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"HIS MASTER'S VOICE"

" HIS MASTER'S VOICE "

SERVICE MANUAL

for

TELEVISION RECEIVER

CHASSIS TYPE E1

20 valves plus 5 metal rectifiers and 17" aluminised, electrostatically - focused Emiscope picture tube

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THE GRAMOPHONE COMPANY LIMITED
(Incorporated in England)
HOMEBUSH - - - N.S.W.

PART No. 682 - 4681

TV Receiver — Chassis Type EI

SPECIFICATION

POWER SUPPLY:
200, 210, 230, 240V. A.C., 50 cycles per second.

CONSUMPTION:
160 watts.

CARRIER FREQUENCIES:

Channel	*Vision Carrier*	*Sound Carrier*
1.	50.25 mc/s	55.75 mc/s
2.	64.25	69.75
3.	86.25	91.75
4.	133.25	138.75
5.	140.25	145.75
6.	175.25	180.75
7.	182.25	187.75
8.	189.25	194.75
9.	196.25	201.75
10.	210.25	215.75

In two of the switch positions marked with dots between Channel 10 and Channel 1, a straight-through I.F. connection is provided from the aerial input socket. This is to provide for the future attachment of a U.H.F. adaptor, if required, and to facilitate servicing.

AERIAL INPUT:
Provision for 300 ohm balanced twin, or 75 ohm coaxial feeder.

INTERMEDIATE FREQUENCIES:
Vision I.F. — Carrier .... 36.0 mc/s.
Sound I.F. — Carrier .... 30.5 mc/s.

FUSE TYPES:
2 amp. — Mains.
250 mA — H.T. (2 off) Anti-surge type.

VALVE COMPLEMENT

V1	6CW7	R.F. Amplifier.
V2	6BL8	Frequency Changer
V3	6BX6	1st I.F. Amplifier
V4	6BX6	2nd I.F. Amplifier
V5	6BX6	3rd I.F. Amplifier
V6	6BL8	Video Amplifier and Cathode Follower
V7	6N3	Power Rectifier
V8	6N3	Power Rectifier
V9	6BL8	Gated A.G.C. and Noise Inverter
V10	6BL8	Sync. Amplifier and Sync. Separator
V11	6BX6	Intercarrier Amp.
V12	6BX6	Limiter
V13	6AL5	Ratio Detector
V14	6BM8	Audio Amplifier and Audio Output
V15	6BM8	Blocking Oscillator & Vertical Output
V16	6BX6	Reactance Valve
V17	6BL8	Horizontal Osc. and Horizontal Drive
V18	6CM5	Horizontal Output
V19	6W2	E.H.T. Rectifier
V20	6R3	Damping Diode
MR1	0A70	Vision Detector
MR2	39K2	Frame Sync. Clipper
MR3 MR4	2.0A79	A.F.C. Phase Discriminator
MR5	39K12	Focus Voltage Rectifier
C.R.T.	5/3T	Emiscope Picture Tube

Caution

The normal B+ voltages in this receiver are dangerous. Use extreme caution when servicing this receiver. The high voltage at the picture tube anode (15,000 volts) will give an unpleasant shock but does not supply enough current to give a fatal burn or shock. However, secondary human reactions to otherwise harmless shocks have been known to cause injury.

Always discharge the picture tube anode to thechassis before handling the tube.

The picture tube is highly evacuated and if broken it will violently expel glass fragments. When handling the picture tube, always wear goggles.

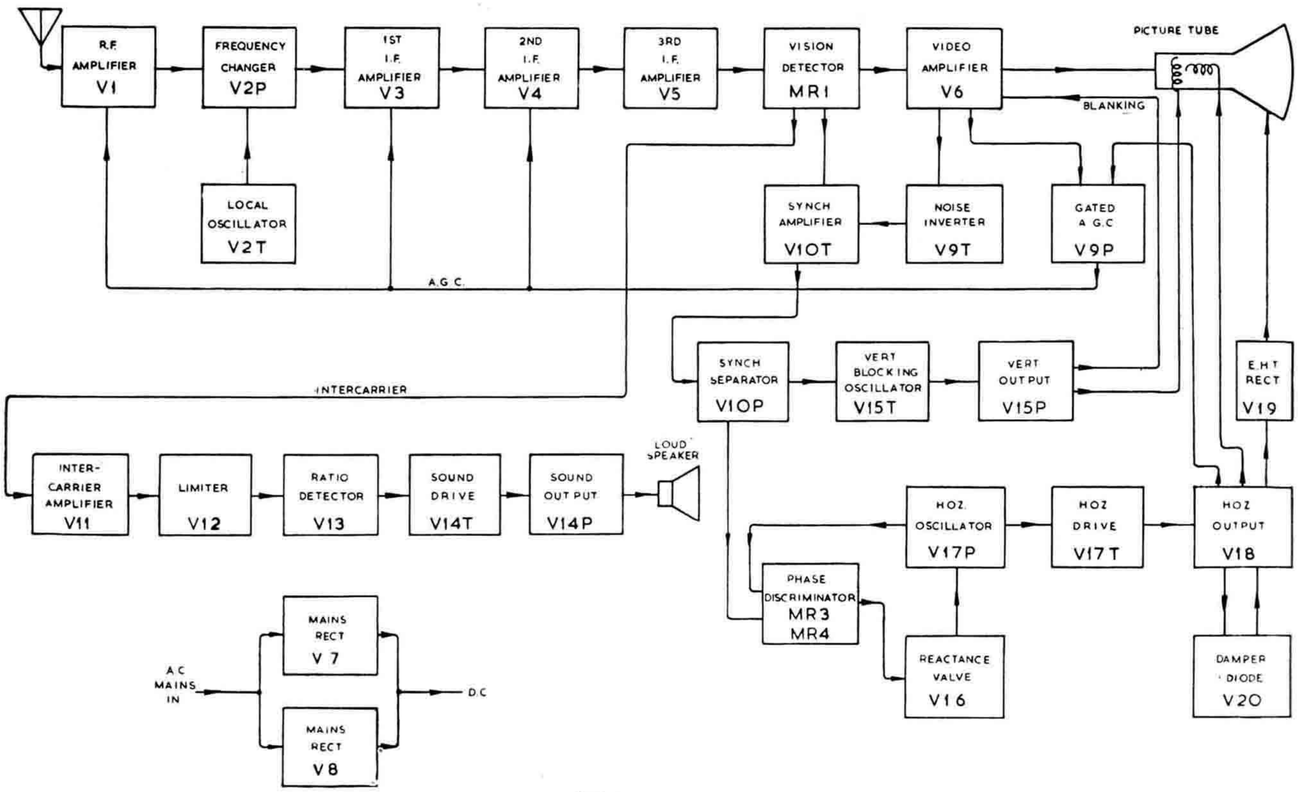


FIG. 1

CIRCUIT DESCRIPTION

R.F. UNIT

The tuner section contains two valves. The two halves of the first valve (V1) in "cascode" connection form the R.F. Amplifier. Tuning of the input circuit between channels is accomplished by switching increments of inductance on the rear card (Card 4) of the switch-tuner. The input to this circuit is matched for 75 ohms. An aerial coupling unit which is, in effect, a balance-to-unbalance transformer, enables a 300 ohm feeder to be used if required. The alternative inputs, 300 ohm and 75 ohm, are provided on the rear of the chassis.

A peaking inductance couples the anode of V1A to the cathode of V1B. This is fixed-tuned to maintain performance in the high frequency channels.

Coupling between the R.F. Amplifier V1 and the Frequency Changer V2 is through a two-section band-pass circuit. The two inductance legs of this circuit have increments switched by Card 3 and Card 2 of the switch. The pentode section of V2 acts as mixer, while the triode is the local oscillator. Tuning (channel selection) of the oscillator is by means of switched inductance increments on Card 1 (front card). In addition, a small variable capacitor provides fine tuning, and the control shaft for this capacitor is concentric with the control shaft for the switch.

Intermediate frequency output from the mixer is via the first I.F. transformer mounted on the tuner and a short 75 ohm cable which forms part of the bottom capacity coupling to the I.F. Amplifier.

In two of the three switch positions not numbered (the two positions adjacent to Channel 1) the oscillator H.T. is removed, and an additional inductance, L16, switched into the input circuit on Card 4. This gives a straight-through connection for intermediate-frequency signals fed into the aerial socket to facilitate servicing, and to provide for the possibility of a U.H.F. adaptor being attached.

I.F. AMPLIFIER

The tuner I.F. output is coupled to the grid of the first I.F. Amplifier V3 and tuned by coil L52. There are three stages of I.F. Amplification using double-tuned inter-stage coupling circuits. Top capacity coupling is used between the two inductance elements of each circuit which are wound on separate formers. Trap circuits are coupled to I.F. coils L52 and L56, the former (L53 and C25) tuned to the sound I.F. and the latter (L57, C35 and C36) to the sound I.F. of the adjacent sound channel. The first two I.F. valves, V3 and V4, have A.G.C. applied to them and consequently have small unbypassed resistors in their cathode circuits to minimise detuning of their grid circuits by A.G.C. bias.

Coupling the last I.F. stage to the vision detector diode is a further double-tuned circuit (IFT2), coupled inductively to L59.

VIDEO AMPLIFIER

The detected video output from germanium diode MR1 is amplified in the pentode section of V6 and fed via a cathode follower (triode section of V6) to the cathode of the picture-tube. To compensate for high-frequency loss in the cathode circuit of the cathode follower, additional drive at high frequencies is applied to the picture-tube grid from a small anode load in the cathode follower. L60 and L62 also assist in maintaining the high frequency response. A 5.5 mc/s trap circuit (L61 and C42) is used in the video amplifier cathode to eliminate the 5.5 mc/s sound component from the vision signal.

INTERCARRIER SOUND AMPLIFIER

The frequency-modulated 5.5 mc/s component from the video detector is applied via transformer IFT3 in the bottom of diode load R67 to the intercarrier I.F. Amplifier V11. A single-tuned circuit couples V11 to the limiter V12. Neutralisation is applied to amplifier V11.

Output from the limiter is demodulated by ratio-detector V13, and after passing through the volume control the audio output is amplified by the two-stages in V14. Audio feedback is derived from the voice coil winding of the speaker transformer and fed back into the cathode of V14 triode and pentode sections.

SYNC. SEPARATOR

Video output from the detector diode is taken from across the diode load R67 and applied to the grid of the sync. amplifier (triode section of V10) and, after amplification and inversion in this stage, is fed to the grid of the pentode section of V10. Grid leak bias on this stage ensures that the valve conducts only on sync. tips and the anode waveform consists of frame and line sync. pulses only.

NOISE INVERTER

The triode section of V9 is normally cut off by D.C. bias on its cathode. Input is also applied to this cathode from the cathode circuit (R35 and C43) of the video amplifier V6. In normal operation the triode is cut-off, but if impulse interference signals with amplitudes greater than that of the sync. pulses are present then the triode of V9 will be driven into conduction and amplified negative interference pulses will appear at the anode. Since the anode load resistor (R59) is common to both the noise inverter and sync. amplifier, these negative pulses will cancel or invert the interference pulses that would otherwise occur in the anode of Sync. Amplifier V10. This ensures that impulse interference does not affect the operation of the sync. separator.

GATED A.G.C.

The same output waveform from the video amplifier cathode is fed to the cathode of the A.G.C. amplifier (Pentode section of V9). The polarity of this waveform is with sync. tips negative, and the valve is biased so that it can conduct during sync. pulses. However, it can only do this if there is a positive pulse applied to its anode via C55 from the line output transformer during line flyback. This overcomes the possibility of the valve conducting on impulse interference occurring during the period between line sync. pulses, and makes the A.G.C. operation immune to impulse interference.

The current through the valve depends on the height of the sync. pulses and this current flows from chassis via R56 and R55 to the anode of the valve. C54 smooths out the current pulses that flow in this circuit and develops a steady D.C. potential at the junction of R56 and R55, which is the A.G.C. bias for the I.F. valves. Note that this potential is negative with respect to Chassis. The contrast control adjusts the control grid voltage of the A.G.C. valve and thereby determines the cathode potential (and hence the peak video detector output) at which the A.G.C. valve conducts. In this way it sets the A.G.C. voltage, and hence the I.F. gain, so that while the input signal varies, the output signal remains constant at the desired level.

A.G.C. voltage is also applied to the R.F. amplifier from the junction of R53 and R54. This latter resistor, together with C53, form a smoothing filter for the pulses appearing at V9 anode. The junction of these two resistors is clamped to earth potential by the control grid of V1 acting as a clamping diode and not until the anode of V9 falls to a value fixed by the H.T. voltage divided by the ratio of R53 to R54 does this point become unclamped. A "delayed" bias is therefore provided to the R.F. stage, ensuring that maximum R.F. stage gain is available with low signal levels to minimise noise from the frequency converter.

VERTICAL DEFLECTION CIRCUITS

Mixed line and frame sync. pulses from the anode of the sync. separator are applied through the frame integrator R90, R91, R92, and C81, C82, C83, and via diode MR2 to the blocking oscillator anode (triode half of V15).

The integrator separates the frame sync. pulse from the mixed pulses. Diode MR2 prevents the blocking oscillator discharge pulse feeding back to interfere with the line synchronising circuit.

Adjustment of the "Vert. Hold" control varies the time constant of the blocking oscillator grid circuit and hence the frequency of oscillation.

The hold control is returned to the junction of the "Height" control VR4 and resistor R95, so that a compensating action is obtained against variation of frequency when the "Height" control is adjusted.

The vertical output stage is the pentode section of V15. The sawtooth waveform from the blocking oscillator is applied to the grid of the output amplifier, and a sawtooth current appears in the vertical output transformer. Feedback is taken from anode back to grid through shaping circuits to linearise the deflection current waveform in the transformer secondary. In addition to the "Vertical Linearity" control in the feedback path, there is a factory adjustment of R103, R104, R105.

To ensure that the retrace lines on the picture tube are blanked out, a flyback pulse from V15 pentode anode is applied to V6 cathode follower grid and thereby to the picture tube cathode, cutting the latter off during frame flyback.

