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"HIS MASTER'S VOICE"

SERVICE MANUAL

for

TELEVISION RECEIVER
CHASSIS TYPE F4

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

PART No. 682-6691

TV Receiver — Chassis Type F4

SPECIFICATION

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

CONSUMPTION:
230 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.
500 mA — H.T.1.
250 mA — H.T.2.

VALVE COMPLEMENT

V1	6CW7	R.F. Amplifier
V2	6BL8	Frequency Changer
V3	6BY7	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	5AS4	Power Rectifier
V9	5AS4	Power Rectifier
V10	6BL8	Gated A.G.C. and Noise Inverter
V11	6BL8 or 6AW8A	Vertical Sync. Separator and Horizontal Sync. Separator
V12	6BX6	Intercarrier Amp.
V13	6BX6	Limiter
V14	6AL5	Ratio Detector
V15	6BM8	Audio Amplifiers & Audio Output
V16	6BM8	(Audio Amplifiers & Audio Output)
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	0A90	Vision Detector
MR2	0A81 or 0A91	Clamping Diode
MR3	M3	Clamping Diode
C.R.T.	21ALP4-A or AW53-80	Picture Tube

Note: An improved, modified F4 has been introduced, production commencing at serial number 07851. The modifications are detailed in the last section of the text of this manual and a second circuit diagram, incorporating the modifications, will be found at the back of the manual.

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 (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 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

23 valves and three metal rectifiers.

90° aluminised, electrostatic focus picture tube, type 21ALP4-A or AW53-80.

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 some cabinets to minimise interference with nearby radio receivers.

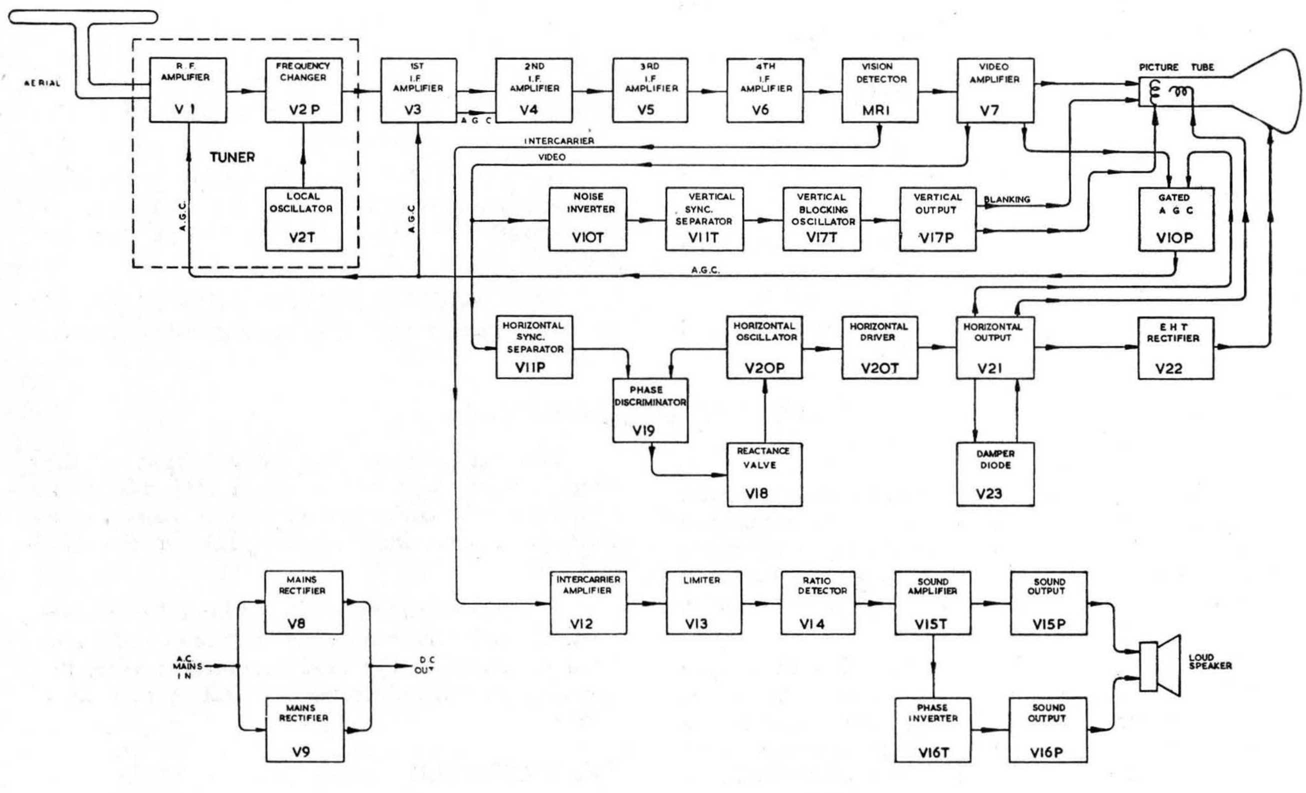


FIG 1

CIRCUIT FEATURES

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

(2) A four-stage I.F. Amplifier gives high 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 6 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." Variable delay on the tuner A.G.C. maintains full R.F. stage gain on weak to moderate signals to minimise frequency converter noise, and can be adjusted for best results when the receiver is installed.

(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 Linearity is controlled by variable inductance which can be adjusted for an indication on a multimeter connected to a test point. This can be done with any transmitted picture. Test card is needed only to make a small, final adjustment for optimum performance.

(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. INPUT

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.

This does not influence their R.F. operation, but since the same current flows through both valves, A.G.C. voltage applied to V3 controls V4 also. In first production chassis, V12 is "stacked" with V5. However, in modified chassis, these valves are connected independently between HT2 and earth.

V5 is coupled to V6, and V6 to the video detector MR1 by inductive coupling. Trimming inductances L16A, L19, and L21 are adjusted in the factory for accurate coupling between stages.

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 the germanium diode MR1 is fed through IFT5 which, in conjunction with R30 and C37A forms a 5.5 Mc/s null trap, and is amplified by V7. L22, L23 and L24 are peaking chokes which maintain the high frequency components of the vision signal fed to the cathode of the picture tube.

INTERCARRIER AMPLIFIER AND SOUND OUTPUT

The frequency modulated 5.5 Mc/s component from the video detector is applied via the transformer IFT5 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 C51 and R66 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 R62 of this valve is also in the path through which video signal is fed to the vertical sync. separator (and, in modified chassis, to the horizontal sync. separator also), the interfering pulses cancel out across this resistor. Thus the video signal fed to the sync. separator is freed from the effects of impulse interference.

GATED A.G.C.

The same video waveform that feeds the noise inverter, feeds the grid of the A.G.C. amplifier (V9 pentode). The polarity of this waveform is with sync. tips positive, and the valve is biased so that it can conduct only during sync. pulses. However, it will conduct only if there is also a positive potential at its anode. This is supplied as a positive-going pulse during line flyback from the line output transformer TR8, via C47. Thus the valve cannot conduct on impulse interference occurring between line sync. pulses and the A.G.C. operation is freed from the effects of impulse interference.

The current through the A.G.C. valve, which charges C47, depends upon the height of the sync. pulses and the setting of the Contrast control. The resulting mean D.C. (negative) voltage at C47 is fed to the first I.F. amplifier V3 via the potential divider R49, VR2, and R50, smoothed by C46. VR2 controls the ratio of I.F. and R.F. A.G.C. voltage. The cathode of the A.G.C. valve is returned to a potential of approximately +50 volts, which is set by the divider network R51, R25, R53, R57, VR3, and VR5.

The Contrast control VR3 operates in the following manner. A D.C. voltage from the moving arm is applied to the A.G.C. valve grid via R54 and R56 together with a proportion of the video output voltage via R59. The A.G.C. valve has a grid base of —2V, which is small compared with the +50V potential between its cathode and earth. Thus so long as any A.G.C. voltage is produced, the voltage between the grid of V9 and earth during conduction on sync. tips, remains substantially constant (+48 to +49 volts). Thus an *increase* of voltage at its grid due to variation of 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, through 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 amplitude of the video signal.

When the Contrast control is turned maximum clockwise, its moving arm is at earth potential. Since this is its most negative value, the sync. tips will then have their most positive value, and the contrast will be a maximum. And the more positive the potential at the A.G.C. valve cathode, the more positive will be the sync. tips at the A.G.C. valve grid, and hence at the video output at this control setting. Thus the 50V Adjust control VR3 sets the amplitude of video signal at maximum contrast.

Similarly, minimum contrast occurs when the Contrast control is maximum anti-clockwise and the video amplitude at this control setting depends on the D.C. potential fed by the Contrast control. This is set by the Contrast Range control VR4. In early production chassis, this control (250K) feeds a variable D.C. voltage from HT2 through an adding resistor R55 to the junction of R56 and R60. In modified chassis, the control (now 10K) varies the voltage fed from the 50 volt rail (V10 cathode) to the Contrast control VR5.

In all chassis, the purpose of the Contrast Range adjustment is to ensure that when the Contrast control is turned to minimum, the picture cannot be "whited-out," so that the receiver would appear inoperative to the customer.

A.G.C. voltage is also applied to the R.F. amplifier from the junction of R50 and R51, smoothed by C45. The junction of these two resistors is clamped to a small negative potential by the clamping diode, MR3, 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 should be adjusted for optimum when the receiver is installed, by VR2.

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 VR9 is returned to the slider of the Height control potentiometer VR8 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 R115, A and B, from the current in the deflection coils. This voltage is stepped up to the input grid of the frame output valve. A tapped resistor, R116, A, B and C, is provided in series with the feedback transformer primary for factory adjustment of linearity.

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 R119 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 R120 is equal to the peak negative voltage applied to the bottom diode and is negative with respect to the centre tap of the winding.

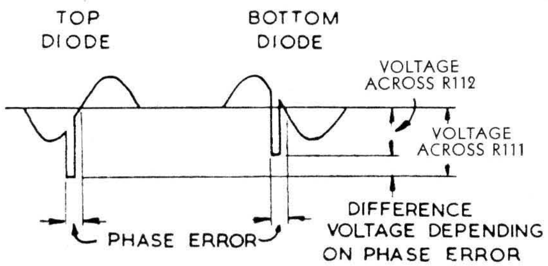
Since the two peak rectified voltages are in the same sense, negative with respect to the transformer centre tap, the discriminator output voltage, taken across the two load resistors R119 and R120, will be their difference.

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.

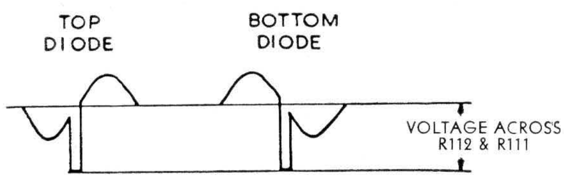
In Fig. 2 (*a*) there is a phase error between the incoming sync pulse and the receiver horizontal oscillator, the sync pulse arriving before the sine-wave crosses the zero axis. Then the voltage across R119 is greater than the voltage across R120, and the discriminator output (the difference between 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 R119 and R120 are equal and the resulting output is zero.

The discriminator output is connected in series with a fixed negative bias voltage derived from the Horizontal Hold 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 that of the fixed bias 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. 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 the Horizontal Drive control VR10 is a variable element to the Horizontal Driver valve (V20 triode). VR10 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.

