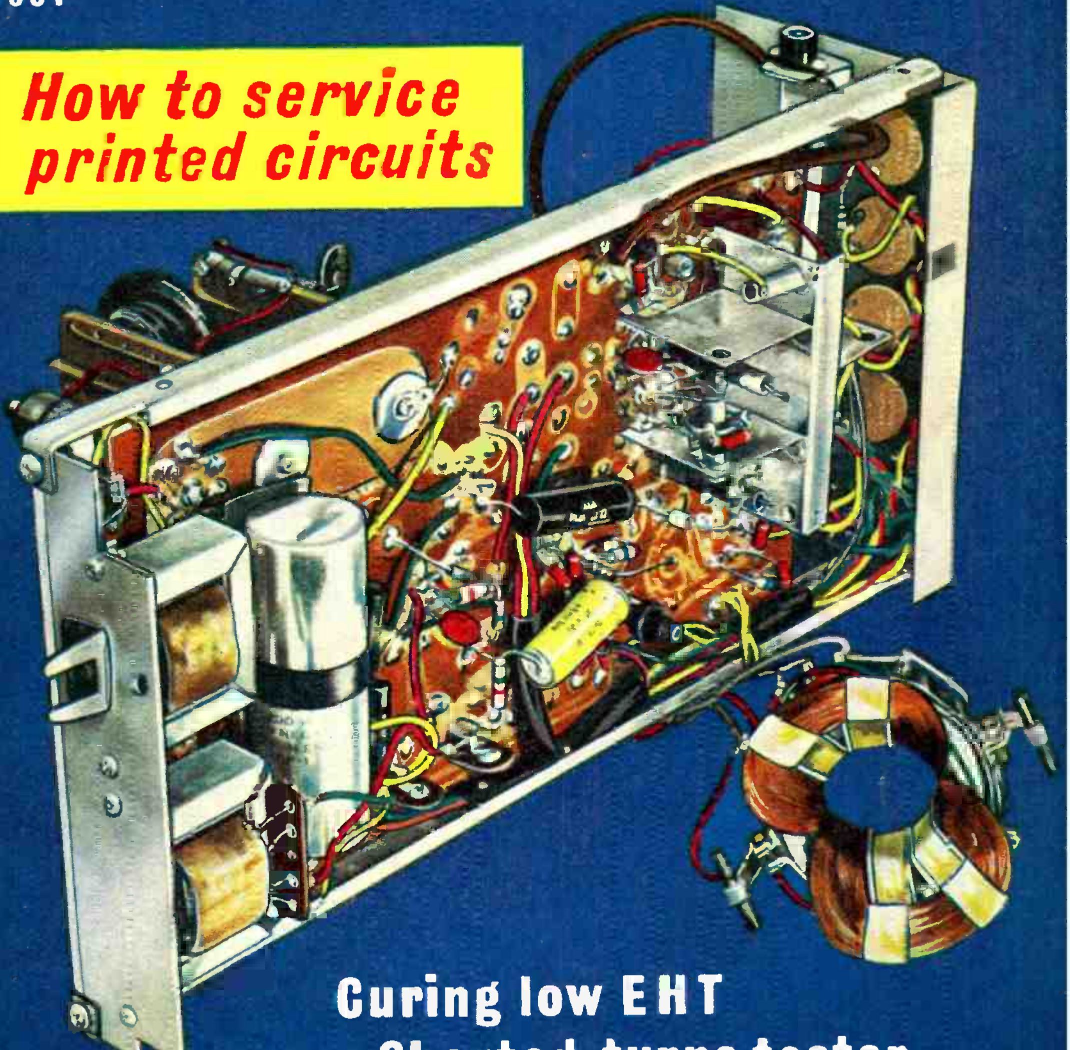
Practical Television

AND TELEVISION TIMES

1'6

MARCH 1961

How to service printed circuits



Curing low EHT

Shorted-turns tester

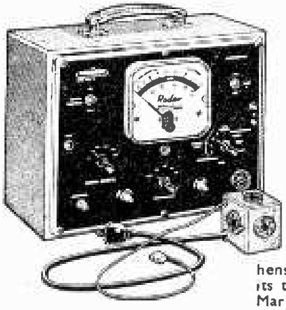
B-K oscillation

Etc., etc., etc.

HARVERSON SURPLUS CO. LTD. (Dept. P.T.1)

83 HIGH STREET, MERTON, LONDON, S.W.19 CHErrywood 3985/6/7

C.R.T. TESTER/REACTIVATOR



★ TESTS any tube without removal from set or carton.
★ REPAIRS tubes discarded for low emission.
★ MEASURES A.C. Volts,
★ D.C. Volts, E.H.T.

The Radar Model 202 Tester-Reactivator is the most comprehensive instrument of its type on the British Market.

● Measures TRUE Beam Current ● Visual Indication when reactivating is complete (a Radar exclusive) ● Tests and Measures ALL tube Voltages including E.H.T. (another exclusive) ● Measures Resistance up to 100 Megohms ● Clears leaks by pressing a button ● Heater Current measurement 0–0.5A and 0–2.5A Linear Scale ● Adjusts heater current to ensure accurate Emission Test ● Portable for field or bench service.

BRIEF SPECIFICATION

Tests: Filament Continuity, Heater Current, Inter-Electrode Insulation, Final Anode Beam Current, Heater-Cathode Leakage, 4-stage Reactivation by New Pulsing Method. Universal socket fits all tubes. E.N.T. Probe. Measures: 0–25 Volts A.C., 0–500 Volts D.C., 0–25 kV., 0–100 Megohms. 0–250 micro-amps.
200–250 Volts A.C. Mains. Size 13in. by 10in by 6in. Weight 14lb.

LIST PRICE ~~£35~~

OUR PRICE £17.17.0

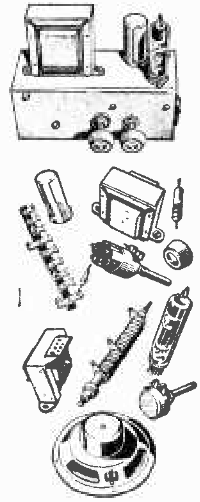
Plus 9/- P. & P.

COSSOR C.R.T. SNIP
108K 10-in. New and boxed, 15/- plus 6/- P. & P.
75K 10-in. New and boxed, 15/-, plus 6/- P. & P.

ION TRAP MAGNETS
To suit the above, 2/9 each. P. & P. 3d.

INTRODUCING...

HARVERSON'S MONAURAL AMPLIFIER KIT



In response to numerous requests from delighted purchasers of our "SUPER STEREO KIT" we have produced a "MONAURAL AMPLIFIER" on similar lines.

★ A UCL 82 valve provides a triode amplifying stage, and a pentode output stage (3 watts), enabling good amplification and sparkling reproduction to be combined with physical compactness (amplifier size, 7 x 3¼ x 6½in. high),

★ Modern circuitry design, good quality O.P. transformer and speaker (5", 3Ω) keep hum and distortion to a very low level.

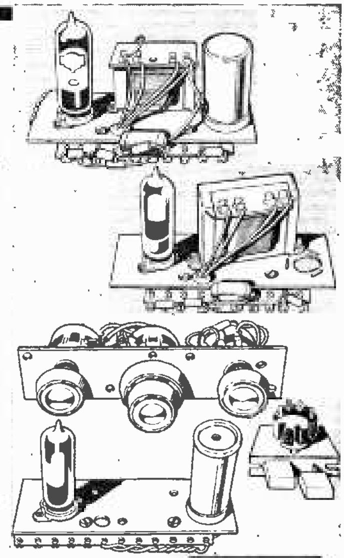
★ The controls, volume on-off, and tone, are complete with attractive cream and gold knobs.

★ The amplifier has a built-in fully smoothed power supply, using a good quality mains transformer (A.C. mains only) and metal rectifier,

★ All you need is supplied including easy to follow instructions which guarantee good results for the beginner and expert. All components, leads, chassis, valve, knobs, speaker, etc., are first grade items by prominent manufacturers.

OUR PRICE (Incl. Speaker) 39/6
Plus 4/6 Post and Packing.

HARVERSONS SUPER STEREO KIT



The product of a renowned maker, this stereo amplifier is composed of "ready-built" units, only requiring interconnection. This system has the advantage of being adaptable to fit any cabinet. Each unit is made from first-grade components, and valves used (ECL82, EZ80 range) are genuine Mullard. The comprehensive instructions supplied make the simple interconnection of units easy even for the novice.

The Kit Comprises...

TWO MIDGET AMPLIFIERS each of 3W output, good reproduction from both your stereo or monaural records. Both amplifiers complete with well-designed O.P. transformers providing perfect matching 3-7 Ω speakers, and have remote bass, treble and volume controls. Size 5" x 2½" x 3" high (each amplifier).

CONTROL UNIT, is a flying panel with three 2-gang pots, enabling the bass, treble and volume controls of each amplifier to be conveniently positioned. Supplied with attractive cream and gold knobs.

SEPARATE POWER PACK with valve rectifier, midget size (5" x 2" x 3¼" high).

ISOLATED MAINS TRANSFORMER of robust construction may be mounted independently.

VOLTAGE SELECTION PANEL. Fitted with the "valve base" type of mains i/p selector and a channel output socket.

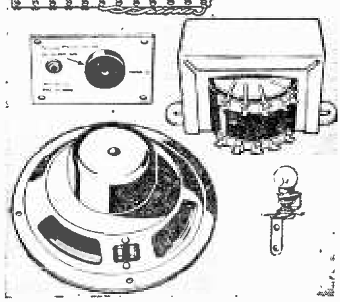
ONE SPEAKER, a quality 5-in. speaker. (*Note:* The 2nd speaker may be purchased from us for 14/6 extra).

CREAM DOUBLE PUSH BUTTONSWITCH of neat design gives positive on/off switching.

INDICATOR LIGHT. Provides visual indication of equipment operating and is complete with gold-finished escutcheon.

59/6

PLUS 6/6 POST & PACKING



B.S.R. UA12 STEREOCHANGER
The ideal changer to suit this amplifier, few only £9, carr. 5/-

BENTLEY ACOUSTIC CORPORATION LTD.

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All with Long Spindle and Double-pole Switch, 4/6 each.

10 K	25 K	50 K	100 K
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JUST OUT. MIDGET SILICON RECTIFIERS. OUTPUT 120 VOLTS AT ½ AMP. TWO IN SERIES GIVE 240 VOLTS AT ½ AMP. NO LARGER THAN A RESISTOR. 10/6 EACH.

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16 x 8 x 8 mfd., 500 v. 4/-	60 x 250 mfd., 275 v. 9/6	200 mfd., 275 v. 4/-	18 mfd., 450 v. 1/9	32 mfd., 350 v. 2/6
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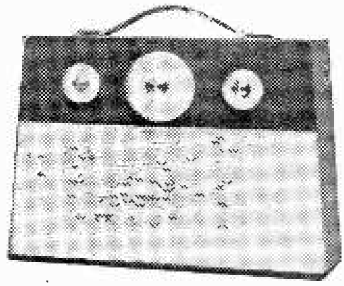
INTRODUCING THE "REAL COMPANION" CAR RADIO/PORTABLE



Now available is a modern receiver quite easy to make up and with all the features of sets being sold at twice the price. The circuit has been well tried and proved and will perform well all over the country. Here at Eastbourne, recognised as a bad reception area, performance on the Home, Light and many Continental Stations including Luxemburg, is extremely good. Demonstration Models can be heard at Eastbourne and our London address.

NOTE THESE FEATURES

- 400/500mw. Output Push-pull.
- 6 First Grade Transistors.
- Latest Type Superhet circuit.
- Medium and Long Wave.
- Internal Ferrite aerial litz wound.
- High "Q" coils.
- Latest type printed circuit with component plan.
- Slow motion tuning.
- Car aerial attachment.
- Two-tone cabinet.
- High flux elliptical speaker.
- Size 11 x 8 x 3in. approximately.
- Easy to follow instructions.
- 12 month guarantee all components.
- No technical knowledge required.
- Service available at moderate charges.

ORDER IN CONFIDENCE

Money returned in full if not up to expectation and returned unassembled. Price complete, less battery, £8.19.6, plus carriage and insurance 7/6.

TRANSISTOR LOUDSPEAKER POCKET RADIOS

Read these testimonials

Mr. J. Bell, Wolverhampton. "I am writing to express my satisfaction at the standard of your kit for your Pocket 4 Transistor set and also to state that it has come up to my expectations in regard to performance".

Mr. N. Elliott, Pontypool. "I have completed the assembly of your Pocket 4 radio and am pleased to say that it works from the first switching on".

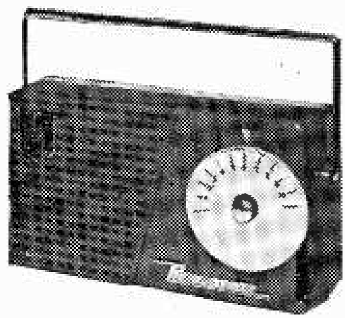
Mr. F. Jackson, Ickenham, Middx. "I have built the Pocket 4 and am more than pleased with the results".

Mr. G. Bamford, Ramsgate. "I find this set even better than you claim it to be and most certainly up to your usual standard of quality. I feel that nobody could fail to build it and get results. Even the first-time-ever novice, as your circuit diagrams and instructions are so clear and precise".

Mr. Graham, Birchington-on-Sea "Re Pocket 4. I must say that it is all you say of it. The stations roll in, and good volume too".

Mr. A. J. Simmonds, Welling, Kent. "I purchased from you a week ago the Pocket 4 Transistor Kit, I put it together last night in 1½ hours, on switching on the set I was right on Radio Luxemburg. I must say thank you, because not only has the set a very attractive appearance, it also behaves fantastically.

Mr. S. Rigby-Jones, South Molton, N. Devon. "I was delighted to receive my Pocket 4 Transistor set. After I assembled and tested it I was amazed such a small receiver had such good reception".



NOW AVAILABLE WITH FIRST GRADE TRANSISTORS AND FOR LONG AND MEDIUM WAVES

Circuit comprises 2 HF transistors reflexed to equal 4 stages. Permanent germanium diode and high gain AF output stage, fitted with miniature speaker, proper tuning condenser, volume control and in case with handle as illustrated (less monogram), completely portable. No aerial or earth required. Pocket 4 uses 3 transistors and 1 diode, price 52/6, plus 2/6 post and insurance. Pocket 5 uses 4 transistors and 1 diode and has feedback control, price 67/6, plus 2/6 post and insurance.

GOOD RESULTS EVERYWHERE

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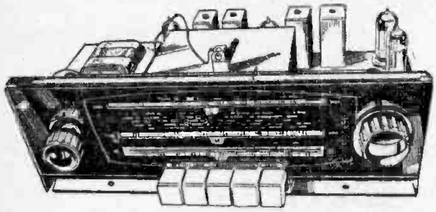

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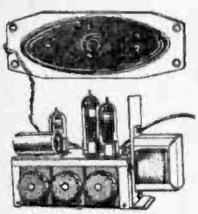

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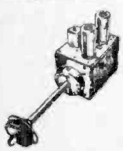

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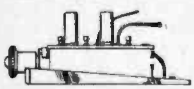

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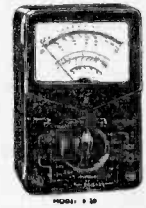

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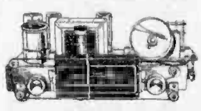

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Practical Television

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Contents

THE LINE BATTLE

THE controversy over the possible change of line structure in our television system grows more complicated, and recently a meeting was called by the Radio Industry Council to issue an authoritative statement about the actual position, and to clear up some misconceptions which arose from the publication, in certain newspapers, of conflicting statements.

When the Memorandum, which was issued to the Pilkington Committee by the R.I.C., was released, it resulted in a long series of discussions by the Television Reception Policy Committee on the R.I.C., representing the British Equipment Manufacturers' Association, the British Valve Manufacturers' Association and the Radio and Electronic Component Manufacturers' Federation.

One of the main recommendations is that 405 line standards should be maintained in Bands I and III and extended into Bands IV and V. The main reason for this is that

> "if a change were made to 625 line standards, a period of 15/20 years would be required to give national coverage to more than three programmes, during which the public would suffer confusion and additional cost."

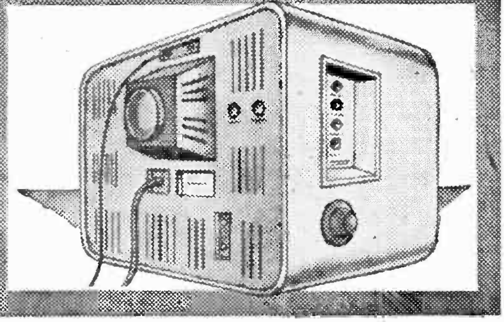
The spokesman for the R.I.C. pointed out that the difference between a 405 line picture and a 625 line picture, as seen on a 17in. screen was almost indefinable, far less, in fact, than the difference between 625 and 825 lines, both of which are received in France.

A chart was drawn showing that if a 405 line standard is maintained, six to seven different programmes would be available—one on Band I, two on Band III, three on Band IV at 98per cent coverage, and four at 90per cent coverage. If there were a change to a 625 line standard, during what might be termed Stage I (a period of duplication), only three programmes would be available, one on Band I and one on Band III at 405 lines, and two duplicates of Bands I and III plus one new (all at 98per cent coverage), on 625 lines. At Stage 2 (which would be after changing Bands I and III to a 625 line standard) only five programmes would be available compared with the previously mentioned six or seven. These would be two new programmes on Bands I and III, and three on Bands IV and V with 98per cent coverage, all at 625 lines. It may be pointed out here that the limits of Band I are 41–68Mc/s, of Band III they are 174–216Mc/s, and in Bands IV and V the limits are respectively 470–582Mc/s and 606–960 Mc/s. The upper part of Band V has, in the United Kingdom, been allocated to other services. For the purpose of the calculations given above, the upper limit of Band V has been taken at 830Mc/s.

In addition to the question of the number of lines to be used, the type of video modulation must be considered, and it must be decided whether a change from A.M. to F.M. in the transmission of sound would be advantageous. Whatever the outcome, it seems that it would be to the good of the public and the economy of the TV industry if the final decision be made in the near future.

Our next issue, dated April, 1961, will be published on March 22nd.

Servicing Television Receivers



No. 65—THE HMV 1854, MARCONI VT 153 AND ASSOCIATED MODELS

By L. Lawry-Johns

No Sound

WHEN the picture is normal but the sound is absent check V13 (EBF80) which often develops an internal fault (o.c. electrode).

Distorted Sound

Check valves V13, V14 and V15 and then R93 (2·2M) which connects to MR5.

Intermittent Sound

If the sound suddenly goes low but is restored by a pulse such as an electric light switch being actuated or by the channel switch being rotated, replace C78 and C81.

No Picture

If the sound is in order and there is no raster

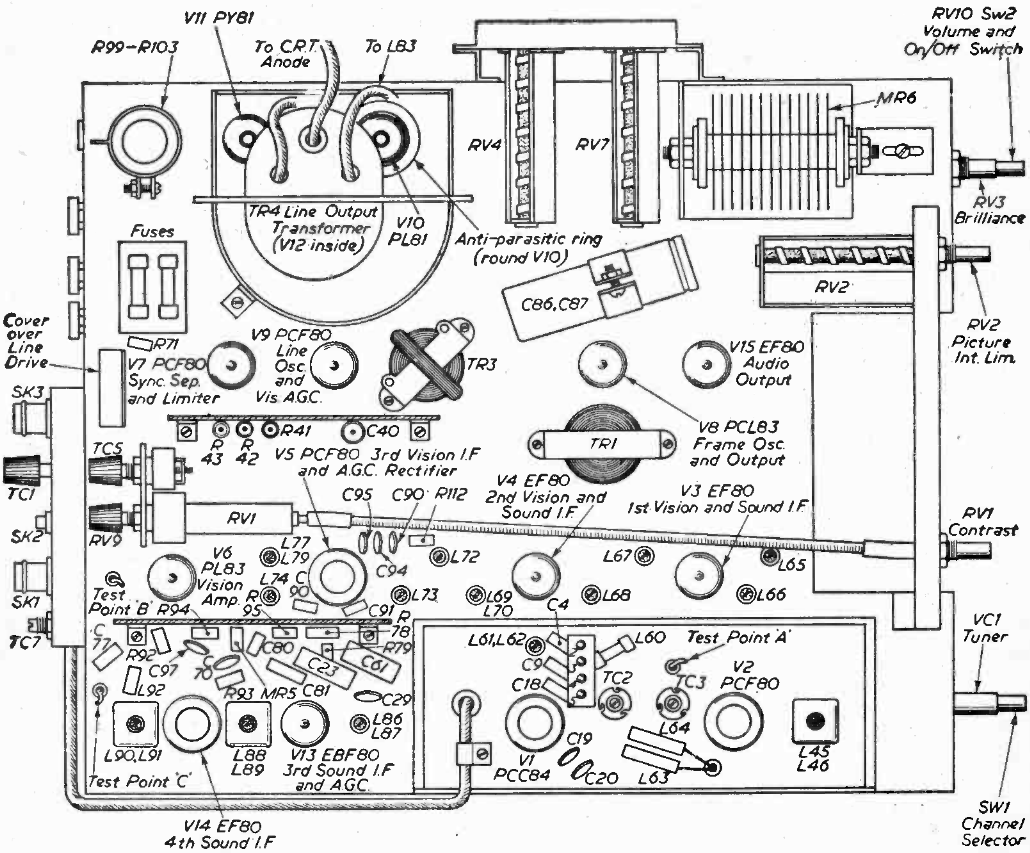


Fig. 4.—An above-chassis view of the HMV 1854.

