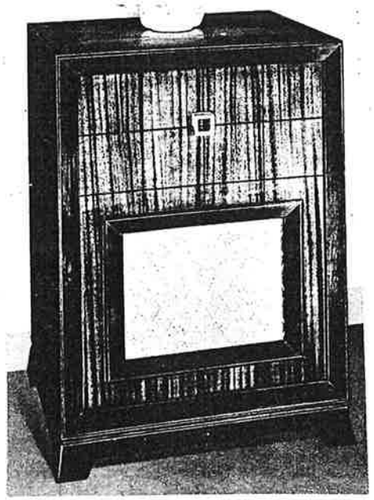
INDEX



Section 1.

GENERAL DESCRIPTION

1. **FACILITIES**—Emerson Model 609 is a console television receiver providing large, high-definition pictures by means of a compact projection unit. The unique cabinet design results in a simple optical system with wide-angle vision on a twelve by sixteen inch translucent screen.

The projection unit consists of two main units and incorporates many design features. A special kinescope is housed in an enclosed projection box which contains the deflection and focusing coils, and the various components of the optical system. A separate high-voltage supply of the pulse type supplies approximately 25 kilovolts to the kinescope.

A modified Schmidt optical system is used for projection of the image. The optical system is folded by a mirror contained in the top lid of the cabinet. The picture is projected on a screen which automatically falls into the correct viewing position when the receiver lid is raised.

The receiver is completely contained on one chassis except for the high-voltage and projection units, and is provided with eight operating controls. An intercarrier sound system is used for automatic synchronization of picture and sound. Automatic gain control, and automatic frequency control in the sync circuits, help provide clear, steady pictures. A special interlock circuit is provided which automatically protects the kinescope in the event of failure of the deflection circuits.

2. SPECIFICATIONS—

a. TUBE COMPLEMENTS: (Table I).

SYMBOL	TYPE	CIRCUIT FUNCTION
V1	6AU6	First I-F Amplifier
V2	6AU6	Second I-F Amplifier
V3	6AU6	Third I-F Amplifier
V4	6AU6	Fourth I-F Amplifier
V5	6AL5	Video Detector and A.G.C.
V6	6AU6	First Video Amplifier
V7	6AQ5	Second Video Amplifier
V8	12AU7	Video Output and D.C. Restorer
V9	12AU7	Sync Amplifier and Limiter
V10	6SN7GT	Sync Inverter and Hor. Control
V11	6AL5	Phase Detector (A.F.C.)
V12	6SN7GT	Horizontal Oscillator
V13	6BG6G	Horizontal Output
V14	5V4G	Horizontal Damper
V15	6SN7GT	Vertical Oscillator
V16	6K6GT	Vertical Output
V17	6AU6	Audio I-F Amplifier
V18	6AU6	Audio Limiter
V19	6S8GT	Discriminator and Audio Amp.
V20	6V6GT	Audio Power Output
V22	6J6	Converter and Oscillator
V23	6AG5	R-F Amplifier
V24	6SC7	Scanning Interlock Control
V25	5Y3GT	Low Voltage Rectifier
V26	6S[illegible]	H.V. Oscillator
V27	6B[illegible]-6G	H.V. Oscillator Amplifier
V28	3NP4	Kinescope
X29	Sel. Rect.	Low Voltage Rectifier (positive)
X30	Sel. Rect.	Low Voltage Rectifier (positive)
X31	Sel. Rect.	Low Voltage Rectifier (negative)
X32	Sel. Rect.	Low Voltage Rectifier (negative)
V34	EY51	High Voltage Rectifier
V35	EY51	High Voltage Rectifier
V36	EY51	High Voltage Rectifier

b. RECEIVER CHARACTERISTICS: (Table II).

ITEM	DESCRIPTION
Voltage Rating	105-125 volts, 60 cycles a.c.
Power Consumption	300 Watts
Current Drain	2.6 amps. at 117 volts a.c.
Channel Selection	Twelve-position rotary turret
Frequency Range	54-88 MC., 174-216 MC.
Intermediate Frequencies	Video—25.75 M.C.; Audio—4.5 MC.
Input Impedance	300 ohms, balanced
Video Band Width	4 MC.
Kinescope Anode Voltage	25 kilovolts
Chassis Model	120084B

TUBE LOCATIONS

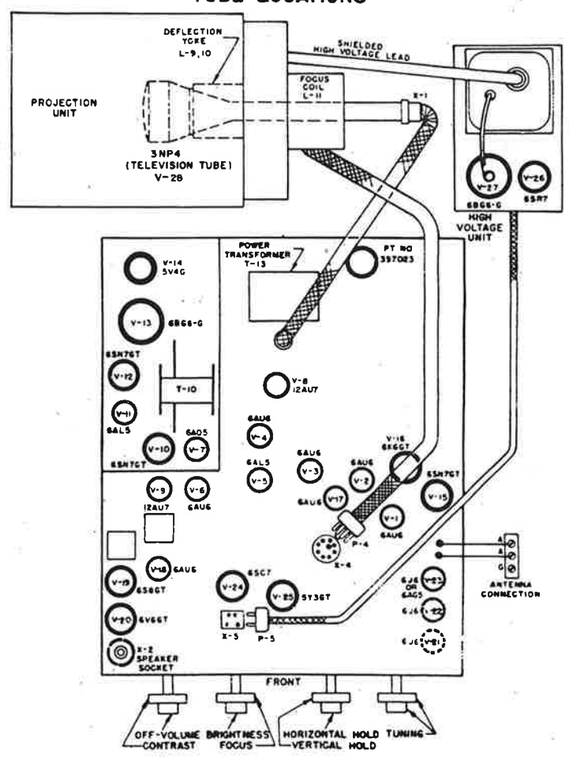
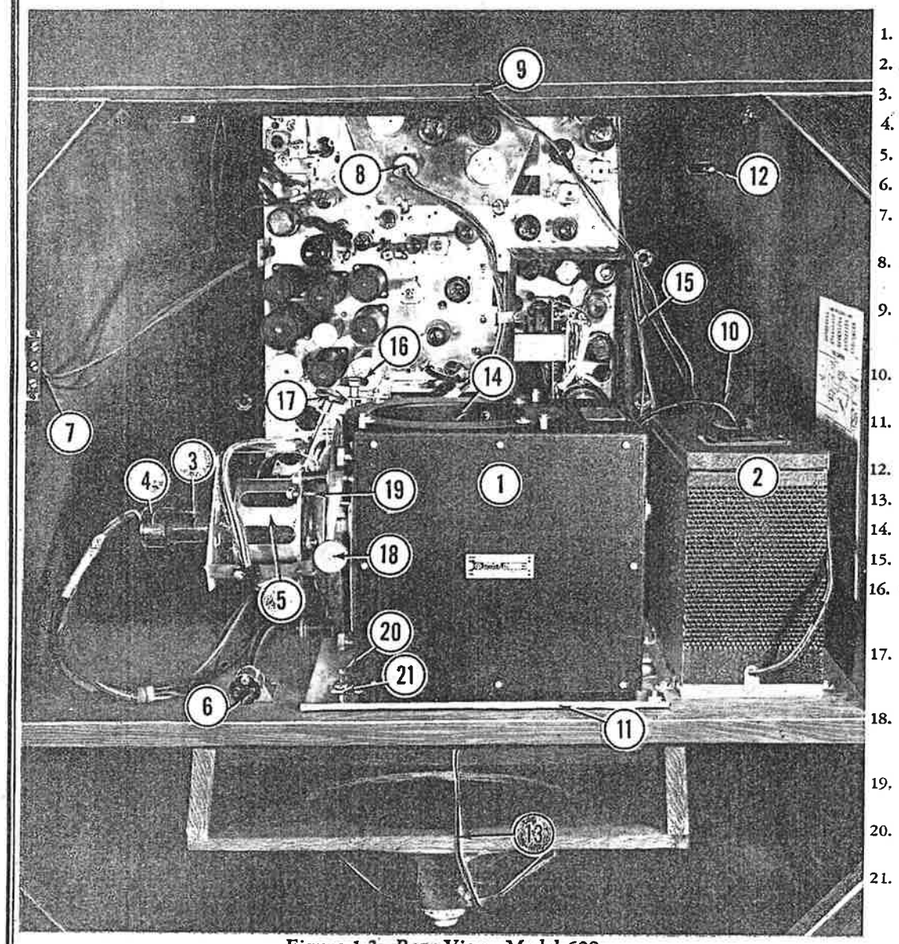


Figure 1-1—Tube Location Diagram—Model 609

©John F. Rider



1. Optical Box
2. High Voltage Unit
3. Kinescope, Type 3NP4
4. Kinescope Socket
5. Focus Coil
6. A.C. Interlock Plug
7. Antenna Terminal Strip
8. Kinescope Deflection Yoke Cable
9. Low-Voltage Power Supply Cable for High-Voltage Unit
10. High-Voltage Kinescope Cable
11. Optical Box Mounting Plate
12. Front Panel Bolt
13. Pilot-light Cable
14. Corrector Lens
15. Speaker Cable
16. Overall Optical Focus Adjustment (Mechanical Focus)
17. Horizontal Focus Adjustment (Mechanical Focus)
18. Vertical Focus Adjustment (Mechanical Focus)
19. Focus Coil Retainer Screw
20. Optical Box Tilt Screw
21. Optical Box Locking Screw

Figure 1-2—Rear View—Model 609

955220

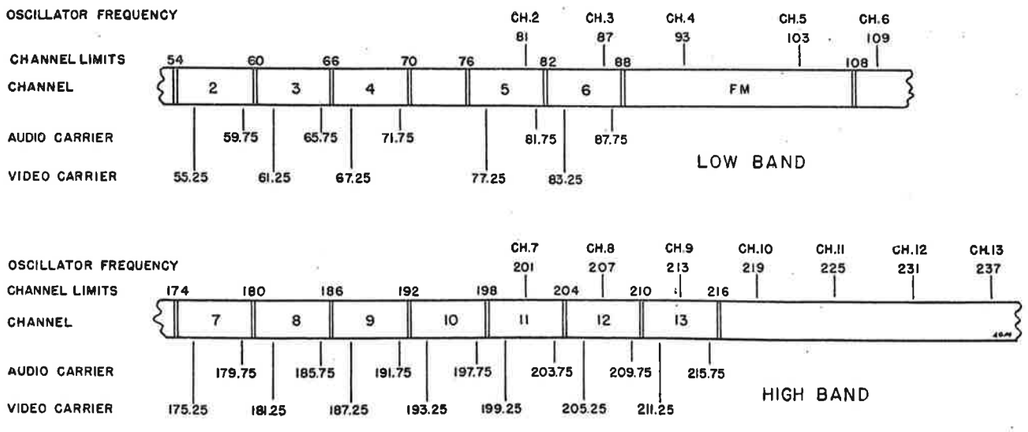


Figure 1-3—Video, Audio, and Oscillator Frequencies

1. PREPARATION FOR INSTALLATION — Model 609 is shipped with the kinescope packed separately. The receiver is contained in a cardboard carton and is bolted at the bottom to a framing support. To unpack, open the carton and carefully remove the packing material and tube container. Remove the framing bolts and lift off the support and carton.

2. KINESCOPE INSTALLATION, ADJUSTMENT, AND REPLACEMENT—The installation of the kinescope must be done following the procedure outlined below, for satisfactory operation. The position of the optical box in the cabinet has been set at the factory. Do not disturb or move the adjustment screws which fasten the box to the cabinet, unless replacement is necessary. Remove the back of the cabinet and proceed as follows:

a. TUBE INSTALLATION:

1) (See figure 2-2). Loosen the four thumb nuts marked "M" which hold the complete assembly (tailpiece) to the optical box.
2) Rotate the complete assembly to the left (counterclockwise).
3) Carefully withdraw the assembly from the box.
4) (See figure 2-3). Loosen the screw on the clamp marked "C" by inserting a screw-driver from the side, and the two screws marked "T" which center the neck of the tube in the opening of the triangle-shaped end plate.
5) Carefully remove the kinescope, light shield, and rubber band from the container. Position the light shield over the top of the tube, locating it over the two lugs projecting from the surface. Fasten it in place with the rubber band.
6) Insert the tube into the assembly, with the high-voltage terminal cup facing down. Carefully move the tube up against the edge of the deflection yoke. Raise the edge of the light shield slightly so that the two springs marked "S" press against the aquadag coating and are under the shield. The springs must make good contact with the coating.