The shape of the current waveform, which should be essentially sawtooth, is controlled by the Linearity control L31 in conjuction with C105 and C106.

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 560 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 VR7A 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 VR5A feeds a variable D.C. voltage into the contrast control chain R59, R60 and R56. 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 effects 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 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 astigmatism, but can damage the picture tube.

A.G.C.

The A.G.C. control should be adjusted when the receiver is installed. 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 H.T. circuits. 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

Slide the yoke assembly over the neck of the picture tube, taking care that the picture tube base does not damage the yoke. Check that the four hard rubber spacers are in position between the rim of the yoke assembly and the picture tube, replace the four securing straps, and screw up tight. Replace the picture centring magnets and the 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 (0 volts), pin 2 (230 volts), or pin 6 (560 volts) on SK1. This should be checked and reset, if necessary, when a picture tube is changed.

HORIZONTAL LINEARITY

Connect a multimeter, set to read 100 mA full scale deflection, between test point V and chassis. Tune to a transmission, and with the picture in lock, adjust the linearity control L31 for minimum current reading. Final adjustment should be made viewing a test card. The reading on the multi-meter will then rise slightly above minimum.

HORIZONTAL DRIVE

Tune to a transmission and, with the picture in lock, adjust the Horizontal Drive control VR7 until a white vertical stripe appears near the centre of the picture. Then adjust this control again until the white stripe just disappears. This control reacts slightly with the Horizontal Hold control. Hence, after adjustment of horizontal drive, the Horizontal Hold control should be reset.

HORIZONTAL HOLD

The Horizontal Hold Control VR11 is reset in the following manner. This is necessary especially when the Reactance Valve V18 is replaced.

Disconnect sync. pulses by removing the Sync. Separator valve V11, and adjust the Horizontal Hold control until the picture just "floats" or locks weakly. Then replace V11.

In first production chassis, the voltage on test point IV, should be found to be within the range –3 to –3.6 volts, read on a vacuum tube voltmeter. If this is not so, it should be set at –3.4 volts using the Horizontal Hold control, with V11 removed and the core of TR7 adjusted for weak or "floating" lock.

In modified chassis, the *cathode* (pin 1) of the reactance valve V18 should read +0.4 volts. If not, the Horizontal Hold control and core of TR7 should be reset as above.

In general, the core of TR7, which is adjusted in the factory, should not need to be reset. However, adjustment will be needed if TR7 or C95 is replaced, and also, at times, if components are replaced in the reactance valve or line oscillator circuits.

50V ADJUST AND CONTRAST RANGE

In first production chassis—

(i) Connect a multimeter, switched to the 300V. range, between pin 8 of V10 and earth. With normal picture displayed, adjust the 50V Adjust control VR3 to give a reading of +50 volts.

(ii) Turn the contrast control maximum anti-clockwise and adjust the Contrast Range control VR4 to give a light under-contrasted picture.

In modified chassis—

(i) Turn the Contrast control maximum clockwise and adjust the "50V Adjust" preset control until sync. tips read 200V D.C. on a direct coupled oscilloscope. If such an oscilloscope is not available, adjust for a sufficiently strong maximum contrast.

(ii) Turn Contrast Control maximum anti - clockwise (minimum contrast) and adjust Contrast Range preset control to give minimum desirable picture.

In all chassis, the purpose of the Contrast Range preset adjustment is to ensure that when the Contrast control is turned to minimum, the picture cannot be "whited out," so that the receiver would appear inoperative to the customer.

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.

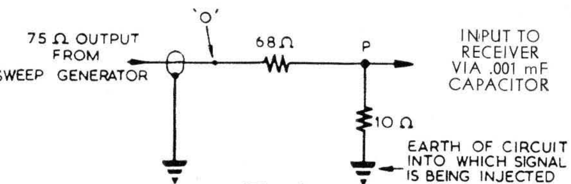


Fig. 4

If there is inadequate output from this arragement 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 —6V. bias across C44. 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.

At all times, the level of the sweep generator output must be kept low enough to avoid overload of the final I.F. Amplifier. The resulting flattening of the displayed sweep waveform can cause faulty alignment. At the same time, the vision detector MR1 may be damaged.

ALIGNMENT

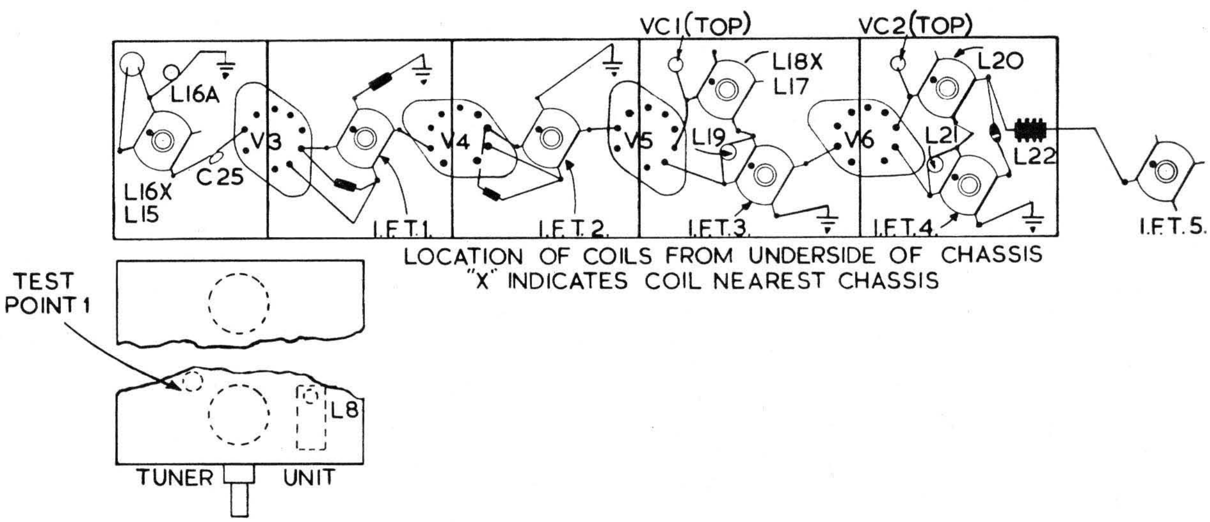
(1) Connect the sweep output between the grid of V6 and earth. Adjust the core of L20 to peak the response at 34.65 Mc/s, with the core in the position closest to the chassis. Adjust the core in IFT4 to give a symmetrical response with the core in the position furthest from the chassis, and then vary both to obtain the response shown in *A* (Fig. 8).

(2) Remove the sweep generator output from the grid of V6 and re-connect it to the grid 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 1½ db. and then adjust VC2 to make the peak response fall a further



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

$1\frac{1}{2}$ 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 L16A, L19, and L21 are coupling coils for factory adjustment and should not be disturbed.

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 8 A.V.O. or similar type).

(iii) A D.C. V.T.V.M.

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

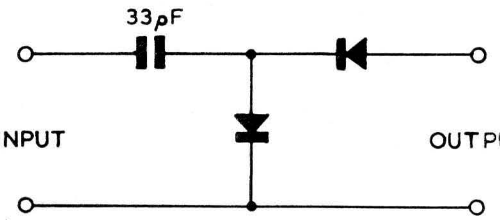


Fig. 6 — Peak-to-Peak Detector

5.5 MC/S. NULL TRAP (IFT4)

IFT5 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 swept 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. Only the primary core should be retuned as the secondary core (nearest chassis) is sealed in the factory.

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

(1) Inject 5.5 Mc/s C.W. at approximately 100 mV between L22 and earth (disconnecting L22 from C37 and MR1).

(2) Connect the input of the peak-to-peak detector illustrated to C.R.T. Pin 11. Connect output of peak - to - peak detector to 20,000 ohm/volt meter on 50 micro-amps. range.

(3) Adjust primary core of IFT5 to give zero reading on meter. NOTE: Do not move secondary core.

If IFT5 is replaced, a similar method is used, but adjustment of both primary and secondary cores is necessary. Set up as in (1) and (2) above, and proceed as follows:

(3) Withdraw both cores to end of former, and then screw in primary core until a minimum reading is obtained on meter.

(4) Screw in secondary core until meter reading increases slightly.

(5) Screw out primary core until meter reading reaches new minimum.

(6) Repeat (3) and (4) until a *zero* reading is obtained.

(7) Seal secondary coil.

SOUND I.F.

(1) Connect the output of the C.W. Oscillator between grid (Pin 2) of V12 and earth and tune the core of L29 amplifier anode coil to obtain maximum negative reading across the 10K. metering resistor, R75, measured with a D.C. V.T.V.M.

(2) Using the same input, connect V.T.V.M. between junction of R80 and R81, and earth. Set the cores of IFT6, ratio transformer, until they are $\frac{3}{8}''$ from ends of former. Rotate top (primary) core of IFT6 one turn in either direction. Continue tuning core in the direction that increases the positive reading, until a maximum is obtained. Screw in bottom (secondary) core of IFT6 so that the reading becomes more positive and then falls rapidly through zero to a negative potential. Carefully adjust core so that the meter reads exactly zero volts.

MODIFICATIONS

1. In the modified chassis, the third I.F. Amplifier V5 and the Intercarrier Amplifier V12, which were previously connected in series for D.C. are now independently connected between HT2 and earth. As a result of more effective earthing of the input to V12, a small shift in the tuning of the sound carrier trap IFT5 with level of intercarrier has been minimised.

