Electrical Adjustments - Check and if necessary adjust the "non-operating" controls of the receiver unit for a clear, symmetrical, centered test pattern on the face of the projection tube. Look down into the top of the projection unit to view the test pattern at the face of the projection tube. Use a test signal from a local TV station and maintain normal picture contrast and brightness during the adjustments. Adjustment of the FOCUS control may be required in some cases to obtain a sharp image with normal brightness and contrast. If the test pattern viewed at the face of the projection tube is normal, disregard the following adjustments and proceed with the Mechanical Adjustments.

HEIGHT CONTROL MISADJUSTMENT

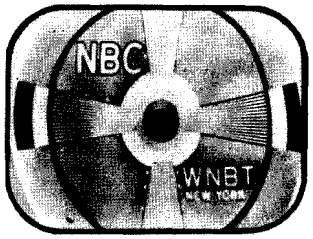


Figure 4

1. Check the vertical dimension of the raster at the viewing screen of the receiver. Adjust the HEIGHT and VERTICAL CENTERING controls to exactly fit the vertical dimension of the screen. The results may be viewed from the back side of the viewing screen.*

2. Make the following adjustments viewing the results at the face of the projection tube by looking down into the window of the projection unit.

(a) Readjust the VERTICAL CENTERING control, if necessary, for a centered pattern on the face of the projection tube. Do not change the setting of the HEIGHT control as the height of the raster was established in step 1. above.

VERTICAL CENTERING CONTROL MISADJUSTMENT

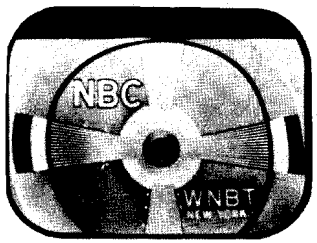


Figure 5

(b) Advance the HORIZONTAL DRIVE control (clockwise) as far as possible without causing crowding of the right hand side of the test pattern or producing picture instability. Insufficient horizontal drive will cause the raster to fall short of filling the face of the projection tube horizontally. Should the HORIZONTAL HOLD control fail to hold the test pattern in the normal manner set the HORIZONTAL HOLD control in the middle of its range and adjust the HORIZONTAL OSC. ADJ. screw for horizontal sync. (See Fig. 13.)

HORIZONTAL DRIVE CONTROL MISADJUSTMENT

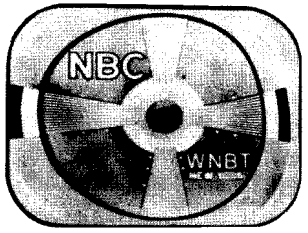


Figure 6.

*NOTE - The use of a dull white sheet of paper the size of the screen, mounted on the back side of the screen, is recommended.

WIDTH CONTROL MISADJUSTMENT

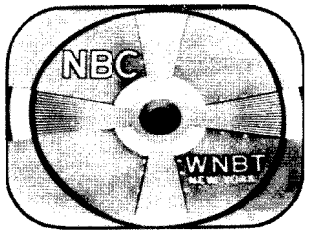


Figure 7

(c) Set the WIDTH and HORIZONTAL CENTERING controls so that the test pattern fits and centers in the horizontal dimension of the projection tube face; i.e. the corners of the raster just touch the rim of the projection tube face.

HORIZONTAL CENTERING CONTROL MISADJUSTMENT

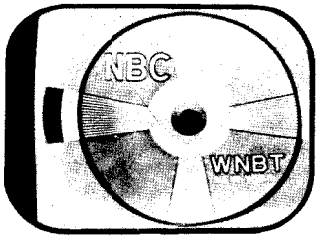


Figure 8

(d) Set the HORIZONTAL LINEARITY control so that the test pattern is symmetrical from left to right. A slight readjustment of the HORIZONTAL DRIVE control may be necessary when making this adjustment.

HORIZONTAL LINEARITY CONTROL MISADJUSTMENT

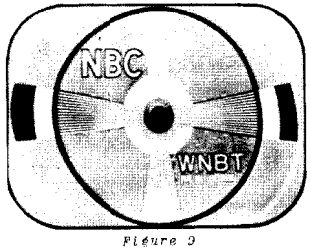


Figure 9

(e) Set the VERTICAL LINEARITY control for a symmetrical test pattern in the vertical dimension. A slight readjustment of the HEIGHT and VERTICAL CENTERING controls may be required when making this adjustment.

VERTICAL LINEARITY CONTROL MISADJUSTMENT

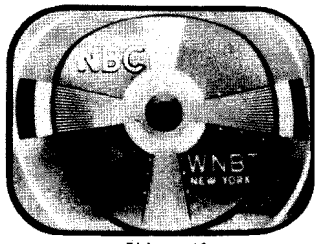


Figure 10

(f) Adjust the FOCUS control for a sharp image on the face of the projection tube with the brightness and contrast controls adjusted for a normal picture. To establish the normal brightness control setting, tune in the local TV station known to have the strongest signal in the area and set the brightness, contrast and focus controls for a clear picture. Switch to a TV station of lower power or field strength in your area and observe whether their picture lacks brilliance. If lacking in brilliance advance the brightness control and readjust contrast and focus for a normal picture. Switch back to the strong TV station and observe whether "blooming" takes place. Also observe whether "blooming" takes place when the contrast of the transmitted picture changes requiring a readjustment of the contrast control. Optimum picture brilliance has been established if "blooming" does not take place when the brightness and contrast controls are properly adjusted for a normal picture on any of the TV channels.

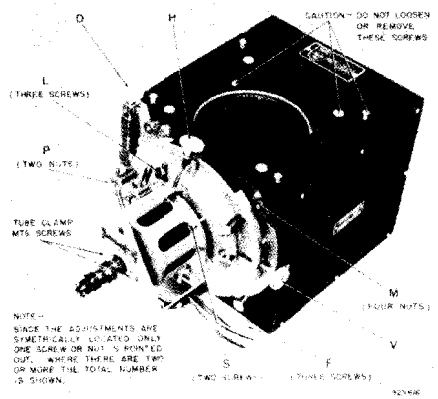


Fig. 11. Projection unit, mechanical adjustments

Mechanical Adjustments - Refer to Fig. 11. for location of adjustments.

1. Before touching the mechanical adjustments check the test pattern at the face of the projection tube. It must be in focus and properly centered. If mechanical centering is required in addition to the electrical centering adjustments, it may be accomplished with the two screws marked "S". Caution - When centering the pattern with the mechanical adjustments be careful not to force the focusing coil housing against the neck of the tube by tilting it excessively in either direction. Excessive tilt indicates that the electrical centering adjustments are not functioning properly and should be checked.

2. Check the position of the test pattern on the viewing screen. If the system is optically centered, the pattern will be centered on the screen. If not, loosen the three mounting bolts of the projection unit and adjust the three leveling screws (F) for a centered pattern on the projection screen. Tighten the mounting screws again after adjustment.

3. Check the pattern on the viewing screen for tilt. If not square with the screen, loosen the four mounting nuts (M) and rotate the mounting assembly slightly as required and retighten the four nuts (M).

4. Check the test pattern for proper focus at the viewing screen. If a test pattern is not available the retrace and scanning lines may be used.

NOTE - The test pattern must be in focus at the face of the projection tube before attempting to focus the optical system. If mechanical focusing is required, loosen the five locking nuts (L and P) about one turn each and proceed as follows:

(a) Adjust the overall focusing thumbscrew (0) until the center portion of the pattern is properly focused.

(b) Adjust the horizontal focusing thumbscrew (H) for equal focus in the areas on each side of the center of the test pattern.

(c) Adjust the vertical focusing (V) for equal focus in the areas above and below the center of the test pattern.

(d) After each slight adjustment of the "H" and "V" screws, check the overall focusing adjustment (0). By carefully manipulating these adjustments, it is possible to bring the entire pattern into satisfactory focus.

(e) After completing the above focusing adjustments, retighten the five locking nuts (L and P) until they are snug.

