Private and Confidential ***For Trade Use Only***

"HIS MASTER'S VOICE"

SERVICE MANUAL

for

TELEVISION RECEIVER

CHASSIS TYPES

M3, M4, M5, M6, M7,
P1, P2, P5, P6, P7 and P8

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

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INTRODUCTION

This combined service manual is intended to give the serviceman, within the one cover, a complete coverage of all of the present series of "H.M.V" 110-degree receivers and provide him with all of the necessary information for servicing these receivers. It is anticipated that by combining this information, that would normally be written in separate manuals, that a more complete understanding of the variations in circuitry between these receivers will result, and that servicing will thus be simplified.

It will be seen that the basic chassis may be divided into 13 or 15 valve receivers; that the method of mounting is divided into cabinet or transportable receivers; that a pre-set tone control is provided only on 15-valve 23-inch receivers; and that the remote control facility is confined to 15-valve receivers.

The receivers covered in this manual are:

Chassis Type	*No. of Valves*	*Picture Tube*	*Style of Receiver*	*Remote Control*	*Tone Control*
M3	15	21 inch	Transportable	Yes	—
M4	13	21 inch	Wooden Cabinet	—	—
M5	13	21 inch	Transportable	—	—
M6	15	21 inch	Wooden Cabinet	Yes	—
M7	13	21 inch	Wooden Consolette	—	—
P1	15	23 inch	Wooden Cabinet	Yes	Yes
P2	15	23 inch	Transportable	Yes	Yes
P5	15	23 inch	Deep Cabinet	Yes	Yes
P6	13	23 inch	Transportable Wooden Cabinet	—	—
P7	13	23 inch	Deep Cabinet. Transportable or Wooden Consolette	—	—
P8	13	23 inch	Transportable	—	—

CAUTION

The normal B+ voltages in these receivers are dangerous. Use extreme caution when servicing. The high voltage at the picture tube anode (16,000 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 or to its aquadag coating 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.

SPECIFICATIONS

POWER SUPPLY:

200, 230, 240, 250 volts, A.C., 50 c.p.s.

CONSUMPTION:

15 valve receivers — 180 watts.
13 valve receivers — 170 watts.

AERIAL INPUT:

300 ohms balanced.
Transportable receivers have additional in-built aerial and provision for a plug-in attenuator.

INTERMEDIATE FREQUENCIES:

Vision carrier — 36.875 Mc/s.
Sound carrier — 31.375 Mc/s.

FUSES:

Mains — 1 amp.
H.T.1 — 1.5 amp.
H.T.2 — 250 mA.

VALVE COMPLEMENTS

15 Valve Receivers—M3, M6, P1, P2 and P5.

V1	6ES8	R.F. Amplifier
V2	6BL8	Frequency Changer
V3	6EH7	1st I.F. Amplifier
V4	6EJ7	2nd I.F. Amplifier
V5	6EJ7	3rd I.F. Amplifier
V6	6DX8	Video Amplifier and Noise Inverter
V7	6DT6	Noise Gated Sync. Separator
V8	6U8	Sound I.F. Amplifier and Gated A.G.C.
V9	6AU6	Sound Limiter
V10	6BM8	Audio Driver and Audio Output
V11	6BM8	Blocking Oscillator and Vertical Output
V12	12AU7	Horizontal Multivibrator
V13	6CM5	Horizontal Output
V14	1S2	EHT Rectifier
V15	6AL3	Damping Diode
MR1	0A80	Vision Detector
MR2	0A210	Mains Rectifier
MR3	0A210	Mains Rectifier
MR4	M3	Clamping Diode
MR5	0A79	Ratio Detector
MR6	0A79	Ratio Detector
MR7	0A81	Phase Discriminator
MR8	0A81	Phase Discriminator

13 Valve Receivers—M4, M5, M7, P6, P7 and P8

V1	6ES8	R.F. Amplifier
V2	6BL8	Frequency Changer
V3	6BY7	1st I.F. Amplifier
V4	6BX6	2nd I.F. Amplifier
V5	6U8	3rd I.F. Amplifier and Noise Inverter
V6	6DX8	Video Amplifier and Sync. Separator
V7	6U8	Sound Limiter and Gated A.G.C.
V8	6BM8	Audio Driver and Audio Output
V9	6BM8	Blocking Oscillator and Vertical Output
V10	12AU7	Horizontal Multivibrator
V11	6CM5	Horizontal Output
V12	1S2	EHT Rectifier
V13	6AL3	Damping Diode
MR1	0A80	Vision Detector
MR2	OA210	Mains Rectifier
MR3	0A210	Mains Rectifier
MR4	0A81	Pre-clamping Diode
MR5	M3	A.G.C. Clamping Diode
MR6	0A79	Ratio Detector
MR7	0A79	Ratio Detector
MR8	0A81	Phase Discriminator
MR9	0A81	Phase Discriminator

The Cathode ray tubes employed in these receivers are shown under the heading, "Picture Tube Replacement," on Page 16.

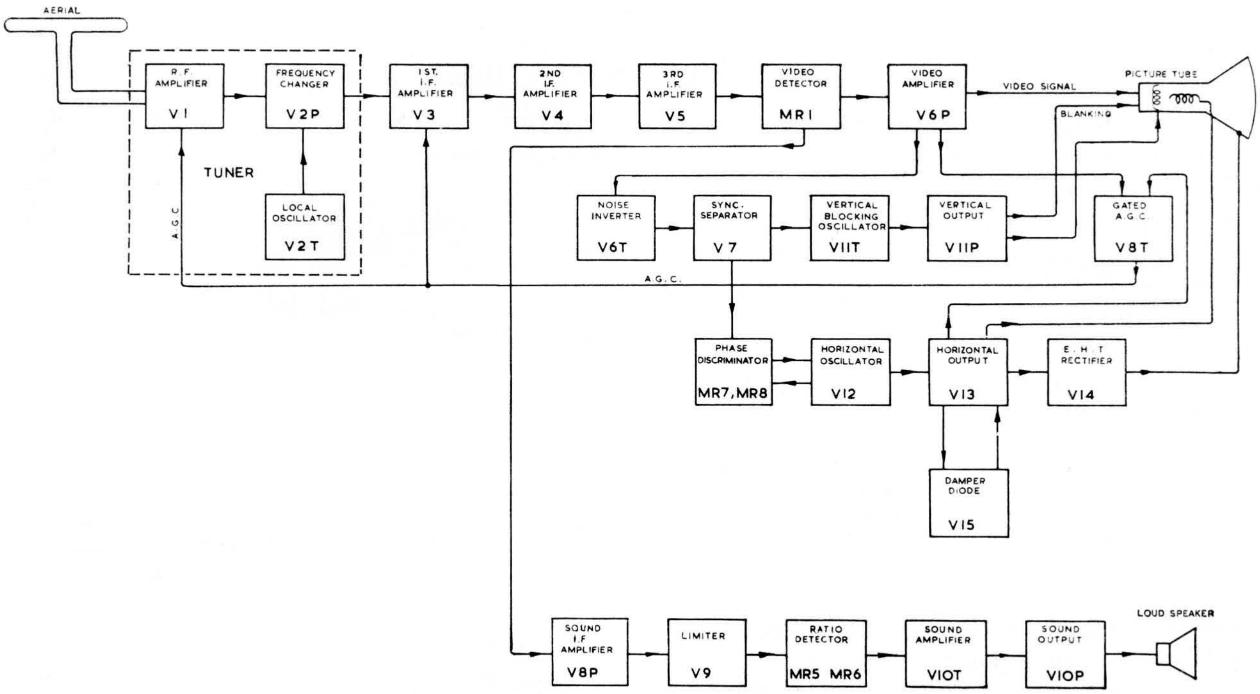


FIG. 1A.

BLOCK DIAGRAM — 15-VALVE CIRCUITS.

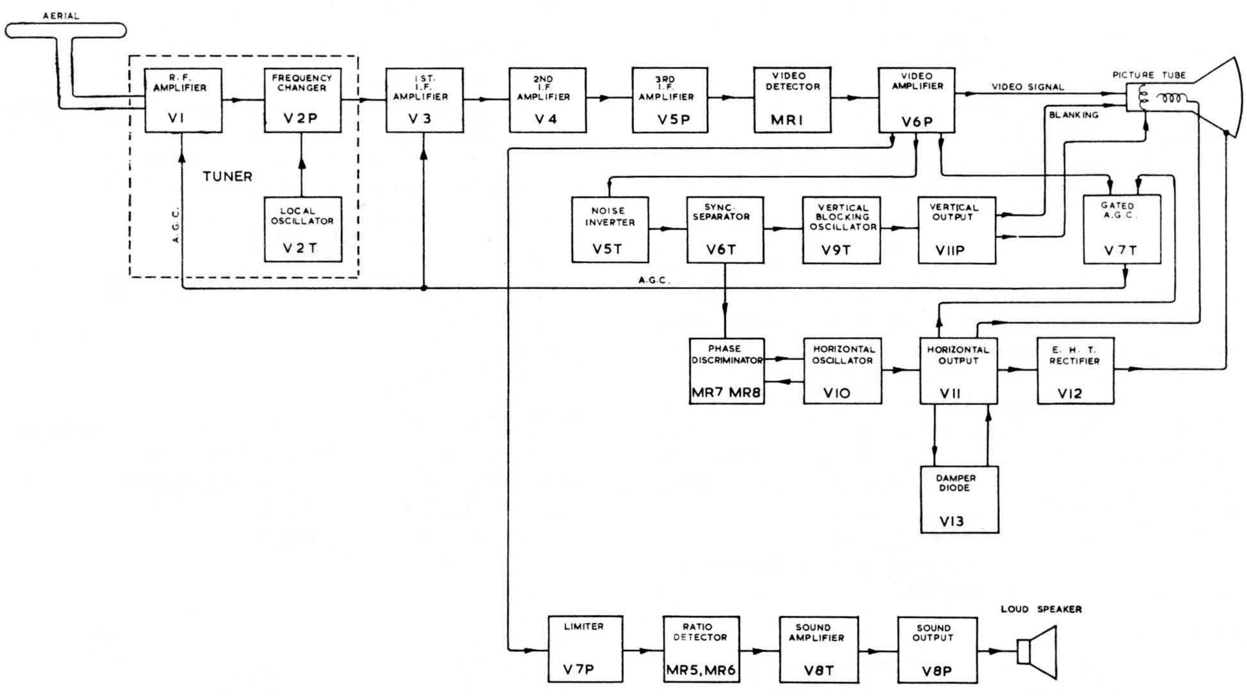


FIG. 1B.

BLOCK DIAGRAM — 13-VALVE CIRCUITS.

SUMMARY OF FEATURES

These features are common to both types of receiver. In later paragraphs features that differ in each type of receiver are listed, so that the main differences are pointed out.

1. The turret tuner has facilities for individual exact alignment, on each channel, of the oscillator tuning so that the fine tuning control range may be limited, thus avoiding gross mistuning.

2: Linear phase treatment of the IF response ensures the best possible definition with freedom from overshoot or smearing, allowing non-critical fine tuning control.

3. The overall frequency response of the system is within 6 db from D.C. up to 4.7 Mc/s.

4. DC coupling from the video detector through to the picture tube ensures that a true black is retained and that all shades retain their true relationship to black. This prevents fading to grey and gives accurate portrayal of night-time scenes.

5. Time-gated A.G.C. is employed, giving immunity from the effects of impulse noise and has a fast action to cope with rapid fading from "aircraft flutter." A variable delay on the tuner is provided to maintain full RF gain on weak to moderate signals, thus minimising frequency converter noise. This delay can be adjusted for best results when the receiver is first installed.