I.F. RESPONSES

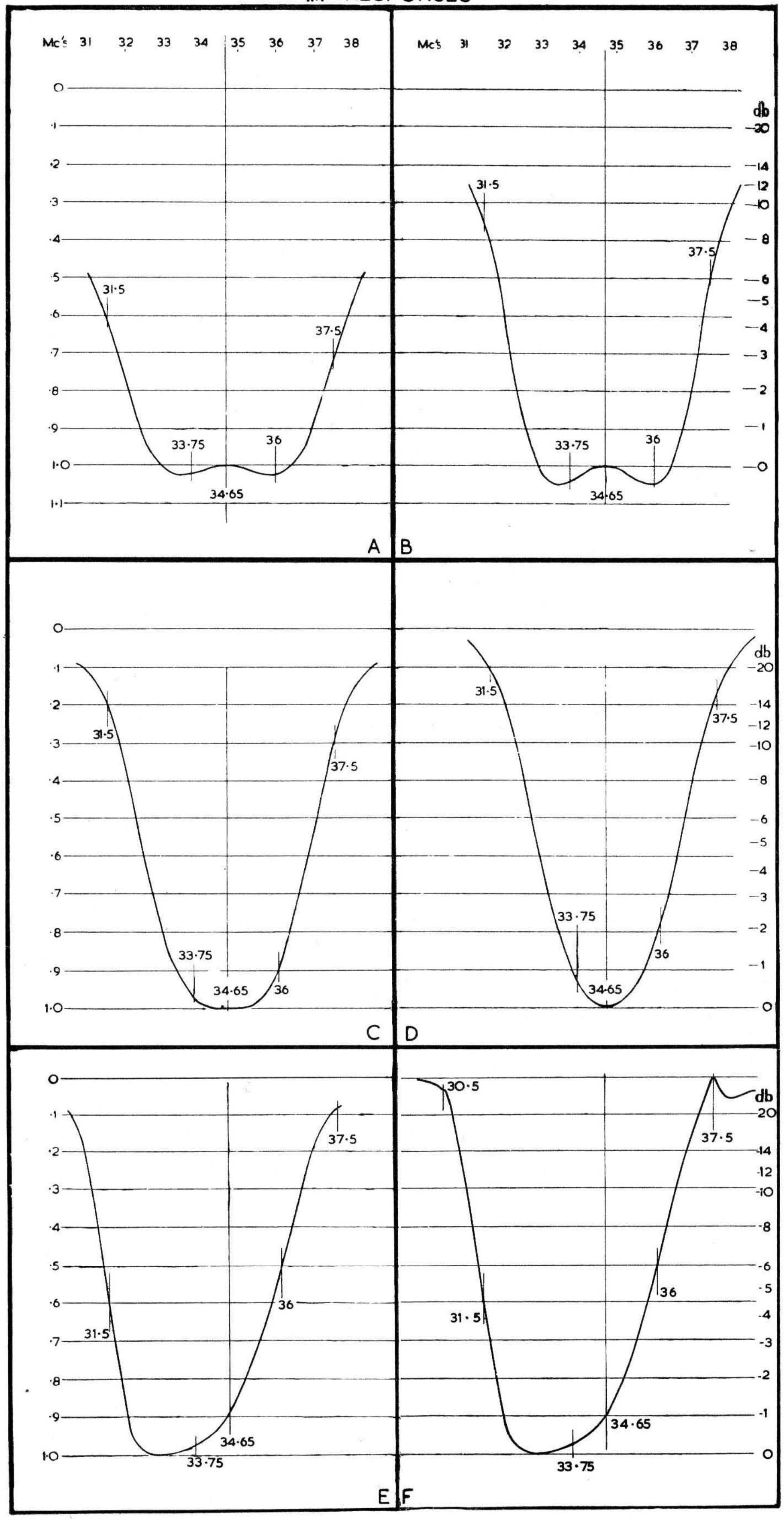


Fig. 5 — Oscilloscope Patterns Obtained with Sweep Oscillator Input.

2. Variations of 6BY7 operation under low bias conditions make it desirable not to reduce the applied bias below –1.3 volts. To achieve this, R48 is no longer returned to chassis, but is connected to the junction of MR3 and C103.

3. Substitution of the 6AW8A in the Sync. Separator V11 makes possible better frame hold in fringe areas. The values of the associated components have been changed also, as shown in the amended circuit.

4. Modifications to the Reactance Valve (V18) circuit ensure (i) much lowered sensitivity of the line oscillator to heavy impulse interference, as in fringe areas; (ii) less shift of oscillator frequency with ageing of the reactance valve; and (iii) virtual immunity against shift of oscillator frequency with large variations in mains supply voltage. The Line Sync. Separator, V11 pentode, is together with the Frame Sync. Separator, V11 triode, now fed from the Noise Inverter. A voltage dependent resistor VDR1 is included in the screen of the reactance valve V18. The reactance valve is now set up by measuring its cathode current (voltage developed across its cathode resistor R117A) instead of its fixed grid bias.

5. A modified form of Contrast Range control improves the operation of the Noise Inverter.

PARTS LIST — MODEL F4

RESISTORS

REF.	PART No.	DESCRIPTION
R15	740-0032	2.2K ohms ± 10% BTS
R16	740-0612	10K ohms ± 20%BTS
R17	740-0483	56 ohms ± 10% ½ W. Morganite
R18	740-0032	2.2K ohms ± 10% BTS
R19	742-0142	270K ohms ± 10% BTA
R20	742-0142	270K ohms ± 10% BTA
R21	740-0112	27K ohms ± 10% BTS
R22	740-0483	56 ohms ± 10% ½ W. Morganite
R23	740-0693	150 ohms ± 20% ½ W. Morganite
R24	740-0302	1.8K ohms ± 10% BTS
R25	740-0653	100 ohms ± 10% ½ W. Morganite
R26	740-0693	150 ohms ± 20% ½ W. Morganite
R27	740-0052	3.3K ohms ± 10% BTS
R28	740-0572	1K ohm ± 20% BTS
R29	740-0572	1K ohm ± 20% BTS
R30	740-0043	2.7K ohms ± 10% ½W. Morganite
R31	740-0322	1.2K ohms ± 10% BTS
R32	740-0382	6.8K ohms ± 10% BTS
R33	749-0191	680 ohms ± 10% BTB
R34	749-0191	680 ohms ± 10% BTB
R35	749-0191	680 ohms ± 10% BTB
R36	749-0191	680 ohms ± 10% BTB
R37	740-0483	56 ohms ± 10% ½ Watt Morganite
R38	740-0162	220K ohms ± 10% BTS
R39	740-0622	470K ohms ± 20% BTS
R40	740-0732	12K ohms ± 10% BTS
R41	740-0262	560 ohms ± 10% BTS
R42	740-0262	560 ohms ± 10% BTS
R43	746-0222	3.9 ohms ± 5% BW½
R45	742-0752	10K ohms ± 20% BTA
R46	742-0712	2.2K ohms ± 20% BTA
R47	742-0712	2.2K ohms ± 20% BTA
R48	740-0583	47K ohms ± 20% ½ W. Morganite
R49	742-0772	3.9 Megohms ± 10% BTA
R50	742-0222	4.7 Megohms ± 10% BTA
R51	742-0192	1 Megohm ± 10% BTA
R51a	742-0172	470K ohms ± 10% BTA
R52	742-0432	18K ohms ± 10% BTA
R53	742-0762	12K ohms ± 10% BTA
R54	740-0862	18K ohms ± 10% BTS
R55	742-0102	82K ohms ± 10% BTA
R56	740-0112	27K ohms ± 10% BTS
R57	742-0522	820K ohms ± 10% BTA
R58	742-0132	220K ohms ± 10%BTA
R59	740-0782	120K ohms ± 10% BTS
R60	740-0082	10K ohms ± 10% BTS
R61	740-0082	10K ohms ± 10% BTS
R62	740-0822	33K ohms ± 20% BTS
R63	740-0202	2.2 Megohms ± 10% BTS
R64	740-0732	12K ohms ± 10% BTS
R65	740-0242	33K ohms ± 10% BTS
R66	740-0202	2.2 Megohms ± 10% BTS
R67	742-0162	390K ohms ± 10% BTA
R68	742-0092	47K ohms ± 10% BTA
R69	740-0092	15K ohms ± 10% BTS
R70	742-0142	270K ohms ± 10% BTA
R71	742-0142	270K ohms ± 10% BTA
R71a	740-0773	39 ohms ± 10% ½ Watt Morganite
R72	740-0273	150 ohms ± 10% ½ W. Morganite
R73	740-0142	100K ohms ± 10% BTS
R74	740-0122	47K ohms ± 10% BTS
R75	740-0082	10K ohms ± 10% BTS
R77	749-0051	47K ohms ± 20% BTB
R78	740-0742	2.2K ohms ± 20% BTS
R79	740-0102	22K ohms ± 10% BTS
R80	740-0092	15K ohms ± 10% BTS
R81	740-0092	15K ohms ± 10% BTS
R82	740-0122	47K ohms ± 10% BTS
R83	740-0102	22K ohms ± 10% BTS
R84	740-0122	47K ohms ± 10% BTS
R85	740-0702	56K ohms ± 10% BTS
R86	742-0122	150K ohms ± 10% BTA
R87	742-0122	150K ohms ± 10% BTA
R88	740-0252	1.5K ohms ± 10% BTS
R89	740-0242	33K ohms ± 10% BTS
R90	740-0112	27K ohms ± 10% BTS
R91	740-0362	390K ohms ± 10% BTS
R92	740-0182	470K ohms ± 10% BTS
R93	740-0182	470K ohms ± 10% BTS
R94	740-0182	470K ohms ± 10% BTS
R95	742-0502	390 ohms ± 10% BTA
R96	742-0502	390 ohms ± 10% BTA
R97	748-0102	470 ohms ± 10% BW1
R98	748-0102	470 ohms ± 10% BW1
R99	742-0252	10K ohms ± 10% BTA
R100	742-0392	47K ohms ± 20% BTA
R101	740-0082	10K ohms ± 10% BTS
R102	740-0082	10K ohms ± 10% BTS
R103	740-0082	10K ohms ± 10% BTS
R104	742-0172	470K ohms ± 10% BTA
R105	740-0142	100K ohms ± 10% BTS
R106	740-0072	4.7K ohms ± 10% BTS
R107	740-0122	47K ohms ± 10% BTS
R108	740-0202	2.2 Megohms ± 10% BTS
R109	740-0522	220K ohms ± 20% BTS
R110	742-0752	10K ohms ± 20% BTA
R111	742-0752	10K ohms ± 20% BTA
R112	749-0191	680 ohms ± 10% BTB
R114	742-0313	330 ohms ± 10% BTA
R115a	750-0201	Wire Wound Strip
R115b	750-0201	Wire Wound Strip
R116a	750-0201	Wire Wound Strip
R116b	750-0201	Wire Wound Strip
R116c	750-0201	Wire Wound Strip
R117	740-0732	12K ohms ± 10% BTS
R118	740-0192	1 Megohm ± 10% BTS
R119	742-0582	120K ohms ± 10% BTA
R120	742-0582	120K ohms ± 10% BTA
R121	749-0081	22K ohms ± 20% BTB
R122	740-0612	10K ohms ± 20% BTS
R123	740-0182	470K ohms ± 10% BTS
R124	740-0142	100K ohms ± 10% BTS
R125	742-0492	68K ohms ± 10% BTA
R126	740-0122	47K ohms ± 10% BTS
R127	740-0392	330K ohms ± 10% BTS
R128	740-0512	100K ohms ± 20% BTS
R129	740-0152	150K ohms ± 10% BTS
R130	740-0142	100K ohms ± 10% BTS
R131	740-0242	33K ohms ± 10% BTS
R132	742-0392	47K ohms ± 20% BTA
R133	742-0172	470K ohms ± 10% BTA
R134	742-0432	18K ohms ± 10% BTA
R135	740-0572	1K ohm ± 20% BTS
R136	750-0231	4.7 ohms ± 10% 5W.
R137	746-0182	1.0 ohms ± 20% BW½
R138	742-0132	220K ohms ± 10% BTA
R139	742-0122	150K ohms ± 10% BTA
R140	740-0492	1.5 Megohms ± 20% BTS
R141	742-0492	68K ohms ± 10% BTA
RT1	752-0011	CZ6 Brimistor
RT2	752-0011	CZ6 Brimistor

CAPACITORS

REF.	PART No.	DESCRIPTION
C24	273-0591	68 pF. ± 1 pF. Silver Mica M.S.
C25	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C26	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C27	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C28	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C29	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C30	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C31	273-0591	68 pF. ± 1 pF. Silver Mica M.S.
C32	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C33	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C34	280-1311	.0033 Mfd. Plastic Tubular ± 20% 400 V.W. DFB 418
C35	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C36	271-0151	6.8 pF. ± ¼ pF. Tubular Ceramic NPO
C37	271-0131	8.2 pF. ± ¼ pF. Tubular Ceramic NPO
C37a	271-0131	8.2 pF. ± ¼ pF. Tubular Ceramic NPO
C38	280-0541	.0022 Mfd. ± 20% 200 VW. Plastic Tubular DFB216
C39	279-4581	.0047 Mfd. ± 10% Paper Tubular 400V.
C40	269-0401	40 Mfd. Electrolytic 250 V.W. (With C42)
C41	269-0441	200 Mfd. Electrolytic 250 V.W. (With C43)
C42	269-0401	80 Mfd. Electrolytic 250 V.W. (With C40)