CAUTION - The optical system inside the projection unit must be adjusted at the factory and under no circumstances should any adjustments be attempted other than those described above. *Optical parts must be replaced at the factory through the authorized UMS distributor.

REPLACING THE PROJECTION TUBE

Check to be sure that the equipment is turned off before working with the projection unit. Play safe and disconnect the line cord.

REMOVAL

1. Disconnect the tube socket at the base of the projection tube.

2. Loosen the four thumbscrews marked "M" in Fig. 11., which hold the mounting and alignment assembly to the optical housing of the projection unit. Rotate the assembly counterclockwise slightly to permit its removal, and withdraw with care.

3. Withdraw the high voltage anode connector which is plugged into the anode terminal at the rim of the tube. The rubber plug fits into and around the glass cup surrounding the anode contact. The glass shield is easily broken. The plug can best be removed by placing the thumb and forefinger on the overlapping edge of the plug and lifting the connector straight out of the cavity of the cup. The anode lead is clamped to the assembly, but need not be removed when changing the projection tube.

4. Loosen the clamping screw in the tube clamp located just behind the focusing coil housing and pull the tube forward and out of the mounting.

INSTALLATION

1. Remove the projection tube from the carton and attach the visor to the rim of the tube. The visor is notched to fit the rim of the tube and must be placed opposite the anode cup.

2. Slip the neck of the tube, base first, through the deflection yoke, focus coil, and clamp. Rotate the tube so that the visor is on top and the anode cup on the bottom.

3. Loosen the two screws holding the tube clamp to the tail plate (See Fig. 11.) and while holding the tube so that its flare seats firmly against the deflection yoke, tighten the tube clamp firmly about the neck of the tube. Center the neck of the tube in the hole in the triangular tail plate and tighten the two screws holding the tube clamp to the tail plate. Check to see that the two springs contact the outer coating of the projection tube. This is very important as the outer coating must be grounded.

4. Plug the high voltage anode connector into the cup at the rim of the projection tube and attach the tube socket at the base.

5. Attach the mounting and alignment assembly to the optical housing and tighten the four thumbscrews (M). If the picture is slightly tilted on the projection screen, loosen these thumbscrews again and rotate the assembly slightly as required. Retighten the thumbscrews.

6. Check the newly installed tube for mechanical focus as described in INSTALLATION CHECKS AND ADJUSTMENTS under Mechanical Adjustments. (Step 4.)

Note - Occasionally a loose particle within the projection tube may come to rest on the fluorescent coating causing a dark spot on the projection screen. If so, tap the projection unit housing lightly so that the particle falls to the bottom of the tube. If the particle is left on the coating it may become permanently attached.

* NOTE - Make no service shipments directly to the factory. The factory cannot accept responsibilities for unauthorized shipments.

PARTS LIST

Illustration No.	Production Part No.	Service Part No.	Description

MECHANICAL PARTS

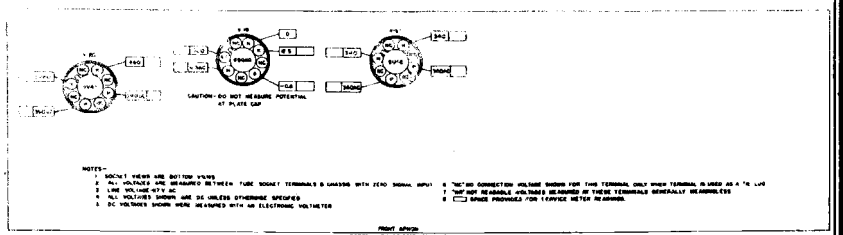
COILS AND TRANSFORMERS

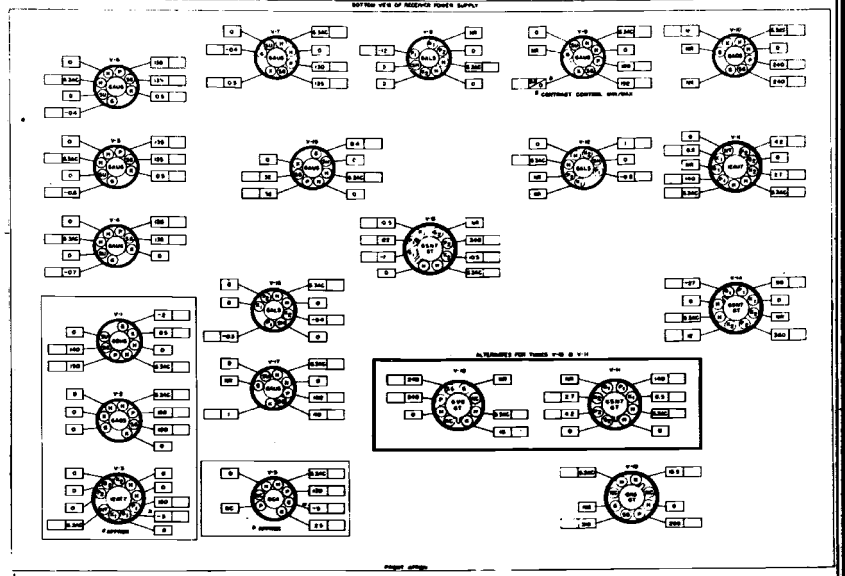
T-1	50B406	1219064	Transformer, ratio detector
T-2			Transformer, audio output (Part of speaker ass'y.)
T-3	55C117	1219343	Transformer, horizontal output
T-4	52C170	1219265	Transformer, power
T-5	55B115	1219264	Transformer, vertical oscillator
T-6	55C114	1219267	Transformer, vertical output
T-201	52A176	1219365	Transformer, H.V. oscillator
T-202	52A177	1219366	Transformer, assembly, H.V. tripler (sealed unit contains V-203, V-204, V-205, C-209, C-210, and C-211)
L-1			Coil, antenna (Part of tuner ass'y.)
L-2			Coil, heater choke (Part of tuner ass'y.)
L-3			Coil, r-f amp. stage (Part of tuner ass'y.)
L-4			Coil, mixer stage (Part of tuner ass'y.)
L-5			Coil, osc. stage (Part of tuner ass'y.)
L-6			Coil, osc. cathode (Part of tuner ass'y.)
L-14	51B1037	1218952	Coil, 4.5 mc sound trap
L-19,20,21, 22,23	51A372-1	1219233	Coil, i-f amplifier
L-24	51A1079	1219234	Coil, video peaking
L-25	51A1080	1219235	Coil, video peaking
L-26	51A1087	1219238	Coil, video peaking
L-27,29	51A1082	1219236	Coil, video peaking
L-28	51A1086	1219237	Coil, video peaking
L-30	50B411	1219263	Coil, horizontal sweep osc.
L-33	51B1072	1219241	Coil, WIDTH control
L-34	51B1071	1219240	Coil, HORIZONTAL LINEARITY control

CONDENSERS

C-1,2,3,4, 10,11,62	47B20A681M5	1219351	680 mmf 500 V., ceramic
C-5	47B20A470K5	1218505	47 mmf 500 V., ceramic
C-8,12	47A160-1	1218895	.68 mmf 500 V., bakelite
C-7	47B20A270K5	1219352	27 mmf 500 V., ceramic
C-8,13,16	47A160-3	1218897	1.5 mmf 500 V., bakelite
C-9,35,49	47A168	1219295	5000 mmf 450 V., ceramic
C-14,36,40, 43,46,50	47B20101K5	1218949	100 mmf. 500 V., ceramic
C-15,18	46AU103J	E103	.01 mfd 200 V., tubular
C-17,37,38, 41,42,44, 45,47	47B20A102N5	1219297	1000 mmf 500 V., ceramic
C-19,21	47B20331K5	1218950	330 mmf 500 V., ceramic
C-20	45A109	J051	5 mfd 50 V., electrolytic
C-22,23,25, 70,205	46AZ103J	E103	.01 mfd 600 V., tubular
C-24	45B135	1219210	10-10-10 mfd 450 V.; 150 mfd 50 V.; electrolytic
C-25	45A121	J100	10 mfd 25 V., electrolytic
C-27	46AU104J	E104	.1 mfd 200 V., tubular
C-39,48	46AT254J	E254	.25 mfd 200 V., tubular
C-51	47A160-11	1218898	10 mmf 500 V., bakelite
C-52	46AU503J	E503	.05 mfd 200 V., tubular
C-53	45B139	1219214	8-8 mfd 300 V.; electrolytic
C-54,57	46AY503J	E503	.05 mfd 600 V., tubular
C-55,72,90, 203,204	46AY104J	E104	.1 mfd 600 V., tubular
C-56,89	46AX254J	E254	.25 mfd 600 V., tubular
C-58,59	CM30A152K	G152	1500 mmf 500 V., mica
C-60	46AY203J	E203	.02 mfd 600 V., tubular
C-61,81, 83,85	46AZ502J	E502	.005 mfd 600 V., tubular
C-63	47B20220K5	1219336	22 mmf 500 V., ceramic

