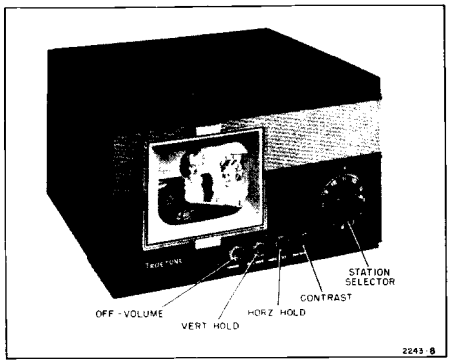


GENERAL DESCRIPTION

The Model D2985 Television Receiver is an 18-tube, direct-view, 7-inch table model which may be operated on either alternating or direct current. The receiver is complete in one unit and is operated by the use of five front-panel controls. Features of the receiver include; complete coverage of all 12 television channels; FM sound system; and reduced-hazard high voltage supplying 5000 volts to the second anode of the picture tube.

SPECIFICATIONS

Sensitivity at the Antenna
Video—100 microvolts (400 with full contrast)
Audio—100 microvolts for 50-milliwatt output

Power-Supply Rating
105-125 volts, 50-60 cycle AC or DC, 100 watts

Audio Power Output Rating
Undistorted—1.2 watts
Maximum—2 watts

Antenna Impedance Requirements
Balanced 300-ohm

Speaker
Type—4-inch P. M.
Voice Coil Impedance (400 cycles)—3.2 ohms

Picture Size
5½ x 4¼ inches

Dimensions
Cabinet—17" x 10" x 16½"
Chassis — 15" x 8½" x 14¾"

Tube Complement

6BH6, R-F Amplifier
6J6, Oscillator-Converter
25L6, Audio Output
19T8, Discriminator and Audio Amplifier
12AU6, Limiter
6BA6, I-F Amplifier
6BA6, I-F Amplifier
6BA6, I-F Amplifier
6AL5, 2nd Detector
12AU6, Sync Separator
12AU6, Video Amplifier
12SN7, Horizontal Multivibrator
50L6, Horizontal Output
12SN7, Vertical Multivibrator
12SN7, Vertical Output
50L6, High-Voltage Oscillator
1B3/8016, High-Voltage Rectifier
7JP4, Picture Tube

TELEVISION FREQUENCY RANGES

(All figures represent megacycles)

Channel	Channel Frequencies	Picture Carrier Frequency	Sound Carrier Frequency	Receiver RF Oscillator Frequency
Low Band				
2	54-60	55.25	59.75	82
3	60-66	61.25	65.75	88
4	66-72	67.25	71.75	94
5	76-82	77.25	81.75	104
6	82-88	83.25	87.75	110
High Band				
7	174-180	175.25	179.75	202
8	180-186	181.25	185.75	208
9	186-192	187.25	191.75	214
10	192-198	193.25	197.75	220
11	198-204	199.25	203.75	226
12	204-210	205.25	209.75	232
13	210-216	211.25	215.75	238

OPERATION OF THE RECEIVER

FUNCTIONS OF THE CONTROLS

All the controls normally used in tuning in a program — both picture and sound — are located on the front of the receiver. On the rear of the set are several controls which are preset at the factory and may need slight re-adjustment at the time of installation. After installation, they should need no further adjustment, unless required by replacement or aging of tubes, variations in power-line voltage, or other external conditions. The functions of each of the controls is described below.

On Front of Set

(See page 1)

Volume-Off — Turns set on or off and adjusts sound volume.

Vert. Hold—Stops pictures from moving up or down.

Horz. Hold—Stops pictures from moving left or right.

Contrast—Varies contrast between light and dark portions of picture.

Station Selector Knob—Tunes set to desired channel (station). May be turned in either direction.

On Rear of Set

(See page 9)

Brightness—Controls brilliance of picture.

Vert. Size — Changes size of picture vertically. Does not affect horizontal size.

Horiz. Size–Changes size of picture horizontally. Does not affect vertical size.

Focus—Focuses picture on face of picture tube.

