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"HIS MASTER'S VOICE"

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SERVICE MANUAL

for

TELEVISION RECEIVER
CHASSIS TYPE F1

THE GRAMOPHONE COMPANY LIMITED

(Incorporated in England)

HOMEBUSH - - - N.S.W.

Part No. 682-5421

TV RECEIVER — CHASSIS TYPE F1

SPECIFICATION

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

CONSUMPTION:
195 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

AERIAL INPUT:
Provision for 300 ohm balanced twin 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	6BX6	4th I.F. Amplifier
V7	6CK6	Video Amplifier
V8	6N3	Power Rectifier
V9	6N3	Power Rectifier
V10	6BL8	Gated A.G.C. and Noise Inverter
V11	6BL8	Vertical Sync. Separator and Horiz. Sync. Separator
V12	6BX6	Intercarrier Amp.
V13	6BX6	Limiter
V14	6AL5	Ratio Detector
V15	6BM8	Audio Amplifiers & Audio Output
V16	6BM8	
V17	6BM8	Blocking Oscillator & Vertical Output
V18	6BX6	Reactance Valve
V19	6AL5	Phase Discriminator
V20	6BL8	Horizontal Osc. and Horizontal Drive
V21	6CM5	Horizontal Output
V22	1S2	E.H.T. Rectifier
V23	6R3	Damping Diode
MR1	0A70	Vision Detector
MR2	0A81	Clamping Diode
C.R.T.	21ALP4-A	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 the chassis 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.

SUMMARY OF FEATURES

21 valves and three metal rectifiers.

90° aluminised, electrostatic focus picture tube, type 21ALP4-A.

Exact 4 : 3 aspect ratio to avoid cutting off picture information by overscanning — important with film titles.

Laminated, tinted safety glass screen for maximum protection against implosion and to reduce reflections.

Metal-foil screening of the cabinet to minimise interference with nearby radio receivers.

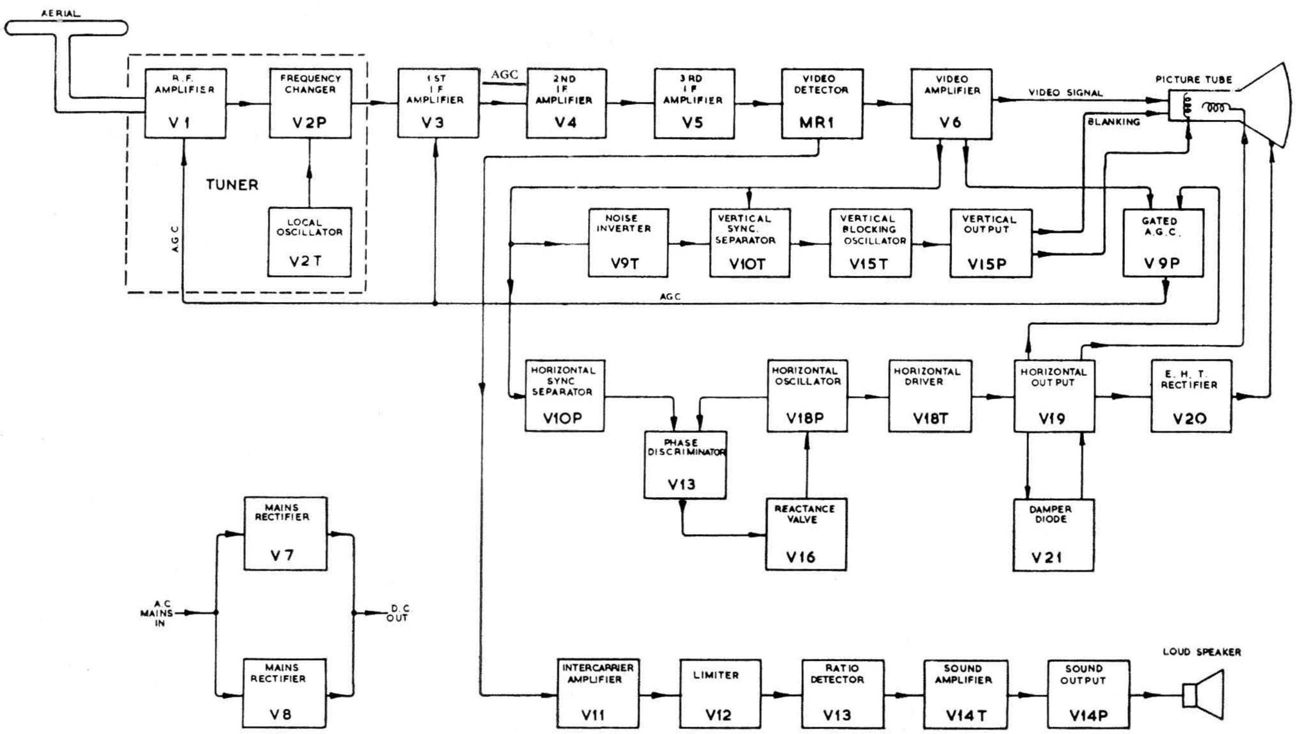


FIG 1

CIRCUIT FEATURES

(1) Turret tuner has facilities for individual exact alignment of oscillator on each channel through the front of the set.

(2) A three-stage I.F. Amplifier gives good sensitivity consistent with wide bandwidth and good definition.

(3) Phase-linear treatment of the I.F. phase response ensures best possible definition with freedom from overshoots or smear and is entirely non-critical with respect to fine tuning. No critical tuning adjustment is needed to obtain a picture free of smear or overshoots.

(4) Overall frequency response of the system is within 3 db. from D.C. up to 4.7 megacycles per second.

(5) D.C. coupling from the video detector through the video amplifier to the picture tube ensures that true scene black is retained and all shades have their true relationship to black. This ensures correct reproduction of special effects such as night-time scenes and shots against a dark background.

(6) Gated A.G.C. gives immunity from effects of impulse noise and has fast action to cope with rapid fading from "aircraft flutter." Delay on the tuner A.G.C. maintains full R.F. stage gain on weak to moderate signals to minimise frequency converter noise.

(7) A noise inverter protects the synchronising circuits from impulse interference. The receiver "holds" well in conditions of severe interference.

(8) Separate vertical and horizontal sync. separators ensure maximum efficiency of separation and positive synchronisation of horizontal and vertical oscillators.

(9) Both amplitude limiter and ratio detector are used to ensure that impulse noise and "sync buzz" on the 5.5 mc/s intercarrier are effectively eliminated even in areas of low signal strength and severe interference.

(10) The push-pull sound amplifier with ample feedback gives excellent quality and a reserve power for handling the "hi-fi" F.M. sound that can be transmitted. A compensated volume control maintains tonal balance at all volume settings.

(11) The Vertical Deflection Amplifier has current feedback to maintain consistent deflection current in coils rather than constant voltage across them. As a result, the height does not shrink as the deflection coils warm up and their resistance increases. This transformer method of feedback also eliminates the need for a vertical linearity control since it is practically independent of wide component tolerances. It also gives excellent interlace.

(12) The Horizontal Hold circuit is a balanced diode discriminator type of phase comparator with a sine-wave oscillator and has sufficient pull-in range to render unnecessary a hold control on the front of the receiver.

(13) Horizontal Deflection uses a unique form of linearity correction which is non-critical and requires no adjustment. The linearity correction is in the form of a metal foil around the picture tube neck under the deflection coils. It also has the advantage that it cannot produce "ringing" or "striations" on the left-hand edge of the picture as other forms of linearity control can do.

(14) Vertical Flyback Blanking eliminates any vertical retrace lines.

(15) Minimum number of controls necessary for operation.

(16) Dustproof seal around picture tube to eliminate dust which is otherwise attracted to the picture tube by static charge.

A REMOTE CONTROL facility is provided whereby sound volume and picture contrast can be controlled at distances up to 25 feet from the receiver.

THERMISTOR PROTECTION is provided to guard against high tension surge when switching on.

CIRCUIT DESCRIPTION

R.F. UNIT

The input to the turret tuner is to a centre tapped transformer which presents an impedance of 300 ohms. In series with each leg of the input is a fixed-tuned video I.F. trap circuit tuned to 36.0 Mc/s. Shunted across the input is a variable sound I.F. trap circuit tuned to 30.5 Mc/s.

R.F. amplification is achieved with a type 6CW7, double triode (V1), in a cascode circuit. The two sections of this stage are connected in series for D.C. The grounded cathode input section is neutralized and is also controllable by A.G.C. from the main chassis. Because of the series D.C. connection of the two portions, A.G.C. voltage to one section also effects control on the other section.

Coupling between the two sections of the cascode is direct and the coil between the two maintains amplification on the high frequency channels.

Inductive coupling is used between the cascode and mixer. V2, a type 6BL8, combined triode-pentode, is used as oscillator and mixer. The oscillator is a Colpitts circuit operating above signal frequency. Injection to the mixer input is by inductive coupling. The fine tuning capacitor is capacitively coupled to the oscillator coil by a contact lug on the coil former. Adjustment on each channel is provided by means of a screwed slug in each oscillator coil, this slug being accessible through a hole in the front plate of the tuner when the fine tuning capacitor is in an approximate mid position.

The fine tuning capacitor takes the form of a specially shaped ceramic wafer which turns between two fixed metal plates.

The intermediate frequency output of the tuner (vision 36.0 Mc/s, sound 30.5 Mc/s) is coupled to the I.F. channel of the main chassis through a secondary winding L9 on the I.F. coil L8.

The heater circuit is filtered by a Ferroxcube bead through which a heater wire is passed. The bead concentrates the field around the wire, increasing its self-inductance so that it acts as a choke.

I.F. AMPLIFIER

The tuner I.F. output is coupled to the grid of the first I.F. Amplifier V3 and tuned by coil L16 with stray capacities. There are four I.F. amplifying stages, the first two are "stacked" as far as D.C. is concerned, i.e., they operate in series with V4 above V3. Similarly, V12 is "stacked" above V5. This does not influence their R.F. operation in any way but does save H.T. current. A.G.C. voltage applied to V3 also controls V4, since the same current flows through both valves.

V5 is coupled to V6 and V6 to the video detector MR1 by inductive coupling.

Trap circuits L15 and L17 are coupled to I.F. coils L16 and L18. The former attenuates the sound carrier 30.5 Mc/s; the latter attenuates the adjacent-channel sound carrier 37.5 Mc/s.

V3 and V4 have small unbypassed cathode resistors R17 and R22 to minimise detuning of their grid circuits when A.G.C. bias is applied.

VIDEO AMPLIFIER

The detected video output from germanium diode MR1 is amplified in V7 and fed to the picture-tube cathode. L22, L24, L25 are peaking chokes to maintain high frequency response. L23 with C39 is a 5.5 Mc/s trap to eliminate the intercarrier component from the vision signal. A modification of this circuit has been introduced in later production, the information being shown in the "Modifications" section of this manual.