Fig. 25. Tube socket voltage chart, receiver chassis and power supply





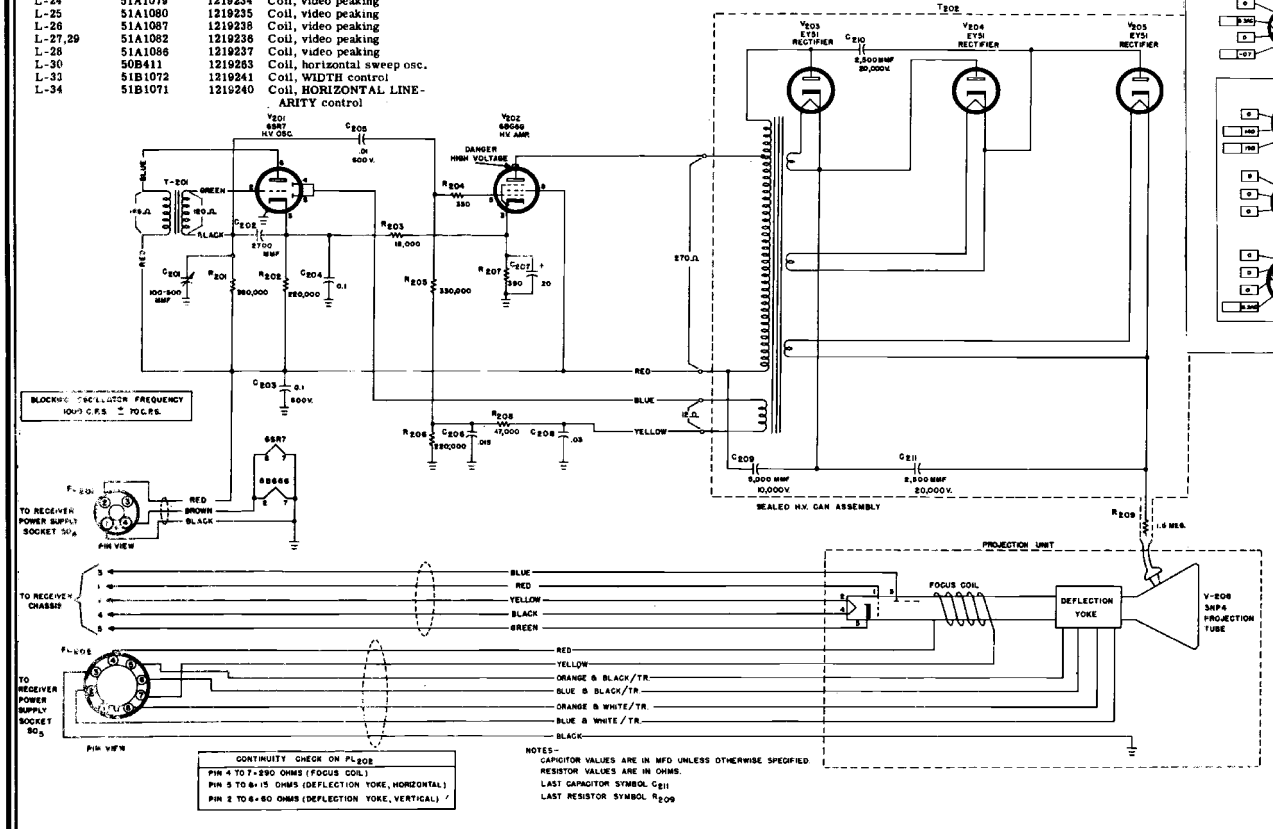
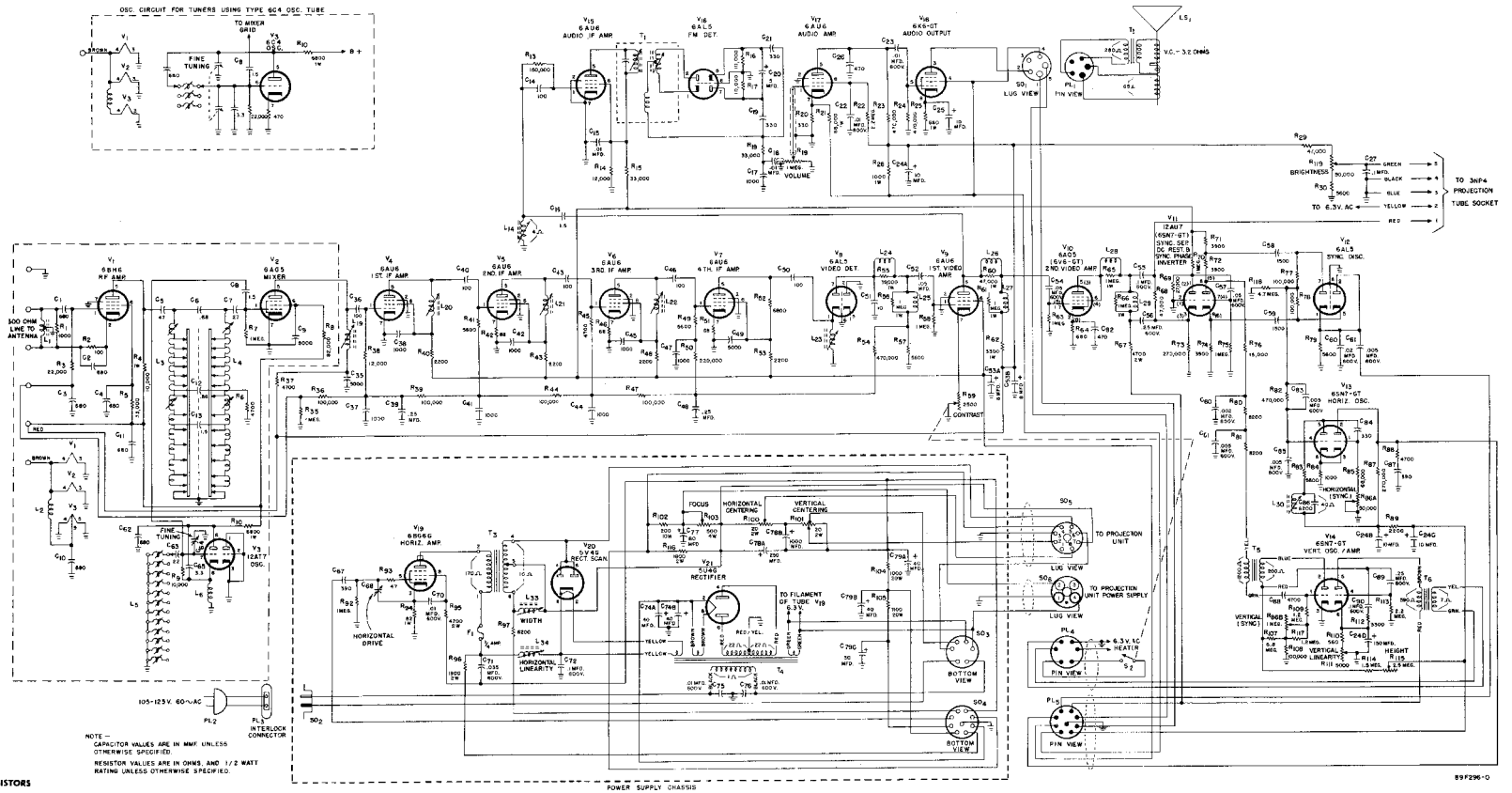


Fig. 24. Schematic diagram, H.V. power supply and projection unit

Illustration No.	Production Part No.	Service Part No.	Description

CONDENSERS (Cont.)