H. Centering—Moves entire picture horizontally

V. Centering—Moves entire picture vertically.

TUNING PROCEDURE

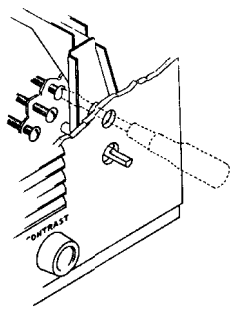
1. Turn the VOLUME control clockwise to turn the set on. Allow one-half minute for the set to warm up.
2. Set the station selector knob to the desired channel.
3. Turn the CONTRAST control fully counter-clockwise.
4. Turn the BRIGHTNESS control (on the rear of the set) fully clockwise, and then turn it slowly counter-clockwise until the picture tube just becomes dark. *For any particular installation this adjustment need be made only the first time a station is tuned in, unless required by replacement of tubes.*
5. Adjust the CONTRAST control until the proper contrast between blacks and whites is obtained.
6. Adjust the VOLUME control for the desired sound level.
7. When switching from one station to another, it may be necessary to readjust the CONTRAST control.

ADJUSTMENT OF STATION SELECTOR

The station selector has been partially pre-set at the factory, but readjustment of the settings may have to be made at the time of the initial installation.

For each station which can be received with the set, adjust the station selector in the following manner. The adjustment must be made at a time when the station is transmitting either its regular program or a test pattern.

1. Turn the set on. Allow the set to warm up for 20 minutes.
2. Turn the contrast control fully counter-clockwise.
3. Turn the brightness control (on the rear of the set) to its extreme clockwise position.* Then turn it slowly counterclockwise until the picture tube just becomes dark.
4. Turn the contrast control approximately two-thirds toward its full clockwise position.
5. Turn the volume control to mid-position .
6. Set the station selector knob to the desired channel.
7. Grasp the station selector knob around its edge and, while rocking it, *pull* it off its shaft.
8. Insert a screwdriver into the hole above the station selector knob shaft (see illustration). Turn the screw slowly counter-clockwise (and then clockwise, if necessary) until maximum sound is heard. This may require several turns in one direction or the other. Adjust the volume control if necessary. (Do not at any time force the screw in either direction if it becomes difficult to turn. The screw has then reached the end of its travel in that direction and its direction should be reversed.)



9. When the sound is at maximum, the picture** will appear on the screen but "sound bars" (dark horizontal bars of varying width) will be seen traveling vertically from bottom to top across the picture. With the screwdriver, turn the station selector screw counter-clockwise *only far enough to remove the sound bars from the picture.*
10. The station selector has now been properly adjusted for this particular channel. Replace the station selector knob and repeat the procedure for all other stations within range of the receiver.

* If the set is being operated on direct current, and at this time the picture tube does not light up, reverse the line plug in the electric outlet. Then wait 15 minutes before proceeding.

** If a steady picture is not obtained, adjust the H. HOLD and V. HOLD controls.

TELEVISION ANTENNAS

Because the antenna is such an important factor in the proper operation of a television receiver, it is thought that a brief general discussion of television antennas might properly be included here.

HEIGHT

The characteristics of transmission at the high frequencies assigned to television differ considerably from those encountered at the lower frequencies. The most important difference is that the straight-line travel of television signals, called line-of-sight propagation, does not follow the curvature of the earth as do broadcast signals. Television transmission can thus be intercepted by a hill or other obstruction, preventing reception by a receiving antenna located behind the obstruction. For this reason it is necessary that the antenna be located high enough to clear intervening obstructions.

GHOSTS

Another peculiarity of television transmission is that re-radiations from conducting structures act as secondary transmissions and may arrive at the receiving antenna at different times, thus repeating video modulation already broadcast. These repetitions appear as "ghosts" or multiple images offset slightly to the right of the true image on the face of the picture tube. When ghosts are caused by reflections from directions other than an angle close to the source of transmission, it is possible to minimize the condition by proper orientation of the receiving antenna.

LEAD-IN

The antenna is connected to the receiver through a transmission line having a characteristic impedance equal to the impedance of the antenna and to the input impedance of the receiver. Improper termination matching of a transmission line will cause reflections of energy to travel back and forth, causing ghosts if the line is long enough. However, even a short length of mismatch transmission line will cause poor definition of the picture and increase energy-transfer losses.