INTERCARRIER AMPLIFIER AND SOUND OUTPUT

The frequency - modulated 5.5 Mc/s component from the video detector is applied via transformer IFT5 in the bottom of the diode load R76 to the intercarrier amplifier V12. A single-tuned circuit couples V12 to the limiter V13.

Output from the limiter is demodulated by ratio-detector V14 to provide the audio signal which passes through the tone control network and volume control and is amplified by the triode section V15, phase inverter (V16 triode) and the push-pull power output pair (V15 and V16 pentodes). Feedback is applied via the pentode cathodes and also via V15 triode cathode.

The tone control provides normal flat response at mid position. Full anti-clockwise rotation cuts high frequencies, as may be needed when excessive sibilance or high frequency noise is transmitted. Full clockwise rotation cuts low frequencies. This facility may be needed in "live" reverberant locations such as halls, or schools, or when low frequency noise such as hum is transmitted.

A margin of sound gain is provided so that the full 6 watts output is obtained from sound signals which are not fully modulated. Moreover, the sound output stage has a controlled overload characteristic which ensures that, when overdriven, it does not "paralyse" but merely clips the peaks and so remains comparatively free from audible distortion.

SYNC SEPARATORS

Separate vertical and horizontal sync. separators are employed (V11 triode and pentode sections). Video signal with sync tips positive is taken from the video amplifier anode and applied to the grids of both sections of V11. Differentiation in C54 and R72 occurs in the pentode grid. Grid leak bias on these valves ensures that they conduct only on sync tips and hence the sync output at their anodes is free of picture information. Since differentiation has occurred at the grid of the pentode section, its output is essentially horizontal sync pulses only. The triode section output is followed by a three-stage integrator and only vertical sync pulses pass out of this circuit.

NOISE INVERTER

Anode current in the triode section of V10 is normally cut off by the steady bias between its grid and cathode. Video signal with sync tips positive is fed to the grid of this valve from the video amplifier and the valve is biased so that under normal conditions this signal will not drive it into conduction. However, if impulse interference with amplitude greater than sync pulse height is present, the valve will conduct during the interfering pulse and amplified, inverted interference pulses will appear at the valve anode. Since the anode load of this valve (R68) is also in the path through which video signal is fed to the vertical sync separator then the interfering pulses cancel out across this resistor and the vertical sync separator thereby has good immunity to the effects of impulse noise.

GATED A.G.C.

The same video waveform that feeds the noise inverter is fed to the grid of the A.G.C. amplifier (Pentode section V10). The polarity of this waveform is with sync tips positive, 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 C50 from the line output transformer during line flyback. This overcomes the possibility of the valve conducting on impulse interference occuring 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 the setting of the contrast control. This current flows from chassis via R55 to R52 to the anode of the valve. C48 smooths out the voltage developed by the current pulses that flow in this circuit and develops a steady D.C. potential at the junction of R53 and R52 which is the A.G.C. bias for the I.F. valve V3. Note that this potential is negative with respect to chassis. Fixed cathode bias for the A.G.C. valve is obtained from the voltage divider R56, R57 and the cathode resistor chain R58 and R62.

The grid voltage is obtained from the CONTRAST control tap on the cathode chain and is applied to the A.G.C. valve grid via R65 and R64. Because the A.G.C. valve has a small grid base (about —2V.) compared with the voltage from its cathode to earth (+50V.), the voltage from its grid to earth during conduction remains substantially constant (+48 to 49 volts) as long as any A.G.C. voltage is produced. Thus an increase of voltage at its grid due to the CONTRAST control produces an equal *decrease* of grid voltage due to sync tips from the video output. In this way the CONTRAST control voltage sets the video output voltage, by automatic control of the A.G.C. voltage and hence I.F. gain. At the same time, the CONTRAST control varies the bias of the noise inverter grid so that sync tips are always held just below cut-off independent of the height of the video signal.

R58, R59 and R60 form a pre-set adjustment of the A.G.C. cathode bias and this is set in the factory.

A.G.C. voltage is also applied to the R.F. amplifier from the junction of R50 and R51. This latter resistor, together with C47, form a smoothing filter for the pulses appearing at V10 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 V10 falls to a value fixed by the H.T. voltage divided by the ratio of R49 and R50 to R51 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.

The division ratio of the voltage divider supplying I.F. bias is important. If the ratio is too small, the tuner will start to receive bias before converter noise has disappeared from the picture. As a result, noise will be visible even at high signal levels. If the ratio is too large, an excessive degree of control will be demanded of the I.F. amplifier before the tuner starts to receive bias. This can cause overloading of the I.F. amplifier. Therefore the ratio is adjusted for optimum in the factory by setting the resistor chain R53, R54, R55.

Note: A modification is to be introduced using a separate diode to perform the clamping function.

VERTICAL DEFLECTION CIRCUITS

Vertical sync pulses from the sync separator via the integrator are used to synchronise the blocking oscillator comprised of transformer TR3 and triode portion of V17. "Height" is varied by adjustment of the D.C. potential fed to the blocking oscillator anode and "Vertical Hold" is adjusted by varying the time constant of the blocking oscillator grid circuit. The Vertical Hold control VR6 is returned to the slider of the Height Control potentiometer VR5 so that the blocking oscillator frequency is unaffected when Height is adjusted. This makes the Vertical Hold almost independent of Height Adjustment.

The pentode section of V17 is the vertical output stage. The sawtooth waveform from the blocking oscillator is applied to the grid of the output amplifier and a sawtooth current waveform appears in the vertical output transformer TR4.

A feedback voltage is developed across R120 from the current in the deflection coils. This voltage is stepped up to the input grid of the frame output valve. In a modified circuit an additional resistor will be provided in series with the primary of the feedback transformer for factory adjustment of linearity to take up transformer inductance tolerances. (See Modifications sheet).

HORIZONTAL OSCILLATOR AND AUTOMATIC PHASE CONTROL

Automatic frequency and phase control is obtained by means of a sine wave type of "flywheel" circuit. Incoming horizontal sync. pulses from the horizontal sync separator are fed via transformer TR6 (damped by diode MR2) into the discriminator V19 where they are compared in phase with a sine waveform taken from the horizontal oscillator transformer TR7. In this circuit the sync pulse is applied in the same phase to both diodes of the discriminator. From the oscillator a balanced winding on the transformer feeds equal and opposite sine-wave voltages to the cathodes of the diodes. These pulse and sine waveforms are added together and detected by the diodes so that the voltage developed across R123 is equal to the peak negative voltage applied to the top diode and is negative with respect to the centre tap of the sine wave winding. Similarly, the voltage across R124 is equal to the peak negative voltage applied to the bottom diode and is negative with respect to the centre tap of the winding.

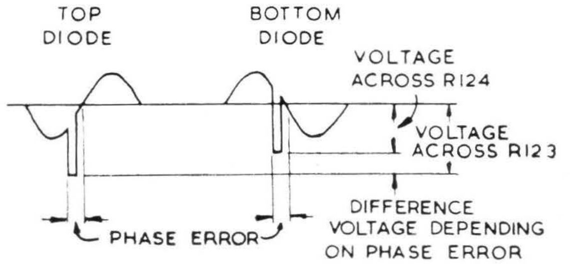
Since the two peak rectified voltages are in the same sense, negative with respect to the transformer centre tap, the discriminator output voltage, taken across the two load resistors R123 and R124, will be their difference.

Fig. 2 shows how the sine wave applied to the diodes in opposite sense and the pulse applied in the same sense are added together.

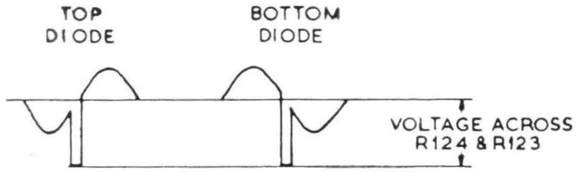
In Fig. 2 (*a*) there is a phase error between the incoming sync pulse and the receiver horizontal oscillator, the sync pulse arriving before the sine-wave crosses the zero axis. Then the voltage across R123 is greater than the voltage across R124 and the discriminator output (the difference between the above two voltages) is negative with respect to the bottom of the discriminator. If the phase error had been in the opposite sense, i.e., the sync pulse arriving *after* the sine-wave had crossed the zero axis, the discriminator output would be in the opposite direction, i.e., positive with respect to the bottom of the discriminator. When the phase error is zero, as in Fig. 2 (*b*), the voltages across R123 and R124 are equal and the resulting output is zero.

The discriminator output is connected in series with a fixed negative bias voltage of approximately —3.4 volts derived from the Reactance Bias potentiometer which taps off part of the grid leak bias developed in the horizontal driver grid circuit. Thus the D.C. voltage on the reactance valve (V18) grid is approximately —3.4 volts when there is zero phase error, more negative when the sync pulse leads in phase and less negative when the sync pulse lags.

The reactance valve V18 is essentially a capacitance shunted across the oscillator tank circuit and the effective value of its capacitance is varied by the control bias on its grid, developed by the discriminator, and is varied in such a direction as to correct for any change of phase which develops a correcting voltage.



(A) WAVEFORMS APPLIED TO PHASE DISCRIMINATOR DIODES WITH PHASE ERROR.



(B) WAVEFORMS APPLIED TO PHASE DISCRIMINATOR. PHASE ERROR ZERO

Fig. 2

HORIZONTAL DEFLECTION CIRCUITS

Negative voltage pulses from the anode of the horizontal oscillator (V20 pentode) are applied via a differentiating circuit of which VR7, the Horizontal Drive control, is a variable element, to the Horizontal Driver valve (V20 triode). VR7 serves to adjust the amount of differentiation and hence the time at which the Horizontal Output valve is driven "on" as required below.

The horizontal driver valve (V20 triode) produces a negative pulse output which is timed to cut off the horizontal output valve V21 at end of a scan. When V21 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, after one-half cycle of oscillation the damping diode V23 starts to conduct. During the "flyback" time the magnetic energy has established itself in the reverse 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 V21 starts the cycle over again.

During flyback a high voltage pulse is produced at the anode of the E.H.T. rectifier V22, which is peak-rectified, and then smoothed by the capacitance between inner and outer bulb coatings of the picture tube, and supplies E.H.T. of approximately 16,000 volts.

Energy recovered by the damping diode produces a boosted H.T. voltage of 530 volts which is used, if required, for focus voltage and also is divided down to 400 volts for supplying the G2 electrode voltage of the picture tube.

REMOTE CONTROL

By plugging into socket SK4, the octal socket in the rear of the chassis, volume and contrast can be controlled from the Remote Control Unit.

The remote volume control VR4A adds a variable resistance across the supply voltage of the sound limiter. Since this control can only *reduce* volume, the main volume control should be set for the maximum volume desired.