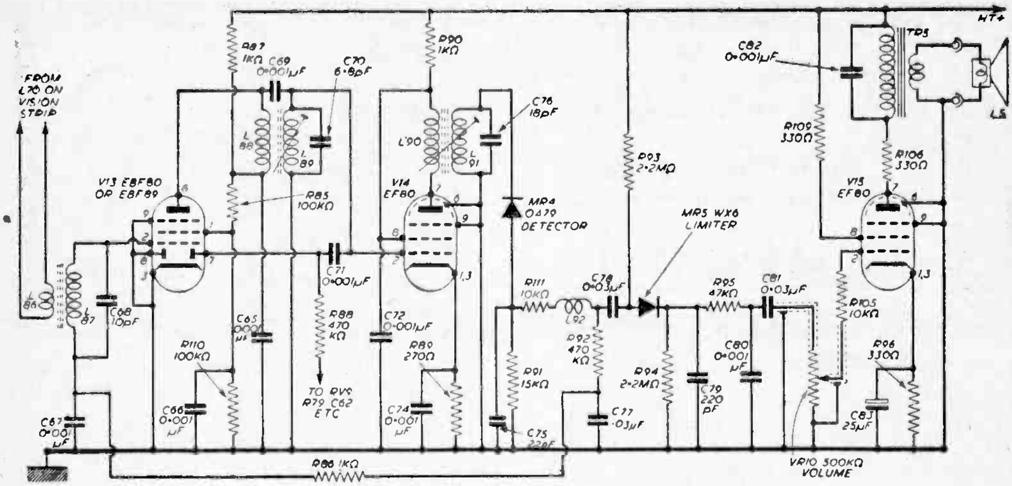
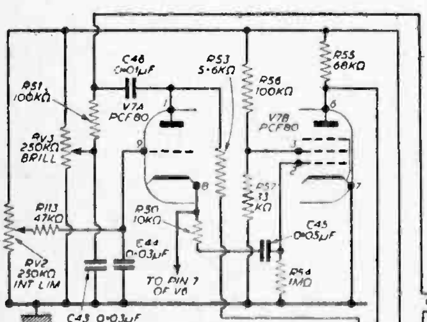


Fig. 5.—The 1854 sound strip.

when the brilliance is advanced it is necessary to check the EHT. First listen for the line timebase whistle which if the stage is working should be audible. If no whistle can be heard, inspect the PL81. If this is overheating, change over V7 with V9 (to check V9). If the PL81 continues to overheat, change it. If the PL81 does not overheat, check the PY81.

Assuming that the whistle is audible, check for spark at the CRT anode (on the side of the tube). If in doubt remove it and advance the clip to the framework. If the EHT is in order a good sizzling spark should arc across.



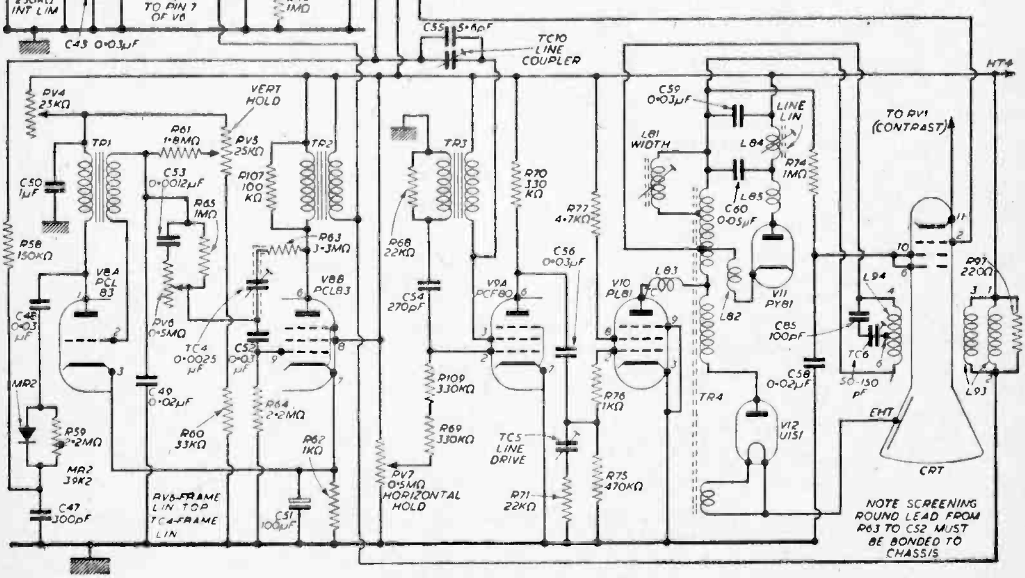


Fig. 6.—The timebase circuit.

If there is only an intermittent spark, the U151 (V12) should be suspected and the presence of EHT at the single-wire end should be verified. The notes on the line output transformer at the beginning of this article should be digested at this point. However, if EHT is present at the CRT anode the tube supplies should be checked and the position of the ion trap magnet on the rear neck of the tube inspected (to see that this has not moved from its original position).

Pin 3	—	0-100V (brilliance)
Pin 6	—	100-120V
Pins 5 and 7	—	8·5V A.C.

The EHT should be between 14-16kV

If the cathode (SE17/70 pin 11) voltage is high, check V6 and associated circuit. If the grid voltage (pin 2) is low, check C43 (0·03μF) which may be leaky. If the first anode voltage is low, check C58 (0·02μF).

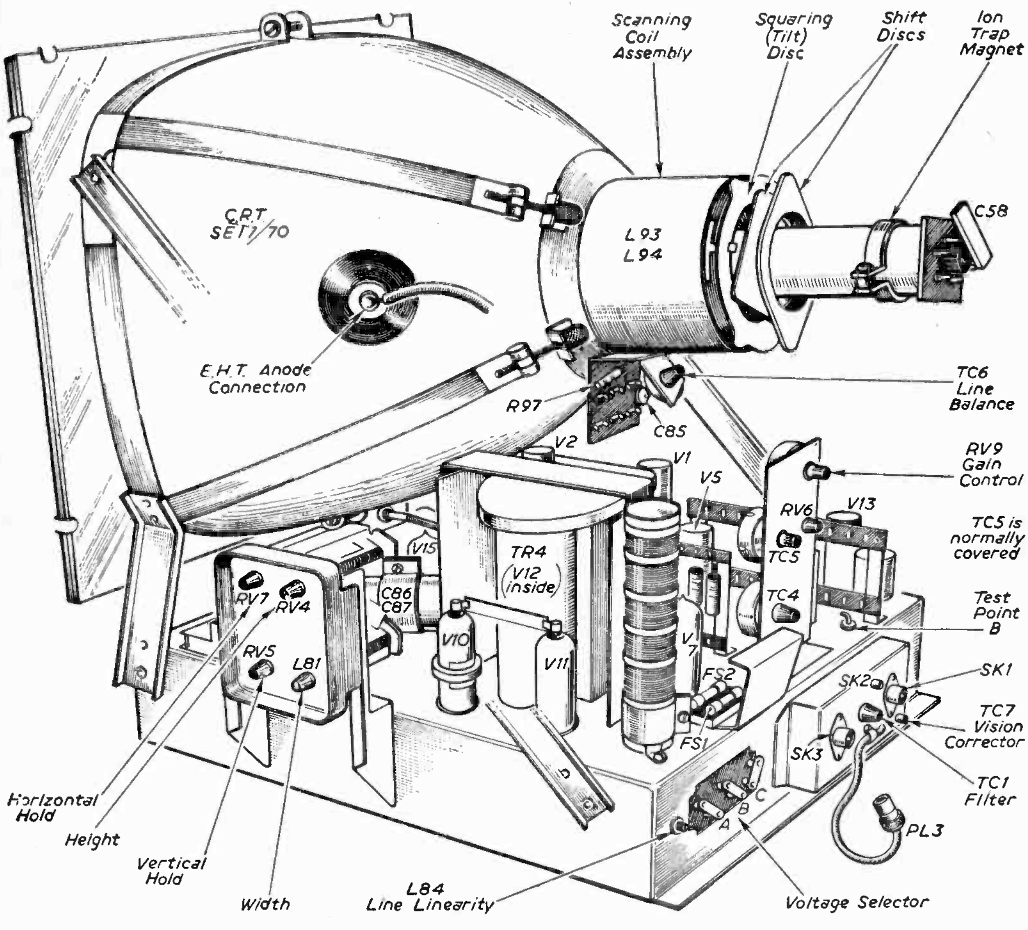


Fig. 7.—A view showing the CRT position of the HMV 1854.

Tube base voltages should approximate to the following:—

SE17/70—	Pins 1 and 12	—	6·3V A.C. (on A.C. mains)
	Pin 2	—	0-140V (depending on brilliance setting)
	Pin 10	—	500V
	Pin 11	—	140-160V
5/2 or 5/3—	Pin 1	—	250-700V (Focus adjust)
	Pin 2	—	400-500V

Uncontrollable Brightness

Check tube for heater-cathode short (in which case there will be no voltage at pin 11) or if the pin 2 voltage is high, check C46, 0·01μF, which is the frame flyback suppression capacitor.

If the cathode voltage is low but not absent, check the V6 circuit and the vision I.F. stages which may be in a state of oscillation. Short pin 2 of V6 to chassis to check this latter possibility, and if necessary check the 0·001μF or 0·003μF decoupling capacitors.

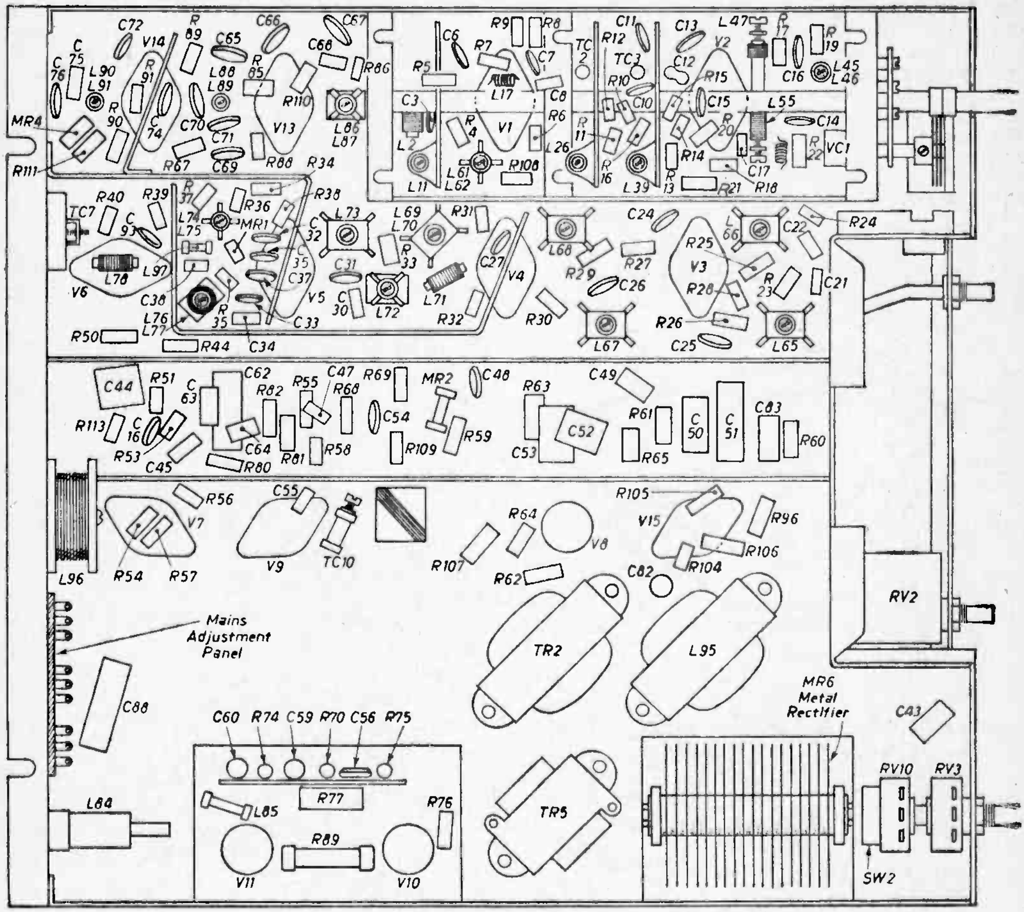


Fig. 8.—The underchassis component layout of the 1854.

White Line Across Centre of Screen

This indicates non-operation of the frame time-base. V8 is the first suspect and replacement will normally restore the frame scan. V8 is the PCL83 valve in the centre of the chassis. If the PCL83 is not responsible check the valve base voltages. Pin 1 should record 140-200V according to the height control setting.

If no voltage is recorded at pin 1, check at the yellow lead tag at the junction of C50. If the voltage is present here the transformer TR1 is at fault. If the voltage is not present check the 25K height control RV4 and C50. Assuming that the voltage is correct here (at pin 1) check at pin 6 and suspect TR2 if no voltage is present. The coupling components and the scanning coils do not, as a rule, give trouble.

Frame Hold

If the hold is at the end of its travel and the picture continues to roll, check R61 (1·8M) and V8. If the roll is in either direction with the control midway or thereabouts, check MR2 and the associated components.

Where the picture vibrates up and down when in the normal locked position, check V8, MR2 and C47.

Bottom Compression

Check V8 then R62, C51 and if the top is much elongated R63. Check TC4 and RV6 if necessary.

Removal of Chassis

Pull off the two front control knobs. Uncleat and remove the leads from the chassis to the cabinet. Remove the speaker leads from the sides of the cabinet. Remove the two rear chassis fixing screws and withdraw the chassis complete with tube.

Discharge EHT connection by shorting to chassis. Unclip the EHT connector from the tube. Remove the base socket and ion trap magnet. Slacken and free the four knurled screws securing the deflector coil assembly to the CRT and pull off the assembly very gently (from the neck of the tube). Supporting the CRT neck with one hand, remove the top screw of the front clamp and gently lift the tube, taking care not to impose any strain on the nock. Place the tube and mask face downward on a soft surface.

A Shorted Turns Tester

AN INSTRUMENT TO ISOLATE DAMAGED COILS

By M. D. Roberts

A VERY useful piece of equipment to the television engineer is a shorted turns tester. This particular tester gives a visual aid for checking deflector coils etc., for any shorted turns within the winding. It will indicate shorted turns on small or large coils alike, so long as there is no metal or ferrite core to the coil.

When a coil is placed over the test probe, the " magic eye " either opens or closes, depending upon whether the coil has a shorted turn.

The circuit is very simple. It employs a double triode as oscillator and amplifier and an EM81 (magic eye) valve as an indicator.

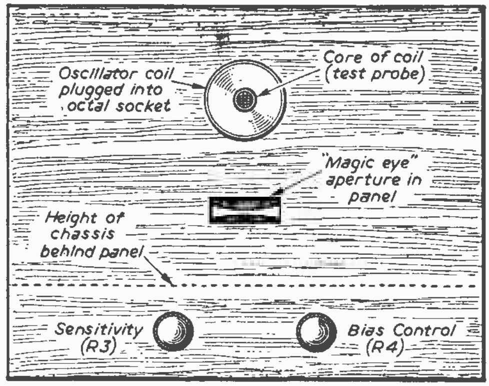


Fig. 1.—A view of the front panel.

Circuit Operation

V1A constitutes a conventional transformer oscillator in conjunction with T1. This oscillates at about 1·5kc/s, dependent on the transformer and on C1. These oscillations are taken off V1A via the blocking capacitor, C2, and fed to V1B. This valve, together with its associated components, constitutes an amplifier which increases the amplitude of oscillations. C3 feeds these oscillations into a rectifier circuit consisting of MR1, R7, C4 and C5. This circuit produces a D.C. bias which is applied to the grid of V2. This bias must be negative, and when the unit is set up and this line becomes less negative the "magic eye" will open.

When a coil with a shorted turn is placed over the oscillator transformer core, referred to previously as the test probe, an impedance is reflected back into the oscillator transformer from the coil under test, which damps T1 heavily. This results in a heavy drop in amplitude from the oscillator. This heavy drop of amplitude reduces the bias considerably on V2 grid, and allows the "eye" to open. From this it follows that any coil placed over T1 having a shorted turn in its winding will cause the " magic eye " to open, and any coil placed over T1 with no shorted turn will have no effect.

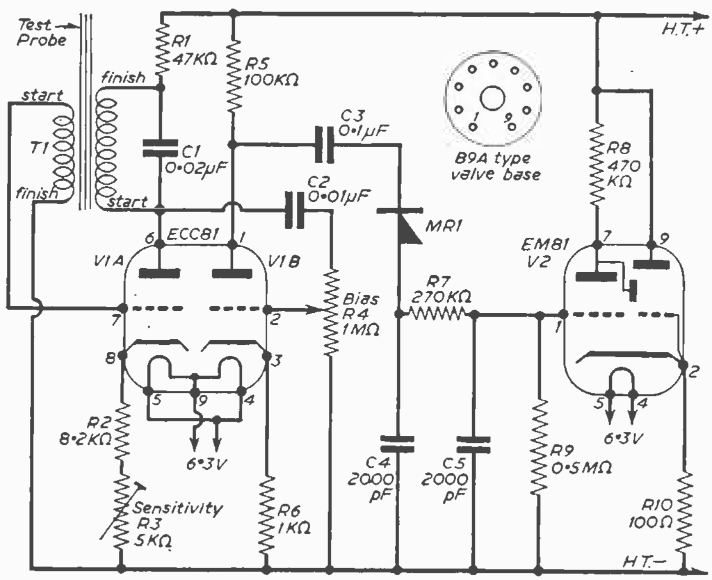


Fig. 2.—The circuit of the tester (without the power section, which is conventional).

Construction

The prototype was built on a chassis 1½in. deep and 8in. x 6in. A wooden front panel was placed on to this chassis to house the oscillator transformer, as this must be kept away from any metal. A general layout is given but actual dimensions are left to the constructor as they are not critical.

The H.T. and heater supply has been omitted from the circuit as any conventional supply will serve, but the approximate position of the mains transformer is shown. Some form of mounting the EM81 valve must be found so that the fluorescent screen can be seen from the front of the unit. An octal socket must be mounted on the front of the front panel so that the oscillator coil can be plugged into it (see Fig. 1).

Little need be said about the underside of the chassis, as the wiring is not very critical. Care must be taken, however, not to cross anode and grid

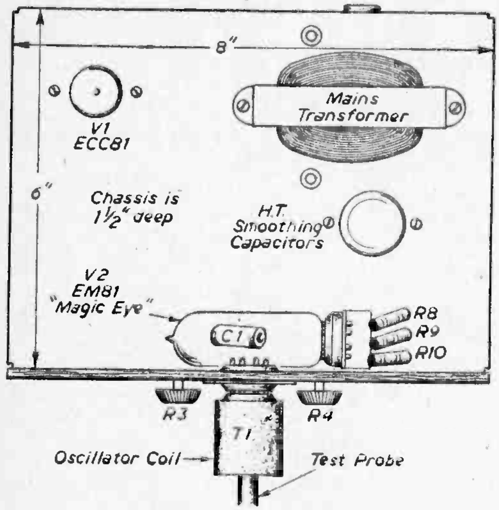
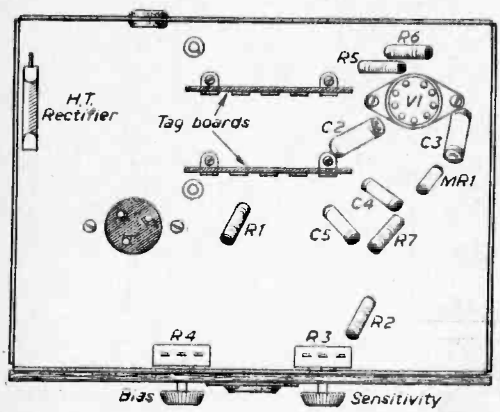


Fig. 3 (above)—An above-chassis view.

Fig. 4 (below)—The component layout.



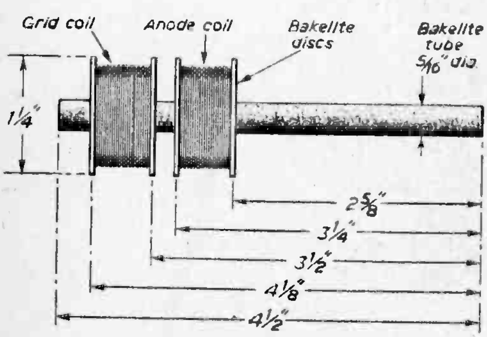


Fig. 5.—The construction of the test probe.