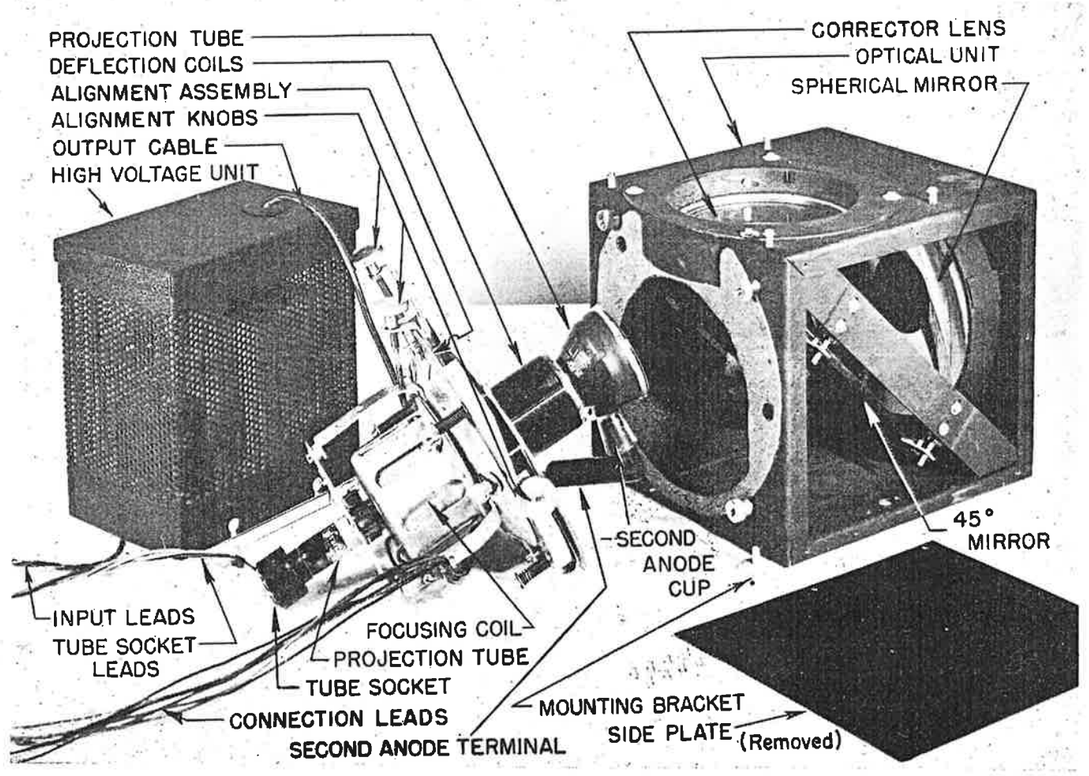


Figure 2-1—Optical System Components

©John F. Rider

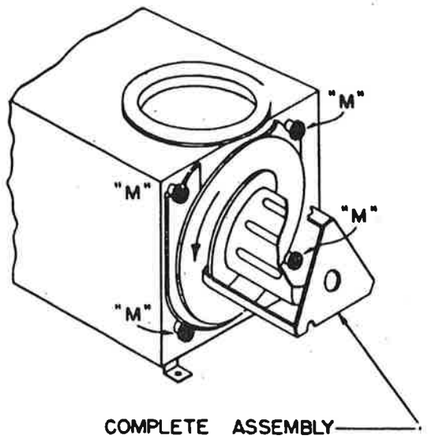


Figure 2-2—Removal of Tailpiece Assembly

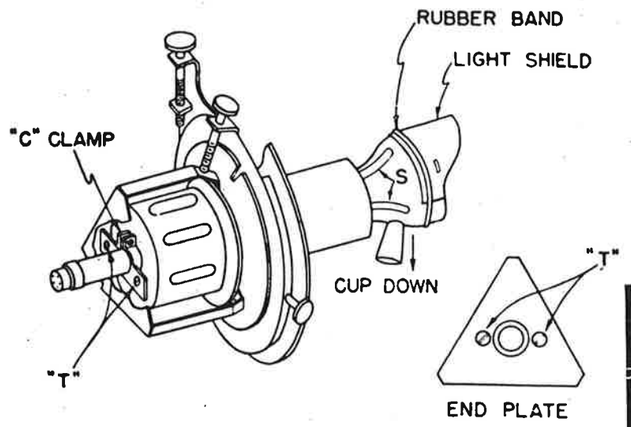


Figure 2-3—Kinescope Insertion

7) Tighten the "C" screw of the tube clamps, while holding the tube firmly in the deflection yoke. Do not exert too great a force.

8) Make certain that the neck of the kinescope is centered in the opening of the end plate and tighten the screws marked "T".

CAUTION

Never hold the tailpiece assembly by the deflection yoke while installing the tube.

9) (See figure 2-4). Insert the high-voltage connector in the anode cup on the tube. Push the spring contact on the cable into the cup as far as it will go, to make proper contact.

10) Remove the bakelite cable clamp at the edge of the assembly plate and place the anode lead in the slot provided. Replace the clamp. Do not allow any slack on the yoke side of the assembly plate.

11) Using extreme care, insert the complete assembly into the optical box. Be sure that the position of the light shield is not disturbed and that the tube clears the opening in the 45° plane mirror.

CAUTION

Since the edges of the mirror are easily chipped, look down through the corrector lens at the top of the box to see that the shield and tube clear the mirror opening during assembly.

12) Rotate the tailpiece assembly to the right (clockwise) until the slots in the assembly plate engage the four screws "M". Keep the bottom of the endplate parallel to the bottom of the box and tighten the four thumbnuts.

13) Hold the neck of the kinescope, to avoid disturbing its position, and place the tube socket in position over the end of the tube.

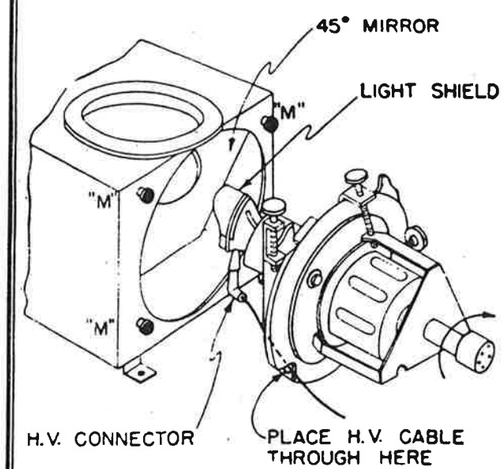


Figure 2-4—Optical Box Assembly

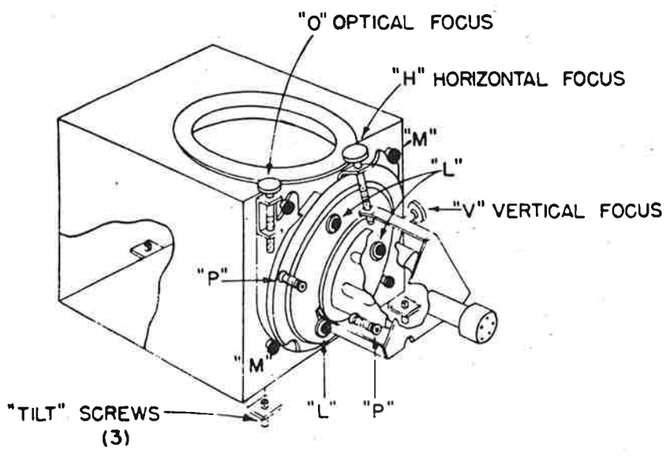


Figure 2-5—Mechanical Adjustments

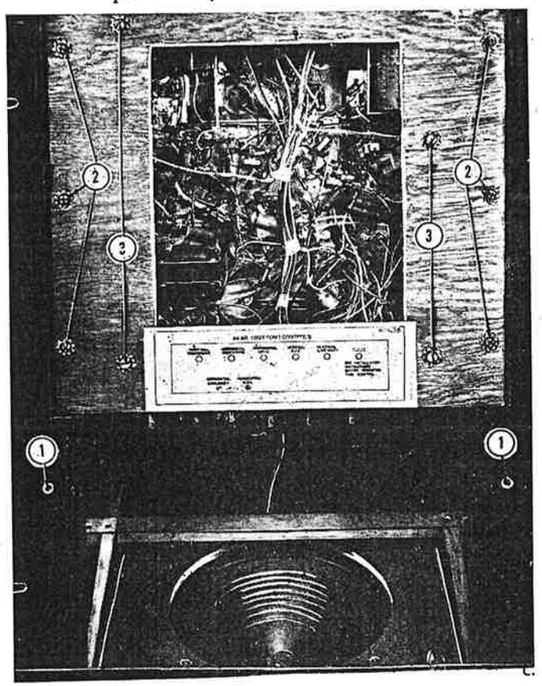
b. ELECTRICAL ADJUSTMENT:

1) Connect the receiver to an a.c. power outlet by means of an adaptor cord, so that adjustments may be made to the optical box.

2) Connect an antenna to the receiver. Raise the projection screen into viewing position and turn on the receiver.

WARNING

Do not operate the kinescope out of the projection unit as the high voltage lead carries a potential of approximately 25 KV. Extreme care should be exercised when working on this unit. Before handling the kinescope be sure to discharge the high-voltage anode to eliminate residual charges.



1. Speaker Baffle-Board Screws: (Remove these screws to permit speaker and baffle board to drop.)
2. Chassis Mounting-Board Screws: (To remove chassis from cabinet, remove these six screws.)
3. Chassis Mounting Screws: (These screws secure the chassis to the chassis mounting-board. Do not remove these screws.)

Figure 2-6—Location of Electrical Adjustments

3) Remove the two wing nuts which fasten the front panel in place. These are reached from the rear of the cabinet and permit the panel to swing free on its hinges. The electrical adjustments at the bottom of the chassis can then be reached from the front. (See figure 2-6 for the location and figure 2-7 for the function of these controls).

4) Tune the receiver to a transmitted test pattern, following the procedure outlined in Section III. Adjust the top panel controls to obtain a properly focused pattern.

5) Do not readjust the electrical controls at the bottom of the chassis unless the chassis has been serviced or realigned, as these controls have initially been properly adjusted at the factory.

6) Note that two electrical focus controls are provided (R55 and R23). After tuning in the test pattern, center the top panel focus control, then readjust the control at the bottom of the chassis for best overall electrical focus.

NOTE

The optimum position of the electrical focus control may produce an indistinct pattern until the mechanical adjustment is completed.

7) In the following step, view the image by looking down into the top of the optical box. Set the BRIGHTNESS control to the minimum position which will produce a clear pattern. Protect the eyes by using dark glasses, if desired.

8) Adjust the size of the pattern by means of the HOR. and VERT. SIZE controls and center the pattern by means of the Hor. and Vert. Centering controls, if necessary, so that each corner of the pattern just touches the edge of the face of the kinescope.

MECHANICAL ADJUSTMENT:

1) (See figure 2-5). Adjust the overall optical focus control "O" to bring the center of the pattern, viewed on the screen, into focus.

2) Loosen the four thumbscrews "M" and level the pattern on the screen by rotating the tailpiece assembly slightly as required. Tighten the screws after positioning.

3) If the optical box has been replaced, center the pattern on the viewing screen by means of the three "TILT" screws.

603238

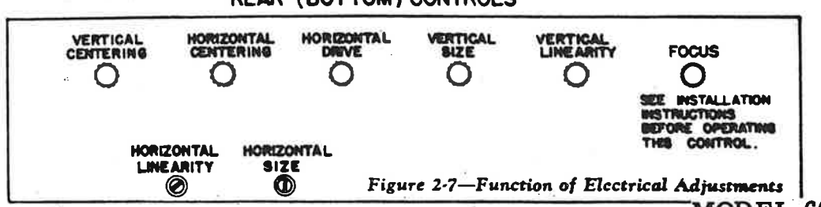


Figure 2-7—Function of Electrical Adjustments

©John F. Rider

NOTE

The mechanical centering adjustments are entirely distinct from the electrical adjustments. The latter controls center and adjust the pattern on the face of the kinescope and must always be done first. They are checked by viewing the image in the optical box. The electrical adjustments are done in the same manner as for a direct-view receiver. The mechanical adjustments center the image produced by the box properly on the viewing screen and have a similar effect to the deflection yoke and focus coil adjustments in a direct-view receiver.

4) With the pattern centered and adjusted for size on the tube face, and the optical box adjusted to center the image on the screen, an overlap of from ¼ to ½ inch will be produced on the viewing screen.

5) To recheck the overall optical focus, slightly loosen the two spring-loaded nuts marked "P" and the three nuts marked "N". Adjust the overall focus thumbscrew "O" to focus the center of the raster. Turn down the CONTRAST control on the top panel and focus by viewing the raster lines on the screen.

5) Adjust the horizontal focus thumbscrew "H" until both sides of the raster are in focus equally well on the screen.

7) Adjust the vertical focus thumbscrew "V" so that both top and bottom of the raster focus equally well.

8) Recheck the overall optical adjustment "O" and repeat steps (6) and (7) if necessary, until the raster is perfectly focused.

9) Tighten the five nuts marked "P" and "L".

10) Using a soft cloth, clean the surface of the corrector lens of any dust or marks.

NOTE

No ion trap is provided or needed with the type 3NP4 kinescope.

d. KINESCOPE REPLACEMENT:

1) Remove the line cord plug from the outlet. Remove the kinescope socket and loosen the four thumbnuts marked "M".

2) Carefully withdraw the complete tailpiece assembly, making certain that the light shield and kinescope clear the 45° mirror.

3) Remove the anode contact and discharge the kinescope to ground with an insulated probe.

4) Pull out the cable clamp and remove the high voltage lead.

5) Loosen the "C" clamp screw and two screws marked "T". Withdraw the kinescope from the assembly.

6) Follow the procedure outlined in paragraph 2. a., b., and c. for tube replacement and adjustment.

3. INSTALLATION — Electrical and mechanical adjustment of the chassis controls and optical box completes the initial receiver preparation.

a. RECEIVER:

1) Close the front panel and replace the two wing-

2) Replace the back of the cabinet and fold the viewing screen.

3) Locate the set to provide maximum visibility and where a minimum of incident light will fall directly on the screen. Consider the maximum viewing angle and the seating arrangement of the room. Provide for access to a power outlet and for connection with the transmission line.

4) Allow adequate space between the cabinet and adjacent wall, for ventilation.

b. ANTENNA: The antenna and transmission line to the receiver are the most important factors in securing good reception. Model 609 is designed for use with a balanced 300-ohm transmission line. The antenna should be installed following standard practice and may be a single dipole, dipole with reflector, or an array using a combination of elements. (For best results, use Emerson high-gain Tele-ray antennas). The transmission line must be firmly held in place away from mast and walls by means of stand-off insulators. Complete the line connection to the terminal strip at the rear of the cabinet.

c. OPERATION: After completion of the antenna and power connections, check the operation of the receiver, as outlined in Section III.

