidth, or both, will occur.

"T" and "π" Type Attenuators

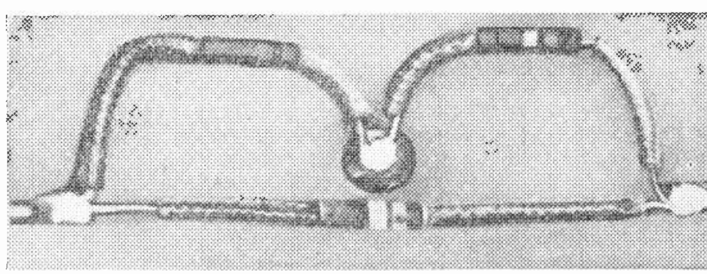
Any attenuator placed between aerial and input must therefore introduce the minimum amount of mis-match, and this feature has to be kept constantly in mind in design. The most usual feeder is the coaxial, of 80Ω nominal impedance, and this is an "unbalanced" structure. The choice is between "T" type and "π" type attenuators, as shown in Fig. 1.

T and π Section Constant Impedance Attenuator

Tables 1 and 2 give design data for values from 1dB to 10dB of voltage attenuation. Both T and π sections are included, but it must be remembered that this is for 80Ω nominal impedance only. For other values of feeder characteristic impedance, Zc, the resistor values must be multiplied by Zc/80.

It will be observed that only seldom do the resistors approximate closely to "preferred values". While this would be important from a manufacturing point of view, and would restrict the range of attenuators available, it matters little to the home constructor who can select, from his stock, values within 10 per cent or so of those listed.

It is unwise to attempt to obtain more than about 10dB attenuation in one attenuator. This is because of the inevitable capacitances and inductances associated with practical components, which introduce unwanted coupling between input and output. Instead, where attenuation in excess of 10dB is required several sections can be cascaded.



The layout of components for a π-section attenuator.

Constructing an Attenuator

In constructing an attenuator, the output should be separated as far as possible from the input. At the same time, the smallest possible physical size of resistor should be used, because although it brings the output terminals nearer to the input terminals, capacitances and inductances will nevertheless be reduced. If the attenuator is to be a permanent fixture it is also best to avoid the use of coaxial sockets and plugs; these have appreciable capacitance and are often badly matched to the cable. However, where only a temporary component is needed (as in experimental work), they can be used as long as care is exercised.

An actual case is considered. It is desired to reduce the amplitude of a signal by a factor of $\frac{1}{2}$, or 6dB. The characteristic impedance of the low-loss cable to be used is 75Ω. A short calculation shows that, for a T-section, R1 is 25Ω and R2, 100Ω. Both these types are readily obtainable—preferred values are 27Ω and 100Ω which are near

TABLE 1.—T-section.
(Resistors as in Fig. 1(a).)

	Decibels Attenuation									
	1	2	3	4	5	6	7	8	9	10
R1(Ω)	4·6	9·2	13·7	18	22·4	26·6	30·5	34·5	38	41·5
R2(Ω)	690	345	226	168	131	107	90	75	65	56·2

TABLE 2.—π-section.
(Resistors as in Fig. 1(b).)

	Decibels Attenuation									
	1	2	3	4	5	6	7	8	9	10
R3(Ω)	9·3	18·5	28·2	38	48·7	60	71·5	85	98·5	114
R4(Ω)	1390	700	467	365	285	242	210	185	169	154

enough. Had a π-section been chosen, R3 would be 56Ω and R4, 225Ω—again, close to preferred values of resistor. Here the choice may be made according to what resistors are in stock.

A further practical case, using 80Ω cable, may be taken. Suppose an attenuation of 10dB is required, accurately; the choice is between a T-section with resistors of 41·5Ω and 56·2Ω and a π-section with resistors 114 and 154Ω. Here the former would be chosen, because it would be easier to select from stock (preferred values 39Ω and 56Ω as compared with 120Ω and 150Ω).

Multiple Section Attenuators

Sometimes it is desired to arrange a variable attenuator, operated by a switch. The "ladder" attenuator results from cascading a number of T or π sections, as shown in Fig. 2. However, this simple type is characterised by considerable variation of input impedance, as will be seen from the diagram. The output impedance also varies, but to a lesser degree.

The resistance values correspond to those in Table 2, R5 being given by R4. Zc/R4+Zc.

An improvement in the constant value of impedance is obtained by inserting a resistor of value Zc/2 in series with the switch.

An Attenuator for two or more Receivers

Another use of a resistor network exists where several receivers have to be connected to the same aerial. A moment's consideration will indicate that if two receiver inputs are paralleled, the impedance presented to the feeder cable is half that of either. If three receivers, the effective load on a feeder of characteristic impedance Zc is Zc/3. This will cause serious mis-match and can prevent receivers operating correctly. All that is required to overcome the difficulty is to equalise impedance, by means of series resistors, as shown in Fig. 3.

The calculation of R7 is as follows. Assuming all characteristic and input impedances are Zc, the impedance at either receiver input, with the aerial feeder disconnected, is R7+R7+Zc.

The aerial feeder will see an impedance, for n receivers, of $R7+(R7+Zc)/n$ and for correct matching this is equal to Zc.

$$\text{Thus } n.R7+R7+Zc=n.Zc$$

$$\therefore R7=\frac{Zc\,(n-1)}{n+1}$$

Thus, for two receivers with Zc equal to 80Ω, the resistors R7 must be 27Ω which is a preferred value in the ±10 per cent range of resistors.

The signal present at each receiver is however reduced by half, and so this type of splitting is only really possible when plenty of signal is available. If several receivers have to be fed from a common aerial in a fringe area it will be preferable to use a pre-amplifier or a much better aerial, or both.

FAULT-FINDING WITH A SIGNAL GENERATOR

(Continued from page 189)

Test Point 17.

The input of strong signal frequency modulated CW with a weak grainy output proves a faulty R.F. stage.

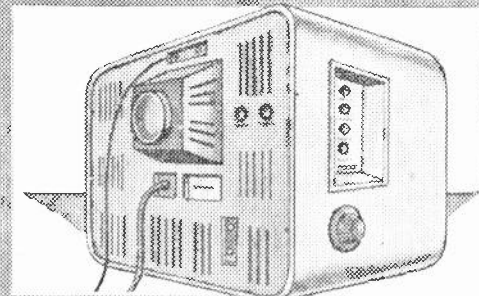
Test Point 18.

This odd test does not come into the other categories but is used to test the vertical output valve circuit. The A.F. sine wave is injected direct on the grid, and if this valve and section is functioning, the faulty condition of a single brilliant horizontal line across the screen is raised into a wobbling raster of criss-cross lines. If the vertical circuit is driven, then the fault is in the vertical oscillator. But if it is a multivibrator then fault in the coupling or other section is indicated.

Check the accuracy of your signal generator by beating it against a known radio station on each range and at both ends of that range.

Once the defective stage is located ordinary component, voltage and valve checks are used to pinpoint the trouble. Band III signals can be obtained from a signal generator that does not rise to that frequency by setting it to one quarter of the Band III frequency and the fourth harmonic, although weak, is useful for R.F. section tests. As can been seen, pattern generators are not essential for many TV tests and the humble radio signal generator can fulfil many of their functions.