The remote contrast control VR2A feeds a variable D.C. voltage into the contrast control chain R63, R64 and R65. It varies contrast either side of a middle (normal) value which is set by the main contrast control.

Note that connection of the Remote Control Unit does not affect operation of the normal receiver volume and contrast controls.

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 terminals. 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.

PICTURE SHIFT

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 shift magnets on the tube neck behind the deflection yoke.

Rotate the centring magnet assembly to shift the picture in the required direction, and move one of the magnets with respect to the other to change the strength of the field and hence the amount of picture shift.

PICTURE TILT

If the picture is not square with the edges of the mask, the deflection coils should be rotated

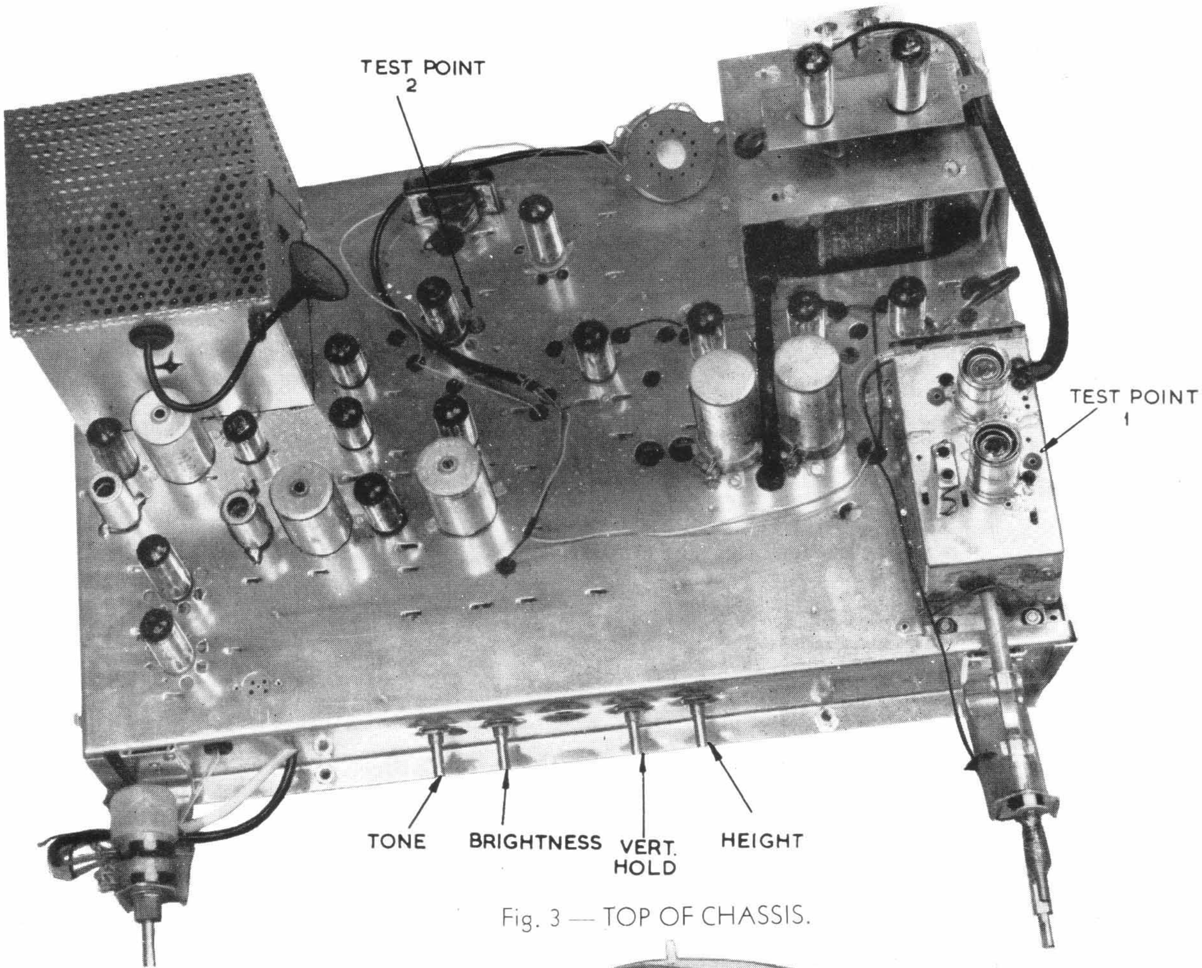


Fig. 3 — TOP OF CHASSIS.

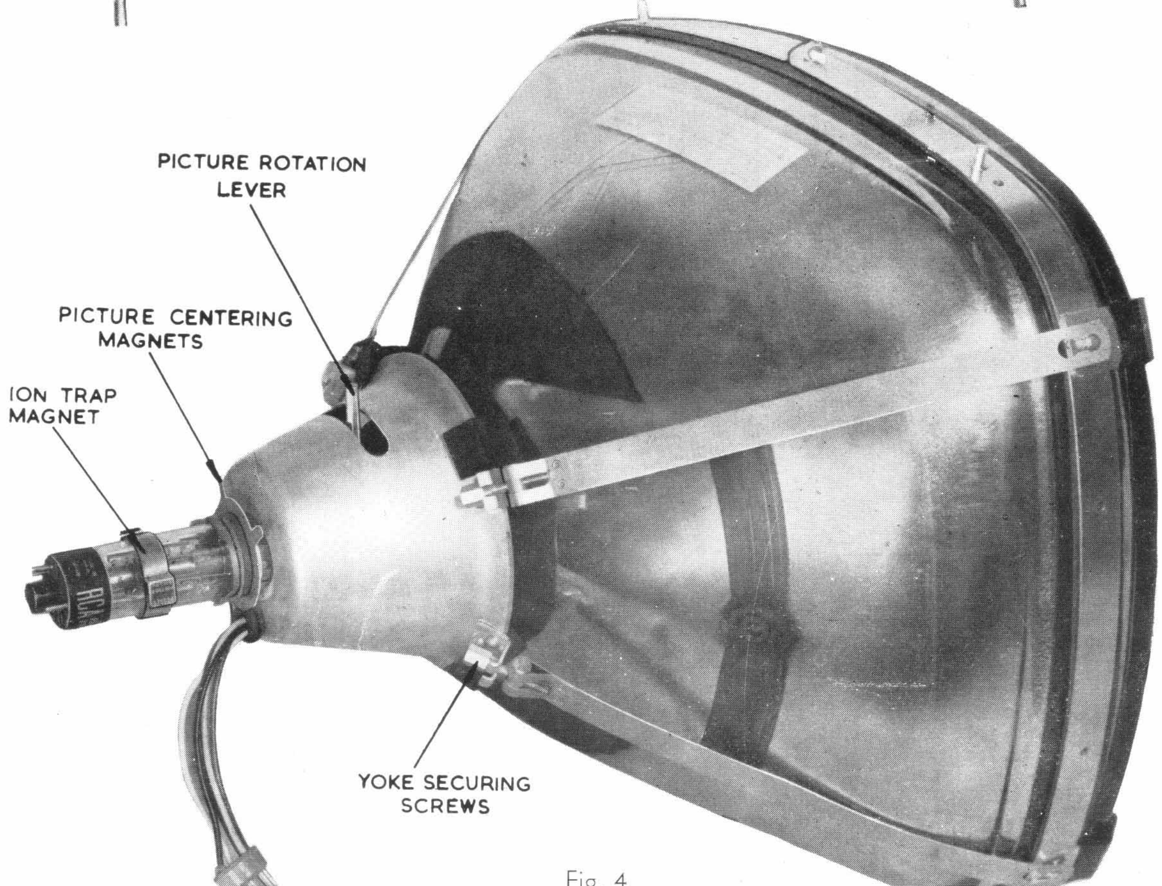


Fig. 4
PICTURE TUBE AND YOKE ASSEMBLY.

by pushing the lever which emerges from the slot in the top of the yoke assembly until the picture is squared up. It may be necessary after this operation to centre the picture by means of the shift magnets.

ION TRAP

If ion trap adjustment is necessary, set brightness control at normal brightness or if no raster is evident at all set brightness control at the centre of its range. Check that ion trap magnet is placed on the neck of the tube in the region of the bend in the gun. (This position is shown in Fig. 4). Rotate magnet around the tube neck and move it backwards or forwards along the neck until the position for maximum brightness of raster is obtained. Readjust brightness setting if necessary to keep raster brightness at that of a reasonably bright picture, but not excessively so.

Check also that the position found for the magnet by the above procedure produces good overall focus.

It is most important that the ion trap be accurately set because misadjustment not only produces astigmation, but can damage the picture tube.

FUSES

Three fuses are provided, one in the mains circuit and two in the H.T. circuits. The H.T. fuses may be 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.

DISMANTLING

REMOVAL OF CHASSIS

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

Remove the two screws securing the back cover of the receiver to the cross rail on which the chassis sits. Ease back the mains interlock socket so that it comes free of the chassis and while holding the socket free, slide the cover downwards in its guide grooves until the top edge is free of its cabinet groove. The cover may then be eased out by bowing it down the centre until the edges are free of the cabinet grooves.

Disconnect the picture tube socket, E.H.T. connector, deflection yoke plug and speaker plug.

Remove all knobs from the front of the set.

Remove four bolts securing chassis to the cabinet shelf.

The chassis may then be withdrawn from the cabinet.

REMOVAL OF DEFLECTION YOKE

First slide the ion trap and picture shift magnets from the picture tube neck.

The deflection yoke may be removed by loosening the four yoke securing screws shown in Fig. 4, lifting them out of the slots in the brackets and then pulling the yoke assembly back off the picture tube.

REMOVAL OF PICTURE TUBE

Having removed the chassis and yoke assembly, lay the cabinet on its face and undo four screws securing the picture tube clamping ring to the cabinet and the mounting brackets.

Lift the tube out carefully by supporting it around the mounting ring.

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

REPLACEMENT OF PICTURE TUBE

First, clean the tube face and the inside surface of the protective glass screen. Stretch the rubber dust-sealing ring around the four spigots moulded into the mask.

Place the tube in position on the mask, and secure with two bottom screws and then two top screws. The top screws should be tightened only until face of tube seats against mask. Prise dust-sealing ring off the spigots until it flicks into position around the mask.

REPLACEMENT OF DEFLECTION YOKE

First, check that the linearity foil insulation on the neck of the picture tube is in its correct position and in good condition. If a replacement picture tube is being fitted it will be necessary to fit a new piece of foil and three layers of insulation (Part No. 892-0251). (Note that this tape is special high voltage insulation material and not cellulose tape). Slide yoke assembly along tube neck and ensure that it slides over the linearity foil without being forced. Replace four securing straps and screw up tight. Replace shift magnets and ion trap magnet.

REPLACEMENT OF CHASSIS

Slide chassis into cabinet, ensuring that the extension spindles on the pre-set controls locate in their guides. Push chassis forward until it comes against a stop, and replace the four screws securing the chassis to the shelf.