HORIZONTAL DEFLECTION CIRCUITS

Automatic frequency and phase control of the horizontal deflection circuits is obtained by means of a sine-wave type "flywheel" circuit. Incoming line sync. pulses from the sync. separator anode are compared in a double-germanium-diode phase discriminator with the sine waveform taken from a winding on the oscillator transformer. Fixed bias for the reactance valve V16 is derived from the negative voltage developed in V17 triode grid leak, and is initially set by a preset potentiometer labelled "Reactance Bias." Any variation of the horizontal oscillator phase from that of the incoming sync. pulses causes variation of the reactance valve bias about that initially set up as above. This is in such a manner as to vary the effective capacitance shunted across the oscillator coil and hence to correct the oscillator frequency. Also shunted across portion of the oscillator coil and thus controlling the free running frequency of the oscillator is the "Horizontal Hold" control. V17 pentode is the oscillator valve which uses the screen grid as the oscillator anode. Current pulses appear in the plate of V17, producing negative voltage pulses which, after differentiation in the coupling circuit C99 and R115, are applied to the grid of the horizontal drive portion of V17. The positive peak of this waveform causes conduction in the triode, and a negative pulse is produced at its anode.

This negative pulse is timed to cut off the horizontal output valve V18 at the end of a line scan. When V18 is cut off sharply, the magnetic field that has been established in the horizontal output transformer during the scan collapses and the oscillatory circuit comprised of the transformer inductance and stray capacitances tends to "ring." However, only one-half cycle of oscillation occurs before damping diode V20 starts to conduct. During the "flyback" time the magnetic energy has established itself in the reversed direction, and the picture tube spot has returned to the left-hand side of the screen.

When the damping diode conducts it permits current to flow at a controlled rate through part of the transformer. This current, passed by the auto-transformer into the deflection coils, forms the initial part of the horizontal scan. As the damper ceases to conduct the line output valve takes over and supplies the necessary current to complete the scan, at which point a further negative pulse on the grid of V18 starts the cycle over again.

During flyback a high voltage pulse is produced at the anode of the E.H.T. rectifier V19, which is peak-rectified, and then smoothed by the capacitance between inner and outer bulb coatings of the picture tube, and supplies the E.H.T. of approximately 14,000 volts.

Similarly, a smaller pulse taken from a tap on the auto-transformer, is controlled by the focus control, rectified by metal rectifier MR5 and applied to the focus electrode of the picture tube.

INSTALLATION

The receiver is shipped from the factory with the picture tube installed and all controls pre-adjusted for normal operation. It should only be necessary to ensure that the mains tapping is correctly adjusted for the mains voltage existing in the particular area and a suitable aerial connected to the aerial input socket. Either 75 ohm or 300 ohm feeder may be used. In very strong signal areas it may be necessary to use an attenuator in the aerial lead to avoid overloading the receiver. The various operating controls should be checked for proper operation, *and their use demonstrated to the purchaser* as described in the installation manual. It is necessary to remove the back of the cabinet to gain access to the mains adjustment panel.

LINEARITY

Apart from the normal and pre-set operating controls available on the front panel, there are two adjustments at the rear of the receiver for vertical and horizontal linearity. Normally these should only need adjustment if a component change is made in the deflection amplifiers.

The "Frame Linearity" control affects the top 1" or so of the picture, and should be adjusted so that this part has the same spacing of lines as the rest of the picture.

(A factory adjustment of the linearity of the central part of the vertical scan is carried out by means of the jumper wire connecting to a junction of the resistors R103, R104, R105. It should not be necessary to alter this setting unless component changes are made in the feedback circuit of the vertical output valve, V15. If this is done then, the jumper on this resistor chain should be connected in the one of the four ways which produces best linearity of the centre and lower parts of the vertical scan. The extreme top of the picture can be taken care of by the "Vertical Linearity" control as mentioned above).

The "Line Linearity" control should be adjusted only with the aid of a meter connected across the horizontal output valve (V18) cathode resistor. With the meter set to a suitable current range, the linearity control should be set to produce a minimum current indication.

With a 1000 ohm per volt meter on the 100 milliamp scale the indication obtained should be between 40 and 55 milliamps. (Note that this represents an actual valve current of 80 to 110 mA.).

PICTURE SHIFT

The electrostatically focussed Emiscope picture tube in this receiver may require only one adjustment on installing the receiver in a new location, and that is to centre the picture. Small shifts in position of picture may occur due to the effect of the earth's magnetic field in different locations. The picture may be re-centred by rotating the two wire-ring shift magnets on the rear of the deflection yoke.

PICTURE TILT

If the picture is not square with the edges of the mask, the deflection coils should be rotated by gripping the rotating plate on the rear of the deflection assembly by its finger-grips, and turning the coils until the picture is squared up. It may be necessary after this operation to centre the picture by means of the shift magnets.

LINE BALANCING TRIMMER

This adjustment is located on the back of the deflection yoke assembly and balances the capacities between deflection coils. The control should be adjusted to minimise the amount of vertical deflection of horizontal lines on the left-hand side of the picture. This deflection appears as a waviness in the horizontal lines.

FUSES

Three fuses are provided, one in the mains circuit and two in the H.T. circuits. The H.T. fuses are of the anti-surge type so that they give adequate protection and yet do not blow with switching on surges. Ensure that they are replaced with similar types.

N.B.: Early production sets had ordinary fuses. See note on inside of fuse cover flap for replacement information.

DISMANTLING

REMOVAL OF CHASSIS

Disconnect the receiver from the mains supply and remove aerial plug.

Remove the back panel and pull off knobs from the main controls on the front of the receiver. It is not necessary to touch the pre-set control panel.

In table models, remove the loudspeaker from the side of the cabinet.

Remove the four screws underneath the cabinet which secure the chassis.

The chassis may then be withdrawn from the cabinet.

REMOVAL OF PICTURE TUBE

Having removed chassis from cabinet, disconnect the picture tube socket and E.H.T. connector.

Undo the four knurled screws holding the deflection yoke assembly to support straps and slide these out of the slots in the brackets.

Disconnect the yoke assembly from the chassis and remove from picture tube.

Remove the two screws holding the top of the tube clamping ring to the sloping side supports and allow the tube to pivot about the two bottom screws on the ring until the tube is lowered forward on to its face on some soft support, such as a thick book or block of wood covered with felt.

Slacken the two screws in the tube clamping ring and lift tube out.

N.B.: The picture tube should be carefully handled and should never be placed face down on a bench. Always ensure that it is placed on a soft, clean surface such as felt, so that the tube face does not become scratched. Whenever possible, keep tubes in their original manufacturer's carton.

REPLACEMENT OF PICTURE TUBE

With clamping ring laid forward as above, place the picture tube in position on its face. Ensure that the conductive rubber band is in position, and then tighten clamping screws.

Pivot clamp ring into its vertical position, and insert the two top support screws.

Replace yoke assembly on neck of tube with its tag panel and trimmer on the underside.

Replace support straps and tighten knurled screws.

Replace deflection yoke connector, picture tube socket and E.H.T. connector.

N.B.: The rubber band around the picture tube is made from conductive rubber and should never be replaced by a similar non-conductive rubber band.

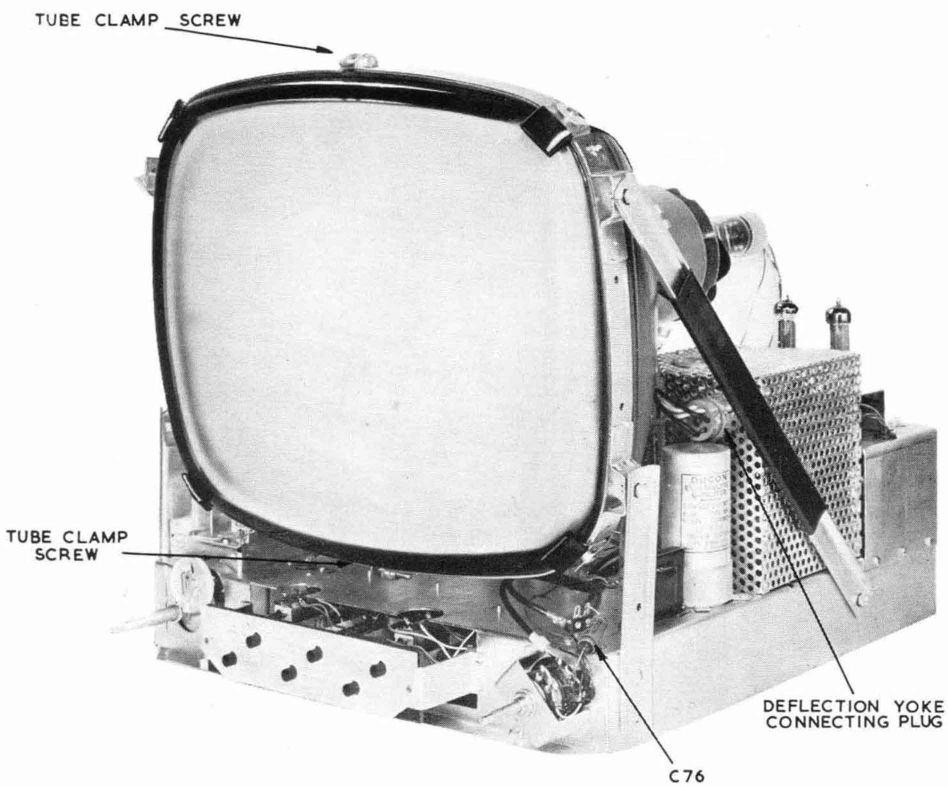


FIG. 2

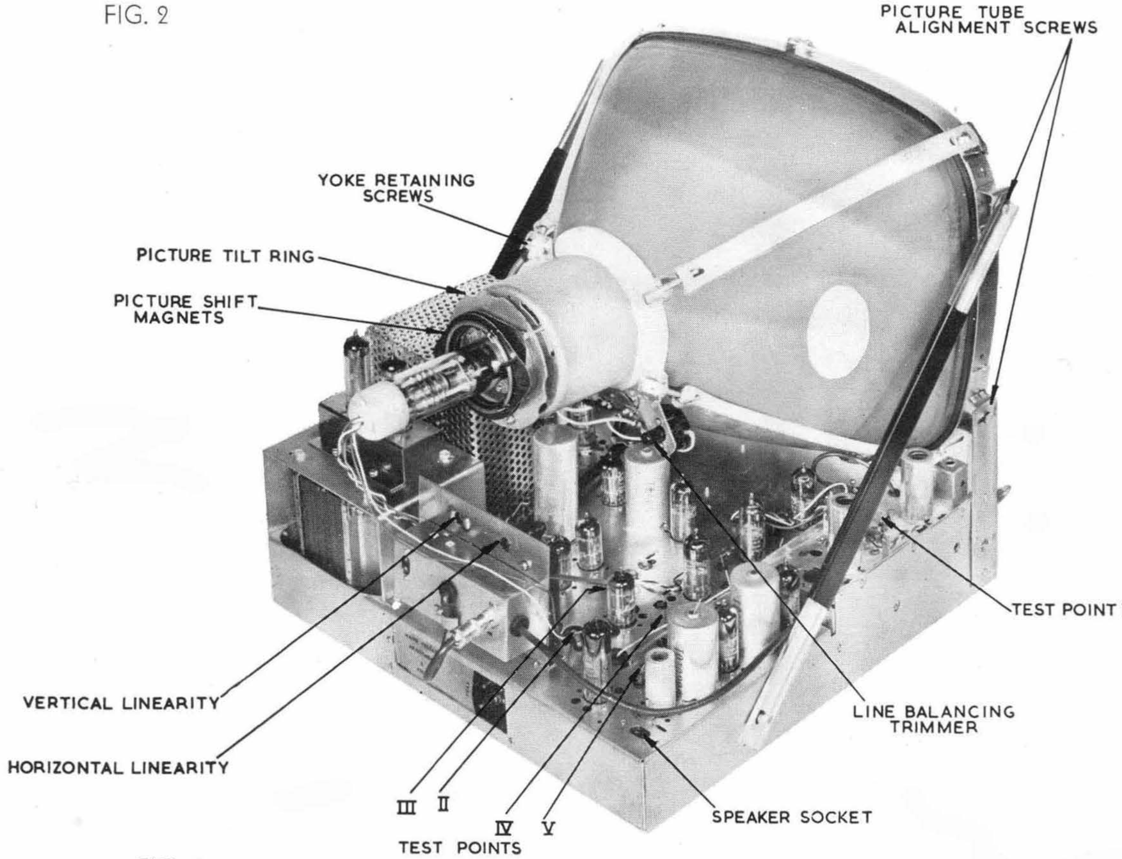


FIG. 3

FRONT AND REAR VIEW OF CHASSIS

REPLACEMENT OF CHASSIS IN CABINET

Before returning the chassis to the cabinet, clean the face of the tube and the inside surface of the protective glass screen in the cabinet. Also stretch the rubber dust-sealing ring around the tube clamping ring by hooking it top and bottom behind the clamping screws so that it will remain in this position until the chassis has been replaced in the cabinet.

Place chassis in cabinet and replace screws holding chassis to cabinet base, ensuring that the picture tube is central and hard up against the mask so that there is no gap between mask and tube face.

From back of cabinet prise dust-sealing ring up over the top clamp screw so that it flicks into position around the mask.

Replace loudspeaker in table models.

Replace cabinet back and knobs.

Replace aerial and mains connections.

REMOVAL OF TUNER

With chassis removed from cabinet the tuner may be disconnected by unplugging the coaxial I.F. lead and the power supply leads joining the tuner to the main chassis. Undo the two screws securing the aerial coupling unit to the rear of the receiver chassis and this unit will then come away with the tuner when the four screws securing the tuner to the side of the chassis are removed.