Servicing Television Receivers



No. 63—THE DEFIANT TR1456T AND TR1756T SERIES

By L. Lawry-Johns

Lack of Width

A LOW emission contact cooled rectifier will cause lack of width and compression of the lower part of the picture when its internal resistance rises, causing a large voltage drop across it, thus leaving the H.T. line low. A voltmeter check from the H.T. fuse to chassis will show whether the rectifier is at fault or not. If the H.T. falls much below 200V the rectifier should be changed. If the H.T. is about 200V or more, check the 20P4 line output valve and check the setting of the line drive control TC1. Adjustment of TC1 should produce a kink or white line down the screen centre when compressed (tightened). If the H.T. is in order and the time base valves are proved efficient but lack of width persists, despite adjustment of TC1, check C90 and C91, either of which can become leaky.

The correct setting for TC1 is to tighten until a white line or kink appears and then slacken off until this kink just vanishes. It should not be slackened beyond this point.

The screen feed resistor of V12, R99, should not escape attention when lack of width is being investigated.

Variation of Picture Size

If the picture expands and defocuses, finally failing altogether when the brilliance or contrast is advanced, when a bright scene is transmitted or when changing from a weak signal to a strong one (e.g., ITV to BBC in some areas), suspect a low emission U25 EHT rectifier. Should the reverse be the case, as far as the width is concerned, that is, a brighter screen causes the picture to contract from the sides, check the line time base valves and components as for lack of width.

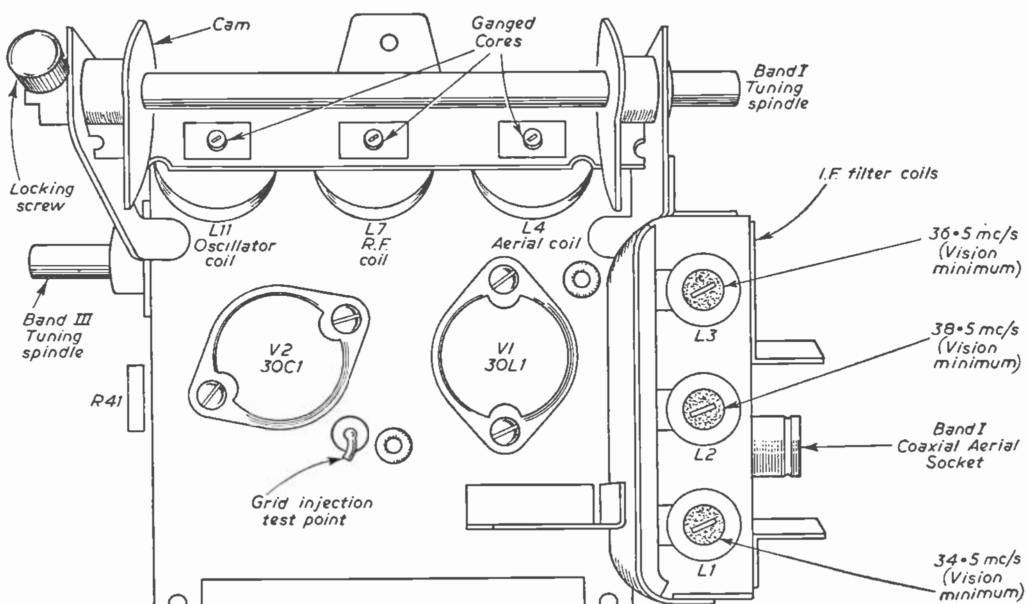


Fig. 5.—The top view of the tuner unit.

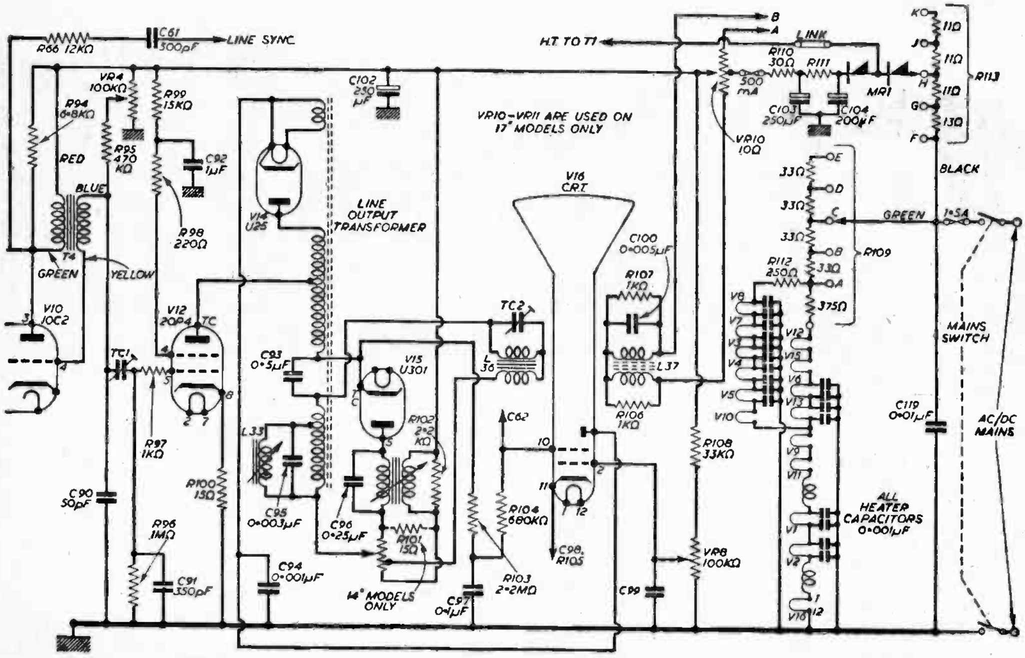


Fig. 6.—Line oscillator, tube and power circuits. (Note: The link from MR1 is not normally joined but the H.T. is derived from the junction of R110 and R111—this point is joined to "L" of the link.)

When advancement of the brilliance produces no raster at all but the sound continues unaffected, carry out the usual spark test at the U25. If a healthy spark is available at the anode (single wire end), but the U25 does not glow (heater) and the normal spark is absent at the double wire end, in all probability the U25 is at fault with an o.c. heater. If the U25 has a blue glow, perhaps a red-hot anode, check C94 ·001μF 15kV. If there is no spark at the anode and the time base whistle is absent or subdued, check the 20P4, U301, 10C2 and C93 (0·5μF).

If a fine whistle is still audible when the hold control VR4 is rotated, the 10C2 may be assumed in order, together with T4, etc. In stubborn cases where a fine whistle is audible, the line output transformer may be suspected. If the 20P4 overheats and the valve itself is not at fault, check the 10C2, TC1, C90, C91 and ensure that H.T. is reaching pin 3 of the 10C2. The green-red winding of T4 could be o.c. leaving low H.T. at pin 3 (remember that H.T. will still be applied via R94).