The 300-ohm transmission line used with this receiver is balanced to ground and should be kept as far as possible away from metal objects, including the mast of the antenna structure itself. Also, to reduce the amount of noise pick-up, the lead-in should have the shortest possible horizontal runs and should be twisted about one turn per foot. While the attenuation in this transmission line is fairly low (about 1 db per 100 feet at 90 megacycles), it is recommended that the line be kept as short as possible, with the excess cut off.

Lengths of Folded Dipole Antennas (Air Dielectric) Required at Various Frequencies

Channel	Frequency (mc)	Folded Dipole Total Length (ft)
Low Band		
2	54-60	7.8
3	60-66	7.0
4	66-72	6.4
5	76-82	5.6
6	82-88	5.2
High Band		
7	174-180	2.51
8	180-186	2.42
9	186-192	2.35
10	192-198	2.28
11	198-204	2.21
12	204-210	2.15
13	210-216	2.09

CIRCUIT DESCRIPTIONS

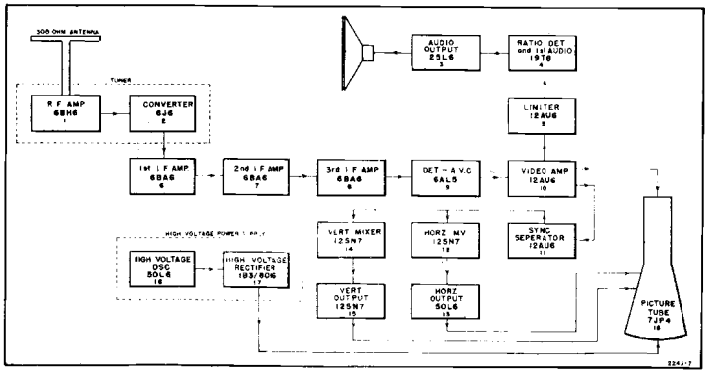


Figure 1. Complete Block Diagram

TUNER

The tuner uses a 6BH6 r-f amplifier and a 6J6 oscillator-converter. Coil L1 is an impedance-matching coil which matches the 300-ohm balanced antenna lead-in to the 6BH6, between grid and cathode.

Coils T1 and T2 are low- and high-band plate coils tuned with iron cores to the proper r-f frequencies corresponding to channel positions. These coils are coupled, by capacitors C117, C118, and C6, to converter grid coils T3 and T4, which are also tuned to the same r-f frequency. This gives an overall r-f response of 6 megacycles at 6 db down which covers the complete channel being tuned.

Coils T5 and T6 are low- and high-band oscillator coils tuned in the same manner to 22.25 megacycles above the sound carrier frequency. The signal is coupled to the converter grid, thru capacitor C13, giving a converter output of 22.25 megacycles at sound carrier and 26.75 megacycles at picture carrier.

Voltage and Resistance Readings from Tube-Socket Terminals to Ground

Tube	Terminal				
	1	2	5	6	7
1	0 100K	.7 68	80 (LB) 125 (HB) > 500K	122 500K	0 5600
2*	105 > 500K	95 > 500K	—1 10K	0 10K	2 220

*Voltage readings on pins 2, 5, and 7 taken thru an r-f choke similar to Coil L7.

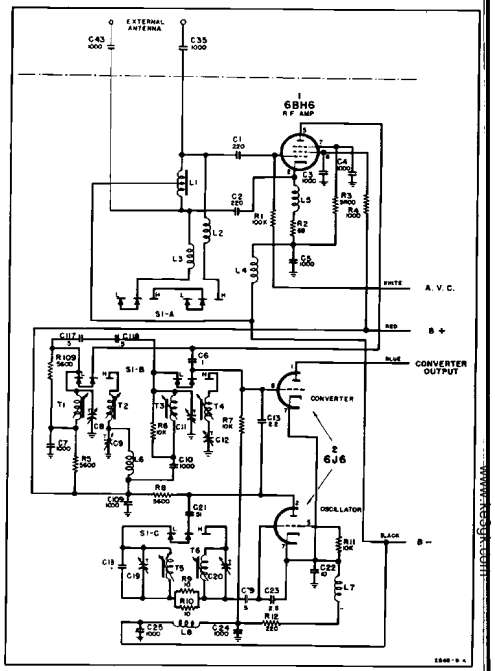


Figure 2. Tuner

INTERCARRIER SOUND SYSTEM

The intercarrier sound system utilizes the beat frequency (4.5 megacycles) between the picture carrier and the sound carrier as transmitted. Three tubes are used, a 12AU6 limiter, a 19T8 ratio detector and first audio amplifier, and a 25L6 audio output tube. Coil T9, tuned to 4.5 megacycles, picks the intercarrier sound off of the video output tube. This is fed thru capacitor C40 to the grid of limiter tube 5, the output of which is applied to the primary of the ratio detector coil T8, also tuned to 4.5 megacycles.