COMPONENTS LIST

Resistors:

- R1—47k (¼W).
- R2—8·2k (¼W).
- R3—5k W.W. pot.
- R4—1M carbon pot.
- R5—100k (¼W).
- R6—1k (¼W).
- R7—270k (¼W).
- R8—470k (¼W).
- R9—0·5M (¼W).
- R10—100Ω (¼W).

V1—ECC81.
V2—EM81.

Capacitors:

- C1—0.02μF paper.
- C2—0·01μF.
- C3—0·1μF.
- C4, 5—2000pF mica.

Piece of 5/16in. Bakelite tube, 4½in. long; Bakelite sleeve, 1⅞in. long; and 1¼in. internal diameter, 2 B9A valve bases.

leads during wiring, as this might produce instability and upset the operating conditions.

Construction of T1

This is the most difficult part of the operation, as the sensitivity of the tester relies on this transformer. The two coils are pile wound in a clockwise direction, preferably with Lewmex Medium wire. If this wire is used the windings can be fused together by heat after the coils have been wound. Alternatively, enamelled copper wire may be used (40s.w.g.).

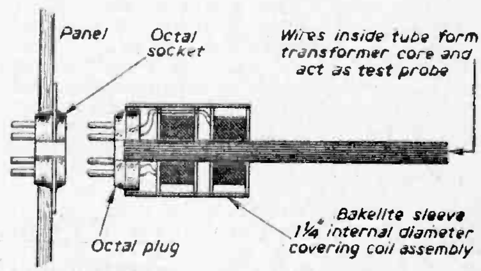


Fig. 6.—The completed probe, with the octal plug attached (the core is formed from iron wires).

Coil Former

The coil former consists of four Bakelite discs and a piece of Bakelite tube. The dimensions of the tube and the Bakelite discs are given in Fig. 5. The discs should be a push fit on to the tube. When these have been obtained place them in the positions shown, and cement them with a contact adhesive. Now wind 4,000 turns of 40s.w.g., preferably Lewmex Medium for the anode coil in the position shown. Before winding, however, it is advisable to cut notches in the discs so that the wires can be led to the end of the rod after they have been wound.

Next wind 3,400 turns of the same gauge wire on to the space for the grid coil. If the wire used is Lewmex bonding wire, the coils can be bonded together, but the constructor must be very careful

(Continued on page 306)

B.-K. OSCILLATION

By J. Rivers

AN EXPLANATORY ACCOUNT OF A TROUBLESOME TYPE OF OSCILLATION

BARKHAUSEN-KURZ oscillation (named after its discoverer) is an oscillation which causes much trouble in the line amplifier section of TV sets, and which gives rise to a variety of symptoms. It is a form of electron oscillation which can be best understood by reference to Fig. 1. This shows a triode valve on the anode of which is a negative potential and on the grid a positive potential. This is by no means a conventional way of operating such a valve, but, nevertheless, under certain conditions valves may be subjected to these reversed potentials, particularly timebase valves.

Cause of Oscillation

When a valve is connected in this way, electrons emitted in the normal way from the cathode are attracted by the grid, and some of them pass into the grid circuit as if it were an anode. Other electrons, however, pass through the grid mesh and find themselves in an electric field with a diminishing gradient between grid and anode.

These electrons are thus reduced in velocity as they near the anode, since the anode, being negative, tends to repel them, until they finally stop and change their direction of travel to follow the rising electric field gradient. In effect, the electrons are attracted by the grid once again, and as they near this electrode they increase in speed and are either absorbed into the grid circuit or pass through the grid mesh into the grid-cathode space, as shown.

On nearing the cathode, the electrons slow down, stop, and once more change their direction of travel. They continue in this mode of oscillation in and out of the grid mesh at reducing amplitude until they are eventually removed from the valve by impact with the grid wires. The valve then operates under a stable condition. The paths taken by electrons are traced by the curved arrows in Fig. 1.

B-K Oscillation in the Line Amplifier

In Fig. 2 is shown the basic circuit of a line amplifier stage. The screen grid is connected to a reasonably steady H.T. voltage and the anode is also positive by way of the connection through the primary of the line output transformer. The control grid receives the pulse or sawtooth drive from the line oscillator.

As the line scanning stroke makes the control grid go progressively more positive, more current flows through the primary of the transformer, and the anode potential drops. As this may mean that the screen grid is more positive than the anode, electrons which at that instant are travelling between the screen and anode are subjected to a retarding force. By reason of their speed, some of them reach the anode, but others follow the potential gradient back to the screen grid, and are absorbed by it, or pass through its mesh.

At that instant, however, the line flyback occurs and the control grid of the valve swings heavily negative. Further, owing to the occurrence of the back EMF across the line output transformer primary, the valve anode swings highly positive, and the electrons referred to above are deflected in the opposite direction—towards the anode—but, before they are absorbed in the anode circuit, the valve anode swings negative owing to the collapsing back EMF and the rising line-drive signal at the control grid. The electrons are again repelled by the anode and attracted by the screen grid, and as a result continue the oscillatory motion as shown in the diagram.

Oscillatory Currents

These electron oscillations set up oscillatory currents in the wiring and associated components of the line output stage, and the frequency of these currents is influenced by the design of the line output stage, the type of valve used and capacitive and inductive factors of the circuit as a whole.

It may happen that the B-K oscillation contains a signal component at a frequency which is accepted by the normal pass-band of the receiver. Thus, the set receives two signals, the required signal and the interfering signal. As the B-K or interfering signal is synchronised to the line timebase, the interference effect on the screen takes the form of irregular, vertical white lines, often about 2in. or so from the left-hand side of the screen. The symptom is far more noticeable when the applied aerial signal is weak and when the contrast control has to be advanced towards maximum in order to secure a reasonable picture.

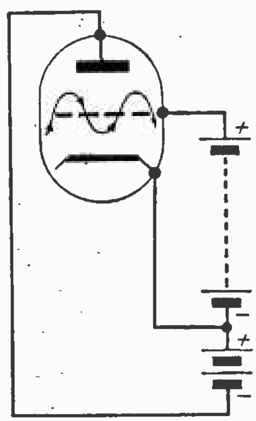


Fig. 1.—A simple circuit illustrating the production of B-K oscillation.

The effect is also aggravated by any mismatch at the aerial input to the set, owing to poor coaxial cable or an incorrect aerial. This is because the set is then much more susceptible to the pickup of interfering signals. It may also be well in evidence if ITA reception is obtained via the BBC aerial or vice versa. There is also a possibility that it may not occur on all channels, partly owing to the reasons given above and partly because the interference may have a frequency which corresponds only to one particular channel. Thus, it may appear on ITV but not on BBC, or vice versa.

It is also possible for the frequency of the B-K oscillation to be outside the passband of the receiver and yet still interfere with a picture in the form described. In this case it usually happens that the B-K oscillation beats with the local oscillator signal and produces a signal of frequency which is accepted by the set. In less severe cases of this nature, the interference effect can sometimes be tuned out by slight adjustment to the fine tuning control.

Proving B-K Oscillation

As a similar sort of interference effect can be caused by poor insulation in the windings of the line output transformer, a quick check for B-K oscillation is highly desirable. This is, in fact, possible by holding a small bar magnet against the envelope of the line output valve while observing the interference—taking care to avoid electric shock. The magnetic field alters the transit time of the electrons which are oscillating and appreciably modifies the interference effect as seen on the screen—in certain cases eliminating it completely.

Curing B-K Oscillation

A worn line output valve sometimes aggravates B-K troubles, and when this is so, a cure may be effected simply by replacing the valve. Moreover, although of similar characteristics, certain specimens of line output valve tend to promote this mode of oscillation more than others. A slight alteration in the setting of the line hold control may clear the trouble without upsetting the line lock, but this is not usually a permanent cure as oscillator drift may well bring the effect back again.

If it is discovered that a small bar magnet held close to the valve envelope clears the interference, a magnetic field can be arranged as a permanent cure. Possibly the best way of doing this is to clip an ion trap magnet on the envelope and adjust its position until the effect disappears. It may be necessary to modify the clamping arrangement to facilitate a reasonably firm fit.

It is interesting to note that certain EMI receivers adopted this magnetic field method of keeping the picture clear of B-K effects by the use of a small magnet clipped around the line output valve.

Stoppers

Installing a 27Ω resistor in series with the anode and screen leads of the valve represents another possible way of eliminating the disturbance. Loading the valve anode (top cap) capacitively often results in a cure. High peak voltages exist at this electrode and an ordinary capacitor would quickly fail—one way of achieving the required capacitance without this trouble is by connecting a short length of twin P.V.C. cable between the anode of the line output valve and receiver chassis, as shown in Fig. 3.

There are times when the B-K interference is injected via the picture tube leads, usually to the grid or cathode, by way of a coupling between the leads on the tube and the wiring of the line output stage. Thus, in persistent cases of the symptom, the tube leads should be altered in position and re-routed if it is found that this clears the trouble. The contrast control wiring is another vulnerable point at which the interference may find its way into the set. Again, re-routing of the contrast control leads should be tried.

Under certain conditions, the trouble may be cleared by connecting the focusing unit to chassis via a short length of fairly stout wire. A piece of copper braiding removed from the outside of a length of coaxial cable serves admirably for this purpose.

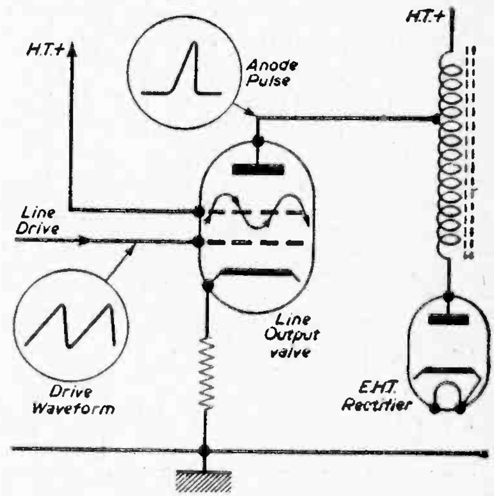
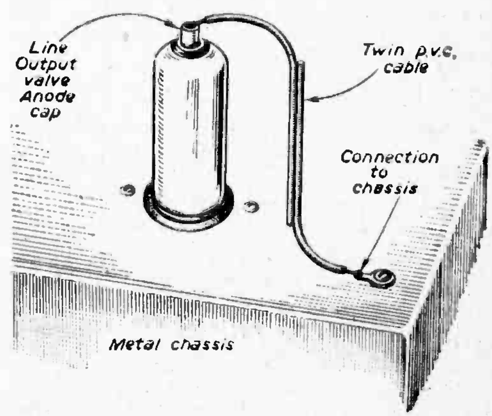


Fig. 2 (above).—The basic circuit of a line output stage and its waveforms. The sinuous arrow traces the path of the electrons.

Fig. 3 (below).—A capacitor formed of P.V.C. covered twin cable connected between the valve anode and the chassis.



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EHT Generation

No. 3—THE USE OF TRANSISTORS

By G. K. Fairfield

(Continued from page 199 of the January issue)

THE result of increasing the load therefore by reduction in load resistance will only result in the transistors conducting for longer periods during each half cycle. This allows an extremely good regulation of supply voltage to be obtained.

A further advantage is that the danger of damaging the transistors owing to voltage overloads when the load resistor is removed, present with the ringing-choke system, cannot happen with this circuit.

One practical disadvantage is that fairly tight coupling is required between transformer windings and this prevents the narrow wavewinding technique being used in transformer construction. Consequently the maximum value of peak voltage across the secondary winding is limited to about 2kV since layer-wound coils must be used to obtain the tight coupling required.

Voltage multiplying circuit can be employed however, and as the frequency of oscillation is in the audio frequency range only small value of smoothing capacitors are required.

A suitable practical circuit for providing 5kV at load currents of up to 5mA is shown in Fig. 8. As in the previous design a starting device is necessary to initiate the commencement of oscillations.

In this case a diode D1 is used together with a fixed resistor R1. Initially this diode is non-conducting and the base of the transistor is made negative by returning this to the negative pole of the battery via the transformer winding and R1. As soon as one transistor commences to draw collector current D1 conducts so that its resistance value is small compared with R1. Oscillations then commence with D1 always kept in the conduction or low resistance state by conduction of either Tr1 or Tr2.

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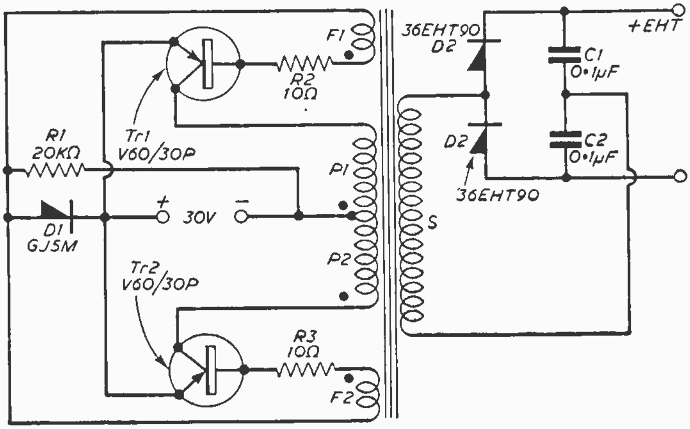


Fig. 8.—A practical circuit to provide 5kV.

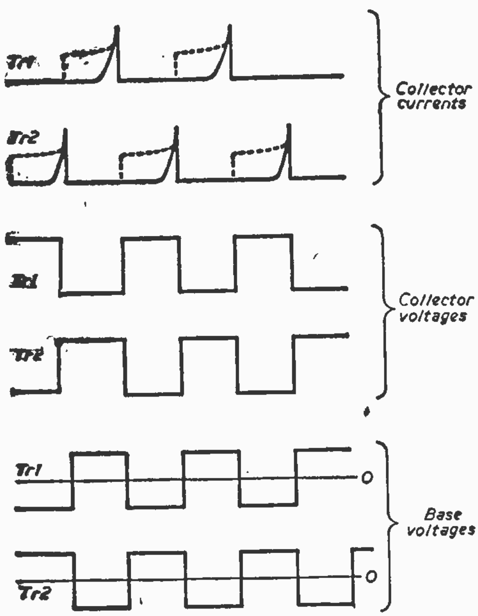


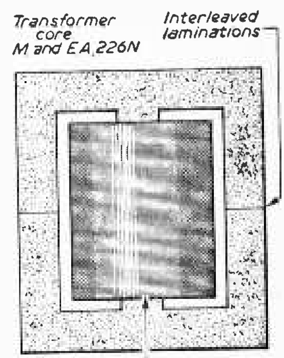
Fig. 7.—The waveforms associated with Fig. 6, the dotted line shows the result when a constant load current is imposed on the rising inductive load.

WINDING DATA FOR FIG. 9

Winding	No. of turns and wire gauge
P1 and P2	62 turns of 22s.w.g. enamelled copper wire.
F1 and F2	10 turns of 22s.w.g. enamelled copper wire.
S (total)	5,000 turns of 36s.w.g. enamelled copper wire.

Interleave 5 turns of 0·005in. polythene tape between windings ½S and P1 and P2.

Fig. 9 (right).—The construction of the transformer.



Telenews

Television Receiving Licences

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

Region	*Total*
London Postal	188,870
Home Counties	1,521,734
Midland	1,673,237
North Eastern	1,791,881
North Western	1,454,804
South Western	934,944
Wales and Border Counties	667,451
Total England and Wales	9,932,921
Scotland	986,290
Northern Ireland	156,793
Grand Total	11,076,004

Border Television Stations

THE Independent Television Authority has placed orders on Marconi's for the supply and installation of two further transmitting stations. One of these will be located at Caldbeck, near Carlisle, Cumberland, and the other, a satellite station, will be at Selkirk, over the border in Scotland.

The Caldbeck station will comprise two Marconi 4kW vision transmitters Type BD 366A, two 1kW sound transmitters Type BD 270A, combining units and programme input equipment. The aerial system will be a 16-stack (twin-eight) quadrant array supported on a 1,000ft triangular mast.

Although paralleling equipment will form part of the installation the transmitters will be used on a main/standby basis, with the combined outputs of one vision and one sound equipment feeding into the 16-stack aerial to give an effective radiated (vision) power of approximately 100kW in the direction of maximum propagation.

A Type BD 368B/375 equipment consists in this instance of a 10W translator (BD 368B) feeding into an amplifier (BD 375) which raises the vision output to 500W and the amplitude-modulated sound output to 250W.

The radiated signals from Caldbeck are picked up and fed to the translator input for amplification and conversion to a new frequency, after which they are fed to the 500W amplifier and finally re-radiated.

The initial installation at Selkirk will consist of two translators and two amplifiers. One 10W unit will drive the two 500W amplifiers which will be connected in parallel to give an output of 1kW vision and ½kW sound. The remaining 10W translator will be on standby.

Australian Interstate Telecasts

TWO-WAY radio played an important part in the success of the recent Sydney-Melbourne and Melbourne-Sydney cricket telecasts organised by ATN-7 and GTV-9.

Lining-up the microwave link equipment used in the operations was an exacting task, requiring extreme accuracy in throwing images from one relay point to another. A slight error in adjustment could have meant a "miss" of about a mile.

Under normal conditions the relaying of signals is painstaking work, but for GTV and ATN engineers the job was made doubly difficult by poor atmospheric conditions which prevailed during the greater part of "Operation Kangaroo".

With the aid of two-way radio, engineers on the project were able to make rapid adjustments to compensate for interference and any loss of signal.

The equipment used at the GTV relay-points consisted of three Pye VHF base stations fitted special yagi aerials. These in turn were linked to other Pye base

A GTV technician using a Pye two-way base station at the relay point on Mount Buffalo. Microwave dish aerials at right link other relay points at Black Jack peak and Mount Macedon high in the Snowy Mountains.

stations at GTV's Melbourne studios and to their transmitter at Mount Dandenong.

Two of the base stations were already in service with GTV prior to "Operation Kangaroo". The three additional units were borrowed from Pye Pty, Ltd., Melbourne, for the duration of the exercise. However, GTV engineers were so pleased with the performance of the sets that they decided to buy two of the borrowed units for GTV's permanent use.

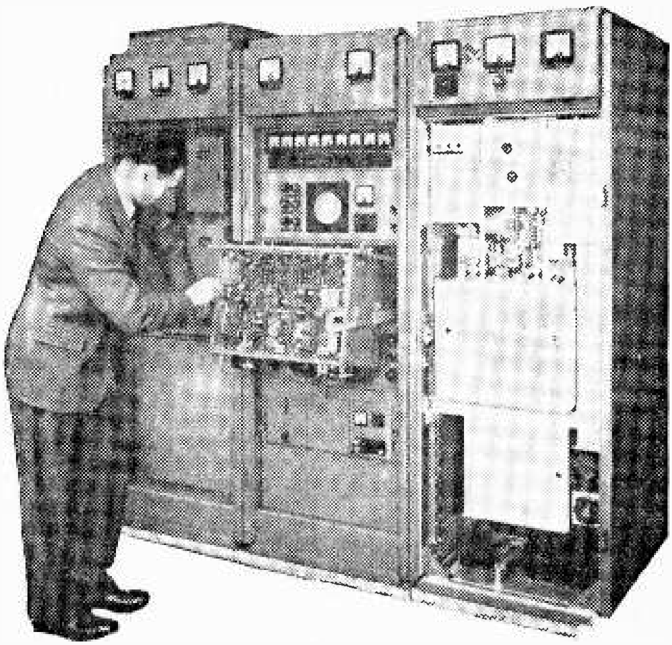
Czechoslovakia Buys British Telerecording Equipment

"FAST pull-down" telerecording equipment by Marconi supplied to KOVO Prague two years ago has proved so successful that an order for a second installation, complete with sound recording equipment, has been placed.

The first unit has been in constant use by Ceskoslovenska Televise, the Czechoslovakian Television Authority, in their Prague studios. The second will be used at their station at Bratislava.

A special feature of the Marconi telerecording equipment, type BD679B, is the extremely high quality of the filmed picture. This is made possible by the unique fast pull-down device incorporated; whereas many other systems record only one-half of the television picture information (with a consequent degradation in picture quality), the patented mechanism in the BD679B is so rapid in its pull-down action that a fresh film frame can be brought into position in the brief interval (approximately two milliseconds) between successive television pictures, thus enabling the whole of the picture information to be recorded.

Similar equipments are in use by the BBC and Granada Television Ltd; by television authorities in Bavaria, Italy and Australia, and by a company producing commercials for television in Canada.



A Marconi type BD 366A, 4kW vision transmitter under test at the Company's Chelmsford works. The front doors have been removed and the submodulator unit withdrawn for test purposes.

Improved Southampton Television Studio

THE BBC's television studio at Southampton has recently been remodelled and additional equipment has been installed to extend the available facilities.