6. A noise inverter is used, before the sync. separator, giving protection to the input circuit of the sync. separator in the presence of impulse noise, preventing paralysis of the sync. separator action following large bursts of impulse noise.

7. The audio amplifier with ample feedback gives excellent quality sound with ample power. A compensated volume control maintains tonal balance at all volume settings.

8. The horizontal hold circuit is a multivibrator employing a stabilising coil in the oscillator anode circuit and this, together with the cathode coupling employed, gives a stable oscillator virtually unaffected by large HT variations. This stability, together with an adequate pull-in range, renders a front horizontal hold control unnecessary. A pre-set control is provided on the back of the receiver.

9. A linearity control of the horizontal deflection circuit that can be adjusted by an indication on a multimeter gives the advantage that the linearity can be set without the need for a transmitted test pattern.

10. Vertical retrace lines are eliminated by Vertical Flyback Blanking.

11. Dustproof seal around picture tube to eliminate dust which would, otherwise, be attracted by static charge.

12. The user controls are reduced to the minimum necessary to ensure correct operation, which is made as simple as possible. There are no interacting controls, and since the receiver is completely DC coupled then the Brightness control will vary the light output of the picture tube and the Contrast control will vary the depth of shades without any interaction between them.

13. Silicon Junction Diodes are used in a voltage doubler full-wave power supply. These diodes are noted for their robustness, economy of power and high surge rating. Since they have no heated cathode they cannot be damaged by operation on low mains voltage as is the case with valve rectifiers. Thermistor protection is included in the power supply to ensure that diodes and electrolytic capacitors are not subjected to large surges when first switching on the receiver.

14. The chassis is hinged and can be swung out in such a manner that almost any repair can be made in the home without removing the whole chassis from the cabinet. It is also possible to remove the whole receiver, complete with the picture tube, from the cabinet in one piece as a complete working unit, and can be operated as such on the workshop bench.

The following features are not common to both models and the differences are well worth noting so that circuitry differences can be checked on the relevant circuit diagrams.

1. The 15-valve receiver uses a noise-gated sync. separator to give the best synchronisation obtainable, necessary for receivers operating under "fringe" conditions. In the 13-valve receivers a triode sync. separator is employed.

2. To keep impulse interference to a minimum in the audio output of the 15-valve receivers, when operating under adverse conditions, a Sound I.F. Amplifier has been included before the Sound Limiter. The substantial increase in overall gain, as compared with the 13-valve model, gives virtually noise-free sound, even under extreme "fringe" conditions.

3. Current feedback, to keep a constant deflection current in the coils, is used in the 15-valve receiver Vertical Deflection circuit. A conventional Blumlein circuit is used in the 13-valve receiver but with the added compensation of a thermistor, in series with the Vertical Deflection coils and in direct contact with them. As the coils heat up their resistance increases, but the resistance of the thermistor decreases and compensation is made to keep the deflection current a constant. Both circuits hold the height constant as the deflection coils warm up. Good interlace is maintained in both circuits.

4. Transformer-coupled focusing is employed on the 15-valve receivers giving good overall edge-to-edge focus. Degradation of definition due to change in spot shape across the tube is thus obviated. Normal DC focusing is employed on the 13-valve models.

5. The 15-valve receiver employs frame-grid valves in the I.F. stages. These valves give more gain than previously used types and ensure that the receiver has ample gain even under the worst signal conditions.

CIRCUIT DESCRIPTION

R.F. INPUT

The input to the turret tuner is to a centre tapped transformer which presents an impedance of 300 ohms.

R.F. amplification is achieved with a type 6ES8, double triode (V1), in a cascode circuit. The two sections of this stage are connected in series for DC. The grounded cathode input section is neutralised and is also controllable by A.G.C. from the mains chassis. Because of the series DC 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 36.875 Mc/s., sound 31.375 Mc/s.) is coupled to the IF channel of the main chassis through a secondary winding on the IF coil L7.

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.

IF AMPLIFIER

The tuner IF output is coupled to the grid of the first IF Amplifier V3 and tuned by coil L9 with stray capacities. There are three IF amplifying stages and AGC voltage is applied to V3.

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

Trap circuits L11, L12 and L15 are coupled to the IF coils L10, IFT1 and IFT2. The first attenuates the sound carrier 31.375 Mc/s and the second attenuates the adjacent vision carrier 29.875 Mc/s. The third trap attenuates the adjacent sound carrier 38.375 Mc/s.

V3 and V4 have small unbypassed cathode resistors R15 and R20 to minimise detuning of their grid circuits with varying input levels.

VIDEO AMPLIFIER

The detected video output of the germanium diode MR1 is amplified in the pentode section of V6. L20, L21, L22 and L23 are peaking chokes which maintain the high frequency components of the vision signal fed to the picture tube. The 5.5 Mc/s. component is removed by the combined transformer and trap, IFT4.

INTERCARRIER SOUND

The output of IFT4 is fed to the Sound IF amplifier, in 15-valve receivers, or to the Limiter in 13-valve receivers. The output from the limiter is demodulated by the ratio detector, 2-0A79, to provide the audio signal which passes through the volume control to be amplified in the driver triode and output pentode sections of the Audio Output valve. Feedback is applied in both audio circuits.

A full margin of sound gain is provided so that the full 2 watts undistorted output is obtained from sound signals which are not fully modulated. Moreover, the sound output stage has a controlled overload characteristic which does not "paralyse" but merely clips the peaks and so remains comparatively free from audible distortion.

NOISE INVERTER

The anode load of the noise inverter is formed by the resistor coupling the sync. separator to the video output. The valve is biased such that it cannot conduct on the positive sync. tips. However, noise pulses appearing more positive at its grid will drive the valve into conduction, causing current to flow and a voltage drop across this resistor. Consequently a noise pulse will appear less positive, at the anode of the noise inverter, than a sync. tip and the sync. separator will not conduct on the noise pulse since the pulse will now fall outside of the sync. separator's grid base.

NOISE-GATED SYNC. SEPARATOR

(15-valve receivers only).

Video signal, with sync. tips positive, is applied to the suppressor grid of a 6DT6 from the output of the video amplifier. At the same time, video signal wth sync. tips negative, is applied to the control grid of this valve, via the potentiometer R45, R46 and is so arranged that the negative excursion of the signal will not affect the current through the sync. separator valve. However, when a noise pulse, which will sit more negative than the sync. tips, occurs at the control grid, then the current through the valve is cut off and the anode voltage will rise to HT, giving no spurious sync. output. Double protection is thus afforded by the Noise Inverter and the Noise-gated Sync. Separator.

GATED A.G.C.

Video signals with sync. tips positive are fed from the Video Amplifier anode to the grid of the AGC valve, and the valve is biased so that it will only conduct on sync. tips. During line flyback, a positive pulse is applied to its anode via the 68 pfd coupling capacitor and the valve will conduct when this pulse at its anode and a sync. tip at its grid coincide. The valve cannot, therefore, conduct in the period between sync. pulses and is thus immune to noise pulses appearing in the period between sync. pulses.

The current through the valve will depend on the height of the sync. pulses at its grid and the height of these sync. pulses is adjusted by the contrast control. The cathode of the A.G.C. valve is held at about 50 volts. Operation of the Contrast Control will vary the bias applied to the grid of the A.G.C. valve and so increase or decrease the height of sync. tips in respect to the fixed cathode volts. Increasing the height of the sync. tips will cause the valve to conduct harder and will produce more A.G.C. volts, reducing the gain of the receiver and decreasing the voltage available to drive the C.R.T. cathode. Decreasing the height of the sync. tips will reduce the conduction of the A.G.C. valve, thus producing less A.G.C. volts, increase the gain of the receiver and increase the volts available to drive the C.R.T. cathode. Increasing the height of the sync. tips therefore reduces the contrast, and decreasing the height of the sync. tips will increase the contrast.

The ratio of IF A.G.C. voltage to Tuner A.G.C. voltage is important and the ratio can be adjusted by means of RV3. If the ratio is too small then, even on large signals, the tuner will be biased back and the IF amplifier will be operating at an unnecessarily large gain and converter noise will be evident in the picture. If the ratio is too large, then no controlling bias will be applied to the tuner and it will be held at the clamping voltage and all control will be made in the IF amplifiers. This can cause severe overloading of the IF amplifier.

VERTICAL DEFLECTION CIRCUITS

Vertical sync. pulses from the sync. separator are used to synchronise the blocking oscillator, T3 and the triode portion of the valve. "Height" is adjusted by varying the DC potential fed to the blocking oscillator anode and "Vertical Hold" is adjusted by varying the time constant of the blocking oscillator grid circuit. 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. In 15-valve receivers, a feedback voltage is developed across R97, R98, from the current in the deflection coils. This voltage is stepped up to the input grid of the vertical output valve. A potentiometer, RV9, is provided for adjustment of linearity. In the Blumlein circuit, employed in the 13-valve receivers, two linearity controls are provided to achieve good, overall vertical linearity.

HORIZONTAL OSCILLATOR AND AUTOMATIC PHASE CONTROL

Automatic frequency and phase control is obtained by means of a DC controlled, cathode coupled, stabilised multivibrator controlled by a germanium diode phase discriminator.

Sync. pulses from the sync. separator are fed into the centre of the discriminator and a sawtooth waveform from the multivibrator output is fed across the diode loads.

Since the negative going sync. pulse is fed to the diode cathodes and the diodes are effectively in parallel, then the discriminator output will be zero volts. The sawtooth is not of sufficient amplitude to cause the diodes to conduct, due to the bias caused by the coupling capacitor, so that the DC component of the sawtooth (average AC) is zero volts. Neither the sawtooth nor the sync. pulses can cause a bias voltage to be developed across the discriminator but that part of the sawtooth that occurs at the instant of the sync. pulses will have an affect on the bias voltage produced. If the sync. pulse occurs in the centre of the sawtooth, then the output is zero volts, and if it occurs before the retrace passes through its zero axis then the oscillator is running slow and the output voltage will be negative. The reverse will be the case if the oscillator is running fast.

The frequency of the Horizontal Multivibrator is controlled by the DC output of the discriminator. If the output voltage of the discriminator is positive it causes the cathode voltage to rise, lengthening the discharge time of the coupling capacitor to the second triode and slows down the firing rate of the multivibrator. A negative output from the discriminator will have the reverse effect.

HORIZONTAL DEFLECTION CIRCUITS

The horizontal driver valve produces a negative pulse output which is timed to cut off the horizontal output valve at the end of a scan. When 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 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 starts the cycle over again.

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

Energy recovered by the damping diode produces a boosted HT voltage of 830 volts, which is divided down to 560 volts for supplying the G2 electrode voltage of the picture tube.

In 15-valve receivers, T7 is the focus transformer. The sawtooth scanning current in its primary winding produces, in the secondary, a large parabolic voltage waveform which is fed direct to the focus electrode of the CRT and the cold end of the secondary is connected to a suitable voltage to give good overall focus.

REMOTE CONTROL

(15-valve receivers only).

By plugging into socket SKT2 the five-pin socket in the rear of the chassis, volume and contrast can be controlled from the Remote Control Unit.

The remote volume control RV6A 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 RV4A feeds a variable DC voltage into the contrast control chain R57, R58. 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.

A facility is provided on the socket for use of a remote hearing aid.

INSTALLATION

The receiver is shipped from the factory with the picture tube installed and all controls preadjusted 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.

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 until the picture is squared up. It may be necessary after this operation to centre the picture by means of the shift magnets.

A.G.C.

The A.G.C. control is normally preset in the factory but if it is necessary to adjust it at any time the procedure is to turn the control to the maximum anti-clockwise position, then observing the picture, advance the control until the noise or "snow" in the picture is no longer reduced. The receiver should then be checked on all channels to ensure that no overloading is evident, which may be due to the control being adjusted too far in a clockwise position, and that the minimum noise condition has been achieved for all signals.

