PHILCO TELEVISION

SERVICE MANUAL

PHILCO Factory-Supervised Service

10AT10 CHASSIS

SPECIFICATIONS

Intermediate Frequencies
- Video Carrier.....45.75 mc
- Sound Intercarrier.....4.5 mc

Operating Voltage
- Line.....105 to 120 volts, 60 cycles, a.c.
- Battery.....7.5 volts, d.c.

Power Consumption—117V a.c. line.9 watts
- 7.5V battery...4.5 watts

Tuner—T110.....12 position incremental

TRANSISTOR COMPLEMENT

Tuner, T110

TR3T	T1561	R-F Amplifier
TR2T	T1600	Mixer
TR1T	T1597	Oscillator

VISS Panel

TR1	2N536	Noise Switch
TR2	T1596	Sync Sep.
TR3	2N225	Audio Output
TR4	T0067	Audio Driver
TR5	2N225	Audio Output
TR6	T1595	Sound I-F
TR7	T1598	Limiter
TR8	T1593	1st Video
TR9	T1594	Video Output
TR10	T1559	4th VIF
TR11	T1559	3rd VIF
TR12	T1559	2nd VIF
TR13	T1559	1st VIF

DEFLECTION PANEL

TR14	2N224	Horizontal Ampl. (buffer)
TR15	T1599	Horizontal Oscillator
TR16	T1602	Horizontal Output
TR17	2N224	Vertical Oscillator

VERTICAL OUTPUT PANEL

TR18	T1601	Vertical Output

TUBE COMPLEMENT

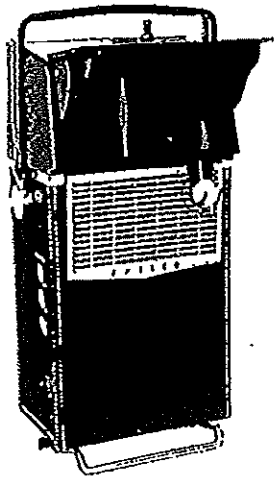
V1 and V2 5642 (2 used).....High Voltage Rectifier

Picture tube 2EP4, 2-inch electrostatic focus CRT

RECEIVER SET-UP CONTROL LOCATIONS

(Refer to figures 10 and 17)

1. *Vertical Linearity*—Accessible from chassis rear. Left-hand control of dual controls in single housing, mounted on vertical output panel.
2. *Aux. Vertical Linearity*—Accessible from chassis rear. Right-hand control of dual controls in single housing, mounted on vertical output panel.
3. *Horizontal Hold Centering*—Accessible from chassis rear. Bottom control of triple controls in single housing, mounted on deflection panel.
4. *Vertical Hold Centering*—Accessible from chassis rear. Center control of triple controls in single housing, mounted on deflection panel.
5. *Height*—Accessible from chassis rear. Top control of triple controls in single housing, mounted on deflection panel.
6. *Drive Level Control*—Accessible from right rear of chassis. Potentiometer is located on VISS panel.
7. *3 Ampere Slow-Blow Fuse*—Accessible from rear of chassis. In series with power transformer center tap.



CABINET DISASSEMBLY AND CRT REMOVAL

The cabinet is a two piece unit, the bottom section composed of leather, to which the carrying handle is secured, and the top plastic housing containing the optical system. To remove the cabinet assembly from the chassis proceed as follows:

1. Remove all external knobs except the Elapsed-Time knob on the lower right side.
2. Remove the 4 screws on the bottom which secure the cabinet stand and the cabinet to the chassis. The leather bottom cabinet section can then be removed by sliding it off the chassis.
3. Remove the two mounting screws in the rear and one mounting screw in the front of the top plastic housing. Disconnect the antenna plug from the tuner. Lift the housing off the chassis.
4. Remove the battery mounting bracket.
5. Remove the sleeve and magnet assembly from the neck of the CRT.
6. Slide the CRT forward out of the yoke assembly through the opening in the chassis.

HORIZONTAL OSCILLATOR ALIGNMENT

1. Allow set to warm up. Tune in picture.
2. Pre-set the horizontal hold control VR5 to its mechanical center. This control must not be moved during the following procedure to assure proper alignment.
3. Place a short across the horizontal stabilizing coil, L17 to L20 and short the sync test lug, L8 to ground.
4. With a video signal being received, adjust the aux. horz. hold control, VR7C to set the oscillator to the correct horizontal line frequency (to stop the picture; it will not be stable).
5. Remove the short from the horizontal stabilizing coil and adjust the coil to bring the horizontal oscillator back on frequency. Again, as in step 4, the picture will not be stable.
6. Remove the ground from the sync test point, L8. Rotate the aux. horz. hold control VR7C counter clockwise until the picture is out-of-sync. Now slowly rotate VR7C clockwise until the picture just pulls into sync. The horizontal oscillator now is completely aligned.

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VIDEO I-F ALIGNMENT

AM ALIGNMENT

CHANNEL SELECTOR: Set to channel 4.
RANGE SWITCH: Normal.
DRIVE LEVEL CONTROL: Approximately ½ way on.
SIGNAL INJECTION: Unplug i-f cable from tuner and feed signal into cable.
BIAS: Apply to agc, test point 3, L6. Bias will range from —1.5 volts dc to +3 volts dc. During alignment procedure, bias is +.2 volts dc unless otherwise stated.
SCOPE: Connect to 2nd detector, test point 4, L5.
NOTE: To gain access to i-f coils, remove battery and battery holder.

1. 39.75 mc, adjust T-10 for minimum. Raise bias in positive direction if necessary to obtain adequate scope deflection being careful not to overload.
2. 41.25 mc, adjust T-11 and T-12 for minimum. Adjust bias as required. (Access to T-12 through bottom of panel.)
3. 47.25 mc, adjust T-4 for minimum. Adjust bias as required. This trap has a very sharp null and must be minimized carefully. (Access through bottom of panel.)
4. 45.3 mc, adjust T-9 for maximum. This pole has a rather broad peak and must be maximized carefully. (Access through bottom of panel.)
5. 45.0 mc, adjust T-6 for maximum.
6. 44.0 mc, adjust T-5 for maximum.
7. T-7 and T-8 are to be pre-padded and will not require maximizing at a particular frequency. Adjust so that the top of the inner core is flush with the top of the outer core.

SWEEP ALIGNMENT

CHANNEL SELECTOR: Set to channel 4.
RANGE SWITCH: Normal.
DRIVE LEVEL CONTROL: Approximately ½ way on.
SIGNAL INJECTION: Antenna input jack on tuner, J2T. Reconnect i-f cable. Adjust signal input level to give reasonable scope deflection.
BIAS: +.2 volts dc.
SCOPE: Connect to 2nd detector, test point 4, L5.

1. Inject 65.75 mc, AM, 30% modulated. Adjust fine tuning control for minimum output. Do not disturb fine tuning during balance of adjustments.
2. Inject 44.7 mc, AM, 30% modulated. Adjust T-4, tuner mixer collector coil, for maximum. It is possible to get two peaks with this coil; adjust the core to the peak occurring toward the top of the coil.
3. Inject channel 4 sweep signal (69 mc with 6 mc sweep width). Adjust the following cores to bring the curve within limits (see figure 3).
   T-6 or T-4—Carrier level (T-6 preferred)
   T-5—Curve tipping
   T-9—42.5 slope
   Use marker generator set to 45.75 mc and 42.5 mc to set proper level of these two points.

SOUND I-F ALIGNMENT

SIGNAL INJECTION: 4.5 mc, AM, 30% modulated signal injected at 2nd detector, test point, 4, L5, VISS panel. Keep signal input below limiting level of sound system.
METER: Connect 20,000 ohm/volt meter set to 2.5 volt range to lug #5 on the discriminator transformer, T1.
BIAS: —3 volts to the i-f agc test point 3, L6 on the VISS panel.

1. Adjust T3 for maximum.
2. Adjust T2 for maximum.
3. Pre-set disc transformer, T1, cores to maximum outer position (Top core toward top of can; bottom core toward bottom).
4. Tune disc transformer secondary, T1 top core, for maximum on first peak coming in.
5. Tune disc transformer primary, T1 bottom core, for maximum on first peak going in.
6. Retouch secondary of disc transformer, T1 top core, on weak air signal for minimum noise and/or distortion.

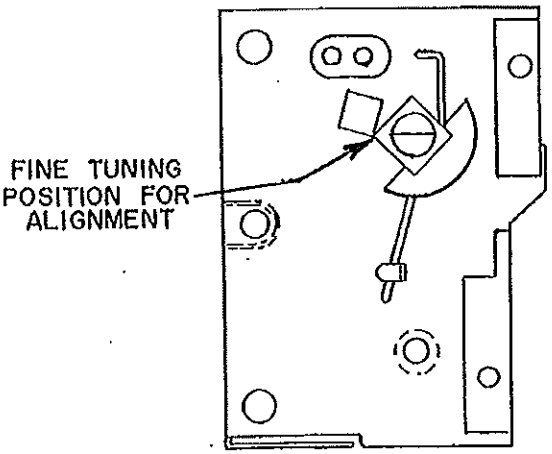


Fig. 1. Presetting Fine Tuning

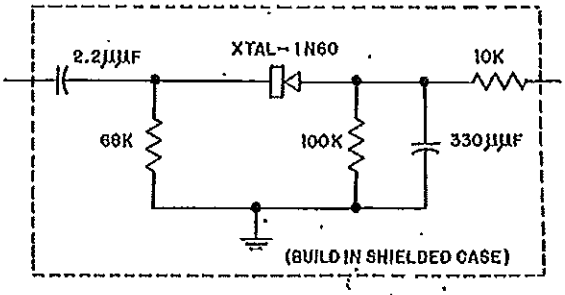


Fig. 2. Special Detector Jig

TUNER OSCILLATOR ALIGNMENT

AM GENERATOR: Connect to receiver antenna-input terminals (no matching network is required). Use 30% modulated signal.
PRE-SET: Fine tuning control as indicated in figure 1.
OSCILLOSCOPE: Connect to L5, video detector output, on VISS panel.
NOTE: This procedure uses the traps of the video I-F channel. Proper oscillator adjustment is therefore dependent upon an accurately aligned I-F strip.
NOTE: Counter-clockwise rotation of fine tuning causes a lowering of oscillator frequency.

STEP	AM. GEN. FREQ.	TUNER POSITION	ADJUST FOR MIN.
1	209.75 mc	Channel 13	T1
2	203.75 mc	Channel 12	T1
3	197.75 mc	Channel 11	T1
4	191.75 mc	Channel 10	T1
5	185.75 mc	Channel 9	T1
6	179.75 mc	Channel 8	T1
7	173.75 mc	Channel 7	T1
8	81.75 mc	Channel 6	T5
9	75.75 mc	Channel 5	T5
10	65.75 mc	Channel 4	T7
11	59.75 mc	Channel 3	T7
12	53.75 mc	Channel 2	T9

(Steps 1–7: See Note Below)

NOTE: T1 is the adjustable oscillator coil for channel 13. This adjustment is also used to set the oscillator position for channels 12 through 7 inclusive. Normally, this is the only adjustment required. However, if one or more of the high channels cannot be properly set, the coils for channels 12 through 7 may be spiked; i.e., moved. Moving the coil closer to the switch wafer will decrease the oscillator frequency, moving the coil away from the wafer will increase the oscillator frequency.