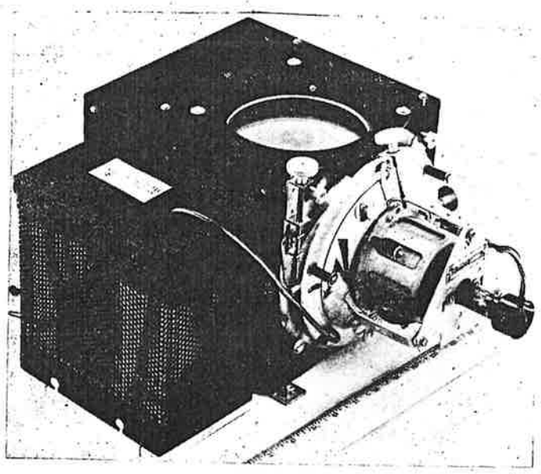


Figure 2-8—Assembled Projection Unit

1. OPERATING CONTROLS—To position the screen for viewing, lift the top lid as far as it will move. The viewing screen will be automatically raised to a vertical position and operate the latch button (interlock) located at the top center of the cabinet. The operating controls, consisting of four dual-controls, are located at the top of the cabinet. The operation and function of each control is indicated in figure 3-1.

2. OPERATION—Initial tuning of Model 609 requires operation of the various controls as indicated.

a. STATION SELECTION:

1) Turn the OFF-VOLUME control clockwise approximately a quarter turn. This turns the receiver on and sets the sound volume to a reasonable level.

2) Set the SELECTOR control so that the desired channel number is indicated on the edge of the control. The control may be rotated in either direction.

3) Allow approximately 15 seconds for warm-up. (This time is necessary to allow the tubes to attain the proper temperature for operation).

4) If the desired station is broadcasting, music or speech will be heard. Adjust the TUNING control for best picture quality. Readjust the VOLUME for desired sound level.

5) Rotate the CONTRAST control to its extreme counterclockwise position.

6) Rotate the BRIGHTNESS control to the maximum counter-clockwise position and adjust slowly clockwise until light is just visible on the screen, then rotate counter-clockwise until light just disappears.

7) Adjust CONTRAST control carefully until a picture appears on the screen and desired contrast is attained.

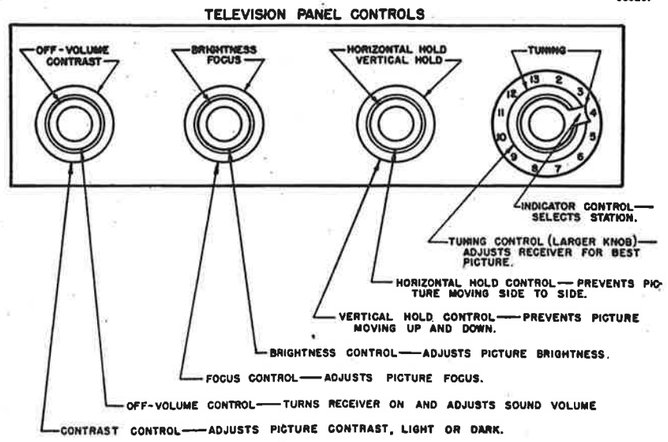


Figure 3-1—Operating Controls

8) If the picture moves vertically or horizontally, make the adjustment indicated in steps 9 and/or 10.

9) Adjust the VERTICAL HOLD control until the picture stops moving up or down.

10) Adjust the HORIZONTAL HOLD control until the picture stops moving from side to side.

11) Readjust the CONTRAST control until the desired picture intensity is obtained. It may be necessary to readjust the BRIGHTNESS control slightly at the same time for optimum brilliance.

12) Adjust the FOCUS control for sharpest picture.

CAUTION:

Do not operate the CONTRAST control at too high a level as this will cause the focus to vary with changes in camera scenes.

13) After the receiver has been operating for some time, it may be necessary to readjust the TUNING control slightly for best picture quality.

b. CHANGING STATION DURING OPERATION:

1) Set the SELECTOR control to the proper channel number.

2) Readjust the TUNING control if necessary to obtain best picture quality.

3) Readjust the CONTRAST control slowly until the desired picture quality is obtained.

4) Readjust VOLUME to suitable level.

5) Readjust BRIGHTNESS control for desired brilliancy.

c. TURNING RECEIVER OFF:

1) Turn the VOLUME control to the extreme counterclockwise position. A click will be heard, indicating that the receiver is turned off.

2) Press down on the latch button and push the screen back, to close the lid.

d. CHECKING OPERATION: The use of automatic frequency control in the sync circuits of the receiver makes readjustments of the VERTICAL HOLD and HORIZONTAL HOLD controls infrequent provided the control settings for proper operation are not disturbed. The following figures indicate correct and incorrect adjustment of the various controls. Proper operation may be obtained by operation of the associated control.

©John F. Rider

Section 4.

CIRCUIT DESCRIPTION

1. **GENERAL**—Model 609 uses a thirty tube chassis, including the projection kinescope and associated tubes. Four selenium rectifiers are used for the main chassis low-voltage power supply; a second low-voltage power supply is used in conjunction with the pulse-type high-voltage power supply for the kinescope.

The receiver employs the intercarrier method of sound separation, with the 4.5 MC. audio i-f produced by heterodyning the video and audio carriers at the video detector. A special scanning interlock circuit is provided for protection of the kinescope in the event of failure of the deflection circuits. The various stages are indicated in the functional block diagram, figure 4-1.

The projection system consists of a completely enclosed optical box, which contains the kinescope, optical system and deflection yoke; an enclosed high-voltage power supply unit; and a front-surfaced mirror and viewing screen. The arrangement of these components is illustrated in figure 4-2.

2. **PROJECTION SYSTEM**—The optical system employed produces a large projected picture, 12 by 16 inches, on the translucent viewing screen. A type 3NP4 kinescope is used with a very small spot and fine grain screen, resulting in a picture of high resolution and brightness which may be viewed from a considerable angle without loss in brilliancy. The various parts of the projection unit are shown in figure 2-1.

a. OPTICAL SYSTEM: A modified Schmidt system is used for projection to produce an overall magnification of about nine times. The projection-box contains the kinescope, a concave mirror, a 45° plane mirror, and a corrector lens. The light from the 3NP4 is gathered by the concave mirror, reflected to the 45° mirror, and projected through the corrector lens to the cabinet mirror contained in the lid. The front-surfaced cabinet mirror reflects the image on the translucent screen which unfolds into viewing position when the lid is raised. The image is in focus on the screen at a distance of approximately 32 inches from the corrector lens.

The elements of the optical system, including the concave mirror, 45° mirror, and corrector lens, are carefully aligned and are rigidly held in place by the optical box. They do not require any adjustment. Mechanical adjustments are provided for focusing, and for vertical and horizontal positioning.

b. KINESCOPE: The special kinescope, type 3NP4, operates at 25 kilovolts and its provided with a glass cup surrounding the second anode contact. A special optical glass coated with aluminum-backed phosphor to increase light output and eliminate ion spots, is used for the face of the tube. No ion trap is required as a result.

The second anode coating covers most of the inside of the cone. The outside coating is grounded and the resultant capacity is used as the final filter for the high-voltage supply. Electromagnetic deflection and focusing are used; the deflection yoke is inside the projection box while the focusing coil is on the outside. A special five-prong tube socket is used with the kinescope.

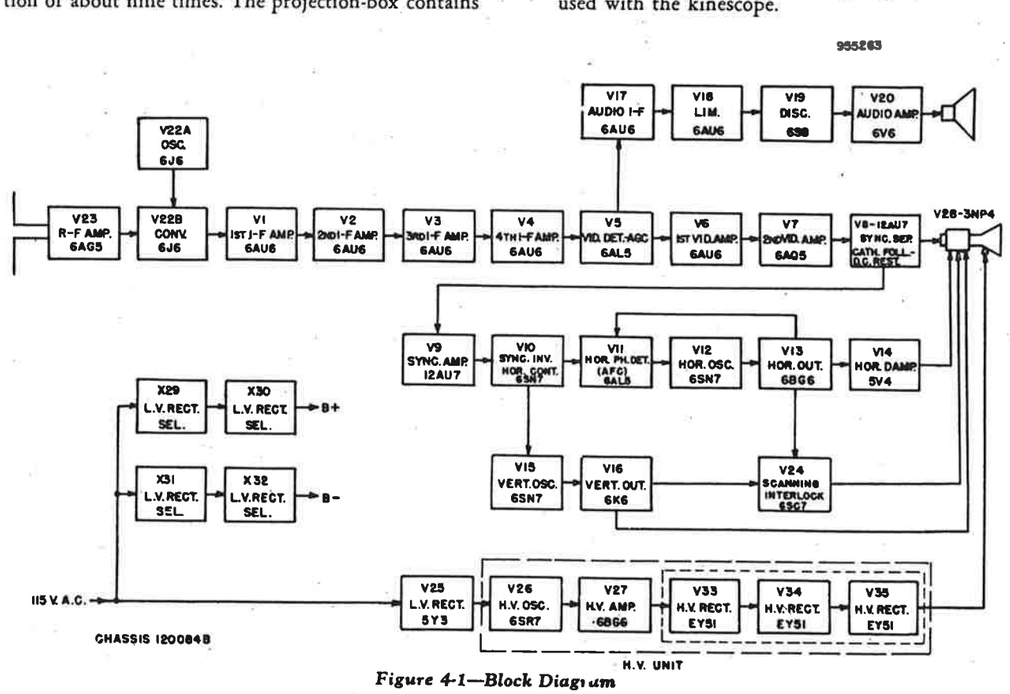


Figure 4-1—Block Diagram

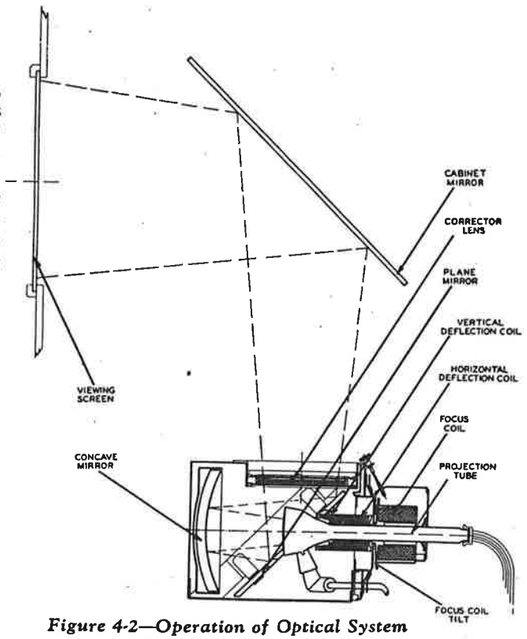


Figure 4-2—Operation of Optical System

c. HIGH-VOLTAGE POWER SUPPLY: The 25 kilovolt second anode voltage is developed by the high-voltage pulse-type power supply, independently of the horizontal sweep circuits. Radiation interference is eliminated by special shielding and circuit design.

The high-voltage chassis contains a type 6SR7 and a type 6BG6G, together with the circuit components and a sealed transformer unit. The triode section of the 6SR7 (V26) acts as a one kilocycle blocking oscillator feeding the grid of the 6BG6G (V27) which is biased almost to cut-off by R207. The one kc. plate current pulses of the 6BG6G go through part of the primary of the sealed transformer, which is tuned to 25 kc. The resulting damped oscillations are about 8½ kilovolts and are applied to three special rectifiers, type EY51, connected in a tripler circuit to produce an output of about 25 kilovolts. The rectifier heaters are supplied by extra secondary windings on the high-voltage transformer. The sealed transformer assembly is oil filled and contains the transformer, rectifiers, and high-voltage condensers.

An extra winding on the transformer supplies a feedback voltage to the diode section of the 6SR7, where it is rectified and used to automatically regulate the control-grid bias of the 6BG6G. This controls the peak plate current through the transformer and improves the regulation.

Power to the high-voltage chassis is supplied by a separate low-voltage supply using a conventional transformer and full-wave rectifier, type 5Y3GT (V25).

d. DEFLECTION SYSTEM: The mounting and alignment assembly of the projection box includes the deflection yoke and focus coil. The conical section of kinescope is seated in the deflection yoke and the tube is held in place by the clamp attached to the assembly. The focus coil can be tilted with respect to the axis of the tube by an adjustment knob, for mechanical centering and focusing. Vertical and horizontal adjustments are also provided to permit rapid and precise adjustment of the projected picture for sharp optical focus. Manipulation of these controls is required only when the kinescope is installed or replaced. The assembled projection unit is dustproof to protect the optical elements.

3. **TUNER**—The r-f unit constitutes a separate sub-chassis of the receiver. This sub-chassis contains the r-f amplifier, converter, and oscillator stages. The channel switch, fine-tuning control, tuned circuits, and first video i-f transformer are also contained on this chassis. Tuning and tracking adjustments for all twelve channels currently in use are provided. The tuner serves to select and amplify the desired video and audio frequencies and convert them to the carrier i-f frequencies of 25.75 MC. for video and 21.25 MC. for audio. No separation of these two intermediate frequencies is made, and the complete signal is fed to the first video i-f stage.

The tuner uses a rotary turret carrying individual coils for each tuned circuit, for each channel setting. A type 6AG5 (V22) serves as the r-f amplifier and a type 6J6 (V21) as the converter and oscillator. The r-f amplifier is a wideband, tuned stage whose output is inductively coupled to the converter (V21A). The oscillator (V21B) operates in a Colpitts type circuit. Individual slugs provide for alignment and tracking of the various channels. A variable-dielectric type of condenser is used for fine tuning of the oscillator. The output of the converter (V21A) is connected to double-tuned i-f transformer T1 (L7 and L9).