It was originally opened in 1958 as an interview studio and comprised a single room with an area of 400sq. ft containing all the equipment, lighting, cameras, etc. Two Vidicon television cameras were provided, one being normally available for transmission with the other spare. Now a control cubicle has been added and provision made for both cameras to be used on transmission. The control cubicle also contains the transistorised waveform generators, distribution amplifiers and other ancillary equipment.

The output from the Southampton studio can be radiated by the BBC's television station at Rowridge in the Isle of Wight for such programmes as local news and sports items; alternatively, it can be broadcast by all BBC transmitters in the West Region, or by the whole BBC television network.

The television signals are carried from the Southampton studio to Rowridge by a microwave radio link and the appropriate routeing of the signals is performed by switching equipment installed at Rowridge. Remote control of this switching equipment from the Southampton studio has been provided using a new UHF radio link which has been installed for the purpose.

Lord Mayor of London to Open Television Train

THE Rt. Hon. the Lord Mayor of London, Sir Bernard Waley-Cohen, performed the ceremony launching the Westward Television Exhibition Train at Olympia station on February 9th.

The train, consisting of reception, cinema, studio and exhibition coaches, stayed at Olympia station, London, for two days prior to travelling to Truro, where it started a six-weeks tour of the Westward area — Devon, Cornwall, and parts of Somerset and Dorset.

4½in. Image Orthicons in Studio 4

IN Studio 4 the latest BBC television studio to go into operation, English Electric 4½in. Image Orthicon pick-up tubes are used in all four television cameras. The type 7389 tubes as used in "Studio 4" are also used in "Studio 3" and the success of this tube is due to the considerable improvements in signal to noise ratio, resolution, true edge reproduction, black halo elimination and grey scale reproduction, which are made possible by the large storage target area.

TRACING AND CURING LOW EHT

INTER-DEPENDENCE OF LINE OSCILLATOR AND EHT CIRCUITS

By K. Royal

MOST cases of low EHT can usually be attributed to a fault somewhere in the line timebase circuits or in the EHT rectifier and associated components, between the line output transformer and the tube final anode. Almost all modern receivers obtain EHT voltage from the rapid change in current which occurs in the line output transformer during the line flyback. This gives rise to a large voltage pulse across the inductive elements of the circuit, which is stepped up by the EHT over-wind on the transformer and then rectified by the EHT rectifier to give a high D.C. voltage to operate the tube.

Line Timebase Fault

It follows, therefore, that a fault developing in the line timebase is likely to affect not only the horizontal scanning of the picture, but also the EHT voltage. If the trouble is that of low EHT only, such as would occur from a low emission EHT rectifier valve, then the usual symptom is that the raster or picture is considerably oversize and that it cannot be reduced adequately to its normal dimensions by means of the width and height controls. This is invariably accompanied by a lack of normal brilliance in the picture and the necessity for moving the focus control or lever to the limit of its travel to effect sharp focus.

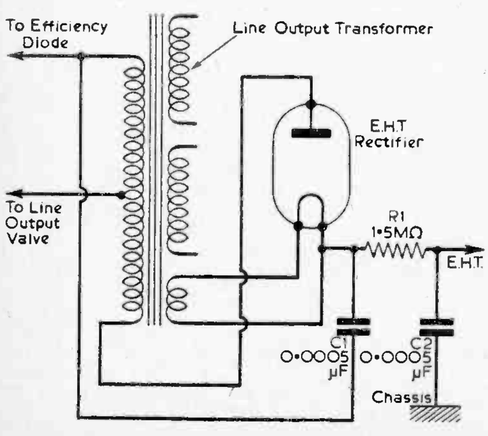
The EHT regulation is also affected. This means that the picture will vary in size as the brightness control is rotated. In extreme cases, the picture will enlarge greatly as the brightness control is turned up, and will eventually disappear completely from the screen at maximum setting. These two symptoms, which signify low EHT coupled with poor EHT regulation, often occur together. There is little doubt that both effects can be eliminated simply by replacing the EHT rectifier valve.

If it is apparent that the line timebase circuits are working correctly, there being no horizontal distortion of the raster and no vertical light or dark lines down the centre of the screen, and yet the picture is oversize and out of focus, low EHT owing to a fault between the line output transformer and the tube final anode is the most likely cause. This may happen without the EHT regulation being unduly disturbed, and, again, could be the result of a worn EHT rectifier valve. In these circumstances, however, attention should be directed towards any EHT smoothing or filter capacitors, which may be connected between the cathode of the EHT rectifier and tube final anode. Such capacitors may be impaired insulation or low capacitance. Also check the EHT filter resistor, between the two capacitors, through which the EHT current passes, as this may have increased in value.

Certain receivers use the components shown in Fig. 1, in the EHT circuit, and in some sets the resistor R1 may comprise two resistors in series or parallel to make up the requisite valve. Replacement resistors should always have, at least, a 4kV pulse working rating.

EHT Capacitors

Not many current receivers use EHT capacitors as external units. The smoothing capacitance is formed by the two conductive layers, one on the outside surface and the other on the inside surface of the picture tube itself. The inside layer is connected internally to the tube final anode and the outside layer is connected to receiver chassis via clips or springs. These two layers thus form the two plates of a capacitor, while the glass of the tube serves as the dielectric (Fig. 2). When this method is adopted a smoothing or filter resistor is not required.



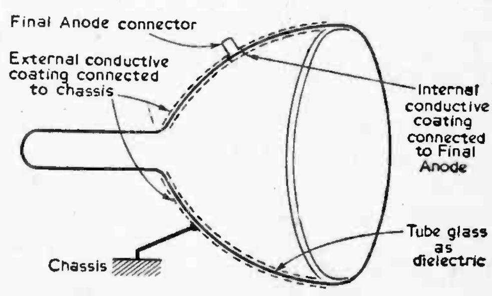


Fig. 1. (Left)—Circuit components should be checked when EHT is low and its regulation impaired.

Fig. 2. (Above)—The EHT smoothing capacitance is usually formed by conductive coatings on the tube with the glass as the dielectric.

Attention should also be given to any bleeder or Metrosil resistor connected between the final anode and receiver chassis, such as that long black rod, which looks like a carbon rod in certain receivers. This is, in fact, a piece of Metrosil whose purpose is to stabilise the EHT voltage during changes in the current which occur mainly during changes in picture brightness.

Line Timebase Troubles

When low EHT is caused by a fault in the line timebase, the normal symptoms of low EHT may be neutralised by a reduction in line scanning power. Thus, although the EHT is less, the line scanning power is also less, so the picture may not overscan horizontally. It may or may not overscan vertically depending on whether the frame timebase is fed direct from the H.T. line or from the boosted H.T. line.

If, for instance, the frame timebase or frame oscillator is fed from the boosted H.T. line, then a fault in the line timebase will reduce the boost voltage as well as the EHT, so that the symptom of overscan is likely to cancel out, as in the line scan case. However, if the frame circuits are fed direct from the normal H.T. line, a vertical overscan will almost certainly occur, but as normal height can usually be restored by adjusting the height control, the effect may not be noticed.

Indeed, from the line angle, the picture width may be reduced. This is because the line scanning power drops more rapidly than the EHT voltage, with certain line timebase faults. A picture lacking in width, out of focus and exhibiting the symptoms of poor EHT regulation should lead first to a check of the line output valve. If this is in order, the screen grid resistor of the line output valve should be tested. This component passes a substantial current, and if of the carbon variety, is likely to increase in value after many hours working. If an ohmmeter is not to hand, it is well worth while to try the suspect by substitution.

Efficiency Diode

The efficiency diode, if low emission, can also produce low EHT, but this invariably causes an unpleasant distortion and haziness on the left-hand side of the picture. Nevertheless, if the emission is not too low this symptom may not be easily seen. Also check the capacitors in the circuit of the efficiency diode.

Low EHT can also be caused by shorting turns or poor insulation in the line scanning coils, or if these coils develop a "leak" to chassis or to the frame scanning coils. Perhaps the commonest cause of low EHT is either poor insulation in the line output transformer or a fracture in the core of the transformer. This latter possibility is not all that well known, but is well worth investigating in persistent cases of low EHT and/or insufficient width.

Width and linearity inductors in the line output stage are also vulnerable to insulation breakdown since across these occur rather high pulse potentials. A symptom of their failure is that they tend to overheat and drip wax. The capacitors and resistors associated with such inductors should also be checked, preferably by substitution, bearing in mind that certain components in these circuits have a high pulse voltage rating.

Line Drive Control

A point sometimes overlooked by the experimenter is the line drive trimmer or control which is connected between the line oscillator and line output stage. This control is mostly a compression type trimmer (though it is a potentiometer control on certain sets), and is mounted inside the EHT screening can, and not always easily visible.

These components should usually be adjusted to give a specific value of EHT voltage, and the measurement is made either at the first anode of the tube (in the case of a tetrode or pentode), or on the boosted H.T. line. EHT voltage cannot easily be measured accurately by the experimenter, and unless a high resistance voltmeter is available, the same applies to the first anode potential. In this case, the line drive trimmer should be advanced until a bright vertical line appears down the centre of the picture, it should then be slowly retarded until the line just disappears and the picture is free from horizontal distortion. It will be noticed that this control seriously affects both the width and focus of the picture.

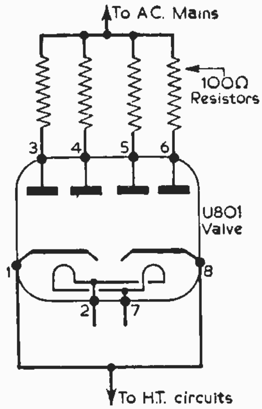


Fig. 3.—Low H.T., resulting in low EHT, is often caused by surge limiting resistors in the anodes of this type of valve going open-circuit.

If this control is misadjusted, and full width is secured by means of the width control or inductor, and the focus control is pushed hard against one of its stops to achieve a reasonable focus, then the EHT will be well below normal and the EHT rectifier heater will be starved of current. This will give the effect of very poor EHT regulation, which may induce the experimenter to delve unnecessarily into the line timebase circuits to try to find a fault which does not exist.

The compression trimmer type of control, again, owing to the fact that large pulse voltages occur across it, may break down or become "leaky". A fault may develop in the line oscillator itself and produce a similar symptom. This trouble should be suspected in particular if it is found that the line hold locking point has shifted considerably from its normal position.

Low H.T. Voltage

The commonest cause of insufficient width, which is a reflection in most cases of low EHT, is low H.T. voltage. Low H.T. voltage can be caused by component failures that are not always obvious. For example, after having checked the obvious things, like the H.T. rectifier and reservoir and smoothing electrolytics with no success, attention should be focused on the surge limiting resistors which are usually connected to the anodes of the H.T. rectifier.

(Continued on page 335)

Tricks of the Trade

SIMPLE SERVICING HINTS

By L. E. Higgs

OVER the years, engineers and enthusiasts have naturally established numerous short-cuts and temporary repairs when servicing TV receivers.

Adjusting Mains Input

One of the easiest tests to make, on a A.C./D.C. receiver with no power through the heater chain, is to see if the upper sections of the volts dropper have become open circuit. Simply by adjusting the mains input panel to the next few volts down will restore the set to action. Providing that the drop in mains input is only 5-10 in 200V, then the receiver can be left working while a replacement part is obtained. When a defective component is located with a meter in an older receiver that is a trouble to remove from the cabinet, but partly accessible through a bottom panel—provided that there is sufficient room to cut away the wire ends of the old part—a new component mounted on crocodile clips can be clipped back into the confined space, until it was convenient to dismantle the set later (Fig. 1).

Certain paxolin pre-set potentiometers of a flimsy construction and fitted in groups of more than two, in some of the later printed circuit receivers have a habit of dropping their wiper contact owing to a weak punched rivet, or cracking across the composition track. Whatever the reason, the set has to be kept running until the special pre-set control assembly is obtained. By pencilling as shown with a soft lead pencil across either the tags or the track with the receiver on until the desired control effect is obtained, a temporary repair can often be effected with controls of a value of 100k or greater (Fig. 2).

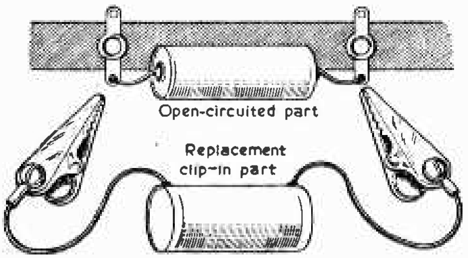


Fig. 1.—Bridging an open-circuit component in a restricted position.

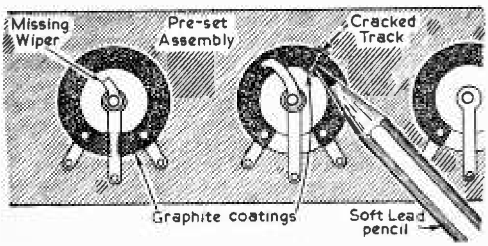


Fig. 2.—Repairing broken pre-sets.

Turret Coil Repairs

Broken or missing turret coils or slugs can often be replaced from one of the unused pairs. Retuning the oscillator is simply by core adjustment, with larger increments of frequency shift obtained by squeezing the coil turns together or apart. Do not forget the R.F. or aerial coil—the improvement in gain is surprising.

Always avoid turning a TV on its face. Too often on returning to a normal position, a clutter of dust is found on the screen to be followed by the unenviable job of a screen-clean.

Signal tracing is not the process most used in commercial work. When symptoms of no power in the heater chain are present—possibly an open circuit valve—it takes no time at all to eliminate the most frequent offender, i.e. a loose mains plug connection or fractured conductors in the mains flex insulation. Just pull the plug while holding the lead (disconnect first!). Cut back and remake the connection, this proves much quicker than elaborate preparations with a multimeter to arrive at the fact that no mains is present.

Replacing Valves

Valves are changed according to the laws of probability rather than for a specific reason. Although this is unscientific, it is usually quicker. If a receiver gives a lot of trouble owing to its H.T. rectifier, time is lost hunting around when it takes only a minute to try a new one.

When signal tracing of stages promises a faster solution, and there is no time or room to set up a signal generator, the blade of a small screwdriver can produce known effects on screen or speaker by the process of disturbance-testing or "grid scratching". This method is no use for distorted or low output symptoms, but it can speedily locate a dead stage. Brushing, corona or tracking can be made visible by extinguishing the room lights, and if the view from the rear is obscured, a small mirror held inside the cabinet helps look from the other direction—but take care the silvering on the back is kept away from the EHT points.

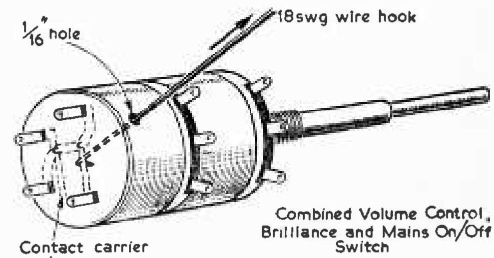


Fig. 3.—Loosening welded mains contacts.

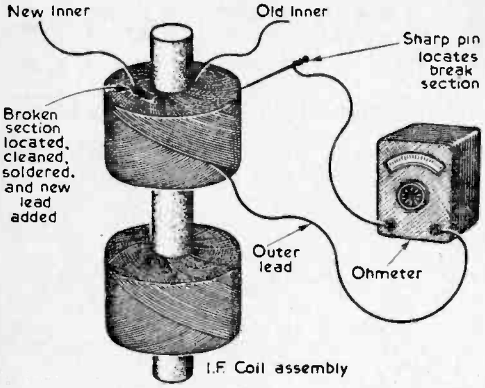


Fig. 4.—Locating and repairing broken windings.

Special Tools

Special tools in a repair kit speeds servicing. The old-fashioned gas soldering iron (small size) takes up no room in the tool bag and is quicker in the winter months when most people have a coal fire —just poke it in and save the unravelling of an electric iron lead and fiddling with mains plugs and multisockets. Never be short of solder by carrying a few inches on your key ring. Dental mirrors are invaluable when looking for damage or clues under components in confined space. A wire hook of 18s.w.g., a few inches long, can be used for many purposes, including the releasing of welded mains switch contacts caused by accidental short circuit. By drilling a one sixteenth inch hole in the insulated cover of the switch, taking care not to let the tip of the drill protrude too far in and damage the interior, this hook can be introduced and the contact carrier can be pulled off of the lightly welded fixed springs. This is invaluable in saving time replacing a combined control (Fig. 3).

Coil Repairs

Open circuit coils in signal circuits are usually replaced by a new assembly, but many points of breakage are near the ends of windings, and once located with a pin and multimeter can be surface rubbed with fine glass paper and solder contact made with a piece of fuse wire (Fig. 4). The "Q" drops of course, but again it gets the set working. This repair is not suitable for power transformers and coils.

A final point is to notice how certain experienced men keep one hand in their pocket when handling a live set. The nonchalant attitude is bred from the realisation that shocks across the heart via each arm can be avoided by keeping to one hand at a time in a live chassis—thus one hand in the pocket is habitual good insurance. For the same reason be particular on the floor conditions—damp, stone, concrete, tile, and nearby earthed metal radiators and pipes are treated with much more caution in these days of "chassis mains" than the several thousand volts EHT which quite often means only a painful sizzle.

A SHORTED TURNS TESTER

(Continued from page 297)

not to overheat the coil. If the coils are to be bonded the wires of each coil in turn are placed across a variable A.C. supply, preferably a Variac. The A.C. voltage is gradually increased until the winding begins to smoke. It is left in this state for a minute or two, and the coils should then be bonded together when they are cool.

To complete the coils (Fig 6), take leads out from the two coils as shown. Drill a hole in the centre of a Bulgin octal plug so that the $\frac{5}{16}$in. Bakelite tube is a push fit into it. Lead the wires from the coils through four of the pins on the octal plug, and cement the $\frac{5}{16}$in. Bakelite rod into the hole.

Then fit a Bakelite sleeve over the transformer and cut it to $1\frac{7}{8}$in. long. Cement this into place with it flush against the octal plug. The connections on the pins should then be made to correspond with the connections on the octal socket that is mounted on the front panel. The start of the anode winding should go to the anode of V1A, and the end on to R1. The start of the grid winding should go to the grid of V1A and the finish to earth.

When the adhesive has set the $\frac{5}{16}$in. diameter tube must be packed tight with $4\frac{1}{2}$in. lengths of iron wire of about 22s.w.g. (This can be obtained from wire manufacturers, and it may sometimes be bought at the local ironmongers.) The iron wire should then be cemented into place.

This completes the transformer and it can be inserted into the unit so that the unit can be set up for maximum sensitivity. If oscillation is not obtained reverse the leads to either the primary or secondary of the probe.

Test Procedure

After carefully checking the wiring against the circuit diagram connect the power unit to the mains, and check H.T. and heaters. The H.T. should be about 200V D.C. If an oscilliscope is available check the output from the oscillator between C2 and the chassis. Then check the output from V1B, between C3 and the chassis. Lastly check that there is some negative bias on the grid (pin 1) of V2. Then solder the two ends of a piece of 22s.w.g. tinned copper wire together, making a closed loop about 1in. across. R3 is a sensitivity control and R4 is a bias control for V2. These controls are very critical and they must be set carefully if maximum sensitivity is to be obtained.

Set R3 at one end of its track and adjust R4 until the "magic eye" is just closed. Place the loop of wire momentarily over the test probe and watch V2 for results. Advance R3 a little, and re-adjust R4, repeating the process with the wire loop. Continue this trial and error adjustment until the most sensitive position is found. The unit is then set up and is ready for use.

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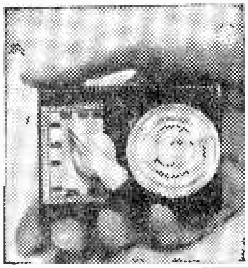

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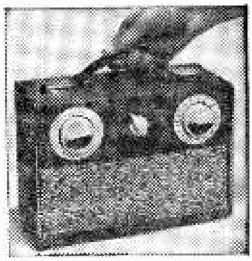

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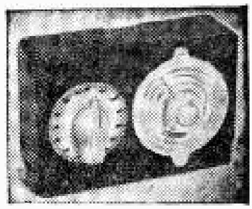

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Line Oscillator and Sync Circuits

No. 4—IMPROVING SYNCHRONISATION

By A. G. Priestley

(Continued from page 255 of the February issue)

THE oscillator, then, runs at a natural frequency determined by the time constants built into the circuit, particularly the grid. In the case of the grid waveform (Fig. 15), the oscillator triggers itself at A, every 111μsec, corresponding to a natural frequency of 1,000,000/111=9·0kc/s. Supposing however that a large positive-going sync pulse comes along at B, after only 98·9μsec, then the grid is driven positive immediately so that the valve starts to conduct current. The oscillator is thus triggered at a higher repetition frequency of 1,000,000/98·9=10·125kc/s; i.e. the oscillator is synchronised. A sync pulse of this size can trigger the oscillator anywhere between A and B and so the hold range is 10·125−9·0$\doteqdot$approx. 1·1kc/s, which is a fairly normal value. A large sync pulse will of course give a larger hold range.