REPLACEMENT OF LINE OUTPUT TRANSFORMER AND E.H.T. RECTIFIER

These two components are contained within petroleum jelly in a moulded plastic continer to minimise the effects of corona. If faulty, the unit should be replaced as a whole. When fitting a replacement item ensure that the leads are trimmed to the exact length required and that leads carrying high voltage are not touching the

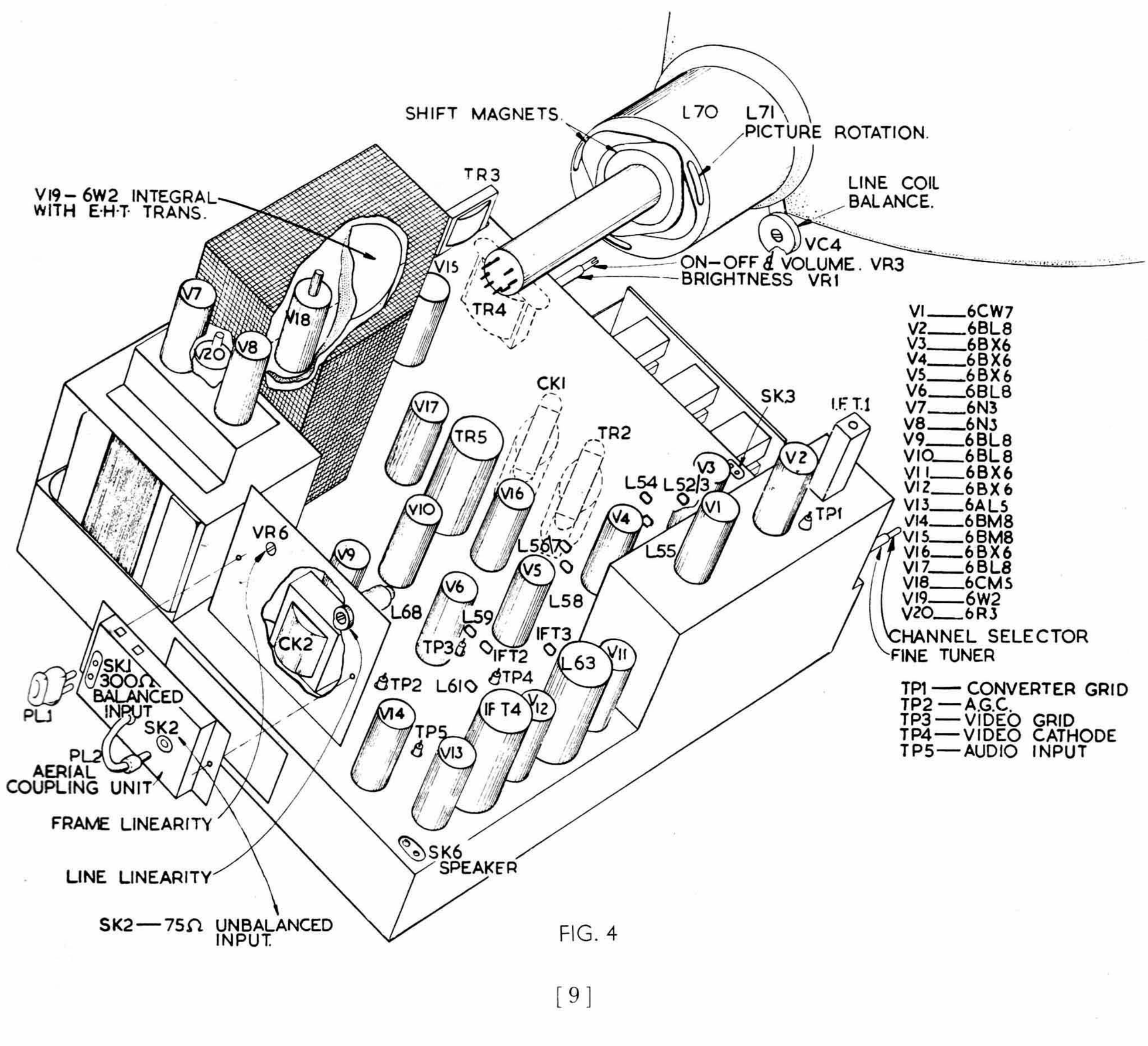


FIG. 4

perforated cover. Suppressor chokes on the caps of the line output and damper valves should be well away from the side of the cover also.

HORIZONTAL A.P.C. ADJUSTMENT

If either the reactance valve, V16, or the horizontal oscillator valve, V17, are changed, it may be necessary to readjust the pre-set control labelled "Reactance Bias" (VR7). Also, it may be found that as the oscillator valve ages the "Horizontal Hold" control has insufficient range of control to pull-in to lock, in which case it may be possible to correct the trouble by adjustment of "Reactance Bias" without changing the valve.

The procedure for adjustment is as follows:

Set the "Horizontal Hold" control to the centre of its range.

Render the A.P.C. action ineffective by shorting pin 2 of V10 to earth.

Rotate the "Reactance Bias" control located beneath the centre of the chassis slowly until the line frequency is approximately correct as will be evidenced by a complete picture appearing on the tube (even thought it is not solidly "locked"). Slow manipulation of this control is necessary as the long time-constant of this circuit makes it slow in following any change in bias.

When the best setting has been found, remove the short circuit. The A.P.C. action is now effective again and the picture will "lock."

After this adjustment, the "Reactance Bias" voltage should be checked with a V.T.V.M. and should be within the range of 2.5 to 3.1 V.

TEST POINTS

A number of test points is provided above the chassis to facilitate fault finding and alignment checking. The location of these points is shown in Figure 4, and their functions are as follows:

TEST POINT 1: Mixer grid circuit. For connection of meter to check whether the oscillator is operating, or a C.R.O. to check R.F. response curves during sweep alignment.

TEST POINT 2: A.G.C. To check A.G.C. operation or for connection of a 3-volt battery during I.F. alignment. A V.T.V.M. on this point may assist in setting up the aerial for maximum signal strength.

TEST POINT 3: Video Grid, and TEST POINT 4: Video Cathode. For insertion of video test signal or for checking the demodulated waveform from the vision detector. For either of these purposes test point 4 should be earthed, while the signal generator output or Y-plate of the C.R.O. is connected to test point 3. When TP4 is earthed the A.G.C. is inoperative, and it may be necessary to provide battery bias on TP2 while examining waveforms from a transmitter.

TEST POINT 5: Audio Grid. For insertion of audio oscillator or to check the output of the ratio detector.

ALIGNMENT OF SOUND I.F. STAGE

METHOD 1. Using a Signal Generator:

It is essential that the signal generator is accurately set to 5.5 mc/s by a crystal controlled reference.

(1) Connect output of signal generator between the grid of the sound I.F. Amplifier (V11, pin 2) and earth, using an unmodulated output of between 100 mV and 150 mV.

(2) Connect a D.C. V.T.V.M. across the 10K metering (R74) resistor in the grid of Sound Limiter (V12, pin 2).

(3) Tune core of Amplifier anode coil (L63) until V.T.V.M. shows maximum negative volts.

(4) Connect unmodulated output between the grid of Video Amplifier (V6, pin 2, and junction of R35 and L61. Tune core of IFT3 until V.T.V.M. reads maximum negative volts.

(5) Set bottom and top cores of IFT4 until they are $\frac{3}{8}''$ from ends of former. (A marked trimming tool is useful for this purpose). Connect V.T.V.M. between junctions of R79 and R80 and earth.

(6) Rotate top (primary) core of IFT4 one turn in either direction. Note that meter reads more positive in one direction. Continue turning core in positive direction until a maximum positive reading is obtained.

(7) Screw in bottom (secondary) core so that meter continues to rise, positively, and then falls rapidly, to zero volts and would continue negative. Carefully adjust core so that meter reads exactly zero volts.

METHOD 2:

Where an accurate 5.5 mc/s is not available, it is advisable to use the 5.5 mc/s intercarrier derived from an actual TV transmission. In this case, L63 and then IFT3 are tuned for maximum negative volts across the 10K metering resistor (R74). The procedure outlined in (5), (6) and (7) above may then be followed in tuning the ratio-detector transformer (IFT4).

THE VIDEO SOUND TRAP (L61)

The trap is tuned to 5.5 mc/s. It may be tuned, on an incoming signal, by setting the core at a point where no 5.5 mc/s can be seen on the C.R.T. face. The 5.5 mc/s pattern gives the dot-pattern appearance of a newspaper photograph to the picture on the tube face and this may be seen to disappear as the trap is tuned through 5.5 mc/s.

NOTES

(1) An input of 160 mV unmodulated 5.5 mc/s carrier at the video grid will produce 5.2V. across the 10K metering resistor (R74).

(2) During limiting conditions, the discriminator output is 4V. p.p. with input of 50 Kc/s deviation.

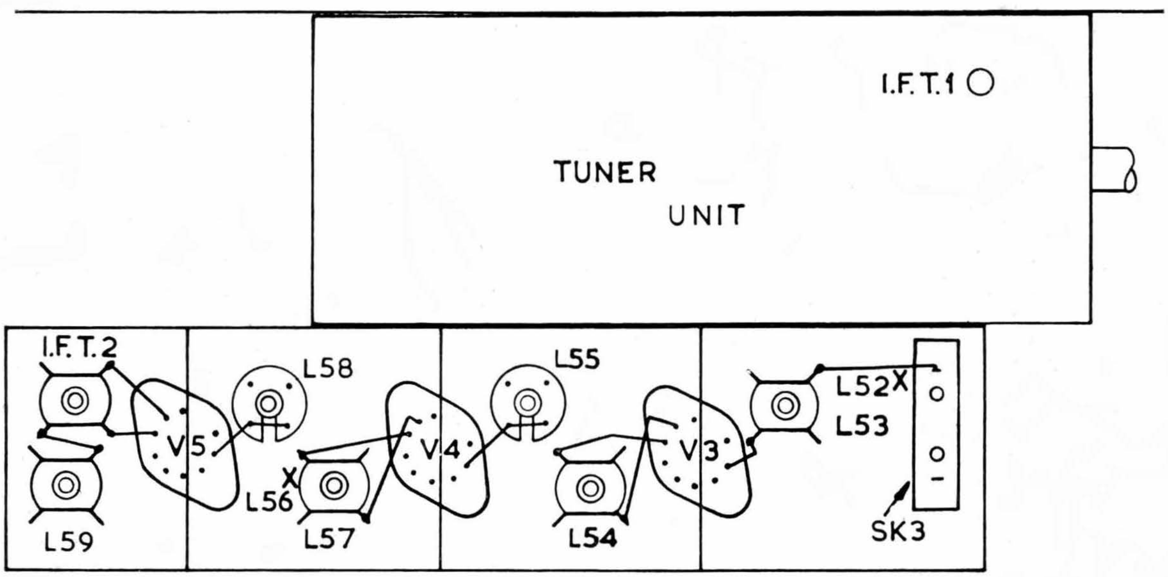
(3) The peak separation of the discriminator is ± 110 Kc/s.

(4) The I.F. stage has a response of –3 db at ± 110 Kc/s.

VISION I.F. ALIGNMENT

GENERAL NOTES

To align the vision I.F., a sweep generator and a marker generator, both covering the range 28.5 to 38.5 mc/s are required, together with a display unit. The marker generator may be a signal generator and the display unit a C.R.O. These instruments should be inter-connected as described in the instructions supplied with the sweep generator. The sweep generator should be terminated with a resistor equal to its output impedance, and connected to the receiver through a capacitor, say, .01 mfd. The display unit should be adjusted to present a reasonable amplitude display from a signal of 0.75V. peak to peak. During alignment this amplitude of display should be kept constant by adjusting the sweep output level.



LOCATION OF COILS FROM UNDERSIDE OF CHASSIS.
X INDICATES COIL NEAREST CHASSIS

FIG. 5

Before commencing alignment, remove the cores from L53 and L57, and adjust the core in L52 to the maximum inductance position (centre of winding). Move the rest of the cores until they are visible above the top of the chassis. Apply –3 volts bias to test point 2, short test point 4 to chassis, and connect the input terminals of the display unit between cathode (pin 7) of V6 and chassis. Remove V9, and the plug from the tuner unit connecting to the socket in the I.F. strip (SK3), then allow the test equipment and the receiver to warm up for 20 minutes before proceeding.

ALIGNMENT. *Note*: The correct tuning position for all cores except L53 and L57 is the one nearest the chassis.

(1) Connect the sweep generator to the grid (pin 2) of V5 and adjust the core of IFT2 for maximum response at about 33.5 mc/s. Using the core

of L59, obtain a symmetrical over-coupled response. Vary these two cores to centre the response on 34.65 mc/s (Fig. 6A).

(2) Move the sweep generator output from V5 to grid (pin 2) of V4 and adjust the core of L56 for maximum response at about 33.5 mc/s. Using the core of L58, obtain a symmetrical overcoupled response. Vary L56 and L58 to centre the response on 34.65 mc/s (Fig. 6B).

(3) Move the sweep generator output from V4 to the grid (pin 2) of V3 and adjust the core of L54 for maximum response at about 34 mc/s. Using the core of L55, obtain a symmetrical response. Vary L54 and L55 to centre the response on 34.65 mc/s (Fig. 6C).

(4) Insert the plug from the tuner to SK3. Remove the sweep generator from the grid of V3 and connect it to the 75 ohm socket on the aerial connector. Switch the tuner to the I.F. position, i.e., the position one back from Channel 1. Adjust the core of IFT1 for maximum response at 34.65 mc/s and adjust the core of L52, together with that of IFT1, to obtain the correct symmetrical response centred on 34.65 mc/s (Fig. 6D).

(5) Readjust IFT2 to move the peak response to about 34.2 mc/s so that the response at 36 mc/s is 65% of the peak. Then readjust L56 so that the peak moves to about 33.2 mc/s, and the response at 36 mc/s is 50% of the peak (Fig. 6E).

(6) Insert the core in L57 and take it in until the response at 37.5 mc/s reaches its first minimum.

Insert the core in L53 and take it in until the response at 30.6 mc/s reaches its first minimum.

Adjustment of these traps (L53 and L57) may have altered the final response and some minor adjustments of one of more of the cores may be necessary to achieve the final shape Fig. 6G).