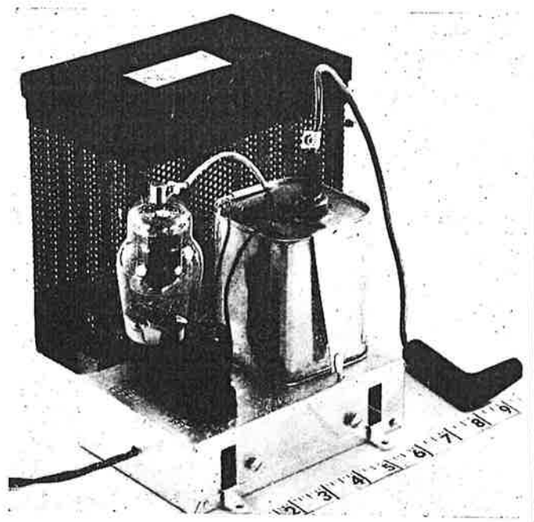


Figure 4-3—High Voltage Unit

©John F. Rider

4. VIDEO SECTION—The video section consists of the following stages: video i-f; video detector and automatic gain control; video amplifier and d.c. restorer.

a. VIDEO I-F: Both the 25.75 MC. video carrier and 21.75 MC. audio carrier are amplified by the wideband four-stage i-f amplifier. The five tuned circuits are peaked at different frequencies, forming a stagger-tuned system of relatively flat overall response to produce the required band-pass.

Transformers T1, T2, and T3 are double-tuned while T4 and T5 are single-tuned units. Both T2 and T3 contain 21.25 MC. sound traps which are tuned to minimize the audio carrier i-f. The audio level is maintained just below the point of interference with the video i-f. However, the audio i-f is not completely rejected as the audio signal is recovered in the video detector by heterodyning with the video i-f. The 4.5 MC. beat between the video and audio intermediate frequencies is obtained from the tuned circuit consisting of L4 and C79 and is fed to the first audio i-f amplifier (V17).

b. VIDEO DETECTOR AND A.G.C.: A type 6AL5 (V5) is used as the video detector and A.G.C. The first diode section (V5A) rectifies the negative portion of the video i-f. The resultant signal is coupled through peaking coil L3 to the grid of the first video amplifier (V6). The signal level is determined by the setting of CONTRAST control R19.

The other diode section (V5B) acts as the automatic gain control and develops a delayed negative A.G.C. voltage which is used to bias the first three video i-f stages.

c. VIDEO AMPLIFIER AND D.C. RESTORER: The video amplifier consists of two wideband stages using type 6AU6 and 6AQ5 tubes (V6 and V7), followed by a cathode follower (V8A). The cathode follower is necessary in order to prevent loading of the video amplifier by the capacitance of the long kinescope grid lead between the chassis and picture tube.

The output of the video detector (V5A) contains both a.c. and d.c. components of the video signal, as well as the blanking and sync pulses. Since the video amplifiers will not pass the d.c. component of the video signal, the background level of the picture will vary. The d.c. restorer (V8B) develops a bias voltage across R28 which varies with the average video signal level. This bias voltage is fed to the grid of the kinescope, thus maintaining the proper brightness level.

5. DEFLECTION SECTION — The sync and sweep stages produce and control the deflection of the electron beam in the kinescope. The horizontal sweep circuits incorporate a horizontal phase detector (sync discriminator) to maintain automatic sync with the horizontal pulses of the video signal. A scanning interlock circuit is provided to protect the kinescope in the event of failure of the sweep circuits. This circuit is required since the operation of the high-voltage power supply circuit is independent of the operation of the sweep circuits.

a. SYNC CIRCUITS: The output of the video amplifier (V7), complete with sync pulses, is coupled through C20 and R26 to the second triode section of a type 12AU7 (V8B) which acts as the sync separator as well as d.c. restorer. The sync pulses are fed through C22 to the first and second sync amplifiers (V9A and V9B). The amplified sync pulses are coupled through C54 to the sync inverter, a type 6SN7 (V10A), which further amplifies the pulses. The output of V10A is connected through C67 to the integrating network of the vertical oscillator (V15), consisting of R91, C69, R92, and C70. The integrated output of the vertical sync pulses thus controls the lock-in frequency of V15. The output of V10A also feeds the horizontal phase detector, (V11), through C53.

b. HORIZONTAL SWEEP: The horizontal deflection circuits contain an automatic frequency stabilizing arrangement which improves stability and ease of operation. The sync phase inverter (V10A) amplifies the horizontal sync pulses and feeds them to the horizontal phase detector (V11). At the same time, V11 receives voltages fed back from the horizontal output tube (V13) through C58. Any phase shift between the horizontal sync pulses and the horizontal oscillator signal will cause the input voltage applied to one diode section of V11 to differ from that of the other and result in a d.c. bias voltage on the grid of V10A. This bias voltage will be proportional to the phase displacement between the incoming sync pulses and the horizontal oscillator voltage and of a polarity determined by the lead or lag of the oscillator frequency. The plate resistance of V10A is part of the bias network of the grid circuit of the horizontal oscillator (V12). The output of the phase detector (V11) will thus synchronize the oscillator to the horizontal pulses of the video signal.

The horizontal blocking oscillator (V12) operates at a frequency determined by C57, R76, R75, and the plate resistance of V10A. The horizontal sync pulses cause V12 to lock in at the sync frequency when the HORIZONTAL HOLD control, R75, is properly adjusted. The output of V12 is fed through C60 to the horizontal output tube (V13). The signal level to the horizontal output tube is adjusted by the HORIZONTAL DRIVE control, R120.

V13 supplies the required driving power for the horizontal deflection coil, L11. The output of V13 is coupled to the horizontal deflection coil through transformer T10. A portion of the output transformer is shunted by HORIZONTAL SIZE control L8. By varying the inductance of L8, the horizontal sweep current may be controlled.

The horizontal damper tube (V14) acts to damp out oscillations which occur over part of the horizontal scanning cycle. HORIZONTAL LINEARITY control, L9, helps provide a linear trace.

c. VERTICAL SWEEP: The vertical oscillator (V15) operates at a frequency determined by C71, R95, and VERTICAL HOLD control R94, in the absence of a vertical sync pulse. The integrated sixty-cycle sync pulse derived from the video signal reaches the grid of V15 just before it would normally trip. This sync pulse is great enough to drive the tube to conduction and cause it to lock in at the sync frequency. The sync pulse thus maintains control of the vertical oscillator sweep frequency when R94 is correctly adjusted.

The output of the vertical oscillator is fed to the vertical output stage (V16) through C72. The output of V15 is controlled by the VERTICAL SIZE control, R96. R100 varies the gain of V16 by varying the bias, acting as the VERTICAL LINEARITY control. This control is necessary due to the nonlinearity of the Eg-Ip curve, over its operating range. The sweep voltage of V16 is coupled to the vertical deflection coil, L10, by means of vertical output transformer T12.

d. SCANNING INTERLOCK: The brightness control supplies a positive voltage to the cathode of the kinescope, as for normal operation. The control, R88, is returned to ground through the cathode bias resistor, R116, of the interlock tube (V24), a dual-triode type 6SC7. Positive horizontal pulses are taken from the secondary of the horizontal output transformer, T10, and coupled through C89 to one section of V24. The bias developed in the grid-cathode circuit, acting as a diode, cuts off the tube in the presence of horizontal sweep output voltages. Similarly, positive vertical pulses are applied to the other triode section of V24 and bias the tube to cutoff. In the event that either or both of the sweep voltages fail, the respective triode section will draw a relatively large plate current and increase the cathode voltage. The increased voltage biases the kinescope to cutoff as it is in series with the brightness control voltage, thus protecting the kinescope. The plate supply of V24 is obtained from the same low-voltage power supply which energizes the high-voltage unit, to prevent loss of protection if the sweep power supply fails.

6. POWER SUPPLIES—Three power supplies are used to supply the required voltages. One low-voltage supply is of the transformerless, voltage-doubler type; the second uses a conventional full-wave transformer and rectifier. The high-voltage supply for the kinescope is of the pulse type and is energized by a separate oscillator. The unit is self-contained and is independent of the receiver sweep circuits.

a. LOW VOLTAGE SUPPLY: Positive and negative rectifiers are used to supply approximately 370 volts from B— to B+. Selenium rectifiers X31 and X32 are used in the positive doubler circuit and produce about + 170 volts; rectifiers X29 and X30 are used in the negative doubler circuit and supply about —200 volts. Focus coil L12 is connected in the negative power supply and is shunted by FOCUS control R55, which adjusts the current through the coil. Transformer T13 supplies 6.3 volts a.c. to all tubes. A separate 5.0 volt winding is necessary for damper tube V24 because of the presence of B+ voltage on the heater. A third filament winding is used for rectifier V25. A 700 volt center-tapped secondary supplies V25, for the kinescope B+ supply. The ballast tube contains protective and filter resistors for the low-voltage main chassis rectifier circuits.

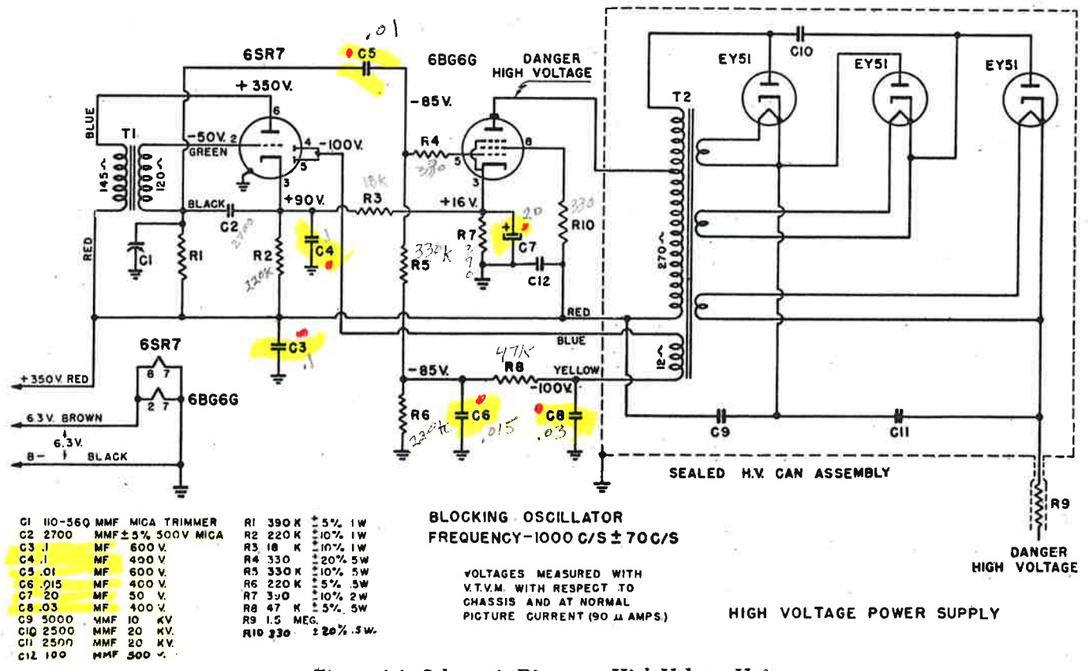


Figure 4-4—Schematic Diagram—High Voltage Unit

©John F. Rider

b. HIGH VOLTAGE SUPPLY: (See figure 4-4). The high voltage power supply is a separately contained unit which provides about 25 kilovolts for the kinescope. The operation of the power supply has been outlined in paragraph 2., in connection with the projection system. The high-voltage lead terminates in a special connector which plugs into the contact in the second anode cup of the kinescope.

7. CIRCUIT CONTROLS—The receiver controls are of two types: operating controls at the top panel; adjustment controls at the bottom of the chassis.

a. TOP PANEL CONTROLS: (Table III).

CONTROL	SYMBOL	FUNCTION	ACTION
Channel		Connects proper coils in tuned circuits of V22 and V23.	Selects desired channel.
Fine Tuning		Adjusts frequency of oscillator V22.	Adjusts for best picture quality.
Contrast	R19	Controls input to video amplifier V6.	Adjusts range of black and white in picture.
Brightness	R88	Controls average d.c. bias to kinescope V26.	Adjusts average level of illumination.
Vertical Hold	R94	Controls lock-in of vertical oscillator V15.	Prevents up and down movement of raster.
Horizontal Hold	R75	Controls lock-in of horizontal oscillator V12.	Prevents side to side movement of raster.
Focus	R55	Controls current in focusing coil L12.	Adjusts sharpness of raster detail.
Off-Volume	R46	Controls input to audio amplifier V19B. Energizes power supply.	Adjusts volume level. Operates receiver.

b. ADJUSTMENT CONTROLS: (Table IV).

CONTROL	SYMBOL	FUNCTION	ACTION
Horizontal Linearity	L9	Controls inductance in cathode of horizontal damper V14.	Adjusts end portions of horizontal scan relative to central portion of raster.
Horizontal Size	L8	Controls inductance shunted across secondary of horizonal output transformer T10.	Adjusts horizontal raster size.
Horizontal Drive	R80	Controls voltage to horizontal output V13.	Adjusts maximum raster width without crowding right size of picture.
Horizontal Centering	R103	Controls d.c. centering current in horizontal deflection coil L11.	Adjusts horizontal position of raster.
Vertical Linearity	R100	Controls operating point of vertical output V16 by varying bias.	Adjusts relative proportions of upper, central, and lower portions of raster.
Vertical Size	R96	Controls vertical deflection voltage to vertical output V16.	Adjusts vertical raster size.
Vertical Centering	R104	Controls d.c. centering current in vertical deflection coil L10.	Adjusts vertical position of raster.

Section 5.

MAINTENANCE AND ALIGNMENT

1. GENERAL—All adjustments must be made only by qualified service technicians. Unsatisfactory operation should be analyzed and circuits checked systematically to locate and correct sources of trouble.

The sealed optical box requires no adjustment or maintenance other than cleaning of the corrector lens, after installation and adjustment of the kinescope and the associated deflection and focusing circuits.

WARNING

High-voltage of 25 kilovolts is used for the kinescope of this receiver. Always disconnect the line-cord from the power outlet when doing any work on the high-voltage or optical units. Do not operate the kinescope outside of the projection box as bombardment of the face plate produces soft x-rays which are absorbed by the box, when the tube is in its normal position. Always exercise care when looking into projection unit as the image produced is extremely brilliant.