How to Improve the Synchronisation

Having examined some of the causes of bad synchronisation, ways and means of overcoming the difficulties and assessing the results must be considered. This seems to depend more on the shaping and control of the sync pulses than on the choice of particular circuits, and so there is plenty of scope for experimenting without involving much expense. But first it must be established which experimental technique will be needed to decide whether a new modification improves the picture or not.

It is important to bear in mind that the real test of this aspect of the picure quality is the behaviour under poor signal conditions, where noise and interference pulses form a significant proportion of the total, and the picture-detail is somewhat broken up. Testing should always be carried out with a really weak signal, such that the picture just holds steadily but with plenty of " noise " visible, giving a speckled effect.

This reduced signal can be obtained by putting a suitable attenuator in the aerial, or by using a piece of wire as an abbreviated indoor aerial in place of the proper one. Periodic checks can be made under strong signal conditions to make sure that no other undesirable effects have appeared.

When trying to assess changes in qualities which cannot be measured, but only judged by visual inspection, the best way to do it is on the basis of comparison. Borrow a second receiver, adjusting the signal strength until the performance of each is similar, and then take a careful look at the two pictures side by side. Any significant change, for better or for worse, will be fairly easy to see.

Another method of comparison is to use the receiver by itself, but to fit a multiple switch so that it is possible to change over from one piece of circuitry to another almost instantaneously.

Choice of Hold Range

The professional setmaker uses a large hold range to make sure that customers hardly ever have to adjust their control. To achieve this a large sync pulse is supplied to take firm control of the oscillator, but inevitably a correspondingly large amount of electrical noise is fed to it as well because this is superimposed on the sync pulse and this tends to cause poor synchronisation. The home constructor does not mind adjusting his controls occasionally, and so is free to choose a hold range of perhaps half the size by using a smaller sync pulse. Since there is less external control on the circuit, the noise has less effect, and the synchronisation is improved.

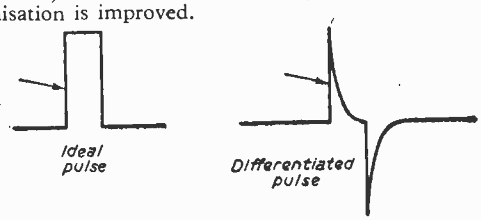
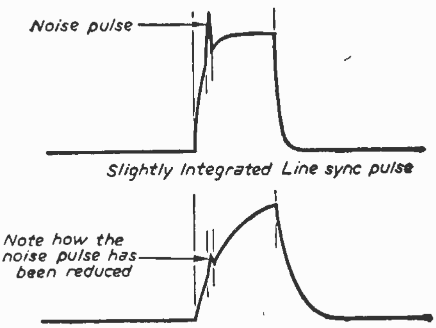


Fig. 17.—(above) Sync pulses with steep leading edges.

Fig. 18.—(below) The effect of integrating line pulses and noise.



Probably the easiest way of doing this is to reduce the size of the capacitor which couples the sync pulse to the oscillator. The smallest usable hold range is determined by the amount of long term and short term frequency drift, which in turn is governed by the quality and character of the components, and by the temperature rise.

Use of a Line Sync Clipper

If frame sync pulses find their way on to the line oscillator they cause the top of the picture to go out of sync before the rest of it does so, and a larger hold range has to be provided to allow for this. Conversely line pulses on the frame sync cause bad

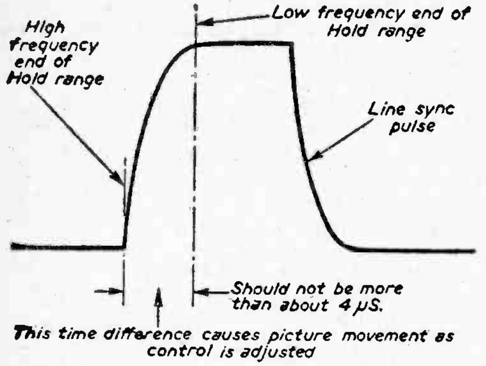


Fig. 19.—Sloping sync pulses cause picture movement when the hold control is adjusted.

interlace, or pairing. A good way of alleviating this trouble is to use a line sync clipper, which acts as a buffer between the two sets of circuits. Another advantage is that it makes it easier to shape the line sync pulses independently, because a larger voltage is available. It can be made to select a portion of the sync pulse from the sync separator and amplify it to 50V or more.

A simple circuit, and its effect on the pulses, is shown in Fig. 16. If double valves are used whenever possible, such as triode pentodes, it is a fairly cheap and simple matter to provide a clipper stage and it is often well worth doing.

While on the subject of frame and line sync inter-action, it is worth noting that the two timebases, and their associated wiring, should be kept well spaced apart so that the relatively large line pulses will not be picked up by the frame oscillator.

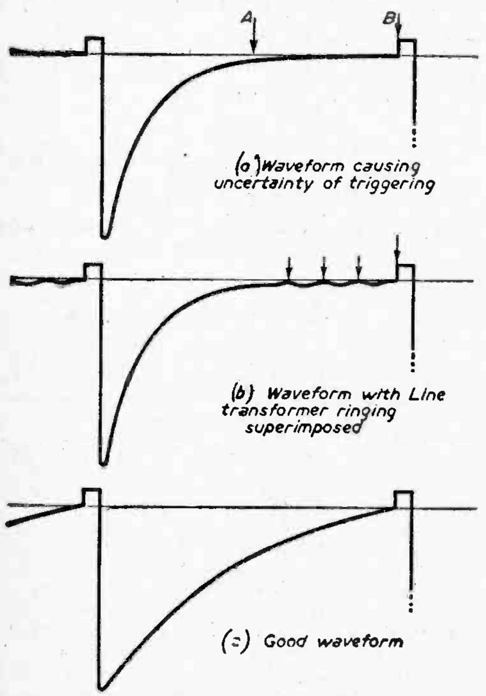


Fig. 20.—Grid waveforms and their effect on synchronisation.

Sloping Sync Pulses

Another means of obtaining better synchronisation in the presence of noise is to shape the sync pulses so that the leading edge slopes appreciably. This contradicts the advice given in many books lacking a practical bias to the effect that the pulse must have a steep leading edge as in Fig. 17. The idea is probably that a steep pulse will carry less noise on the part that triggers the oscillator, thus giving better synchronisation.

The reasons for sloping the sync pulse are twofold. Firstly, if they are shaped by using a simple integrating capacitor connected between chassis and the anode of the clipper, the narrow steep noise pulses will be reduced in size much more than the broad sloping sync pulses, and so will cause less trouble. A circuit that will pass a steep sync pulse will pass a noise pulse just as easily. The effect of integrating a pulse with noise superimposed on it is illustrated in Fig. 18.

Secondly, if a sloping sync pulse arrives slightly too early or slightly too late, the error in the time of firing of the oscillator is reduced by the effect of the slope. These two beneficial effects more than balance the advantages of using a steep pulse.

A by-product of sloping the pulses is to cause the picture to move sideways as the hold control is adjusted. This adjustment causes the oscillator to trigger at differing levels on the leading edge of the pulse, and as it slides up, so the instant of triggering becomes later and later, owing to the slope, and the picture moves to the left (Fig. 19).

The picture must not be allowed to move about too much over the hold range as centring becomes difficult, and there may be a blurred image at the left-hand side of the picture owing to some of it occurring just before the end of flyback, and thus folding over on itself.

It is a good plan to add capacity to the anode of the clipper until the sideways picture movement is about ¾in. on a 17in. CRT when sweeping through the hold range of the desired size. Adding capacity will reduce the size of the sync pulse, thus making the hold range smaller, and this may have to be increased again by using a larger coupling capacitor, or by other means.

The combined effect of reducing the hold range and sloping the sync pulses can sometimes make a very worthwhile improvement to picture quality.

Oscillator Grid Waveform

Some oscillators have an inherently better chance of providing good synchronising performance than others, owing to the slope of their grid waveforms. A bad case is shown in Fig. 20 (a). The grid is charged from a large negative potential towards the cut-off voltage of the oscillator, and then flattens out before being triggered at the end of each line of the picture. It is clear that a very small sync pulse, noise pulse or interference pulse is capable of triggering the circuit anywhere between A and B, and the synchronisation will be all over the place, giving a ragged picture.

In addition to this any spurious oscillation or ringing fed back from the line transformer, as occurs in one type of circuit, and superimposed on this waveform—see Fig. 20(b)—will cause uncertainty of triggering. This results in the raster having a wavy edge.

A more satisfactory case is shown in Fig. 20 (c). Here triggering is only achieved by fairly definite pulses occurring at, or close to, the correct instant in time, and most spurious effects are too small to cause trouble.

It is a good idea, then, to choose an oscillator which has a satisfactory shape of grid waveform. failing this, however, it is sometimes possible to make improvements. In multivibrators, for example, the grid is normally returned to the chassis through a fixed series resistor and the line hold potentiometer. This can be returned to H.T., or an intermediate D.C. voltage, accompanied by a large increase in the value of these two components. This will steepen a flat waveform quite a lot.

The same effect can be obtained in some circuits by connecting a small capacitor between the oscillator grid and the screen of the line output valve (Fig. 21). It also tends to make the output pulse steeper through the action of positive feedback.

Narrow Sync Pulses

The last characteristic of the sync pulse, which needs to be controlled, is the width. A wide pulse contains too much energy, and if this is transferred to the grid of the oscillator it upsets the triggering characteristics. It may, for example, cause electrical backlash in the hold control, thus making a larger hold range necessary and degrading the sync performance.

Another peculiarity is a delay in triggering after the sync pulse arrives. This means that there is always excess raster visible, when turning up the brightness, after the end of the picture and front porch. When centring up the picture, after setting the hold control to its mid position, the raster has to be offset towards the right by means of the centring magnets. In the case of wide angle 110deg deflection cathode-ray tubes there may be a tendency for shading in the top or bottom right hand corners. This is because if the beam is offset in order to centre the picture, it may strike the cone of the CRT instead of the screen.

Another trouble caused by this offsetting of the beam is raster distortion, which shows up as a curve on any vertical line in the picture. Generally speaking, the less control exerted, by means of the centring magnets, the less raster distortion there will be.

An indirect effect of using sync pulses with too much energy is the presence of a spurious locking position of the line hold control which causes the two halves of the picture to be transposed left to right, with the line flyback blanking period appearing as a wide bar down the middle.

All these effects are reduced by making the sync pulse smaller, and this can be done by using a short hold range, i.e. a pulse of small height, and by differentiating it more at the grid of the clipper to make it narrower. This is equivalent to reducing C1 and R1 in Fig. 16.

Compromises

Most of the adjustments made in controlling a particular feature of the sync pulse have an effect on the other characteristics also, and this complicates matters somewhat. In practice it is necessary to adjust each part of the circuit several times in turn in order to obtain the overall result that is wanted, with each characteristic correctly chosen.

For example, increasing the value of the integrating capacitor on the anode of the clipper (C2 of Fig. 16), in order to make the sync pulse more sloping, the height will also be reduced, thus shortening the hold range. The coupling capacitor (C3) will then have to be increased to restore this.

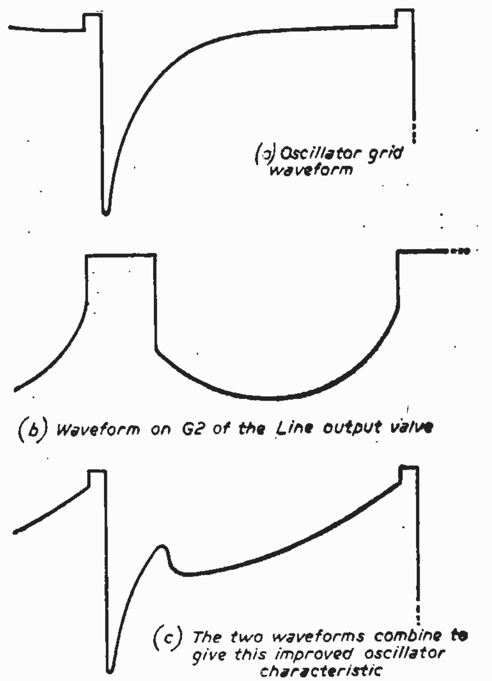


Fig. 21.—Steepening the grid waveform by feedback from G2 of the line output valve.

Conclusion

A fairly close look has been taken at most of the desirable and undesirable characteristics of line oscillator and line sync circuits. We have tried to sort out how they should behave, and some means of achieving this behaviour. At a first glance it all tends to sound rather complicated, but in practice not all of these problems will arise at any one time, as some of them will more or less solve themselves. Most line oscillators, for example, give pulses which are big enough and steep enough to cut off the line output valve without much trouble. Similarly sync circuits often give a pulse which is somewhere near the mark and only need slight adjustment to give a satisfactory performance. In any case a new receiver will doubtless perform sufficiently well to give a satisfactory picture and hours of good viewing.

If time or equipment is in short supply it is far better to have built a receiver, even if it does not work quite as perfectly as it might have done, than not to have built anything at all.

How to service Printed Circuits

VALUABLE HINTS FOR CARRYING OUT REPAIRS

By P. Gaymead-Frazer

ALTHOUGH there is very little difference between servicing a printed circuit receiver and a conventionally wired receiver, there are several points to keep in mind. Some hints gained from practical experience together with some of the manufacturers' recommendations will enable work to be carried out more effectively from the point of view of both speed and efficiency.

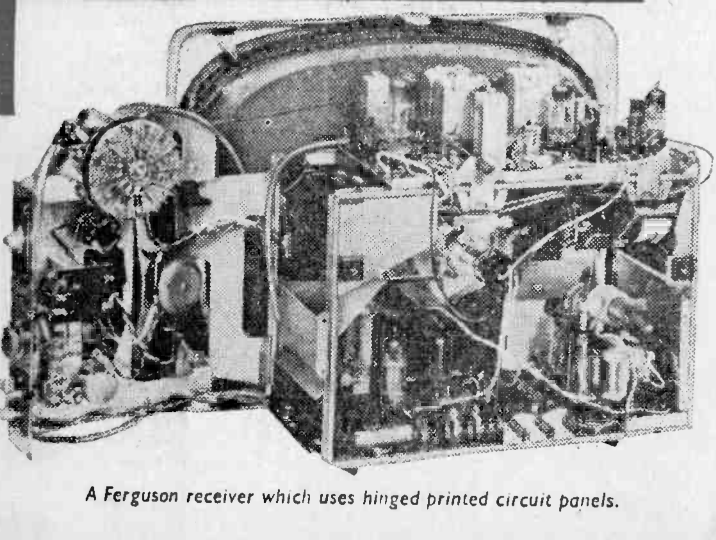
Most work, such as replacement of components; resistors, capacitors, small chokes and diodes, does not require much involved operation and the most useful hint as far as these items are concerned is to clip out the faulty component with a pair of wire cutters as near the component as possible, leaving the wires protruding from the panel. (Fig. 1.) Properly tinned, these then provide soldering tags for the replacement, thus avoiding interference with the panel itself. The fact that the new component may protrude more than the original need cause no concern and this may even be an advantage. The usual heat sink—a pair of pliers or crocodile clip—to grip the wire between the components and the joint when soldering is necessary to prevent heat being conducted to the component, particularly if this is a crystal diode or a transistor (Fig. 2). The type of soldering iron used is important and should have a small pencil-point or wedge-bit and a rating of less than 50W. Among other items which will be found most useful is a fairly bright lamp (about 60W), which is sufficient to show through the Paxolin of a printed circuit board, thus enabling the circuit to be followed when studying the component layout on the opposite side to the copper. This allows the circuit to be observed from component to component and avoids the necessity to view both sides of the board alternately (which can be most confusing). Another valuable tool is a small wire brush to brush away solder while a component is being freed. In most printed circuit receivers the copper tracks have polystyrene dope applied as a protective covering and in some cases a solvent such as acetone will remove it. It should be remembered that this layer of dope prevents voltage readings being taken on the track side of the panel, unless the probe has a sharp point to penetrate it. Thus, voltage readings are best taken at the component side to prevent misleading results which could cause loss of time and perhaps unnecessary replacement of components.

Hair Cracks

A magnifying glass is sometimes useful to enable the track to be examined for hair cracks which do occur. Hair cracks usually result in intermittent operation whereby the slightest movement of the board causes the fault to appear and can be very difficult to trace. When the crack has been located two methods of bridging are possible. One is to solder across the crack, ensuring that the track is cleaned off and properly tinned. The other method is to solder a wire across the crack or gap. It is essential to use the minimum amount of solder as the tracks may be close together and if the solder is allowed to flow over two particular strips, a short may be caused.

Shorts

When a short occurs between tracks, the board may become conductive and it is then necessary to remove the tracks completely at the point concerned. The thermo-plastic adhesive softens with heat and the track can be lifted from the board and the circuit completed with normal wiring.



A Ferguson receiver which uses hinged printed circuit panels.

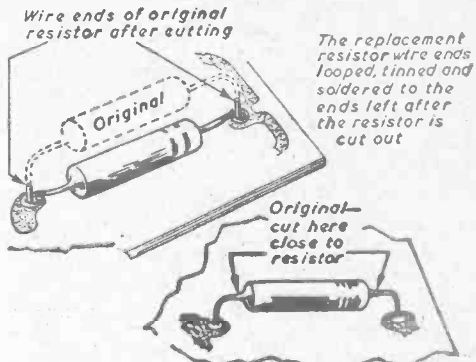


Fig. 1.—Methods of using the original wire ends of resistors, etc., for mounting new components.

Replacing Components with Short Leads

If the lead between the component and the panel is very short it is often possible to cut the actual component in two, clearing away the pieces to leave sufficient wire to be tinned and used as soldering posts. The soldering joint should be made quickly to prevent the heat causing the base joint solder to run and the short lead to come adrift. The following method is advised. Clean the protruding wire end and quickly tin it. Cut the leads of the new component to size and form a small loop at either end. Tin the loops. Slip the loops over the protruding wires and apply the soldering iron to the loop (Fig. 2). This will enable a secure joint to be made in the minimum time. Sometimes components are mounted in such a way that it is not possible to leave a lead protruding when replacement is necessary. It is then necessary to unsolder at the board and this should be carried out as follows. Apply the soldering iron to the connection. When the solder is hot enough, brush it away at the same time removing the iron to prevent overheating. Repeat until the wire is exposed. Brush away any remaining solder and insert a thin knife blade to raise the lead (straighten). Apply the iron to the connection again and "wiggle" the component until the wire comes through. Remove any smatterings of solder which may have been deposited in the vicinity of the joint during this process.

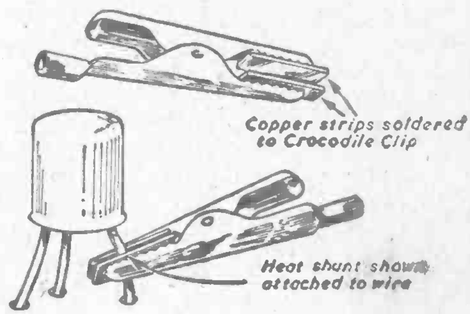


Fig. 2.—Making heat shunts for removing transistors.

If the iron is applied for too long, the hole may be filled with solder and this will have to be reheated when the wire of the new component is inserted.

Some special components have been produced for use with printed panels but there is no reason why normal replacements should not be used in most cases, suitably forming the lead-out wires to fit into the original connections.

Wrapped connections

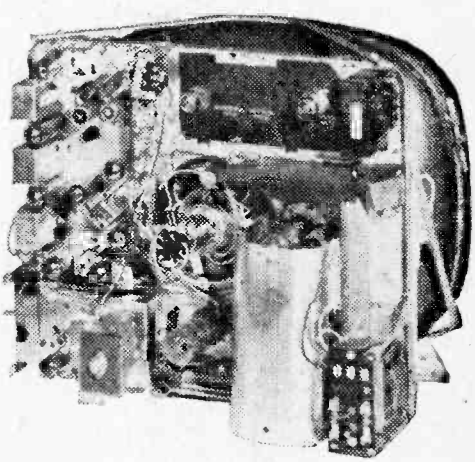
Some receivers include a number of "wrapped" connections to pegs on the printed panels. These connections are made with a special tool and when it is necessary to remake such a connection, a normal soldered joint is advised.

Removing Multi-contact Components

The replacement of items such as I.F. transformers, electrolytic capacitors, valveholders and some types of controls, does tend to present difficulties and unless a special tool for the job is available, such as a multi-headed iron or solder bath, each soldered contact will have to be melted, brushed free and released separately. In most cases each contact can be picked or prised with the knife or pick, brushed clear of solder and freed without too much overheating taking place, but replacement of valveholders should be avoided if possible. Intermittent contact between the valve base and the valve pins can usually be overcome by bending the contacts so that they make a better grip on the pins.