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

Replace knobs.

Replace the cabinet back panel and ease home the mains interlock plug. Ensure that this is properly aligned with the pins on the chassis before pushing it home. Do not force it on.

Replace two screws securing the back panel.

IMPORTANT: Before replacing back on receiver, the ion trap must be adjusted in accordance with instructions. Do not operate the receiver for any length of time with the ion trap misadjusted.

ADJUSTMENTS

PICTURE TUBE FOCUS

The voltage on the focus electrode G4 of the picture tube is set in the factory for best overall focus by connecting the focus lead to either pin 8 (earth), pin 2 (225v.) or pin 6 (530 volts) on SK1. This should be checked and reset, if necessary, when a picture tube is changed.

HORIZONTAL DRIVE

Tune to a channel which is operating and, with the picture in lock, adjust VR7 (Horizontal Drive) until a white vertical stripe appears about one-third of the way across from the left-hand edge of the screen. Then adjust this control again until the white stripe just disappears. After this adjustment, check that the reactance bias is —3.4V. and adjust this, if necessary, as below.

REACTANCE BIAS

Use a V.T.V.M. to read the voltage at C98 and set this at —3.4V. by means of the Reactance Bias potentiometer VR8.

HORIZONTAL HOLD

Adjust reactance bias to —3.4V. and set "Horizontal Hold" control on the rear of chassis to the centre of its range. Remove sync pulses by shorting pin 2 of V11 to chassis. Adjust the core of the horizontal oscillator transformer until the picture just "floats" or locks weakly. Remove the short circuit on V11.

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 as suggested below.

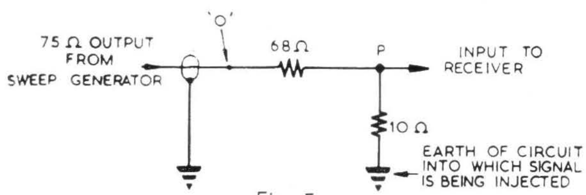


Fig. 5

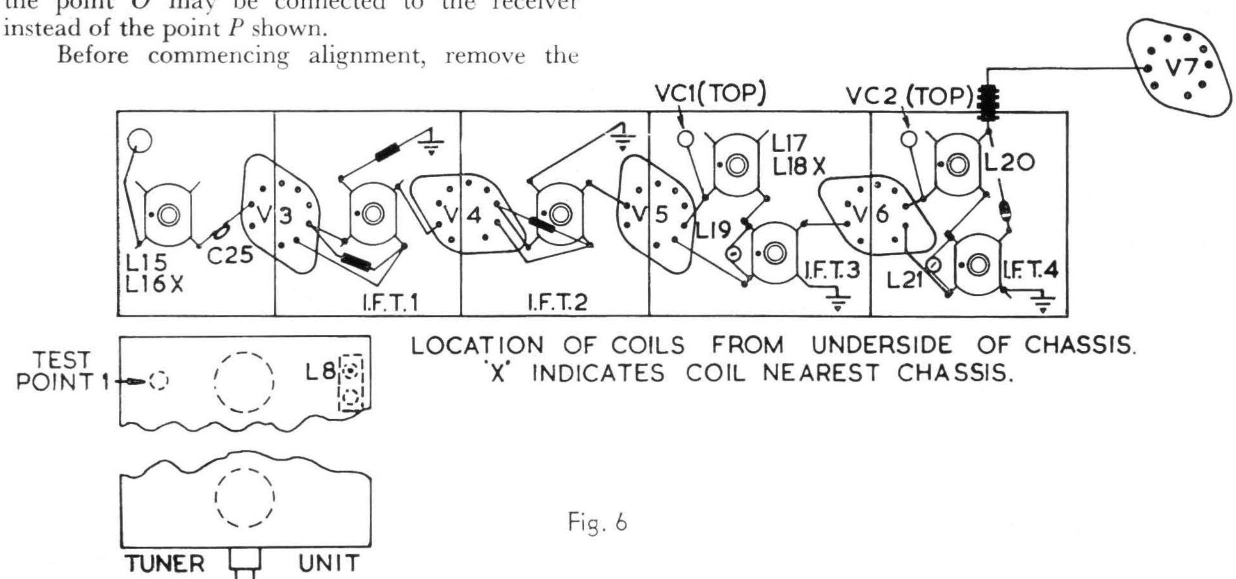
If there is inadequate output from this arrangement for alignment of the final I.F. stage, the point *O* may be connected to the receiver instead of the point *P* shown.

Before commencing alignment, remove the cores from L15, L17 and L18. Turn the two trimmers, VC1 and VC2 to their minimum capacitance position, i.e., $\frac{7}{16}''$ of thread on the screw should be visible above the chassis. Connect —3V. bias across C48. Connect the input to the display unit between the grid of V7 and earth. Throughout alignment, the display unit should be adjusted to present a reasonable amplitude display from a signal 2.5V. peak to peak, and the output from the I.F. strip should be maintained at that level by varying the output from the sweep generator.

ALIGNMENT

(1) Connect the sweep output between the grid of V6 and earth. Adjust the core of L20 to peak the response at 34.65 Mc/s, with the core in the position closest to the chassis. Adjust the core in IFT4 to give a symmetrical response with the core in the position furthest from the chassis, and then vary both to obtain the response shown in *A* (Fig. 7).

(2) Remove the sweep generator output from the grid of V6 and re-connect it to the grid



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

Fig. 6

VOLTAGE TABLE

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

VALVE No.	FUNCTION	TYPE	PENTODE SECTION				TRIODE SECTION			COMMENTS
			ANODE	G2	K	G1	ANODE	K	G1	
1	R.F. Amplifier	6CW7	165	—	89	87	89	0	0	Both sections are Triodes.
2	Frequency Changer	6BL8	165	113	0	−2.5*	68	0	−4*	*This is Min. Negative Voltage
3	1st I.F. Amplifier	6BX6	105	105	0.3	−1.9	—	—	—	
4	2nd I.F. Amplifier	6BX6	210	210	105	104	—	—	—	
5	3rd I.F. Amplifier	6BX6	105	105	0.9	0	—	—	—	
6	4th I.F. Amplifier	6BX6	180*	180*	2.2	0	—	—	—	*G1 earthed when readings taken
7	Video Amplifier	6CK6	100	210	1.8	−2.2	—	—	—	
8	Power Rectifier	6N3	235AC	—	242	—	—	—	—	Diode
9	Power Rectifier	6N3	235AC	—	242	—	—	—	—	Diode
10	A.G.C. and Noise Inverter	6BL8	—	115	55	33	100	55	27	Pentode Anode fed with Line Pulse
11	Horiz. & Vert. Sync. Separators	6BL8	150	50	0	−5	45	0	−5	
12	Intercarrier Amplifier	6BX6	210	210	105	104	—	—	—	
13	Limiter	6BX6	60	58	0	−0.6	—	—	—	
14	Ratio Detector	6AL5	0	—	4.5	—	−4.5	0	—	Both sections are Diodes. Voltages subject to considerable variation with no signal input.
15	Sound Output and Amplifier	6BM8	205	210	16	0	110	1.4	0	
16	Sound Output and Amplifier	6BM8	205	210	16	0	110	1.4	0	
17	Vert. Output and Oscillator	6BM8	190	200	15	0	90	0	−25	
18	Reactance Valve	6BX6	210	180	0	−3.2	—	—	—	
19	Phase Discriminator	6AL5	−3.4	—	—	—	−3.5	—	—	Both sections are Diodes. Voltages subject to considerable variation with no signal input.
20	Horizontal Osc. and Drive	6BL8	100	120	0	−6	150	0	−20	
21	Horizontal Output	6CM5	*	140	0	−50	—	—	—	*High Voltage. Do not measure.
22	E.H.T. Rectifier	1S2	*	—	16KV	—	—	—	—	*High Voltage. Do not measure.
23	Damping Diode	6R3	225	—	*	—	—	—	—	*High Voltage. Do not measure.
C.R.T.	Picture Tube	TYPE	ANODE	G2	K	G1	G4			G1 Voltage adjusted on Test at Factory.
		21ALP4	16KV	530	100	0—80V.	0.225 or 530 V.			

HT1: 225V.
HT2: 210V.
HT3: 180V.
Boost H.T.: 530V
Reactance Bias: −3.4 on Wiper of Control.
Filaments: 6.3V. A.C.
Current Fuse (2 Amp): 830 mA.
Current Fuse 2 (250 mA Anti-Surge): 220 mA.
Current Fuse 3 (250 mA): 140 mA.

Condition of Measurement:

Brightness — Normal.
Width and Height — Normal.
Contrast — —Maximum.
Tuner — No Signal, Aerial Short Circuited.
No Remote Control Unit.

of V5. Insert a core in L18 and peak the response at 34.65 Mc/s with the core in the position closest to the chassis. Adjust the core of IFT3 to give a symmetrical response with the core in the position furthest from the chassis, and then vary both to obtain the response shown in *B*.

(3) Remove the sweep generator output from the grid of V6 and re-connect it to the junction of C25 and L16. Adjust the core of IFT2 to make the output maximum possible at 33.5 Mc/s, with the core in the position closest to the chassis, adjust the core in IFT1 to give the maximum possible output at 36.0 mc/s with the core in the position closest to the chassis, and then using both cores, obtain the response shown in *C*.

(4) Remove the sweep generator output from the junction of C25 and L16 and connect it to the test point 1 on the turret. Switch the turret to position 12. Adjust the core in L8 to give the maximum response at 34.65 Mc/s. Adjust the core in L16 to the position nearest the chassis which peaks at 34.65 Mc/s, and then using both L8 and L16 cores, obtain the response shown in *D*.

(5) Increase capacity of VC1 so that the peak response falls about $1\frac{1}{2}$ db. and then adjust VC2 to make the peak response fall a further $1\frac{1}{2}$ db. Vary both to obtain *E* as closely as possible, and if necessary, make an alteration to the setting of IFT4.

(6) Insert a core into L17 and adjust for minimum response at 37.5 Mc/s. Insert a core into L15 and adjust to set the 30.5 Mc/s marker in the middle of the step created by this coil.

(7) Make any small final adjustments that may prove necessary to obtain the end result shown in *F*.

Note that L19 and L21 are coupling coils for factory adjustment and should not be disturbed.

MODIFICATIONS

(1) Some early receivers did not include R137A (18K) in the horizontal output valve screen grid circuit. The inclusion of this resistor gives greater maximum width of horizontal scan.

An additional capacitor of value .0033 or .0066 may be shunted across C103 (.015) for the same reason.

(2) Some early receivers did not include R142A (220K) which was added to enable the receiver to use picture tubes which require a large cut-off voltage.

The following modifications have been made subsequent to publication of the circuit diagram. It is not suggested that any receivers in the field should require these modifications, but they have been made to enable wide component tolerances to be accepted in production or in service replacement.