FUSES

Three fuses are provided, one in the mains circuit and two in the HT circuits. Ensure that they are replaced with similar types.

NOISE INVERTER

The cathode bias of the noise inverter can be adjusted on installation (if necessary) by means of a pre-set control on the rear panel of the receiver. Tune to the strongest signal and turn contrast control to maximum. Turn the Noise Inverter control in an anti-clockwise direction until the picture tends to go out of lock. Turn control slightly clockwise so that picture returns to lock. Check that receiver locks quickly on all channels when changing channels.

SERVICING

The vertical chassis of this receiver has been especially designed to make servicing as easy as possible. All valves, test points and major components are accessible to the serviceman when the cabinet back is removed. All other components may be serviced by swinging the chassis out so that all of the receiver is accessible.

To do this, remove the EHT lead from its support; slacken off the screws on the right-hand side of the chassis and remove the clamp. Note that one of these screws is intended as a factory transit screw only, and need not necessarily be replaced. Remove screw from below mains transformer. This is also a transit screw and need not necessarily be replaced. The chassis, pivoting about the left-hand side, may be swung out to an angle of approximately 40 degrees.

In order to swing it out further than this, disconnect the yoke and EHT anode lead.

To secure the chassis, reconnect any disconnected leads and replace the screw below the power transformer before the retaining clamp and its screws are replaced.

If the repair or replacement cannot be made without removing the chassis from the cabinet, the receiver can be withdrawn as a complete working unit and can be operated as such on the workshop bench.

DISMANTLING

Chassis Types M4, M6, P1 and P6

REMOVAL OF CHASSIS ASSEMBLY

Remove the bottom screws securing the back cover of the receiver to the cabinet. Ease the back cover down until the top edge is free of the cabinet groove. Withdraw the cover straight back over the picture tube neck.

WARNING: Be careful not to drop the cover on to the neck of the picture tube when the bottom screws are removed.

Pull off the four small knobs from the front of the receiver. Undo the grub screws and remove the brass collar on the contrast spindle. Set the Channel Selector knob to channel 5. Flex the black plastic cover back with a screwdriver at the channel 7 position. Undo the securing screw at this position and pull off both the Channel Selector and the Fine Tuning knobs.

Remove two bolts that secure the base board to the cabinet shelf.

Remove two bolts that secure the top of the picture tube clamp bracket to the cabinet.

Slacken off two screws on the antenna bracket. Slide the bracket toward the rear of the cabinet in its guide grooves and remove the bracket from the cabinet.

The chassis and picture tube may then be withdrawn from the cabinet.

DISMANTLING *continued)*

Chassis Types M3, M5, M7, P2, P5, P7 and P8

REMOVAL OF CABINET

Remove the cabinet back by undoing the nine securing screws (two are underneath).

Disconnect the tuner lead from the antenna bracket by withdrawing the lead pins from the antenna socket.

Disconnect the speaker leads.

Pull off the four small knobs from the front of the receiver. Undo the grub screw on the contrast spindle and remove the brass collar. Set the Channel Selector knob to channel 5. Flex the black plastic cover back with a screwdriver at the channel 7 position and undo the securing screw. Pull off both the Channel Selector and Fine Tuning knobs.

Remove the two screws that secure the top of the picture tube clamp to the cabinet.

Remove six screws that secure the cabinet to the wooden base board.

Remove the cabinet.

REMOVAL OF PICTURE TUBE SCREEN

Once the cabinet has been removed, the front screen may be removed by undoing the four corner screws.

The covering material of the cabinet is washable vinyl, and if necessary may be cleaned with a damp cloth. The clear, protective picture tube screen and plastic moulded front may also be cleaned with a soft, damp cloth, but avoid the use of chemical and abrasive cleaners. Do not use any preparation normally sold as window cleaning or furniture polishing agents, as these generally prove harmful to those materials.

If the plastic becomes stratched or accidentally marked by a fly-spray, the marks may be removed by polishing gently with a soft cloth moistened with Wattyl or Dupol Cabinet Burnisher. Very deep scratches should be removed first with Water Rubbing Compound and then finished off with Burnisher.

DEFLECTION YOKE

First remove the picture tube socket. Loosen the clamp-fixing screws on the rear of the yoke assembly, remove the yoke plug from the socket on the rear of the EHT assembly and slide yoke over neck of tube. When replacing yoke, do not use force and do not tighten clamping screws until set has been operated and picture is squared up.

REMOVAL OF PICTURE TUBE

Having removed the chassis and picture tube assembly, remove the spring which rests against the aquadag coating on the rear of the picture tube. Undo the top and bottom screws that secure the clamping ring to the picture tube on 21-inch receivers, or slacken the retaining nut on 23-inch receivers. 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 stratched. Whenever possible, keep tubes in the original manufacturers' carton.

ADJUSTMENTS

HORIZONTAL LINEARITY

A typical multimeter employing a 100 ohm 1 mA fullscale deflection meter, when on 100 mA range, has a total resistance of 1 ohm. If such a meter is connected from pin 8 of the Horizontal Output valve to earth, *i.e.*, across the 1 ohm metering resistor, it will indicate half of the current flowing in the cathode of the valve. The Horizontal Linearity control should be adjusted to reduce this current to a minimum.

HORIZONTAL HOLD

Disconnect sync. pulses by removing the sync. separator valve, in 15-valve receivers, or earthing the grid test point of the sync. separator in 13-valve receivers. Short circuit the Horizontal Stabilising coil. Adjust the Horizontal Hold so that the picture "floats" or locks weakly. Remove the short across the stabilising coil and adjust the core of this coil so that the picture again floats or locks weakly. Replace the sync. separator valve or remove the short from the grid test point, whichever is applicable.

CONTRAST RANGE

Turn the Contrast Control to its maximum clockwise position and adjust the Contrast Range control to give sync. tips at 190 volts at the Video anode, read on a DC coupled oscilloscope.

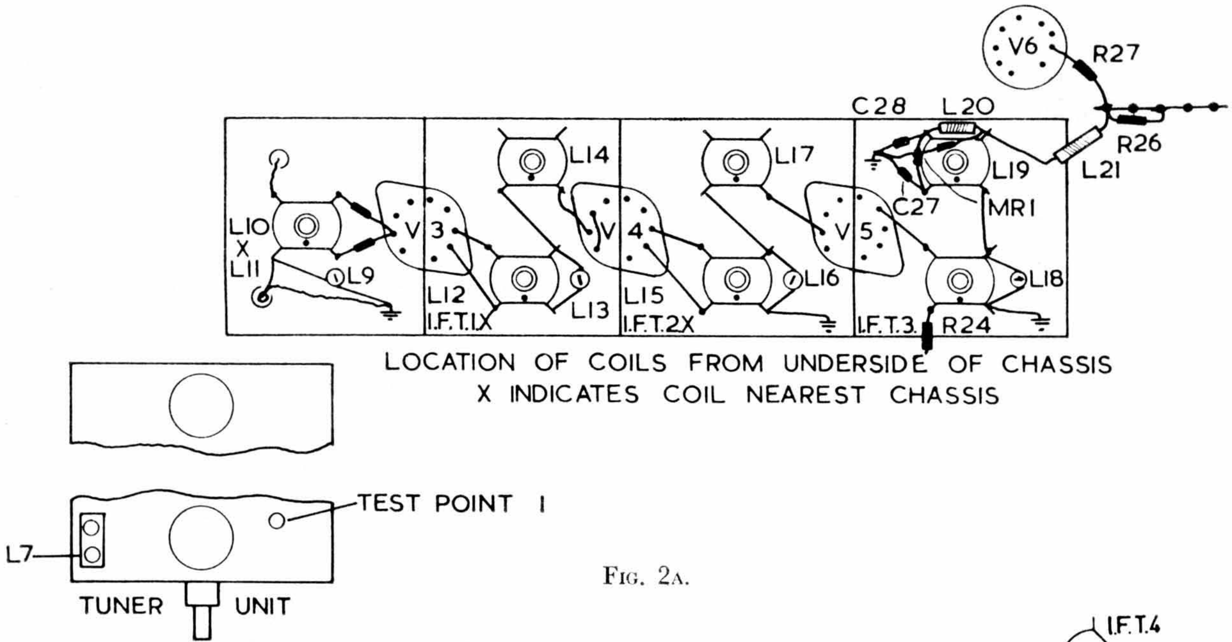


FIG. 2A.