The Future

There is little doubt that if the present trend continues, conventional servicing will become more and more difficult and that "packaged" servicing in which a complete panel is replaced, instead of the defective component, will be the accepted procedure. Many receivers already employ component packs in which several resistors and capacitors are moulded together and fitted as units.



A recent Ekco receiver.

The Practical Television OLYMPIC

FINAL ADJUSTMENTS

By D. R. Bowman

(Continued from page 263 of the February issue)

THE line control is used in the normal way, and once set to the correct point it is doubtful whether it will ever need to be touched again.

The frame control is hardly used as such, because an extremely hard lock is obtained even in the presence of some interference. It is best considered as an interlace control, and should be adjusted on a good signal for perfect interlace or on a weak signal for best interlace. This control will not need to be touched again once set.

The vertical form of the picture is set by means of three controls. Below the chassis the 2k variable resistor across the 500μF condenser is set to give 17·2V drop. Then, linearity I and linearity II are adjusted together to give best vertical linearity. The control on the back vertical of the chassis alters linearity over the picture generally, while the control on the horizontal part of the chassis (adjacent to the frame output valve) affects chiefly the top of the picture. Both affect flyback time to some extent, and should be adjusted to avoid fold-over at the top of the picture. The 2k variable resistor, linearity III, may be varied a little one way or the other to correct linearity, chiefly at the bottom of the picture.

Owing, however, to the characteristics of the frame output transformer specified, if too much use is made of this control a band may appear about two-thirds of the way up the picture, where the lines are closely cramped together. This can be remedied by correct adjustment of the linearity III control.

The above adjustments should be carried out with the height control about $\frac{7}{8}$ advanced. When the linearity is satisfactory, full height can be obtained easily enough.

A small vertical contraction of the picture appears gradually about half to one hour after switching on. This is due to the resistances in the frame output circuit changing as temperature rises. The contraction amounts to only about $\frac{1}{4}$in. on a 17in. screen, and so is hardly worth the trouble of correcting with a thermistor. However, some little vertical overscan should be arranged at first, so that when the set is thoroughly warmed up, the picture is correct. The need for adequate ventilation of the cabinet interior is again stressed.

In this receiver no width control is provided. If the picture width needs to be altered—and the components specified allow of about 7 per cent overscan—slight adjustment of the value of C83 (the 1000pF capacitor across the scan coils) will give the necessary alteration of width. [In the 70deg version of the receiver a width control is used, as it is supplied with the scan coils and transformers.]

Line linearity is achieved by the correct choice of the boost H.T. capacitor C82. A value of 0·1μF is used in the 90deg version, and this may be decreased to 0·05μF eventually if the left-hand edge of the picture is "stretched". In the 70deg version 0·05μF is specified, but may be varied also for best linearity.

At the vertical edges of the picture severe "pincushion" distortion would be obtained if it were not for the presence of small magnets at each side of the scan coil assembly. These are pre-set by the manufacturer; but very slight alteration may be attempted by variation of the horizontal placing by bending the aluminium arms which hold the magnets. Placing the magnets nearer the tube tends to bow vertical outwards, so correcting the "pincushion" effect; vertical lines about $1\frac{1}{2}$in. within the picture should be corrected, not the edge itself for best results.

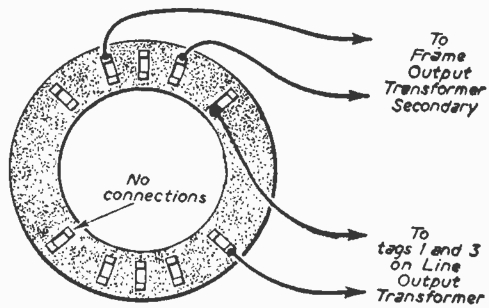


Fig. 20.—The scanning coil connections.

As supplied, the scan coils may fit loosely on the tube neck. This is corrected by packing underneath the scan coil, using folded polythene sheet.

In the 90deg. output transformer no limiting resistor (R90) is included. The EY86, the rectifier supplied, appears to stand up well to the absence of a limiting resistor, using the coating of the tube as the EHT smoothing capacitor. As it is virtually impossible to introduce a limiting resistor without damaging the line transformer assembly, its absence is tolerated. Nevertheless, it will be wise to avoid using the tube at any great brilliance until the ion trap magnet is properly adjusted.

It is essential to make a good connection between the tube outer coating and the chassis. Any convenient method may be used, and a piece of thin brass strip, obtained perhaps from a used cycle lamp battery forms as good a spring contact as any. It should be screwed to the cabinet as far from the EHT connection as is convenient.

This information was omitted from the Table of Winding Data; L.D. consists of 10 turns of 24s.w.g. enamel copper wire, wound on a $\frac{1}{4}$in. former secured with polystyrene varnish, and then supported by its own wires. The former may then be removed if desired.

SERVICING TUNERS

THE MECHANICS AND THEORY OF MODERN TURRET TUNERS

By G. J. King

(Continued from page 237 of the February issue)

TUNER valves may give rise to curious troubles. Excessive picture grain or " noise " is often caused by a low emission double-triode R.F. valve, while undue frequency drift of the oscillator could be caused by the frequency changer valve drifting in characteristic as it increases in temperature. A substitution test is the only real way of revealing tuner valve trouble conclusively.

Sometimes the frequency changer valve appears to be excessively microphonic and will promote ringing on the sound, and dark horizontal lines across the picture when tapped. This may, in fact, be caused by the valve itself and substitution would quickly prove this, On the other hand, an increase in the value of the oscillator anode feed resistor, such as R10 in Fig. 2, may produce the same trouble with a valve which is inherently free from microphony.

Fig. 5.—The result of excessive picture "noise."

Table 2 gave the base connections of valves usually employed in tuners (Feb. issue), while Table 4 lists the components and values employed in the Cyldon tuner of Figs. 1 and 2, but these are fairly typical of all turret tuners of this kind. Table 3 gives a list of the frequencies of the British Television System, which are useful to know when alignment of a tuner unit is undertaken.

Figs. 3 (a) and 3(b) gave typical response curves of the R.F. stage of a tuner on Band I and Band III respectively (Jan issue). Details of alignment cannot be dealt with in this article, of course, as the procedure differs somewhat between tuners of different make, and it is desirable when alignment is undertaken to have at hand the maker's service sheet and alignment instructions.

The Switch Tuner

Fig. 4 (last month) depicts a general view of a switch tuner with the side covers removed. The various switch wafers were revealed, as also were the self-supporting inductors connected between adjacent tags on the wafers. The circuit of a typical switch tuner is shown in Fig. 6, which will be seen to be very much like the turret circuit in Fig. 2, apart from the switched coil system. V1 is, again, a double triode cascode stage, and V2 a triode pentode frequency changer stage.

The input impedance of 75Ω unbalanced (for co-axial cable) and the input matching is provided by the transformer T1. L1 and C2 form a series tuned circuit resonated to the tuner's I.F. output to act as a trap. The reason for this is that in some locations interference from aircraft marker beacons and other such devices occurs within the I.F. channel. The I.F. trap serves greatly to attenuate this interference. Adjustment is carried out by the dust-iron slug in L1 which is accessible from the top of the tuner chassis. With tuners giving the standard I.F., the trap is tunable from 33Mc/s to 40Mc/s.

Coupling from T1 is via C1 on Band III and via C3 on Band I to the switched coils L2 to L8 inclusive, and thence to the first triode of the cascode stage. The output from the cascode stage is coupled to the pentode mixer of V2 by the band-pass coils, L10 to L22 and L26, which are switched

Channel	Sound Frequency (Mc/s)	Vision Frequency (Mc/s)
1	41·5	45
2	48·25	51·75
3	53·25	56·75
4	58·25	61·75
5	63·25	66·75
6	176·25	179·75
7	181·25	184·75
8	186·25	189·75
9	191·25	194·75
10	196·25	199·75
11	201·25	204·75
12	206·25	209·75
13	211·25	214·75

Table 3—The frequencies of the British television system.

CAPACITORS
(all 350V 20per cent unless otherwise stated)

	Function	Value and Rating
C1	V1 Triode 2 grid decoupling	1000pF
C2	AGC decoupling	1000pF
C3	Aerial tuning	5pF ± 5per cent
C4	Neutralising condenser	2pF ± 5per cent
C5	V1 Triode b anode trimmer	0·5—3pF
C6	V1 Triode a cathode decoupling	1000pF
C7	V1 Triode b anode decoupling	47pF ± 10per cent (low inductance)
C8	V1 Heater decoupling	1000pF
C9	V1 Heater decoupling	1000pF
C10	V2 pentode grid coupling	47pF ± 10per cent (low inductance)
C11	V2 oscillator tuning	9·1pF ± 0·5pF (Neg. Temp. N.750)
C12	V2 oscillator trimmer	0·5—3 pF
C13	V2 mixer grid trimmer	0·5—3pF
C14	V2 oscillator fine tuner	—
C15	V2 Triode grid coupling	10pF 10per cent
C16	V2 pentode screen decoupling	1000pF
C17	V2 Heater decoupling	1000pF
C18	V2 Heater decoupling	1000pF
C19	H.T. decoupling	4000pF

RESISTORS
(all ¼W 20per cent unless otherwise stated)

	Function	Value and Rating
R1	AGC feed	10k
R2	V1 Triode b grid voltage divider	220k (10per cent)
R3	V1 Triode b grid voltage divider	220k (10per cent)
R4	V1 Triode a Cathode Bias	100Ω
R5	V1 Triode b anode decoupling	1k
R6	L4 damping	47k
R7	V2 pentode grid leak	100k
R8	V2 Triode grid leak	10k
R9	V2 Pentode screen dropper	22k
R10	V2 Triode anode load	15k 1W
R11	L6 (I.F.) damping	as required

INDUCTORS

L1	Aerial Transformer
L2	Coupling coil
L3	Cascode anode coil
L4	Mixer grid coil
L5	Oscillator coil
L6	I.F. Trimmer

VALVES

V1	PCC84 or 30L1
V2	PCF80 or 30C1

Table 4.—The values of the components in the circuit diagram, Fig. 2 (page 186, January issue).

by S2 and S3. The unwanted coil sections are short-circuited by the switches when not in use, These coils are inductively coupled by L12 and L21 with additional bottom inductive coupling at the higher frequencies provided by the coupling sections L23, L24 and L25.

The oscillator inductors comprise L30 to L36 and are switched by S4. The oscillator frequency can be adjusted for each channel by the fine tuning control C15, and the I.F. output (sound and vision) is fed from the mixer anode coil L28 by the coupling and isolated capacitor C12 to the I.F. input circuit of the receiver chassis. As with the turret tuner, the manual operation of the tuner is controlled by dual concentric spindles, the inner spindle giving channel selection over 13 positions of the switches and the outer spindle giving fine tuning for optimum adjustment on each channel selected.

Incremental Tuning

Since the required change in inductance of the coils from one channel to the next is extremely small, the coil sections mounted around the switches are called increments of inductance, and for this reason the switch tuning method is sometimes referred to as "incremental inductance tuning". A study of the switching circuits will reveal that as the switches are moved from one position to the adjacent position so the total inductance of the circuit, as seen by the valve, is either increased or decreased depending on whether the channel below or channel above is selected.

Servicing Hints

Almost all that has been written concerning the servicing of the turret tuner applies also to the switch tuner, and it is most important to ensure that the alignment is not affected when components are replaced. Any replacement component should have identical physical and electrical characteristics to the original and must be replaced in the same position. As common to all VHF units and

TUBES

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1A7GT	11/9	6AT6	7/-	6K6GT	6/6	7A7	10/6	12K8GT	11 6	50L6GT	9/3	DH63	6/9	ECC84	8/9	EM81	9/3	P61	2/3	U18	8/6	UF42	6/9
1C5GT	9/9	6AU6	7/9	6K7	5/9	7B5	12/6	12Q7GT	5/6	53KU	10/6	DH70	5/6	ECC85	8/3	EM84	9/9	PABC80	11/-	U22	6/9	UF80	9/-
1D5	9/6	6B7	9/6	6K7G	2/3	7B6	9/6	12SG7	6/-	54KU	8/9	DH77	7/-	ECF80	9/9	EM85	10/6	PCC84	7/6	U24	15/-	UF85	9/-
1D6	9/9	6B8G	3/6	6K7GT	5/-	7B7	7/3	12SJ7	5/6	61SPT	11/-	DK32	11/9	ECF82	9/9	EN31	16/-	PCC85	9/3	U25	13/6	UF86	14/6
1H5GT	9/9	6BA6	6/-	6K8G	5/6	7C5	7/6	12SK7	5/6	75	8/-	DK91	6/-	ECH21	14/-	EY51		PCC88	19/-	U26	11/-	UF89	7/3
1L4	3/6	6BE6	6/-	6K8GT	10/-	7C6	7/3	12SN7GT	8/6	77	6/6	DK92	8/6	ECH35	9/9	SMALL	8/9	PCC89	13/9	U31	7/3	UL41	7/6
1LD5	3/6	6BG6G	12/6	6L1	11/-	7E7	9/6	12Y4	9/6	78	7/6	DK96	7/9	ECH42	8/6	EY86	8/-	PCF80	7/6	U33	13/-	UL44	12/6
1LN5	4/6	6BH6	6/-	6L6	9/9	7H7	7/6	14S7	14/9	80	6/6	DL33	8/9	ECH81	8/3	EZ35	6/-	PCF82	7/6	U35	8/9	UL46	9/9
1N5GT	9/9	6BJ6	6/-	6L6G	7/6	7K7	8/-	19AQ5	7/-	83	9/6	DL35	9/9	ECL80	7/6	EZ40	6/9	PCL82	8/6	U37	26/6	UL84	7/9
1R5	6/-	6BR7	9/3	6L7	9/-	7R7	10/6	19BG6G	15/-	90AV	4/6	DL82	9/6	ECL82	10/-	EZ41	7/3	PCL83	11/6	U43	8/9	UM80	9/6
1S4	8/6	6BW6	7/9	6L7G	7/6	7S7	9/6	20D1	9/6	117Z7	10/6	DL91	8/9	ECL83	14/6	EZ80	6/3	PCL84	9/9	U50	6/-	UU6	12/6
1S5	5/3	6BW7	6/6	6L18	9/-	7V7	7/9	20F2	9/6	185BT	16/-	DL92	6/-	EF22	12/-	EZ81	7/-	PEN25	4/6	U52	5/-	UU7	9/6
1T4	4/-	6BX6	5/3	6L19	12/6	7Y4	7/-	20L1	13/6	723A	29/-	DL94	7/-	EF36	3/3	GT1C	7/-	PEN45	7/3	U76	5/6	UU8	16/6
2D21	4/6	6C4	3/6	6LD3	8/6	7Z4	7/6	20P1	11/6	807A	5/-	DL96	7/9	EF39	4/3	GZ32	8/9	PEN46	5/3	U78	5/6	UYIN	11/-
3A4	5/6	6C5	5/6	6LD12	7/6	8D3	3/6	20P3	12/6	807E	3/9	EA50	9d.	EF40	13/6	GZ34	12/6	PL33	9/-	U191	9/6	UY21	11/6
3A5	9/6	6C6	4/9	6LD20	8/6	10C1	11/-	20P4	17/-	808	15/-	EABC80	7/6	EF41	8/6	GZ37	10/6	PL36	11/-	U281	9/6	UY41	6/6
3Q4	7/3	6C9	9/6	6N7	6/6	10C2	13/6	20P5	12/6	955	3/9	EAC91	4/9	EF42	7/6	HABC80	9/6	PL38	14/6	U282	15/-	UY85	6/9
3Q5GT	8/9	6CD6G	18/6	6P1	14/-	10C14	9/-	25A6G	8/-	956	2/9	EAF42	8/6	EF50-BR	2/-	HL41DD	9/6	PL81	9/9	U301	14/-	VR150/30	5/6
3S4	6/-	6CH6	9/3	6P25	9/-	10F1	6/9	25L6G	6/9	2050	3/6	EB34	1/6	EF50-USA		HVR2	7/6	PL82	7/6	U309	12/6	W61M	11/-
3V4	7/-	6D1	9d.	6P28	12/6	10F9	10/3	25L6GT	9/-	5763	10/-	EB41	7/-		2/6	KT32	6/9	PL84	11/-	U329	12/6	W76	5/6
5R4G	9/6	6D2	3/9	6Q7G	6/9	10L14	8/-	25Y5G	9/-	9001	4/-	EB91	3/9	EF54	3/3	KT33C	6/6	PM84	10/6	U339	11/-	W77	4/9
5U4G	5/-	6D3	12/6	6Q7GT	9/3	10LD3	8/3	25Z4G	7/3	9003	4/-	EBC3	9/-	EF80	5/3	KT36	9/-	PX25	16/-	U403	9/6	W81	5/9
5V4G	9/6	6D6	4/9	6R7G	7/6	10LD12	8/9	25Z5	8/-	ATP4	2/9	EBC33	5/-	EF85	7/-	KT44	9/-	PY31	8/3	U404	6/6	X61M	12/6
5X4G	11/-	6F1	5/9	6SA7	5/9	10P13	9/6	25Z6	9/-	AZ31	9/-	EBC41	8/6	EF86	10/3	KT45	8/6	PY32	10/6	U801	19/-	X63	9/6
5Y3G	6/-	6F6G	6/3	6SG7	4/9	10P14	9/6	27SU	16/-	B36	8/6	EBC81	7/9	EF89	8/-	KT61	9/-	PY80	7/-	UABC80	8/9	X65	11/-
5Y3GT	6/6	6F6M	7/-	6SH7	4/6	10P18	8/-	30C1	7/6	B65	4/9	EBF80	8/6	EF91	8/6	KT63	6/6	PY81	6/6	UAF42	9/-	X66	11/-
5Z4G	8/6	6F12	3/6	6SJ7	5/-	12A6	5/3	30F5	7/-	CBL31	21/-	EBF89	8/6	EF92	4/9	KT66	12/6	PY82	6/9	UB41	8/-	X76M	9/6
5Z4GT	11/-	6F13	3/9	6SK7	5/3	12AH7	6/9	30FL1	9/6	CL33	13/-	EBL21	14/-	EF95	6/9	KT81	14/-	PY83	9/-	UBC41	8/3	X78	14/6
6A7	10/-	6F14	9/6	6SL7GT	6/-	12AH8	9/9	30L1	7/9	CY31	9/9	EBL31	21/-	EK32	7/9	KTW61	5/6	PZ30	12/-	UBC81	10/-	X79	16/6
6A8G	9/6	6F15	9/6	6SN7GT	4/9	12AT6	7/9	30P4	12/6	D63	1/6	EC52	3/9	EL32	4/6	KTW63	4/9	R18	12/6	UBF89	8/6	Y63	6/3
6A8GT	13/6	6F16	8/9	6SQ7	6/3	12AT7	5/9	30P12	8/-	D77	3/9	EC90	3/6	EL33	9/-	KTZ63	6/6	R19	12/6	UBL21	14/6	Z63	5/3
6AB8	8/3	6F33	6/9	6SS7	5/-	12AU7	6/6	30P16	7/9	D152	6/6	EC91	4/6	EL35	11/6	L63	2/9	SD6	9/-	UCC84	14/6	Z66	9/6
6AC7	4/3	6H6	2/-	6U4GT	10/6	12AX7	7/-	30PL1	10/6	DA30	12/6	ECC31	9/6	EL37	11/6	LN152	7/6	SP6	8/9	UCC85	8/-	Z77	3/6
6AG5	4/3	6J5	4/3	6U5G	6/3	12BA6	8/-	35L6GT	9/-	DA90	2/6	ECC32	4/-	EL38	12/6	LZ319	7/6	SP41	2/6	UCF80	16/-	Z152	5/3
6AG7	8/-	6J5G	2/9	6V6G	5/6	12BE6	8/9	35W4	6/9	DAC32	9/9	ECC33	4/9	EL41	8/6	MU14	8/-	SP61	2/6	UCH21	14/6	Z719	5/3
6AK5	6/9	6J5GT	3/9	6V6GT	6/6	12BH7	10/6	35Z4GT	5/6	DAF91	5/3	ECC34	9/-	EL42	9/6	N37	11/-	SU25	15/-	UCH42	7/9		
6AL5	3/9	6J6	4/-	6X2	8/9	12C8	8/6	35Z5GT	8/6	DAF96	7/9	ECC35	6/9	EL84	7/-	N78	15/-	SU2150A	4/6	UCH81	8/6		
6AM5	4/6	6J7	7/9	6X4	5/6	12E1	12/6	42	7/6	DF33	9/9	ECC81	5/9	EL91	4/9	N108	12/6	T41	7/6	UCL82	11/3		

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circuits, lead lengths, position of components, especially coils, are very critical and any undue disturbance will cause detuning of the unit.

Under normal conditions of operation, the switch tuner is inherently stable and it is, therefore, unlikely that the need for realignment will arise. A valve can usually be replaced without upsetting the tuning of the unit, but certain component changes may make realignment necessary, and in these cases it is recommended that the unit is returned to the makers or their servicing agents.