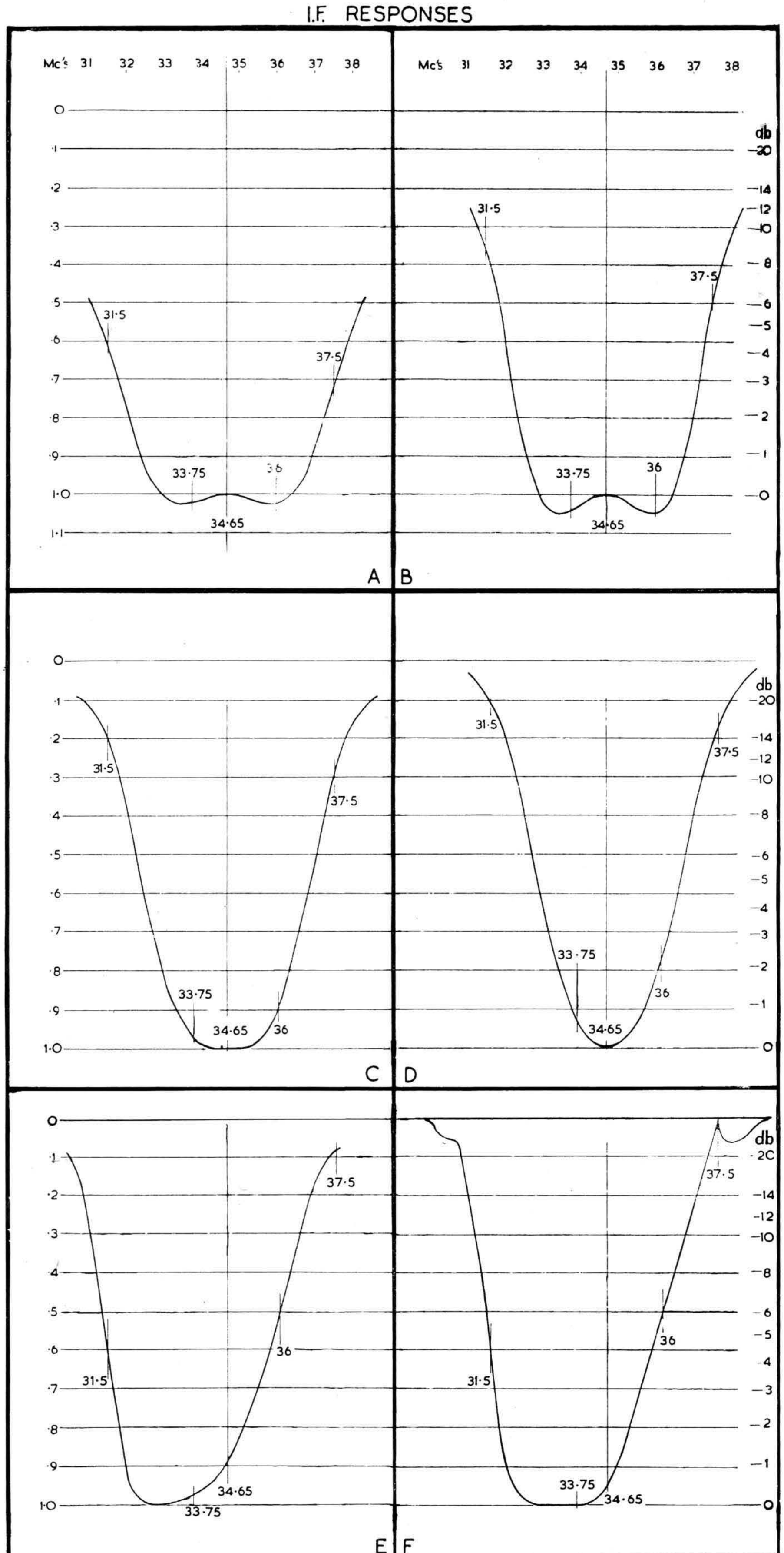


FIG. 6

OSCILLOSCOPE PATTERNS OBTAINED WITH SWEEP OSCILLATOR INPUT

SWITCHED TUNER ALIGNMENT

INTRODUCTION

The following notes outline the procedure to be adopted when realignment of the tuner unit is contemplated. It is emphasised that the tuner is aligned very accurately in the factory and under normal conditions no further adjustments will be necessary. However, if the converter valve or other component of the tuner is replaced, then realignment is necessary, and the operations should be carried out in the order given.

A marker generator and a sweep generator covering Television Channels 1 - 10 and the I.F. channel (28.5 to 38.5 mc/s) and a display unit are required. A signal generator covering the same range may be used instead of the marker generator, and a C.R.O. substituted for the display unit. The sweep generator output impedance should be 75 ohms, and it should be plugged into the 75 ohm input of the tuner (aerial connection). The 300 ohm input is not suitable.

The tuner must be removed from the receiver chassis for alignment. Filament and H.T. supplies (190V.) can be obtained from the main chassis by extending the leads which normally plug into the sockets on the tuner's power supply strip (See Fig. 9). The A.G.C. terminal on the strip should be shorted to earth.

Wherever reference is made to the television channels by number, e.g., channel 6, the mid-band frequencies are the ones to which the test equipment should be set. A list is given below.

MID-BAND FREQUENCIES

Ch. 1	52.75 mc/s	Ch. 6	177.75 mc/s
Ch. 2	66.75 mc/s	Ch. 7	184.75 mc/s
Ch. 3	88.75 mc/s	Ch. 8	191.75 mc/s
Ch. 4	135.75 mc/s	Ch. 9	198.75 mc/s
Ch. 5	142.75 mc/s	Ch. 10	212.75 mc/s

OSCILLATOR ALIGNMENT

The oscillator section must be aligned first. Attach a germanium diode (0A79 or similar) to the I.F. output plug in the manner shown in Fig. 7).

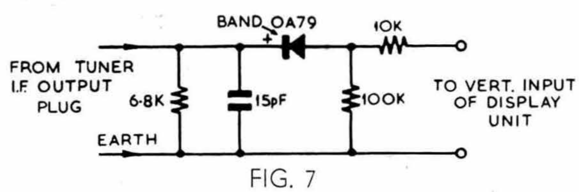


FIG. 7

Set the fine tuning control at the centre of its travel. It should be left in this position throughout the whole alignment procedure. The tuner cover must be in position for all tests.

Switch the tuner unit and the sweep generator to Channel 10 and adjust L42 brass screw until the display unit shows a trace similar to that in Fig. 8. Switch the tuner unit and sweep generator to Channel 3, and adjust L49 brass screw for the same results as on Channel 10. Return to Channel 10 and step down the sweep generator and tuner unit in unison through all channels, noting the position of the peak on each channel with regard to the tolerance given in Fig. 8.

In an extreme case, such as when the oscillator coils have been damaged or pushed out of shape, it will be necessary to adjust certain of the coils. These are L47 (Ch. 5), L48 (Ch. 4), L50 (Ch. 2), L51 (Ch. 1). The procedure, then, is as follows: Carry out the alignment steps as outlined in the preceding paragraph, then switch to Channel 5. Examine the C.R.O. trace for any variation from the limits of the tolerance. Movement of the peak towards the low frequency (vision) end of the channel may be obtained by squeezing the turns of L47 together. Similarly, the insertion of a knife blade between the turns and a slight opening movement will move the peak towards the high frequency (sound) end of the channel.

Now switch to Channel 4, and after examining the trace, make any adjustment necessary on L48.

The next adjustment is made on Channel 3 by the brass screw in L49.

The remaining two steps are similar to the others in that the peaks are examined and any adjustments necessary are made on L50 (Channel 2) and L51 (Channel 1).

Finally, return to Channel 10 and step down through all channels, checking the position of the peak with regard to the tolerance.

Remove the germanium diode and its circuit from the I.F. output plug.

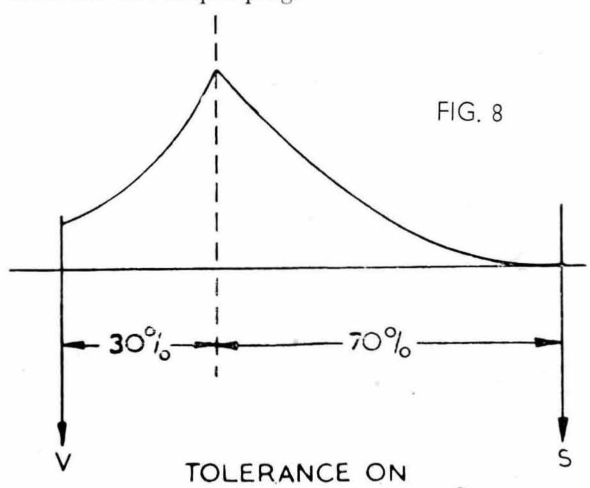


FIG. 8

TOLERANCE ON POSITION OF PEAK ± 15%

This completes the oscillator alignment.

Note: As this is a switched incremental tuner, i.e., inductances are added as the frequency is decreased, any adjustment on the high frequency channels will effect those of a lower frequency. Consequently, any change of inductance such as knifing, must commence at the

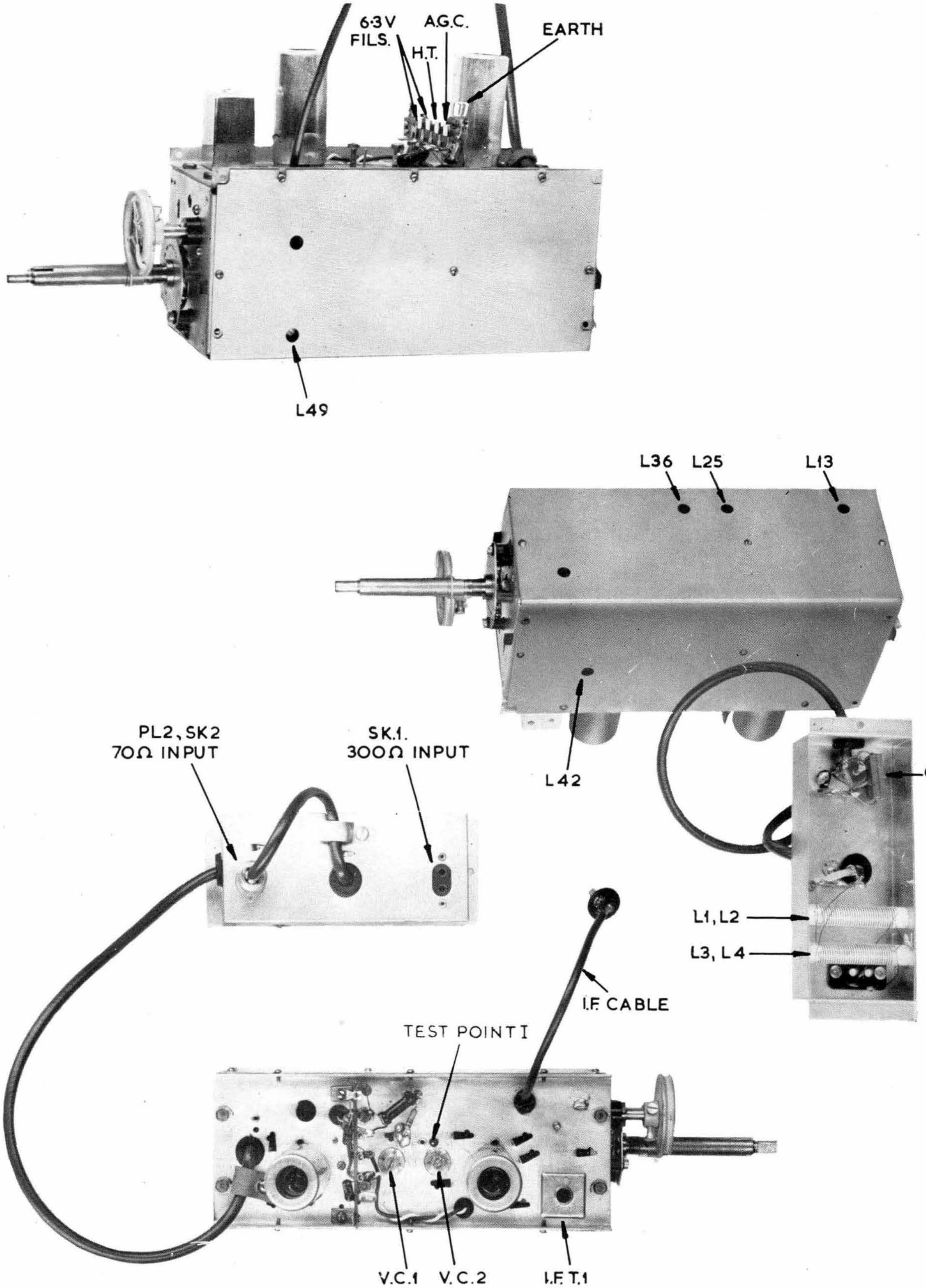

6·3V
FILS.
A.G.C.
H.T.
EARTH
L49
L36
L25
L13
L42
C1
L1, L2
L3, L4
PL2, SK2
70Ω INPUT
SK.1.
300Ω INPUT
I.F. CABLE
TEST POINT I
V.C.1
V.C.2
I.F.T.1

FIG. 9

highest channel requiring it, and carried through the other channels in descending order of frequency. For instance, knifing of Channel 5 (L47) oscillator coil will result in a change on Channel 4 (L48), which, in turn, must be adjusted. Similarly, a readjustment of the brass screw in Channel 3 oscillator coil will effect the range of the fine tuning control on Channels 3, 2 and 1. An adjustment of Channel 2 oscillator coil will also be reflected on Channel 1. Reference to the circuit diagram will make this clear.

SIGNAL CIRCUIT ALIGNMENT

Attach the vertical amplifier input lead of the display unit or C.R.O. to Test Point 1 (see Fig. 4), connecting the earth lead to the tuner chassis.