Vertical rulings on the left side of the screen may be minimised by adjustment to TC2 on the

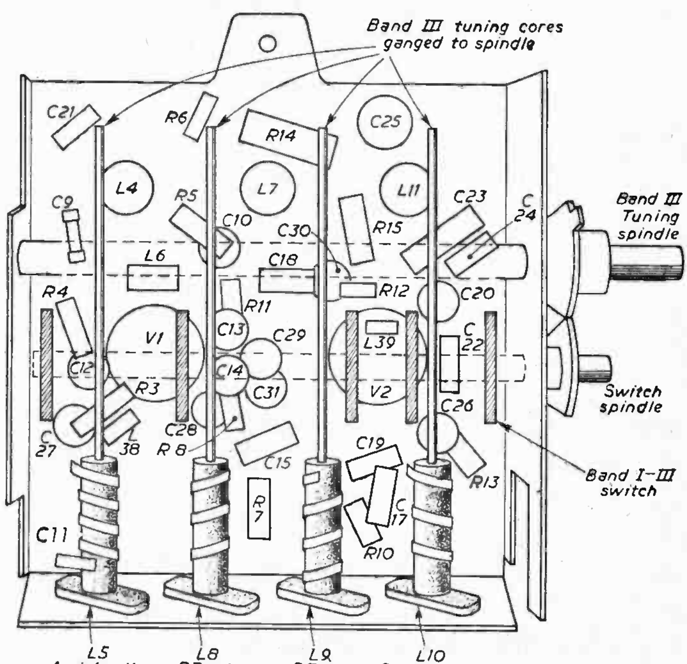


Fig. 7.—Underside view of the tuner.

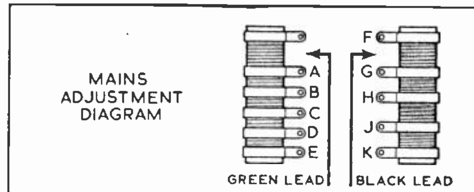
scanning coils panel, but when these are severe R102 (2·2k) on the lower right side of the line output transformer should be checked. This will also affect the linearity of the line scan.

Low and Distorted Sound

If the sound tends to distort more as the contrast is advanced or on a strong signal, suspect R85, which will normally be found to have risen in value. Also check R91 if the volume is very low. If these items are not at fault, check V7, V8 and V9 and the voltage supplies to each. The circuit of V7 is very similar to that shown for V8. Voltages at pins 2 and 4 of these bases should fall between 175-200V, with a cathode voltage of about 2-3V. Check C81.

No Sound at all

This means that there is no response from the speaker and no trace of hum. If V9 is in order, check for voltage at pin 6. If absent check blue lead connection (H.T.). The same remarks apply for T1 as for T3, the resistance reading being about 500Ω.



	AC					D.C.				
VOLTS	205	215	225	235	245	205	215	225	235	245
GREEN LEAD	A	B	C	D	E	A	B	C	D	E
BLACK LEAD	F	G	H	J	K	F	G	H	J	K
						AND SHORT LINKS				

Fig. 9.—Mains adjustment.

Dropping the fluid down the spindle at the front is not generally successful. A switch cleaner of the solvent type will not stop a noisy control for any useful length of time and it is more satisfactory to replace the unit than use this type of fluid.

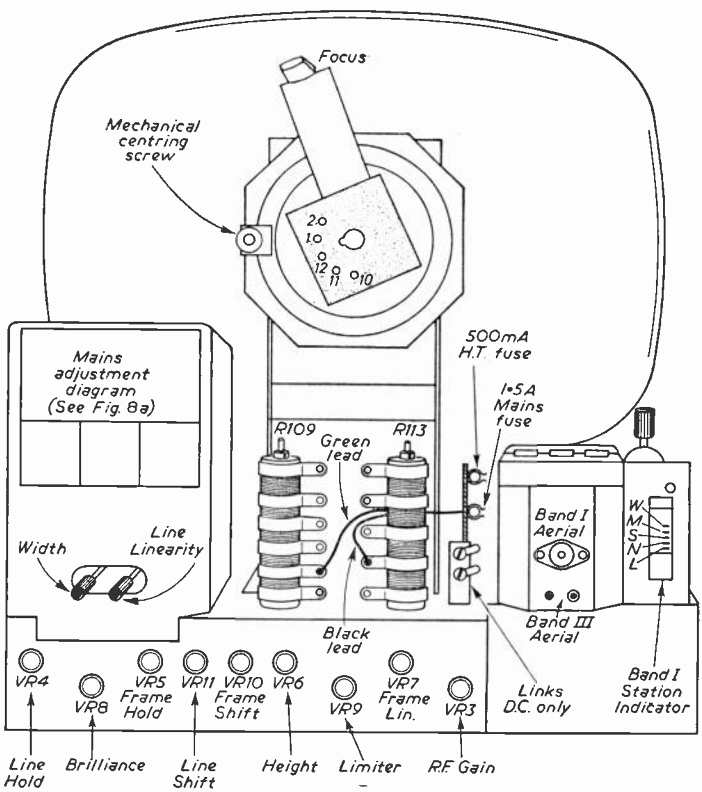


Fig. 8.—Rear view of the chassis.

No Vision or Sound Signals

(Raster present when the brilliance is advanced and the speaker alive.)

Check the tuner unit V2 30C1 (PCF80) and then if still absent V1 30L1 (PCC84). The replacement of one of these will normally restore normal conditions. If this is not so, check V3 (10F1) and then the voltage supplies to the tuner unit (we presume the aerial and connections are not at fault!). Approximate voltages are: V1, pin 9 100V, pin 3 175V, pin 7 and 8 varies with R.F. gain control, but should not be less than about 1·8V; V2, pin 6 170V, pin 1 115V, pin 3 175V.

Poor and Grainy Picture

This particularly occurs on Band III. The 30L1 will normally be found at fault and a replacement will restore normal conditions, check aerial and the setting of R.F. gain control.

Vision Buzz on Sound

This will normally only be noticeable on BBC and denotes overloading (reduce R.F. gain) or incorrect tuning. Slacken the thumb screw on Band 1 tuning shaft and reset the cam for maximum sound. The cores of L11, L7 and L4 should not be separately tuned unless they have already been disturbed.

Noisy Volume Control

A few drops of "Electrolube" into the track of the control where the three volume control tags are brought out will normally clear up this trouble.

(Continued on page 223)

Letters to the Editor

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

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

UNIT CONSTRUCTION

SIR,—In looking through some of the service manuals of up-to-date sets, I note that there is a tendency to go back to an old idea, and one which although I believe it was adopted by one firm seems to have sunk into disuse. I refer to the use of units in the assembly of a set—the latest idea being to use printed circuit boards of a plug-in type. This idea is surely what we all need as one can easily service a set and it does not become necessary to turn a heavy and cumbersome chassis on its end in order to get at some component, and in other ways servicing becomes very simple. I think other readers would agree that plug-in units are highly desirable, and I trust that in any future designs which are sponsored by "Practical Television" this will be borne in mind.—H. Rawlings (Hove).