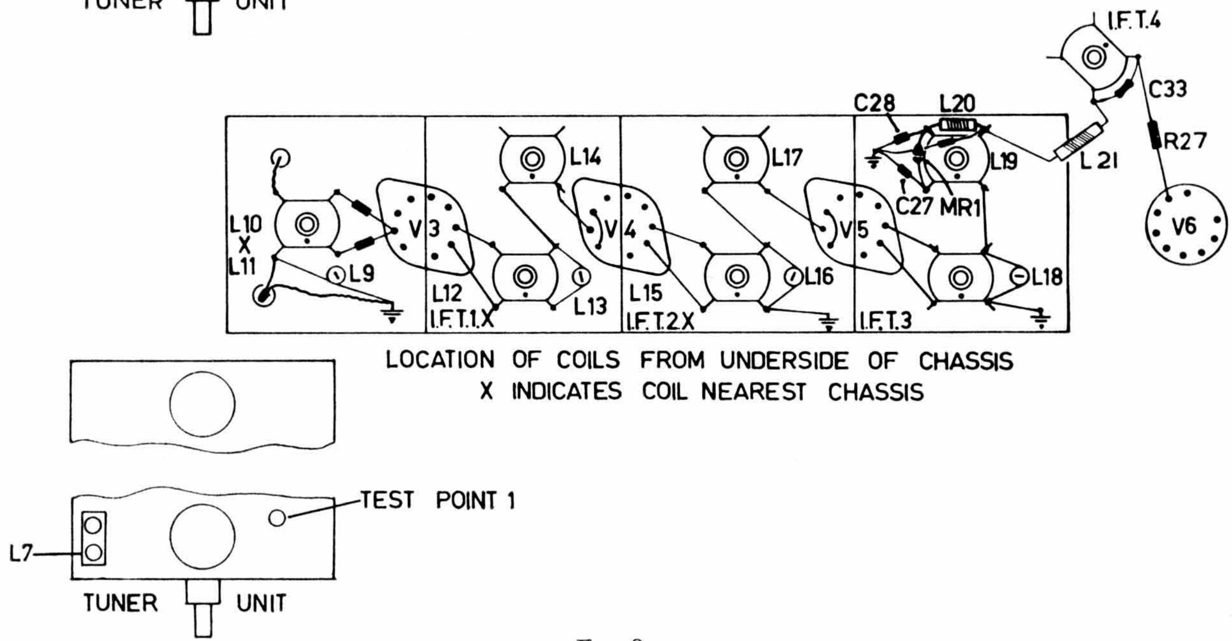
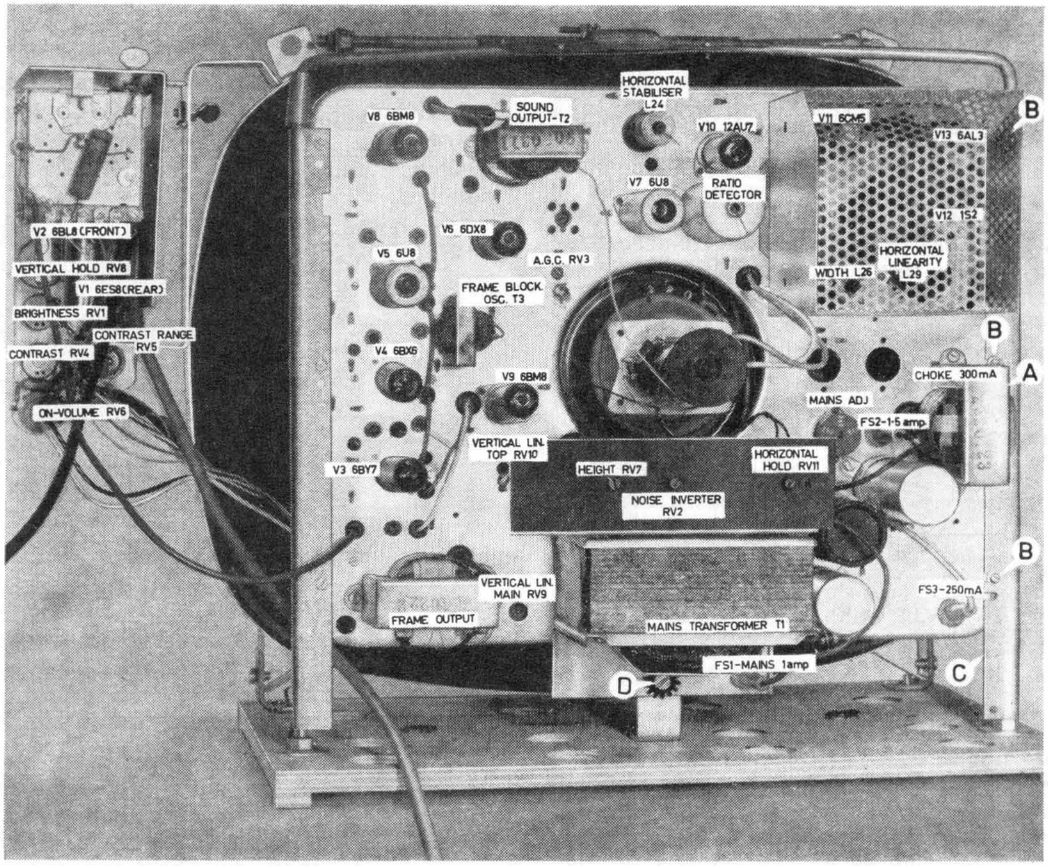
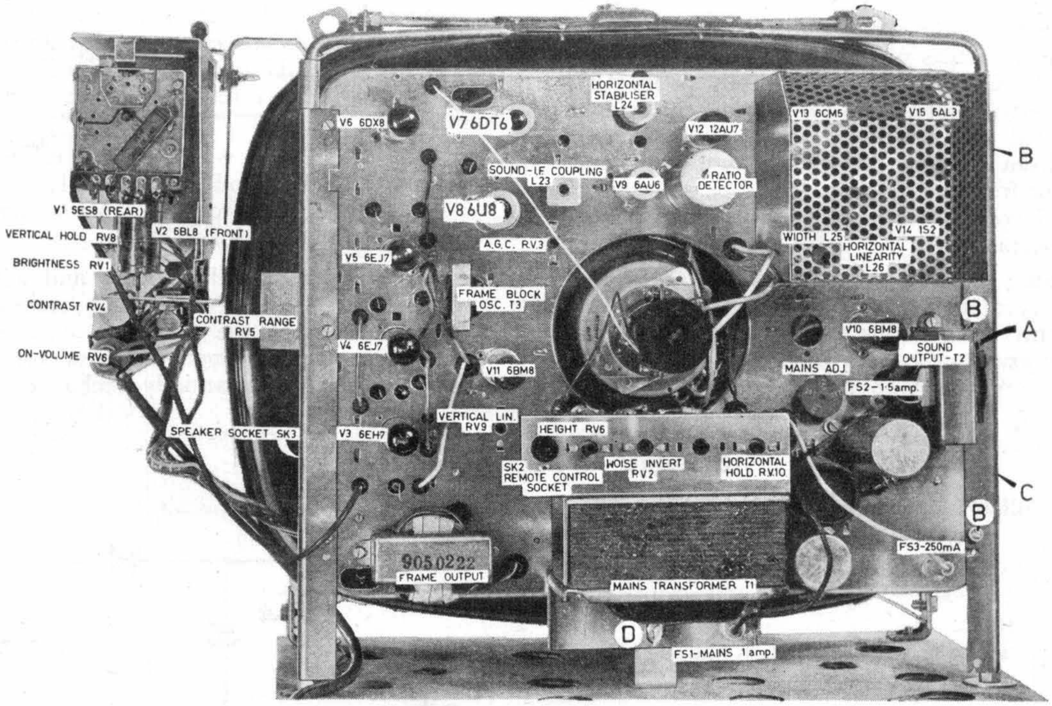


FIG. 2B.



REAR VIEW — 13-VALVE CHASSIS



REAR VIEW — 15-VALVE CHASSIS

ALIGNMENT

VISION IF

To align the vision IF 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 interconnected 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 shown in Figure 3.

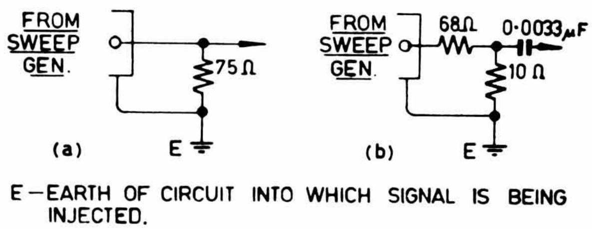


Fig. 3.

Coils L9, L13, L16, L18 adjust the bandwidth of the coupling circuits and are adjusted and sealed in the factory. It should only be necessary to adjust these on realignment if IF transformers or coils have been replaced in the circuit.

Before commencing alignment, remove slugs from L11, L12 and L15, and screw the slugs of IFT1 and IFT2 to set flush with the chassis.

Connect a bias supply of —6 volts across the IF A.G.C. Connect the display unit across R27. Throughout the alignment the display unit should be adjusted to present a reasonable amplitude display from a signal 2.5 volts peak-to-peak, and the output from the IF strip should be maintained at that level by varying the output from the sweep generator.

Because of the high gain of the 15-valve receiver, care should be taken to ensure that all components replaced are on short leads and are placed in exactly the same position as the original part. Care must also be taken to prevent feedback in interconnecting leads of alignment equipment.

The following procedure must be followed step by step, and do not proceed to the next step until sure that each response has been accurately obtained.

(1) Connect the sweep via input as in 3a to pin 2 of V5. Adjust the slugs in IFT3 (slug in position nearest the chassis) and L19 (slug in position farthest from chassis) to achieve a response as shown in Fig. 5A.

(2) Remove sweep from V5 pin 2 and connect through a terminating pad as in Fig. 3b to pin 2 of V4. Adjust the slugs of IFT2 (slug in position nearest chassis) and L17 to achieve the response shown in Fig. 5B.

(3) Remove the sweep from V4 and connect, through the same terminating pad, to V3 pin 2. Adjust the response, with the slugs of IFT1 (slug nearest chassis) and L14 (slug farthest from chassis) to that shown in Fig. 5C.

(4) Remove the sweep from V3 and connect to the tuner through Test Point 1, using the same terminating pad. Adjust L10 (with slug nearest chassis) and L7 to produce final response as shown by Fig. 5D.

Note: The correct final response will be obtained only if each stage is accurately aligned. It may therefore be necessary to slightly readjust coils other than L11 and L7, on the final alignment, to produce the response shown in Fig. 5D, exactly.

(5) Insert slugs with retaining rubber, into L11, L12 and L15. Set L11 to 31.375 Mc/s., L12 to 29.875 Mc/s., and L15 to 38.375 Mc/s. (Fig. 5E).

(6) Check overall response and adjust if necessary. Also, check stability by removing the bias and adjusting the input accordingly. The response should remain substantially unchanged.

SOUND I.F. ALIGNMENT

The following equipment is necessary to carry out this procedure:

(i) A C.W. Oscillator accurately tuned to 5.5 Mc/s by a crystal controlled reference.

(ii) A 20,000 ohm / volt meter (Model 8AVO or similar type).

(iii) A DC V.T.V.M.

(iv) A peak-to-peak detector as shown.

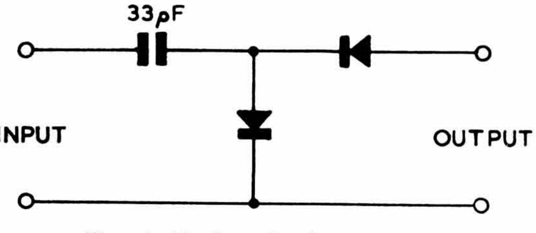


Fig. 4: Peak-to-Peak Detector.

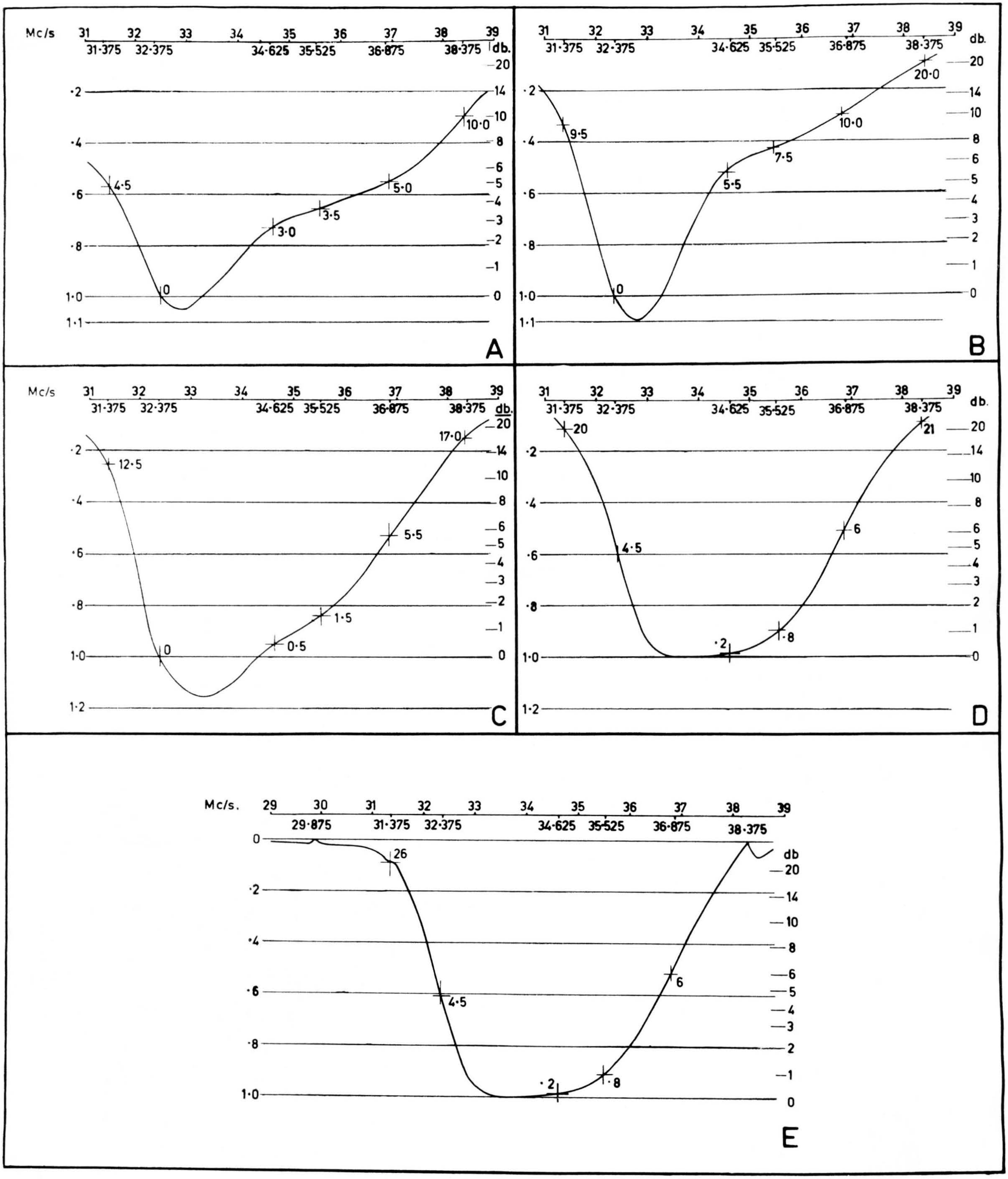

Mc/s
31 32 33 34 35 36 37 38 39
31·375 32·375 34·625 35·525 36·875 38·375
db.
20 14 10 8 6 5 4 3 2 1 0
·2 ·4 ·6 ·8 1·0 1·1
4·5
0
3·0
3·5
5·0
10·0
A
9·5
0
5·5
7·5
10·0
20·0
B
1·2
12·5
0
0·5
1·5
5·5
17·0
C
20
4·5
·2
·8
6
21
D
29 30
29·875
0
26
4·5
·2
·8
6
E

Fig. 5.