C-64			Trimmer, FINE TUNING (Part of tuner ass'y.)
C-65	47A160-5	1218409	3.3 mmf 500 V., ceramic
C-67	47B20391K5	1218951	390 mmf 500 V., ceramic
C-68	44A361	1219207	Trimmer, HORIZONTAL DRIVE adjustment
C-71	46AY353J	E353	.035 mfd 600 V., tubular
C-74	45B137	1219212	40-40 mfd 450 V., electrolytic
C-75,76	46BR103L6	1219217	.01 mfd 600 V., molded paper
C-77	45B136	1219211	80 mfd 450 V., electrolytic
C-78	45B134	1219209	250 mfd 10 V.; 1000 mfd. 6V.; electrolytic
C-79	45B138	1219213	40 mfd 150 V.; 40 mfd 350 V.; 30 mfd 250 V.; electrolytic
C-80	46AZ202J	E202	.002 mfd 600 V., tubular
C-84	CM20A331K	G331	330 mmf 500 V., mica
C-86	CM35C622J	G622	6200 mmf 500 V., mica
C-87	CM20A391M	G391	390 mmf 500 V., mica
C-88	CM35A472K	G472	4700 mmf 500 V., mica
C-92	CM20A471M	G471	470 mmf. 500 V., mica
C-201	44A372	1219353	Trimmer, H.V. adjustment
C-202	CM30A272J	1219350	2700 mmf 500 V., mica
C-206	46AU153J	1219348	.015 mfd 400 V., tubular
C-207	45A040	1219347	20 mfd 50 V., electrolytic
C-208	46AW303J	1219349	.03 mfd 400 V., tubular
C-209,210, 211			Not replaceable, part of T-202



NOTE — CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES ARE IN OHMS, AND 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.

RESISTORS

R-1			1000 ohms 1/2 watt, carbon (Part of coil L-1)	R-50,208	RC20AE224K	A226	220,000 ohms 1/2 watt, carbon	R-201	RC30AE394J	B394	390,000 ohms 1 watt, carbon
R-2	RC20AE101M	A101	100 ohms 1/2 watt, carbon	R-53	RC20AE682K	A682	6800 ohms 1/2 watt, carbon	R-202	RC30AE224K	B224	220,000 ohms 1 watt, carbon
R-3,38	RC20AE223M	A223	22,000 ohms 1/2 watt, carbon	R-55			39,000 ohms 1 watt, carbon (Part of coil L-24)	R-203	4C30AE183K	B183	18,000 ohms 1 watt, carbon
R-4	RC30AE103M	B103	10,000 ohms 1 watt, carbon				1 megohm 1 watt, carbon (Part of coil L-25,27,28, and 29)	R-205	RC30AE334K	A334	330,000 ohms 1/2 watt, carbon
R-5	RC20AE686M	A683	68,000 ohms 1/2 watt, carbon	R-56,61, 65,66				R-207	RC40AE394K	C394	390 ohms 2 watts, carbon
R-6,37,45,88	RC20AE472K	A472	4700 ohms 1/2 watt, carbon	R-59	25B783	1219242	2500 ohms, CONTRAST control	R-208	13A074	1219354	1.5 megohms, special (Screw end)
R-7,35,56 63,75,92	RC20AE105M	A105	1 megohm 1/2 watt, carbon	R-60			47,000 ohms 1 watt, carbon (Part of coil L-26)	R-209	13A075	1219355	1.5 megohms, special (Spring end)
R-8	RC20AE823M	A823	82,000 ohms 1/2 watt, carbon	R-62	RC30AE332K	B332	3300 ohms 1 watt, carbon				
R-9	RC20AE103M	A103	10,000 ohms 1/2 watt, carbon	R-64	RC2fAE681K	A681	680 ohms 1/2 watt, carbon				
R-10	RC30AE682M	B682	6800 ohms 1 watt, carbon	R-67,68	RC40AE472K	C472	4700 ohms 2 watts, carbon				
R-13	RC20AE154K	A154	150,000 ohms 1/2 watt, carbon	R-69	RC20AE273K	A273	27,000 ohms 1/2 watt, carbon				
R-14	RC20AE123K	A123	12,000 ohms 1/2 watt, carbon	R-71,73,74	RC20AE392K	A392	3900 ohms 1/2 watt, carbon				
R-15,18	RC20AE333K	A333	33,000 ohms 1/2 watt, carbon	R-73,87	RC20AE274K	A274	270,000 ohms 1/2 watt, carbon				
R-16,17	RC20AE103J	A103	10,000 ohms 1/2 watt, carbon	R-76	RC2?AE153K	A153	15,000 ohms 1/2 watt, carbon				
R-19	25B785	1219244	1 megohm, VOLUME	R-80,81,97	RC20AE822K	A322	8200 ohms 1/2 watt, carbon				
R-20,204	RC20AE331K	A331	330 ohms 1/2 watt, carbon	R-84	RC30Ab102K	A102	1000 ohms 1/2 watt, carbon				
R-21	RC30AE682K	B683	68,000 ohms 1 watt, carbon	R-85	RC30Ab683K	A683	68,000 ohms 1/2 watt, carbon				
R-22,113	RC20AE225M	A225	2.2 megohms 1/2 watt, carbon	R-86	25B786	1219250	50,000 ohms 1 meg-ohms, HORIZONTAL, VERTICAL control (Dual control				
R-23,24, 34,82	RC20AE474K	A474	470,000 ohms 1/2 watt, carbon	R-93	RC20AE470K	A470	47 ohms 1/2 watt, carbon				
R-25	RC30AE68.K	B681	680 ohms 1 watt, carbon	R-94	RC30Ab820K	B820	82 ohms 1 watt, carbon				
R-26	RC30AE103K	B102	1000 ohms 1 watt, carbon	R-96,116	RC40AE102K	C102	1000 ohms 2 watts, carbon				
R-28,88,208	RC20AE473K	A473	47,000 ohms 1/2 watt, carbon	R-100	25B707	1219246	20 ohms 2 watts, HORIZONTAL CENTERING control				
R-32,41,45, 57,79,83	RC20AE561K	A562	5600 ohms 1/2 watt, carbon	R-101	25B706	1219245	20 ohms 2 watts, VERTICAL CENTERING control				
R-36,39,44, 47,77,78, 108	RC20AE104K	A104	100,000 ohms 1/2 watt, carbon	R-102	24BG201A	1219326	200 ohms, 10 watts, WW				
R-40,43,48, 53,89	RC20AE222K	A222	2200 ohms 1/2 watt, carbon	R-103	25B709	1219338	500 ohms, 4 watts, FOCUS control				
R-42,46,51	RC20AE682K	A680	68 ohms 1/2 watt, carbon	R-104	24BH202K	1219361	2000 ohms, 20 watts, WW				
				R-105	24BE252K	1219362	2500 ohms, 5 watts, WW				
				R-107	RC20Ab565K	A565	5.6 megohms 1/2 watt, carbon				
				R-109,117	RC20Ab125K	A125	1.2 megohms 1/2 watt, carbon				
				R-110	RC20AE561K	A561	560 ohms 1/2 watt, carbon				
				R-111	25B780	1219249	5000 ohms, VERTICAL LINEARITY control				
				R-112	RC20Ab332K	A332	3300 ohms 1/2 watt, carbon				
				R-114	RC20Ab155K	A155	1.5 megohms 1/2 watt, carbon				
				R-115	25B768	1219248	2.5 megohms, HEIGHT control				
				R-116	RC20AE476M	A476	4.7 megohms 1/2 watt, carbon				
				R-119	25B784	1219243	50,000 ohms, BRIGHTNESS control				

RESISTORS (Cont.)