THE "OLYMPIC"

SIR,—I must congratulate you on the design of your latest television receiver, and I would mention that I have built all the P.T. designs, up to and including the Supervisor. This has given major service and although still working I am trying my hand at your latest. (I hope to sell the Supervisor when the Olympic is finished.) I have made up most of the set and tried to get it working, but there has been no circuit of the timebases yet, and I tried to use values from my own theoretical knowledge, using the blueprint as a guide and parts of the various articles which have been published, including the one on Interlace by the designer Mr. Bowman. I get very indifferent results on the frame section and think perhaps I may have made some error in the values here, and should be glad if a list could be given showing the correct R and C values.—R. Towney (Hammersmith).

[*We are including in this issue all the remaining circuits of the Olympic, but in view of the very advanced design we thought it better not to include these until explanations had been made in the text to cover certain features.—Ed.*]

SIR,—Your welcome series on the "Olympic" TV appeared just as I was half-way through building a new set for myself, and I have been able to incorporate several of its features. A couple of points from my experience may be of interest:

1. Page 80, November issue—L17/18. I took the information literally and had the ends of the winding touching. The 300V P.D. between the windings which exists before the valves warm up promptly broke down the enamel insulation. Two or three turns of silk thread are indicated to ensure safety.
2. Page 30, October issue, Fig. 2—surely diode D3 should be connected the other way round.

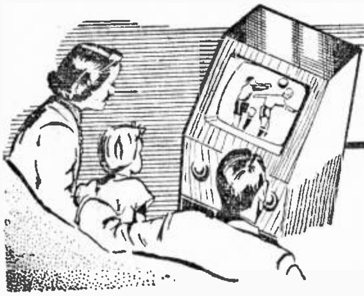
One more point, I would like to incorporate spot wobble or elongation in this set, which uses an AW43/80. Have you published any articles on this subject?—F. J. Templeton (Keymer Hassocks).

[*We imagine that Mr. Templeton forced the windings L17/18 tightly together, leaving no space for polystyrene cement between. By "ends touching" was meant "just touching" and no difficulty was found with the prototype receiver. However, a space between the windings of the thickness of a piece of cotton thread (say 0.01in.) would have little effect on the coupling and would certainly provide an extra safety margin.*

Spot wobble is simple enough to arrange (an article appeared in the June and July issues, 1959), but when a 21in. tube is used, we suggest it is hardly worth the trouble. The lines cannot be seen at 6ft on the 17in. tube unless noise impairs interlace (and even Patchett's sync separator can do little about noise).]

VALVE RADIATION

SIR,—I recently experienced a fault which leads me to think that everything is not yet known about the valve. I know that in some cases screens are placed over valves to prevent certain forms of instability, but I wonder if many experimenters know that this also prevents or limits radiation from the valve. Although there are no inductive components or circuits in a valve I recently had trouble through line and frame interaction, and nothing in the circuit would remedy this. I changed the positions of all R's and C's and also the direction or run of the wiring and finally went to the trouble of unscrewing the valveholder and mounting all the leads to the base of two extra pieces of flex (3in. in length). This enabled me to lift the valve in its holder and to lay the valve in various positions. It was found that when placed horizontally, even in the original place on the chassis, the trouble was avoided, and as the valve was turned through 90deg it could be reintroduced. Placing a valve screen on only partially removed the trouble, presumably because the contact between screen and skirt was not 100per cent efficient.—R. Langbourne (N.W.6).



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

Acquired Tastes—on TV

A PALATE for paté de fois grâs, oysters and Plymouth gin indicates a taste acquired by the gastronomically adventurous, those who seek an occasional escape from the usual joint and two veg. (tinned, of course) and suet pudding. The unusual dish, however, does not always please at the first mouthful—it is often an acquired taste. There are many writers who tell us what we should eat and drink for good health, good fellowship, good taste or merely for slimness. Critics tell us what books to read, films to see or television shows to remember.

Television Critics

The newspaper television critic deals in the past. He is different from the literary and film tipsters in that he can only give his opinion on what you ought to have liked or disliked. He's seen the TV show he's writing about —with eight million other viewers, maybe—and it's over and done with. All these musings are leading up to an evaluation of the amazing reactions of the press critics and the public to the off-beat "progressive" comedy series "The Strange World of Gurney Slade", starring Anthony Newley. The critics unanimously praised it. The viewers—a large section of them, that is—hated it. Was it good? Who is right?

This is an interesting situation because of the enthusiastic unanimity of the television critics in the national newspapers and the trade papers. With the film critics, one can generally anticipate the remarks of the "egg-heads" (usually female) who rarely give a good notice to a non-Continental film though they show a fondness for "kitchen sink" dramas and other works by the "angry boys". On the other hand, one can also give a reasonable forecast of film criticisms by the popular, less high-brow critics.

With one voice, the TV scribes hailed the Anthony Newley series as a new trend in progressive comedy. They accepted the new production as the natural successor of "Fred", "Son of Fred", "Yes, It's the Cathode Ray Tube Show". and similar goon-like deviations from the orthodox and traditional laughter-raisers. But I hear that thousands of viewers disliked "Gurney Slade" so much that they choked A.T.V.'s telephone board with angry complaints.

A.T.V.'s Programme Department became anxious. The TAM rating was low. The advertisers sardonic. Question: why should anyone be interested in a teenage pop-singer, a dreamer, exchanging confidences with a dustbin, a dog, or with himself, searching for a soul mate or contemplating the infinite? Well—Gurney Slade is an unusual individual who is still trying to find his feet, and I, for one, was of the minority on the side of the TV critics. I was interested in the new avenues of thoughtful humour opened up. My one criticism: the poor photographic values of the exterior filmed shots evidently taken in bad weather. The episode in which Gurney-Slade was put on trial for having no sense of humour was an all-interior episode, technically first-rate and, for me, worth waiting up for at its new late-night timing. The main mistake, however, was to start this mentally surrealistic comment on life at a peak viewing time. That's the time when most viewers are devouring their "pease pudden" of Westerns and give-away shows.

The site for the proposed Westward TV Studios at Plymouth. The architect explains points to Westward's technical general manager and local building contractors.

Candid Camera

Having placed myself on the minority side of "Gurney Slade", let me now comment upon another new approach to comedy which, though not in the top ten, is collecting quite a good crop of viewers. I refer to A.B.C.'s Candid Camera in which a hidden 16mm camera records the reactions of the ordinary man in the street in out-of-ordinary situations, such as being invited to rescue a young lady whose toe was trapped in a bath tap; asked to take part in the blowing up of the House of Commons; waiting on the pavement holding a pile of books for a lady who disappears. These incidents are more or less trivial, excepting the first one—and the viewers' amusement arises from the picture and sound being recorded without the knowledge of the victims, who later on are invited to view the resultant film and give permission for it to appear in this programme.

The joke is good—sometimes very good — especially when Jonathan Routh, one of the authors of this feature, plays the part of the foil. In the episode in which he acted as a tailor's assistant, fitting a plump Lancashire publican with a ludicrously ill-fitting suit, his superb "dead-pan" sales talk was a gem of its kind and, like his client's suit, was completely "off the cuff".