PARTS LIST — MODEL F4

CAPACITORS — *continued*

REF.	PART No.	DESCRIPTION
C43	269-0441	100 Mfd. Electrolytic 250 V.W. (With C41)
C44	279-1161	.22 Mfd. ± 20% Paper Tubular 200 V.W.
C45	279-1161	.22 Mfd. ± 20% Paper Tubular 200 V.W.
C46	271-0231	68 pF. ± 10% Ceramic 3KV N750
C47	279-1161	.22 Mfd. ± 20% Paper Tubular 200 V.W.
C48	271-0221	2.2 pF. ± ¼ pF. Bead NPO
C49	280-1311	.0033 Mfd. ± 20% 400 V.W. Plastic Tubular DFB418
C50	279-4661	.022 Mfd. ± 10% Paper Tubular 400 V.W.
C51	280-1311	.0033 Mfd. ± 20% 400 V.W. Plastic Tubular DFB418
C52	271-0221	2.2 pF. ± ¼ pF. Bead NPO
C53	279-1121	.1 Mfd. ± 20% Paper Tubular 200 V.W.
C54	526-2701	.8 pF. Lead Capacitor
C55	280-0041	.0022 Mfd. ± 5% Plastic Tubular DFB 216 200 V.W.
C56	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C58	279-1621	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C59	273-0561	10 pF. ± 10% I.F. Type
C60	271-0151	6.8 pF. ± ¼ pF. Ceramic Tube NPO
C61	271-0271	.0022 Mfd. ± 20% CRT Style B Ceramic Tubular
C62	273-0561	10 pF. ± 10% I.F. Type
C63	271-0031	.0033 Mfd. + 100% — 0% Ceramic Disc 500V Wkg.
C65	273-0331	100 pF. ± 10% I.F. Type
C66	280-1501	100 pF. ± 5% Plastic Tubular 600 V.W. DFB 600
C67	280-1501	100 pF. ± 5% Plastic Tubular 600 V.W. DFB 600
C68	269-0371	10 Mfd. Electrolytic 40 P.V. 25 V.W.
C69	279-4021	.015 Mfd. ± 10% Paper Tubular 200 V.W.
C70	280-0311	.0033 Mfd. ± 10% Plastic Tubular DFB218 200V.
C71	280-1851	680 pF. ± 10% Plastic Tubular DFB610 600V.
C72	279-4001	.01 Mfd. ± 10% Paper Tubular 200 V.W.
C73	280-1751	100 pF. ± 10% Plastic Tubular DFB 600
C74	279-1621	.01 Mfd. ± 20% Paper Tubular 400 V.W.
C75	279-1621	.01 Mfd. ± 20% Paper Tubular 400 V.W.
C76	269-0221	25 Mfd. Electrolytic 40 P.V.
C77	269-0221	25 Mfd. Electrolytic 40 P.V.
C78	269-0401	40 Mfd. Electrolytic 250 V.W. (With C86)
C79	269-0211	8 Mfd. Electrolytic 350 P.V.
C80	279-1541	.0022 Mfd. ± 10% Paper Tubular 400 V.W.
C81	279-0281	1 Mfd. ± 25% Metallised Paper 200 V.W.
C82	279-1541	.0022 Mfd. ± 10% Paper Tubular 400 V.W.
C83	279-1541	.0022 Mfd. ± 10% Paper Tubular 400 V.W.
C84	279-4721	.068 Mfd. ± 10% Paper Tubular 400 V.W.
C85	279-1161	.22 Mfd. ± 20% Paper Tubular 200 V.W.
C86	269-0401	80 Mfd. Electrolytic 350 P.V. (With C78)
C87	279-1741	.1 Mfd. ± 20% Paper Tubular 400 V.W.
C88	279-1661	.0022 Mfd. ± 20% Paper Tubular 400 V.W.
C89	269-0361	100 Mfd. Electrolytic 40 P.V. 25 V.W.
C90	280-1791	220 pF. ± 10% Plastic Tubular D.F.B. 604 600V.
C91	279-0281	1.0 Mfd. ± 25% Metallised Paper 200 V.W.
C92	273-0821	33 pF. ± 5% Silver Mica M.S.
C93	280-0331	.0047 Mfd. ± 10% Plastic Tubular DFB 220 200 V.W.
C94	280-0331	.0047 Mfd. ± 10% Plastic Tubular DFB 220 200 V.W.
C95	280-0821	.0039 Mfd. ± 5% Plastic Tubular DFB 419 400 V.W.
C96	279-1121	.1 Mfd. ± 20% Paper Tubular 200 V.W.
C97	280-1851	680 pF. ± 10% Plastic Tubular DFB 610 600 V.W.
C98	279-1121	.1 Mfd. ± 20% Paper Tubular 200 V.W.
C99	273-0541	47 pF. ± 10% Silver Mica M.S.
C100	279-1661	.022 Mfd. ± 20% Paper Tubular 400 V.W.
C101	279-1581	.0047 Mfd. ± 20% Paper Tubular 400 V.W.
C102	279-1661	.022 Mfd. ± 20% Paper Tubular 400 V.W.
C103	279-1121	.1 Mfd. ± 20% Paper Tubular 200 V.W.
C104	279-5141	.015 Mfd. ± 10% Paper Tubular 600V.W.
C105	279-5201	.047 Mfd. ± 10% Paper Tubular 600V.W.
C106	279-5221	.068 Mfd. ± 10% Paper Tubular 600V.W.
C107	279-1781	.22 Mfd. ± 20% Paper Tubular 400V.W.
CR1	753-0001	Resistive Capacitive Coupled Unit 150 ohms/1K5 Mfd.

COILS

REF.	PART No.	DESCRIPTION
L15, L16	259-0811	1st I.F. Grid and Trap
L16a	259-0671	Coupling Trimmer
L17, L18	259-0691	3rd I.F. Anode and Trap
L19	259-0671	Coupling Trimmer
L20	259-0611	4th I.F. Anode
L21	259-0671	Coupling Trimmer
L22	259-0741	Video Peaking (Grid)
L23	259-0771	Video Peaking (Shunt)
L24	259-0022	Video Peaking (Series)
L25	259-0031	I.F. Sound Coupling
L26	232-0151	Filament Choke
L27	232-0151	Filament Choke
L28	259-0623	Width Coil
L29	259-0042	Coil — Anti-Parasitic
L30	259-0042	Coil — Anti-Parasitic
L31	259-0861	Horizontal Linearity

MISCELLANEOUS

REF.	PART No.	DESCRIPTION
VR1	677-0351	500,000 ohms Curve A (Brightness)
VR2	677-0421	500,000 ohms Curve A E.C. (A.G.C.)
VR3	677-0171	25,000 ohms Curve A E.C. 50V. Adjust.)
VR4	677-0341	250,000 ohms Curve A E.C. (Contrast Range)
VR5	677-0331	10,000 ohms Curve A (With VR7) (Contrast)
VR6	677-0372	500,000 ohms Curve C (Tone)
VR7	677-0331	1 Megohm Tap. 500,000 ohms Curve A (With VR5) (Volume)
VR8	677-0362	50,000 ohms Curve A (Height)
VR9	677-0351	500,000 ohms Curve A (Vert. Hold)
VR10	677-0341	250,000 ohms Curve A E.C. (Horizontal Drive)
VR11	677-0471	25,000 ohms Curve A E.C. (Horizontal Hold)

PARTS LIST — MODEL F4

MISCELLANEOUS — *continued*

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
VC1	281-0131	Capacitor Trimmer	V5	932-0521	6BX6 Valve
VC2	281-0131	Capacitor Trimmer	V6	932-0521	6BX6 Valve
IFT1	906-0151	Transformer I.F.	V7	932-0661	6CK6 Valve
IFT2	906-0151	Transformer I.F.	V8	932-0981	5AS4 Valve
IFT3	906-0162	Transformer I.F.	V9	932-0981	5AS4 Valve
IFT4	906-0171	Transformer I.F.	V10	932-0501	6BL8 Valve
IFT5	906-0181	Transformer I.F. and Trap	V11	932-0501	6BL8 Valve
IFT6	906-0101	Transformer I.F. (Ratio Det.)	V12	932-0521	6BX6 Valve
TR1	904-0202	Transformer Power	V13	932-0521	6BX6 Valve
TR2	905-0201	Transformer Audio	V14	932-0491	6AL5 Valve
TR3	908-0052	Transformer Blocking Oscillator	V15	932-0511	6BM8 Valve
TR4	905-0221	Transformer Vertical Output	V16	932-0511	6BM8 Valve
TR5	908-0182	Transformer Vertical Feedback	V17	932-0511	6BM8 Valve
TR6	908-0111	Transformer Sync. Coupling	V18	932-0521	6BX6 Valve
TR7	908-0191	Transformer Hor. Oscillator	V19	932-0491	6AL5 Valve
TR8	908-0174	Transformer Hor. Output	V20	932-0501	6BL8 Valve
CH1	232-0122	Choke 1.5H 300 mA	V21	932-0531	6CM5 Valve
CH2	232-0211	Choke 5.0H 100 mA	V22	932-0771	1S2 Valve
MR1	932-0971	Diode 0A90	V23	932-0561	6R3 Valve
MR2	932-0791	Diode 0A81	CRT	932-0671	21ALP4 21in. Picture Tube
MR3	932-0991	Diode M3	or	932-0871	AW53-80
V3	932-0881	6BY7 Valve		224-0721	Tuner Assembly
V4	932-0521	6BX6 Valve			