5.5 MC/s. NULL TRAP (IFT4)

IFT4 is a combined null trap and transformer, working at 5.5 Mc/s. When tuned in the factory, both primary and secondary cores are tuned together to give a zero output at 5.5 Mc/s. at the video grid, and a maximum transfer to the intercarrier amplifier. This can only be done accurately with a sweep oscillator and a suitable display having a high gain at 5.5 Mc/s. Once set, however, it should not need retuning unless quite large circuit alterations have been made.

Should it be necessary to retune IFT4, the following precedure should be adopted:

(1) Inject 5.5 Mc/s. at approximately 100 mV between the junction L20 and L21 and earth (disconnecting the grid peaking choke, L20).

(2) Connect the input of the peak-to-peak detector illustrated to CRT cathode, pin 7. Connect the output of the peak-to-peak detector to a 20,000 ohm/volt meter on the 50 micro-amp range.

(3) Adjust primary core of IFT4 (nearest chassis) to give zero reading on meter. If IFT4 is replaced, it is necessary to adjust both cores to give a zero reading at 5.5 Mc/s.

(4) Withdraw both cores from former. Screw in primary core (nearest chassis) to give a minimum reading.

(5) Screw in secondary core until meter reading rises slightly and then adjust primary core until a new minimum is obtained.

(6) Repeat adjustment of primary and secondary cores until meter reads zero.

ANODE COUPLING COIL (L24)

(15-valve receivers only)

With the oscillators connected as in (1) above and the VTVM connected across R67, adjust the core of L24 so that a maximum negative reading is obtained on the VTVM.

RATIO DETECTOR TRANSFORMER (IFT5)

Connect oscillator as in (1) above. Adjust secondary core (nearest chassis) so that a positive or negative reading is obtained on a DC VTVM between the junction of the diode loads and earth. Adjust primary core (top of coil) so that this reading shows a maximum. Then adjust secondary core so that this reading is zero volts. This procedure may be used on a signal from a transmission.

PICTURE TUBE REPLACEMENT

Physical differences in the bulbs of various single-face 23-inch picture tubes impose some restrictions on the type of tube which should be used for replacement purposes. Generally speaking, the 23-inch chassis can be divided into two groups, which can be identified by the shape of the chassis support rods in the region where they cross one another. Some rods are straight and others are bent in this region to provide a greater distance between chassis and picture tube clamping band.

In chassis with straight rods only picture tubes with a "K" moulded on to the glass bulb are suitable. These types are AW59-30, 23WP4, 23MP4-K, and 2351B.

In chassis with bent rods, any of the 23-inch single-face tubes may be used.

A tabulation of the chassis and picture tube variations is given below:

Chassis	*Replacement Tube Type*
M3 M4 M5 M6 M7	AW53-88 or 21DAP4.

Chassis	*Replacement TubeType*
P1 (early production) P2 P8	AW59-30, 23WP4, 23MP4-K, 2351B.
P1 (late production) P5 P6 P7	AW59-30, 23WP4, 23MP4-K, 2351B, 2354B. AW59-90, 23MP4-J,

PARTS LIST

MODELS M4, M5, M7, P6, P7 and P8

RESISTORS

REF.	PART No.	DESCRIPTION
R13	740-0032	2.2K ohms ½ W ± 10%
R14	740-0032	2.2K ohms ½ W ± 10%
R15	740-0483	56 ohms ½ W Morganite ± 10%
R16	740-0653	100 ohms ½ W Morganite ± 10%
R17	742-0712	2.2K ohms 1 W ± 20%
R18	740-0572	1K ohms ½ W ± 10%
R19	740-0483	56 ohms ½ W Morganite ± 10%
R20	740-0273	150 ohms ½ W Morganite ± 10%
R21	742-0712	2.2K ohms 1 W ± 20%
R22	740-0653	3.3K ohms ½ W ± 10%
R23	740-0653	100 ohms ½ W Morganite ± 10%
R24	742-0052	22K ohms 1 W ± 10%
R25	742-0712	2.2K ohms 1 W ± 20%
R26	740-0042	2.7K ohms ½ W ± 10%
R27	740-0322	1.2K ohms ± 10%
R28	749-0242	1.8K ohms 2 W ± 10%
R29	749-0242	1.8K ohms 2 W ± 10%
R30	740-0773	39 ohms ½ W Morganite ± 10%
R31	742-0162	390K ohms 1 W ± 10%
R32	740-0122	47K ohms ½ W ± 10%
R33	740-0622	470K ohms ½ W ± 10%
R34	740-0732	12K ohms ½ W ± 10%
R34a	740-0142	100K ohms ½ W ± 10%
R35	750-0291	250 ohms 5 W WW ± 5%
R36	749-0142	1K ohms 2 W ± 20%
R37	749-0252	12K ohms 2 W ± 10%
R38	740-0752	68K ohms ½ W ± 10%
R39	740-0162	220K ohms ½ W ± 10%
R40	740-0162	220K ohms ½ W ± 10%
R41	740-0092	15K ohms ½ W ± 10%
R42	740-0822	33K ohms ½ W ± 20%
R43	740-0202	2.2M ohms ½ W ± 10%
R44	740-0162	220K ohms ½ W ± 10%
R45	742-0112	100K ohms 1 W ± 10%
R46	742-0072	33K ohms 1 W ± 10%
R47	742-0772	3.9M ohms 1 W ± 10%
R48	742-0772	3.9M ohms 1 W ± 10%
R49	740-0312	1.2M ohms ½ W ± 10%
R50	742-0202	1.5M ohms 1 W ± 10%
R51	740-0782	120K ohms ½ W ± 10%
R52	740-0702	56K ohms ½ W ± 10%
R53	740-0782	120K ohms ½ W ± 10%
R54	749-0182	22K ohms 2 W ± 10%
R55	740-0082	10K ohms ½ W ± 10%
R56	740-0122	47K ohms ½ W ± 10%
R57	742-0392	47K ohms 1 W ± 20%
R58	740-0082	10K ohms ½ W ± 10%
R58a	740-0082	10K ohms ½ W ± 10%
R59	740-0112	27K ohms ½ W ± 10%
R60	740-0112	27K ohms ½ W ± 10%
R61	740-0752	68K ohms ½ W ± 10%
R62	740-0702	56K ohms ½ W ± 10%
R63	742-0152	330K ohms 1 W ± 10%
R64	742-0132	220K ohms 1 W ± 10%
R65	740-0022	1K ohms ½ W ± 10%
R66	740-0622	470K ohms ½ W ± 20%
R67	740-0622	470K ohms ½ W ± 20%
R68	740-0382	6.8K ohms ½ W ± 10%
R69	750-0332	680 ohms 5 W WW ± 10%
R70	742-0823	270 ohms 1 W Morganite ± 10%
R71	749-0272	270K ohms 2 W ± 10%
R72	742-0202	1.5M ohms 1 W ± 10%
R72a	740-0252	1.5K ohms ½ W ± 10%
R73	740-0653	100 ohms ½ W Morganite ± 10%
R74	740-0782	120K ohms ½ W ± 10%
R74a	742-0162	390K ohms 1 W ± 10%
R75	742-0022	4.7K ohms 1 W ± 10%
R76	740-0182	470K ohms ½ W ± 10%
R77	740-0582	47K ohms ½ W ± 20%
R78	742-0512	2.2K ohms 1 W ± 10%
R79	742-0512	2.2K ohms 1 W ± 10%
R80	742-0823	270 ohms 1 W Morganite ± 10%
R82	742-0112	100K ohms 1 W ± 10%
R83	742-0092	47K ohms 1 W ± 10%
R84	740-0042	2.7 ohms ½ W ± 10%
R85	740-0852	560K ohms ½ W ± 10%
R86	740-0852	560K ohms ½ W ± 10%
R87	740-0182	470K ohms ½ W ± 10%
R88	740-0142	100K ohms ½ W ± 10%
R89	740-0102	22K ohms ½ W ± 10%
R90	742-0042	15K ohms 1 W ± 10%
R91	742-0472	1.8K ohms 1 W ± 10%
R92	740-0702	56K ohms ½ W ± 10%
R93	740-0112	27K ohms ½ W ± 10%
R94	740-0122	47K ohms ½ W ± 10%
R95	742-0602	470K ohms 1 W ± 10%
R96	740-0572	1K ohms ½ W ± 20%
R97	750-0182	2.7K ohms 5 W WW ± 10%
R98	746-0242	1 ohm ½ W WW ± 10%
R99	742-0262	2.7K ohms 1 W ± 10%
R100	Part of 908-0381	1.5 ohms Wire Resistor
R103	740-0492	1.5M ohms ½ W ± 20%
R104	749-0302	150K ohms 2 W ± 10%