The brass cores of T1, T5, T7 and T9, when turned clockwise (moved into coil), will cause an increase in oscillator frequency.

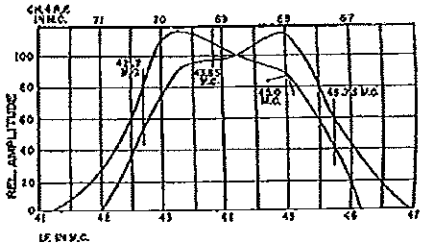


Fig. 3. Overall R-F I-F Response Curve

TUNER BANDPASS ALIGNMENT—T-110

SWEEP (FM) GENERATOR: Connect to receiver antenna input circuit.

OSCILLOSCOPE: Connect a high-gain scope through the special det. jig in figure 2, to L10 mixer base test point. Connect the ground lead to convenient tuner ground near the test point.

SUPPLY VOLTAGE: Inject 12 volts to tuner red and blue leads.

TUNER, CIRCUIT ALTERATIONS: Remove tuner bottom cover and shunt mixer collector to ground with a 330 ohm, ½W resistor. Replace cover.

NOTE: Do not adjust any coils on the antenna wafer other than X4 and T33.

STEP	SWEEP (FM) GENERATOR SWEEP DIAL SETTING	SWEEP (FM) GENERATOR MARKER DIAL SETTING	RECEIVER TUNING	ADJUST	REMARKS
1	Channel 13 (213 mc., with maximum sweep width)	Set first to 210 mc. and note position of marker on response curve. Then set to 216 mc. and note position of marker on response curve.	Channel 13	Adjust antenna coil X4 for maximum output of the response curve.	Use oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve; response curve should be flat between limits (See tuner bandpass limit curve. Fig. 4A) If not, proceed with step 2.
2	Channel 13	213 mc.	Channel 13	Adjust X2 and X3 alternately to give maximum symmetrical response about 213 mc.	Adjust by "spiking" coils.
3	Channel 13	210 mc. and 216 mc.	Channel 13	Adjust spacing between gimmick wires in r-f and mixer tank return circuit for proper band width.	When tank return wires are moved closer together, band width increases. This is a low-side mutual inductance adjustment. They are accessible through a hole in the tuner top cover.
4	Channel 7 (177 mc., with maximum sweep width)	Set first to 174 mc. and note position of marker on response curve. Set to 180 mc. and note position of marker on response curve.	Channel 7		Note curve with respect to tilt and center frequency. Curve should be centered in pass-band and symmetrical. If not, proceed with step 5.
5	Channel 7	174 mc. and 180 mc.	Channel 7	VC2 and VC3 to obtain correct tilt on top of curve.	VC2 and VC3 compensate for the tuning effect of channel 13 adjustment upon channel 7 (See tuner tracking compensation curves. See fig. 5).
6	Channel 13	213 mc.	Channel 13	Retouch X2 and X3 for symmetrical response, centered about 213 mc. markers.	To retouch, only turn cores slightly.
7	Channel 7	174 mc. and 180 mc.	Channel 7	Repeat step 5.	Check response curve for correct center frequency and symmetry.
8				Repeat steps 6 and 7.	Repeat channel 13 and channel 7 adjustments alternately, until favorable curves are obtained on both.
9	Channel 6 (85 mc., with 10 mc. sweep width)	Set first to 82 mc. and note position of marker on response curve. Then set to 88 mc. and note position of marker on response curve.	Channel 6		Curve should be as shown in fig. 4B. If not, proceed with step 10.
10	Channel 6	87.75	Channel 6	Adjust T20 and T21 for approximate correct bandpass with sound carrier on curve skirt. (Fig. 4B)	Band width may be varied somewhat by adjusting coils T20 and T21 with respect to each other.
11	Channel 6	83.25	Channel 6	Adjust T33 ant. coil for max. curve height at video freq.	It may be necessary to increase sweep generator output.
12	Channel 6	87.75 and 83.25	Channel 6	Retouch T20 and T21 for response as shown in fig. 4B.	To retouch, only turn cores slightly.
13		43.5 mc.	Channel 4	I-F trap, T2, for minimum.	Connect scope to 2nd det. test point 4, L5, VISS panel. Remove 330 ohm resistor from across mixer collector to gnd. Use AM signal, 30% modulation. Coil has a range of 41 to 46 mc. Do not adjust T3.

TUNER BANDPASS ALIGNMENT CURVES

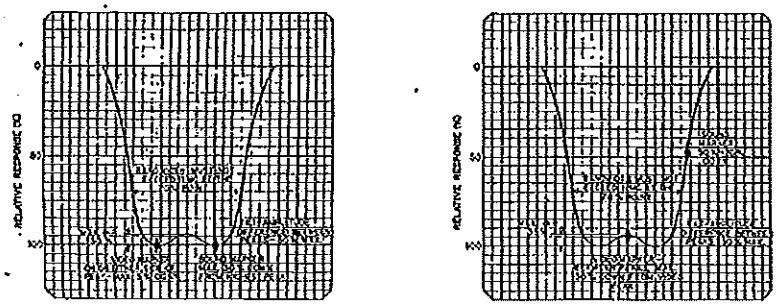


Figure 4A and Figure 4B. Television Tuner Response Curve, Showing Bandpass Limits

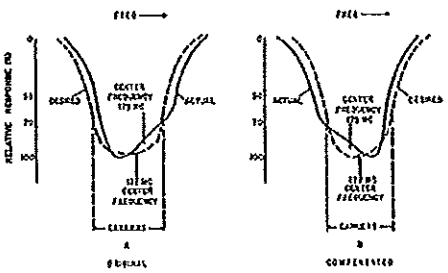


Figure 5. Television Tuner Response Curve, Showing Tracking Compensation at Channel 7