Switch the tuner unit and the sweep generator to Channel 10 and step down through all channels in unison, examining the passband curves on the display unit, and comparing them with the 'ideal" curves for the same group of channels as shown in Fig. 12.

If realignment is decided upon, then it should be carried out in steps in the order given in Table 1.

A useful tool for this purpose is a length of PVC tubing with a small diameter iron-dust core extending from one end, and a small piece of brass rod similarly placed in the other. One end is inserted inside a coil under test, and the movement or tilt of the trace in either the high or low frequency direction will indicate the change which has to be made in the inductance (knifing or squeezing) for a symmetrical passband shape.

Signal circuit alignment is carried out with the A.G.C. terminal on the tuner strip earthed. No bias is required.

The trimmers (VC1 and VC2), located on top of the tuner chassis, and the iron-dust cores (L13, L25 and L36), located underneath through holes in the shield can, will provide sufficient adjustment for realignment as part of normal service procedure.

The tuner cover must always be replaced after any adjustment to coils.

PASSBAND SHAPES

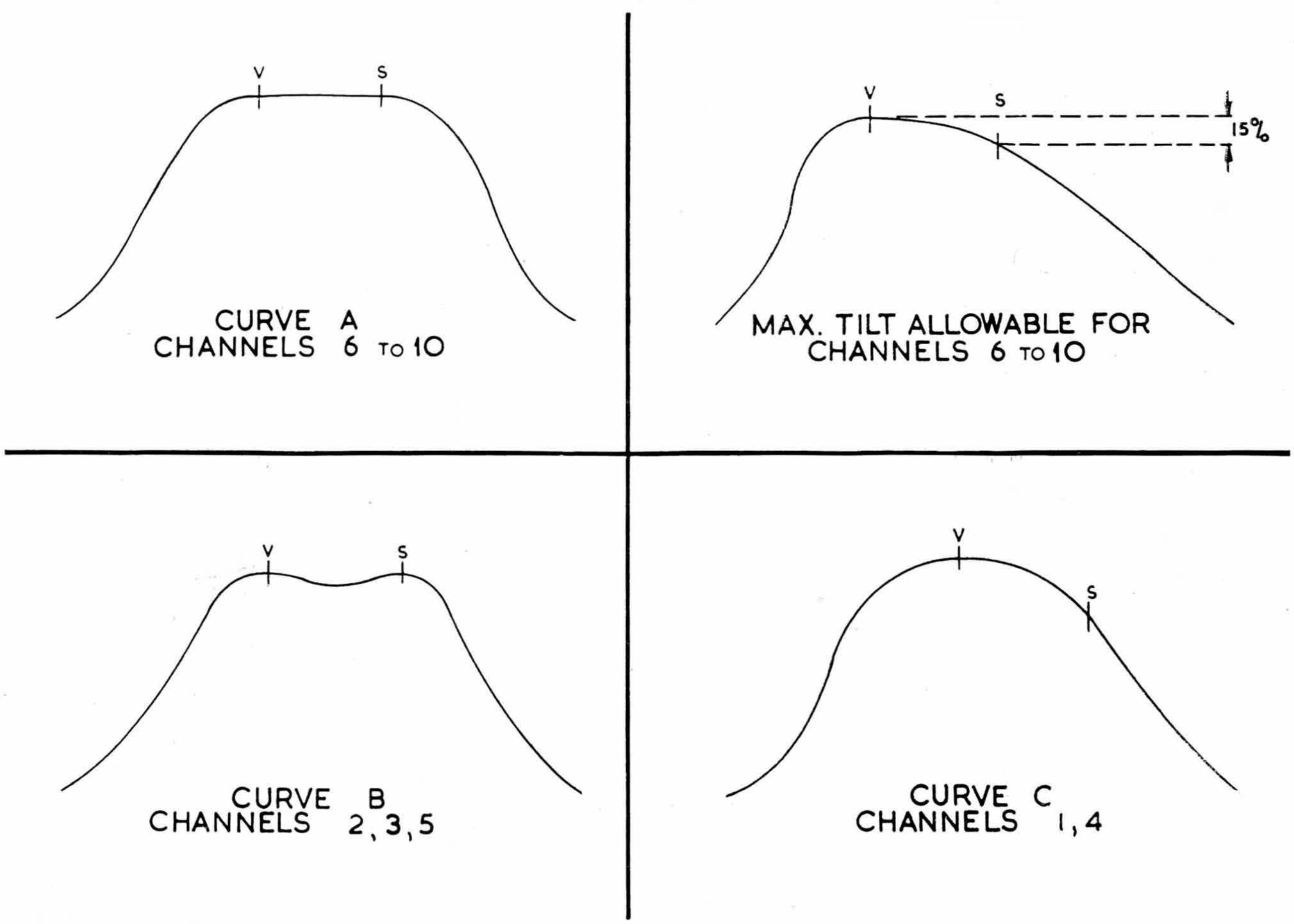


FIG. 10

Table I: SIGNAL CIRCUIT ALIGNMENT CHART

Step	Tuner and Sweep	Adjust	Remarks
1	Ch. 6	Trimmers VC1, VC2 for maximum gain, symmetry and bandwith, as shown at "A". Compromise tilt for Channels 7-10, if necessary	Keep vision marker on "flat top" of trace, before "roll off" on low frequency end.
2	Ch. 10	Peaking coil L17 on 6CW7 socket—knife for maximum gain.	Required only when coil has been damaged.
3	Ch. 5	Anode coil L23, grid coil L34 for symmetry as at "B".	Set at factory — no adjustment required in normal service alignment.
4	Ch. 4	Anode coil L24, grid coil L35 for symmetry as at "C".	
5	Ch. 3	Iron-dust cores in L25, L36 for symmetry. L13 for maximum gain as at "B".	Keep vision marker on "flat top" of trace.
6	Ch. 2	Anode coil L26, grid coil L37 for symmetry as at "B".	Set at factory — not adjusted in normal service.
7	Ch. 1	Anode coil L27, grid coil L38 for symmetry as at "C".	Same as above.
8	Ch. 10 to Ch. 1	Step tuner and sweep generator down through all channels for a final check and comparison.	

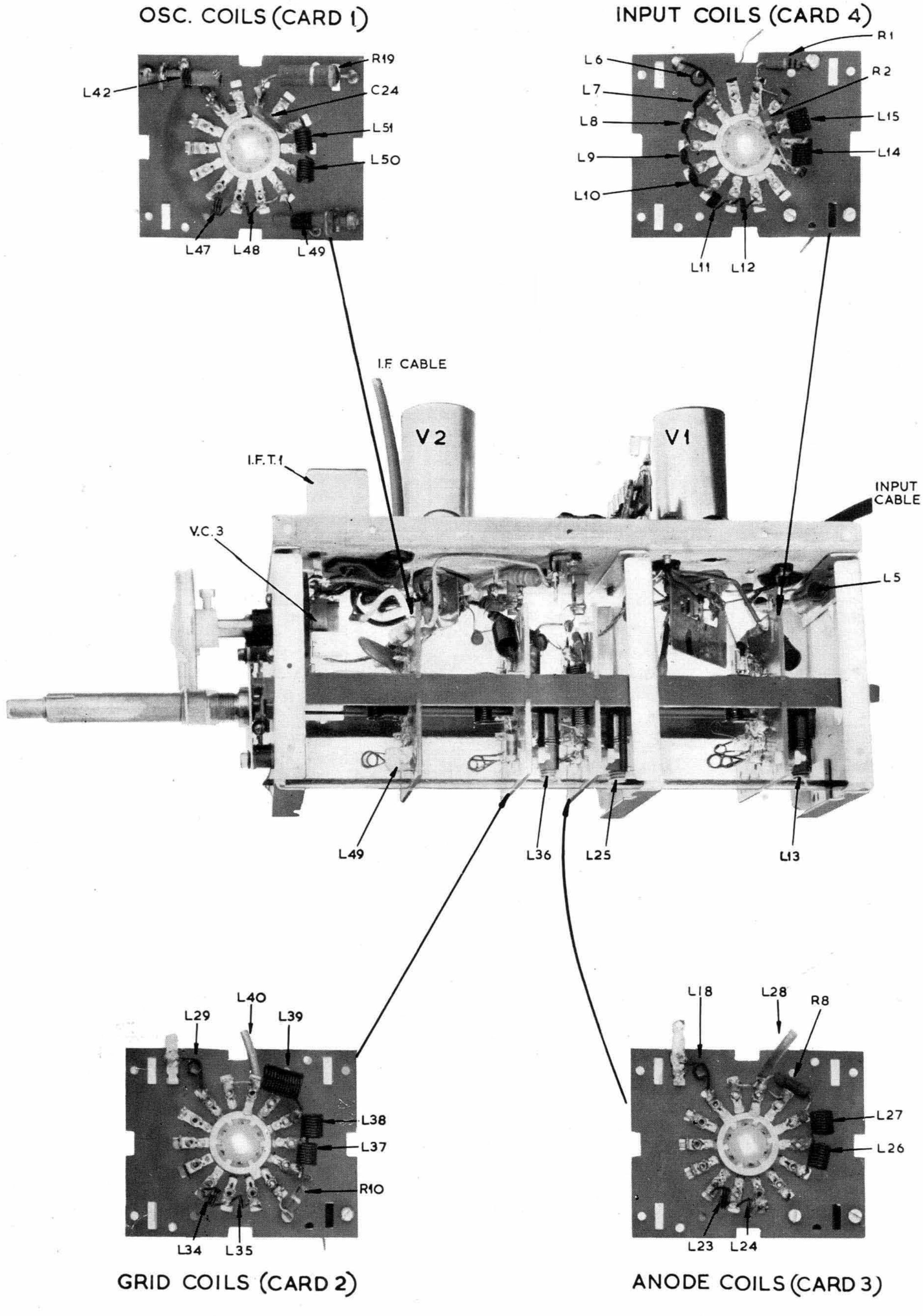


FIG. 11
SWITCH CARDS VIEWED FROM FRONT END OF TUNER

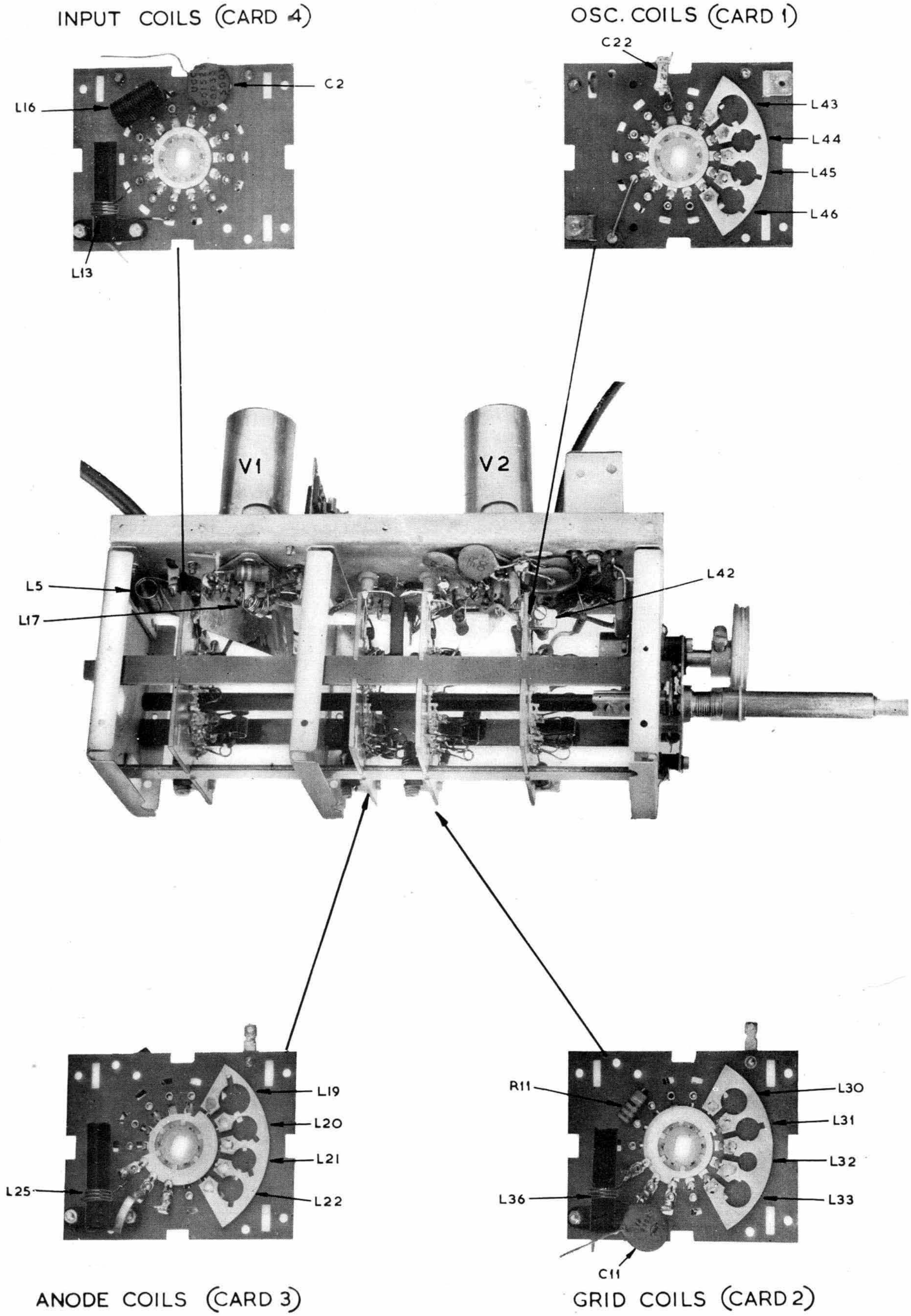


FIG. 12
SWITCH CARDS VIEWED FROM REAR END OF TUNER

VOLTAGE TABLE

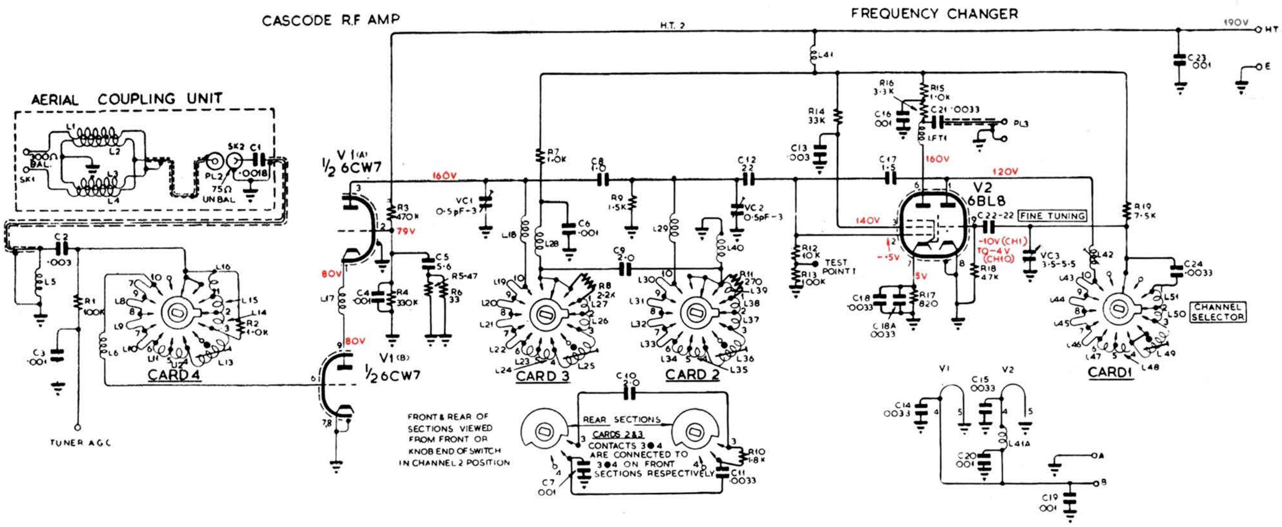
All measurements are taken with a vacuum-tube voltmeter and with nominal mains voltage.