TUBE AND RECTIFIER COMPLEMENT

V-1	90X6BH6	5270	Type 6BH6: RF amp.
V-2	90X6AG5	5263	Type 6AG5: mixer
+V-3	90X12AT7	5271	Type 12AT7: oscillator
V-4,5,6,7, 9,15,17	90X6AU6	5380	Type 6AU6: 1st, 2nd, 3rd, 4th IF amp.; 1st video amp.; audio IF amp.; and audio amp.
V-8,12,16	90X6AL5	5251	Type 6AL5: video det.; sync disc; and FM det.
+V-10	90X6AQ5	5268	Type 6AQ5: 2nd video amp.
6V-11	90X12AU7	5328	Type 12AU7: sync. separator; DC restorer; and sync. phase inverter
V-13,14	90X6SN7GT	5258	Type 6SN7GT: horizontal osc.; and vertical osc. & amp.
V-18	90X6K6GT	5198	Type 6K6GT: audio output
V-19,202	90X6BQ6G	5269	Type 6BQ6G: horizontal amp.; and H.V. amp.
V-20	90X5V4G	5112	Type 5V4G: rewrtion scanning
V-21	90X5U4G	5117	Type 5U4G: low voltage rectifier
V-201	90X6SR7	5233	Type 6SR7: H.V. oscillator.

* Some tuners use a type 6C4 ..... 90X6C4. ..... 5265.
+ Some sets will use a type 6V6-GT. ... 90X6V6GT: .... 5241.
# Some sets will use a type 6SN7-GT ... 90X6SN7GT .... 5256.

V-203,204, 205			Not replaceable, part of assembly T-202
V-206	90X3NP4	5532	Type 3NP4: projection tube

MISCELLANEOUS

ELECTRICAL PARTS

	1C727	1219344	Tuning unit assembly complete
LS-1	65C082	1219345	Speaker assembly (includes connector PL-1)
PL-1			Plug, speaker (Part of speaker assembly)
PL-2	87B1668-1	1218960	Line cord and plug PL-3
PL-4	10A298	1219229	Plug, 6 prong (Power)
PL-5	10A299	1219230	Plug, 8 prong (Power)
	10A324	1219204	Shell, plug (Used on PL-4 and PL-5)
PL-201	10A236-1	1219332	Plug, 4 prong (Power)
PL-202	10A239-1	1219333	Plug, 5 prong (Focus and deflection coils)
	69A207	1219341	Shell, plug (Used on PL-201 and PL-202)
SO-1	10A303	1219331	Socket 5 pin (Speaker)
SO-5	10A290-1	1219330	Socket, 8 pin (Focus and deflection coils)
SO-6	6A270-4	1219329	Socket, 4 pin (Power)
	69A207	1219341	Shell, socket, (Used on SO-5 and SO-6)
F-1	39A334	448657	Fuse, 1/4 ampere, type 3AG
	86B077	1219339	Socket, projection tube

MECHANICAL PARTS

CHASSIS PARTS

SO-2	10A296	1218859	Socket, u-c power
SO-3	6A312	1219224	Socket, 6 pin (Power)
SO-4	6A313	1219225	Socket, 9 pin (Power)
	6B290	1218360	Socket, octal (Tube)
	6A308	1219222	Socket, miniature 7 pin (Tube)
	6A311	1219223	Socket, miniature 9 pin (Tube V-11)
	67A866	1219325	Bracket, VERT. LINEARITY and HEIGHT control mtg.
	67B874	1219324	Bracket, tuner mounting (Rear)
	67B893	1219326	Bracket, tuner mounting (Front)
	63B348	1219327	Plate, receiver chassis mounting
	63B350	1219328	Plate, power supply chassis mtg.

CABINET PARTS

22C216	1219346	Screen, viewing
76A414	1219322	Clip, screen
22C221	1219342	Mirror
53A239	1219323	Mirror support
15B148-1	1219253	Knob, VOLUME, BRIGHTNESS, and CONTRAST
15B147-1	1219252	Knob, VERTICAL (Front section)
15B146-1	1219251	Knob, HORIZONTAL (Rear section)
15B150	1219334	Knob, CHANNEL SELECTOR (Front section)
15B151	1219335	Knob, FINE TUNING (Rear section)
66F491	1219359	Cabinet
66F491-3	1219360	Cabinet back
1X750	1219356	Projection unit optical ass'y (Contains concave mirror, 45-degree mirror, and corrector lens)
1X749	1219357	Projection unit mounting and alignment ass'y (Contains focus coil, deflection coil, etc.)
87A1677	1219358	Projection unit H.V. cable ass'y (Includes resistor R-109, second anode connector, etc.)

ADJUSTMENT OF H.V. SUPPLY OSCILLATOR

The frequency of the blocking oscillator in the high-voltage supply must be maintained at 1000 ± 70 cycles. Adjustment should not be necessary unless a frequency determining element has been replaced or altered. The frequency should be checked when the 6SR7 tube (V-201) and any of the associated components are replaced.

The 1000 cycle adjustment has negligible effect on either the output voltage or current regulation and should not be tampered with in an attempt to rectify failure. Its only function is to control the oscillator frequency which determines the amount of heater power supplied to the three rectifiers sealed in the high voltage transformer assembly (T-202). Heater voltage control is necessary to assure maximum tube life.

The test equipment required to adjust the frequency of the blocking oscillator are an oscilliscope and 1000 cycle signal generator. Sufficient blocking oscillator voltage can usually be obtained from the "B+" lead (Red lead to 4-pin connector) to operate the vertical amplifier of the oscilloscope. If sufficient voltage cannot be obtained from the red lead directly, connect a 10-ohm resistor in series with the red lead. An increased oscillator signal can be obtained from the supply side (receiver side) of the resistor. Be sure to remove the resistor after the frequency is set. With the 1000 cycle signal from the generator applied to the horizontal sweep amplifier of the oscilliscope, adjust the variable capacitor (C-201) for a single stable Lissajous figure similar to that shown in Fig. 12.

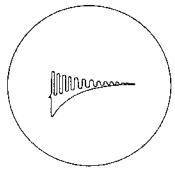


Fig. 12. Lissajous figure for 1000 cycle adjustment

HIGH VOLTAGE SUPPLY SERVICE HINTS

In the interests of safety, testing of this unit should be conducted, as much as possible, with the power supply turned off. If the defective component cannot be located in this manner, an operating voltage check should prove helpful. (See voltage chart Fig. 23.) These check points are accessible by removing the bottom cover of the unit, where under normal circumstances, no voltages in excess of those externally applied are present.

SYMPTOMS OF HIGH VOLTAGE SUPPLY FAILURE

Partial failure of sealed can -	1. Low H.V. output (10 to 17 KV) 2. Reduced picture brightness 3. Excessive sweep width and height 4. Inability to focus picture electrically
Complete failure of sealed can -	1. No. H.V. output 2. No picture 3. Excessive input current (70-90 ma) Normally 30 ma

NOTE - If symptoms are no picture and a high input current to the power supply from the receiver chassis supply, check to see that the blocking oscillator is functioning, i.e., a bias voltage of approx. -50 volts on the grid of the 6SR7 tube (V-201). (See Fig. 23)

ALIGNMENT PROCEDURE

The following alignment adjustments do not require the use of the projection tube. It is recommended that the 4-prong connector (PL-201 and SO-5) between the projection unit and receiver power supplies be disconnected to disable the high-voltage supply when making extensive alignment adjustments or doing general service work on the receiver circuits. If it is desirable to leave the units connected, set the BRIGHTNESS and CONTRAST controls at minimum to protect the projection tube.