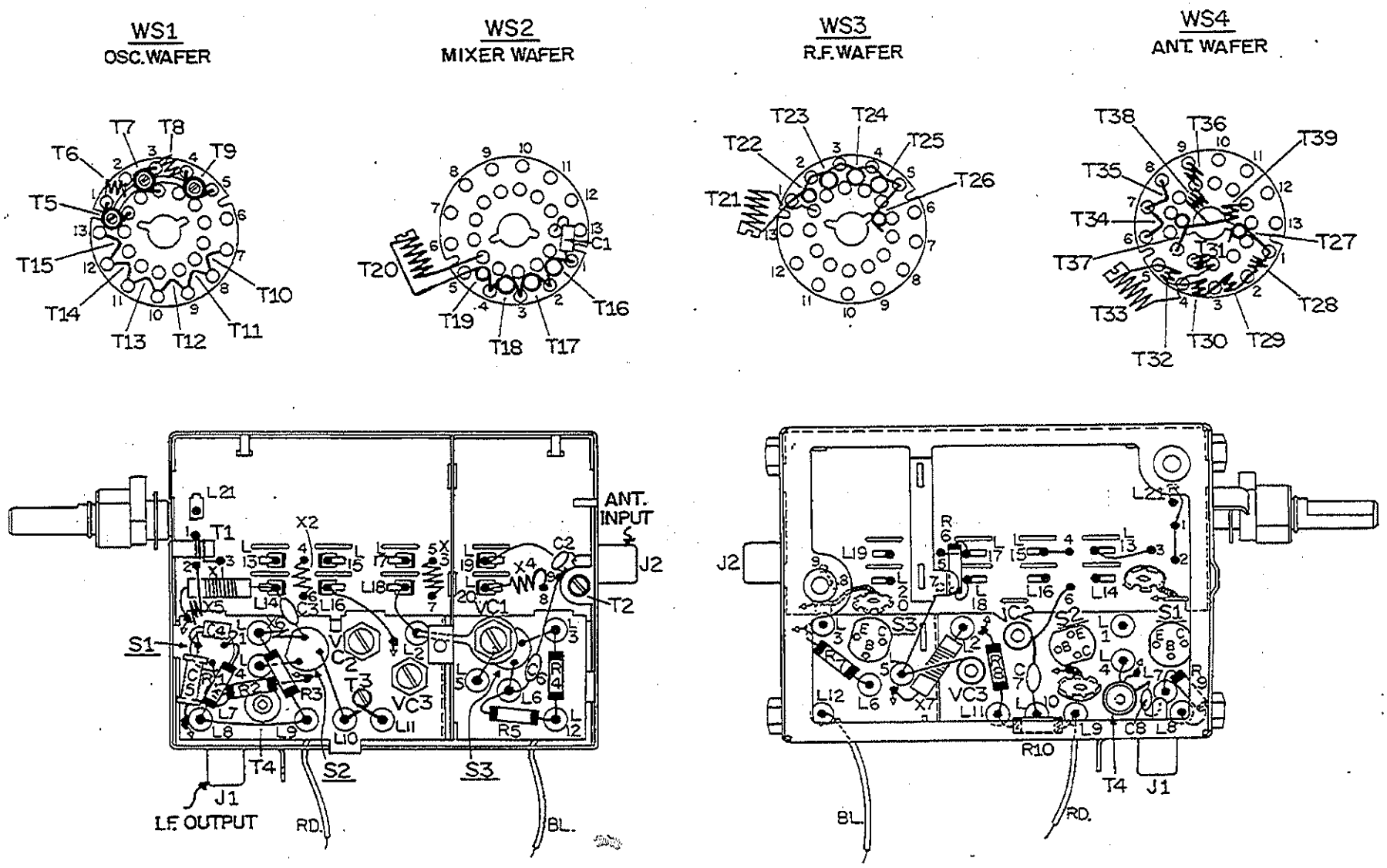


Fig. 7. Tuner T110 Electrical Components

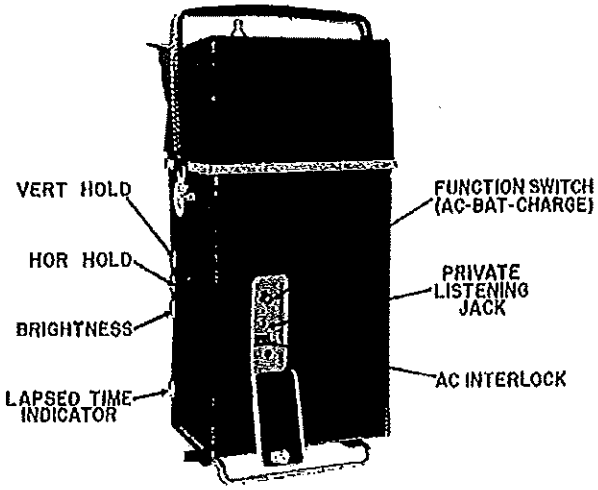


Fig. 8. 10AT10 Cabinet Rear View

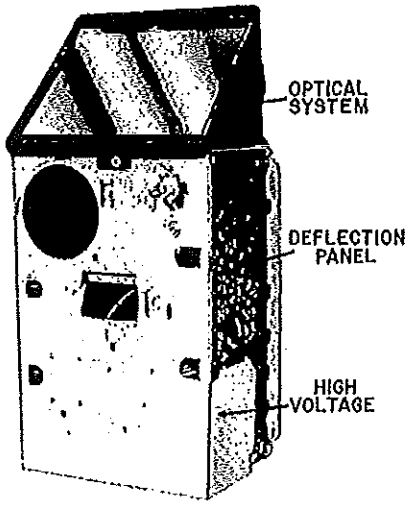


Fig. 11. 10AT10 Chassis Front View

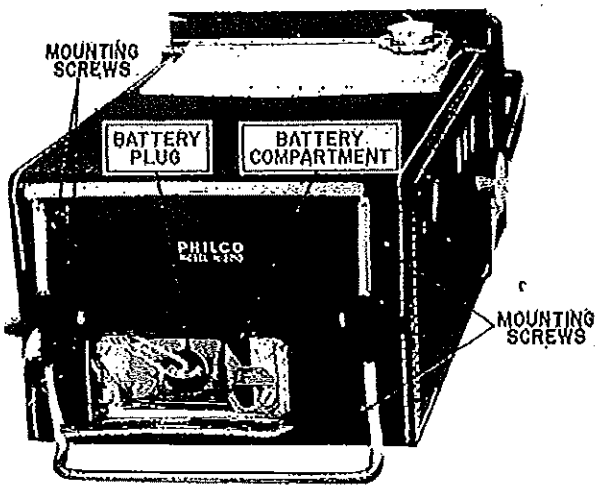


Fig. 9. 10AT10 Cabinet Bottom View

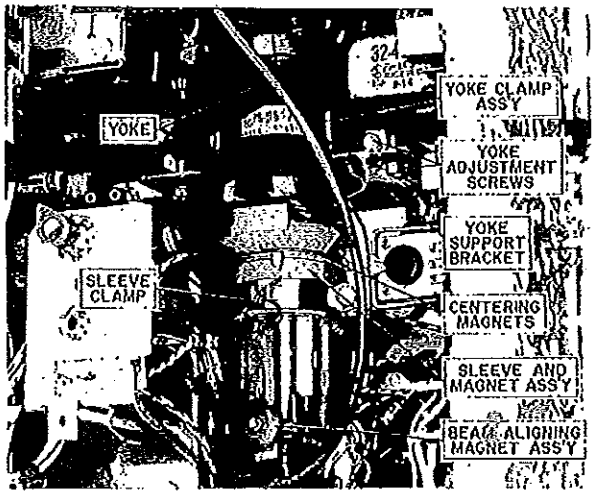


Fig. 12. 10AT10 CRT Assemblies

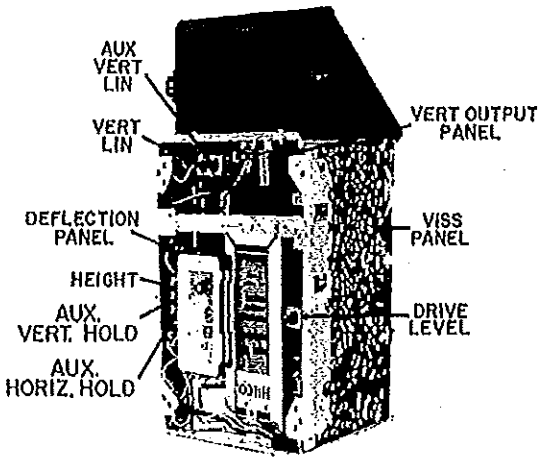


Fig. 10. 10AT10 Chassis Rear View

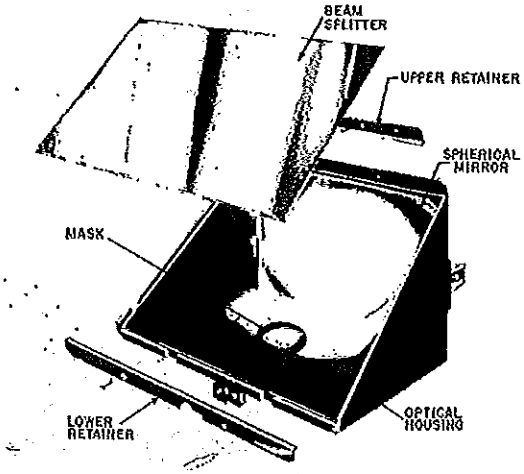


Fig. 13. 10AT10 Optical System

OSCILLOSCOPE WAVEFORM PATTERNS

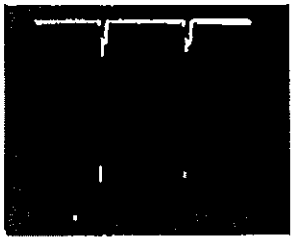
These waveforms were taken with the drive level control VR3 set for .5 volt p/p at 2nd detector test point L5. The contrast control VR1 is adjusted just below sync compression. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. They were taken with an oscilloscope having good high-fcequency response. With oscilloscopes having poorer response, the peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ. Measurements given below were taken with the range switch in local position.

1. Composite video signal, 2nd detector output, L5 of VISS panel, 0.5 volt, p/p, 15,750 cps.

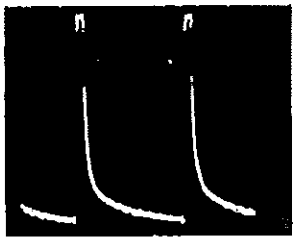
2. Composite video signal, video output collector, 12 volts, p/p, 15,750 cps.

3. Composite video signal, sync sep. input, L8 of VISS panel, 4 volts, p/p, 15,750 cps.

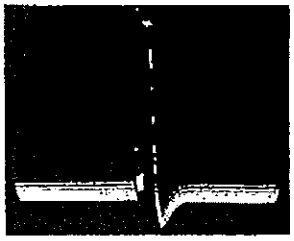
4. Composite video signal, sync sep. base, 4 volts, p/p, 15,750 cps.



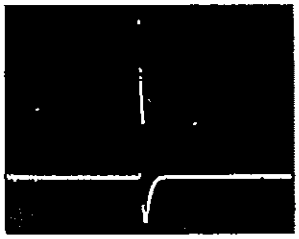
5. Sync sep. emitter, .55 volt, p/p, 15,750 cps.



6. Sync sep. collector, 4 volts, p/p, 15,750 cps.

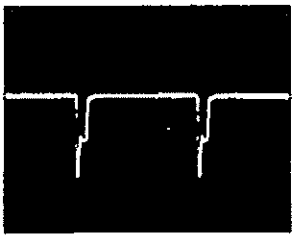


7. Sync sep. collector, 4 volts, p/p, 60 cps.

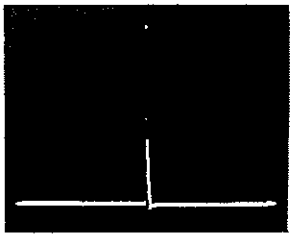


8. Sync sep. circuit, L7 of VISS panel or L19 of deflection panel, 15 volts, p/p, 60 cps.

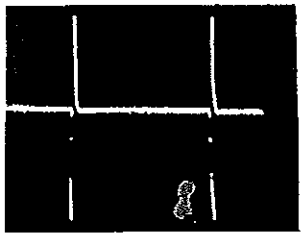
9. Sync sep. circuit, L10 of VISS panel or L28 of deflection panel, 1.9 volts, p/p, 15,750 cps.



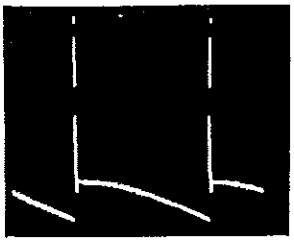
10. Noise switch base, .1 volt, p/p, 15,750 cps.



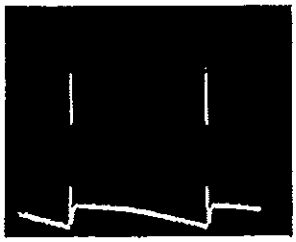
11. Terminal 1 of vertical oscillator transformer, V.OS.T., 11.5 volts, p/p, 60 cps.



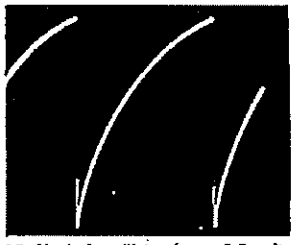
12. Terminal 3 of vertical oscillator transformer, V.OS.T., 7 volts, p/p, 60 cps.



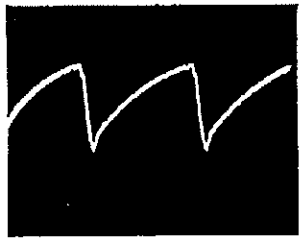
13. Terminal 4 of vertical oscillator transformer, V.OS.T., 4 volts, p/p, 60 cps.



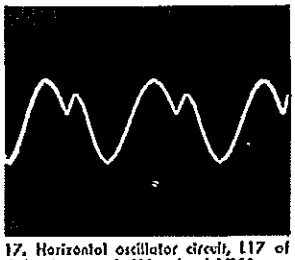
14. Terminal 6 of vertical oscillator transformer, V.OS.T., 7 volts, p/p, 60 cps.



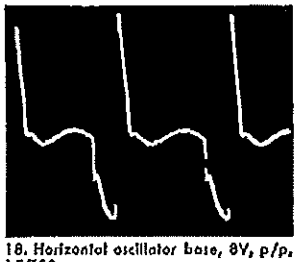
15. Vertical oscillator base, 3.5 volts, p/p, 60 cps.



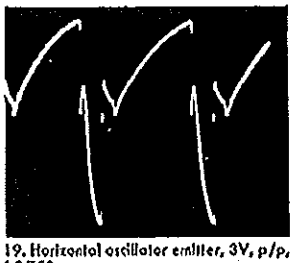
16. Phase comparer circuit, cathode of diode D6, 1 volt, p/p, 15,750 cps.



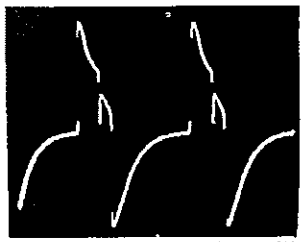
17. Horizontal oscillator circuit, L17 of deflection panel, 1V, p/p, 15,750 cps.



18. Horizontal oscillator base, 8V, p/p, 15,750 cps.

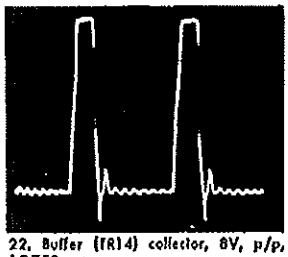


19. Horizontal oscillator emitter, 3V, p/p, 15,750 cps.

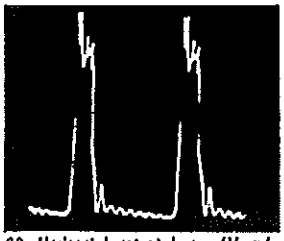


20. Horizontal oscillator collector, 8V, p/p, 15,750 cps.

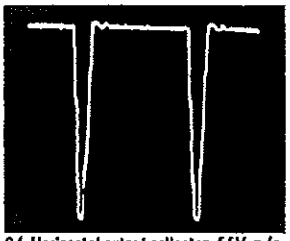
21. Buffer (TR14) base, 3.5V, p/p, 15,750 cps.



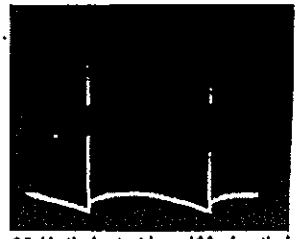
22. Buffer (TR14) collector, 8V, p/p, 15,750 cps.