It was nice to see also on the screen the immediate sequel to this jape, as the camera continued to turn when it was disclosed to the publican that the whole thing was a hoax. It is much nicer to see actual evidence that a practical joke has created no ill-feeling. Bob Monkhouse's assurance that the victim has taken it well is clear enough. The showing of the denouement after the victim has been let into the secret, provides a better ending. This publican laughed heartily, was pronounced a "good sport" by Monkhouse, by the viewers and—I'll be bound—by a capacity attendance of well-wishers at his hostelry that night! Good health, sir, too!

Sound Blasts

Commercial television advertisers used to blow the heads off viewers in their zeal to punch home their advertising message. The mood is changing and the "soft sell" has become the mode in smart advertising circles. Sometimes the "soft sell" results in a sickening diapason of lisping sibilants on sound accompanying an ingratiating archness on the picture. The resultant appeal usually carries glutinous background music with syrupy heart-throb beats. I'll wager that before the commercial reaches its inevitable glissando on the harp, a good many males are half-way to the local pub for a reviver—or else they turn over to the BBC for musical entertainment of a more brittle character. If they happen to switch over to Alan Melville's quite bright "Parade" feature, their ears will, as often as not, be assaulted with a musical accompaniment so busy and strident that the vocalists take second place. This always impresses TV studio audiences. When will TV orchestral conductors realise that the viewers count more than the studio audience?

The Beverley Sisters, a good-looking act of conventional type, have pleasant soft voices that blend nicely with soft lights and sweet music. But if words are of any importance at all, they should be heard and if faces are easy to look at, they should not be back-lit in the studio like a frying-pan full of sausages in a commercial. The poor girls fought a losing battle against a musical score overloaded with sforzandos on the brass, percussion and what-have-you. Even the harp in the "Old Fashion Girl" number acquired an aggressiveness usually reserved for the last thirty-two bars of Tschaikowsky's "1812".

Whose fault was this? My guess is that the BBC's sound balancer was fooled by having a loud-speaker of super-hi-fi quality which gave the Beverley girls an intelligibility of speech far better than it was on the ordinary viewers' set, especially those with footling little loud-speakers around the back.

The remedy? Monitor screens and loud-speakers in the BBC control rooms should be adjusted to good average viewing quality and the sign "ff" should be taboo in the scores of vocal accompaniments. Sh - sh - sh! Tacet! Try the soft pedal, Harry —the one on the left—and let the trumpet players save their spittle for Sousa's rousing "Stars and Stripes" march.

Travelogues

I must admit that I like to see the world from my armchair even more than from a cinema seat, though in this day and age, one is plain and the other coloured. Mere pictorial views are insufficient and impersonal. Motion picture views of foreign parts have to be linked with strong and interesting personalities, either in the picture or on the commentary.

Early documentary films, such as Ponting's film of Scott's Antarctic Expedition, or Cherry Kearton's African Safaris, or Capt. Noel's film record of the first Everest Expedition, were the first monumental records of this kind—which are still of absorbing interest.

Trade News

NEW PROSPECTS AND DEVELOPMENTS

Stub-matched 3-element Array.

THIS new Antiference Band I fringe aerial comprises a stub matched Band I dipole with wide spaced reflector and director. It has a 1in. diameter boom and ½in. diameter elements loaded with anti-resonance plugs. Optimised models are available for all Band I channels 1—5. The matching stub is supplied ready connected and terminated in a watertight junction unit which can be easily attached to masts up to 2in. diameter. Arrays are supplied complete with universal clamp for masts up to 2in. diameter, permitting vertical or horizontal mounting.

The 135 Array, which retails at 75/-, can be supplied with or without mast or lashings, and a wide selection of alternative mountings are available. *Antiference Ltd., Aylesbury, Bucks.*

Linear Scan Coils for 110deg Tubes

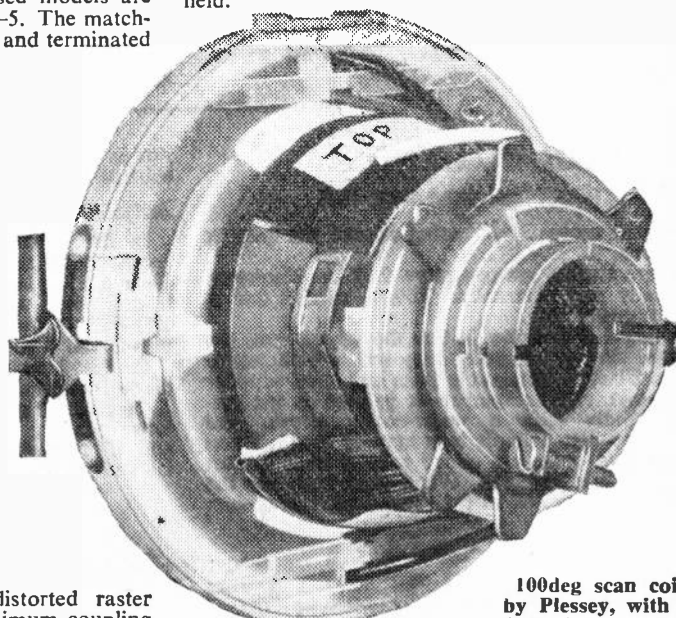
RECENTLY introduced by the Plessey Company Ltd. is a series of scan coils for 17 to 23in. 110deg TV tubes. The coils are wound on a polypropylene moulding and can be used at all temperatures likely to be encountered in TV receiver service.

Special form jigs are used in winding the coils to ensure undistorted raster shape and good focus overall. Minimum coupling between line and frame coils means that full advantage can be taken of modern trends in simplified frame timebase circuits.

The coils are available with high or low impedance windings and there is a choice of fixed or adjustable magnets for picture control.

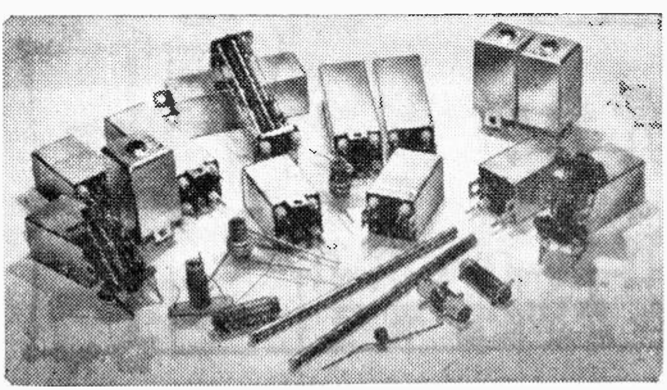
A new centring unit has been developed which uses a ferrite loaded plastic to eliminate the power loss present in conventional centring devices.

Another advantage of this plastic control magnet is that it retains its magnetism permanently and does not become de-magnetised by the scan coil field.



100deg scan coils by Plessey, with a plastic centring magnet.

The coils are produced by the *Plessey Co. Ltd., Ilford, Essex.*



The complete set of "Olympic" coils.

"Olympic" Coils

SETS of coils for the "Olympic" TV receiver are now available from Ajax Electronic Products.