PARTS LIST — MODIFIED MODEL F4

RESISTORS

REF.	PART No.	DESCRIPTION
R15	740-0032	2.2K ohms ± 10% BTS
R16	740-0612	10K ohms ± 20% BTS
R17	740-0483	56 ohms ± 10% ½ W. Morganite
R18	740-0032	2.2K ohms ± 10% BTS
R19	742-0142	270K ohms ± 10% BTA
R20	742-0142	270K ohms ± 10% BTA
R21	740-0112	27K ohms ± 10% BTS
R22	740-0483	56 ohms ± 10% ½ W. Morganite
R23	740-0693	150 ohms ± 20% ½ W. Morganite
R24	740-0302	1.8K ohms ± 10% BTS
R25	740-0273	150 ohms ± 10% BTS
R25a	742-0712	2.2 ohms ± 20% BTA
R27	740-0052	3.3K ohms ± 10% BTS
R28	740-0572	1K ohm ± 20% BTS
R29	740-0572	1K ohm ± 20% BTS
R30	740-0043	2.7K ohms ± 10% ½ W. Morganite
R31	740-0322	1.2K ohms ± 10% BTS
R32	740-0382	6.8K ohms ± 10% BTS
R33	749-0191	680 ohms ± 10% BTB
R34	749-0191	680 ohms ± 10% BTB
R35	749-0191	680 ohms ± 10% BTB
R36	749-0191	680 ohms ± 10% BTB
R37	740-0483	56 ohms ± 10% ½ W. Morganite
R39	740-0622	470K ohms ± 20% BTS
R40	740-0732	12K ohms ± 10% BTS
R41	740-0262	560 ohms ± 10% BTS
R42	740-0262	560 ohms ± 10% BTS
R43	746-0222	3.9 ohms ± 5% BW½
R45	742-0062	27K ohms ± 10% BTA
R45a	742-0962	5.6 ohms ± 10% BTA
R46	742-0712	2.2K ohms ± 20% BTA
R47	742-0712	2.2K ohms ± 20% BTA
R48	740-0583	47K ohms ± 20% ½ W. Morganite
R49	742-0772	3.9 Megohms ± 10% BTA
R50	742-0222	4.7 Megohms ± 10% BTA
R51	742-0192	1 Megohm ± 10% BTA
R51a	742-0172	470K ohms ± 10% BTA
R52	742-0432	18K ohms ± 10% BTA
R53	742-0762	12K ohms ± 10% BTA
R54	740-0862	18K ohms ± 10% BTS
R55a	740-0072	4.7K ohms ± 10% BTS
R55b	740-0072	4.7K ohms ± 10% BTS
R56	740-0112	27K ohms ± 10% BTS
R56a	742-0492	68K ohms ± 10% BTA
R57	742-0522	820K ohms ± 10% BTA
R58	742-0132	220K ohms ± 10% BTA
R59	740-0782	120K ohms ± 10% BTS
R60	740-0082	10K ohms ± 10% BTS
R61	740-0082	10K ohms ± 10% BTS
R62	740-0822	33K ohms ± 20% BTS
R63	740-0592	4.7 Megohms ± 10% BTS
R64a	740-0102	22K ohms ± 10% BTS
R66	740-0592	4.7 Megohms ± 10% BTS
R67	742-0162	390K ohms ± 10% BTA
R68	742-0092	47K ohms ± 10% BTA
R69	740-0092	15K ohms ± 10% BTS
R71a	740-0773	39 ohms ± 10% ½ W. Morganite
R71b	740-0273	150 ohms ± 10% ½ W. Morganite
R72	740-0572	1K ohm ± 10% BTS
R72a	740-0622	470K ohms ± 20% BTS
R73	740-0142	100K ohms ± 10% BTS
R74	740-0122	47K ohms ± 10% BTS
R75	740-0082	10K ohms ± 10% BTS
R77	749-0051	47K ohms ± 20% BTB
R78	740-0742	2.2K ohms ± 20% BTS
R79	740-0102	22K ohms ± 10% BTS
R80	740-0092	15K ohms ± 10% BTS
R81	740-0092	15K ohms ± 10% BTS
R82	740-0122	47K ohms ± 10% BTS

REF.	PART No.	DESCRIPTION
R83	740-0102	22K ohms ± 10% BTS
R84	740-0122	47K ohms ± 10% BTS
R85	740-0702	56K ohms ± 10% BTS
R86	742-0122	150K ohms ± 10% BTA
R87	742-0122	150K ohms ± 10% BTA
R88	740-0252	1.5K ohms ± 10% BTS
R89	740-0242	33K ohms ± 10% BTS
R90	740-0112	27K ohms ± 10% BTS
R91	740-0362	390K ohms ± 10% BTS
R92	740-0182	470K ohms ± 10% BTS
R93	740-0182	470K ohms ± 10% BTS
R94	740-0182	470K ohms ± 10% BTS
R95	742-0502	390 ohms ± 10% BTA
R96	742-0502	390 ohms ± 10% BTA
R97	748-0102	470 ohms ± 10% BW1
R98	748-0102	470 ohms ± 10% BW1
R99	742-0252	10K ohms ± 10% BTA
R99a	740-0142	100K ohms ± 10% BTS
R100	742-0392	47K ohms ± 20% BTA
R101	740-0082	10K ohms ± 10% BTS
R102	740-0082	10K ohms ± 10% BTS
R103	740-0082	10K ohms ± 10% BTS
R104	742-0172	470K ohms ± 10% BTA
R105	740-0142	100K ohms ± 10% BTS
R106	740-0072	4.7 ohms ± 10% BTS
R107	740-0122	47K ohms ± 10% BTS
R108	740-0202	2.2 Megohms ± 10% BTS
R109	740-0522	220K ohms ± 20% BTS
R110	742-0752	10K ohms ± 20% BTA
R111	742-0752	10K ohms ± 20% BTA
R112	749-0191	680 ohms ± 10% BTB
R114	742-0313	330 ohms ± 10% BTA
R115a	750-0201	Wire Wound Strip
R115b	750-0201	Wire Wound Strip
R116a	750-0201	Wire Wound Strip
R116b	750-0201	Wire Wound Strip
R116c	750-0201	Wire Wound Strip
R117	740-0382	6.8K ohms ± 10% BTS
R117a	740-0652	100 ohms ± 10% BTS
R118	740-0842	820K ± 10% BTS
R118a	742-0962	5.6K ohms ± 10% BTA
R119	742-0582	120K ohms ± 10% BTA
R120	742-0582	120K ohms ± 10% BTA
R121	742-0432	18K ohms ± 10% BTA
R122	740-0612	10K ohms ± 20% BTS
R123	740-0182	470K ohms ± 10% BTS
R124	740-0142	100K ohms ± 10% BTS
R125	742-0492	68K ohms ± 10% BTA
R126	740-0122	47K ohms ± 10% BTS
R127	740-0392	330K ohms ± 10% BTS
R128	740-0822	33K ohms ± 20% BTS
R129	740-0152	150K ohms ± 10% BTS
R130	740-0142	100K ohms ± 10% BTS
R131	740-0382	6.8K ohms ± 10% BTS
R132	742-0392	47K ohms ± 20% BTA
R133	742-0172	470K ohms ± 10% BTA
R134	742-0432	18K ohms ± 10% BTA
R135	740-0572	1K ohm ± 20% BTS
R136	750-0231	4.7K ohms ± 10% 5 W.
R137	746-0182	1.0 ohms ± 20% BW½
R138	742-0132	220K ohms ± 10% BTA
R139	742-0122	150K ohms ± 10% BTA
R140	740-0492	1.5 Megohms ± 20% BTS
R141	742-0492	68K ohms ± 10% BTA
RT1	752-0011	CZ6 Brimister
RT2	752-0011	CZ6 Brimister
VDR1	750-0241	Voltage Depedent Resistor Type VD1150/330B.

CAPACITORS

REF.	PART No.	DESCRIPTION
C24	273-0591	68 pF ± 1 pF Silver Mica M.S.
C25	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C28	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C26	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C27	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C29	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C30	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C31	273-0591	68 pF ± 1 pF Silver Mica M.S.
C32	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.

REF.	PART No.	DESCRIPTION
C33	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C34	280-1311	.0033 Mfd. ± 20% 400V W. Plastic Tubular DFB418.
C35	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C36	271-0151	6.8 pF ± ¼ pF Tubular Ceramic NPO
C37	271-0131	8.2 pF ± ¼ pF Tubular Ceramic NPO
C37a	271-0131	8.2 pF ± ¼ pF Tubular Ceramic NPO
C38	280-0541	.0022 Mfd. ± 20% 200V W. Plastic Tubular DFB216
C39	279-4581	.0047 Mfd. ± 10% 400V W. Paper Tubular

PARTS LIST — MODIFIED MODEL F4

CAPACITORS — *continued*

REF.	PART No.	DESCRIPTION
C40	269-0401	40 Mfd. 250V W. Electrolytic (With C42)
C41	269-0441	200 Mfd. 250V W. Electrolytic (With C43)
C42	269-0401	80 Mfd. 250V W. Electrolytic (With C40)
C43	269-0441	100 Mfd. 250V W. Electrolytic (With C41)
C44	279-1161	.22 Mfd. ± 20% 200V W. Paper Tubular
C45	279-1161	.22 Mfd. ± 20% 200V W. Paper Tubular
C46	271-0231	68 pF ± 10% Ceramic 3KV N750
C47	279-1161	.22 Mfd. ± 20% 200V W. Paper Tubular
C48	271-0221	2.2 pF ± ¼ pF Bead NPO
C49	280-1311	.0033 Mfd. ± 20% 400V W. Plastic Tubular DFB418.
C50	279-4661	.022 Mfd. ± 10% 400V W. Paper Tubular
C51	280-1791	220 pF ± 10% 600V W. Plastic Tubular DFB604
C53	279-1121	.1 Mfd. ± 20% 200V W. Paper Tubular
C54	526-2991	Lead—Capacitor 1.5 pF.
C55	280-0291	.0022 Mfd. ± 10% 200V W. Plastic Tubular DFB216
C56a	271-0281	.022 Mfd. ± 20% 100 V.W. CDT. Ceramic Disc
C58	279-1621	.01 Mfd. 400V W. Paper Tubular
C59	273-0561	10 pF ± 10% I.F. Type
C60	271-0151	6.8 pF ± ¼ pF Ceramic Tubular NPO
C61	271-0271	.0022 Mfd. ± 20% CRT Style B Ceramic Tubular
C62	273-0561	10 pF ± 10% I.F. Type
C63	271-0031	.0033 Mfd. + 100%—0% Ceramic Disc 500V Wkg.
C65	273-0331	100 pF ± 10% I.F. Type
C66	280-1501	100 pF ± 5% 600V W. Plastic Tubular DFB600
C67	280-1501	100 pF ± 5% 600V W. Plastic Tubular DFB600
C68	269-0371	10 Mfd 40 P.V. Electrolytic
C69	279-4021	.015 Mfd. ± 10% 200V W. Paper Tubular
C70	280-0311	.0033 Mfd. ± 10% 200V W. Plastic Tubular DFB218
C71	280-1851	680 pF ± 10% 600V W. Plastic Tubular DFB610
C72	279-4001	.01 Mfd. ± 10% 200V W. Paper Tubular
C73	280-1751	100 pF ± 10% 600V W. Plastic Tubular DFB600
C74	280-1371	.01 Mfd. ± 20% 400V W. Plastic Tubular
C75	280-1371	.01 Mfd. ± 20% 400V W. Plastic Tubular
C76	269-0221	25 Mfd. 40 P.V. Electrolytic
C77	269-0221	25 Mfd. 40 P.V. Electrolytic
C78	269-0401	40 Mfd. 250V W. Electrolytic (With C86)
C79	269-0211	8 Mfd. 350 P.V. Electrolytic
C80	279-1541	.0022 Mfd. ± 10% 400V W Paper Tubular
C81	279-0281	1 Mfd. ± 25% 200V W. Metal-ised Paper
C82	279-1541	.0022 Mfd. ± 10% 400V W Paper Tubular
C83	279-1541	.0022 Mfd. ± 10% 400V W Paper Tubular
C84	279-4721	.068 Mfd. ± 10% 400V W Paper Tubular
C85	279-1161	.22 Mfd. ± 20% 200V W Paper Tubular
C86	269-0401	80 Mfd. 350 P.V. Electrolytic (With C78)
C87	279-1741	.1 Mfd. ± 20% 400V W. Paper Tubular
C88	279-1661	.022 Mfd. ± 20% 400V W. Paper Tubular
C89	269-0361	100 Mfd. 40 P.V. Electrolytic
C90	280-1751	100 pF ± 10% 600V W. Plastic Tubular DFB600
C90a	279-0281	1 Mfd. ± 25% 200V W. Metalised Paper
C91	279-0551	2.0 Mfd. ± 25% 200V W. Metalised Paper
C91a	279-1121	.1 Mfd. ± 20% 200V W. Paper Tubular
C92a	279-1121	.1 Mfd. ± 20% 200V W. Paper Tubular
C92b	271-0311	27 pF ± 10% Tubular Ceramic NPO
C93	280-0331	.0047 Mfd. ± 10% 200V W. Plastic Tubular DFB220
C94	280-0331	.0047 Mfd. ± 10% 200V W. Plastic Tubular DFB220
C95	280-0841	.0056 Mfd. ± 5% 400V W. Plastic Tubular DFB421
C96	279-1121	.1 Mfd. ± 20% 200V W. Paper Tubular
C97	280-1851	680 pF ± 10% 600V W. Plastic Tubular DFB610
C99	273-0541	47 pF ± 10% Silver Mica M.S.
C100	280-1411	.022 Mfd. ± 20% 400V W. Plastic Tubular
C101	279-1581	.0047 Mfd. ± 20% 400V W. Paper Tubular
C102	280-1411	.022 Mfd. ± 20% 400V W. Plastic Tubular
C103	279-1121	.1 Mfd. ± 20% 200V W. Paper Tubular
C104	279-5141	.015 Mfd. ± 10% 600V W. Paper Tubular
C105	279-5201	.047 Mfd. ± 10% 600V W. Paper Tubular
C106	279-5221	.068 Mfd ± 10% 600V W. Paper Tubular
C107	279-1781	.22 Mfd. ± 20% 400V W. Paper Tubular
CR1	753-0001	Resistive Capacitive Coupled Unit 150 ohms/1K5 Mfd.