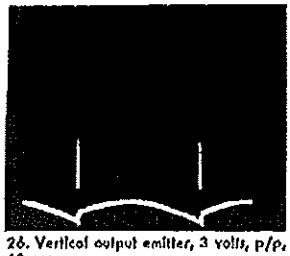
23. Horizontal output base, 6V, p/p, 15,750 cps.



24. Horizontal output collector, 55V, p/p, 15,750 cps.

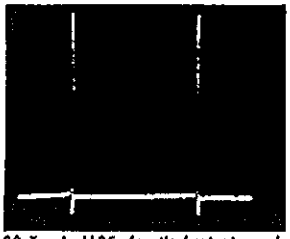


25. Vertical output base, L33 of vertical output panel or L27 of deflection panel, 3.5 volts, p/p, 60 cps.



26. Vertical output emitter, 3 volts, p/p, 60 cps.

27. Vertical output collector, 14 volts, p/p, 60 cps.



28. Terminal L35 of vertical output panel, 26V, p/p, 60 cps.

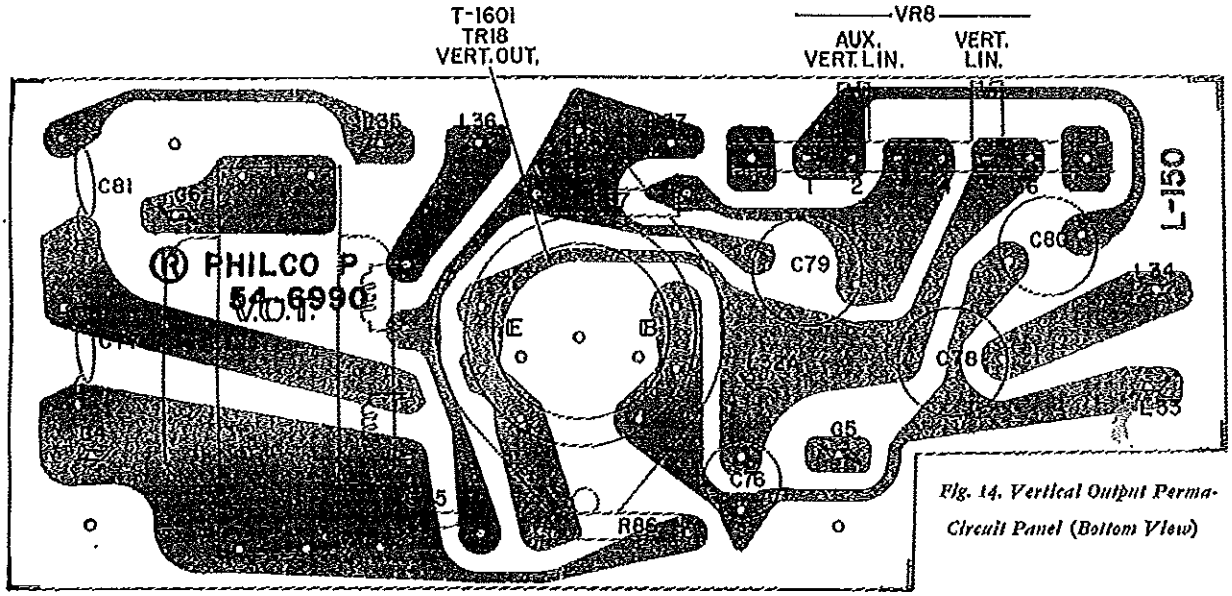


Fig. 14. Vertical Output Perma-Circuit Panel (Bottom View)

TERMINAL LUG IDENTIFICATION—VISS PERMA-CIRCUIT PANEL

LUG NO.	CONNECTED TO:
L1	Terminal 6 of terminal board B3
L2	Tuner (blue wire)
L3	Lug L14 of VISS panel
L4	Terminal 1 of private listening jack
L5	Test point # 4
L6	Test point # 3
L7	Lug L19 of deflection panel
L8	Test point # 5
L9	I.F. link, plug J2
L10	Lug L28 of deflection panel
L11	Lug L21 of deflection panel
L12	Pin 3 of crt socket (control grid)
L13	Lug L26 of deflection panel
L14	Lug L3 of VISS panel
L15	Lug L29 of deflection panel and terminal 4 of terminal board B4
L16	Tuner (red lead) and lug L30 of deflection panel

TERMINAL LUG IDENTIFICATION—DEFLECTION PERMA-CIRCUIT PANEL

LUG NO.	CONNECTED TO:
L17	Test point # 1
L18	Terminal 1 of horz. output transformer and horz. yoke
L19	Lug L7 of VISS panel
L20	Test point # 2
L21	Lug L11 of VISS panel
L22	Terminal 5 of horz. output transformer
L23	Terminal 2 of horz. output transformer
L24	Lug L35 of vertical output panel
L25	Terminal 6 of horz. output transformer
L26	Lug L13 of VISS panel
L27	Lug L33 of vertical output panel
L28	Lug L10 of VISS panel
L29	Lug L36 of vertical output panel and lug L15 of VISS panel
L30	Lug L16 of VISS panel
L31	Pin 7 of crt socket (cathode)
L32	Terminal 3 of terminal board B1

TERMINAL LUG IDENTIFICATION—VERTICAL OUTPUT PERMA-CIRCUIT PANEL

LUG NO.	CONNECTED TO:
L32A	Lug L27A of deflection panel
L33	Lug L27 of deflection panel
L34	Vertical yoke
L35	Lug L24 of deflection panel
L36	Lug L29 of deflection panel
L37	Vertical yoke

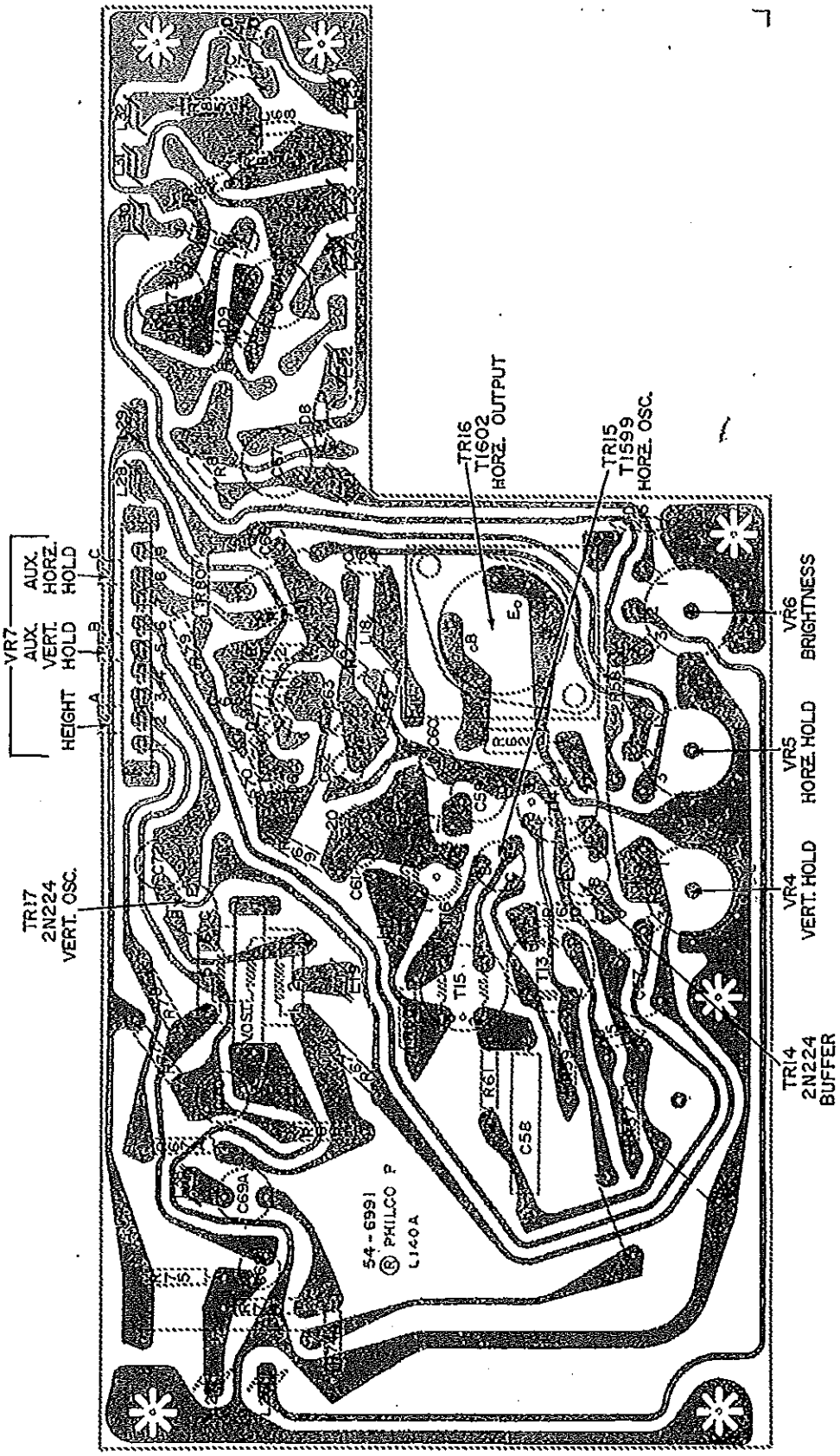


Fig. 15. Deflection Perma-Circuit Panel (Bottom View)