The dynamic limiter circuit is made up of coil L9 (self-resonant to 4.5 megacycles), capacitor C115, and

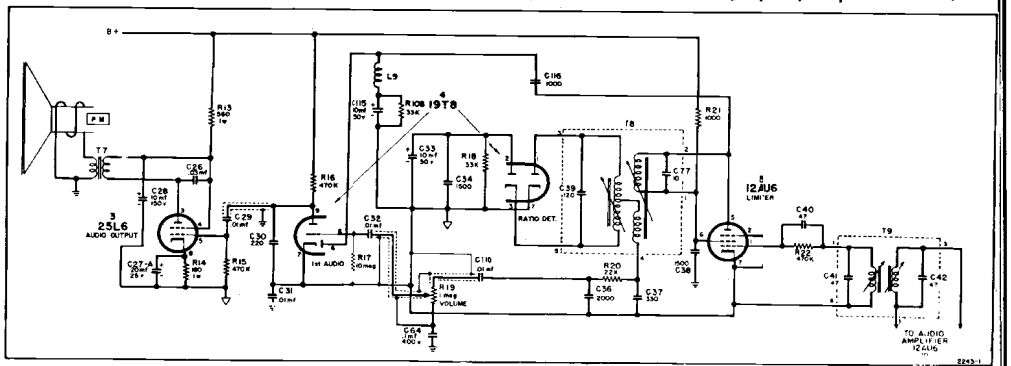


Figure 3. Intercarrier Sound System

resistor R108, coupled to the plate of the limiter tube thru capacitor C116 and back to the diode plate (pin 6) of tube 4. The limiter operates as a variable-threshold voltage regulator to maintain the instantaneous peak carrier voltage constant at its average level. This varies the damping introduced by the diode as the carrier level varies.

The double-diode section of tube 4 is used as a conventional ratio detector with the audio coming off the tertiary winding of coil T8. Capacitor C37 is the balancing capacity and resistor R20 and capacitor C36 make up the de-emphasis network. Resistor R19 is a 1-megohm tapered volume control in the grid circuit of the first audio triode portion of tube 4. This triode has a large plate load, R16, giving sufficient output to drive a conventional 25L6 output tube. The speaker is a 4-inch P.M. type with a 3.2-ohm voice coil.

The separate B+ filter to output tube 3, consisting of resistor R13 and capacitor C28, keeps audio ripple out of the B+ line. The shields around the long audio leads running to the volume control and between the two audio tubes are used to reduce hum pickup.

Voltage and Resistance Readings from Tube-Socket Terminals to Ground

Tube	Terminal								
	1	2	3	4	5	6	7	8	9
3			100 30K	100 30K	0 470K			8 180	
4	0 Inf.	0 30K	0 Inf.			0 33K	0 0	0 10 Meg.	40 500K
5	0 500K	0 0			115 30K	115 30K	0 0		

I-F SYSTEM AND DETECTOR

The i-f system uses three 6BA6 amplifiers and one 6AL5 detector. The four stagger-tuned coils—T15, T10, T11, and T12—give an overall response at 6 db of 3.5 megacycles.

Stage 1 (T15), or converter output, is tuned to 23.0 megacycles.
Stage 2 (T10) is tuned to 24 megacycles.
Stage 3 (T11) is tuned to 26.4 megacycles.
Stage 4 (T12) is tuned to 25.45 megacycles.

AVC voltage is obtained across R39, thru capacitor C66, from the second half of tube 9. This AVC voltage is fed to the first two i-f tubes and to the r-f tube in the tuner. Resistors R40 and R42 constitute an AVC delay of approximately 3 volts.