Ceramic insulated beads are supplied loose so that they may be slid over the coil wires after mounting them on the chassis. *Ajax Electronic Products, 572 Fulham Road, London, S.W.6.*

New Aerial Isolator

A NEW introduction to the Egen range of components is an Aerial Isolator Type 364. It provides aerial isolation of A.C./D.C. television receivers in a single compact and rugged unit which complies fully with the individual requirements of

BS415. Insertion loss is very low and its electrical specification ensures maximum performance at all frequencies envisaged for domestic receivers.

It is completely co-axial with full screening of the inner conductor. The series inductance of the feed-through capacitor in the outer conductor is exceptionally low. The feed-through capacitance is 470pF in both conductors, tested to 3,000V D.C.

Provision is made for direct mounting to the chassis or a separate bracket and it can be supplied with any required length of co-axial cable, already attached, for connection to the receiver input circuit. The external socket accepts a standard co-axial plug to R.E.C.M.F. specification. *Egen Electric Ltd., Charfleet Industrial Estate, Canvey Island, Essex.*

New Wander Plug and Socket

A NEW miniature wander plug and socket by Clix, particularly suited to printed circuit mounting, is introduced by the radio components and special products department, A.E.I. radio and electronic components division, 155 Charing Cross Road, London, W.C.2.

The socket mounting pin diameter is 0·05in., conforming to the 0·1in. module printed circuit technique, and the socket can be mounted on a 0·2in. centre using the standard nominal 0·05in. diameter mounting hole. The overall diameter of the socket body is 0·19in. and the diameter of the plug is 0·19in.

All metal parts are brass, silver plated, and the insulation is nylon. Standard colours are red or black, but other colours can be supplied against special order.

THE "OLYMPIC"

(Continued from page 183)

additional necessary screening around the base of the valve.

Where screens are necessary they are blackened internally and externally. This is carried out in the following way.

A finger is inserted in the top of the can, the internal spring first being removed. Photographic "Dead Black"—obtainable from any good supplier of photographic equipment—is painted on the outside rapidly with a water-colour brush, and allowed to dry. (Gentle heat may be used.) When dry, further coats are added rapidly until a matt black finish is obtained. When completely dry the insides are prepared in the same way, taking care not to cover the part which will engage with the skirt of the valveholder. The spring is inserted last.

Amendments

In the blueprint given away with the October issue, (i) a wire is required from the tag-board (near the VR74, R50), the end of R73 to the positive terminal of C65; (ii) on the valveholder of V11 (EB91), the apparent wire connection between pins 2 and 5 should be ignored.

In Fig. 2 on page 30 of the October issue the diode D3 should be reversed in polarity.

On page 80 of the November issue, in the inductance winding table, L1 and L2 should read L3 and L4 respectively, and L3 and L4 should read L1 and L2, again respectively.

(To be continued)

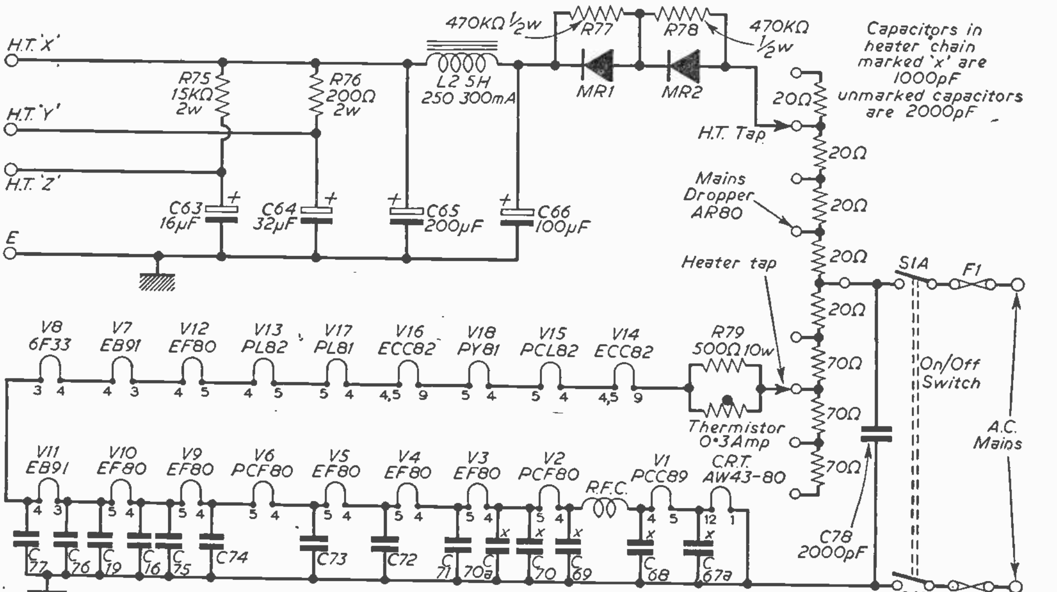


Fig. 18.—The H.T. supply circuit and the heater chain wiring details.

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VALVES *SAME DAY SERVICE*

NEW! TESTED! GUARANTEED!

SETS
IR5, IS5, IT4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94 .. any 4 for 19/6
DAF96, DF96, DK96, DL96 .. .. 4 for 27/6
6K7G, 6K8G, 6Q7G, 6V6G, 6X5G, or 5Y3G .. .. 5 for 27/-

1A7GT	11/6	6K8GT	9/8	25L6GT	9/-	EBL21	13/6	EZ40	6/9	T41	9/6
1D5	8/-	6L1	14/-	25Z4G	7/6	EC92	11/-	EZ41	7/-	TH41	19/6
1H5GT	10/-	6L18	10/3	25Z6GT	9/6	ECC81	5/-	EZ80	6/3	U22	7/3
1N5GT	10/-	6LD20	8/-	35A5	9/6	ECC82	6/3	EZ81	7/-	U25	13/-
1R5	5/6	6P1	13/6	35L6GT	9/-	ECC83	7/-	FW4/500	8/-	U26	10/-
1S4	8/-	6P25	9/-	35Z4GT	6/-	ECC84	8/9	GZ30	8/6	U50	6/-
1S5	5/3	6Q7G	6/-	35Z5GT	8/6	ECC85	8/3	GZ32	9/6	U52	4/6
1T4	4/-	6Q7GT	9/6	50L6GT	8/9	ECF80	8/6	HBC90	7/-	U78	4/9
1U5	5/9	6SL7GT	6/3	AC/TH1	16/9	ECF82	8/6	KT33C	7/-	UABC80	7/9
3A5	9/-	6SN7GT	4/9	AZ31	9/6	ECH21	13/6	KT41	11/6	UAF42	9/-
3Q4	7/-	6U4GT	11/-	B36	8/9	ECH35	6/3	KT44	6/6	UBC41	7/9
3S4	6/-	6V6G	5/-	CL33	12/3	ECH42	8/9	KT61	10/-	UBF80	8/9
3V4	7/-	6V6GT	6/6	DAC32	10/-	ECH81	8/-	KT63	6/6	UBF89	8/-
5U4G	4/6	6X4	4/9	DAF91	5/3	ECL80	7/3	MU14	7/6	UC92	12/6
5V4G	3/-	6X5GT	5/-	DAF96	7/6	ECL82	9/6	MX40	9/6	UCC84	12/9
5Y3GT	6/-	7B6	9/-	DCC90	9/-	EF39	4/6	N18	7/-	UCC85	7/6
5Z4G	7/9	7B7	7/6	DF33	10/-	EF41	8/3	PCC84	7/6	UCF80	14/-
6AL5	3/9	7C5	7/6	DF91	4/-	EF42	9/6	PCC89	11/-	UCH21	13/6
6AM6	3/6	7C6	7/6	DF96	7/6	EF80	5/6	PCF80	7/6	UCH42	8/-
6AQ5	6/-	7H7	7/6	DH76	4/9	EF85	6/-	PCF82	8/-	UCH81	8/-
6AT6	6/9	7S7	9/-	DH77	6/9	EF86	9/9	PCL82	7/6	UCL82	10/9
6BA6	6/-	7Y4	7/-	DK32	11/6	EF89	7/-	PCL83	11/-	UCL83	13/3
6BE6	5/9	10C1	11/6	DK91	5/6	EF91	3/6	PCL84	7/6	UF41	8/9
6BH6	5/9	10C2	17/6	DK92	7/6	EF92	4/3	PENA4	11/-	UF85	8/6
6BJ6	5/9	10P13	14/6	DK96	7/6	EL33	10/-	PEN36C	8/-	UF89	7/-
6BR7	9/9	12AT6	7/-	DL33	9/-	EL41	8/6	PEN45	7/6	UL41	8/-
6BW6	8/-	12AT7	5/-	DL35	9/6	EL42	9/-	PL36	11/6	UL84	7/6
6BW7	5/6	12AU7	6/3	DL92	6/-	EL81	12/-	PL81	9/-	UR1C	8/-
6C9	9/-	12AX7	7/-	DL94	7/-	EL84	7/-	PL82	7/-	UY21	11/3
6CD6G	26/9	12K7GT	5/3	DL96	7/6	EM34	6/9	PL83	7/6	UY41	6/6
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H.M.V. 1840