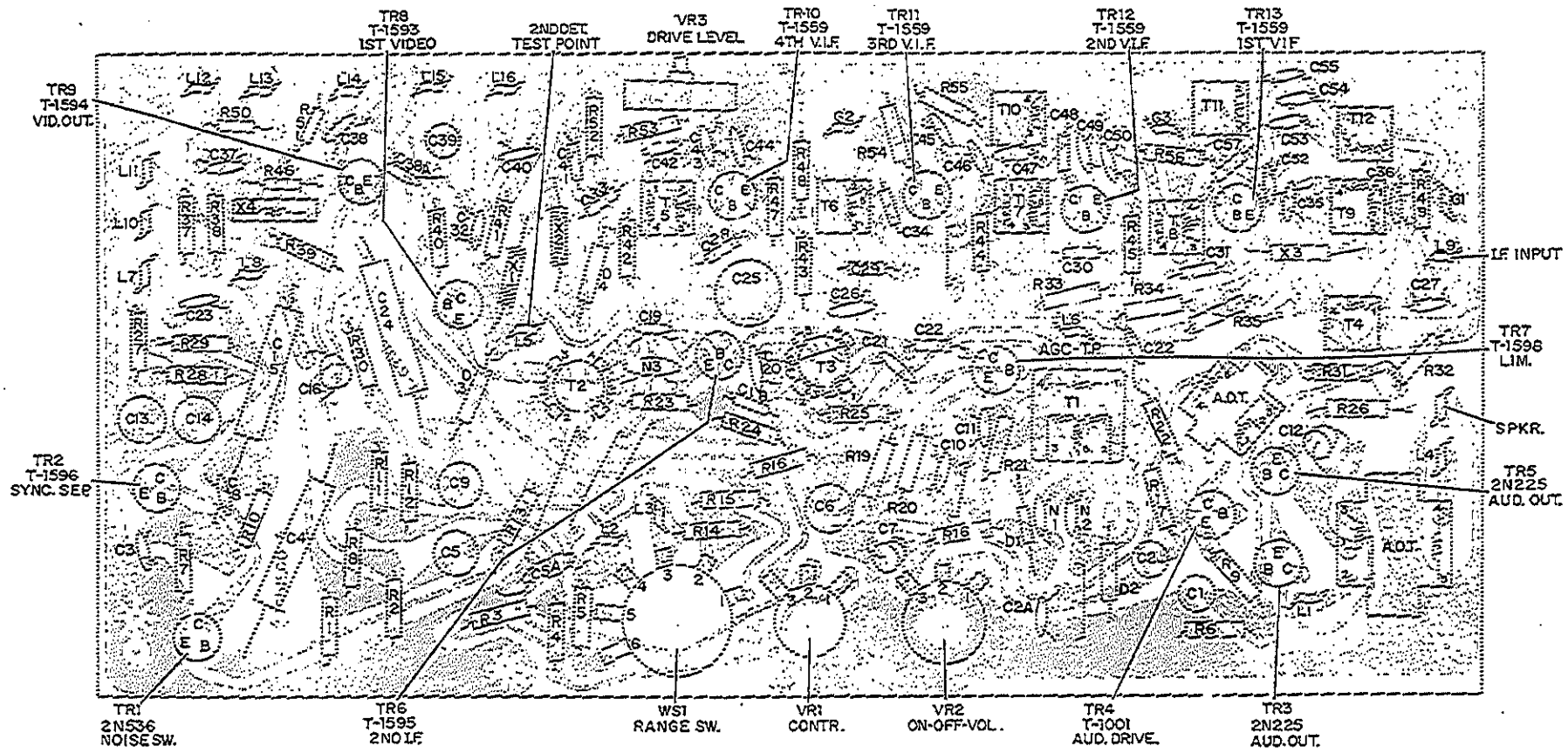
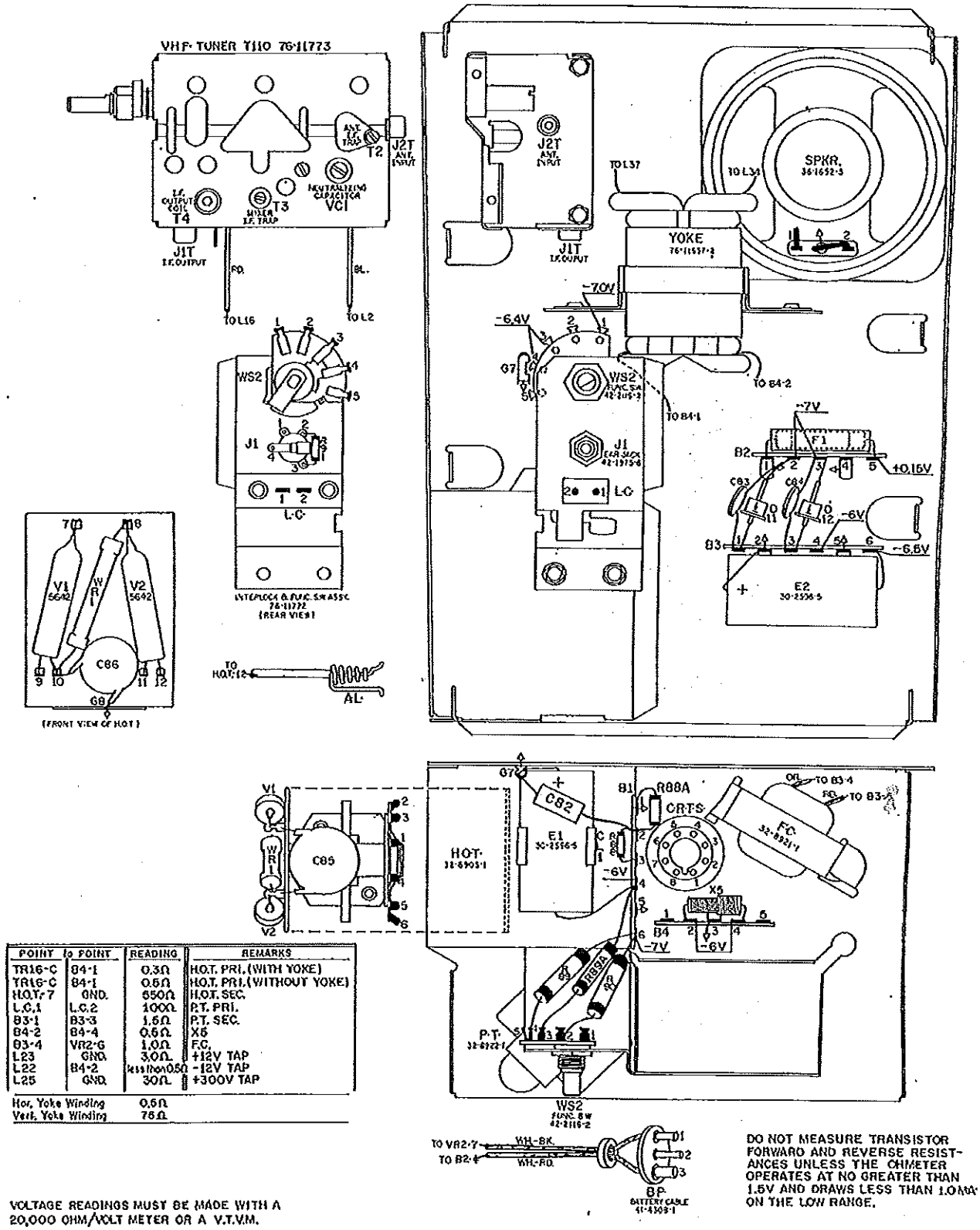


Fig. 16. Video, I-F, Sync, Sound Perma-Circuit Panel (Bottom View)



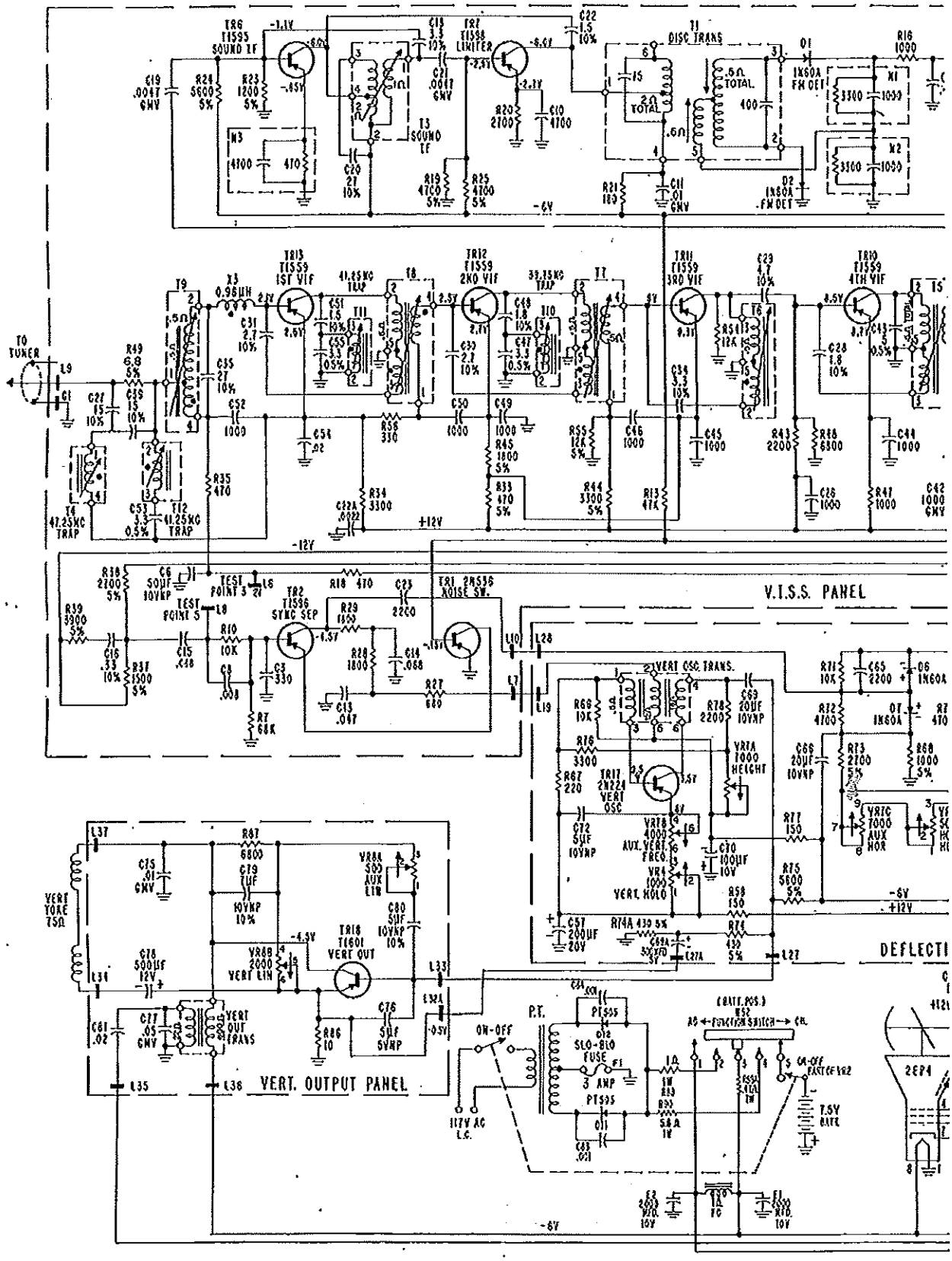
POINT	to POINT	READING	REMARKS
TR16-C	B4-1	0.3Ω	H.O.T. PRI. (WITH YOKE)
TR16-C	B4-1	0.5Ω	H.O.T. PRI. (WITHOUT YOKE)
H.O.T.-7	GND.	650Ω	H.O.T. SEC.
L.C.1	L.C.2	100Ω	P.T. PRI.
B3-1	B3-3	1.5Ω	P.T. SEC.
B4-2	B4-4	0.5Ω	X5
B3-4	VR2-6	1.0Ω	F.C.
L23	GND.	3.0Ω	+12V TAP
L22	B4-2	less than 0.5Ω	-12V TAP
L25	GND.	30Ω	+300V TAP
Hor. Yoke Winding		0.5Ω	
Vert. Yoke Winding		75Ω	

VOLTAGE READINGS MUST BE MADE WITH A 20,000 OHM/VOLT METER OR A V.T.V.M.

ALL VOLTAGE READINGS MEASURED TO GND.

DO NOT MEASURE TRANSISTOR FORWARD AND REVERSE RESISTANCES UNLESS THE OHMETER OPERATES AT NO GREATER THAN 1.5V AND DRAWS LESS THAN 1.0mA ON THE LOW RANGE.