2. MAINTENANCE OF PROJECTION UNIT—The optical box contains the concave mirror, 45° plane mirror, and the corrector lens. These are optically aligned at the factory and no adjustments should be attempted under any conditions.

a. OPTICAL ELEMENTS: The projection unit is a sealed unit and the side plates should not be removed except in those cases where the mirrors may require cleaning. Normally this will not be required unless the unit is used in areas where the dust accumulation may be unusually severe. To clean the mirrors, first remove one side panel. Then remove dust with a camel's-hair brush and polish with lens tissue. Use a cleaning spray for excessive discoloration. Clean the top of the corrector lens with a soft-lintless cloth or tissue.

b. TAILPIECE ASSEMBLY: The tailpiece assembly includes the deflection yoke, focus coil, and mechanical focusing adjustments. The electrical characteristics of the coils and wiring color code are tabulated below:

DEFLECTION CABLE: (Table V).

COIL	SYMBOL	COLOR CODE	PIN CONNECTIONS	NOMINAL RESISTANCE OHMS
Vertical	L10	Blue-Blk. Tr. Blue-Wh. Tr.	2 6	68
Horizontal	L11	Orange-Blk. Tr. Orange-Wh. Tr.	7 5	15
Focus	L12	Red Yellow	1 3	290

c. REPLACEMENT OF FOCUS COIL ASSEMBLY: (See figure 5-1).

1) Disconnect the tube socket at the end of the kinescope.

2) Loosen the four thumbnuts marked "M"; rotate the tailpiece assembly counterclockwise, and carefully remove the assembly from the optical box.

3) Disconnect the anode connector from the contact in the tube cup.

4) Loosen the screws marked "C" and "T" and remove the kinescope.

5) Unscrew the three screws marked "E" and remove the triangular endplate, "D".

6) Loosen the two adjustment screws "G" and the cable clamp "F".

7) Remove the two snap washers marked "H" together with spring "I".

8) Remove the defective focus coil and replace with the new coil.

9) Reassemble the fastenings in reverse order to disassembly.

3. MAINTENANCE OF HIGH-VOLTAGE SUPPLY—For safety, the high-voltage unit should be checked first with the low-voltage supply cable disconnected from the main chassis. If the defective component cannot be located in this manner, reconnect the cable, and remove the high-voltage chassis from the cabinet.

a. VOLTAGE ANALYSIS:

1) Remove the chassis base and operate the receiver.

2) If power supply failure occurs, first replace the 6SR7 and 6BG6G tubes. When replacing the 6BG6G tube, keep the plate lead away from all other connections by at least one-quarter inch.

3) Check the socket voltages against the values tabulated in table VI.

4) Operation of the oscillator is evidenced by the presence of approximately —50 volts bias on the grid of the 6SR7.

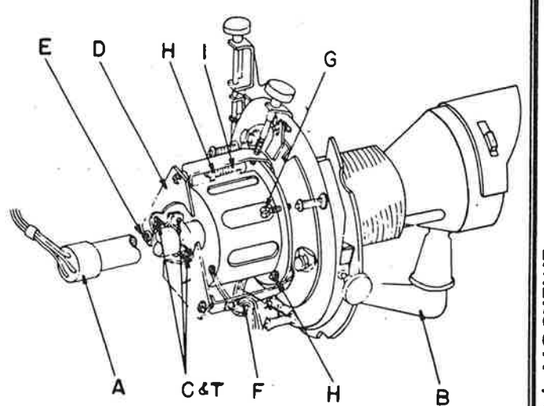


Figure 5-1—Focus Coil Replacement

©John F. Rider

VOLTAGE ANALYSIS—H.V. POWER SUPPLY: (Table VI).

TUBE	SYMBOL	VOLTAGE							
		PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
6SR7	V26	0	−50	90	−100	−100	350	0	6.3 AC
6BG6G	V27	—	6.3 AC	16	—	−85	—	0	320

b. REPLACEMENT OF HIGH-VOLTAGE SEALED UNIT: (See figure 5-2).

1) To replace the sealed unit containing the high-voltage transformer and rectifiers, first remove the tailpiece assembly and disconnect the high-voltage lead.

2) Loosen the four screws which fasten the cover of the high-voltage unit and slide the anode lead through the grommet at the top.

3) Remove the mounting screws which hold the unit to the cabinet shelf. Remove the bottom of the chassis by unscrewing the four screws marked "S".

4) Unsolder the three leads from the terminal strip at the bottom of the chassis and the black ground lead.

CAUTION

Do not unsolder the leads from the top of the sealed unit. Do not unscrew the high-voltage cable gland nut "G" at the top of the can.

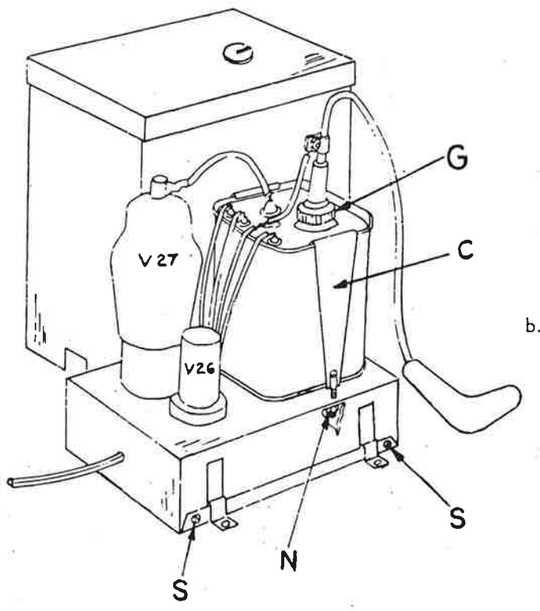


Figure 5-2—H-V Sealed Can Replacement

5) Loosen the hold-down clamps "C" by partly unscrewing the two nuts "N" on the underside of the chassis.

6) Remove the defective unit and replace with the new can. Tighten the clamps marked "C" by means of the nuts "N".

7) Insert the leads from the can through the top of the chassis and solder in place on the terminal strip and to the chassis.

8) Replace the chassis base and fasten the chassis to the cabinet.

9) Replace the chassis cover, making certain that it is not reversed. The high-voltage lead must go up directly through the cover and not cross over inside the case.

4. MAINTENANCE OF MAIN CHASSIS—The main receiver chassis contains all r-f, i-f, video, audio, and power supply circuits except the high-voltage supply.

a. REMOVAL OF CHASSIS: (See figures 1-2 and 2-6). To remove the main chassis from the cabinet, the following procedure is suggested:

1) Raise the top lid into viewing position and remove the knobs.

2) Remove the back of the cabinet and remove the speaker cable plug (P-2), high-voltage power supply cable plug (P-5), and deflection cable plug (P-4), from the chassis. Remove the kinescope socket (X-4) from the base of the tube.

3) Unfasten and remove the antenna terminal strip and line interlock plug, at the rear of the cabinet. Remove the pilot light socket from the cabinet base.

4) Remove the two wingnuts at the side of the cabinet which fasten the front panel in place. Swing the panel out and remove the two screws which hold the speaker baffle board in place. Allow the speaker board to drop down.

5) Unscrew the six bolts which fasten the chassis board in place. Remove the chassis and board as a unit from the front of the cabinet.

6) To replace the chassis, follow the above procedure in reverse.

b. VOLTAGE AND RESISTANCE ANALYSIS: Voltage and resistance readings are tabulated below, for the following conditions:

1) Line voltage maintained at 117 volts a.c.

2) All measurements made with voltohmyst.

3) Measured values are from socket pin to chassis, unless otherwise noted.

4) Measurements made with all controls in normal position and selector on empty channel.

5) All voltage measurements are in d.c. volts and resistances in ohms, unless otherwise noted.

SYM-BOL	TUBE TYPE	VOLTAGE								RESISTANCE							
		PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
V1	6AU6	-.8	0	0	6.3 AC	127	127	.4	—	3.2M	0	0	.1	1K*	1K*	39	—
V2	6AU6	-.8	0	0	6.3 AC	127	127	.4	—	3.2M	0	0	.1	1K*	1K*	39	—
V3	6AU6	-.8	0	0	6.3 AC	108	130	.3	—	3.2M	0	0	.1	4.9K*	1K*	39	—
V4	6AU6	0		0	6.3 AC	130	130	1.5	—	.1	0	0	.1	1K*	1K*	180	—
V5	6AL5	2.1	-.7	0	6.3 AC	0	0	.8	—	100K	2.2K	0	.1	0	0	2.2M	—
V6	6AU6	0	0	0	6.3 AC	85	110	0	—	2.2K	0	0	.1	3.9K*	600*	0	—
V7	6AQ5	-5.3	0	6.3 AC	0	73	140	-5.3	—	1M	0	.1	0	3K*	0*	1M	—
V8	12AU7	116	0	6.5	0	0	140	7	9	22K	0	220K	0	0	0*	1.2M	12.5K
V9	12AU7	130	-15	0	0	0	40	1.1	0	11K	180K	0	0	0	—	1M	0
V10	6SN7	-90	112	-90	-110	-68	-110	6.3AC	0	1M	7K*	2.2K	Inf.	100K*	2.1K	.1	0
V11	6AL5	-110	-110	0	6.3 AC	-105	-110	-115	—	Inf.	Inf.	0	.1	150K	1.1K	150K	—
V12	6SN7	-150	105	-110	-150	-39	-110	6.3AC	0	150K*	4.7K*	1.1K	150K*	470K*	1.1K	.1	0
V13	6BG6G	0	0	-200	0	-215	0	6.3AC	3.5	Inf.	Inf.	250	Inf.	470K	—	.1	18K*
V14	5V4G	0	200	0	138	0	138	0	200	Inf.	6.5K*	Inf.	38*	Inf.	38*	Inf.	6.5K*
V15	6SN7	-350	72	-205	-350	55	-205	6.3AC	0	1.5M to 2.5M	.5M to 1.5M	150	1.5M to 2.5M	100K*	150	.1	0
V16	6K6	0	0	46	46	-180	0	6.3AC	-175	Inf.	0	10K*	10K*	4.7M	—	.1	5K to 14K
V17	6AU6	0	0	0	6.3 AC	102	108	.7	—	0	0	0	.1	1.6K*	1.6K*	68	—
V18	6AU6	0	0	0	6.3 AC	110	32	0	—	100K	0	0	.1	1.6K*	1.6K*	0	—
V19	6S8	-3.2	0	-2.6	0	1.65	85	6.3AC	0	100K	0	100K	Inf.	200K	480K†	.1	0
V20	6V6	0	0	236	196	-5.7	0	6.3AC	1.7	0	0	2.5K†	12K†	.47M	—	.1	47
V22	6J6	-80	100	0	6.3 AC	80	-4.5	-1.7	—	80	4.5K*	0	0	10K	220K	0	—
V23	6AG5	0	-.5	0	6.3 AC	80	80	0	—	0	0	0	0	12K*	2.5K*	0	—
V24	6SC7	0	340	-62	-44	340	2.1	0	6.3AC	—	0	1M	1M	0	16K	0	.1
V25	5Y3	0	370	0	350AC	0	350AC	0	370	Inf.	Inf.	Inf.	60	Inf.	60	Inf.	Inf.

SYMBOL	TUBE TYPE	VOLTAGE		RESISTANCE	
		PIN 9	CAP	PIN 9	CAP
V8	12AU7	6.3 AC	—	.1	—
V9	12AU7	6.3 AC	—	.1	—
V19	6S8	—	- .9	—	13 M

Notes: * Measured to B+ (junction of C44 and R57).
† Measured to point (D) (pin 4 of X5, with P5 removed).
K=Kilohms.
M=Megohms.
Inf.=Infinity.

c. WAVEFORM ANALYSIS: (See figure 5-3). The sweep voltages produced in the horizontal and vertical deflection circuits indicate typical operating conditions.

Waveforms are observed under the following conditions:

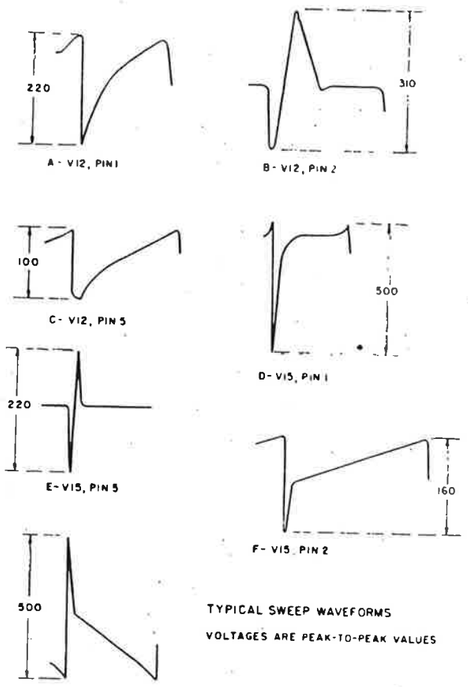
1) Line voltage maintained at 117 volts.

2) All controls set at normal.

SWEEP CIRCUIT TEST POINTS: (Table VIII).

WAVE FORM KEY LETTER	TEST POINT		APPROXIMATE P. TO P. VOLTAGE
	TUBE	PIN	
A	V12	1	220
B	V12	2	310
C	V12	5	100
D	V15	1	500
E	V15	5	220
F	V15	2	160
G	V16	3	500

©John F. Rider



TYPICAL SWEEP WAVEFORMS

VOLTAGES ARE PEAK-TO-PEAK VALUES

Figure 5-3—Sync Circut Waveforms

5. ALIGNMENT—Alignment of the intercarrier receiver circuit employed in Model 609 should be done in the following order: video i-f stages; audio i-f stages; r-f stages.

a. TEST EQUIPMENT: Proper alignment of the various circuits requires the test equipment indicated.