CAUTION - The horizontal and vertical deflection output transformers should be loaded by the projection unit, therefore do not make alignment adjustments with the 8-prong connector (PL-202 and SO-4) disconnected.

EQUIPMENT REQUIRED

Signal generator covering 4 mc to 30 mc.
Signal generator covering 40 mc to 215 mc.
Electronic voltmeter
Two 150-ohm carbon resistors
One .01 mfd. 600 V. tubular paper condenser.

F-M SOUND CHANNEL I-F ALIGNMENT

1. Connect the low frequency signal generator output between the control grid (pin 1) of the 6AU6 1st VIDEO AMP. tube (V-9), and chassis ground.
2. Connect the electronic voltmeter between pin 7 of the 6AL5 FM DET. tube (V-16) and chassis ground.
3. With the signal generator (unmodulated) set at 4.5 mc, set the 4.5 MC LIMITER GRID ADJ. and FM DET. PRI. ADJ. for maximum d-c voltage as measured by the electronic voltmeter. Adjust the limiter grid coil (L-14) before adjusting the FM DET. TRANS. (T-1) primary. (See Fig. 13). Use just enough signal generator output to obtain approx. one volt at the electronic voltmeter.
4. Connect the electronic voltmeter across the 1000 mmf condenser (C-17) at the output of the f-m detector stage and adjust the FM DET. SEC. ADJ. of the f-m detector transformer (T-1) for the null.
5. Shift the frequency of the signal generator either side of 4.5 mc and touch up the FM DET. PRI. ADJ. for approximately equal peaks. Use just enough signal generator output to obtain one-volt peaks for best results.

I-F AMPLIFIER ALIGNMENT

1. Connect the electronic voltmeter across the 5600-ohm resistor (R-57) in the plate circuit of the 6AL5 VIDEO DET. tube (V-8). This resistor is located on the terminal strip between the 6AL5 VIDEO DET. tube (V-8) and the 6AU6 1st. VIDEO AMP tube (V-9).
2. Connect the high side of the low frequency signal generator directly to the grid of the OSC tube (V-3) (Pin 7 of the 12AT7 or pin 6 of the 6C4). Connect the generator ground to the frame of the tuning unit.
3. Set the channel selector at channel 2.
4. Set the signal generator output (unmodulated) to develop two volts at the electronic voltmeter and adjust the five i-f amplifier coils, according to the following chart, for maximum d-c voltage as measured by the electronic voltmeter. Readjust the signal generator output as required to maintain the two-volt potential at the electronic voltmeter.

IF AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment (Refer to Fig. 13.)	Stage Adjusted
25.8 mc	25.8 MC IF ADJ.	Mixer
22.3 mc	22.3 MC IF ADJ.	1st IF amp.
25.5 mc	25.5 MC IF ADJ.	2nd IF amp.
23.7 mc	23.7 MC IF ADJ.	3rd IF amp.
26.3 mc	26.3 MC IF ADJ.	Video detector

5. Check the i-f amplifier frequency response by tuning the signal generator from 21 mc through 26.25 mc. and observing the change in d-c voltage at the electronic voltmeter. If the signal generator output is set for an electronic voltmeter reading of 1.5 volts at the peak i-f response, the d-c voltage should not drop below one volt between the two peaks normally obtained with this i-f amplifier. If the response is unsatisfactory, repeat the procedure or try slight modifications of the recommended settings to obtain the desired response. Avoid resonating the coils with the iron core at the bottom end of the coil form. (Adjustment screw near limit of its travel.) Check the two carrier i-f responses, 21.75 mc and 26.25 mc. The 21.75 mc response will be approx. 20 db below the peak response (Approx. 0.15 volt) and the 26.25 mc response will fall approx. 6 db below the peak. (Approx. 0.4 volt). Refer to Fig. 14.

The average i-f amplifier sensitivity when feeding the signal generator output through the receiver in the above manner, will run approx. 800 to 5000 microvolts for the one-volt d-c peak measured at the 5600-ohm resistor (R-57). (Receiver's oscillator operating on channel 2.)

STATION CHANNEL ALIGNMENT

1. Due to the broad frequency response of the i-f amplifier, it is necessary to use a 24.5 mc signal generator or oscillator (unmodulated) as a beat frequency oscillator (BFO)

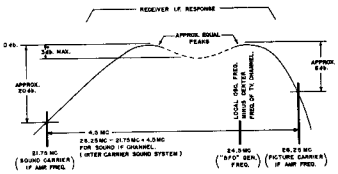


Fig. 14. IF amplifier response

in order to locate the center frequency of the i-f amplifier response for the correct local oscillator adjustment. The "BFO" generator should be loosely coupled by means of a wire from the generator output placed in close proximity to the 6AL5 VIDEO DET. tube (V-8).

2. Connect the high frequency signal generator output to the receiver's antenna transmission line through the two 150-ohm carbon resistors, one connected in each conductor of the transmission line.

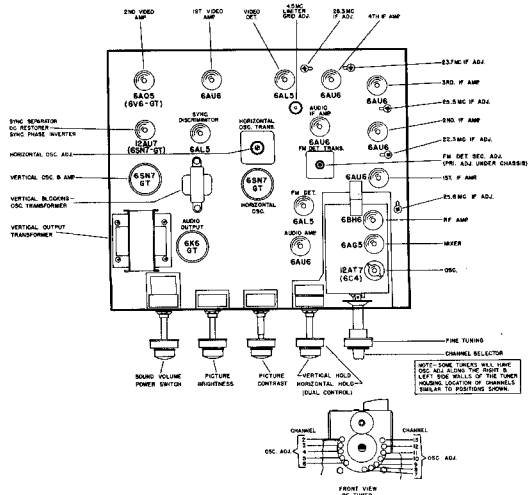


Fig. 13. Top view, alignment points

3. Each channel may be aligned independently without affecting the alignment of the others. Alignment of the individual channel is carried out as follows:

(a) Set the FINE TUNING control in the center of its range.
(b) Set the channel selector for the channel number to be aligned.
(c) Clip on an .01 mfd condenser between pin 1 of the 3NP4 projection tube (V-206) and pin 1 of the 6AU6 AUDIO AMP tube (V-17). The connection at pin 1 of the projection tube can be made at the terminal strip under the chassis provided for the socket leads of this tube.
(d) Set the "BFO" generator at 24.5 mc. (No modulation).
(e) Set the high frequency signal generator per the alignment chart (No modulation).
(f) Adjust the OSC. ADJ. screw, or shift turns on the oscillator coil corresponding to the channel being aligned for a rough audio beat note using the speaker as a detector. This ordinarily completes the alignment of any one channel, all others are to be treated in the same manner.

NOTE - Although the resonant circuits in the r-f amplifier and mixer stages of the tuning unit are not provided with adjustments and should not ordinarily require adjustment, they may be touched up by compressing or expanding the coils as required to bring up the overall gain. Adjust the coils for maximum d-c voltage as measured by the electronic voltmeter. (Voltmeter connected as for i-f alignment).

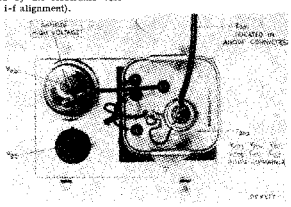


Fig. 17. Top view, high voltage power supply chassis, component location

CHANNEL ALIGNMENT CHART

Channel No.	Channel Freq. (mc)	H.F. Signal Generator Freq. (No modulation)	Channel No.	Channel Freq. (mc)	H.F. Signal Generator Freq. (No modulation)
2	54-60	57 mc	8	180-186	183 mc
3	60-66	63 mc	9	186-192	189 mc
4	66-72	69 mc	10	192-198	195 mc
5	76-82	79 mc	11	198-204	201 mc
6	82-88	85 mc	12	204-210	207 mc
7	174-180	177 mc	13	210-216	213 mc

The overall sensitivity for the receiver will run approximately 100 to 200 microvolts for one volt DC at resistor R-57 when measured in the above manner.