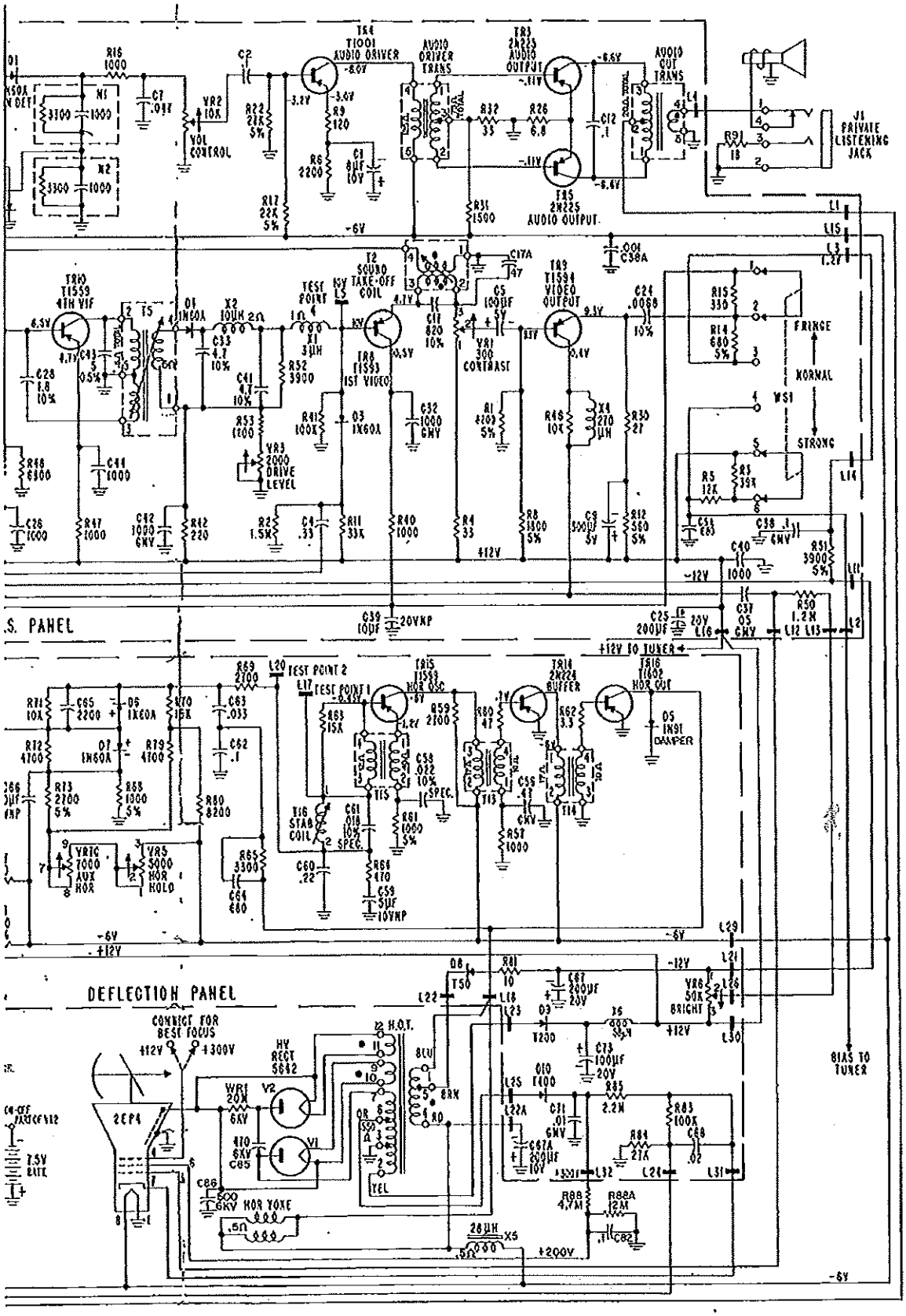
Fig. 17. 10AT'10 Chassis Component Layout



NOTES

1. All capacitor values greater than 1 are in MMF unless otherwise noted. All capacitor values less than 1 are in MFD unless otherwise noted.
2. All resistors are ½ watt, 10%, carbon unless otherwise noted.
3. Voltages are dc using a VTVM. V was adjusted fo brightness, widt sync, then signal

Fig. 18. Schematic Diagra



18. Schematic Diagram for Chassis 10AT10

ted, 3. Voltages are dc from point shown to chassis. Voltages are read using a VTVM. Voltages were taken with no signal. The receiver was adjusted for a good quality picture, i.e., normal contrast, brightness, width, height, vertical lin. and sound, picture in sync, then signal is removed.

4. • Indicates a coil resistance of less than .5 ohms. Resistance measured with coil in circuit.