1) Sweep Generator—

a) Frequency ranges of 18 to 30 MC., 50 to 90 MC., and 170 to 225 MC.

b) Sweep width variable to 10 MC.

c) Output of at least 0.1 volt, with an attenuator for adjustment of output.

d) Constant output over sweep width, with flat output on all ranges and at all attenuator positions.

2) Marker Generator—

a) Frequency ranges of 4 to 30 MC. and 50 to 225 MC., for i-f and r-f alignment. The marker generator must provide an accurate (crystal calibrated) frequency or 4.5 MC. for audio i-f alignment, and accurate frequencies from 21.25 MC. to 25.75 MC., for video i-f alignment. The required r-f frequencies from 50 to 225 MC. may be provided by a calibrated signal generator or a heterodyne frequency meter with crystal calibrator.

b) Output of at least 0.1 volt, with an attenuator for adjustment of output.

c) R-F frequencies for all video and audio carriers. (See figure 1-3).

3) Vacuum-Tube Voltmeter—

a) Diode probe for high-frequency measurements is desirable.

b) High input impedance, with provision for low-voltage measurement (three or five volt scale).

4) Oscilloscope—

a) Vertical input should be provided with a calibrated attenuator and low capacity probe.

b) Flat vertical amplifier frequency response, with good low-frequency response.

c) Adequate vertical sensitivity of at least .07 volts-per-inch.

5) Adapter Cable—An adapter cable is required for deflection yoke connections when the chassis is removed from the cabinet. The adaptor consists of a short length of nine wire cable terminated in a plug at one end and a socket at the other end. The cable wiring is shown in figure 5-4.

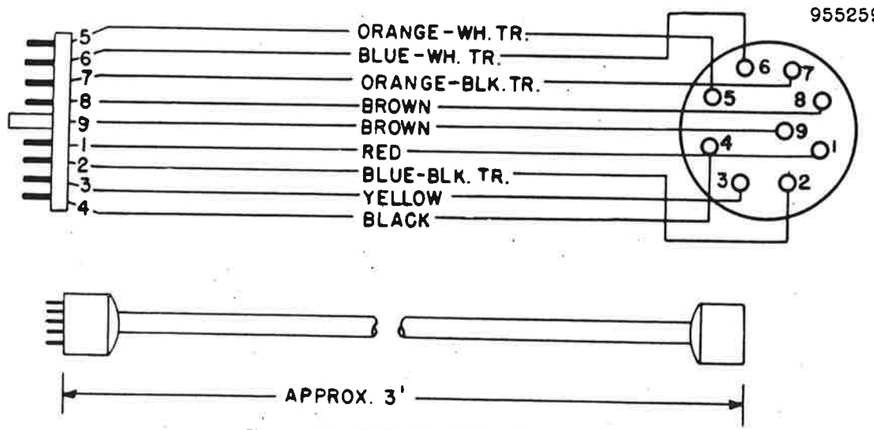


Figure 5-4—Deflection Yoke Adaptor Cable

b. VIDEO I-F and TRAP ALIGNMENT:

1) Waveforms shown may be inverted, depending on the number of amplifying stages in the vertical amplifier of the scope being used.

VIDEO I-F ALIGNMENT: (Table IX).

STEP	SIGNAL GENERATOR INPUT		MEASURING INSTRUMENT	ADJUST	PROCEDURE
	CONNECTION	FREQUENCY			
1	Connect marker generator to pin 1 (grid) of V1 (6AU6), through .001 mfd. condenser. Low side to chassis.	25.2 MC.	Connect d.c. probe of v.t.v.m. to point F (junction of L3 and R19 Contrast Control). Low side to chassis.	T5	Peak for maximum response. Adjust generator signal level to produce approx. 1 volt at point F.
2	"	25.3 MC.	"	T4	"
3	"	22.3 MC.	"	T3 (Bottom)	"
4	"	21.8 MC.	"	T2 (Top)	"
5	"	21.25 MC.	" (Use three or five volt meter scale)	T3 (Top)	Adjust for minimum response. Two peaks may be noted. The correct position is with the core at the outside end of the coil.
6	"	21.25 MC.	"	T2 (Bottom)	"
7	"		"	T5, T4 T3, T2	Repeat steps 1 through 6. Readjust T2 (Top) and T3 (Bottom) after adjusting 21.25 MC. traps.
8	Connect sweep generator to three turn loop of wire slipped over converter tube V22. Connect marker gen. in parallel.	Sweep Gen. 23.0 MC. (10 MC. Sweep) Marker Gen. 21.75 MC. and 25.75 MC.	Connect vertical input of scope in series with 10K resistor to point F (junction of L3 and R19 Contrast Control).	T1 (Top) and T1 (Bottom)	Adjust to position markers as shown on the overall response curve, figure 5-6. It is essential that the video carrier marker (25.75 MC.) be at the 50% point (6db down). Adjust T5 and T4 if necessary, to correctly position this marker.

2) The marker generator is coupled in parallel with the sweep generator. The marker should be unmodulated and attenuated so that only a small pip is visible.

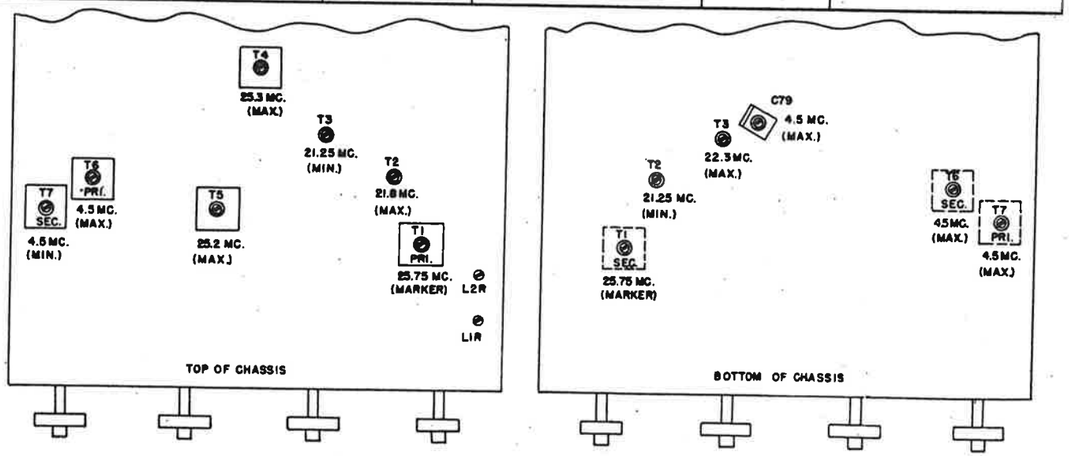


Figure 5-5—Location of Alignment Points

©John F. Rider

3) Connect the sync sweep voltage from the sweep signal generator to the horizontal input of the scope.

4) Set the selector to channel three, for all alignment steps.

5) Refer to figure 5-5 for alignment points, figure 5-6 for response curves and figure 5-11 for schematic diagram.

6) Use the adaptor cable between the deflection cable plug and chassis socket.

7) Connect a three volt bias battery in the A.G.C. circuit, with the negative to junction of R17 and C7, and the positive grounded.

c. AUDIO I-F AND DISC. ALIGNMENT:

1) Couple the marker generator in parallel with the sweep generator for step 4.

2) Refer to figure 5-5 for alignment points; refer to figure 5-6 for response curves; refer to figure 5-11 for schematic diagram.

AUDIO I-F AND DISC. ALIGNMENT: (Table X).

STEP	SIGNAL GENERATOR INPUT		MEASURING INSTRUMENT	ADJUST	PROCEDURE
	CONNECTION	FREQUENCY			
1	Connect marker generator to pin 2 (plate) of V5 (6AL5), through 100K resistor.	4.5 MC.	Connect d.c. probe of v.t.v.m. to point B (junction of C27 and R38). Low side to chassis.	C79	Peak for maximum response.
2	"	"	"	T6 (Top and Bottom)	"
3	"	"	Connect d.c. probe of v.t.v.m. to point D (pin 5 of V19). Low side to chassis.	T7 (Top)	Adjust secondary for minimum response.
4	Connect sweep generator in parallel with marker generator.	Sweep Gen. 4.5 MC. (450 KC. sweep) Marker Gen. 4.5 MC. (Unmod.)	Connect vertical input of scope in series with 10K resistor to point D, in place of v.t.v.m.	T7 (Bottom)	Adjust primary for maximum linearity and symmetry. Adjust secondary to center marker, as shown in figure 5-6.

d. R-F ALIGNMENT:

1) Set fine tuning control to maximum clockwise position. This setting will expose the oscillator tuning slugs for each channel, as the turret is rotated. Do not change this setting during the entire r-f alignment.

2) Use 300 ohm carbon resistor as a dummy antenna.

3) Couple the marker generator to the receiver input by placing the output lead near the sweep generator output lead.

4) Adjustments of the r-f amplifier and converter stages, and shaping of the response curve are done on Channel 12 for Tuner 470452.

5) Use 10 MC. sweep for the sweep generator, with the marker generator unmodulated.

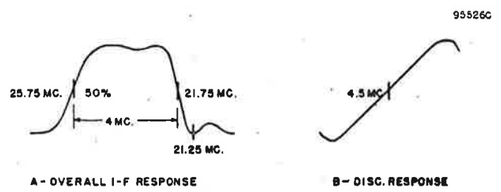


Figure 5-6—I-F and Disc Response Curve—

6) Attenuate the signal from the marker generator to give as small a pip as possible.

7) Connect the vertical input of the scope to point F, (junction of L3 and R-19) in series with a 10 K resistor.

8) Refer to figure 5-7 for Tuner 470452 alignment points; refer to the schematic diagram, figure 5-11, for location of chassis reference points.

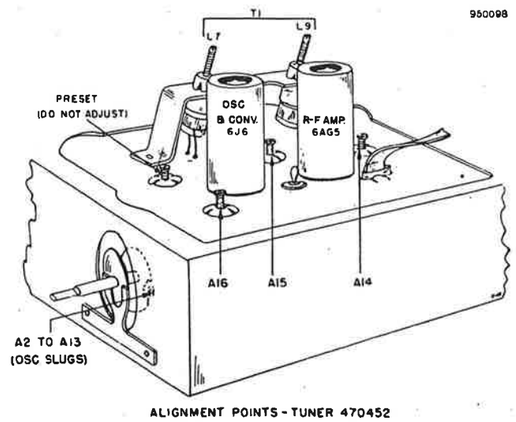


Figure 5-7—Alignment Points—Tuner 470452

R-F ALIGNMENT—TUNER 470452: (Table XI).

STEP	SIGNAL GENERATOR INPUT		CHANNEL	ADJUST	PROCEDURE
	SWEEP GEN.	MARKER GEN.			
1	207.0 MC.	209.75 MC.	12	A12	Adjust for proper placement of sound marker (21.25 MC.) as shown in figure 5-6.
2	"	"	12	A14, A15 A16	Adjust for maximum amplitude and band- (21.25 MC.) as shown in figure 5-6.
3	213.0 MC.	215.75 MC.	13	A13	Adjust for proper placement of sound marker as in step 1.
4	201.0 MC.	203.75 MC.	11	A11	"
5	195.0 MC.	197.75 MC.	10	A10	"
6	189.0 MC.	191.75 MC.	9	A9	"
7	183.0 MC.	185.75 MC.	8	A8	"
8	177.0 MC.	179.75 MC.	7	A7	"
9	85.0 MC.	87.75 MC.	6	A6	"
10	79.0 MC.	81.75 MC.	5	A5	"
11	69.0 MC.	71.75 MC.	4	A4	"
12	63.0 MC.	65.75 MC.	3	A3	"
13	57.0 MC.	59.75 MC.	2	A2	"

e. ADJUSTMENT OF HIGH-VOLTAGE 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 such as the blocking oscillator transformer has been 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 provide the correct frequency which determines the proper amount of power to the heaters of the three high-voltage rectifier tubes inside the sealed can, to assure maximum life for these tubes.

1) Adjust C-202 with an oscilloscope and an accurate 1000 cycle generator.

2) Sufficient blocking oscillator voltage can usually be obtained from B+ red lead to operate the vertical amplifier of the oscilloscope, pin 4 of X5. If sufficient voltage cannot be obtained from the B+ lead to produce a signal on the scope, a resistor of about 10 ohms should be soldered in series with the lead. Be sure to remove this resistor after the frequency is set.

3) With the 1000 cycle signal from the generator applied to the horizontal sweep amplifier of the oscilloscope, adjust C-202 until a single stable Lissajou figure is obtained, as shown in figure 5-8.