COILS

REF.	PART No.	DESCRIPTION
L15 } L16 }	259-0811	1st I.F. Grid and Trap
L16a	259-0671	Coupling Trimmer
L17 } L18 }	259-0691	3rd I.F. Anode and Trap
L19	259-0671	Coupling Trimmer
L20	259-0611	4th I.F. Anode
L21	259-0671	Coupling Trimmer
L22	259-0741	Video Peaking (Grid)
L23	259-0771	Video Peaking (Shunt)
L24	259-0022	Video Peaking (Series)
L25	259-0031	Sound I.F. Coupling
L26	232-0151	Filament Choke
L27	232-0151	Filament Choke
L28	259-0623	Width Coil
L29	259-0042	Coil Anti-Parasitic
L30	259-0042	Coil Anti-Parasitic
L31	259-0862	Horizontal Linearity

MISCELLANEOUS

REF.	PART No.	DESCRIPTION
VR1	677-0351	500,000 ohms Curve A (Brightness)
VR2	677-0421	500,000 ohms Curve A E.C. (A.G.C.)
VR3	677-0171	25,000 ohms Curve A E.C. (50V Adjust.)
VR4	677-0511	10,000 ohms Curve A E.C. (Contrast Range)
VR5	677-0332	10,000 ohms Curve A (With VR7) (Contrast)
VR6	677-0372	500,000 ohms Curve C (Tone)
VR7	677-0332	1 Megohm Tap. 500,000 ohms Curve A (With VR5) (Volume)
VR8	677-0362	50,000 ohms Curve A (Height)

PARTS LIST — MODIFIED MODEL F4

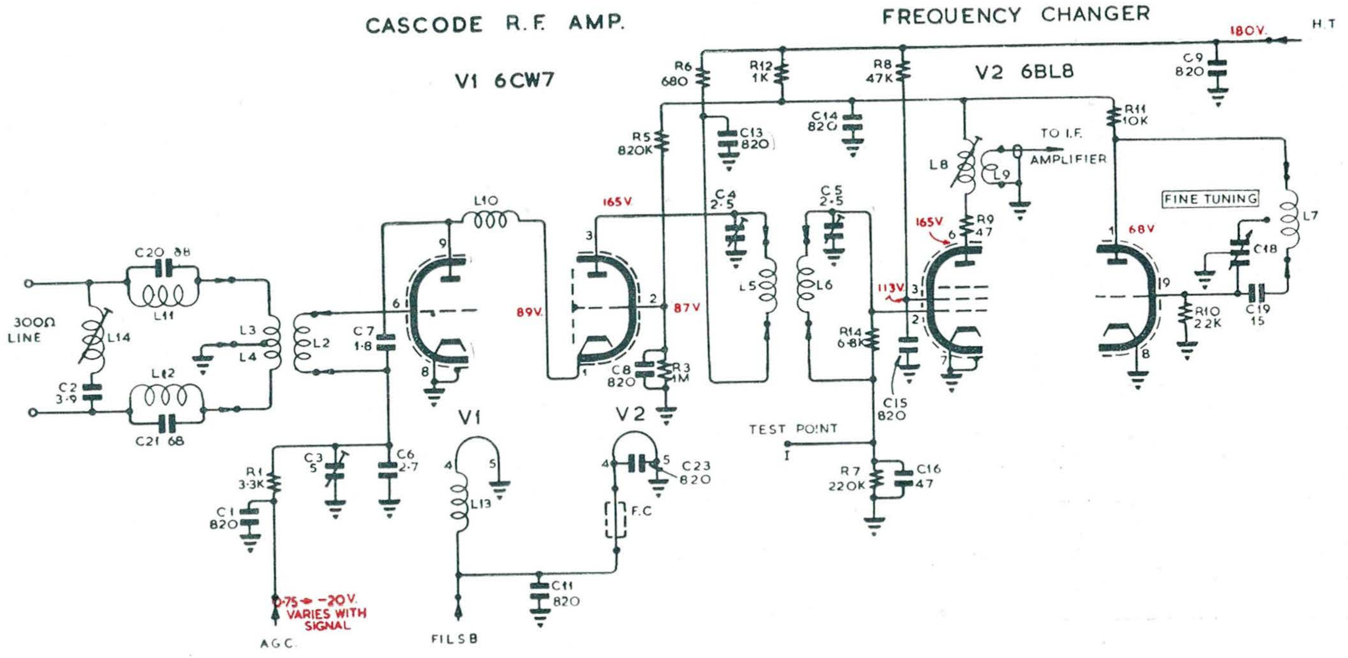
MISCELLANEOUS — *continued*

REF.	PART No.	DESCRIPTION	REF.	PART No.	DESCRIPTION
VR9	677-0351	500,000 ohms Curve A (Vert.	MR3	932-0991	Diode M3
		Hold)	V3	932-0881	6BY7 Valve
VR10	677-0341	250,000 ohms Curve A E.C.	V4	932-0521	6BX6 Valve
		(Hor. Drive)	V5	932-0521	6BX6 Valve
VR11	677-0471	25,000 ohms Curve A E.C.	V6	932-0521	6BX6 Valve
		(Hor. Hold)	V7	932-0661	6CK6 Valve
VC1	281-0131	Capacitor Trimmer	V8	932-0981	5AS4 Valve
VC2	281-0131	Capacitor Trimmer	V9	932-0981	5AS4 Valve
IFT1	906-0152	Transformer I.F.	V10	932-0501	6BL8 Valve
IFT2	906-0152	Transformer I.F.	V11	932-1021	6AW8A Valve
IFT3	906-0162	Transformer I.F.	V12	932-0521	6BX6 Valve
IFT4	906-0171	Transformer I.F.	V13	932-0521	6BX6 Valve
IFT5	906-0182	Transformer I.F. and Trap	V14	932-0491	6AL5 Valve
IFT6	906-0101	Transformer I.F. (Ratio Det.)	V15	932-0511	6BM8 Valve
TR1	904-0203	Transformer Power	V16	932-0511	6BM8 Valve
TR2	905-0201	Transformer Audio	V17	932-0511	6BM8 Valve
TR3	908-0052	Transformer Blocking Oscillator	V18	932-0521	6BX6 Valve
TR4	905-0222	Transformer Vertical Output	V19	932-0491	6AL5 Valve
TR5	908-0183	Transformer Vertical Feedback	V20	932-0501	6BL8 Valve
TR6	908-0111	Transformer Sync. Coupling	V21	932-0531	6CM5 Valve
TR7	908-0191	Transformer Hor. Oscillator	V22	932-0771	1S2 Valve
TR8	908-0176	Transformer Hor. Output	V23	932-0561	6R3 Valve
CH1	232-0122	Choke 1.5H 300 mA	CRT	932-0671	21 ALP4-A 21in. Picture Tube
CH2	232-0211	Choke 5.0H 100 mA	or	932-0871	AW53-80
MR1	932-0971	Diode OA90		224-0721	Tuner Assembly
MR2	932-0791	Diode OA81			

THE GRAMOPHONE COMPANY LIMITED
(*Incorporated in England*)
2 PARRAMATTA ROAD, HOMEBUSH, N.S.W.

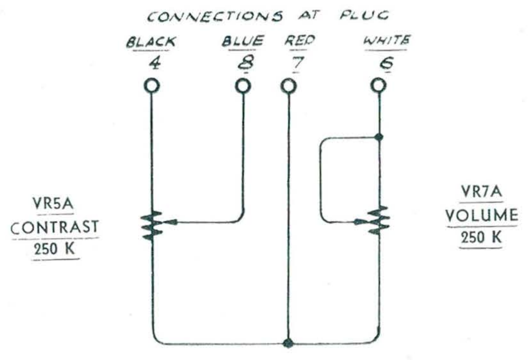
H. CLARK PTY. LTD.
Printers
CAMPERDOWN — N.S.W.