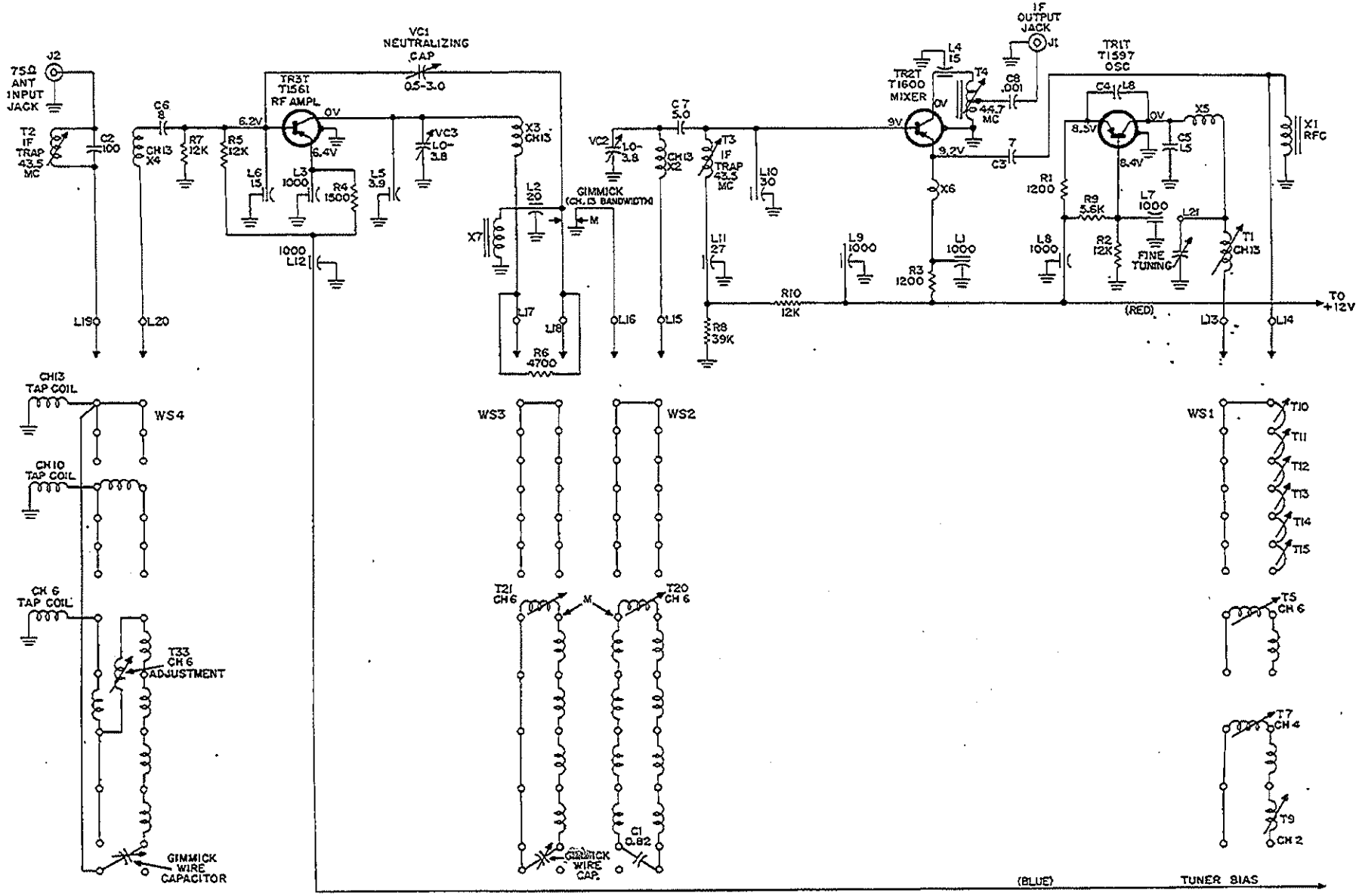


Fig. 6. Tuner T110 Schematic

REPLACEMENT PARTS LIST

10AT10 CHASSIS, ELECTRICAL

Reference Symbol	Description	Service Part No.
A.D.T.	Audio Driver Transformer	32-8916-1
A.O.T.	Audio Output Transformer	32-8908-1
C1	Capacitor, electrolytic, audio driver emitter, 8 mfd, 10V	30-2600-4
C2	Capacitor, audio coupling, .1 mfd, 10V	30-1274-1
C3	Capacitor, sync separator base, 330 mmf	30-1262-21
C4	Capacitor, noise switch coupling, .33 mfd	30-4695-33
C5	Capacitor, electrolytic, video coupling, 100 mfd, 5V	30-2600-2
C5A	Capacitor, range switch, 680 mmf	30-1238-22
C6	Capacitor, electrolytic, bypass, 50 mfd, 10VNP	30-2600-13
C7	Capacitor, de-emphasis, .047 mfd	30-4695-28
C8	Capacitor, sync separator input, .008 mfd	30-1272-19
C9	Capacitor, electrolytic, emitter bypass, 300 mfd, 5V	30-2600-3
C10	Capacitor, emitter bypass, .0047 mfd	30-1262-3
C11	Capacitor, bypass, .01 mfd, GMV	30-1272-2
C12	Capacitor, audio output bypass, .1 mfd	30-4695-30
C13	Capacitor, vertical integrator, .047 mfd	30-4695-28
C14	Capacitor, vertical integrator, .068 mfd	30-4695-29
C15	Capacitor, sync separator input, .068 mfd	30-4695-29
C16	Capacitor, sync separator, .33 mfd, 10%	30-4696-3
C17	Capacitor, sound take-off, 820 mmf, 10%	30-1262-52
C17A	Capacitor, sound take-off, 47 mmf,	62-047009011
C18	Capacitor, sound i-f neutralizing, 3.3 mmf, 10%	30-1221-9
C19	Capacitor, sound take-off coupling, .0047 mfd, GMV	30-1262-2
C20	Capacitor, sound i-f collector, 27 mmf, 10%	30-1263-23
C21	Capacitor, limiter base, .0047 mfd, GMV	30-1262-2
C22	Capacitor, sound lim. neutralizing, 1.5 mmf, 10%	30-1221-3
C22A	Capacitor, 12 volt, B+ bypass, .0022 mfd	30-1238-12
C23	Capacitor, sync separator output, 2200 mmf	30-1262-7
C24	Capacitor, range switch, .0068 mfd, 10%	30-4651-31
C25	Capacitor, +12V output filter, 200 mfd, 20V	30-2600-9
C26	Capacitor, bypass, 1000 mmf	30-1262-12
C27	Capacitor, 47.25 mc trap, 15 mmf, 10%	30-1263-25
C28	Capacitor, 4th vif neutralizing, 1.8 mmf, 10%	30-1221-17
C29	Capacitor, 3rd vif coupling, 4.7 mmf, 10%	30-1221-13
C30	Capacitor, 2nd vif neutralizing, 2.7 mmf, 10%	30-1221-18
C31	Capacitor, 1st vif neutralizing, 2.7 mmf, 10%	30-1221-18
C32	Capacitor, 1st video collector bypass, 1000 mmf, GMV	30-1262-11
C33	Capacitor, video detector output, 4.7 mmf, 10%	30-1221-13
C34	Capacitor, 3rd i-f neutralizing, 3.3 mmf, 10%	30-1221-9
C35	Capacitor, 1st vif input, 27 mmf, 10%	30-1263-23
C36	Capacitor, 47.25 mc trap, 15 mmf, 10%	30-1263-25
C37	Capacitor, video coupling, .05 mfd, 50V, GMV	30-1272-6
C38	Capacitor, bypass, .1 mfd, GMV	30-1272-8
C38A	Capacitor, bypass, 1000 mmf	30-1262-12
C39	Capacitor, electrolytic filter, 10 mfd, 20VNP	30-2600-17
C40	Capacitor, bypass, 1000 mmf	30-1262-12
C41	Capacitor, video detector, 4.7 mmf, 10%	30-1221-13
C42	Capacitor, video detector bypass, 1000 mmf, GMV	30-1262-12
C43	Capacitor, 4th vif collector, 5 mmf, 10%	30-1263-17
C44	Capacitor, 4th vif emitter bypass, 1000 mmf	30-1262-12
C45	Capacitor, 3rd vif emitter bypass, 1000 mmf	30-1262-12
C46	Capacitor, 3rd vif bypass, 1000 mmf	30-1262-12
C47	Capacitor, 41.25 mc trap, 3.3 mmf, ±0.5 mmf, NPO	30-1263-38
C48	Capacitor, 39.75 mc trap, 1.8 mmf, 10%	30-1221-17
C49	Capacitor, 2nd vif, emitter bypass, 1000 mmf	30-1262-12
C50	Capacitor, 2nd vif bypass, 1000 mmf	30-1262-12
C51	Capacitor, 41.25 mc trap, 1.5 mmf, 10%	30-1221-3
C52	Capacitor, 1st vif, bypass, 1000 mmf	30-1262-12
C53	Capacitor, 41.25 mc trap 3.3 mmf, ±0.5 mmf, NPO	30-1263-38
C54	Capacitor, 1st vif, bypass, .02 mfd, GMV	30-1272-3
C55	Capacitor, 39.75 mc trap, 3.3 mmf, ±0.5 mf, NPO	30-1263-38
C56	Capacitor, hor. buffer, .47 mfd, GMV	30-1274-3
C57	Capacitor, electrolytic, vert. osc. 200 mfd, 20V	30-2600-9
C58	Capacitor, hor. osc. emitter, .022 mfd, 10%, spec.	30-4696-2
C59	Capacitor, electrolytic, hor. osc., 5 mfd, 10VNP	30-2600-14
C60	Capacitor, hor. osc., .22 mfd	30-4695-32
C61	Capacitor, hor. stabilizing coil, .018 mfd, 10%, spec.	30-4696-1
C62	Capacitor, phase det. feedback, .1 mfd	30-4695-30
C63	Capacitor, phase det. feedback, .033 mfd	30-4695-27
C64	Capacitor, phase det. feedback, 680 mmf	30-1262-15
C65	Capacitor, phase det. 2200 mmf	30-1262-7
C66	Capacitor, electrolytic, 20 mfd, 10VNP	30-2600-12
C67	Capacitor, electrolytic, 200 mfd/20V	30-2600-9
C67A	Capacitor, electrolytic, 200 mfd/10V	30-2600-6
C68	Capacitor, vert. ret. .02 mfd	30-1272-18
C69	Capacitor, electrolytic, vert. osc. output, 20 mfd, 10VNP	30-2600-12
C69A	Capacitor, electrolytic, vert. osc., 300 mfd, 5VNP	30-2600-3
C70	Capacitor, electrolytic, vert. osc., 100 mfd, 10V	30-2600-8
C71	Capacitor, B+ filter, .01 mfd, GMV	30-1262
C72	Capacitor, electrolytic, vert. osc., 5 mfd, 10VNP	30-2600-15
C73	Capacitor, electrolytic, 12V filter, 100 mfd, 20V	30-2600-18
C75	Capacitor, vert. output, .01 mfd, GMV	30-1262
C76	Capacitor, electrolytic, vert. output base, 5 mfd, 5VNP	30-2600-11
C77	Capacitor, vert. output transformer, .05 mfd, GMV	30-1272-6
C78	Capacitor, electrolytic, vert. output emitter, 500 mfd, 12V	30-2600-7
C79	Capacitor, electrolytic, vert. transformer, 7 mfd, 10VNP, 10%	32-2600-16
C80	Capacitor, electrolytic, vert. linearity, 5 mfd, 10VNP	30-2600-15
C81	Capacitor, vert. retrace, .02 mfd, GMV	30-1272-19

REPLACEMENT PARTS LIST

Reference Symbol	Description	Service Part No.
C82	Capacitor, CRT spot decay, .1 mfd, 400V	30-4686-47
C83	Capacitor, diode rectifier, .001 mfd, GMV	30-1238-3
C84	Capacitor, diode rectifier, .001 mfd, GMV	30-1238-3
C85	Capacitor, high voltage rect., 470 mmf, 6KV	30-1278-1
C86	Capacitor, high voltage rect., 500 mmf, 6KV	30-1278-2
D1	Diode, FM discriminator, 1N60A	34-8022-3
D2	Diode, FM discriminator, 1N60A	34-8022-3
D3	Diode, noise switch, 1N60A	34-8022-3
D4	Diode, video detector, 1N60A	34-8022-3
D5	Diode, horizontal damper, 1N91	34-8051
D6	Diode, phase detector, 1N60A	34-8022-3
D7	Diode, phase detector, 1N60A	34-8022-3
D8	Diode, neg. 12V supply, T50	34-8050-2
D9	Diode, pos. 12V supply, T200	34-8050-7
D10	Diode, B+ 300V supply, T400	34-8050-3
D11	Diode, Rectifier, PT505	34-8048-3
D12	Diode, Rectifier, PT505	34-8048-3
E1	Capacitor, electrolytic, power supply, 2000 ufd, 10V	30-2596-5
E2	Capacitor, electrolytic, power supply, 2000 ufd, 10V	30-2596-5
FC	Filter choke	32-8921-1
F1	Fuse, 3 amp, slow-blow	45-2656-61
H.O.T.	Hor. Output Transformer	32-8905-3
J1	Jack, private listening	42-1975-6
LC	AC interlock, conn.	27-6240-16
N1	RC Network, FM detector load	30-6031-4
N2	RC Network, FM detector load	30-6031-4
N3	RC Network, sound i-f emitter	30-6031-5
P.T.	Power Transformer	32-8922-1
R1	Resistor, video output base, 8200 ohms, 5%	66-2828240
R2	Resistor, 1st video ampl. base circuit, 1.5 megohm	66-5158340
R3	Resistor, range switch, 39,000 ohms	66-3398340
R4	Resistor, 1st video emitter, 33 ohms	66-0338340
R5	Resistor, range switch, 12,000 ohms	66-3128340
R6	Resistor, audio driver emitter, 2200 ohms	66-2228340
R7	Resistor, sync separator base, 68,000 ohms	66-3688340
R8	Resistor, video output base, 1800 ohms, 5%	66-2188240
R9	Resistor, audio driver emitter, 120 ohms	66-1128340
R10	Resistor, sync separator base, 10,000 ohms	66-3108340
R11	Resistor, 1st video base, 33,000 ohms	66-3338340
R12	Resistor, video output emitter, 560 ohms, 5%	66-1568240
R13	Resistor, noise switch base, 47,000 ohms	66-3478340
R14	Resistor, range switch, 680 ohms, 5%	66-1688240
R15	Resistor, range switch, 330 ohms	66-1338340
R16	Resistor, deemphasis, 1000 ohms	66-2108340
R17	Resistor, audio driver base, 22,000 ohms, 5%	66-3228240
R18	Resistor, range switch, 470 ohms	66-1478340
R19	Resistor, limiter base, 4700 ohms, 5%	66-2478240
R20	Resistor, limiter emitter, 2700 ohms	66-2278340
R21	Resistor, limiter, 180 ohms	66-1188340
R22	Resistor, audio driver base, 27,000 ohms, 5%	66-3278240
R23	Resistor, sound i-f base, 1200 ohms, 5%	66-2128240
R24	Resistor, sound i-f base, 5600 ohms, 5%	66-2568240
R25	Resistor, limiter base, 4700 ohms, 5%	66-2478240
R26	Resistor, audio output emitter, 6.8 ohms	66-9333360
R27	Resistor, vertical integrator, 680 ohms, 10%	66-1688340
R28	Resistor, vertical integrator, 1800 ohms	66-2188340
R29	Resistor, sync separator collector, 1800 ohms	66-2188340
R30	Resistor, video output emitter, 27 ohms	66-0278340
R31	Resistor, audio output base bias, 1500 ohms	66-2158340
R32	Resistor, audio output base, 33 ohms	66-0338340
R33	Resistor, 2nd vif emitter, 470 ohms, 5%	66-1478240
R34	Resistor, 1st vif emitter, 3300 ohms	66-2338340
R35	Resistor, 1st vif base, 470 ohms	66-1478340
R37	Resistor, sync separator base, 1500 ohms, 5%	66-2158240
R38	Resistor, sync separator base, 2700 ohms, 5%	66-2278240
R39	Resistor, sync separator base, 3900 ohms, 5%	66-2398240
R40	Resistor, 1st video collector, 1000 ohms	66-2108340
R41	Resistor, 1st video base, 100,000 ohms	66-4108340
R42	Resistor, video detector, 220 ohms	66-1228340
R43	Resistor, 4th vif base, 2200 ohms	66-2228340
R44	Resistor, 3rd vif base, 3300 ohms, 5%	66-2338240
R45	Resistor, 2nd vif emitter, 1800 ohms, 5%	66-2188240
R46	Resistor, video output collector, 10,000 ohms	66-3108340
R47	Resistor, 4th vif emitter, 1000 ohms	66-2108340
R48	Resistor, 4th vif base, 6800 ohms	66-2688340
R49	Resistor, 1st vif input, 6.8 ohms, 5%	66-9688240
R50	Resistor, CRT grid, 1.2 megohm	66-5128340
R51	Resistor, range switch, 3900 ohms, 5%	66-2398240
R52	Resistor, 1st video base, 3900 ohms	66-2398340
R53	Resistor, video detector, 1200 ohms	66-2128240
R54	Resistor, 3rd vif collector, 12,000 ohms	66-3128340
R55	Resistor, 3rd vif base, 12,000 ohms, 5%	66-3128240
R56	Resistor, 2nd vif base, 330 ohms	66-1338340
R57	Resistor, hor. buffer base, 1000 ohms	66-2108340
R58	Resistor, vert. decoupling +12V, 150 ohms	66-1158340
R59	Resistor, hor. osc. collector, 2700 ohms	66-2278340
R60	Resistor, hor. buffer base, 47 ohms	66-0478340
R61	Resistor, hor. osc. emitter, 1000 ohms, 5%	66-2108240
R62	Resistor, hor. output base, 3.3 ohms	66-9333360
R63	Resistor, hor. osc. base, 15,000 ohms	66-3158340
R64	Resistor, hor. oscillator, 470 ohms	66-1478340
R65	Resistor, phase det. feedback, 3300 ohms	66-2338340
R66	Resistor, vert. oscillator, 10,000 ohms	66-3108340
R67	Resistor, vert. oscillator, 220 ohms	66-1228340
R68	Resistor, phase detector, 1000 ohms, 5%	66-2108240
R69	Resistor, phase det. output, 2700 ohms	66-2278340
R70	Resistor, phase detector, 15,000 ohms	66-3158340
R71	Resistor, phase detector, 10,000 ohms	66-3108340
R72	Resistor, phase detector, 4700 ohms	66-2478340
R73	Resistor, phase detector, 2700 ohms, 5%	66-2278240
R74	Resistor, vert. feedback, 430 ohms, 5%	66-1438240
R74A	Resistor, vert. feedback, 430 ohms, 5%	66-1438240
R75	Resistor, vert. output base, 5600 ohms, 5%	66-2568240
R76	Resistor, vert. oscillator, 3300 ohms	66-2338340
R77	Resistor, vert. decoup. —6V, 150 ohms	66-1158340
R78	Resistor, vert. oscillator collector, 2200 ohms	66-2228340
R79	Resistor, phase detector, 4700 ohms	66-2478340
R80	Resistor, phase detector, 8200 ohms	66-2828340
R81	Resistor, —12 Volt filter, 10 ohms	66-0108340
R83	Resistor, vert. retrace, 100,000 ohms	66-4108340
R84	Resistor, vert. retrace, 27,000 ohms	66-3278340
R85	Resistor, vert. retrace, 2.2 megohm	66-5228340
R86	Resistor, vert. output emitter, 10 ohms	66-0108340
R87	Resistor, vert. output collector, 6800 ohms	66-2688340
R88	Resistor, CRT spot decay, 4.7 megohm	66-5478340
R88A	Resistor, CRT spot decay, 12 megohm	66-6128340
R89	Resistor, AC limiting, 1 ohm, 1W	66-9104360
R89A	Resistor, battery limit., .47 ohms, 1W	66-8474360
R90	Resistor, charge limiting, 5.6 ohms, 1W	66-9564360
R91	Resistor, private listening jack, 18 ohms	66-0188340
SPKR	Speaker	36-1652-5
T1	Transformer, discriminator	32-4789-1
T2	Transformer, 4.5 mc sound take-off	32-4644-22