If excessive picture " noise " occurs (see Fig. 5) on all channels, but in particular on the ITV programme, the cascode valve V1 should first be checked, preferably by substitution. If " noise " still persists, a check should be made on the electrodes of this valve, as often a feed resistor goes high in value and its associated capacitor develops a leak which may either burn out the resistor or cause it to go very high in value.

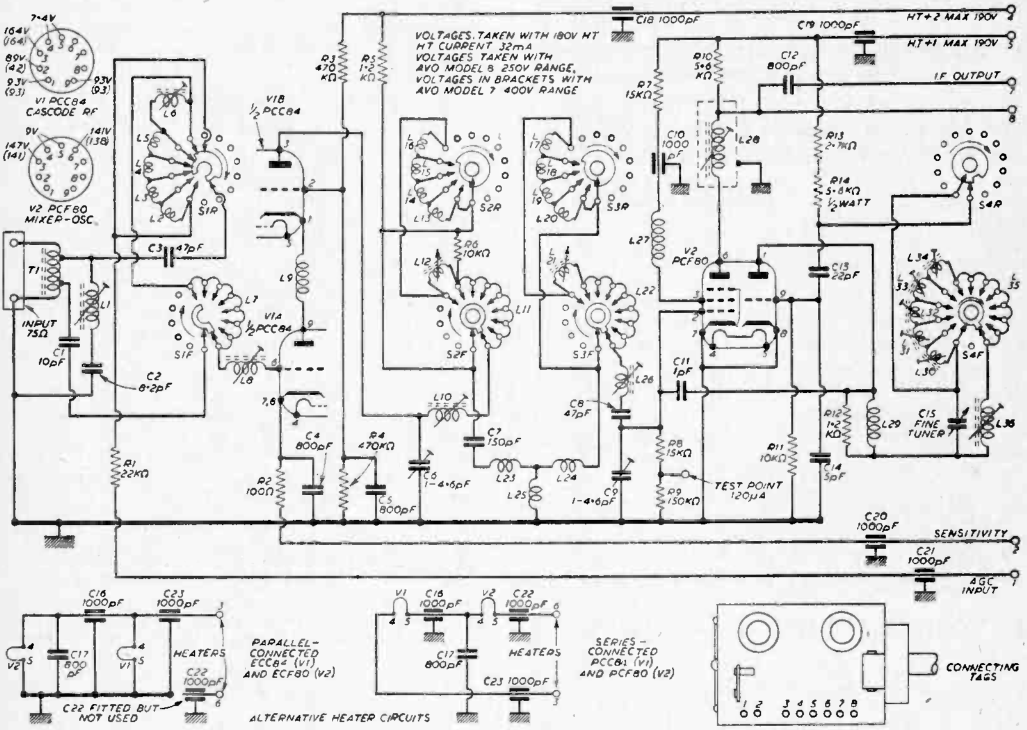

Fig. 6.—The circuit diagram of a switch tuner.

B.-K. OSCILLATION

(Continued from page 299)

It should be noted that B-K interference may not only affect the set which is responsible, but may also be radiated and interfere with a neighbour's receiver. There is also a possibility that the offending set may not display the interference itself, as it may not be tuned to the channel on which it is responsive, though the neighbour's set may be tuned to the affected channel and display the interference.

Windscreen Wiper Interference

In the above connection, an effect known as " windscreen wiper interference " is often present. The single or double vertical column of short irregular lines, in this case, tend to swing to-and-fro horizontally across the screen, rather like a windscreen wiper—hence the name. It is often caused by a form of B-K oscillation generated in a nearby receiver which is tuned, say, to Band III while the affected receiver is tuned to Band I, or vice versa. Since the interference, as already described, is a function of the line flyback, and since the flyback does not occur precisely at the same time on both the BBC and ITV receivers, there occurs a random drifting of the interference across the screen as described. This is due mainly to the random variation between the line sync pulses of the BBC and ITV transmitters.

Excessive radiated interference of this kind should first lead to a check of the screening of the line output stage. The introduction of a small R.F. choke in series with the line output valve anode lead, as close as possible to the valve, invariably clears the radiation.

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.

AERIAL EXPERIMENTS

SIR,—I have recently had an experience which I would like to pass on to other readers, as I think it would be found very valuable. I had scrapped an old home-made receiver and bought a commercial set together with an elaborate aerial array which I put up, using as my guide the aerials on the houses near me, which had been put up by a local man. When I tried the set out, the results were not at all encouraging, and after a lot of messing around I decided to experiment with the aerial. I turned this slightly and the signals came up so much that the set was overloaded, and beyond the range of the contrast control. The signal was obviously being diverted in some way and the layout of neighbour's aerials was definitely not the best in my case. Eventually I had to fit an attenuator. The moral is, of course, that each installation must be seen to individually, and you should not be necessarily guided by neighbours. — G. PLESSAY (Northampton).

SYSTEM CHANGES

SIR,—I was interested in your recent Editorial and comments which I have since seen in the daily Press concerning the proposed changes in our television system. I am at a loss to know on whose side to range myself, as one should always be tolerant and prepared for improvements, but in view of the expense of a TV set I would not like to have to buy a new one. Yet we cannot stand in the way of progress, and surely the ultimate in television is colour, which I understand from Press comments does call for a line change. Let us hope that the industry is not guided by its need to make money and that they do not ignore the public upon whom, after all, their livelihood depends.—G. DE BIERE (N.W.).

VALVE RADIATION

SIR,—I read Mr. Langbourne's letter in the January issue with interest and would like to point out that I have had a somewhat similar experience. I had found that a valve in my set was running very hot and not wishing to remove the screen I read the notes on your "Olympic" receiver and was intrigued by the note about blacking the screen. I did this and the set failed to perform as before, slight instability being noted. I went over everything carefully and eventually put it down to the blackening of the screen, so I washed it off with turps. When replaced, the set was in its original form. I could not see how the blackening could have affected performance, so I carried out the process again, only to experience exactly the same trouble. It then dawned on me what was happening. I had painted the entire surface, outside and inside the can, with the result that when it was put into the skirt, it did not make good contact. Part of the paint was scraped off it is true, but when I scratched away all the paint up to the top of the skirt level, and when I put the can in place, the set worked perfectly and I have hopes that the life of the valve will be considerably increased by the heat dissipation. — R. OLIVER (Chelmsford).

EHT GENERATION

(Continued from page 300)

The square wave across the secondary winding is rectified by the voltage doubling circuit D2, D2 and a 5kV d.c. supply is obtained across the output terminals. The actual value of this can be adjusted by means of the supply volts and the full output is obtained when a 30V input supply is in use.

Transformer Design

The transformer uses a core of M and E.A. type 226N HCR laminations. This gives the double window transformer construction shown in Fig. 9.

The EHT winding is split into two halves as shown in the diagram, and extreme care must be taken to insulate these windings from the core and other windings. Several layers of 0·005in. polythene tape must be used on either side of the two windings concerned and they must not be allowed to approach nearer than ¼in. to the sides of the former.

The leads-out and interconnecting lead are insulated with polythene sleeving for the same reason.

The completed transformer should be impregnated in molten wax by dipping it in the wax for about 10min. to allow this to fill all the gaps and crevices between windings.

This is necessary both to prevent the ingress of moisture and also to damp any tendency for transformer buzz at the low oscillation frequency employed.

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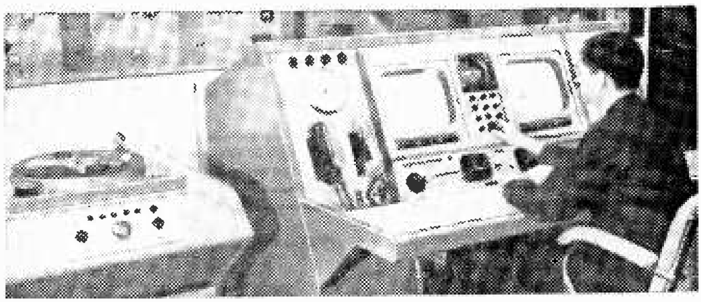

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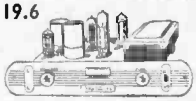

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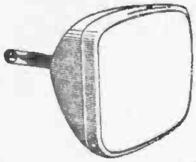

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FUL 1514

Valves and their Habits

SOME OF THE CHARACTERISTICS OF VALVES USED IN TV RECEIVERS By H. Peters

(Continued from page 268 of the February issue)

LAST month the valves dealt with were the EB91 to the U26.

U191

The U191 is a current efficiency diode with 19V 0·3A heater and octal base. Earlier versions marked "QS" were very susceptible to cathode flaking, but the later version marked "NL" is free from this defect. (See U25, February issue.)

U251

A 9 pin efficiency diode which is equivalent to the U329. It usually fails due to a heater fault. A PY81 may be fitted as an emergency replacement without alteration.

U282

This is an octal based efficiency diode, which is found in receivers in the immediate pre-ITA era. Seldom fails but can be destroyed by insulation breakdown of the heater winding on the mains transformer. Should this occur, the cheapest cure is to earth the heater winding via a 100Ω resistor, and rewire the stage to accept the U301.

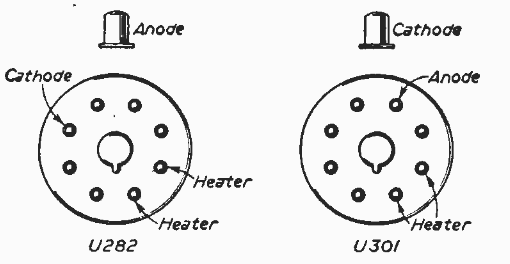

Fig. 6.—To use a U301 valve in place of a U282, the anode and cathode leads are transposed.

U301

An efficiency diode with similar characteristics to the U282 but different basing, this valve is the 200mA heater equivalent of the U191, and has as its main fault symptoms cathode flaking causing bright flashes during warming up, and a short-circuited heater. (See U25.)

U801

An early 200mA 80V H.T. rectifier which has four separate anodes and two separate cathodes. Fault symptoms are purple flashes, open heaters and fuse-blowing. Signs of age are loose white powder in bottom of envelope and a metallic patch on the glass above each anode. It is commonly used with 50Ω or 100Ω surge limiters in the anode circuits. These surge limiters should all be checked at the same time as the valve is replaced to ensure that current is taken evenly by all sections.

UU8

A 4V H.T. rectifier used in early TV receivers. Although spells of trouble with this valve were experienced, many failures were not due to the valve itself. Condensation between the valve and its holder is a frequent cause of trouble especially in console models where the power unit is near ground level. 50Ω surge limiters fitted in each anode lead will often prolong the life of the valve.

6F12 See EF91.

6F19 See EF85.

6F23

A 6·3V high gain pentode which may be used as an emergency replacement for a 30F5 and EF80 in series circuits.

6K25 See T41.

6/30L2

This valve is a general-purpose 6·3V 0·3A double triode. Gives most trouble in timebase circuits where synchronism may take a while if the valve is slow heating. Faulty valves usually produce a higher timebase speed than normal, and also give rise to variable contrast symptoms when faulty in AGC circuits. For versatility the triodes are equal to each other and also have the same characteristics as the triode sections of the 30FL1, 30PL1, 30PL13.

6L18

A 200mA triode used as a frame amplifier in 5 channel sets. Symptoms of low emission in frame timebase are foldover at the bottom of the screen, and a short picture. It may often be exchanged with the less important "spot wobble" valve where fitted.

6P25

The 6P25 is an early sound and frame output valve. Common faults are open circuit filament and frame foldover at the bottom of the screen. Valves suffering from the latter trouble may be changed over with the sound output valve, if of the same type. Emergency equivalents are 6P1, EL33 or 6V6.

6U4

This 6V efficiency diode frequently develops an open circuit heater.

10C2

A 28V 100mA triode pentode whose commonest fault is that the heater blows soon after switching on. Check the heater voltage if repeatedly troublesome and fit a small resistor across the heaters if necessary to absorb surplus.

10P13

A 40V 100mA output tetrode used as a frame and sound amplifier. It has the normal fault symptoms of a frame output stage—i.e. varies when tapped, the bottom of the picture becomes cramped and Barkhausen-Kurz (parasitic) oscillations, producing "telegraph wires" across the centre of the picture. When withdrawing old 10P13s make sure that the glass envelope does not pull out of the metal base. Should it do so the heater pins are those adjacent to the keyway.

10P14

This 40V 100mA output pentode is the octal based version of the 10P13. Used in one receiver as the frame and sound output pentodes in which it is common to find that if one valve fails the other may shortly follow suit.

20D1

The 20D1 is the 9·5V 200mA version of the 6D2 (see EB91 for fault symptoms). A 6D2 may be used as an emergency replacement but it will take longer to heat up.

20F2

An 11V 200mA R.F. pentode used mainly as a sync separator. It seldom gives trouble except in the frame output stage of one certain receiver. If the valve fails in the sync separator stage a 6F15 may be used as an emergency replacement.

20L1

This 12·6V 200mA double triode is most troublesome in flywheel sync/line oscillator stages where the symptom of a low emission valve is high line frequency. Frequently valves of some age are slow heating and involving constant adjustment of the line hold control during the first half hour. If the verticals are bent, suspect heater cathode leakage.

20P1

A 38V 0·2A line output valve whose low emission fault symptoms are lack of width with the picture cramped on the right. The emergency replacement is the 20P4, although this may give excessive width and EHT.

20P3

This 20V 0·2A output tetrode is the 200mA version of the 10P14. It gives the normal low emission symptoms in the frame timebase, i.e. cramped bottom of screen. (See 10P14.)

20P4

The 20P4 is a 38V 0·2A line output valve. A smaller and more economic version of the 20P1. In certain receivers with self-oscillating line output stage, a specially tested valve coded "GP" should be used.

20P5

The 20V 0·2A version of the 10P13, is comparatively trouble-free. (See 10P13.)

30C1 See PCF80.

30C15

The frame grid version of the 30C1 which cannot be interchanged due to different basing.

30F5

This is a 7·3V 0·3A R.F. pentode. Its high gain occasionally produces an unstable I.F. stage unless the decoupling is perfect. An EF80 or 6F23 may be used as emergency replacement in series heater circuits.

30FL1

This 9·4V 0·3A beam tetrode/triode is a general-purpose valve with various applications. Works hardest as an A.F. amplifier/sound output valve judging by the frequent replacements for low gain. Commonest faults are open circuited heater and heater-cathode breakdown. The latter may produce perplexing symptoms in VHF/TV combined receivers where the offending valve is in the part of the set which is out of circuit on radio. (See also 6/30L2.)

30L1 See PCC84 and 30L15.

30L15

The frame grid version of the 30L1 with almost double the gain on ITV. This valve has the same basing and heaters as the 30L1 and has successfully been fitted as its replacement despite the fact that it is not an equivalent. The present R.F. trimmers on the turret tuner normally have to be readjusted (usually unscrewed about 3 turns) but no other alteration appears necessary and the stage does not overheat. At odd times the substitution of the 30L15 for the 30L1 has produced beat patterns due to self-oscillation on certain channels, but the sensitivity of the receiver in such cases has usually been found sufficient to make the change of types unnecessary. The PCC89 has not been found to interchange well with the 30L15.

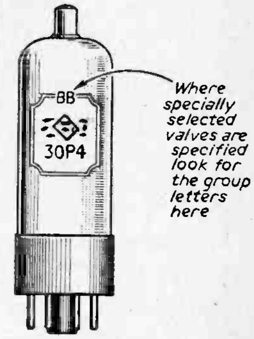

Fig. 7 (right).—A 30P4, showing the group letters for selected valves.

30P4

This 25V 0·3A line output valve is the 300mA version of the 20P4. Like the 20P4 it has a few special batches which have been tested to meet certain requirements. It is interchangeable in an emergency with the PL36. The 30P4 has the habit of producing spurious oscillations on Band III, especially in timebases designed for wide-angle scanning. These take the form of ragged vertical lines on the left of the picture, and may be cured by substitution or by fitting ferrite beads in the anode lead.

30P12

This 12·6V 0·3A tetrode is the 0·3A equivalent of the 20P5. It suffers the usual troubles of a frame output valve, namely microphony and cramped picture at the top and bottom. Sometimes it exhibits bright flashes when tapped. It is interchangeable in an emergency with a 30P16 (PL82), preferably with adjustment of bias.

30P16 See PL82.

30P18

This valve is a 15V 0·3A tetrode. A recent development for the 110° frame timebase. It is equivalent to the PL84.

30PL1

This 13V 0·3A triode beam tetrode is a useful sound amplifier/output valve with 5W output and widely used in frame timebases up to 90° scanning angle. The triode section seldom gives trouble but the tetrode suffers the normal symptoms in frame timebases, i.e. the picture takes a long time to reach full height, is cramped at the top and bottom, and the picture jumps when the valve is tapped. It will replace the PCL83 in an emergency, but the reverse does not always apply.

30PL13

A 16V 0·3A triode beam tetrode which is the 110° scanning-angle version of the 30PL1. It exhibits the same fault symptoms, plus the vertical "judder" which may not occur until an hour or so from switch-on and is preceded by lack of interlace.

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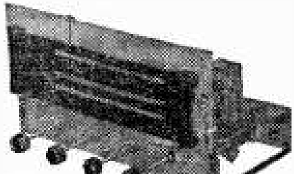

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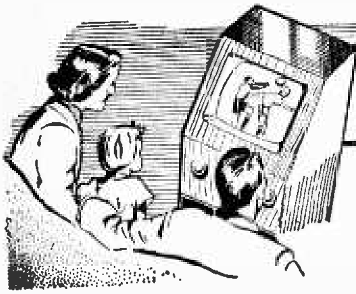


UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

TIME and tide wait for no man—especially if he happens to be a television executive. Gone are the happy-go-lucky days of early television, when a minute or so either way didn't matter very much and a late-running show was accepted with a tolerant shrug of the shoulders. The producers may have glanced at the clock occasionally, but if the special master-clock system failed, sufficient accuracy could be ensured by glancing at their wrist watches. Some people even claimed that an egg-timer or (on outside broadcasts) a sundial, could be used!

Split Second Timing

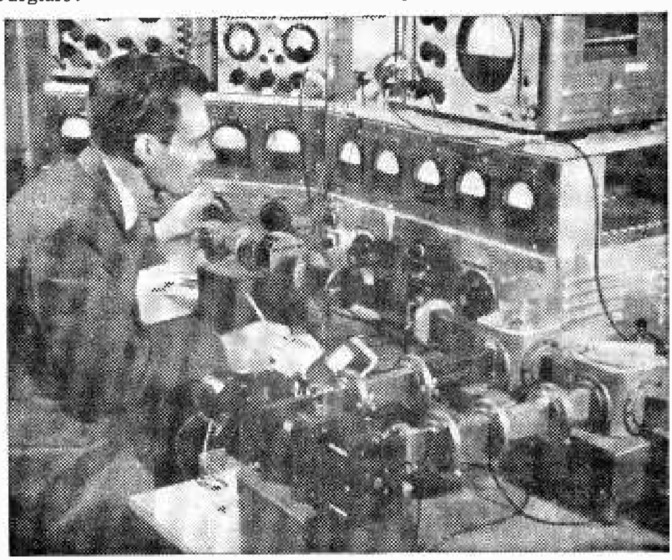
Then came the ITA and all television clocks suddenly had to be in step. The advertising slots, time spots and all the other jargon of the new world of commercial television stressed the importance of time schedules and a new look appeared on all programme charts, even the BBC's. Accuracy to half a second was the order of the day for ITA programme contractors to ensure that the advertising spots retained their full measure of time. Secret signals and electronic cue dots were quickly evolved for dealing with "natural breaks" which arrived at abnormal time spots, such as an interval which was two or three minutes away from a normal break for advertising. These warned the control engineers of each ITA programme company of an impending break, to be ready for inserting their own announcements, advertising or promotional.

Public Service "Spots"

Not all breaks are filled with advertising on the ITA. Instead, various "promotional" announcements are made of forthcoming attractions and programmes, trailers of future films or special films of national importance provided by the Central Office of Information. The technique of integrating these promotional and public service films into the programmes has been taken up by the BBC, who are always ready to drop in a 30 second or one minute (or more) film of this type to bring the programme back to its correct timing, if it is getting ahead. If it's on the slow side, then the end rolling-title is likely to move very fast indeed to catch up the odd seconds. Very elaborate slave-clock systems are now installed at all British Television Stations, BBC as well as ITA. The master clock is a key piece of apparatus, guarded against temperature changes and humidity as well as burglars!