"H·M·V" CHASSIS TYPE F4



CIRCUIT DIAGRAM — TUNER

REMOTE CONTROL



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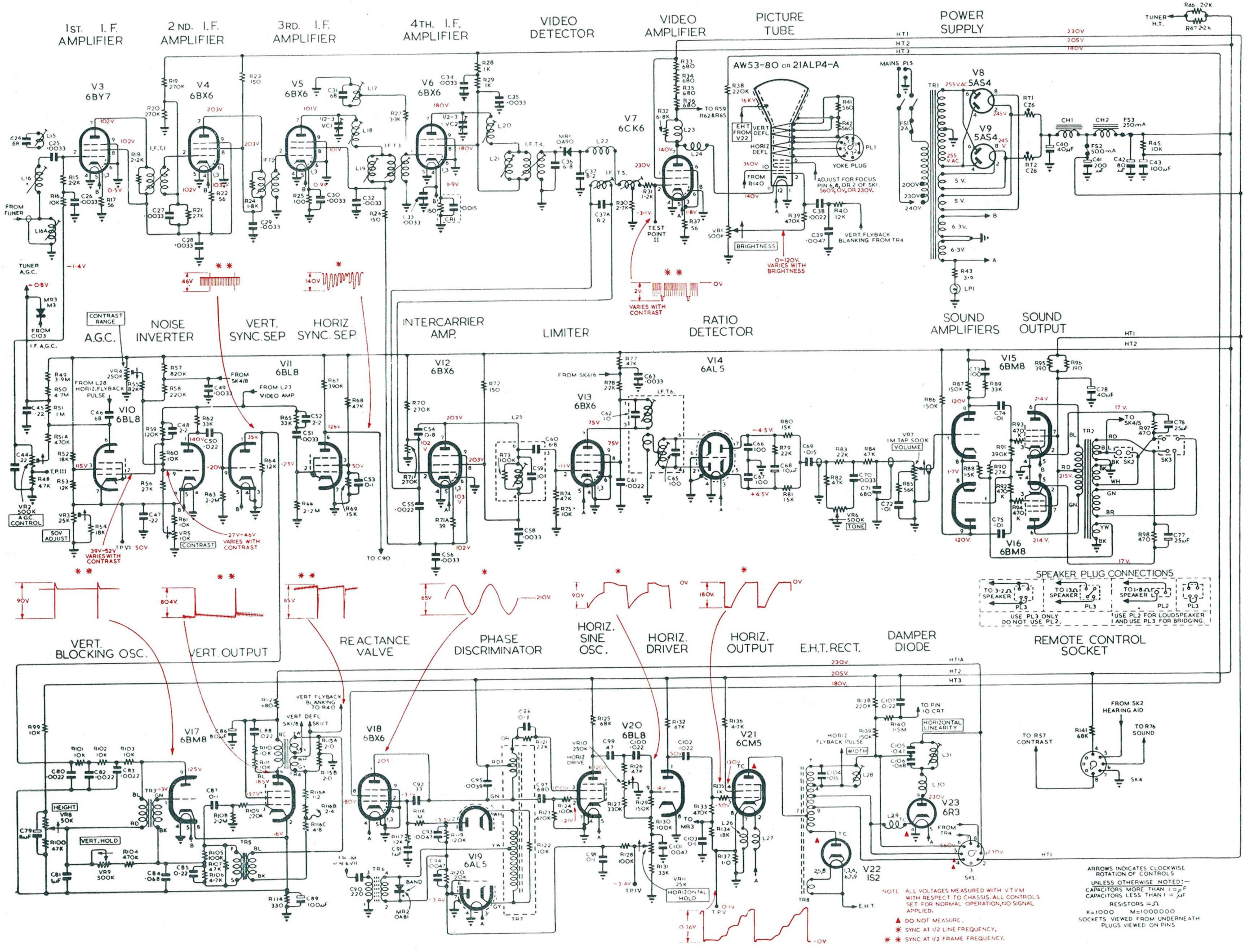
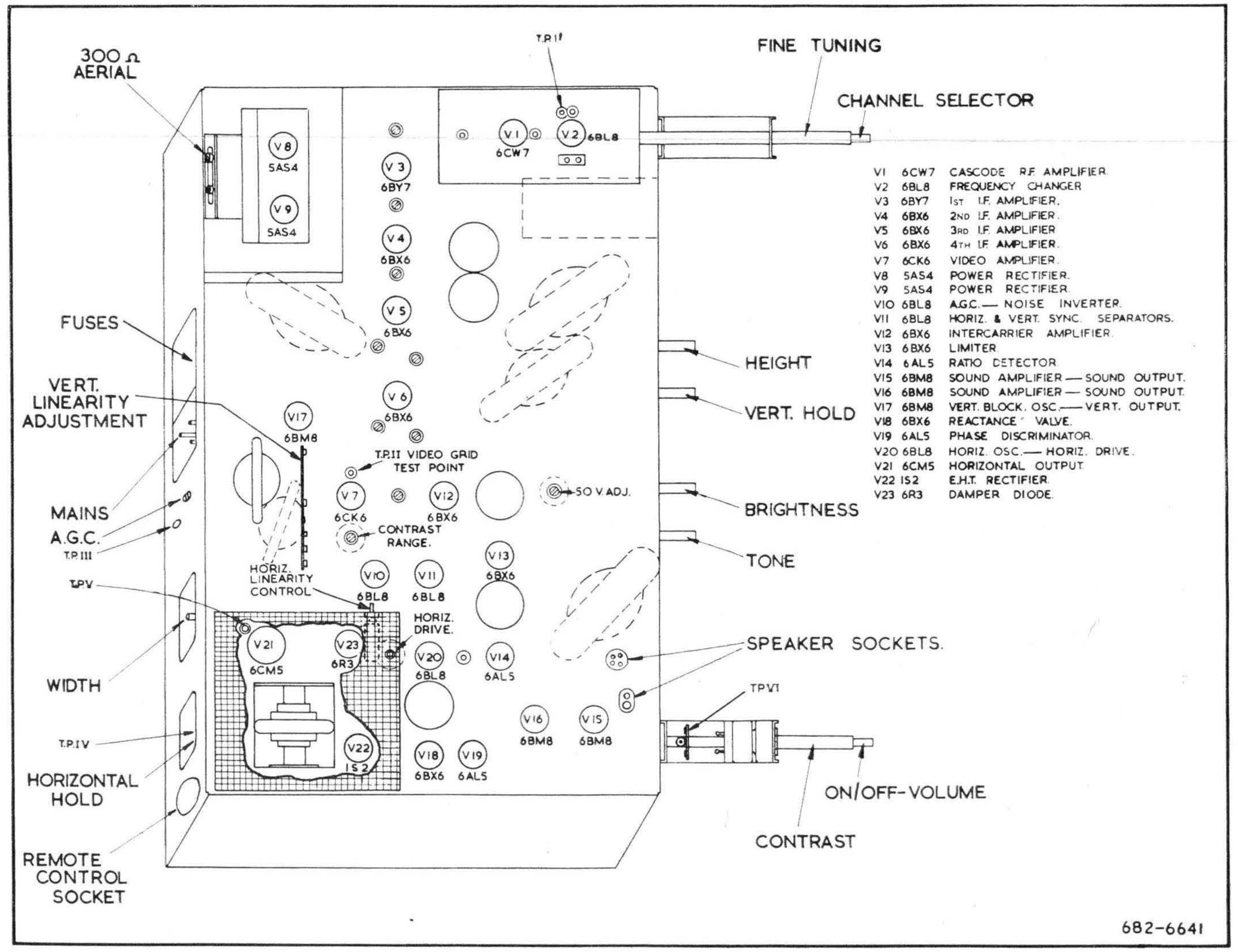




VOLTAGE TABLE — CHASSIS F4

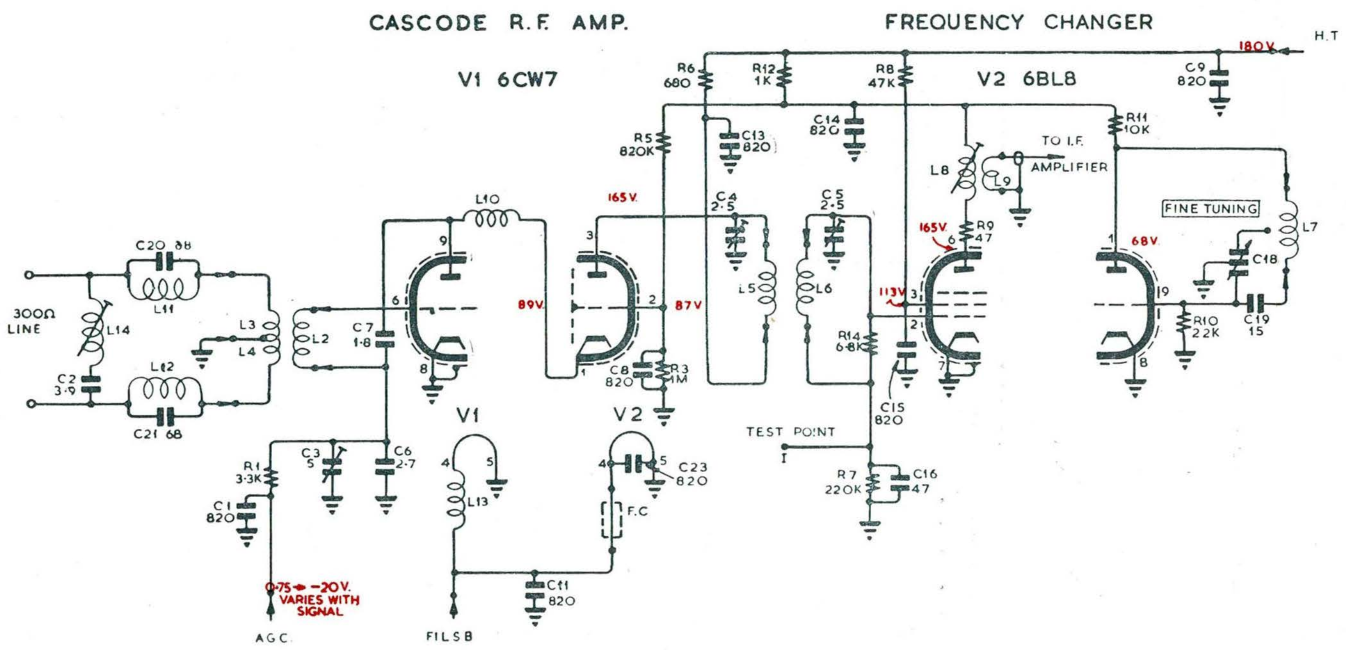
All D.C. Measurements are taken with a Vacuum-type Voltmeter. A.C. Measurements taken with AVO Model 7.

VALVE No.	FUNCTION	TYPE	PENTODE SECTION				TRIODE SECTION			REMARKS
			ANODE	G2	CATHODE	G1	ANODE	CATHODE	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	6BY7	102	102	0.5	-1.4	—	—	—	
4	2nd I.F. Amplifier	6BX6	203	203	103	102	—	—	—	
5	3rd I.F. Amplifier	6BX6	101	101	0.9	0	—	—	—	
6	4th I.F. Amplifier	6BX6	180	180	1.9	0	—	—	—	
7	Video Amplifier	6CK6	140	230	1.8	-3.1	—	—	—	
8	Power Rectifier	5AS4	255v. AC	—	245	—	—	—	—	Diode.
9	Power Rectifier	5AS4	255v. AC	—	245	—	—	—	—	Diode.
10	A.G.C. and Noise Inverter	6BL8	—	115	50	39	140	50	31.5	Pentode Anode fed with Line Pulse
11	Horiz. & Vert. Sync. Separators	6BL8	126	50	0	-23	35	0	-20	
12	Intercarrier Amplifier	6BX6	203	203	103	102	—	—	—	
13	Limiter	6BX6	75	75	0	-1.1	—	—	—	
14	Ratio Detector	6AL5	0	—	4.5	—	-4.5	0	—	Both Sections are Diodes.
15	Sound Output and Amplifier	6BM8	210	215	17	0	120	1.7	0	
16	Sound Output and Amplifier	6BM8	210	215	17	0	120	1.7	0	
17	Vert. Output and Oscillator	6BM8	185	197	16	0	125	16	-13	
18	Reactance Valve	6BX6	205	185	0	-3.1	—	—	—	
19	Phase Discriminator	6AL5	-3.4	—	—	—	-3.4	—	—	Both Sections are Diodes.
20	Horizontal Osc. and Drive	6BL8	120	100	0	-21	150	0	-18	
21	Horizontal Output	6CM5	*	130	0.1	-50	—	—	—	*High Voltage. Do not measure.
22	E.H.T. Rectifier	1S2	*	—	16KV	—	—	—	—	*High Voltage. Do not measure.
23	Damping Diode	6R3	230	—	*	—	—	—	—	*High Voltage. Do not measure.
CRT	Picture Tube	AW53-80 or 21ALP4-A	ANODE	G2	CATHODE	G1	G4			
			16KV	360	140	0-120	0,230 or 560			

HT1: 230V.
HT2: 205V.
HT3: 180V.
Boost HT 560V.
Filaments 6.3V A.C. and 5V. A.C. for Rectifiers.
Current through Fuse (2 Amp) 1 Amp.
Current through Fuse (500 mA) 265 mA.
Current through Fuse (250 mA) 110 mA.