CAPACITORS

REF.	PART No.	DESCRIPTION
C14	273-0591	68 pFd MS silver mica ± 2½%
C15	271-0031	.0033 mFd Ceramic disc G.M.V.
C16	271-0031	.0033 mFd Ceramic disc G.M.V.
C17	271-0031	.0033 mFd Ceramic disc G.M.V.
C18	271-0031	.0033 mFd Ceramic disc G.M.V.
C19	280-1651	.0018 mFd Styroseal 600V ± 5%
C20	273-0591	68 pFd MS silver mica ± 2½%
C21	271-0031	.0033 mFd Ceramic disc G.M.V.
C22	280-1651	.0018 mFd Styroseal 600V ± 5%
C23	273-0591	68 pFd MS silver mica ± 2½%
C24	271-0031	.0033 mFd Ceramic disc G.M.V.
C25	271-0031	.0033 mFd Ceramic disc G.M.V.
C26	271-0031	.0033 mFd Ceramic disc G.M.V.
C27	271-0471	6.8 pFd Ceramic Disc NPO ± ¼ pFd
C28	271-0131	8.2 pFd Ceramic Tube NPO ± ¼ pFd
C29	271-0181	15 pFd Ceramic Tube NPO ± ½ pFd
C30	271-0221	2.2 pFd Ceramic Bead NPO ± ¼ pFd
C31	271-0311	27 pFd Ceramic Tube NPO ± 5%
C32	269-0211	8 mFd Electrolytic ET2D 300V Wkg.
C33	279-4701	.047 mFd Paper Tubular 400V ± 10%
C34	279-4541	.0022 mFd Paper Tubular 400V ± 10%
C34a	279-4661	.022 mFd Paper Tubular 400V ± 10%
C35	269-0521	100 mFd Electrolytic, Insulated, 150V Wkg.
C36	269-0531	100 mFd Electrolytic, Uninsulated, 150V Wkg.
C37	269-0511	80 mFd Electrolytic 300V Wkg., with C38
C38	269-0511	40 mFd Electrolytic 300V Wkg., with C37
C39	271-0031	.0033 mFd Ceramic disc G.M.V.
C40	269-0611	4 mFd Electrolytic 300V Wkg.
C41	279-4661	.022 mFd Paper Tubular 400V ± 10%
C42	280-1791	220 pFd Styroseal 600V ± 10%
C43	273-0921	68 pFd MS Silver Mica ± 10%
C44	279-1161	.22 mFd Paper Tubular 200V ± 20%
C45	279-0281	1 mFd Metallised Paper 200V ± 25%
C46	271-0231	68 pFd Ceramic Disc N750 3KV ± 10%
C47	279-1161	.22 mFd Paper Tubular 200V ± 20%
C48	271-0351	33 pFd Ceramic Tube NPO ± 5%
C49	271-0031	.0033 mFd Ceramic Disc, G.M.V.
C50	273-0561	10 pFd Type IF ± 10%
C51	273-0031	100 pFd type IF ± 5%
C52	280-1501	100 pFd Styroseal 600V ± 5%
C53	280-1501	100 pFd Styroseal 600V ± 5%
C54	269-0371	10 mFd Electrolytic ET1B 25V Wkg.
C55	279-1641	.015 mFd Paper Tubular 400V ± 20%
C56	280-1851	680 pFd Styroseal 600V ± 10%
C57	279-4001	.01 mFd Paper Tubular 200V ± 10%
C58	279-4621	.01 mFd Paper Tubular 200V ± 10%
C59	269-0061	16 mFd Electrolytic 300V Wkg.

PARTS LIST

MODELS M4, M5, M7, P6, P7 and P8

CAPACITORS—*continued*

REF.	PART No.	DESCRIPTION
C60	269-0371	10 mFd Electrolytic 25V Wkg.
C62	279-2281	.22 mFd Paper Tubular 600V ± 20%
C63	279-1121	.1 mFd Paper Tubular 2VV ± 20%
C64	279-4701	.047 mFd Paper Tubular 400V ± 10%
C64a	269-0371	10 mFd Electrolytic 25V Wkg.
C65	279-4661	.022 Paper Tubular 400V ± 10%
C66	279-4661	.022 Paper Tubular 400V ± 10%
C67	279-4701	.047 Paper Tubular 400V ± 10%
C68	269-0481	24 mFd Electrolytic 300V Wkg., with C69
C69	269-0481	24 mFd Electrolytic 300V Wkg., with C68
C70	269-0361	100 mFd Electrolytic 25V Wkg.
C71	279-4681	.033 mFd Paper Tubular 400V Wkg. ± 10%
C72	273-1061	75 pFd Silver Mica ± 5%
C73	273-1031	47 pFd MS silver mica ± 1 pFd
C74	280-1891	.0015 mFd Styroseal 600V ± 10%
C75	280-1001	.001 mFd Styroseal 400V ± 10%
C76	279-1581	.0047 mFd Paper Tubular 400V ± 20%

REF.	PART No.	DESCRIPTION
C77	279-0561	.5 mFd Metallised Paper 200V ± 25%
C78	280-1751	100 pFd Styroseal 600V ± 10%
C79	280-0061	.0033 mFd Styroseal 200V ± 5%
C80	280-1861	820 pFd Styroseal 600V ± 10
C81	280-1751	100 pFd Styroseal 600V ± 10%
C82	280-1781	180 pFd Styroseal 600V ± 10%
C83	279-4581	.0047 mFd Paper Tubular 400V ± 10%
C84	271-0481	82 pFd Ceramic Tubular ± 5%
C85	271-0341	150 pFd Ceramic Disc 5KV N750 ± 10%
C85a	279-5161	.022 mFd Paper Tubular, 600V ± 20%
C86	279-1781	.22 mFd Paper Tubular 400V ± 20%
C87	279-5771	.22 mFd Paper Tubular 1KV ± 10%
C88	279-5701	.047 mFd Paper Tubular 1KV ± 10%
C89	279-4161	.22 mFd Paper Tubular 200V ± 10%
C90	271-0431	470 pFd Ceramic Disc, K2000, 3KV ± 20%

COILS

REF.	PART No.	DESCRIPTION
L9	259-0672	Tuner Coupling Trim
L10	259-0941	1st IF Grid
L11	259-0941	31.375 Mc/s Trap
L12	Part of 906-0232	29.875 Mc/s Trap (On IFT1)
L13	259-1061	1st IF Coupling
L14	259-1061	2nd IF Grid
L15	Part of 906-0281	38.375 Mc/s Trap
L16	259-0672	2nd IF Coupling
L17	259-1061	3rd IF Grid
L18	259-0672	3rd IF Coupling

REF.	PART No.	DESCRIPTION
L19	259-0931	Detector Input
L20	259-0953	Grid Peaking Choke
L21	259-0953	Grid Peaking Choke
L22	259-1081	Peaking Choke—Shunt
L23	259-1091	Peaking Choke—Series
L24	259-0992	Horizontal Stabilising Coil
L25	259-0044	Coil, Anti-Parasitic
L26	259-0902	Width Control
L27	259-0044	Coil, Anti-Parasitic
L28	259-0044	Coil, Anti-Parasitic
L29	259-0922	Horizontal Linearity Control

POTENTIOMETERS

REF.	PART No.	DESCRIPTION
RV1	677-0641	500K Cure A type Q—Brightness
RV2	677-0171	25K Curve A type EC — Noise Inverter
RV3	677-0421	500K Curve A type ES—A.G.C.
RV4	677-0601	25K Curve A type Q—Contrast
RV5	677-0611	50K Curve C type ES—Contrast Range
RV6	677-0621	1M ohms tapped 500K Curve A, with D.P.P.P. Switch—Volume

REF.	PART No.	DESCRIPTION
RV7	677-0343	250K Curve A type EC—Height
RV8	677-0841	100K Curve A type Q — Vertical Hold
RV9	677-0343	250K Curve A type ES — Vertical Linearity Main
RV10	677-0343	250K Curve A type ES — Vertical Linearity Top
RV11	677-0631	50K Curve A type P.T.U.—Horizontal Hold

TRANSFORMERS

REF.	PART No.	DESCRIPTION
IFT1	906-0232	IF Vision
IFT2	906-0281	IF Vision
IFT3	906-0253	IF Vision
IFT4	906-0261	Sound Take off and 5.5 Mc/s Trap
IFT5	906-0101	Ratio Tarnsformer

REF.	PART No.	DESCRIPTION
T1	904-0253	Power Transformer
T2	905-0312	Audio Output
T3	908-0461	Blocking Oscillator
T4	905-0226	Vertical Output
T5	908-0381	Horizontal Output

VALVES

REF.	PART No.		DESCRIPTION
V1	932-1161	6ES8	RF Amplifier
V2	932-0501	6BL8	Frequency Changer
V3	932-0881	6BY7	1st IF Amplifier
V4	932-0521	6BX6	2nd IF Amplifier
V5	932-1101	6U8	3rd IF Amplifier and Noise Inverter
V6	932-1081	6DX8	Video Amplifier and Sync. Separator

REF.	PART No.		DESCRIPTION
V7	932-1101	6U8	Limiter and A.G.C.
V8	932-0511	6BM8	Audio Drive & Output
V9	932-0511	6BM8	Blocking Oscillator and Vertical Output
V10	932-0481	12AU7	Horizontal Multivibrator
V11	932-0531	6CM5	Horizontal Output
V12	932-0771	1S2	EHT Rectifier
V13	932-1151	6AL3	Damping Diode

PARTS LIST

MODELS M4, M5, M7, P6, P7 and P8

MISCELLANEOUS

REF.	PART No.	DESCRIPTION
CH1	232-0124	Choke 300 mA
MR1	932-0971	Diode 0A80
MR2	932-1071	Diode 0A210
MR3	932-1071	Diode 0A210
MR3a	932-0791	Diode 0A81
MR4	932-0991	Diode M3
MR5, MR6	932-0601	Diodes, 2 — 0A79
MR7	932-0791	Diode 0A81
MR8	932-0791	Diode 0A81
RT2	752-0021	Thermistor CZ4
VDR1	750-0281	Voltage Dependent Resistor, type E298GD/A260
FS1	431-0071	Fuse, 1 amp.
FS2	431-0081	Fuse, 1.5 amp.

REF.	PART No.	DESCRIPTION	
FS3	431-0031	Fuse, 250 mA.	
Yoke	259-1171	21-inch Yoke, with Thermistor RT1 for M4, M5, M7.	
Yoke	259-1101	23-inch Yoke, with Thermistor RT1, for P6, P7, P8.	
CRT	932-1121	AW53-88	M4, M5, M7
	932-1121	21DAP4	
	932-1262	AW59-30	P6, P7, P8
	932-1262	23MP4	
	932-1262	23MP4-K	
	932-1261	23MP4-J	
	932-1261	AW59-90	
	932-1262	2351B	
	932-1261	2354B	

Refer to Text before replacing CRT.