BBC Gains Ground

Published TAM Rating regional charts have indicated a steady rise in popularity of BBC programmes. During one recent week the BBC's "Charlie Drake" show shared third place with "Sunday Night at the London Palladium" and "Bootsie and Snudge" in the London area Top Ten, and "Charlie Drake" came second only to "Bootsie and Snudge" in Ulster region. The same BBC show also scored near misses in all the other ITA areas. I had the privilege of glancing at the unpublished dossier which is circulated to the programme companies, which gives in great detail the upward drift of the BBC programme curve. However, the ITA programmes are particularly



In the Radio Communications Group (G.E.C. Research Laboratories), an engineer assesses the performance of a travelling wave amplifier, type TWC5. This device has been specially developed for a wideband microwave radio system—the first planned to operate in this country in the 6,000 Mc/s band. The system has already been chosen for the new British television link between Carlisle and Kirk o'Shotts.

well established in the industrial areas of the North, Tyne Tees regularly scoring ratings of up to 79per cent with the top BBC programme trailing behind with less than 50per cent. The Midlands is another area in which the viewers are almost permanently switched on to the ITA programmes. There is no denying that the combined production efforts of the four major ITV Companies will take a lot beating. It rather looks as though four heads are better than one—and those four heads are determined to hold their place in public appreciation.

Old Films

1960 ended up with a number of very old films finding their way into both BBC and ITA programmes. Two real vintage ones stood out: "42nd Street" and "Prisoner of Zenda", with Ronald Colman, both films being made about thirty years ago. Frankly, I thought they had an interest greater than their historical curiosity value—though this was important. Seeing famous film stars, some of them now old or dead, appearing in youthful roles is interesting and rather sad. It is another reminder that time flies.

The ITV programme companies are continuing to diversify their activities and investments in many ways. The first and most obvious one that they plunged into, before they got "out of the red" at the beginning of commercial TV, was in the publishing business — the production and distribution of their own weekly programme magazines. This undertaking was approached with great caution at the beginning, the first of these publications being a joint one, with special regional editions for each separate area. Later on, individual local regions, especially those with overlap areas, felt the need for a programme magazine of a different format, more likely to be recognised on those bookstalls which sold magazines for two (or even more) ITV areas. Thus, TWW published a newspaper type of magazine, and Tyne Tees have produced a local programme paper with a very individual cover. Ulster TV has its own lively local programme magazine and now Westward is intending to have its own weekly, with coloured front page.

Manchester Progress

Granada have taken journalism seriously with a number of attractive brochures explaining the organisation and techniques of their television centre at Manchester—not forgetting the enormous building programme which has transformed the Quay Street site into one of the most striking pieces of architecture in the cotton city. Granada make continuous technical progress within those buildings, too. Their newest studio will include a new type of lighting grid, with telescope suspension for lamps; a further improvement on the system that was installed in their first large Manchester stage. Trends in TV studio operation are towards suspending as much as possible from the roof (or the lighting grid)—not only lamps, but monitor sets, pieces of scenery and anything that can be conveniently kept off the floor. This gives greater freedom of action for camera movement on the stage and economises in stage space. Every lamp can be operated on its own individual dimmer. Audience participation programmes play an important part in a programme company's output, and ingenious methods have been evolved for getting their seats on and off the stages in the minimum time. Nevertheless, I always feel that the "improvised Theatre" effect of temporary chairs gives the flavour of the parish hall rather than the professional theatre.

Palladium Show

"Sunday Night at the London Palladium" is just about the most consistently successful television show in the world and ATV must be congratulated in keeping up the high standard of over two hundred transmissions — right from the beginning of commercial television. It is, of course, straight forward televising of a music hall show with the minimum of arty-crafty camera tricks, plus the "Beat the Clock" competitions, which are always put over in a high tension atmosphere of the "race against time". Personally, I don't care for the "Beat the Clock" feature, but I am one of a minority. The fact remains that the show has maintained its high standard because of its first-class music hall talent, slick presentation (including use of a stage revolve), attractive stage settings, music (especially the exciting introductory signature tune), and its warm audience participation atmosphere. This atmosphere can only be authentically obtained in a theatre. Notice the difference in audience shows when played at the BBC's London TV Theatre (Shepherd's Bush Empire) or at Granada's Chelsea Theatre (formerly Chelsea Palace), or the BBC's Manchester TV Theatre (Junction Theatre, Hulme). The audiences always seem more relaxed in the genuine theatre auditorium as compared with a few rows of seats in a TV studio.

Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 335 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

COSSOR 927

I am unable to trace the fault in this set. All the valves have been checked and are in order. The picture closes in from both sides, and it also starts to roll down and sideways. If I leave the set off for a few days it seems to be fine for about half an hour until it has warmed up, then the same thing happens.—S. Postlethwaite (Egremont).

The usual causes of your faults are low H.T. Suspect the smoothing condensers, or a faulty 21A6 line output valve. A slight heater-cathode leakage on the tube will also produce the same symptoms.

PYE 17T

I am having trouble with the picture on this receiver. I cannot obtain a flicker of light although I am receiving the oscillating whistle which the picture always follows. The controls make no impression at all; there is a complete black-out although the sound is perfect.—P. Pims (Huyton).

Check the 3 valves inside the EHT compartment, especially the EY86 EHT rectifier, and also look to see if the ion trap magnet on the tube neck has worked loose and moved from its original setting.

SOBELL T121

There is lack of width on this set. It is a 12in. screen but I can only obtain about a 9in. picture. I have changed the ECL80, the PL81 and the PY80, also the 600pF condenser which goes from the EY51 to the plate of the PY80 but it makes no difference. I find if I disconnect the 600pF I can fill the screen but the picture is not so good, small print cannot be read but close-ups are good. There is plenty of brightness.—N. Dunstan (Pennywell).

We would advise you to check the PY82 H.T. rectifier, also the 75kΩ resistor to pin 8 of the PL81. If necessary check the 270Ω bias resistor of the PL81, from pin 3 to chassis.

FERGUSON 998T

There are a pair of white lines varying in height on the screen, also shading on the left of the picture. This can be seen when there is a blank screen. The picture also rolls upwards when the set is switched to no transmission (this is done for setting of ion trap magnet). The shading is not noticeable when the full picture is on, though the lines are quite prominent at times, I have fitted a new PY81, PY82 and PL81. I have a service sheet for the 992T series but notice that most of the timebase circuit is different.—C. Belcher (Beckenham).

The two drifting white lines are probably caused by line timebase interference from a neighbour's receiver tuned to a channel different from that to which your set is tuned. For example, if the neighbour is working on BBC, then interference would occur on ITA, or if the neighbour is tuned to ITA, then the interference would occur on BBC. This is known as " windscreen wiper " interference. It is aggravated by a poor aerial signal on the affected channel or by mismatch at the feeder.

The hum effect should first lead to a check of the electrolytic smoothing capacitors, and secondly to a check of the grid circuit components in the PL81 valve.

PURATONE

This is a 12in. receiver about 5 years old and I believe it is a Raymond chassis. The set was not used for about six weeks, and on switching on a picture could not be received although the sound was in order. I made a brief test and found that all filaments of all valves and the tube were in order but I could not see the rectifiers because they are in a metal container. Could this be due to the failure of the EHT rectifier which is on the left side of the set?—J. Bailey (New Malden).

The Puratone 12in. (equivalent Raymond F60), is more than five years old. If this is the type of set, however, you should check for spark at the U37 (EHT rectifier) anode. If a good spark is present but the U37 does not light change the valve. If there is no spark, change the PL81, check the ECL80 and the resistor to pin 8 of the PL81.

G.E.C. ADAPTOR FOR BUSH 24A

I would like to fit the above adaptor, Model BT204, to my receiver. However, the adaptor had an I.F. output of 34Mc/s vision and 38Mc/s sound while the Bush has an I.F. of 16-19Mc/s. Could I alter the oscillator coils in the adaptor to give the lower I.F. and if so how many turns would I have to add or what capacitance would need to be shunted across?—A. Mason (Whitley Bay).

Not only the oscillator circuits, but also the I.F. output circuits of the tuner would need to be altered. This is a job which requires a good working knowledge of practical circuitry and suitable test instruments for alignment, etc.

MARCONI VT150

The small resistor wired from the I.F. output transformer to the small wire-wound resistor on top of the tuner has burnt out. Could you tell me the value of this resistor?—J. Stephens (Grantham).

The resistor has a value of 1k but the PCF80 and

0·003μF decoupling capacitor should be checked for shorts before replacing it.

ENGLISH ELECTRIC C4FM

The picture has gone out of focus and I cannot see any controls for re-focusing. I have had PL81 line output valve tested and was told that it was very low, and also that the metal rectifier was low. Could this be the cause or is it a failing tube—now 3½ years old?

This is a 21in. model, and I was wondering if it is possible to exchange it with a 17in. G.E.C. tube which is only 18 months old.—M. Ward (Glasgow, W.3).

You should replace the PL81 and the metal rectifier. This will no doubt restore the focus to an extent depending upon the efficiency of the tube. A focus lever is provided on the focus magnet.

The G.E.C. tube may be fitted if desired; the outer conductive coating will have to be chassis-connected and the EHT connection modified.

ULTRA V14-53

This set has suddenly lost ITV sound and picture. Bars appear as the fine tuner is adjusted but will not form a picture. 30C1 and 30L1 on the turret tuner have been changed without any effect.—E. Stutt (Blackwell).

If the 30C1 is not at fault, check the tuner unit resistors, particularly R14 (6·8k), which is wired from the H.T. point in the oscillator coil to pin 1 of the 30C1. This is a fairly large resistor wired under the turret near the 30C1 valve base.

FERRANTI T1023

The set is 14 months old and since it was new the BBC picture has always been partly torn and every time the picture content exceeds a certain brightness, the picture flickers badly. The dealer says that the aerial is at fault but as the ITV is now becoming affected I do not agree. Until recently it was very good.—R. Hobbs (Port Talbot).

The aerial could well be at fault if distinct ghost images can be seen to the right of the normal images. Rotating the aerial may help. Apart from this however, the U26 EHT rectifier could be at fault if the effect only occurs on bright scenes. This valve is located in the lower right side section.

MARCONIPHONE VT59DA

The line hold is critical in setting and needs constant adjustment I have changed the line-scan output valves V11 and V10, the sync separator and line-scan oscillator.—F. Rothwell (Denton).

You should check the 4μF decoupling capacitor of the video amplifier and the components associated with V10, C20, C44 and C45. Check R42 if necessary.

PHILIPS 1768U

After switching the set on, I find that there is a hum on the loudspeaker coupled with a streaky picture and also flyback lines. On rotating the turret channel switch the fault disappears, only to occur a few minutes later. Am I right in suspecting the fault to be in the turret?—A. Bullards (Co. Shields).

Whilst one of the tuner valves, probably PCC84, could be at fault, you should not overlook the 250μF main smoothing capacitor which may be intermittently defective.

PYE VT4

I am having trouble trying to hold the picture steady. When I adjust the horizontal hold it brings back the picture almost. I then lose it completely. Then I cannot get the picture back without the horizonal control and have to leave the set to cool off. Then the picture returns, pulling.—R. Margetson (Neath).

Try replacing the ECL80 line oscillator valve which is just in front of the "black box" EHT compartment.

G.E.C. BT5147

This set has suddenly gone dead. I have checked the house mains and the set fuses and find them to be in perfect order. It was working normally then suddenly went blank as if there were a power cut.—H. Millington (Manchester 12).

If valves do not light and you know power is arriving at the receiver, then the trouble may be due to either a faulty valve or the barretter, or the Brimistor. If the valves light up and there is still no sound or picture, it could be the metal rectifier. In either case check points mentioned and also the mains dropper which applies to both heater and H.T. circuits.

MURPHY V250

The picture faded but I managed to get it back again by breaking and making the mains supply. The sound is perfect and all the valves have been checked and found to be in good order. The picture has now disappeared completely and there is no raster at all.—C. Rowley (Rainow).

Check the valves inside the screened compartment, namely the 20P4 line output valve (which may have a dry joint top cap), the U251 efficiency diode, and the U25 which is inside the line output transformer and involves replacing the entire transformer.

EKCO T205

This set is fitted with a converter and up to now has been working perfectly. However, all I can now obtain is the sound only on both channels. The raster is satisfactory but it seems to have a slight ripple which slowly rises up the screen. I have tried changing round several valves, but it has not helped matters in any way.—F. Ware (New Cross, S.E.14).

Your C.R. tube would appear to have a heater-cathode short and this can be checked usually by tapping the base gently. A cure for this condition is to fit a low capacity filament transformer on the tube heater pins (13V) after removing all the existing wiring to these pins (1 and 12) and taping these wires back individually.

McMICHAEL MP17

The trouble is low sound. It is quite audible when the television is working but can hardly be heard on VHF with the volume full on.—B. Farmer (Stourbridge).

An efficient VHF aerial should be in use, either separate from or attached to the TV aerial. Check the tuner unit valve PCC84 and then the PCL82 valve on the lower right side of the I.F. panel.

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COIL PACK, 2/9. Contains 7 way, 4 pole Yaxley switch, 12 coils and transformers mounted on switch. H.F. choke, 00075 uf V/Condensers, 12 capacitors, varied. 6 mixed resistors, tag boards, nuts, bolts, screws. Aluminium partition chassis, size 4 x 4 x 5in. Post and packing 2/3.

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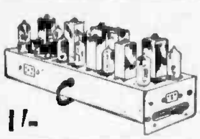

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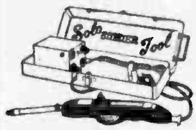

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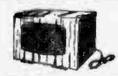

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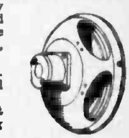

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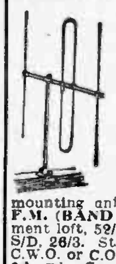

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ELECTRO SERVICES & CO.
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ULTRA D700

This set is for channel 1 only. Could you please tell me what coils to alter to receive channel 5?—F. Hood (Seaham).

The coils to be altered are the aerial coil (remove required turns, say 4 and shunt resistor), R.F. coil (remove 3 turns and resistor) and the oscillator coil (halve valve of shunt capacitors). Do not alter the I.F. coils.

H.M.V. 1826

On the above set the sound has cut out and there is no picture or raster. When the set is switched on for a few seconds there is excessive heat and a smell of burning insulation in the field coil of the speaker. I have been able to try all the valves by substitution except V13 and C70-71 and these seem to be in order. There is no timebase whistle from the speaker, only normal mains hum.—J. McCarthy (Sheffield).

There is definitely a short on the H.T. line and it may well be between the field coil and the yoke of the speaker. Disconnect the field coil and substitute a wire wound resistor of about 100Ω. Although there will be no sound, the presence of H.T. will be obvious.

DEFIANT TR1247

Could you please tell me the sound and vision I.F. of this set as I have been unable to obtain a circuit diagram, and would like to convert this receiver for ITA, using a turret tuner.—R. Peak (Gravesend)

The TR1247 has an I.F. of 10-14Mc/s. A suitable turret tuner would therefore be a Cyldon E10L or a Brayhead 10P.

PETO SCOTT TV1719

For a few weeks now the BBC picture has been very ragged and out of focus. On switching the set on the other evening the picture had gone on both stations, although the sound was in order. I smelt something burning so removed the back and found the 22pF condenser smoking. I replaced this with a new one. On switching on, the picture appeared for a moment then faded away and once again the condenser was smoking hot. The filament on the tube is in order and all three valves have been tested, PL81, EY86, PY81, and found to be satisfactory.—L. Wheatley (Walthamstow, E.17).

The 22pF must be a special high voltage (6kV) ceramic. If an ordinary working voltage capacitor is fitted it will break down immediately.

VIDOR CN4213

A Brayhead turret tuner has been fitted to the above set. A fault has developed in the tuner resulting in complete loss of picture and sound. I can still obtain a raster and also a faint signal through set. How can I return the set to BBC only when I disconnect the tuner; i.e. what must be done to return it to its former status minus the converter.—J. Smith (Lea Mills).

Check the tuner unit valves PCC84 and PCF80 and the voltage supplies to them, via the feed resistors. We will advise you further if necessary.

To revert to normal Band I working, remove the rear right side tuner plug and replace with an EF80 valve, remove the adaptor from the second socket and insert another EF80.

TRACING AND CURING LOW EHT

(Continued from page 304)

Surge Limiting Resistors

In many receivers each of the four anodes of the H.T. rectifier in this valve is fed independently via a wire-wound surge limiting resistor of about 60Ω as shown in Fig. 3. The anodes are, therefore, effectively in parallel, so that if one surge limiting resistor breaks down, the receiver continues to operate at reduced H.T. and EHT voltage. This puts an extra load on the anodes which are left in circuit, and the valve usually starts to arc internally and blow the H.T. fuse. The remaining surge limiting resistors are subjected to an increase load and shortly another breaks down, and the H.T. and EHT voltages drop further.

Nevertheless, the valve may operate for quite a long time under this condition, with a receiver exhibiting the symptoms already described.

The same applies to those receivers using two H.T. rectifier valves in parallel. Each valve is usually fed via its own surge limiting resistor or resistors, and the effect as described under "Surge Limiting Resistors" is also likely to occur. In addition, there is the possibility that one rectifier may fail completely—from the emission angle, anyway. The set will continue to work, but with substantially reduced H.T. and EHT voltage.

Sets using metal rectifiers invariably give the symptom of reduced width as soon as the rectifier is in need of replacement. If the D.C. output voltage is less than the A.C. input voltage, the rectifier should be replaced. It is interesting to note that a fall in H.T. voltage by only 15per cent will cause the EHT voltage to reduce by a ratio far in excess of this amount. This is because the line output valve is called upon to operate under reduced anode and screen voltages, and in most sets a full scan and the requisite value of EHT is obtainable only when the line output valve is working at optimum efficiency.

QUERIES COUPON

This coupon is available until MARCH 22nd, 1961, and must accompany all Queries sent in accordance with the notice on page 331.

PRACTICAL TELEVISION. MARCH, 1961.

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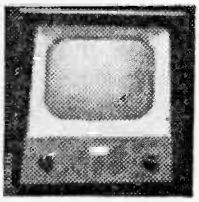

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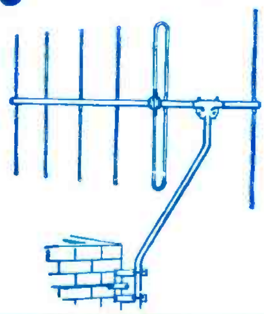

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SINGLE, 50 pF, 2/6; 75 pF, 100 pF, 160 pF, 7/-. Solid dielectric 100, 300, 500 pF, 3/6.
SPEAKER FRET. GOLD CLOTH. 17in., 25in., 5/-. 25in. x 35in., 10/-. Tygan 4ft. 6in. wide, 10/- ft.; 2ft. 3in. wide, 5/- ft. Brown, green or red. Samples S.A.E.

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1R5	7/6	6K8G	7/6	EABC80	8/6	HABC80	12/6
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3V4	7/6	6SJ7M	6/-	ECC84	9/6	PCC84	9/6
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6BW6	9/6	12BE6	8/6	SP61	3/6		
6D6	6/-	12K7	6/6	EF91	5/-	UBC41	9/6
6F6G	7/6	12Q7	6/6	EF92	5/6	ECH42	9/6
6H6	3/6	35L6	9/6	EL32	5/6	UF41	9/6
6J5	5/6	35Z4	7/6	EL84	8/6	UL41	9/6
6J6	5/6	80	9/6	EM81	9/6	UY41	8/6
6J7G	6/6	807	5/6	EZ40	7/6	U22	8/6
6K6GT	6/6	954	1/6	EZ80	7/6	VR105	9/6
6K7G	5/6	EA50	1/6	E1148	1/6	VR150	9/6

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70/- ea. from stock.
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HIGH GAIN TV PRE-AMP KITS
BAND I BBC
Tunable channels 1 to 5. Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)
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Tunable channels 8 to 13. Gain 17dB. ECC84 valve. (PCC84 valves if preferred.)

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only ⅞in. x 3/16in., 6/6.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2½in. sides, 7 x 4in., 4/6; 9 x 7in., 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.

JASON F.M. TUNER COIL SET. 29/-. H.F. coil, aerial coil. Oscillator coil. Two I.F. trans. 10.7 Mc/s. Ratio Detector and heater choke. Circuit book using four 6AM6, 2/6.
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BBC TRANSISTOR RADIO. Med. and Long Wave. Two transistors and diode. Complete kit, 32/6, phones 7/6 extra. Deaf Aid Earpiece with Special Lead, 12/6. Details 6d.

CYLDON TURRET TELETUNER
I.F. 33/38 megs, complete with frame-grid valves, 30C1, 30L15. With coils for channels 1 to 5 and 8 to 11. Brand new, price 45/-. operating data and circuit supplied.
IDEAL for P.T. "OLYMPIC".

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CERAMIC CONDS. 500 v., 0.3 pF to 0.01 mfd., 9d.
SILVER MICA CONDENSERS. 10% 5 pF to 500 pF. 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance (±1 pF) 1.5 pF to 47 pF, 1/6. Ditto 1% 50 pF to 815 pF, 1/9; 1,000 pF to 5,000 pF, 2/-.

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465 Kc/s Slug Tuning Miniature Can. 1⅜ x ⅞ x 1in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.
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16/450v.	3/-	8+16/450v.	3/9	32+34/450v.	6/-
16/500v.	4/-	8+16/500v.	5/6	32+32+32/350v.	7/-
32/450v.	3/9	16+16/450v.	4/3	50+50/350v.	7/-
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