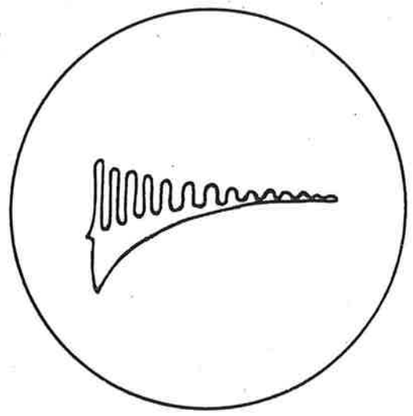


Figure 5-8—Adjustment of H.V Oscillator

©John F. Rider

SYMBOL	PART No.	DESCRIPTION
V-1	800533	Vacuum tube, 6AU6, 1st video i-f amp.
V-2	800533	Vacuum tube, 6AU6, 2nd video i-f amp.
V-3	800533	Vacuum tube, 6AU6, 3rd video i-f amp.
V-4	800533	Vacuum tube, 6AU6, 4th video i-f amp.
V-5	800541	Vacuum tube, 6AL5, video det.& A.G.C.
V-6	800533	Vacuum tube, 6AU6, 1st video amp.
V-7	800031	Vacuum tube, 6AQ5, 2nd video amp.
V-8	800026	Vacuum tube, 12AU7, 3rd video amp. & DC restorer
V-9	800026	Vacuum tube, 12AU7, sync. amp. & limiter. . . . .
V-10	800380	Vacuum tube, 6SN7-GT, horiz. phase inverter & DC amp.
V-11	800541	Vacuum tube, 6AL5, phase det.
V-12	800380	Vacuum tube, 6SN7-GT, horiz. osc. & discharge
V-13	800004	Vacuum tube, 6BG6-G, horiz. output tube
V-14	800011	Vacuum tube, 5V4-G, horiz. damper
V-15	800380	Vacuum tube, 6SN7-GT, vert. osc. & discharge
V-16	800016	Vacuum tube, 6K6-GT, vertical output amp.
V-17	800533	Vacuum tube, 6AU6, sound i-f amp.
V-18	800533	Vacuum tube, 6AU6, sound i-f limiter
V-19	800015	Vacuum tube, 6S8-GT, sound disc. & audio amp.
V-20	800270	Vacuum tube, 6V6-GT, audio output
V-22	800536	Vacuum tube, 6J6, osc. & conv.
V-23	800535	Vacuum tube, 6AG5, R.F. amp.
V-24	800012	Vacuum tube, 6SC7, scanning interlock control tube
V-25	800160	Vacuum tube, 5Y3-GT, low voltage rectifier
X-29	817004	Selenium Rectifier, 250 MA
X-30	817004	Selenium Rectifier, 250 MA
X-31	817005	Selenium Rectifier, 200 MA
X-32	817005	Selenium Rectifier, 200 MA
V-33	807000	Pilot light
X-1	585039	Socket, cable assembly
X-2	508100	Socket, Speaker
X-3	500005	Socket, interlock
	470339	Shell holder assembly
X-4	500013	Socket, 9 pin
X-5	500011	Socket, 4 pin
	470419	High voltage unit
V-26	800033	Vacuum tube, 6SR7 Pt. of Hi-
V-27	800004	Vacuum tube, 6BG6G Volt. Unit
	470421	Projection box assy.
V-28	810004	Television tube, 3NP4, Pt. of Proj. Unit
C-1	928006	1500 mmf Ceramic, 400v
C-2	928006	1500 mmf Ceramic, 400v
C-3	922101	.05 mf Paper molded, 400v
C-6	928006	1500 mmf Ceramic, 400v
C-7	923064	.1 mf Paper, 400v
C-8	928006	1500 mmf Ceramic, 400v
C-9	910015	270 mmf Mica, 400v
C-10	928006	1500 mmf Ceramic, 400v
C-11	928006	1500 mmf Ceramic, 400v
C-12	910015	270 mmf Mica, 400v
C-13	928006	1500 mmf Ceramic, 400v
C-14	928006	1500 mmf Ceramic, 400v
C-15	910290	30 mmf Mica -20%
C-16	923062	.05 mf Paper, 400v
C-17	928006	1500 mmf Ceramic, 400v
C-18	923062	.05 mf Paper, 400v
C-19	925114	8 mf Elect., 350v
C-20	923062	.05 mf Paper, 400v
C-21	923066	.25 mf Paper, 400v
C-22	923061	.01 mf Paper, 400v
C-23	923062	.05 mf Paper, 400v
C-24	910130	10 mmf Mica, 400v
C-25	928006	1500 mmf Ceramic, 400v
C-26	928006	1500 mmf Ceramic, 400v
C-27	910031	68 mmf Mica -20%
C-28	928006	1500 mmf Ceramic, 400v
C-29	928006	1500 mmf Ceramic, 400v

SYMBOL	PART No.	DESCRIPTION
C-30	910010	110 mmf Mica -20%
C-31	923079	.001 mf Paper, 600v
C-32	923078	.005 mf Paper 400v
C-33	923061	.01 mf Paper, 400v
C-34	923061	.01 mf Paper, 400v
C-35	923062	.05 mf Paper, 400v
C-36	925114	8 mf Elect., 350v
C-37	923078	.005 mf Paper, 400v
C-38	922101	.05 mf Paper Molded, 400v
C-39	925099	80 mf Elect., 150v
C-40	925128	80 mf Elect., 150v
C-41	925129	80 mf Elect., 300v
C-42		80 mf Elect., 300v
C-43	925131	80 mf Elect., 300v
C-44		80 mf Elect., 300v
C-45	925134	60 mf Elect., 300v
C-46	925132	80 mf Elect., 300v
C-47	925133	80 mmf Elect., 300v
C-48		80 mf Elect., 300v
C-49	925111	8 mf Elect., 250v
C-50	910027	.001 mf Mica, 500v
C-51	923062	.05 mf Paper, 400v
C-52	923066	.25 mf Paper, 400v
C-53	910027	.001 mf Mica, 500v
C-54	923062	.05 mf Paper, 400v
C-55	910010	110 mmf Mica
C-56	925111	8 mf Elect., 250v
C-57	910023	780 mmf Mica, 400v
C-58	923077	.005 mf Paper, 600v
C-59	910017	470 mmf Mica, 400v
C-60	923079	.001 mf Paper, 600v
C-61	923064	.1 mf Paper, 400v
C-62	923073	.05 mf Paper, 600v
C-63	923062	.05 mf Paper, 400v
C-64	923074	.035 mf Paper, 600v
C-65	923073	.05 mf Paper, 600v
C-66	923064	.1 mf Paper, 400v
C-67	923075	.01 mf Paper, 600v
C-68	923066	.25 mf Paper, 400v
C-69	923078	.005 mf Paper, 400v
C-70	923078	.005 mf Paper, 400v
C-71	923085	.003 mf Paper, 600v -10%
C-72	923073	.05 mf Paper, 600v
C-73	923073	.05 mf Paper, 600v
C-74	925072	10 mf Elect., 50v
C-75	925111	8 mf Elect., 250v
C-76	925097	1000 mf Elect., 15v
C-77		1000 mf Elect., 15v
C-78	910015	270 mmf Mica, 400v
C-79	900044	3-35 mmf Trimmer
C-80	928006	1500 mmf Ceramic, 400v
C-81	928006	1500 mmf Ceramic, 400v
C-82	910015	270 mmf Mica, 400v
C-83	928006	1500 mmf Ceramic, 400v
C-84	925127	40 mf Elect., 450v
C-85		40 mf Elect., 450v
C-86	925127	40 mf Elect., 450v
C-87		40 mf Elect., 450v
C-88	925114	8 mf Elect., 350v
C-89	923071	.001 mf Paper, 400v
C-90	928019 or 910014	470 mf Ceramic, 400v 470 mmf, Mica, 400v
C-91	Pt. of T-2	75 mmf Mica, 300v
C-92	Pt. of T-3	75 mmf Mica, 300v
C-93	923061	.01 mf Paper, 400v
C-94	923062	.05 mf Paper, 400v
F-1	808050	Fuse, 1/4A, 3A, 250v
L-1	705014	R.F. Choke, 20 uh -10%
L-2	708097	Peaking coil, 45 uh -10%
L-3	708097	Peaking coil, 45 uh -10%
L-4	708097	Peaking coil, 45 uh -10%
L-5	708094	Peaking coil, 125 uh -10%
L-6	708094	Peaking coil, 125 uh -10%
L-7	705009	R.F. Choke, 3mh
L-8	708082	Size coil
L-9	708003	Linearity coil
L-13	705014	R.F. Choke, 20 uh -10%

P-2	505040	Connector plug, Speaker
P-3	470398	Shell holder assembly
P-3	505008	Plug, Interlock switch
P-4	505013	Plug, 9 Pin
P-4	410504	Shell
P-5	505019	Plug, 4 Pin
P-5	410504	Shell
R-2	340492	1,000 ohm Carbon, 1/2w -10%
R-3	340672	5,600 ohm Carbon, 1/2w -10%
R-4	340152	39 ohm Carbon, 1/2w -10%
R-5	340492	1,000 ohm Carbon, 1/2w -10%
R-6	340492	1,000 ohm Carbon, 1/2w -10%
R-7	340732	10,000 ohm Carbon, 1/2w -10%
R-8	330732	15,000 ohm Carbon, 1/2w -5%
R-9	340152	39 ohm Carbon, 1/2w -10%
R-10	340492	1,000 ohm Carbon, 1/2w -10%
R-11	340992	1,000 ohm Carbon, 1/2w -10%
R-12	340572	2,200 ohm Carbon, 1/2w -10%
R-13	340312	180 ohm Carbon, 1/2w -10%
R-14	340492	1,000 ohm Carbon, 1/2w -10%
R-15	341292	2.2 meg Carbon, 1/2w -10%
R-16	340972	100,000 ohm Carbon, 1/2w -10%
R-17	341212	1 meg Carbon, 1/2w -10%
R-18	340992	120,000 ohm Carbon, 1/2w -10%
R-19	Pt. of R-46	2,200 ohm Contrast Control (front)
R-21	360612	3,300 ohm Carbon, 1w -5%
R-22	341212	1 meg Carbon, 1/2w -10%
R-23	390082	400 ohm W.W. Focus Control (front) 4W
R-24	397057	47 ohm Carbon, 2w -10%
R-25	394045	3,000 ohm W.W., 5w -5%
R-26	341212	1 meg Carbon, 1/2w -10%
R-27	340812	22,000 ohm Carbon, 1/2w -10%
R-28	341052	220,000 ohm Carbon, 1/2w -10%
R-29	340972	100,000 ohm Carbon, 1/2w -10%
R-30	341032	180,000 ohm Carbon, 1/2w -10%
R-31	340892	47,000 ohm Carbon, 1/2w -10%
R-32	370812	22,000 ohm Carbon, 1w -10%
R-33	340732	10,000 ohm Carbon, 1/2w -10%
R-34	340492	1,000 ohm Carbon, 1/2w -10%
R-35	340212	68 ohm Carbon, 1/2w -10%
R-36	340492	1,000 ohm Carbon, 1/2w -10%
R-37	340492	1,000 ohm Carbon, 1/2w -10%
R-38	340972	100,000 ohm Carbon, 1/2w -10%
R-39	340652	4,700 ohm Carbon, 1/2w -10%
R-40	370732	10,000 ohm Carbon, 1w -10%
R-41	340492	1,000 ohm Carbon, 1/2w -10%
R-42	340972	100,000 ohm Carbon, 1/2w -10%
R-43	340972	100,000 ohm Carbon, 1/2w -10%
R-44	340932	68,000 ohm Carbon, 1/2w -10%
R-45	351492	15 meg Carbon, 1/2w -20%
R-46	390071	1 meg Volume Control & switch
R-47	341132	470,000 ohm Carbon, 1/2w -10%
R-48	341132	470,000 ohm Carbon, 1/2w -10%
R-49	340732	10,000 ohm Carbon, 1/2w -10%
R-50 1-2	Part of Ballast Tube 397023	30 ohm W.W., 12w -10%
R-51 2-3		30 ohm W.W., 20w -10%
R-52 4-5		75 ohm W.W., 5w -10%
R-53 5-6		75 ohm W.W., 5w -10%
R-54 7-8		75 ohm W.W., 5w -10%
R-55	390084	400 ohm W.W. Focus Control (rear)
R-56	394052	105 ohm W.W., 5w -10%
R-57		600 ohm W.W., 6w -10%
R-58	394043	1,550 ohm W.W., 7w -10%
R-59		3,100 ohm W.W., 7w -10%
R-60	370312	180 ohm Carbon, 1w -10%
R-62	340292	150 ohm Carbon, 1/2w -10%
R-63	341212	1 meg Carbon, 1/2w -10%
R-64	330492	1,000 ohm Carbon, 1/2w -5%
R-65	330492	1,000 ohm Carbon, 1/2w -5%
R-66	330652	4,700 ohm Carbon, 1/2w -5%
R-67	330572	2,200 ohm Carbon, 1/2w -5%
R-68	360972	100,000 ohm Carbon, 1w -5%
R-69	340892	47,000 ohm Carbon, 1/2w -10%
R-70	341052	220,000 ohm Carbon, 1/2w -10%
R-71	341052	220,000 ohm Carbon, 1/2w -10%