The trouble is erratic line hold. I have changed valves 7 and 8, 9 and 11 as numbered on the service sheet, without success.—J. Morlidge (Newcastle-on-Tyne).

Check the 330k resistors wired from the hold control to pin 2 of the PCF80. If replacement resistors do not effect a cure check the 270pF to pin 2. If the loss of hold is not complete, i.e. the picture pulls in sections, check the aerial which may be picking up reflected signals.

VIDOR CN4226

This set has a Brayhead converter fitted to it. Three faults have now developed in the receiver. First, there are vertical lines like a heavy curtain, more prominent on the left-hand side of the screen. Secondly, heavy horizontal lines appear at the top and bottom of the screen. The third fault is a hum rather like a very distant motor which increases as the volume is turned up. I have had all the valves checked and they are in order. When I use the set without the converter the trouble is still there but not so prominent.—H. Wilks (Southampton).

You should check the 100μF capacitor under the front of the chassis between the large smoothing capacitor can and the smoothing choke. Then, if necessary, check the 3·3k resistor associated with the horizontal linearity coil and the 5·6k across the width coil. Also if necessary, check the ECL80 valve immediately to the left of the tube neck.

R.G.D. 1756

To remove the chassis, I took off the two front inner and outer knobs, four screws from below and also the loudspeaker but the chassis appears to be holding at the front somewhere and will not come out. There is a clip at the top of the tube at the screen end. Has this anything to do with chassis binding?—W. Clark (Glasgow N.1.).

When the four fixing screws are removed there is no reason why the chassis should not slide out except that the corners may be bedded into the cabinet at the front owing to the screws having been tightly driven home. You should therefore gently lift the front of the chassis to free it.

PHILIPS 1229

I am unable to trace the fault on this receiver. I have had all the valves tested and they are in order. I can obtain a weak spark on the anode on the tube, but the EY51 becomes overheated and red hot. On removing the smoothing capacitor on the side of the EHT transformer, the set gives good results and a good picture and the EY51 goes back to normal. I have tried two smoothing capacitors but the EY51 becomes red hot again.—E. Owens (Bolton).

The set will function quite well without the capacitor but if you want to trace the actual fault and you are sure the replacement capacitors were rated at over 12·5kV we would suggest that either the presence of the capacitor raises the EHT and causes a short in a weakened EY51 or the tube itself has a fault which only shows, as would the EY51 short, when the voltage is above a certain figure. It is possible that the replacement capacitors, however, did not have a sufficiently high voltage rating.

EKCO 330F

After being switched on the picture will break up into horizontal lines, but it can be restored by turning the horizontal hold, sometimes up and sometimes down. Occasionally this has to be carried out 9 or 10 times in an hour, nearly always after switching on. There is a slight whistle all the time and this becomes louder when the picture goes off. The sound is perfect. — D. Peacock (Bawdsey).

Suspect the 6/30L2 valve near the EHT compartment. This is the line oscillator and all that may be necessary is to exchange it for the AGC valve behind the I.F. strip. Also suspect the flywheel line discriminator diodes especially if they are a D321YZ unit in a small black plastic capsule. If they are, try replacing them with the standard D321Y which is pea-sized, grey in colour and with a yellow label.

MURPHY V320C21

The picture collapsed into a jagged white flash in the centre of the screen, momentarily and as this happened, I noticed the U191 valve (efficiency diode) arcing internally. I replaced the U191 with another which in size is about 1in. longer (glass envelope) than the original but I managed to fit the top cap connection without lengthening the wire. I am unable to obtain a picture with this valve (which has been tested) but the picture presents itself when I replace the original which is quite good apart from intermittent arcing. Is the valve type correct? Mazda U191?—E. Brentishaw (Stockport).

The U191 comes in two sizes and although either should work, the larger valves are no longer produced. The ideal U191 to fit is one of the small ones coded " NL ". Suspect your 30P4 and try replacing it, preferably with one coded " MR " on the label.

K.B. QUEEN DE LUXE

This set has sound on vision on BBC. (ITV is perfect.) The fine tuner does not correct this. Would the oscillator need adjustment and if so could you please give the location?—V. Curtis (Neath).

Remove the switch knob and fine tuner and retune the oscillator coil core through the exposed hole with a long, plastic or bone knitting needle with one end filed so that it may be used as a screwdriver. If the trouble persists, instal a Band I aerial attenuator to reduce the input signal.

DECCA DM45

The picture on this set is 1in. from the bottom of the screen. I can fill the screen by operating the height control but I lose some of the picture at the top.—R. Houston (Glasgow S.W.3.).

You should be able to adjust the picture by re-setting the two pre-set controls on the lower right side (at the rear) in conjunction with the height, although the bottom centre PL84 may be losing emission.

INVICTA 119T

On turning up the brightness control the picture fades and becomes grey and a large drop in EHT occurs. Also the vertical size of the raster varies with operation of the brightness control giving a short frame scan when turned down and over-scan when turned up. The EY51 has been renewed also the frame output valve. — J. Bentham (Co. Durham).

You should check the PL81 and PY81 valves after having ensured that the ion trap magnet on the rear of the tube neck is in the correct position (maximum brightness). Then check the top cap and cathode 47Ω resistors of the PL81, the setting of the line drive pre-set capacitor under the chassis and the 3·3k resistor to pin 8 of the PL81.