(3) A.G.C.

R49 changed to 3.9 meg. 10% type BTA.
R51 changed to 2.2 meg. 10% type BTS.
R52 changed to 1.8 meg. 10% type BTS.
R21 changed to 27 K. 10% type BTS, removed from earth and connected across C28.

(4) VERTICAL OUTPUT STAGE FEEDBACK

Some 3.9 ohm BW1 resistors used in R120 position have proved intermittent. Consequently a resistor wound on a tag panel has been substituted. On the same panel a resistor R120A is wound in three sections which are respectively 1.2, 2.4 and 4.8 ohms. R120A connects between the junction of R120 with the vertical output transformer and the BL lead of the vertical feedback transformer TR5. Part number for this combination resistor is 750-0151.

Wire jumpers across the tags of R120A can be used to produce any value of resistance from 0 to 8.4 ohms in steps of 1.2 ohms to act as a vertical linearity adjustment. To facilitate adjustment of linearity without removing the chassis from the cabinet, this resistor panel is mounted on the top of the chassis.

Note that R120 and R120A are wound on the same strip and when adjusting linearity only R120A should be varied. Do not alter R120. Increase of R120A crushes the top of the picture, decrease opens it.

Some 6BM8 vertical output valves require a lower value of bias resistor than 330 ohms. Accordingly, R119 has been reduced to 270 ohms in later production. The symptoms of this trouble is an excessive crushing at the top of the picture as the height is increased. It may be rectified by changing the bias resistor or replacing the vertical output valve.

(5) 5.5 MC/S. TRAP

L22 wound on R31 replaced with new part, No. 259-0741.

IFT5 replaced with new part, No. 906-0181.

C56 deleted.

L23 and C39 deleted.

R78A added (39 ohm 10% BTS).

The modified circuit diagram is shown in Fig. 8.

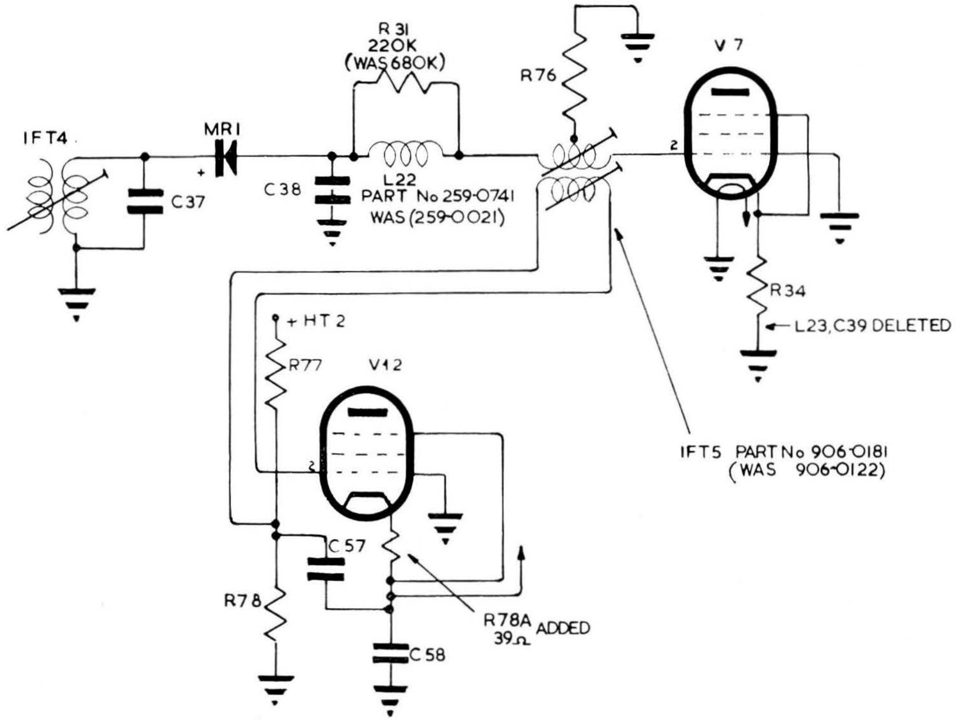


Fig. 8

(6) SOUND OUTPUT TRANSFORMER

To provide for the addition of a 13 ohm connection on the secondary.

TR2 changed to Part No. 905-0201. The modified transformer connections are shown in Fig. 9.

(7) POWER TRANSFORMER

A new mains transformer, Part No. 904-0191, replaces Part No. 904-0152. The new transformer also requires the addition of a 22 ohm 10 watt resistor (Part No. 750-0141) added in series with the thermistor RT1.

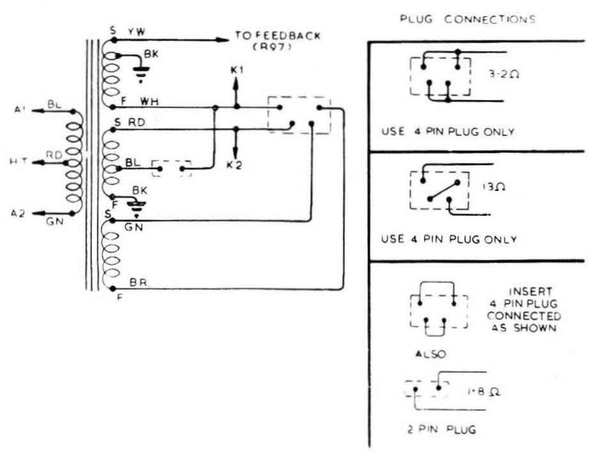


Fig. 9

PARTS LIST

RESISTORS

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
R15	740-0252	1500 ohms ± 10% BTS	R81	740-0122	47,000 ohms ± 10% BTS
R16	740-0612	10,000 ohms ± 20% BTS	R82	740-0082	10,000 ohms ± 10% BTS
R17	740-0483	56 ohms ± 10% ½ Watt Morganite	R83	740-0612	10,000 ohms ± 20% BTS
R18	740-0032	2,200 ohms ± 10% BTS	R84	742-0492	68,000 ohms ± 10% BTA
R19	742-0142	270,000 ohms ± 10% BTA	R85	740-0742	2,200 ohms ± 20% BTS
R20	742-0142	270,000 ohms ± 10% BTA	R86	740-0102	22,000 ohms ± 10% BTS
R21	740-0532	1 megohm ± 20% BTS	R87	740-0092	15,000 ohms ± 10% BTS
R22	740-0483	56 ohms ± 10% ½ Watt Morganite	R88	740-0092	15,000 ohms ± 10% BTS
R23	740-0693	150 ohms ± 20% ½ Watt Morganite	R89	740-0122	47,000 ohms ± 10% BTS
R24	740-0302	1,800 ohms ± 10% BTS	R90	740-0102	22,000 ohms ± 10% BTS
R25	740-0653	100 ohms ± 10% ½ Watt Morganite	R91	740-0122	47,000 ohms ± 10% BTS
R26	740-0693	150 ohms ± 20% ½ Watt Morganite	R92	740-0702	56,000 ohms ± 10% BTS
R27	740-0052	3,300 ohms ± 10% BTS	R93	742-0122	150,000 ohms ± 10% BTA
R28	740-0273	150 ohms ± 10% ½ Watt Morganite	R94	740-0242	33,000 ohms ± 10% BTS
R29	740-0572	1,000 ohms ± 20% BTS	R95	742-0122	150,000 ohms ± 10% BTA
R30	740-0572	1,000 ohms ± 20% BTS	R96	740-0252	1,500 ohms ± 10% BTS
R31	742-0362	680,000 ohms ± 20% BTA	R97	740-0112	27,000 ohms ± 10% BTS
R32	742-0562	470,000 ohms ± 20% BTA	R98	740-0362	390,000 ohms ± 10% BTS
R33	750-0121	2,700 ohms ± 5% 10 Watts Reco.	R99	740-0182	470,000 ohms ± 10% BTS
R34	740-0773	39 ohms ± 10% ½ Watt Morganite	R100	740-0182	470,000 ohms ± 10% BTS
R35	742-0522	820,000 ohms ± 10% BTA	R101	740-0182	470,000 ohms ± 10% BTS
R36	742-0172	470,000 ohms ± 10% BTA	R102	742-0502	390 ohms ± 10% BTA
R37	740-0172	270,000 ohms ± 10% BTS	R103	742-0502	390 ohms ± 10% BTA
R38	740-0492	1.5 megohms ± 20% BTS	R104	748-0102	470 ohms ± 10% BW1
R39	740-0622	470,000 ohms ± 20% BTS	R105	748-0102	470 ohms ± 10% BW1
R40	740-0032	2,200 ohms ± 10% BTS	R106	742-0252	10,000 ohms ± 10% BTA
R41	740-0072	4,700 ohms ± 10% BTS	R107	742-0392	47,000 ohms ± 20% BTA
R42	740-0072	4,700 ohms ± 10% BTS	R108	740-0082	10,000 ohms ± 10% BTS
R43	740-0262	560 ohms ± 10% BTS	R109	740-0082	10,000 ohms ± 10% BTS
R44	740-0262	560 ohms ± 10% BTS	R110	740-0082	10,000 ohms ± 10% BTS
R45	746-0202	3.9 ohms ± 20% BW½	R111	742-0522	820,000 ohms ± 10% BTA
R46	742-0712	2,200 ohms ± 20% BTA	R112	740-0142	100,000 ohms ± 10% BTS
R47	742-0712	2,200 ohms ± 20% BTA	R113	740-0072	4,700 ohms ± 10% BTS
R48	742-0752	10,000 ohms ± 20% BTA	R114	740-0122	47,000 ohms ± 10% BTS
R49	742-0222	4.7 megohms ± 10% BTA	R115	742-0322	1,000 ohms ± 20% BTA
R50	742-0222	4.7 megohms ± 10% BTA	R116	742-0322	1,000 ohms ± 20% BTA
R51	740-0192	1 megohm ± 10% BTS	R117	740-0202	2.2 megohms ± 10% BTS
R52	740-0192	1 megohm ± 10% BTS	R118	740-0522	220,000 ohms ± 20% BTS
R53	740-0752	68,000 ohms ± 10% BTS	R119	742-0312	330 ohms ± 10% BTA
R54	740-0122	47,000 ohms ± 10% BTS	R120	748-0122	3.9 ohms ± 5% BW1
R55	740-0102	22,000 ohms ± 10% BTS	R121	740-0732	12,000 ohms ± 10% BTS
R56	742-0432	18,000 ohms ± 10% BTA	R122	740-0192	1 megohm ± 10% BTS
R57	742-0762	12,000 ohms ± 10% BTA	R123	742-0582	120,000 ohms ± 10% BTA
R58	740-0042	2,700 ohms ± 10% BTS	R124	742-0582	120,000 ohms ± 10% BTA
R59	740-0022	1,000 ohms ± 10% BTS	R125	749-0181	22,000 ohms ± 10% BTB
R60	740-0013	470 ohms ± 10% ½ Watt Morganite	R126	740-0612	10,000 ohms ± 20% BTS
R61	740-0082	10,000 ohms ± 10% BTS	R127	740-0182	470,000 ohms ± 10% BTS
R62	740-0022	1,000 ohms ± 10% BTS	R128	740-0162	220,000 ohms ± 10% BTS
R63	740-0782	120,000 ohms ± 10% BTS	R129	742-0492	68,000 ohms ± 10% BTA
R64	740-0082	10,000 ohms ± 10% BTS	R130	740-0142	100,000 ohms ± 10% BTS
R65	740-0112	27,000 ohms ± 10% BTS	R131	740-0122	47,000 ohms ± 10% BTS
R66	742-0522	820,000 ohms ± 10% BTA	R132	740-0392	330,000 ohms ± 10% BTS
R67	740-0162	220,000 ohms ± 10% BTS	R133	740-0152	150,000 ohms ± 10% BTS
R68	740-0242	33,000 ohms ± 10% BTS	R134	740-0142	100,000 ohms ± 10% BTS
R69	740-0202	2.2 megohms ± 10% BTS	R135	740-0242	33,000 ohms ± 10% BTS
R70	742-0072	33,000 ohms ± 10% BTA	R136	742-0392	47,000 ohms ± 20% BTA
R71	740-0242	33,000 ohms ± 10% BTS	R137	749-0151	10,000 ohms ± 20% BTB
R72	740-0202	2.2 megohms ± 10% BTS	R137A	742-0432	18,000 ohms ± 10% BTA
R73	742-0162	390,000 ohms ± 10% BTA	R138	742-0562	470,000 ohms ± 20% BTA
R74	742-0092	47,000 ohms ± 10% BTA	R139	740-0572	1,000 ohms ± 20% BTS
R75	740-0092	15,000 ohms ± 10% BTS	R140	749-0151	10,000 ohms ± 20% BTB
R76	740-0043	2,700 ohms ± 10% ½ Watt Morganite	R141	746-0182	1.0 ohm ± 5% BW½
R77	742-0142	270,000 ohms ± 10%BTA	R142	740-0152	150,000 ohms ± 10% BTS
R78	742-0142	270,000 ohms ± 10%BTA	R142A	742-0132	220,000 ohms ± 10% BTA
R79	740-0273	150 ohms ± 10% ½ Watt Morganite	R143	742-0492	68,000 ohms ± 10% BTA
R80	740-0142	100,000 ohms ± 10% BTS			