REPLACEMENT PARTS LIST

Reference Symbol	Description	Service Part No.
T3	Transformer, sound i-f interstage	32-4644-21
T4	Coil, 47.25 mc trap, vif input	32-4784-2
T5	Transformer, 4th vif interstage	32-4784-6
T6	Transformer, 3rd vif interstage	32-4784-5
T7	Transformer, 2nd vif interstage	32-4784-4
T8	Transformer, 1st vif interstage	32-4784-4
T9	Transformer, 1st vif input coupling	32-4784-3
T10	Coil, 39.75 mc trap, 2nd vif col.	32-4784-8
T11	Coil, 41.25 mc trap, 1st vif col.	32-4784-7
T12	Coil, 41.25 mc trap, i-f input	32-4784-1
T13	Transformer, hor. osc. coupling	32-8914-3
T14	Transformer, hor. buffer output	32-8914-2
T15	Transformer, horizontal oscillator tank	32-8914-1
T16	Coil, horizontal oscillator stabilizing	32-4754-4
VR1	Resistor, variable, contrast	33-5583-12
VR2	Resistor, variable, volume W/switch	33-5583-11
VR3	Resistor, variable, drive level	33-5600-1
VR4	Resistor, variable, vert. hold	33-5583-13
VR5	Resistor, variable, hor. hold	33-5583-14
VR6	Resistor, variable, brightness	33-5583-15
VR7	Resistor, variable tri-sect. height, aux. vert. hold, aux. hor. hold	33-5600-3
VR8	Resistor, var., two-sect., vert. lin. and aux. vert. lin.	33-5600-2
VOST	Vertical Oscillator Transformer	32-8917-1
VOT	Vertical Output Transformer	32-8915-1
WR1	Resistor, wire wound, hor. output trans., 20 meg.	33-1352-8
WS1	Range switch	42-2113-1
WS2	Switch, wafer, function	42-2116-2
X1	Choke, channel 8 beat, 3 uh	32-4645-7
X2	Choke, 40 mc, 10 uh	32-4674-1
X3	Choke, video i-f input, .96 uh	32-4548-12
X4	Choke, vid. peaking 270 uh	32-4762-9
X5	Choke, high voltage transformer, 28 uh	32-4720-8
X6	Choke, +12V filter, 58 uh	32-4762-17
	Deflection Perma-Circuit Panel	54-6991
	Video, i-f, sync and sound (VISS) panel	54-6992
	Vertical output Perma-Circuit Panel	54-6990
	Yoke and clamp ass'y	76-11657-2
	Yoke sleeve and magnet ass'y	76-11601
	Magnet and spring	76-10970-1

10AT10 CHASSIS, MECHANICAL

Anode lead	41-4142-22
Battery, P-560, 7.5 volt	41-8066
Cup, function switch	54-5627
CRT cable	41-4264-18
Cable, battery	41-4308-1
Sink, heat, horizonal output	28-12950
Socket, transistor, horizontal output	27-6325-4
Socket, transistor, vertical output	27-6325-4

T-110 TUNER—ELECTRICAL PARTS

C1	Capacitor, mixer wafer, 0.82 mmf, 10%	30-1221-10
C2	Capacitor, i-f trap, 100 mmf.	
C3	Capacitor, mixer emitter, 7 mmf, disc	30-1251-33
C4	Capacitor, osc. feedback, 1.8 mmf, molded	30-1221-29
C5	Capacitor, osc. collector, 1.5 mmf, ceramic	30-1224-136
C6	Capacitor, r-f ampl. base, 8 mmf, disc	30-1251-31
C7	Capacitor, mixer base coupling, 5 mmf, disc	30-1251-32
C8	Capacitor, i-f link blocking, .001 mfd, GMV, disc	30-1238-13
J1	Jack, i-f output	57-0590-2
J2	Jack, antenna input	57-0590-2
L1	Capacitor, feed-thru, mixer emitter bypass, 1000 mmf	30-1268-7
L2	Capacitor, feed-thru, r-f coil tank, 20 mmf	30-1268-17
L3	Capacitor, feed-thru, r-f emitter bypass, 1000 mmf	30-1268-7
L4	Capacitor, feed-thru, mixer collector bypass, 15 mmf	30-1268-8
L5	Capacitor, feed-thru, r-f collector bypass, 3.9 mmf	30-1268-15
L6	Capacitor, feed-thru, r-f base bypass, 15 mmf	30-1268-8
L7	Capacitor, feed-thru, osc. base bypass, 1000 mmf	30-1268-7
L8	Capacitor, feed-thru, osc. B+ bypass, 1000 mmf	30-1268-7
L9	Capacitor, feed-thru, mixer B+ bypass, 1000 mmf	30-1268-7
L10	Capacitor, feed-thru, mixer base bypass, 30 mmf	30-1268-9
L11	Capacitor, feed-thru, mixer i-f trap, 27 mmf	30-1268-16
L12	Capacitor, feed-thru, r-f bias bypass, 1000 mmf	30-1268-7
R1	Resistor, oscillator emitter, 1200 ohms	66-2128340
R2	Resistor, oscillator base, 12,000 ohms	66-3128340
R3	Resistor, mixer emitter, 1200 ohms	66-2128340
R4	Resistor, r-f emitter, 1500 ohms	66-2158340
R5	Resistor, r-f base bias, 12,000 ohms	66-3128340
R6	Resistor, r-f neutralizing, 4700 ohms	66-2478340
R7	Resistor, r-f base to ground, 12,000 ohms	66-3128340
R8	Resistor, mixer base bias, 39,000 ohms	66-3398340
R9	Resistor, oscillator bias, 5600 ohms	66-2568340
R10	Resistor, mixer base bias, 12,000 ohms	66-3128340
T1	Coil, channel 13, oscillator	32-4788-1
T2	Coil, r-f trap, antenna input	32-4788-2
T3	Coil, r-f trap, mixer base	32-4786-13
T4	Coil, mixer i-f output	32-4787
VC1	Capacitor, variable, r-f neut., 0.5-3.0 mmf	31-6520-1
VC2	Capacitor, variable, interstage tracking, 1-3.8 mmf	31-6520-28
VC3	Capacitor, variable, r-f collector, 1-3.8 mmf	31-6520-28
X1	R-F choke, mixer emitter	32-4785-1
X2	Coil, mixer, channel 13	32-4786-23
X3	Coil, r-f collector, channel 13	32-4786-15
X4	Coil, antenna, channel 13	32-4786-2
X5	Coil, oscillator emitter	32-4786-14
X6	Coil, mixer emitter	32-4786-12
X7	R-F choke, r-f ampl. neut.	32-4785-1

T-110 TUNER—MECHANICAL PARTS

Core, brass, coil tuning (3 used)	76-10896-2
Core, iron, coil tuning (4 used)	56-8033-4
Detent ball	56-8020
Detent spring	28-13173-3
Feed-thru plate	76-10896-22
Grounding clip	76-10896-21
Panel	54-5578
Shaft, fine tuning	54-5579
Socket, transistor, 3 used	27-6333-1
Stator, osc. fine tuning	28-13173-4
Stator support	28-13173-5
Switch and shaft	76-11779
Wiper contact	28-13173-1

TRANSISTORS—T-110 TUNER

TR1T	Transistor, tuner oscillator, T1597	34-6000-27
TR2T	Transistor, tuner mixer, T1600	34-6000-26
TR3T	Transistor, tuner r-f ampl., T1561	34-6000-25

Reference Symbol	Description	Service Part No.
	TRANSISTORS—10AT10 CHASSIS	
TR1	Transistor, noise switch, 2N536	34-6001-26
TR2	Transistor, sync separator, T1596	34-6000-32
TR3	Transistor, audio output (matched pr.), 2N225	34-6001-28
TR4	Transistor, audio driver, T1001	34-6001-33
TR5	Transistor, audio output (matched pr.), 2N225	34-6001-28
TR6	Transistor, sif ampl., T1595	34-6000-31
TR7	Transistor, sif limiter, T1598	34-6000-33
TR8	Transistor, first video ampl., T1593	34-6000-29
TR9	Transistor, video output, T1594	34-6000-30
TR10	Transistor, 4th vif, T1559	34-6000-28
TR11	Transistor, 3rd vif, T1559	34-6000-28
TR12	Transistor, 2nd vif, T1559	34-6000-28
TR13	Transistor, 1st vif, T1559	34-6000-28
TR14	Transistor, hor. buffer ampl., 2N224	34-6001-29
TR15	Transistor, hor. oscillator, T1599	34-6000-34
TR16	Transistor, hor. output, T1602	34-6002-14
TR17	Transistor, vert. oscillator, 2N224	34-6001-29
TR18	Transistor, vert. output, T1601	34-6002-13

10AT10 OPTICAL SYSTEM

Beam Splitter	64-5578
Clip, mirror ret.	28-13115
Gasket, spherical mirror	64-5602
Gasket, beam splitter	64-5603
Housing, optical	64-5568-1
Mask	28-13111
Mirror, spherical	64-5576
Ring, locating	28-13110
Retainer, lower	28-13116
Retainer, upper	28-13117
Retainer, spring	28-13069
Retainer	28-13070
Screw, pan head	W2637FA15
Screw, oval head	W2537-53FA15

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