Filaments: 6.3v. A.C. C.R.T. Filament: 8.5v. A.C.

VALVE	FUNCTION	TYPE	PENTODE SECTION				TRIODE SECTION			COMMENTS
			Anode	Screen	Cathode	Grid	Anode	Cathode	Grid	
V1	R.F. Amplifier	6CW7	160	—	80	79	80	0	0	Both sections are triodes.
V2	Frequency Changer	6BL8	160	140	5.0	−0.5	120	0	*−10 to −4	* −10 (Chan. 1) to −4 (Chan. 10).
V3	1st I.F. Amplifier	6BX6	180	180	1.9	0.1	—	—	—	
V4	2nd I.F. Amplifier	6BX6	180	180	1.9	0.1	—	—	—	
V5	3rd I.F. Amplifier	6BX6	180	180	1.9	0	—	—	—	
V6	Video Amplifier	6BL8	50	190	8.5	6.9	180	55	50	
V7	Power Rectifier	6N3	215 A.C.	—	225	—	—	—	—	Diode.
V8	Power Rectifier	6N3	215 A.C.	—	225	—	—	—	—	Diode.
V9	A.G.C. and Noise Inverter	6BL8	0.4	50	7.1	*0 to 6	35	4.0	0	*Depends on contrast setting.
V10	Sync. Amp. and Separator	6BL8	170	40	0	−6	35	7.1	6.9	
V11	Intercarrier Amplifier	6BX6	180	180	2.0	0	—	—	—	
V12	Limiter	6BX6	35	30	0	−0.8	—	—	—	
V13	Ratio Detector	6AL5	−2.5	—	0	—	0	+4	—	Both sections are diodes.
V14	Audio Amp. and Output	6BM8	185	195	12	0	80	0	−0.8	
V15	Vertical Osc. and Output	6BM8	165	190	14	0	110	0	−20	
V16	Reactance Valve	6BX6	180	180	0	−2	—	—	—	
V17	Horizontal Osc. and Drive	6BL8	90	110	0	−6	130	0	−25	
V18	Horizontal Output	6CM5	*—	125	.08	−45	—	—	—	*High voltage. Do not measure.
V19	E.H.T. Rectifier	6W2	—	—	*14.2kv	—	—	—	—	Care! E.H.T.
V20	Damping Diode	6R3	205	—	*—	—	—	—	—	*High voltage. Do not measure.
C.R.T.			—	—	55	*0 to 100	—	—	—	Varies with Brightness.

HT1: 205
HT2: 190
HT3: 180
Boost H.T.: 510
C.R.T. Focus: 510 - 1000.
C.R.T. G2: 510.
Reactance Bias: −2.9v.

Condition of Measurement:
- Brightness — low.
- Horizontal and vertical holds — central.
- Width and height — set for normal picture.
- Contrast and linearity — set for normal picture.
- Tuner — on Channel 1 and with no input signal.

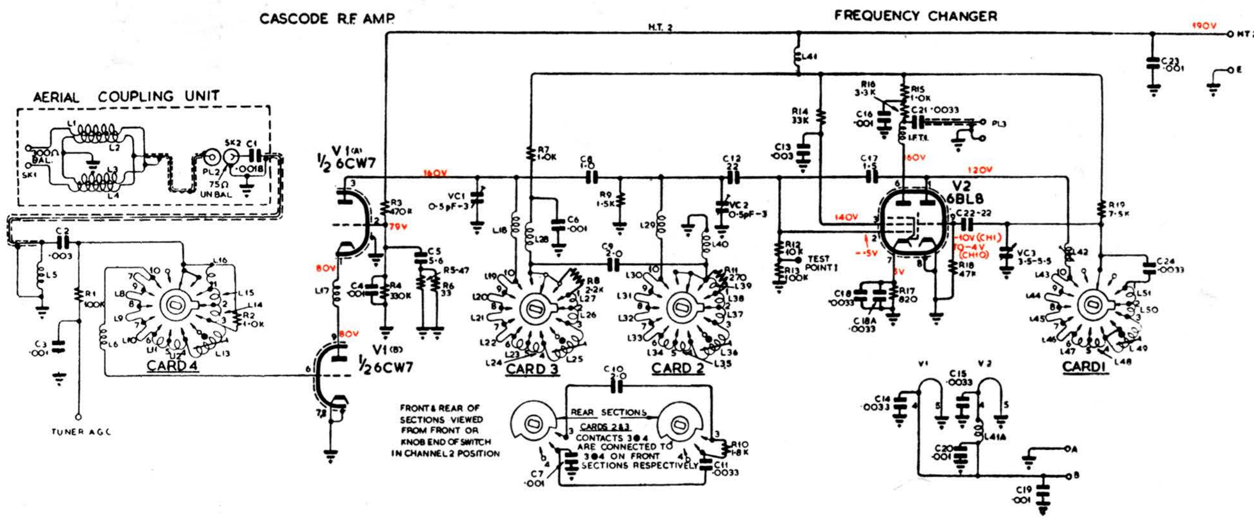


CIRCUIT DIAGRAM — TUNER

AMENDMENT SHEET

Amendment No.	Technical Data Sheet Reference	Reason for Amendment
*1	TV1	Improvement of horizontal hold
*2	TV2	Modification of tuner to improve I.F. rejection.
*3	TV3	Audio feedback modification.

*These Amendments have ben included in the Circuit Diagram and Parts List.



CIRCUIT DIAGRAM — TUNER

CIRCUIT DIAGRAM CORRECTIONS

C82 (.047) should be C86A (.047).

R36 (2.2M) across L60 should be R33 (680K).

VR4 (25K) is "Height" control.

VR5 (500K) is "Vertical Hold" control.

C111 to C115 should be respectively C101 to C105.

V10. GRID PIN SHOULD BE 2 SCREEN PIN 3

MODIFICATION OF HORIZONTAL OSCILLATOR CIRCUIT FOR IMPROVED PERFORMANCE

(Later chassis incorporate this modification)

R64 is removed from HT3 and is taken to HT2.

Pin 5 of TR5 is removed from HT3 and taken to HT2.

C92 (150 mmfd.) becomes 100 mmfd.

R111 (680 ohm BTS) becomes 15K BTA.

A 0.1 mfd. 200V. capacitor is paralleled across R111.

R112 (4.7K) becomes 15K.

R113 (1.8K) becomes 4.7K.

Delete C97A (.001).

PARTS LIST

RESISTORS

Ref.	Part No.	Description	Ref.	Part No.	Description
R1	738-0051	100,000 ohms ± 20% BTS	R65	742-0092	47,000 ohms ± 10% BTA
R2	738-0021	1,000 ohms ± 20% BTS	R66	742-0042	15,000 ohms ± 10% BTA
R3	738-0071	470,000 ohms ± 10% BTA	R67	740-0043	2,700 ohms ± 10% Morg. ½ Watt
R4	738-0061	330,000 ohms ± 10% BTS	R68	740-0142	100,000 ohms ± 10% BTS
R5	738-0001	47 ohms ± 20% Morg. ½ Watt	R69	740-0603	68 ohms ± 10% Morg. ½ Watt
R6	739-0001	33 ohms ± 20% Morg. ½ Watt	R70	740-0603	68 ohms ± 10% Morg. ½ Watt
R7	738-0021	1,000 ohms ± 20% BTS	R71	740-0572	1,000 ohms ± 20% BTS
R8	740-0032	2,200 ohms ± 10% BTS	R72	740-0142	100,000 ohms ± 10 %BTS
R9	740-0253	1,500 ohms ± 10% Morg. ½ Watt	R73	740-0122	47,000 ohms ± 10% BTS
R10	740-0303	1,800 ohms ± 20% Morg. ½ Watt	R74	740-0082	10,000 ohms ± 10% BTS
R11	740-0292	270 ohms ± 10% BTS	R75	742-0412	100,000 ohms ± 20% BTA
R12	738-0031	10,000 ohms ± 20% BTS	R76	740-0592	22,000 ohms ± 20% BTS
R13	738-0051	100,000 ohms ± 20% BTS	R77	742-0402	150,000 ohms ± 20% BTA
R14	738-0041	33,000 ohms ± 10% BTS	R78	740-0102	22,000 ohms ± 10% BTS
R15	740-0022	1,000 ohms ± 10% BTS	R79	740-0092	15,000 ohms ± 10% BTS
R16	740-0052	3,300 ohms ± 10% BTS	R80	740-0092	15,000 ohms ± 10% BTS
R17	738-0011	820 ohms ± 10% BTS	R81	740-0242	33,000 ohms ± 10% BTS
R18	740-0582	47,000 ohms ± 20% BTS	R82	740-0702	56,000 ohms ± 10% BTS
R19	739-0011	7,500 ohms ± 10% BTA	R83	742-0442	10 Megohm ± 20% BTA
R20	740-0412	820 ohms ± 10% BTS	R84	742-0452	220,000 ohms ± 20% BTA
R21	740-0512	100,000 ohms ± 20% BTS	R85	740-0622	470,000 ohms ± 20% BTS
R22	740-0463	33 ohms ± 10% Morg. ½ Watt	R86	740-0622	470,000 ohms ± 20% BTS
R23	740-0653	100 ohms ± 10% Morg. ½ Watt	R87	742-0482	220 ohms ± 20% BTA
R24	742-0322	1,000 ohms ± 20% BTA	R88	742-0552	680 ohms ± 10% BTA
R25	740-0512	100,000 ohms ± 20% BTS	R89	748-0092	390 ohms ± 10% BWI
R26	740-0042	2,700 ohms ± 10% BTS	R90	742-0402	150,000 ohms ± 20% BTA
R27	740-0603	68 ohms ± 10% Morg. ½ Watt	R91	740-0582	47,000 ohms ± 20% BTS
R28	740-0603	68 ohms ± 10% Morg. ½ Watt	R92	740-0582	47,000 ohms ± 20% BTS
R29	742-0322	1,000 ohms ± 20% BTA	R93	740-0552	2.2 Megohm ± 20% BTS
R30	740-0302	1,800 ohms ± 10% BTS	R94	742-0272	8,200 ohms ± 10% BTA
R31	740-0273	150 ohms ± 10% Morg. ½ Watt	R95	742-0392	47,000 ohms ± 20% BTA
R32	742-0322	1,000 ohms ± 20% BTA	R96	742-0172	470,000 ohms ± 10% BTA
R33	742-0362	680,000 ohms ± 20% BTA	R97	740-0552	2.2 Megohm ± 20% BTS
R34	740-0663	82 ohms ± 10% Morg. ½ Watt	R98	740-0582	47,000 ohms ± 20% BTS
R35	742-0312	330 ohms ± 10% BTA	R99	742-0552	680 ohms ± 10% BTA
R36	740-0552	2.2 Megohm ± 20% BTS	R100	742-0422	470 ohms ± 20% BTA
R37	742-0512	2,200 ohms ± 10% BTA	R101	746-0182	1 ohm ± 20% BW½
R38	742-0512	2,200 ohms ± 10% BTA	R102	742-0432	18,000 ohms ± 10% BTA
R39	742-0512	2,200 ohms ± 10% BTA	R103	742-0492	68,000 ohms ± 10% BTA
R40	742-0512	2,200 ohms ± 10% BTA	R104	742-0082	39,000 ohms ± 10% BTA
R41	742-0332	15,000 ohms ± 20% BTA	R105	742-0432	18,000 ohms ± 10% BTA
R42	742-0132	220,000 ohms ± 10% BTA	R106	740-0072	4,700 ohms ± 10% BTS
R43	742-0012	1,200 ohms ± 10% BTA	R107	740-0102	22,000 ohms ± 10% BTS
R44	742-0272	8,200 ohms ± 10% BTA	R108	740-0532	1 Megohm ± 20% BTS
R45	742-0342	330,000 ohms ± 20% BTA	R109	742-0582	120,000 ohms ± 10% BTA
R46	740-0532	1 Megohm ± 20% BTS	R110	742-0112	100,000 ohms ± 10% BTA
R47	740-0542	150,000 ohms ± 20% BTS	R111	742-0332	15,000 ohms ± 20% BTA
R48	750-0051	22 ohms ± 5%, 3 Watt W/W	R112	740-0092	15,000 ohms ± 10% BTS
R49	742-0482	220 ohms ± 20% BTA	R113	740-0072	4,700 ohms ± 10% BTS
R50	742-0512	2,200 ohms ± 10% BTA	R114	742-0492	68,000 ohms ± 10% BTA
R51	742-0522	820,000 ohms ± 10% BTA	R115	740-0152	150,000 ohms ± 10% BTS
R52	740-0612	10,000 ohms ± 20% BTS	R116	740-0532	1 Megohm ± 20% BTS
R53	742-0442	10 Megohm ± 20% BTA	R117	740-0162	220,000 ohms ± 10% BTS
R54	742-0352	1 Megohm ± 20% BTA	R118	740-0092	15,000 ohms ± 10% BTS
R55	742-0362	680,000 ohms ± 20% BTA	R119	742-0392	47,000 ohms ± 20% BTA
R56	740-0522	220,000 ohms ± 20% BTS	R120	742-0562	470,000 ohms ± 20% BTA
R57	742-0392	47,000 ohms ± 20% BTA	R121	742-0022	4,700 ohms ± 10% BTA
R58	740-0502	15,000 ohms ± 20% BTS	R122	742-0022	4,700 ohms ± 10% BTA
R59	749-0053	47,000 ohms ± 20% Morg. 2 Watt	R123	740-0572	1,000 ohms ± 20% BTS
R60	742-0122	150,000 ohms ± 10% BTA	R124	742-0562	4,700 ohms ± 10% BTA
R61	742-0052	22,000 ohms ± 10% BTA	R125	742-0562	4,700 ohms ± 10% BTA
R62	740-0072	4,700 ohms ± 10% BTS	R126	746-0182	1 ohm ± 10% BW½
R63	740-0672	680,000 ohms ± 10% BTS	R127	742-0402	150,000 ohms ± 20% BTA
R64	742-0382	33,000 ohms ± 20% BTA			