R-72	330972	100,000 ohm Carbon, 1/2w -5%
R-73	330972	100,000 ohm Carbon, 1/2w -5%
R-74	370652	4,700 ohm Carbon, 1w -10%
R-75	390036	50,000 ohm Horizontal Hold, Control (front)
R-76	340892	47,000 ohm Carbon, 1/2w -10%
R-77	371132	470,000 ohm Carbon, 1w -10%
R-78	371132	470,000 ohm Carbon, 1w -10%
R-79	331132	470,000 ohm Carbon, 1/2w -5%
R-80	390035	20,000 ohm Horizontal Drive, Control (rear)
R-81	340792	18,000 ohm Carbon, 1/2w -10%
R-82	341132	470,000 ohm Carbon, 1/2w -10%
R-83	370252	100 ohm Carbon, 1w -10%
R-84	397070	18,000 ohm Carbon, 2w -10%
R-85	341212	1 meg Carbon, 1/2w -10%
R-86	394007	7,500 ohm W.W., 25w -5%
R-88	Pt. of R-23	100,000 ohm Brightness, Control (front)
R-89	340172	47 ohm Carbon, 1/2w -10%
R-90	340812	22,000 ohm Carbon, 1/2w -10%
R-91	340812	22,000 ohm Carbon, 1/2w -10%
R-92	340652	4,700 ohm Carbon, 1/2w -10%
R-93	370972	100,000 ohm Carbon, 1w -10%
R-94	Pt. of R-75	1 meg Vertical Hold Control
R-95	331252	1.5 meg Carbon, 1/2w -5%
R-96	390038	2 meg Vertical Size Cont. (rear)
R-97	341132	470,000 ohm Carbon, 1/2w -10%
R-98	340692	6,800 ohm Carbon, 1/2w -10%
R-99	341372	4.7 meg Carbon, 1/2w -10%
R-100	390039	5,000 ohm Vertical Linearity Control (rear)
R-101	340352	270 ohm Carbon, 1/2w -10%
R-102	397043	10,000 ohm Carbon, 3w -10%
R-103	390054	30 ohm Horizontal Center Control (rear)
R-104	390033	30 ohm Vertical Center Control (rear)
R-105	340492	1,000 ohm Carbon, 1/2w -10%
R-106	330692	6,800 ohm Carbon, 1/2w -5%
R-107	340152	39 ohm Carbon, 1/2w -10%
R-108	360632	3,900 ohm Carbon, 1w -5%
R-109	340492	1,000 ohm Carbon, 1/2w -10%
R-110	397014	10,000 ohm Carbon, 2w -10%
R-111	340612	3,300 ohm Carbon, 1/2w -10%
R-112	394092	200 ohm W.W., 5w -10%
R-113	394092	200 ohm W.W., 5w -10%
R-114	394044	2,500 ohm W.W., 10w -10%
R-115	341212	1 meg Carbon, 1/2w -10%
R-116	397024	22,000 ohm Carbon, 2w -10%
R-117	341212	1 meg Carbon, 1/2w -10%
R-118	340912	56,000 ohm Carbon, 1/2w -10%
R-119	370972	100,000 ohm Carbon, 1w -10%
R-120	350892	47,000 ohm Carbon, 1/2w -20%
R-121	341212	1 meg Carbon, 1/2w -10%
SP-1	180050	Speaker, 12"
SW-1	Pt. of R-46	On-Off switch
SW-2	510046	Micro switch
Tuner	470452	Tuner Assembly "Standard"
T-1	720056	1st video i-f transformer
T-2	720042	2nd video i-f transformer
T-3	720042	3rd video i-f transformer
T-4	720078 or	4th video i-f transformer
T-4	720079	4th video i-f transformer
T-5	720078 or	5th video i-f transformer
T-5	720079	5th video i-f transformer
T-6	720081	Sound i-f transformer, 4.5 mc.
T-7	708017 or	Discriminator coil, 4.5 mc.
	708018	Discriminator coil, 4.5 mc.
T-8	734018	Sound output transformer
T-9	738008	Horiz. oscillator transformer
T-10	738012 or	Horiz. output transformer
	738013	Horiz. output transformer
T-11	738004	Vert. oscillator transformer
T-12	738011	Vert. output transformer
T-13	730014	Power transformer

* Add 100K CR76AS in parallel with R76

©John F. Rider

7. CABINET PARTS LIST—Model 609

PART. NO.	DESCRIPTION	PART. NO.	DESCRIPTION
140227	Cabinet	635007	Jewel Light
560075	Cabinet Back	410566	Catch—Screenpanel
470439	Tail Piece Assembly	520103	Selector Escutcheon
470481	Optical Box	450044	Knob—Fine Tuning
635013	Mirror	450041S	Knob—Dual, small
450018	Screen	450045	Knob—Dual, large
410564	Switch Bracket	450049S	Knob—Selector (with hole)
410565	Striker—Microswitch	450042S	Knob—Selector

950098

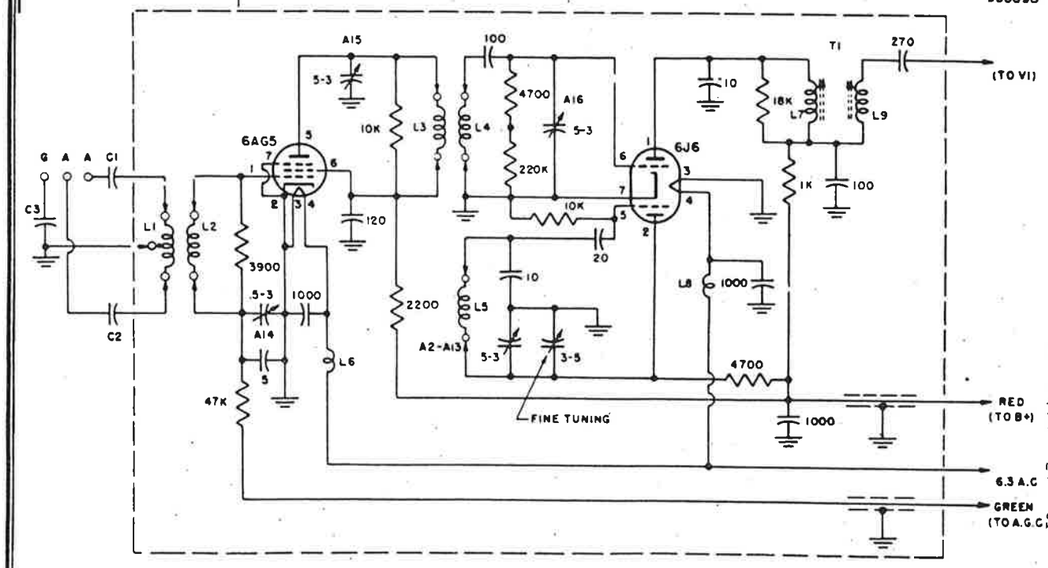


Figure 5-9—Schematic Diagram—Tuner 470452

8. OPTICAL BOX PARTS LIST

No.	DESCRIPTION	No.	DESCRIPTION
1	Projection Tube Light-shield	24	Screw
2	Dust ring—Neoprene	25	Tube clamp
3	Deflection Yoke Assembly	26	Tube clamp plate
4	Mounting and overall adj. plate assy.	27	Washer
5	Vertical adjustment screw assembly	28	Screw 5-40
6	Vertical adjustment plate assembly	29	Screw 8-32
7	Washer	30	Washer
8	Locking sleeve	31	Tube clamp plate spacer
9	Spring	32	Shunt focus coil and housing assembly 11,000 ohm, complete
10	Washer		
11	Thumb nut	33	Focus coil housing
12	Snap ring	34	Screw 5-40
13	Washer	35	Focus coil housing cover
14	Spring washer	36	Yoke mounting screw
15	Horizontal adjustment screw	37	Nut, hexagon, 8-32
16	Coil mounting plate assembly	38	Spring bushing
17	Washer	39	Spring
18	Spring washer	40	Washer
19	Thumb screw	41	Deflection-yoke insulating spacer
20	Focusing Coil adjustment screw	42	Spring
21	Spring	43	H.V. Connector clamp
22	Washer	44	H.V. Connector clamp insulator
23	Snap ring		

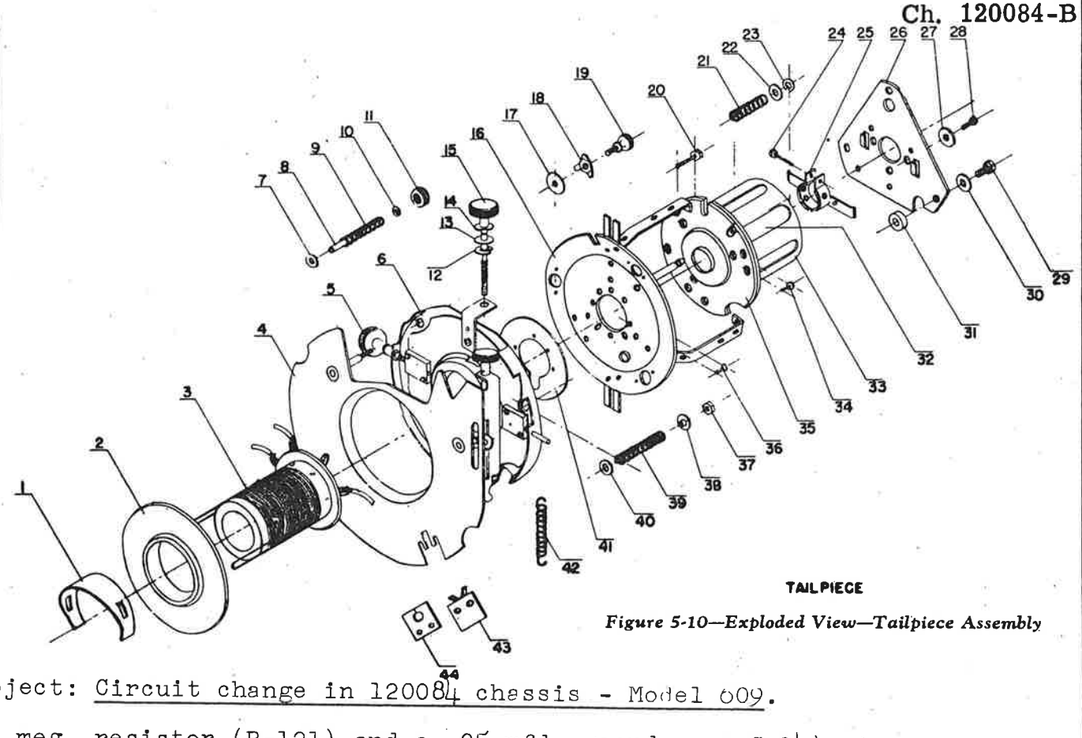


Figure 5-10—Exploded View—Tailpiece Assembly

Subject: Circuit change in 120084 chassis - Model 609.

A 1 meg. resistor (R-121) and a .05 mfd. condenser C-94), in parallel, has been added in series with the grid of the kinescope.

This change may be made conveniently when this model has to be serviced.

Subject: Discoloration of mirror used in the Optical Box on Projection Receiver Model 609.

Due to the high voltage under which the kinescope anode in this unit operates, a small amount of ozone is generated and in conjuntion with microscopic impurities in the mirror glass can result in spotting of the 45° plane mirror.

In order to prevent this from happening a simple procedure, which consists of cleaning only, is recommended. This cleaning procedure, if followed every six months, should prevent tarnishing and discoloration.

The 3NP4 picture tube should be removed from the optical box and the high voltage anode connector removed from the glass cup on the tube. The inside of the glass cup should be cleaned thoroughly with a brush saturated in carbon tetrachloride.

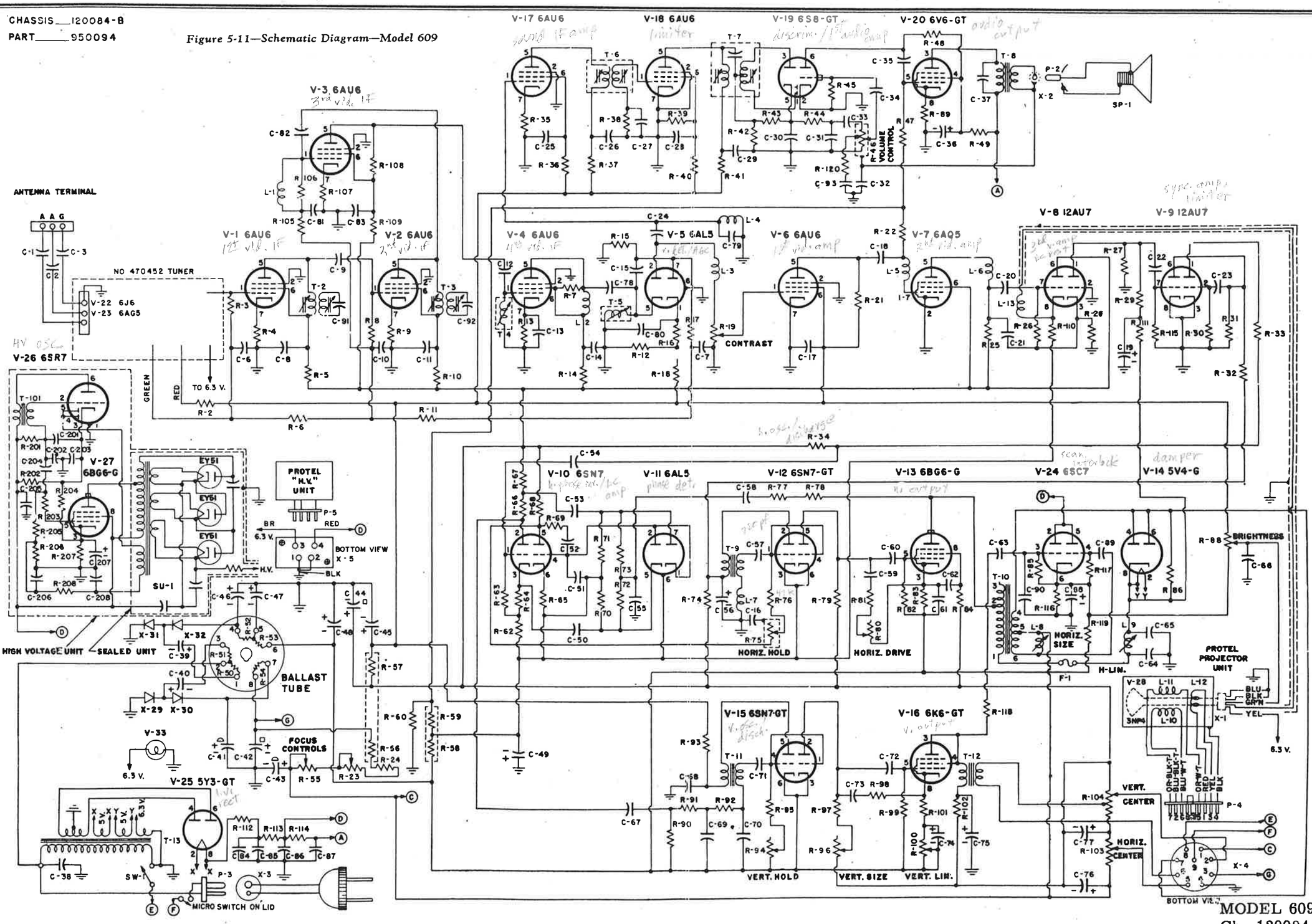
The grounding clips which make contact with the aquadag coating of the picture tube should also be cleaned in the same manner. After drying by evaporation, the tube can be reinstalled in the optical box.

Care should be exercised in handling the tube to reduce hand contact at the high voltage cup to a minimum.

©John F. Rider

CHASSIS 120084-B
PART 950094

Figure 5-11—Schematic Diagram—Model 609



©John F. Rider