CAPACITORS

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
C24	273-0591	60 pF. ± 1 pF Silver Mica M.S.	C35	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.
C25	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C36	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.
C26	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C37	271-0151	6.8 pF. ± ¼ pF. Tubular Ceramic NPO
C27	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C38	271-0131	8.2 pF. ± ¼ pF. Tubular Ceramic NPO
C28	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C39	273-0721	.001 mfd. ± 5% Silver Mica S.S.
C29	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C40	273-0721	.001 mfd. ± 5% Silver Mica S.S.
C30	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C41	279-4581	.0047 mfd. ± 10% Paper Tube 400 V.W.
C31	273-0591	68 pF. ± 1 pF. Silver Mica M.S.	C42	279-4581	.0047 mfd. ± 10% Paper Tube 400 V.W.
C32	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C43	269-0401	40 mfd. Electrolytic 250 V.W.
C33	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C44	269-0441	200 mfd. Electrolytic 250 V.W.
C34	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.	C45	269-0401	80 mfd. Electrolytic 250 V.W.
			C46	269-0441	100 mfd. Electrolytic 250 V.W.
			C47	279-4161	.22 mfd. ± 10% Paper Tube 200 V.W.

PARTS LIST

CAPACITORS—*continued*

REF.	PART No.	DESCRIPTION
C48	279-4161	.22 mfd. ± 10% Paper Tube 200 V.W.
C49	279-1161	.22 mfd. ± 20% Paper Tube 200 V.W.
C50	271-0231	68 pF. ± 10% Ceramic Disc N750 3K.V.W.
C51	271-0221	2.0 pF. ± ¼ pF. Bead NPO
C52	279-4661	.022 mfd. ± 10% Paper Tube 400 V.W. ....
C53	271-0221	2.0 pF. ± ¼ pF. Bead NPO
C54	273-0691	220 mfd. ± 10% Mica M.S.
C55	279-1121	.1 mfd. ± 20% Paper Tube 200 V.W.
C56	271-0141	10 pF. ± ¼ pF. Ceramic Tube NPO
C57	273-0761	.001 mfd. ± 10% Silver Mica S.S.
C58	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.
C59	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.
C60	273-0561	.0010 pF. ± 10% I.F. Type
C61	271-0151	6.8 pF. ± ¼ pF. Ceramic Tube NPO
C62	273-0631	330 pF. ± 10% Mica M.S.
C63	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.
C64	273-0561	10 pF. ± 10% I.F. Type
C65	271-0031	.0033 mfd. + 100% — 0% Ceramic Disc 500V. Wkg.
C66	273-0331	100 pF. ± 5% I.F. Type
C67	273-0351	100 pF. ± 5% Silver Mica M.S.
C68	273-0351	100 pF. ± 5% Silver Mica M.S.
C69	269-0371	10 mfd. Electrolytic 40 P.V.
C70	279-4021	.015 mfd. ± 10% Paper Tube 200 V.W.
C71	273-0951	.0033 mfd. ± 10% Mica M.S.
C72	273-0971	680 pF. ± 10% Mica P.T.
C73	279-4001	.01 mfd. ± 10% Paper Tube 200 V.W.
C74	273-0051	100 pF. ± 10% Mica P.T.
C75	279-1621	.01 mfd. ± 20% Paper Tube, 400 V.W.
C76	269-1621	.01 mfd. ± 20% Paper Tube, 400 V.W.
C77	269-0401	40 mfd. Electrolytic, 250 V.W.
C78	269-0221	25 mfd. Electrolytic, 40 V.P.

REF.	PART No.	DESCRIPTION
C79	269-0221	25 mfd. Electrolytic, 40 V.P.
C80	279-4581	.0047 mfd. ± 10% Paper Tube, 400 V.W.
C81	269-0211	8mfd. Electrolytic, 350 V.P.
C82	279-4581	.0047 mfd. ± 10% Paper Tube, 400 V.W.
C83	279-0281	1 mfd. ± 25% Metalised Paper 200 V.W.
C84	279-4581	.0047 mfd. ± 10% Paper Tube, 400 V.W.
C85	279-4701	.047 mfd. ± 10% Paper Tube, 400 V.W.
C86	269-0401	80 mfd. Electrolytic, 250 V.W.
C87	279-4741	.1 mfd. ± 10% Paper Tube, 400 V.W.
C88	279-4161	.22 mfd. ± 10% Paper Tube, 200 V.W.
C89	269-0361	100 mfd. Electrolytic, 40 V.P.
C90	273-0691	220 pF. ± 10% Mica M.S.
C91	279-0281	1 mfd. ± 25% Metalised Paper 200 V.W.
C92	273-0821	33 pF. ± 5% Silver Mica M.S.
C93	279-4581	.0047 mfd. ± 10% Paper Tube, 400 V.W.
C94	279-4581	.0047 mfd. ± 10% Paper Tube, 400 V.W.
C95	273-0891	.0039 mfd. ± 5% Silver Mica, SM
C96	279-1121	.1 mfd. ± 20% Paper Tube, 200 V.W.
C97	273-0351	100 pF. ± 5% Silver Mica, M.S.
C98	279-1121	.1 mfd. ± 20% Paper Tube, 200 V.W.
C99	273-0541	47 pF. ± 10% Silver Mica, M.S.
C100	279-1661	.022 mfd. ± 20% Paper Tube, 400 V.W.
C101	279-1581	.0047 mfd. ± 20% Paper Tube 400 V.W.
C102	279-1661	.022 mfd. ± 20% Paper Tube, 400 V.W.
C103	279-5141	.015 mfd. ± 10% Paper Tube, 600 V.W.
C104	279-2241	.1 mfd. ± 20% Paper Tube, 600 V.W.
C105	279-2241	.1 mfd. ± 20% Paper Tube, 600 V.W.

COILS

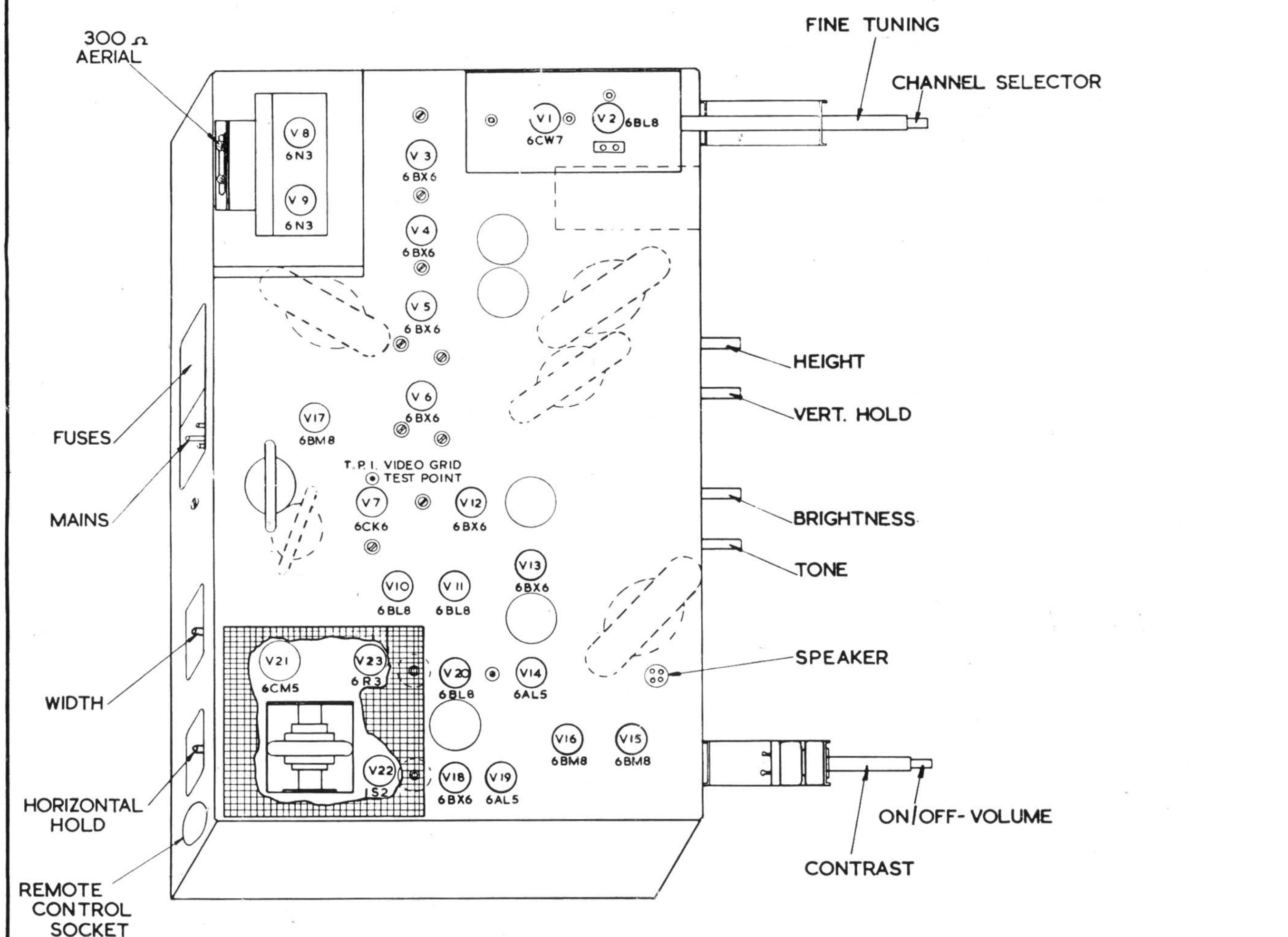
REF.	PART No.	DESCRIPTION
L15, L16	259-0361	1st I.F. Grid and Trap
L17, L18	259-0691	3rd I.F. Grid and Trap
L19	259-0671	Coupling Trimmer
L20	259-0611	4th I.F. Anode
L21	259-0671	Coupling Trimmer
L22	259-0021	Video Peaking (Grid)