CAPACITORS

Ref.	Part No.	Description	Ref.	Part No.	Description
C1	273-0571	.0018 mfd. ± 10% Mica SM	C8	526-1821	1.0 pF Capacitor Lead
C2	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.	C9	271-0161	2.0 pF Bead Type NPO
C3	271-0261	.001 mfd. + 80% — 20%, 400V. Wkg.	C10	271-0161	2.0 pF Bead Type NPO
C4	271-0261	.001 mfd. + 80% — 20%, 400V. Wkg.	C11	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C5	275-0071	5.6 pF ± 20% LEM	C12	271-0071	22 pF ± 5% Ceramic Tube
C6	271-0081	.001 mfd. Lead Through	C13	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C7	271-0081	.001 mfd. Lead Through	C14	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.

PARTS LIST

CAPACITORS — *continued*

Ref.	Part No.	Description
C15	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C16	271-0261	.001 mfd. + 80% — 20% 400v.wkg.
C17	271-0001	1.5 pF ± 33% 750V. Wkg.
C18	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C18A	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C19	271-0261	.001 mfd. + 80% — 20% 400v.wkg.
C20	271-0081	.001 mfd. Lead Through
C21	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C22	271-0071	22 pF ± 5% Tubular Ceramic
C23	271-0261	.001 mfd. + 80% — 20% 400v.wkg.
C24	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C25	273-0591	68 pF ± 1 pF Silver Mica MS
C26	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C27	271-0181	15 pF ± ½ pF Ceramic Tube, Type NPO
C28	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C29	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C30	526-1831	1.45 pF Capacitor Lead
C31	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C32	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C33	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C34	526-1961	1.85 pF Capacitor Lead
C35	273-0061	150 pF ± 10%—PT
C36	273-0061	150 pF ± 10%—PT
C37	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C38	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C39	271-0121	5.6 pF ± ¼ pF Ceramic Tube NPO
C40	526-1971	1.0 pF Capacitor Lead
C41	271-0131	8.2 pF ± ¼ pF Ceramic Tube NPO
C42	273-0351	.001 mfd. ± 10% Silver Mica SS
C43	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C44	279-0471	.0047 mfd. ± 10% 400V. Wkg.
C45	279-0271	.022 mfd. ± 20% 400V. Wkg.
C46	279-0331	.01 mfd. ± 20% 400V. Wkg.
C47	271-0051	100 pF ± 20% Ceramic Tube 2KV
C48	269-0391	40 mfd. 300V.S. — 250V.W. Electrolytic
C49	269-0391	80 mfd. 300V.S. — 250V.W. Electrolytic
C50	269-0381	100 mfd. 300V.S. — 250V.W. Electrolytic
C51	269-0381	200 mfd. 300V.S. — 250V.W. Electrolytic

Ref.	Part No.	Description
C52	279-0481	.1 mfd. ± 20% 200V. Wkg.
C53	279-0441	.22 mfd. ± 20% 200V. Wkg.
C54	279-0281	1 mfd. ± 25% 200V. Wkg.
C55	271-0201	15 pF ± 5% Ceramic Disc 3000V.
C56	279-0481	.1 mfd. ± 20% 200V. Wkg.
C57	279-0281	1 mfd. ± 25% 200V. Wkg.
C58	279-0491	.1 mfd. ± 20% 400V. Wkg.
C59	279-0481	.1 mfd. ± 20% 200V. Wkg.
C60	271-0141	10 pF ± ½ pF Ceramic Tube NPO
C61	273-0351	.001 mfd. ± 10% Silver Mica SS
C62	526-1971	1 pF Capacitor Lead
C63	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc, 500V. Wkg.
C64	279-0331	.01 mfd. ± 20% 400V. Wkg.
C65	273-0561	10 pF ± 10% I.F. Type
C66	271-0151	6.8 pF ± ¼ pF Ceramic Tube NPO
C67	273-0661	100 pF ± 20% — MS
C68	273-0561	10 pF ± 10% I.F. Type
C69	279-0331	.01 mfd. ± 20% 400V. Wkg.
C70	273-0331	100 pF ± 5% I.F. Type
C71	273-0791	100 pF ± 5% Silver Mica MS
C72	273-0791	100 pF ± 5% Silver Mica MS
C73	269-0371	10 mfd. 25V.W. Electrolytic
C74	273-0351	.001 mfd. ± 10% Silver Mica SS
C75	279-0331	.01 mfd. ± 20% 400V. Wkg.
C76	279-0291	.047 mfd. ± 20% 400V. Wkg.
C77	279-0331	.01 mfd. ± 20% 400V. Wkg.
C78	269-0401	40 mfd. 300VS 250VW Electrolytic
C79	269-0221	25 mfd. 40 P.V. Electrolytic
C80	279-0291	.047 mfd. ± 20% 400V. Wkg.
C81	273-0631	330 pF ± 10% — MS
C82	273-0691	220 pF ± 10% — MS
C83	273-0691	220 pF ± 10% — MS
C84	269-0351	1 mfd. 250V.W. Electrolytic
C85	269-0401	80 mfd. 300VS 250VW Electrolytic
C86	279-0401	.1 mfd. ± 10% 350V. Wkg.
C86A	279-0391	.047 mfd. ± 10% 200V. Wkg.
C87	279-0501	.022 mfd. ± 10% 200V. Wkg.
C88	279-0411	.033 mfd. ± 10% 200V. Wkg.
C89	269-0361	100 mfd. 25V.W. Electrolytic
C90	279-0461	.1 mfd. ± 10% 400V. Wkg.
C91	279-0281	1 mfd. ± 25% 200V. Wkg.
C92	273-0791	100 pF ± 5% Silver Mica SS
C93	279-0351	.0047 mfd. ± 20% 200V. Wkg.
C94	273-0741	470 pF ± 20% — MS
C95	273-0791	100 pF ± 5% Silver Mica MS
C96	279-0271	.022 mfd. ± 20% 400V. Wkg.
C97	273-0781	.0027 mfd. ± 5% Silver Mica SM
C97A	279-0481	.1 mfd. ± 20% 200V. Wkg.
C98	279-0281	1 mfd. ± 25% 200V. Wkg.
C99	273-0541	47 pF ± 10% — MS
C100	279-0271	.022 mfd. ± 20% 400V. Wkg.
C101	279-0271	.022 mfd. ± 20% 400V. Wkg.
C102	279-0431	.0047 mfd. ± 20% 1000V. PPS
C103	279-0491	.1 mfd. ± 20% 400V. Wkg.
C104	279-0451	.047 mfd. ± 10% 400V. Wkg.
C105	279-0491	.1 mfd. ± 20% 400V. Wkg.

COILS

Ref.	Part No.	Description
L1, L2	908-0061	Transformer Aerial Input
L3, L4	908-0061	Transformer Aerial Input
L5	259-0061	H.F. Choke
L6	259-0471	Incremental Inductance
L7	259-0451	Incremental Inductance
L8	259-0461	Incremental Inductance
L9	259-0471	Incremental Inductance
L10	259-0481	Incremental Inductance
L11	259-0111	Incremental Inductance
L12	259-0121	Incremental Inductance
L13	259-0131	Incremental Inductance
L14	259-0141	Incremental Inductance

Ref.	Part No	Description
L15	259-0151	Incremental Inductance
L16	259-0161	Incremental Inductance
L17	259-0051	Coupling Coil
L18	259-0211	Incremental Inductance
L19, L20, L21, L22	259-0551	Incremental Inductance
L23	259-0531	Incremental Inductance
L24	259-0501	Incremental Inductance
L25	259-0231	Incremental Inductance
L26	259-0521	Incremental Inductance
L27	259-0201	Incremental Inductance
L28	569-2161	Incremental Inductance

PARTS LIST

COILS — *continued*

Ref.	Part No	Description
L29	259-0271	Incremental Inductance
L30 L31 L32 L33	259-0561	Incremental Inductance
L34	259-0221	Incremental Inductance
L35	259-0541	Incremental Inductance
L36	259-0231	Incremental Inductance
L37	259-0191	Incremental Inductance
L38	259-0201	Incremental Inductance
L39	259-0261	Incremental Inductance
L40	569-2161	Incremental Inductance
L41	232-0131	H.T. Choke
L41A	259-0581	R.F. Choke
L42	259-0301	Incremental Inductance
L43 L44 L45 L46	259-0571	Incremental Inductance
L47	259-0171	Incremental Inductance
L48	259-0181	Incremental Inductance

Ref.	Part No.	Description
L49	259-0281	Incremental Inductance
L50	259-0291	Incremental Inductance
L51	259-0511	Incremental Inductance
L52 L53	259-0361	1st I.F. Grid and Trap
L54	259-0371	1st I.F. Anode
L55	259-0381	2nd I.F. Grid
L56 L57	259-0391	2nd I.F. Anode and Trap
L58	259-0381	3rd I.F. Grid
L59	259-0411	Vision Detector
L60	259-0021	Grid Video Peaking
L61	259-0421	Video Trap
L62	259-0311	Anode Video Peaking
L63	259-0031	I.F. Sound Coupling
L64	259-0331	Horizontal Hold
L65	259-0041	Anti-Parasitic
L66	259-0341	Width
L67	259-0041	Anti-Parasitic
L68	259-0321	Horizontal Linearity
L69	259-0041	Anti-Parisitic

MISCELLANEOUS

Ref.	Part No.	Description
VR1	677-0261	500,000 ohms
VR2	677-0231	25,000 ohms
VR3	677-0261	1.0 Megohm Tapped at 500,000 ohms
VR4	677-0231	25,000 ohms
VR5	677-0241	500,000 ohms
VR6	677-0171	25,000 ohms
VR7	677-0171	25,000 ohms
VR8	677-0241	500,000 ohms
RT1	752-0011	CZ6 Brimister
VC1	281-0131	0.5 — 3 pF Capacitor, Trimmer
VC2	281-0131	0.5 — 3 pF Capacitor, Trimmer
VC3	281-0121	3.5 — 5.5 pF Rotor Assy. Cap.
VC4	281-0151	150 pF Max. 3KV Capacitor, Trimmer
IFT1	906-0112	Transformer I.F.
IFT2	906-0131	Transformer I.F.
IFT3	906-0121	Transformer I.F.
IFT4	906-0101	Transformer I.F.
CK1	232-0121	Choke 1.5H 300 mA.
CK2	232-0111	Choke 2.9H 150 mA.
TR1	904-0112	Transformer—Power
TR2	905-0141	Transformer—Audio
TR3	908-0051	Transformer—Blocking Osc.
TR4	905-0131	Transformer—Frame
TR5	908-0041	Transformer—Horizontal Osc.
TR6	908-0071	Transformer—Line Output

Ref.	Part No.	Description
MR1	932-0591	Diode—0A70
MR2	932-0611	Rectifier—39K2
MR3 MR4	932-0751	Diode—2-0A79 (Matched Pair)
MR5	932-0621	Rectifier—39K12
V1	932-0541	6CW7 Valve
V2	932-0501	6BL8 Valve
V3	932-0521	6BX6 Valve
V4	932-0521	6BX6 Valve
V5	932-0521	6BX6 Valve
V6	932-0501	6BL8 Valve
V7	932-0551	6N3 Valve
V8	932-0551	6N3 Valve
V9	932-0501	6BL8 Valve
V10	932-0501	6BL8 Valve
V11	932-0521	6BX6 Valve
V12	932-0521	6BX6 Valve
V13	932-0491	6AL5 Valve
V14	932-0511	6BM8 Valve
V15	932-0511	6BM8 Valve
V16	932-0521	6BX6 Valve
V17	932-0501	6BL8 Valve
V18	932-0531	6CM5 Valve
V19	932-0631	6W2 Valve
V20	932-0561	6R3 Valve
CRT	932-0581	Picture Tube, 17in., Type 5/3T
	259-0431	Deflection Yoke Assembly