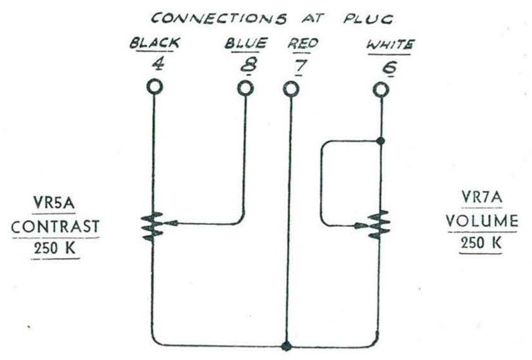
Conditions of Measurement:

Brightness — Normal.
Width and Height — Normal.
Contrast — Maximum.
Line Hold set to give -3.4V on Test Point IV.
Tuner Aerial Terminals short circuit Switched to Channel 5.
No Remote Control Unit.



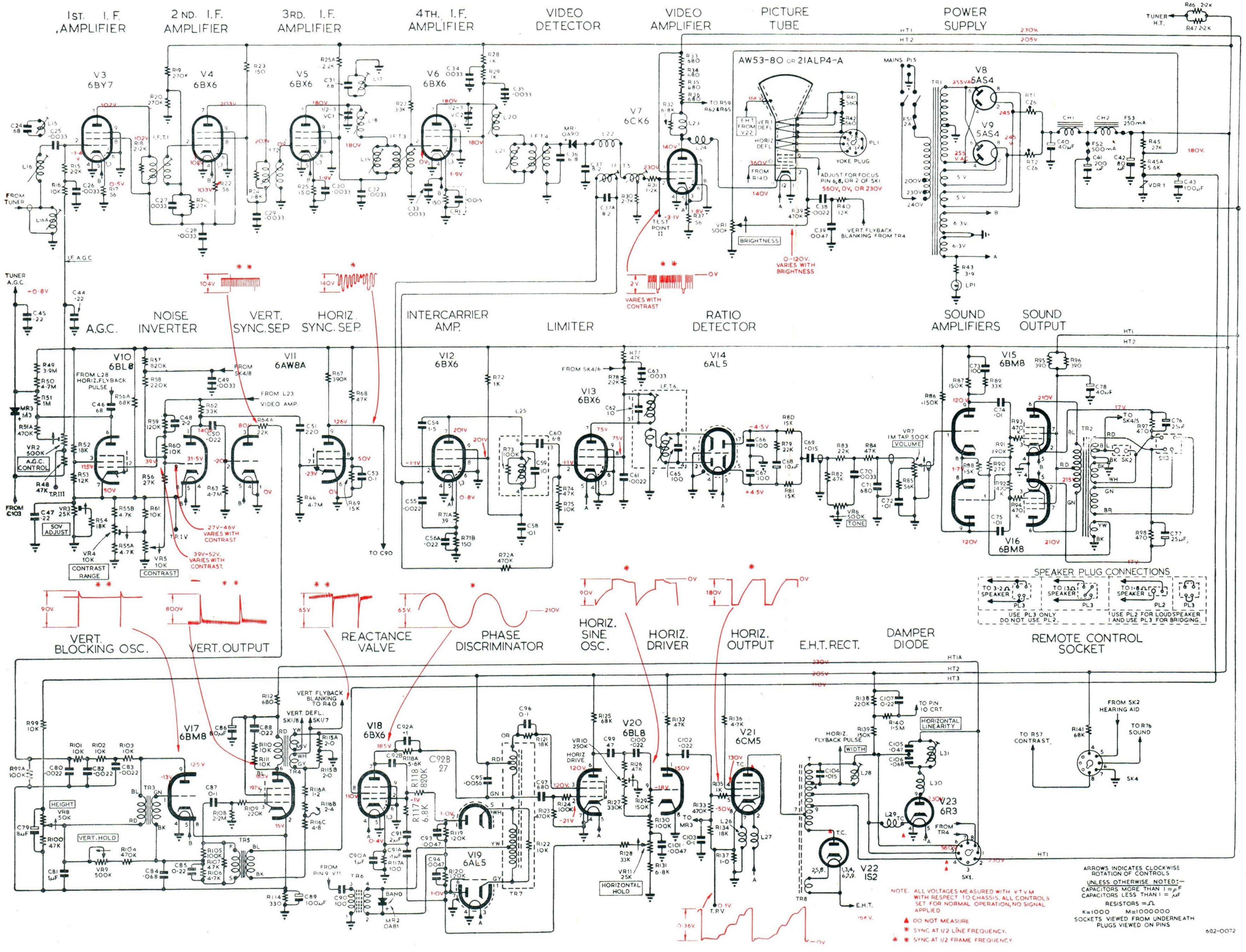
CIRCUIT DIAGRAM — TUNER

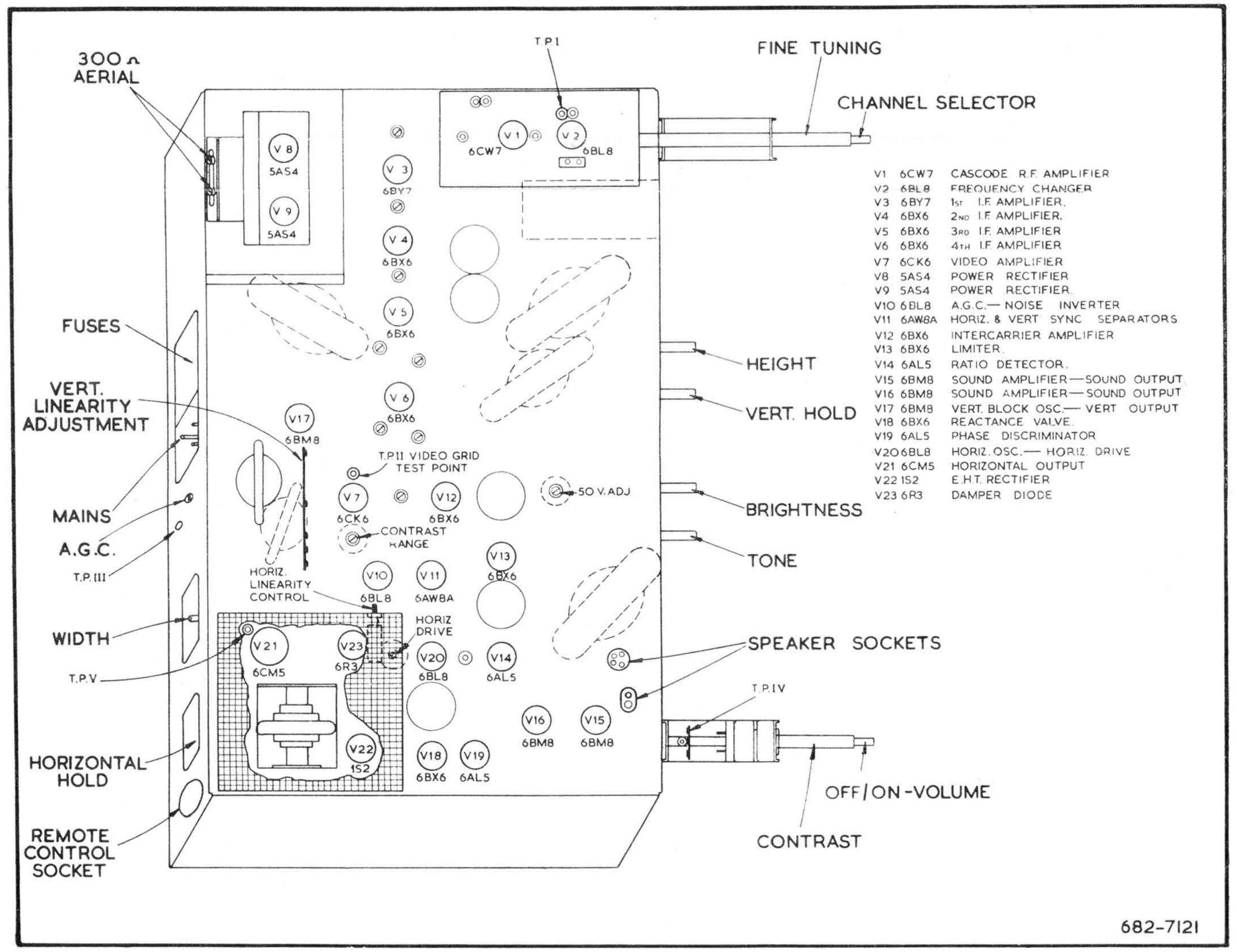
REMOTE CONTROL



CIRCUIT DIAGRAM.

"H·M·V" MODIFIED CHASSIS TYPE F4





VOLTAGE TABLE — MODIFIED CHASSIS F4

All D.C. Measurements are taken with a Vacuum-Tube Voltmeter. A.C. Measurement taken with AVO Model 7.

VALVE No.	FUNCTION	TYPE	PENTODE SECTION				TRIODE SECTION			REMARKS
			ANODE	G2	CATHODE	G1	ANODE	CATHODE	G1	
1	R.F. Amplifier	6CWT	165	—	89	87	89	−0.75	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	6BY7	102	102	0.5	−1.4	—	—	—	
4	2nd I.F. Amplifier	6BX6	203	203	103	102	—	—	—	
5	3rd I.F. Amplifier	6BX6	180	180	1.9	0	—	—	—	
6	4th I.F. Amplifier	6BX6	180	180	1.9	0	—	—	—	
7	Video Amplifier	6CK6	140	230	1.8	−3.1	—	—	—	
8	Power Rectifier	5AS4	255v. AC	—	245	—	—	—	—	Diode.
9	Power Rectifier	5AS4	255v. AC	—	245	—	—	—	—	Diode.
10	AGC and Noise Inverter	6BL8	—	115	50	39	140	50	31.5	Pentode Anode Fed with Line Pulse
11	Horiz. & Vert. Sync. Separators	6AW8A	126	50	0	−23	80	0	−20	
12	Intercarrier Amplifier	6BX6	201	201	0.8	−1.1	—	—	—	
13	Limiter	6BX6	75	75	0	−1.1	—	—	—	
14	Ratio Detector	6AL5	0	—	4.5	—	−4.5	0	—	Both Sections are Diodes.
15	Sound Output and Amplifier	6BM8	210	215	17	0	120	1.7	0	
16	Sound Output and Amplifier	6BM8	210	215	17	0	120	1.7	0	
17	Vertical Output and Oscillator	6BM8	185	197	16	0	125	16	−13	
18	Reactance Valve	6BX6	185	110	0.4	−1.0	—	—	—	
19	Phase Discriminator	6AL5	−1.0	—	—	—	1.0	—	—	Both Sections are Diodes.
20	Horizontal Oscillator and Drive	6BL8	120	120	0	−21	150	0	−18	
21	Horizontal Output	6CM5	*	130	0.1	−50	—	—	—	*High Voltage. Do Not Measure.
22	E.H.T. Rectifier	1S2	*	—	16KV	—	—	—	—	*High Voltage. Do Not Measure.
23	Damping Diode	6R3	230	—	*	—	—	—	—	*High Voltage. Do Not Measure.
CRT	Picture Tube	AW53-80 or 21ALP4-A	ANODE	G2	CATHODE	G1	G4			
			16KV	360	140	0-120	0,230 or 560			

HT1: 230V.
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HT3: 110V.
Boost HT: 560V.
Filaments 6.3V A.C. and 5V A.C. for Rectifiers
Current through Fuse (2 Amp) 1 Amp.
Current through Fuse (500 mA) 265 mA.
Current through Fuse (250 mA) 110 mA.

Conditions of Measurement:

Brightness — Normal.
Width and Height — Normal.
Contrast — Maximum.
Line Hold set to give 0.4V across R117a.
Tuner Aerial Terminals short circuit Switched to Channel 5.