REF.	PART No.	DESCRIPTION
L23	259-0701	Video Trap (I.F.)
L24	259-0641	Video Peaking (Series Anode)
L25	259-0651	Video Peaking (Shunt Anode)
L26	259-0031	I.F. Sound Coupling
L27	259-0631	Horizontal Hold Control
L28	232-0151	Filament Choke
L29	232-0151	Filament Choke
L30	259-0622	Width Control.

MISCELLANEOUS

REF.	PART No.	DESCRIPTION
VR1	677-0351	500,000 ohms
VR2	677-0331	10,000 ohms
VR3	677-0371	500,000 ohms
VR4	677-0331	1 megohm tapped at 500,000 ohms
VR5	677-0361	50,000 ohms
VR6	677-0351	500,000 ohms
VR7	677-0341	250,000 ohms
VR8	677-0171	25,000 ohms
VC1	281-0131	Capacitor Trimmer
VC2	281-0131	Capacitor Trimmer
IFT1	906-0151	Transformer, I.F.
IFT2	906-0151	Transformer, I.F.
IFT3	906-0162	Transformer, I.F.
IFT4	906-0171	Transformer, I.F.
IFT5	906-0122	Transformer, I.F.
IFT6	906-0101	Transformer, I.F.
TR1	904-0151	Transformer — Power
TR2	905-0182	Transformer — Audio
TR3	908-0052	Transformer — Blocking Osc.
TR4	905-0191	Transformer — Frame
TR5	908-0181	Transformer — Vert. Feedback
TR6	908-0111	Transformer — Sync. Coupling
TR7	908-0122	Transformer — Horizontal Osc.
TR8	908-0173	Transformer — Hor. Output
CH1	232-0122	Choke, 1.5H, 300 mA
CH2	232-0112	Choke, 2.9H, 150 mA

REF.	PART No.	DESCRIPTION
MR1	932-0591	Diode 0A70
MR2	932-0791	Diode 0A81
V3	932-0521	6BX6 Valve
V4	932-0521	6BX6 Valve
V5	932-0521	6BX6 Valve
V6	932-0521	6BX6 Valve
V7	932-0661	6CK6 Valve
V8	932-0551	6N3 Valve
V9	932-0551	6N3 Valve
V10	932-0501	6BL8 Valve
V11	932-0501	6BL8 Valve
V12	932-0521	6BX6 Valve
V13	932-0521	6BX6 Valve
V14	932-0491	6AL5 Valve
V15	932-0511	6BM8 Valve
V16	932-0511	6BM8 Valve
V17	932-0511	6BM8 Valve
V18	932-0521	6BX6 Valve
V19	932-0491	6AL5 Valve
V20	932-0501	6BL8 Valve
V21	932-0531	6CM5 Valve
V22	932-0771	1S2 Valve
V23	932-0561	6R3 Valve
CRT	932-0671	21ALP4—A 21in. Picture Tube
	224-0721	Tuner Assembly
	259-0592	Deflection Yoke Assembly.


300 Ω
AERIAL
FINE TUNING
CHANNEL SELECTOR
V 8
6N3
V 9
6N3
V 1
6CW7
V 2
6BL8
V 3
6 BX6
V 4
6 BX6
V 5
6 BX6
V 6
6 BX6
V17
6BM8
T.P.I. VIDEO GRID
TEST POINT
V7
6CK6
V12
6BX6
V13
6BX6
V10
6BL8
V 11
6BL8
V21
6CM5
V23
6R3
V20
6BL8
V14
6AL5
V16
6BM8
V15
6BM8
V22
1S2
V18
6BX6
V19
6AL5
HEIGHT
VERT. HOLD
BRIGHTNESS
TONE
SPEAKER
ON/OFF-VOLUME
CONTRAST
FUSES
MAINS
WIDTH
HORIZONTAL
HOLD
REMOTE
CONTROL
SOCKET

682-5441

I.F. RESPONSES

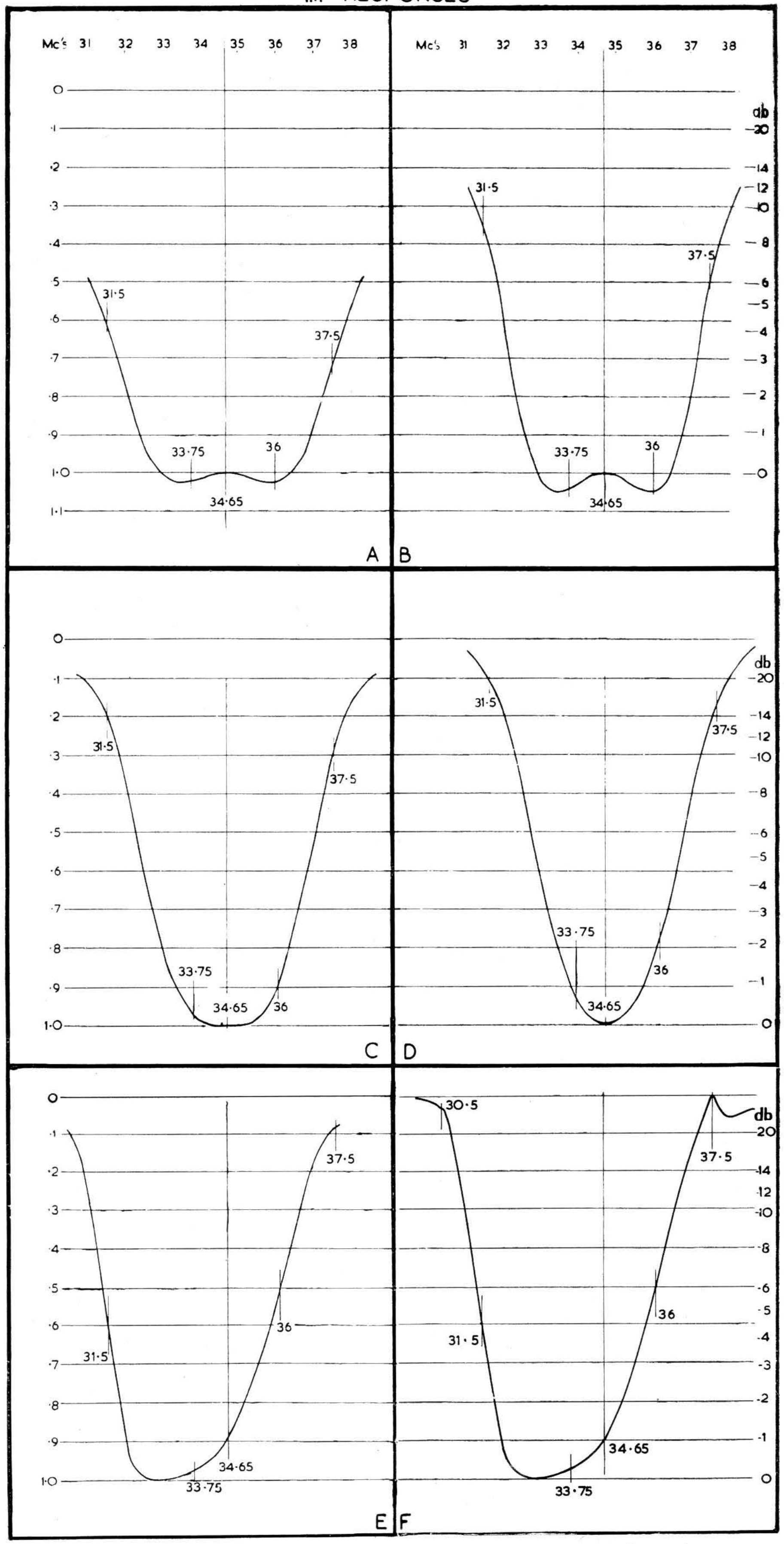


Fig. 7 — Oscilloscope Patterns Obtained with Sweep Oscillator Input.