CARRIER vs IF FREQUENCY CHART

Channel No.	Channel Freq. (mc)	Picture Carrier Freq. (mc)	Sound Carrier Freq. (mc)	Receiver Osc. Freq. (mc)		Picture IF Freq. (mc)		Sound IF Freq. (mc)		Picture IF less Sound IF (mc)
2	54-60	55.25	59.75	*81.5	+81.5	*26.25	+25.25	*21.75	+21.75	4.5
3	60-66	61.25	65.75	87.5	87.5	26.25	26.25	21.75	21.75	4.5
4	66-72	67.25	71.75	93.5	93.5	26.25	26.25	21.75	21.75	4.5
5	76-82	77.25	81.75	103.5	103.5	26.25	26.25	21.75	21.75	4.5
6	82-88	83.25	87.75	109.5	109.5	26.25	26.25	21.75	21.75	4.5
7	174-180	175.25	179.75	152.5	201.5	22.75	26.25	27.25	21.75	4.5
8	180-186	181.25	185.75	158.5	207.5	22.75	26.25	27.25	21.75	4.5
9	186-192	187.25	191.75	164.5	213.5	22.75	26.25	27.25	21.75	4.5
10	192-198	193.25	197.75	170.5	219.5	22.75	26.25	27.25	21.75	4.5
11	198-204	199.25	203.75	176.5	225.5	22.75	26.25	27.25	21.75	4.5
12	204-210	205.25	209.75	182.5	231.5	22.75	26.25	27.25	21.75	4.5
13	210-216	211.25	215.75	188.5	237.5	22.75	26.25	27.25	21.75	4.5

* Oscillator frequency for tuners using type 12AT7 tube.
+ Oscillator frequency for tuners using type 6C4 tube.

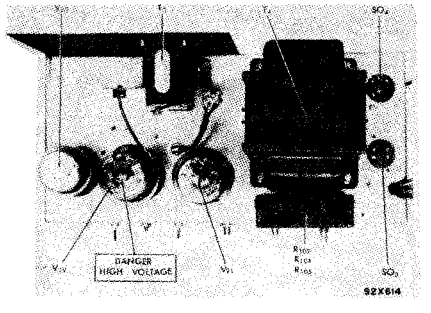


Fig. 16. Top view, receiver power supply chassis, component location

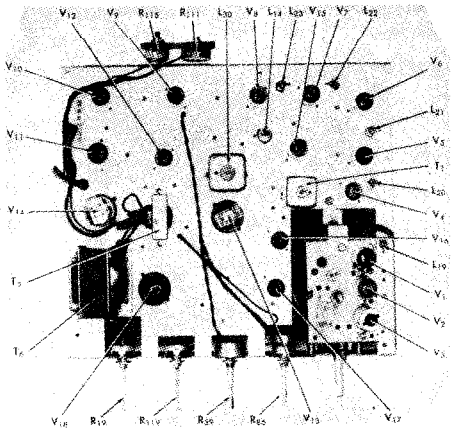


Fig. 15. Top view, receiver chassis, component location

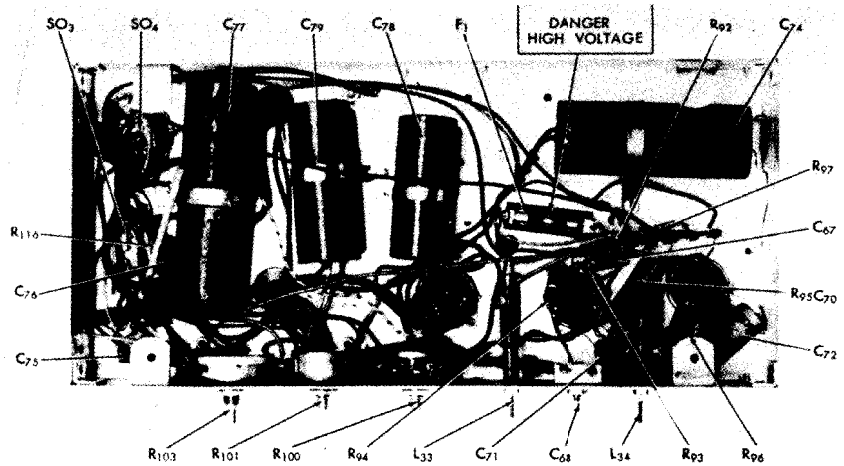


Fig. 19. Bottom view, receiver power supply chassis, component location

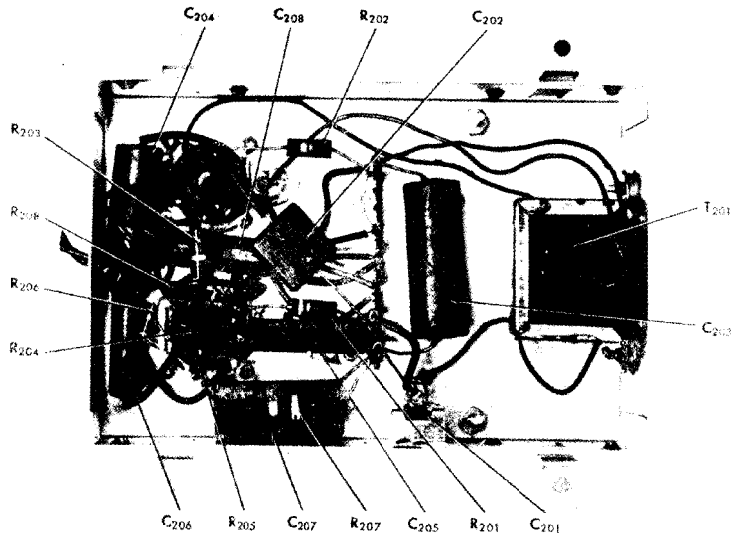


Fig. 20. Bottom view, high voltage power supply chassis, component location

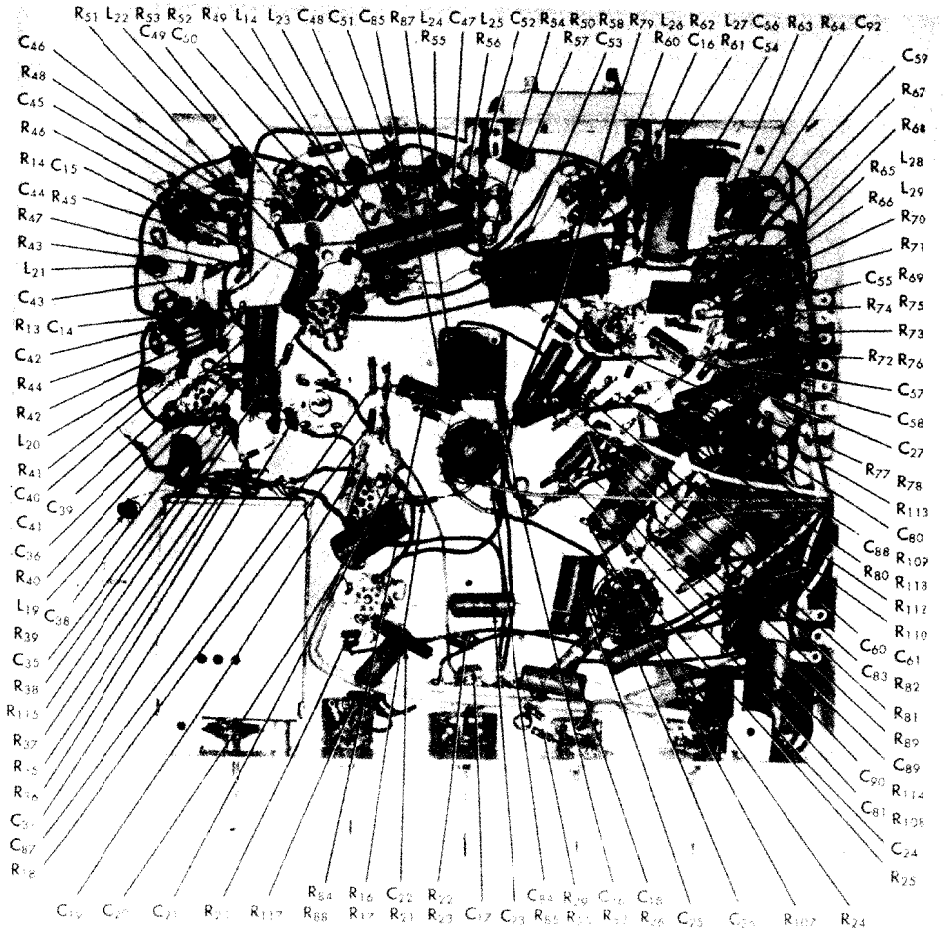
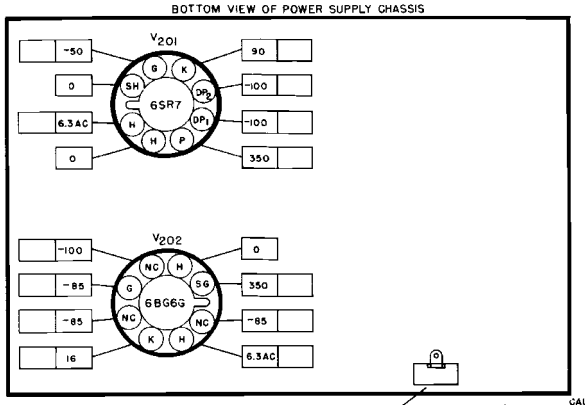
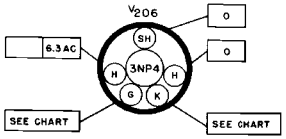