PARTS LIST

MODELS M3, M6, P1, P2 and P5

RESISTORS

REF.	PART No.	DESCRIPTION
R13	740-0032	2.2K ohms ½ W ± 10%
R14	740-0032	2.2K ohms ½ W ± 10%
R15	740-0983	22 ohms ½ W Morganite ± 10%
R16	740-0653	100 ohms ½ W Morganite ± 10%
R17	742-0712	2.2K ohms 1 W ± 20%
R18	740-0682	680 ohms ½ W ± 10%
R20	740-0983	22 ohms ½ W Morganite ± 10%
R21	740-0273	150 ohms ½ W Morganite ± 10%
R22	742-0712	2.2K ohms 1 W ± 20%
R23	740-0032	2.2K ohms ½ W ± 10%
R24	740-0273	150 ohms ½ W Morganite ± 10%
R25	742-0322	1K ohms 1 W ± 20%
R26	742-0322	1K ohms 1 W ± 20%
R27	740-0042	2.7K ohms ½ W ± 10%
R28	740-0572	1K ohms ½ W ± 10%
R29	749-0242	1.8K ohms 2 W ± 10%
R30	749-0242	1.8K ohms 2 W ± 10%
R31	740-0773	39 ohms ½ W Morganite ± 10%
R32	742-0162	390K ohms 1 W ± 10%
R33	740-0122	47K ohms ½ W ± 10%
R34	740-0622	470K ohms ½ W ± 20%
R35	740-0732	12K ohms ½ W ± 10%
R35a	740-0142	100K ohms ½ W ± 10%
R36	750-0291	250 ohms 5 W W.W. ± 5%
R37	749-0142	1K ohms 2 W ± 20%
R38	749-0252	12K ohms 2 W ± 10%
R39	740-0142	100K ohms ½ W ± 10%
R40	740-0162	220K ohms ½ W ± 10%
R41	740-0162	220K ohms ½ W ± 10%
R42	740-0242	33K ohms ½ W ± 10%
R43	740-0162	220K ohms ½ W ± 10%
R44	740-0822	33K ohms ½ W ± 20%
R45	740-0122	47K ohms ½ W ± 10%
R46	740-0112	27K ohms ½ W ± 10%
R47	742-0772	3.9M ohms 1 W ± 10%
R48	740-0202	2.2M ohms ½ W ± 10%
R49	742-0122	150K ohms 1 W ± 10%
R50	749-0232	27K ohms 2 W ± 10%
R51	742-0772	3.9M ohms 1 W ± 10%
R52	742-0772	3.9M ohms 1 W ± 10%
R53	742-0732	1.8M ohms 1 W ± 10%
R54	742-0182	680K ohms 1 W ± 10%
R55	740-0782	120K ohms ½ W ± 10%
R56	740-0702	56K ohms ½ W ± 10%
R57	740-0162	220K ohms ½ W ± 10%
R58	742-0982	1.2M ohms 1 W ± 10%
R59	740-0782	120K ohms ½ W ± 10%
R60	749-0232	27K ohms 2 W ± 10%
R61	740-0082	10K ohms ½ W ± 10%
R62	740-0273	150 ohms ½ W Morganite ± 10%
R63	740-0572	1K ohms ½ W ± 10%
R64	740-0622	470K ohms ½ W ± 20%
R65	740-0142	100K ohms ½ W ± 10%
R66	740-0122	47K ohms ½ W ± 10%
R67	740-0082	10K ohms ½ W ± 10%
R68	749-0052	47K ohms 2 W ± 20%
R69	740-0032	2.2K ohms ½ W ± 10%
R70	740-0082	10K ohms ½ W ± 10%
R70a	740-0082	10K ohms ½ W ± 10%
R71	740-0112	27K ohms ½ W ± 10%
R72	740-0112	27K ohms ½ W ± 10%
R73	740-0122	47K ohms ½ W ± 10%
R74	740-0702	56K ohms ½ W ± 10%
R75	742-0492	68K ohms 1 W ± 10%
R76	742-0132	220K ohms 1 W ± 10%
R77	740-0062	3.9 ohms ½ W ± 10%
R78	740-1052	330K ohms ½ W ± 20%
R79	740-1062	680K ohms ½ W ± 20%
R80	750-0332	680 ohms 5 W W.W. ± 10%
R81	742-0823	270 ohms 1 W Morganite ± 10%
R82	742-0112	100K ohms 1 W ± 10%
R83	740-0112	27K ohms ½ W ± 10%
R84	740-0082	10K ohms ½ W ± 10%
R85	740-0082	10K ohms ½ W ± 10%
R86	740-0122	47K ohms ½ W ± 10%
R87	740-0082	10K ohms ½ W ± 10%
R88	742-0172	470K ohms 1 W ± 10%
R89	740-0082	10K ohms ½ W ± 10%
R90	740-0232	39K ohms ½ W ± 10%
R91	742-0022	4.7K ohms 1 W ± 10%
R92	740-0202	2.2M ohms ½ W ± 10%
R93	740-0582	47K ohms ½ W ± 20%
R94	740-0302	1.8K ohms ½ W ± 10%
R95	749-0142	1K ohms 2 W ± 20%
R96	742-0823	270 ohms 1 W Morganite ± 10%
R97	740-1043	27 ohms ½ W Morganite ± 10%
R98	740-1043	27 ohms ½ W Morganite ± 10%
R99	740-0172	270K ohms ½ W ± 10%
R100	740-0392	330K ohms ½ W ± 10%
R101	740-0182	470K ohms ½ W ± 10%
R102	740-0142	100K ohms ½ W ± 10%
R103	740-0102	22K ohms ½ W ± 10%
R104	742-0042	15K ohms 1 W ± 10%
R105	742-0472	1.8K ohms 1 W ± 10%
R106	740-0702	56K ohms ½ W ± 10%
R107	740-0112	27K ohms ½ W ± 10%
R108	740-0122	47K ohms ½ W ± 10%
R109	742-0172	470K ohms 1 W ± 10%
R110	740-0572	1K ohms ½ W ± 20%
R111	750-0182	2.7K ohms 5 W W.W. ± 10%
R112	746-0242	1 ohm ½ W W.W. ± 10%
R113	742-0262	2.7K ohms 1 W ± 10%
R114	742-0492	68K ohms 1 W ± 10%
R115	742-0112	100K ohms 1 W ± 10%
R116	740-0492	1.5M ohms ½ W ± 20%
R117	Part of 908-0381	1.5 ohm Wire Resistor.

CAPACITORS

REF.	PART No.	DESCRIPTION
C14	273-0591	68 pFd MS Silver Mica ± 2½%
C15	271-0031	.0033 mFd Ceramic Disc G.M.V.
C16	271-0031	.0033 mFd Ceramic Disc G.M.V.
C17	271-0031	.0033 mFd Ceramic Disc G.M.V.
C18	271-0031	.0033 mFd Ceramic Disc G.M.V.
C19	271-0031	.0033 mFd Ceramic Disc G.M.V.
C20	273-0591	68 pFd MS Silver Mica ± 2½%
C22	280-1651	.0018 mFd Styroseal 600V ± 5%
C23	271-0031	.0033 mFd Ceramic Disc G.M.V.
C24	271-0031	.0033 mFd Ceramic Disc G.M.V.
C25	273-0591	68 pFd MS Silver Mica ± 2½%
C26	280-1651	.0018 mFd Styroseal 600V ± 5%
C27	271-0031	.0033 mFd Ceramic Disc G.M.V.
C28	271-0031	.0033 mFd Ceramic Disc G.M.V.
C29	280-1651	.0018 mFd Styroseal 600V ± 5%
C30	271-0031	.0033 mFd Ceramic Disc G.M.V.
C31	271-0471	6.8 pFd Ceramic Disc NPO ± ½ pFd
C32	271-0131	8.2 pFd Ceramic Tube NPO ± ½ pFd
C33	271-0221	2.2 pFd Ceramic Bead NPO ± ½ pFd
C34	271-0311	27 pFd Ceramic Tube NPO ± 5%
C35	271-0181	15 pFd Ceramic Tube NPO ± ½ pFd
C36	269-0211	8 mFd Electrolytic 300V Wkg.
C37	279-4701	.047 mFd Paper Tubular 400V ± 10%
C38	279-4541	.0022 mFd Paper Tubular 400V ± 10%
C38a	279-4661	.022 mFd Paper Tubular 400V ± 10%
C40	269-0521	100 mFd Electrolytic (Insulated) 150V Wkg.
C41	269-0531	100 mFd Electrolytic (Uninsulated) 150V Wkg.
C42	269-0511	80 mFd Electrolytic 300V Wkg. (With C43)
C43	269-0511	40 mFd Electrolytic 300 VWkg. (With C42)
C44	269-0611	4 mFd Electrolytic 300V Wkg.
C45	279-4661	.022 mFd Paper Tubular 400V ± 10%
C46	280-1791	220 pFd Styroseal 600V ± 10%
C46a	273-0921	68 pFd MS Silver Mica ± 10%
C47	279-1161	.22 mFd Paper Tubular 200V ± 20%
C47a	279-1741	.1 mFd Paper Tubular 400V ± 20%
C48	279-0281	1 mFd Metallised Paper 200V ± 25%
C49	271-0231	68 pFd Ceramic Disc N750 3kV ± 10%
C50	271-0031	.0033 mFd Ceramic Disc G.M.V.
C51	279-1161	.22 mFd Paper Tubular 200V ± 20%

PARTS LIST

MODELS M3, M6, P1, P2 and P5

CAPACITORS — *continued*

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
C52	526-2962	1.5 mFd Lead Capacitor	C78	279-4721	.068 mFd Paper Tubular 400V ± 10%
C53	279-4541	.0022 Paper Tubular 400V ± 10%	C79	279-4621	.01 mFd Paper Tubular 400V ± 10%
C54	271-0031	.0033 mFd Ceramic Disc G.M.V.	C80	269-0481	24 mFd Electrolytic 300V Wkg. (With C82)
C55	279-1621	.01 mFd Paper Tubular 400V ± 20%	C81	279-1161	.22 mFd Paper Tubular 200V ± 10%
C56	271-0471	6.8 pFd Ceramic Disc NPO ± ¼ pFd	C82	269-0481	24 mFd Electrolytic 300V Wkg. (With C80)
C57	271-0491	10 pFd Ceramic Disc NPO ± 10%	C83	269-0361	100 mFd Electrolytic 25V Wkg.
C58	280-1651	.0018 Styroseal 600V ± 5%	C84	273-1051	82 pFd MS Silver Mica ± 10%
C59	273-0561	10 pFd Type I/F ± 10%	C85	273-1031	47 pFd MS Silver Mica ± 1 pFd
C60	271-0031	.0033 mFd Ceramic Disc G.M.V.	C86	280-1891	.0015 mFd Styroseal 600V ± 10%
C61	273-0331	100 pFd Type I/F ± 5%	C87	280-1001	.001 mFd Styroseal 400V ± 10%
C62	280-1501	100 pFd Styroseal 600V ± 5%	C88	279-1581	.0047 mFd Paper Tubular 400V ± 20%
C63	280-1501	100 pFd Styroseal 600V ± 5%	C89	279-0561	.5 mFd Metallised Paper 200V ± 25%
C64	269-0371	10 mFd Electrolytic 25V Wkg.	C90	280-1751	100 pFd Styroseal 600V ± 10%
C65	280-1851	680 pFd Styroseal 600V Wkg. ± 10%	C91	280-0061	.0033 mFd Styroseal 200V ± 5%
C66	279-4001	.01 mFd Paper Tubular 200V ± 10%	C92	280-1861	820 pFd Styroseal 600V ± 10%
C66a	280-1791	220 pFd Styroseal 600V ± 10% (P1, P2, P5 only)	C93	271-0481	82 pFd Ceramic Tube NPO ± 5%
C67	279-4001	.01 mfd Paper Tubular 200V ± 10%	C94	280-1781	180 pFd Styroseal 600V ± 10%
C68	269-0371	10 mFd Electrolytic 25V Wkg.	C95	279-4581	.0047 mFd Paper Tubular 400V ± 10%
C69	279-1641	.01 mFd Paper Tubular 400V ± 20%	C96	271-0481	82 pFd Ceramic Tubular NPO ± 5%
C70	269-0061	16 mFd Electrolytic 300V Wkg.	C97	271-0341	150 pFd Ceramic Disc 5 kV N750 ± 10%
C71	269-0221	25 mFd Electrolytic 25V Wkg.	C98	279-2281	.22 mFd Paper Tubular 600V ± 20%
C72	279-1661	.022 mFd Paper Tubular 400V ± 20%	C99	279-5771	.22 mFd Paper Tubular 1 kV ± 10%
C73	279-0281	1 mFd Metallised Paper 200V ± 25%	C100	279-5701	.047 mFd Paper Tubular 1 kV ± 10%
C74	279-4541	.0022 mFd Paper Tubular 400V ± 10%	C101	279-4161	.22 mFd Paper Tubular 200V ± 10%
C75	279-1701	.047 mFd Paper Tubular 400V ± 20%	C102	271-0431	470 pFd Ceramic Disc K2000 3 kV ± 20%
C76	279-4541	.0022 mFd Paper Tubular 400V ± 10%			
C77	279-4541	.0022 mFd Paper Tubular 400V ± 10%			

COILS

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
L9	259-0672	Tuner Coupling Trim	L19	259-0931	Detector Input
L10 }	259-0941	1st IF Grid	L20	259-0953	Grid Peaking Choke
L11 }		31.375 Mc/s Trap	L21	259-0953	Grid Peaking Choke
L12	Part of 906-0232	29.875 Mc/s Trap (On IFT1)	L22	259-1081	Peaking Choke—Shunt
			L23	259-1091	Peaking Choke—Series
L13	259-0672	1st IF Coupling	L24	259-1021	Sound IF Anode
L14	259-1061	2nd IF Grid	L25	259-0992	Horizontal Stabilising Coil
L15	Part of 906-0281	38.375 Mc/s Trap (On IFT2)	L25a	259-0044	Coil—Anti-Parasitic
			L26	259-0902	Width Coil
L16	259-0672	2nd IF Coupling	L26a	259-0044	Coil—Anti-Parasitic
L17	259-1061	3rd IF Grid	L27	259-0922	Horizontal Linearity Coil
L18	259-0672	3rd IF Coupling	L28	259-0444	Coil—Anti-Parasitic

POTENTIOMETERS

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
RV1	677-0641	500K Curve A Type Q—Brightness	RV6a	677-0801	250K Curve A Type PTU — Tone (P1, P2, P5 only)
RV2	677-0171	25K Curve A Type EC — Noise Inverter	RV7	677-0931	50K Curve A Type EC—Height
RV3	677-0911	1M Curve A Type EC—A.G.C.	RV8	677-0641	500K Curve A Type Q — Vertical Hold
RV4	677-0601	25K Curve A Type Q—Contrast			
RV5	677-0611	50K Curve C Type EC—Contrast Range	RV9	677-0511	10K Curve A Type EC — Vertical Linearity
RV6	677-0621	1M Tapped 500K Curve A with D.P.P.P.—Switch Volume	RV10	677-0631	50K Curve A Type PTU — Horizontal Hold.