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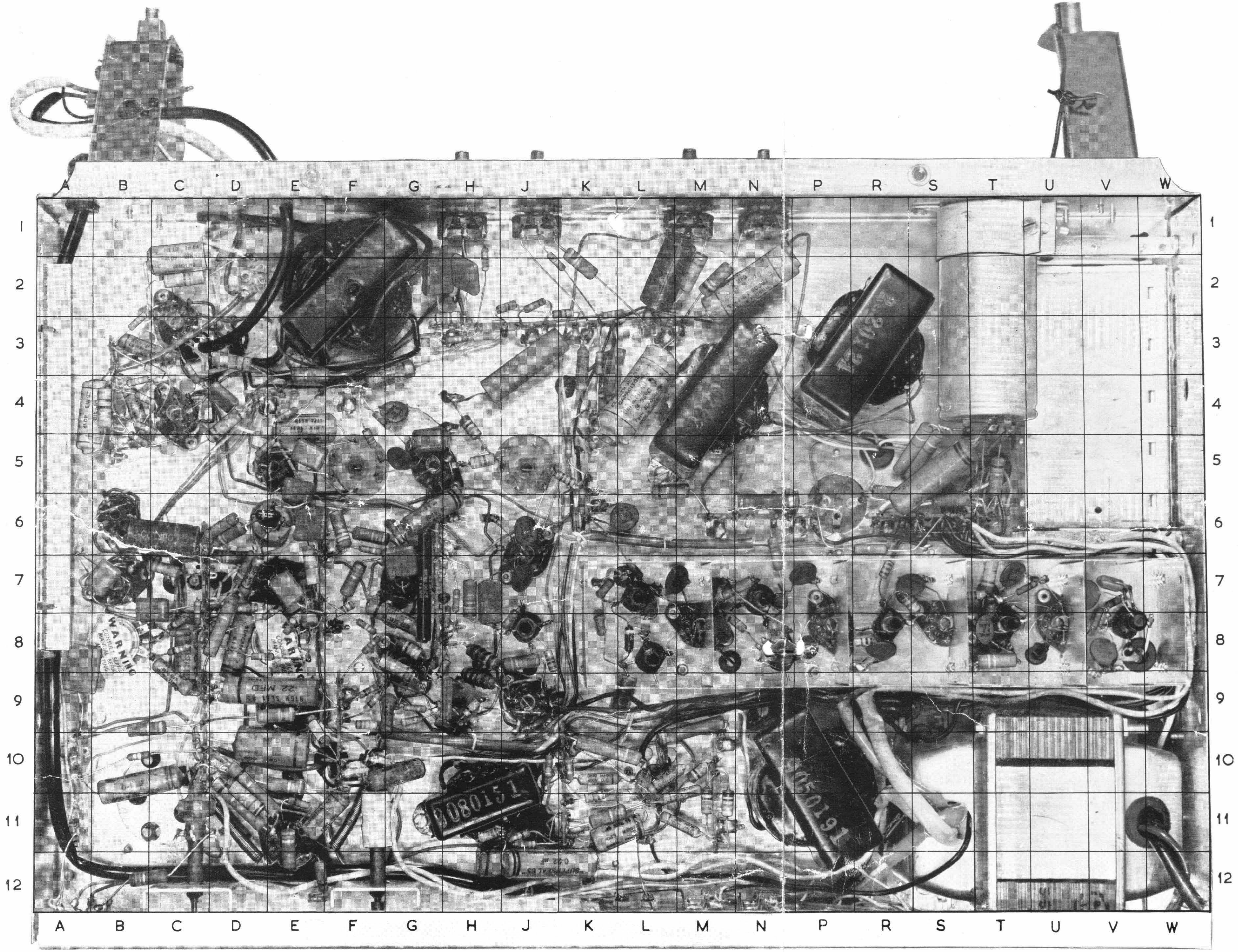


COMPONENT LOCATION

RESISTORS

R15	V-8	R59	J-2	R105	B-4
R16	V-7	R60	J-2	R106	L-6
R17	V-9	R63	H-8	R107	M-2
R18	T-8	R64	G-8	R108	M-11
R19	T-7	R65	F-8	R109	M-11
R20	T-8	R66	E-7	R110	M-10
R21	U-7	R67	F-8	R111	M-2
R22	T-7	R68	H-8	R112	J-11
R23	R-7	R69	F-7	R113	J-11
R24	S-7	R70	F-7	R114	H-11
R25	R-8	R71	H-7	R115	M-9
R26	N-7	R72	F-6	R116	M-9
R27	N-8	R73	F-6	R117	K-11
R28	N-7	R74	F-6	R118	K-11
R29	L-7	R75	G-6	R119	K-11
R30	K-6	R76	J-8	R120	K-10
R31	L-9	R77	J-8	R121	C-7
R32	H-8	R78	H-7	R122	B-6
R33	G-7	R79	K-5	R123	D-6
R34	H-9	R81	H-5	R124	D-7
R35	H-9	R82	H-4	R125	D-8
R36	K-2	R83	F-4	R127	D-7
R37	J-2	R84	E-4	R128	C-7
R38	K-3	R85	F-5	R129	D-7
R39	K-2	R86	E-5	R130	C-8
R40	K-5	R87	E-4	R131	E-8
R41	J-10	R88	D-5	R132	D-8
R42	K-10	R89	H-2	R133	E-8
R45	R-6	R90	H-3	R134	C-8
R46	R-6	R91	H-3	R135	C-8
R47	S-6	R93	B-4	R136	E-10
R48	T-5	R94	C-3	R137	D-11
R49	C-9	R95	D-3	R137A	D-11
R50	E-9	R96	B-5	R138	E-11
R51	F-9	R97	B-4	R139	E-11
R52	F-9	R98	C-3	R140	D-11
R53	F-9	R99	B-4	R141	E-12
R54	G-9	R100	B-3	R142	B-10
R55	G-9	R101	B-4	R142A	B-10
R56	H-9	R102	S-5	R143	B-12
R57	G-8	R103	S-5		
R58	K-2	R104	C-2		

VARIABLE RESISTORS AND CONDENSERS

VR1	J-1	VR6	M-1	VC1	P-9
VR3	H-1	VR7	E-8	VC2	M-9
VR5	N-1	VR8	B-8		

CAPACITORS

C24	V-7	C50	G-9	C81	N-2
C25	V-7	C51	G-8	C82	L-11
C26	V-8	C52	G-8	C83	M-2
C27	T-7	C53	G-7	C84	L-11
C28	T-8	C54	G-7	C85	K-11
C29	S-7	C55	G-6	C86	T-6
C30	R-8	C56	J-8	C87	H-12
C31	N-8	C57	H-7	C88	J-12
C32	P-7	C58	J-7	C89	L-4
C33	M-8	C59	J-6	C90	E-6
C34	M-7	C62	G-5	C91	C-6
C35	L-6	C63	G-5	C92	B-7
C36	L-7	C65	G-4	C93	D-6
C37	K-8	C67	E-5	C94	D-7
C38	K-7	G68	E-5	C95	A-8
C39	H-9	C69	E-4	C96	D-8
C40	K-3	C70	G-4	C97	C-7
C41	K-10	C71	G-2	C98	C-8
C42	K-4	C72	H-2	C99	F-7
C43	P-6	C74	D-4	C100	E-7
C44	S-4	C75	A-3	C101	C-9
C45	P-6	C76	B-4	C102	E-11
C46	T-4	C77	S-5	C103	G-10
C47	E-9	C78	C-2	C104	E-10
C48	S-5	C79	A-4	C105	B-10
C49	J-3	C80	L-11		

COILS

L15	V-8	L21	L-8	L27	C-11
L16	V-8	L22	L-9	L28	F-11
L17	N-8	L23	J-8	L29	D-11
L18	N-8	L24	H-8	L30	F-11
L19	N-7	L25	H-9		
L20	L-8	L26	J-5		

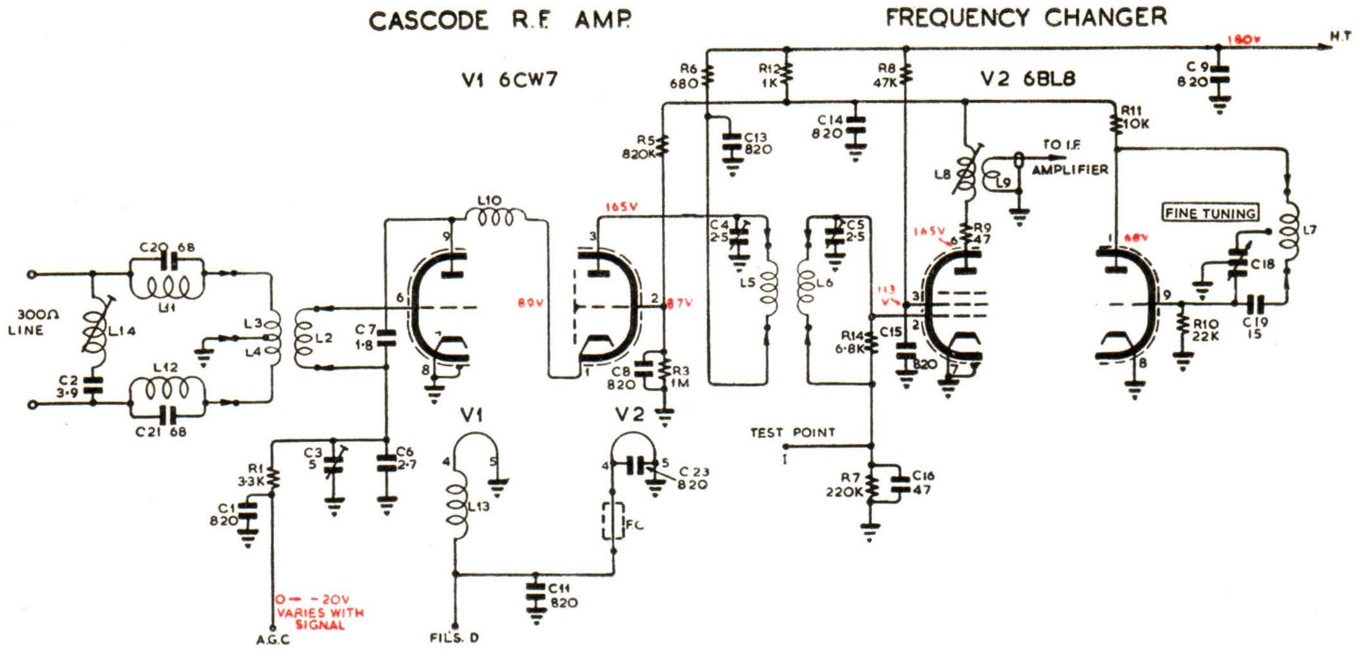
TRANSFORMERS

IFT1	T-8	IFT6	F-5	TR6	E-6
IFT2	R-8	TR1	U-11	TR7	C-7
IFT3	N-7	TR2	F-2	TR8	C-11
IFT4	L-7	TR4	P-11		
IFT5	J-8	TR5	H-11		

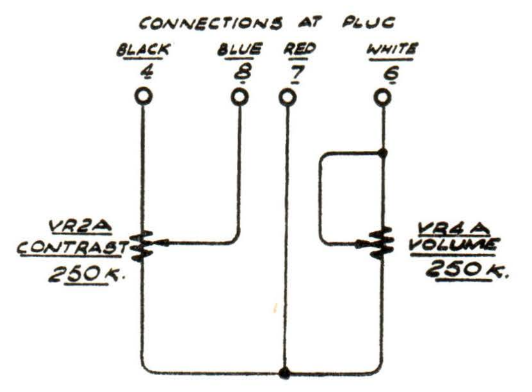
VALVES AND DIODES

V3	V-8	V12	J-7	V19	B-6
V4	S-8	V13	G-5	V20	E-7
V5	P-8	V14	E-5	V21	E-11
V6	M-8	V15	C-3	V23	E-9
V7	J-9	V16	C-4	MR1	L-8
V10	G-8	V17	L-10	MR2	E-6
V11	G-7	V18	B-7		

"H·M·V" CHASSIS TYPE F1



CIRCUIT DIAGRAM — TUNER



CIRCUIT DIAGRAM.

REMOTE CONTROL