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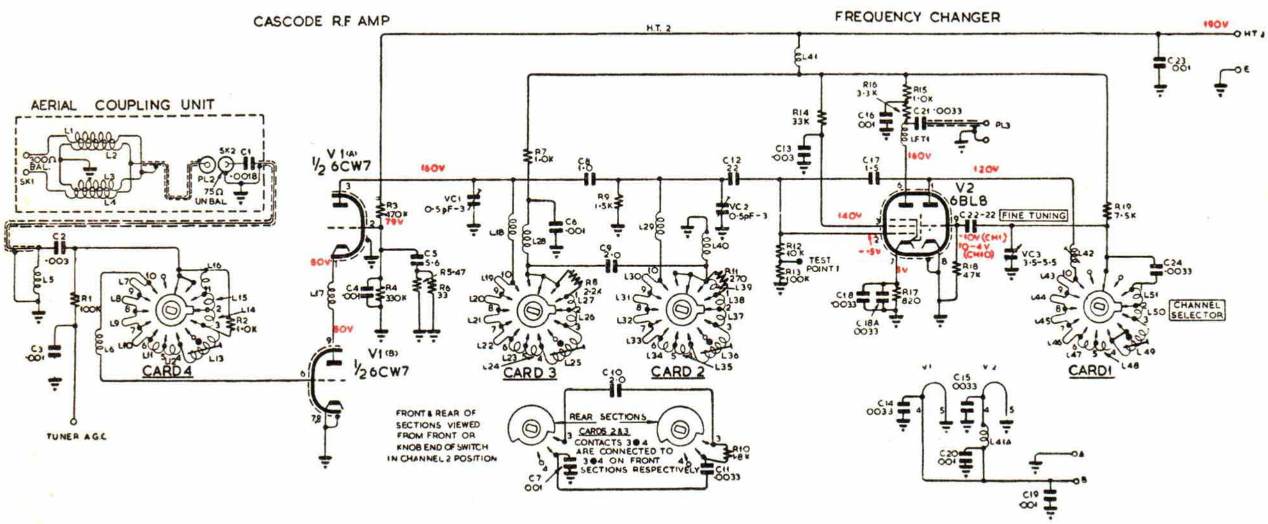


CIRCUIT DIAGRAM — TUNER

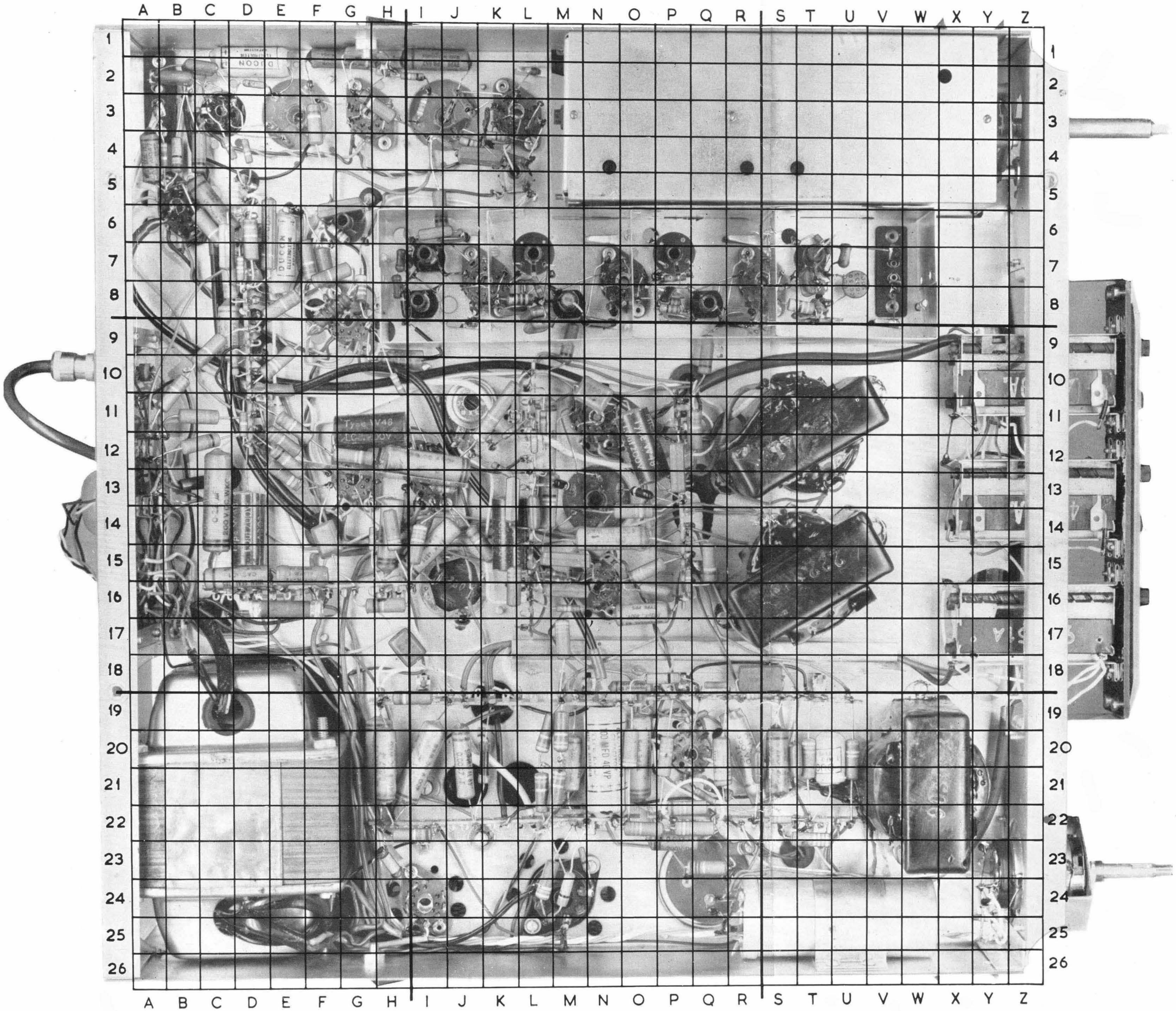


FIG. 13

COMPONENTS LOCATION

RESISTORS

R20	T-7	R58	G-14	R96	T-23
R21	T-6	R59	K-11	R97	Q-18
R22	T-8	R60	G-12	R98	Q-19
R23	T-8	R61	E-11	R99	H-22
R24	Q-9	R62	H-10	R100	O-20
R25	P-6	R63	J-13	R101	P-18
R26	P-7	R64	K-16	R102	P-20
R27	P-8	R65	I-14	R103	P-22
R28	P-8	R66	J-14	R104	Q-22
R29	M-9	R67	G-8	R105	O-22
R30	L-8	R68	K-4	R106	P-12
R31	L-8	R69	K-4	R107	L-12
R32	J-5	R70	J-4	R108	P-12
R33	H-9	R71	J-3	R109	O-14
R34	G-6	R73	I-3	R110	M-13
R35	E-12	R74	I-2	R111	N-14
R36	F-8	R75	H-3	R112	M-15
R37	B-10	R76	G-2	R113	M-15
R38	C-9	R77	F-3	R114	O-15
R39	E-8	R78	D-2	R115	P-15
R40	F-7	R79	D-4	R116	K-12
R41	F-7	R80	D-4	R117	M-16
R42	E-10	R81	D-5	R118	K-11
R43	C-8	R83	C-4	R119	M-17
R44	F-7	R84	C-6	R120	L-24
R45	R-23	R85	D-7	R121	L-20
R46	D-10	R86	C-6	R122	M-20
R48	E-15	R87	C-11	R123	M-23
R50	Q-23	R88	B-4	R124	L-21
R51	U-20	R89	B-4	R125	M-21
R52	L-12	R90	Q-15	R126	M-24
R53	C-12	R91	R-19	R127	H-19
R54	E-12	R92	S-22	RT1	E-16
R55	E-13	R93	Q-21		
R56	D-11	R94	Q-11		
R57	H-14	R95	T-20		

VARIABLE RESISTORS

VR2	Y-13	VR5	Y-14	VR8	Y-17
VR4	Y-10	VR7	J-11		

CAPACITORS

C25	T-7	C52	L-12	C84	T-20
C26	U-7	C53	C-13	C85	S-24
C27	U-7	C54	D-14	C86	R-20
C28	T-8	C55	F-14	C86A	S-20
C29	R-8	C56	H-14	C87	Q-20
C30	P-8	C57	G-11	C88	P-23
C31	P-8	C58	I-12	C89	N-20
C32	P-8	C59	I-15	C90	O-20
C33	N-8	C60	L-4	C91	O-12
C34	L-7	C61	K-4	C92	N-10
C35	L-8	C62	K-3	C93	P-12
C36	L-8	C63	K-4	C94	K-13
C37	K-8	C64	J-1	C95	L-14
C38	J-6	C67	F-1	C96	L-13
C39	H-7	C69	G-1	C97	N-15
C40	I-7	C71	C-2	C97A	N-16
C41	H-8	C72	B-2	C98	K-14
C42	G-6	C73	D-1	C99	P-16
C43	I-6	C74	C-7	C100	P-16
C44	O-18	C77	C-5	C101	M-20
C45	C-9	C78	S-24	C102	J-20
C46	D-15	C79	E-7	C103	I-20
C48	J-16	C80	N-14	C104	H-20
C49	J-16	C81	R-18	C105	G-20
C50	Q-24	C82	S-20		
C51	Q-24	C83	R-20		

COILS

L52	T-7	L57	M-8	L62	F-8
L53	T-7	L58	L-7	L63	J-3
L54	Q-8	L59	I-8	L64	Y-9
L55	P-7	L60	H-9	L65	H-23
L56	M-8	L61	G-6	L66	Y-16

TRANSFORMERS

IFT2	I-7	CK1	T-15	TR4	W-21
IFT3	L-5	TR1	C-22	TR5	N-13
IFT4	E-3	TR2	T-11		

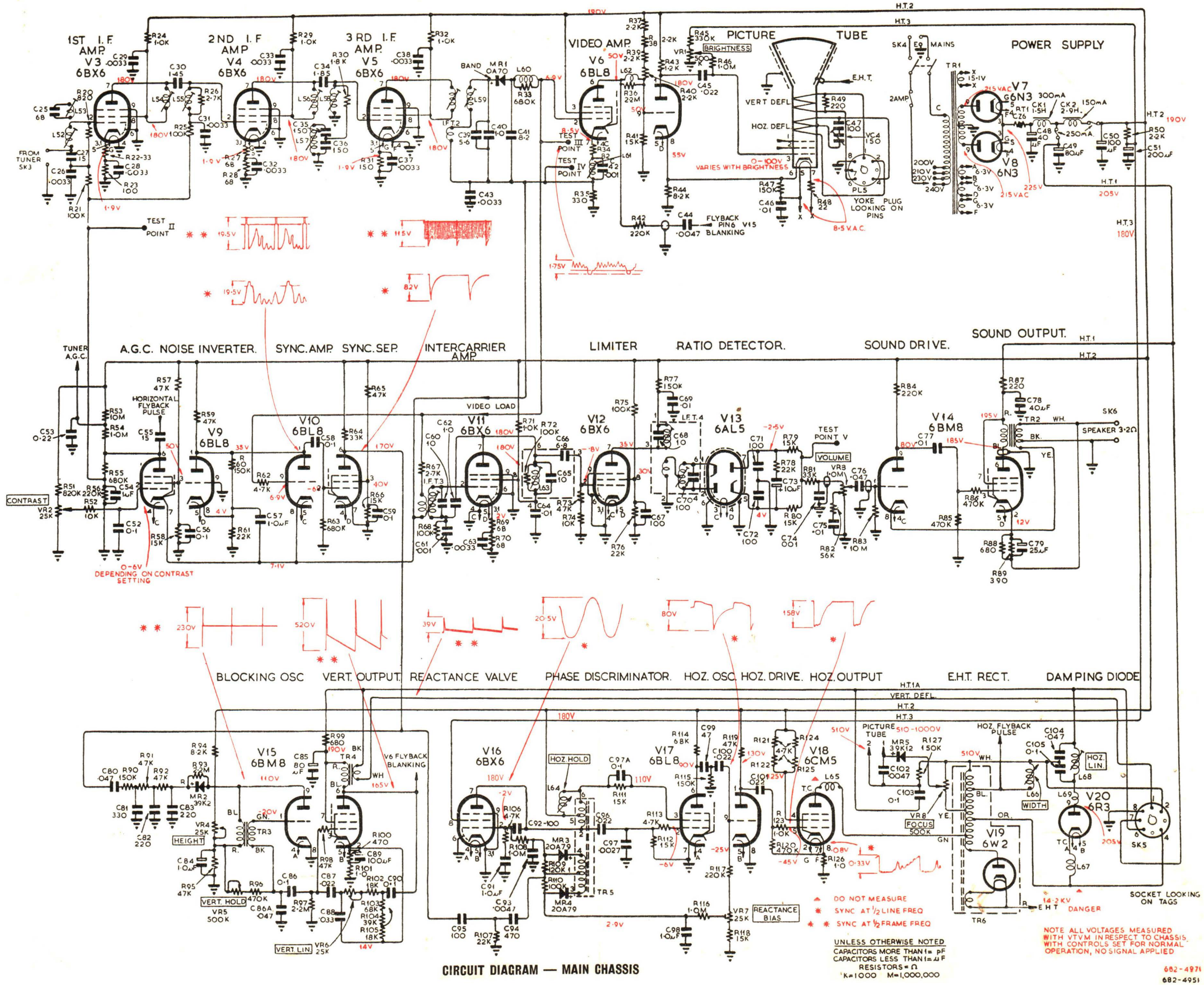
DIODES

MR1	H-8	MR3	O-13	MR5	K-20
MR2	Q-21	MR4	M-13		

VALVES

V3	R-7	V10	I-13	V15	P-20
V4	N-7	V11	L-3	V16	N-11
V5	J-7	V12	G-3	V17	N-15
V6	G-8	V13	C-3	V18	M-24
V9	G-13	V14	5	V20	I-24

"H·M·V" CHASSIS TYPE E1



CIRCUIT DIAGRAM — MAIN CHASSIS