FERGUSON 205T

This set has two faults. After a period of 20 to 30 minutes viewing, the picture becomes negative. Adjustment of the fine tuner usually results in clearing this fault but, naturally, leads to patterning and an unsteady picture. The second fault is that bright lines come in from the right-hand side of the screen, usually after dark objects.—J. Wheatcroft (Chesterfield).

Interchange the AGC amplifier EF80 valve (V7) with a valve of the same type in some other position. We are not clear on the symptom of white lines to which you refer, but there is a possibility that flashover in the line output transformer owing to impaired winding insulation may be responsible.

EKCOVISION T161

This set is a 12in. model with a modified timebase, which I am rebuilding as a hobby. When first received the EHT smoothing condenser was covered with oil, and I assumed it was faulty. After repairing the set, I tried connecting the condenser, but it has no observable effect on the screen and it does not retain any charge. Is there any danger to the EHT transformer by running the set without the condenser? There is no "Metrosil" on this model. What would be the effect of connecting a good condenser? Should the screen show extra brightness?—A. Tarlington (Montgomeryshire).

It is quite in order to omit your EHT condenser and Metrosil provided that the small bright spot seen on switching off does not persist for very long. The only improvement provided by the addition of these two components is better focusing of the white parts of the picture.

PAM 501A

When dark scenes appear on the screen, lines appear vertically down the left-hand side of the screen. In normal scenes, the picture is perfect and contrast is good except that recently a narrow dark line appears around objects, e.g. a man's coat or collar. Interlacing is good, but not perfect, although it can be made so but will not hold and the lines are generally slightly paired.—H. Crooke (Doncaster).

We would say that you have more than one fault. The "curtain" effect on the left can be due to the failure of one of the large resistors in the line circuit, expecially the 10k and 3·9k across the width and linearity controls, and the 3·3k across L13, one of the scancoils. The black-after-white effect is usually due to faulty alignment but it is difficult for us to pinpoint one single circuit which is at fault.

MURPHY V240

The trouble is that the picture will not widen out—there is about a 3in. gap at either side. Also, the picture is split in two. I have renewed the following valves: 20P4, 20P3 and 20L1. I do not have a service sheet for this model.—A. Johnson (Manchester 19).

Low H.T., perhaps owing to faulty main smoothing, can cause your trouble as can a shorted scancoil, especially if the picture you have is tapered. The commonest cause is, however, the failure of the efficiency diode smoothing condenser which is a 0·25μF situated beneath the holders of the line output and efficiency diode valves.

PYE TUNER

I wish to use the above tuner, type 47, with a Ferguson 992T series 14in. television set. Can you please give me some details as to any modification in the circuit? I have your March 1960 issue in which you state that this tuner can be used with my set. Also, do I still use the ECC81 in the unit valveholder?—G. Byrne (Ilford).

To adapt your 47 unit to the 992 remove the EF80 (V1) and plug into its socket the power supply plug from the 47 unit. Remove the "tin box" from the end of the screened cable and connect the screened cable across the 2·2k cathode resistor of the mixer section of the ECC81 (leaving the valve in circuit). Remove the 0·001μF decoupling condenser from across the 2·2k resistor and also remove the anode and grid wires from the oscillator section of the ECC81. Short the mixer grid to chassis. The valve then acts as an impedance match from the 47 unit to the first I.F. transformer and has no gain. It is wise to make

sure that plenty of signal is available before conversion as some gain will inevitably be lost.

SOBELL SC270

The picture and sound on ITV is in order. The picture is fair but there is almost no sound on BBC. If the volume is increased there is a noise but little signal. The V.H.F. sound is poor but this has always been the case, but the BBC was in order until recently.—A. Turner (Slough).

Switch to BBC, set the fine tuner midway and remove the switch knob and cover to expose the oscillator cores. Adjust the lower core, nearest the fine tuner spindle, for maximum BBC sound. It would appear that a properly sited V.H.F. aerial is required.

K.B. FV30

This set has a turret tuner fitted for ITA. The set was perfect until a broad white line appeared across the centre of the screen. There was no picture or raster. I replaced the frame output transformer and got the raster back but still no picture. I have changed a few charred resistances. When the brightness is turned up I can obtain a round ring shadow in the centre of the tube about 3¼in. wide. When the set is switched off there is a square instead of the ordinary spot.—G. Nuttall (Whittingham).

You will no doubt find the fault is concerned with one of the inner row of valves, just to the right of the tube. These valves are 6AM6/8D3 and 6AL5. Check these and the voltage supplies to pins 5 and 7 of each 6AM6/8D3 valve base if the valves are in order.

H.M.V. 1847

Recently I decided to overhaul this set which is a 21in. model. In doing so, I removed the tube for external cleaning generally. Since replacing the tube all is well on sound and vision apart from interference, which is very severe, there being a very high-energy discharge around the tube to frame support and from the tube to the coil housing. I believe this could be due to having destroyed the outer coating around the tube. Can you advise me on what can be done to restore this to normal?—D. Collett (Downend).

You should smear the area around the EHT connection with MS4 grease or similar anti-corona compound. Ensure that the outer coating of the tube is well bonded to chassis. If the discharge persists, you will find it necessary to replace the line output transformer.

ALBA AB81

This set is about five years old and the only number I can find is that quoted above. The picture is a narrow band across the middle of the screen about 3in. from top to bottom with a hum on sound. The picture which is visible is very "jumpy". I was told by a TV engineer that there were two condensers that had failed. I have replaced R12, and both valves PY81 and 82. These have been found to be in order.—J. Watson (Sunderland).

You should change the front large can-electrolytic (100+200μF) and check the left centre PL82 valve and associated components. We assume the model number is T304.

MW43-69 TUBE

Can a line output transformer, together with a set of scanning coils, also frame output transformer (with scanning coils) which were made to scan a 90deg deflection tube, be used to scan a 70deg deflection tube such as MW43-69, MW36-44 (the original type of wide angle tube)? If they can be used what, if any, will be the effects on the visible raster when displayed on the 70deg deflection angle tube?—R. F. Stout (Sheffield 12).

The 90deg deflection components can be used but although the frame height will be easily adjusted, you may find some overscan on the line. The width control may not reduce the scan sufficiently but this should not be serious.

SERVICING TELEVISION RECEIVERS

(Continued from page 207)

Sound on Vision

If this only appears on BBC proceed as above. When present on both stations, however, retune L21 and L17. If ineffective, check C102. When signal generator is available tune L21 for minimum vision at 38Mc/s, L17 for minimum vision at 38·5Mc/s.

Dismantling

The chassis is secured by four screws below, the front knobs pull off and the speaker leads have press-stud contacts at the speaker. The chassis is removed complete with the tube for easy servicing.

Note

The alignment instructions are not always the same and when the sound I.F. is given as 37·5Mc/s and the sound I.F. are aligned to this figure, the alignment of L21 should be the same. L17 remains at 38·5Mc/s.

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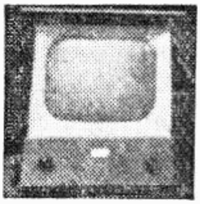

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