TRANSFORMERS

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
IFT1	906-0232	IF Vision	T2	905-0303	Audio Output
IFT2	906-0281	IF Vision	T3	908-0321	Blocking Oscillator
IFT3	906-0253	IF Vision	T4	905-0226	Vertical Output
IFT4	906-0261	Sound Take off and 5.5 Mc/s Trap	T5	908-0352	Vertical Feedback
IFT5	906-0101	Ratio Transformer	T6	908-0381	Horizontal Output
T1	904-0253	Power Transformer	T7	908-0391	Focus Transformer

PARTS LIST

MODELS M3, M6, P1, P2 and P5

VALVES

REF.	PART No.		DESCRIPTION
V1	932-1161	6ES8	RF Amplifier
V2	932-0501	6BL8	Frequency Changer
V3	632-1211	6EH7	1st IF Amplifier
V4	932-1221	6EJ7	2nd IF Amplifier
V5	932-1221	6EJ7	3rd IF Amplifier
V6	932-1081	6DX8	Video Amplifier and Noise Inverter
V7	932-1231	6DT6	Sync. Separator
V8	932-1101	6U8	Sound Amplifier and A.G.C.

REF.	PART No.		DESCRIPTION
V9	932-0441	6AU6	Limiter
V10	932-0511	6BM8	Audio Driver and Output
V11	932-0511	6BM8	Blocking Oscillator and Vertical Output
V12	932-0481	12AU7	Horizontal Multivibrator
V13	932-0531	6CM5	Horizontal Output
V14	932-0771	1S2	EHT Rectifier
V15	932-1151	6AL3	Damping Diode

MISCELLANEOUS

REF.	PART No.	DESCRIPTION
CH1	232-0124	Choke 300 mA
MR1	932-0971	Diode 0A80
MR2	932-1071	Diode 0A210
MR3	932-1071	Diode 0A210
MR4	932-0991	Diode M3
MR5 / MR6	932-0601	Diodes (2—0A79)
MR7	932-0791	Diode 0A81
MR8	932-0791	Diode 0A81
RT1	752-0021	Thermister CZ4
VDR1	750-0281	Voltage Dependent Resistor E298GD/A260
FS1	431-0071	Fuse, 1 Amp.
FS2	431-0081	Fuse, 1.5 Amp.

REF.	PART No.	DESCRIPTION	
FS3	431-0031	Fuse, 250 mA.	
Yoke	259-1011	21-inch Yoke for M3, M6	
	259-1051	23-inch Yoke for P1, P2, P5	
CRT	932-1211	AW53-88	M3, M6
	932-1121	21DAP4	M3, M6
	932-1262	AW59-30	P1, P2, P5
	932-1262	23WP4	P1, P2, P5
	932-1262	23MP4-K	P1, P2, P5
	932-1261	23MP4-J	P1, P2, P5
	932-1261	AW59-90	P1, P2, P5
	932-1262	2351B	P1, P2, P5
	932-1261	2354B	P1, P2, P5

Refer to text before replacing CRT.

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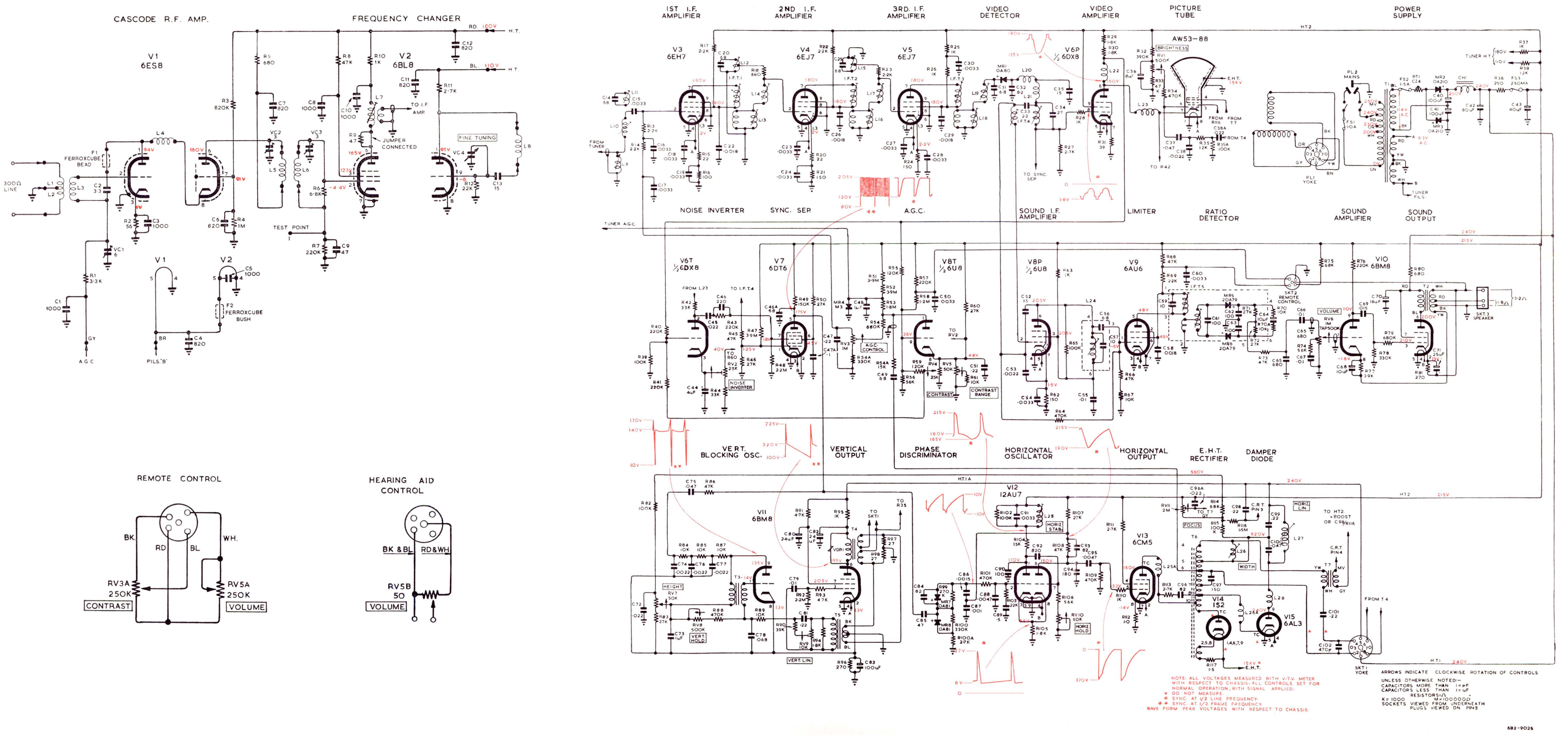
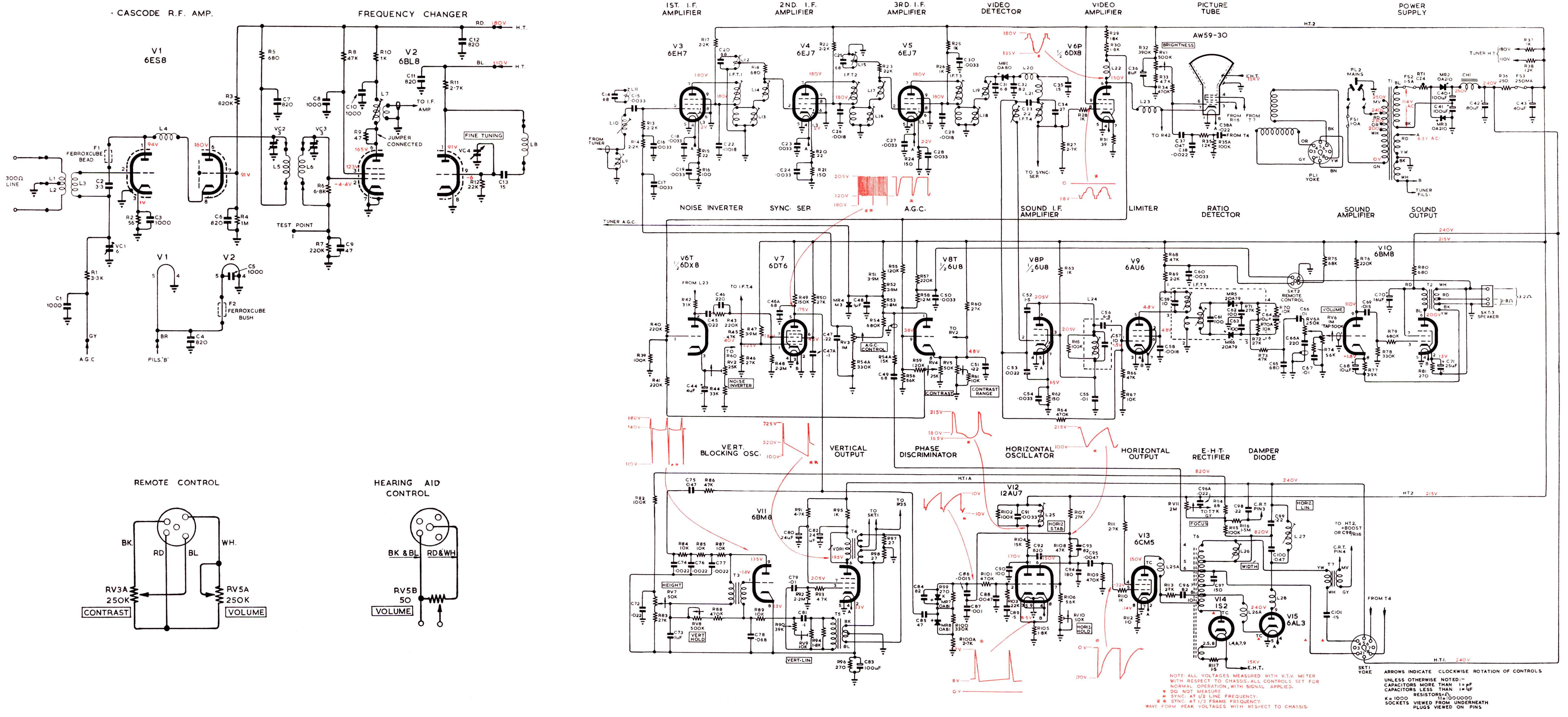
"H·M·V" CHASSIS TYPE M3 & M6



"H·M·V" CHASSIS TYPE P1, P2 & P5



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"H·M·V" CHASSIS TYPE M4, M5, M7, P6, P7 & P8