Fig. 18. Bottom view, receiver chassis, component location





PIN	CONTRAST MIN. BRIGHTNESS MAX.	CONTRAST MIN. BRIGHTNESS MIN.	BRIGHTNESS MIN. CONTRAST MAX.	BRIGHTNESS MIN. CONTRAST MIN.
K	10	100	94	100
G	6	6	54	6

READINGS VARY WITH CHANNEL NUMBER.
READINGS ARE AVERAGED.

CAUTION—SEE TEXT FOR MEASUREMENT OF POTENTIAL AT 2ND ANODE CAP.

Fig. 23. Tube socket voltage chart, H.V. power supply

NOTES—

1. SOCKET VIEWS ARE BOTTOM VIEWS.
2. ALL VOLTAGES ARE MEASURED BETWEEN TUBE SOCKET TERMINALS & CHASSIS.
3. ALL VOLTAGES SHOWN ARE DC UNLESS OTHERWISE SPECIFIED.
4. DC VOLTAGES SHOWN WERE MEASURED WITH AN ELECTRONIC VOLTMETER, AT NORMAL PICTURE CURRENT (90 MICRO—AMPS.)
5. "NC"—NO CONNECTION. VOLTAGE SHOWN FOR THIS TERMINAL ONLY WHEN TERMINAL IS USED AS A TIE LUG.
6. ☐ SPACE PROVIDED FOR SERVICE METER READINGS.

GENERAL CHARACTERISTICS
Type 3NP4
TRIODE PROJECTION TUBE

ELECTRICAL

Heater voltage	6.3 volts
Heater current	0.6 amp ± 10%
Focusing method	Electromagnetic
Deflection method	Electromagnetic
Maximum deflection angle	42 degrees
Phosphor	No. 4 aluminized
Fluorescence	White (Approx. 6200 ° K)
Persistence	Medium

INTERELECTRODE CAPACITANCES

Cathode to all others	7.75 mmf.
Grid to all others	14.5 mmf.
Ext. coating to anode	275 mmf min., 375 mmf max

MAXIMUM RATINGS

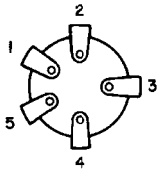
Anode voltage	25,500 volts DC ± 2 kv
Grid voltage (Negative bias)	125 volts DC
Grid voltage (Positive peak)	2 volts DC
*Max. heater to cathode voltage	175 volts DC

* With heater negative

TYPICAL OPERATING CONDITIONS

Anode voltage	24,000 volts DC
Anode current (Normal)	90 microamperes
Anode current (Peak)	150 microamperes
Grid voltage for visual extinction of unreflected focused spot	-65 volts DC ± 40%
Grid circuit resistance not to exceed	1.5 megohms

BASE CONNECTIONS



1. Grid . . . . . Red
2. Heater . . . . . Yellow
3. Ground . . . . . Blue
4. Heater. . . . . Black
5. Cathode. . . . . Green
   Anode . . . . . Side contact

Fig. 22. Base connections

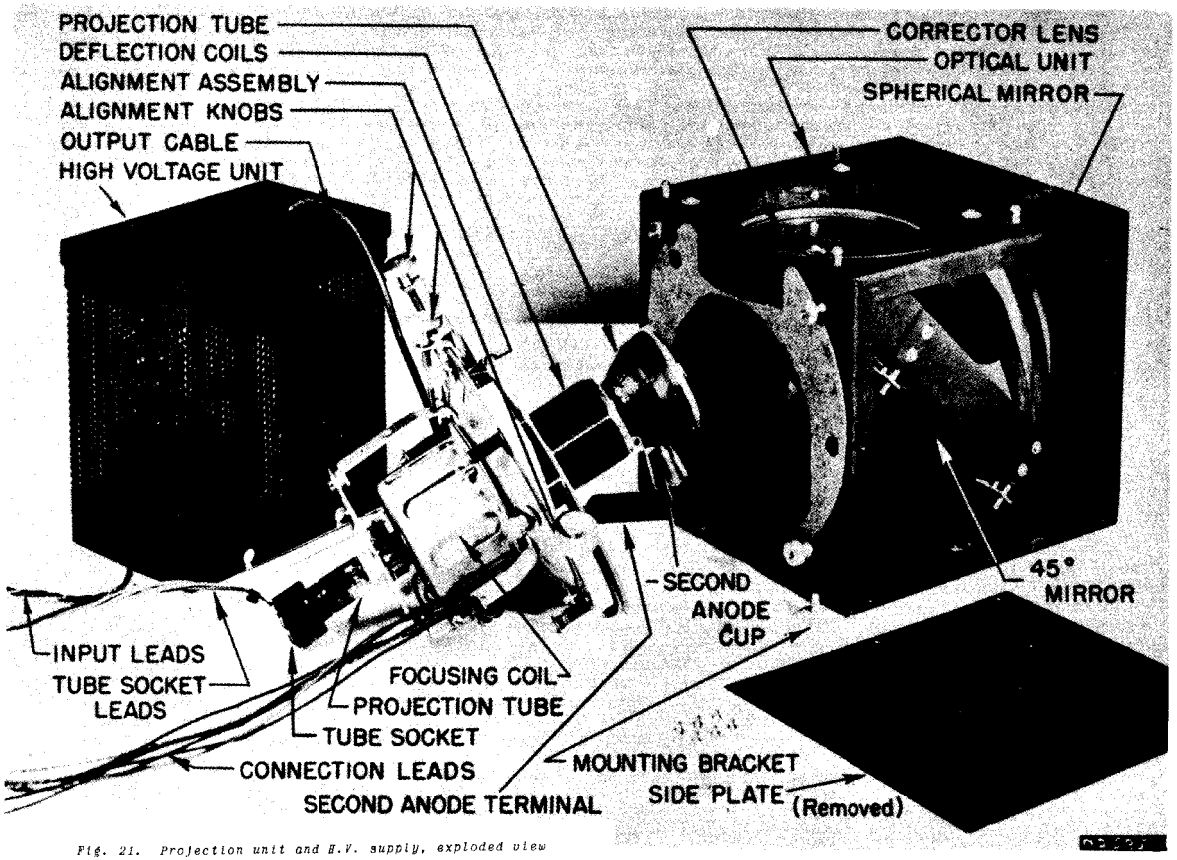


Fig. 21. Projection unit and H.V. supply, exploded view