Voltage and Resistance Readings from Tube-Socket Terminals to Ground

Tube	Terminal				
	1	2	5	6	7
6	0 230K	1 6000	105 30K	105 30K	1 80
7	0 47K	1 6000	105 30K	105 30K	1 80
8	0 0	1 6000	105 30K	105 30K	1 70
9	0 0	0 100K	3 3300		0 5000

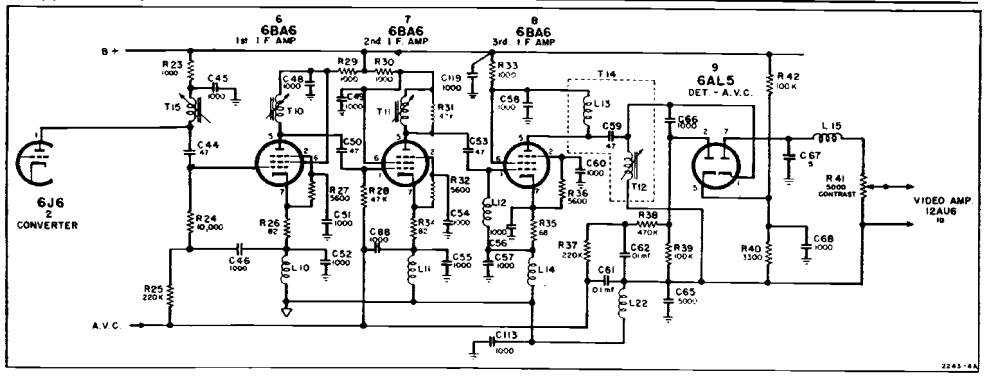


Figure 4. I-F System

VIDEO AMPLIFIER, SYNC SEPARATOR, AND D-C RESTORATION

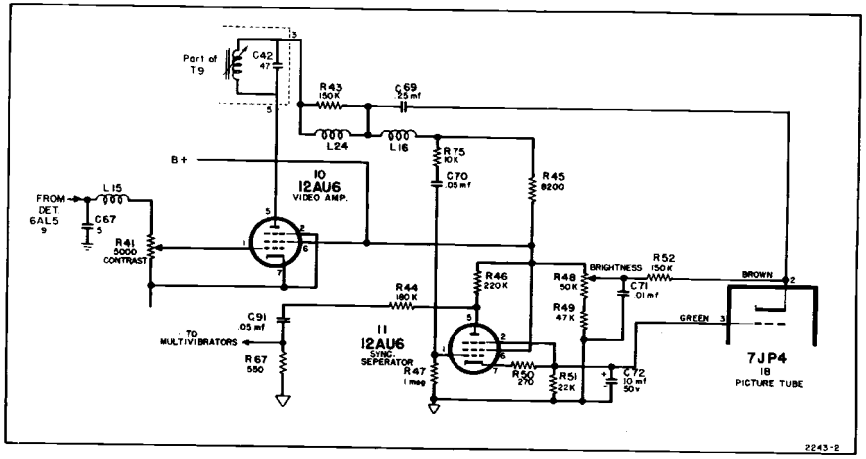


Figure 5. Video Amplifier and Sync Separator

The video amplifier uses a 12AU6 tube (10) which drives the cathode of the picture tube. This requires negative-going sync on the grid of the video tube, which provides noise clipping. Bias for the video tube is obtained from the diode load, contrast control R41. Coils L15, L24, and L16 are peaking coils which in conjunction with load resistor R45 and damping resistor R43 give a response flat to within 3 db out to 3 megacycles.

The sync separator, which separates the video information from the sync pulses, also uses a 12AU6 tube coupled to the video output tube thru capacitor C70 in series with resistor R75. The 10,000-ohm resistance isolates the capacity present in the sync clipper. The high value of resistor R51 is used to bias the tube toward cutoff to improve the capability of the tube in handling positive sync pulses present on the grid. The large value of plate resistor R46, 220,000 ohms, limits the maximum plate current, which clips the sync off above the pedestal. Unbypassed cathode resistor R50 provides sufficient degeneration to stabilize the gain of the tube.

The bypassed cathode resistor R51 and capacitor C72 give a d-c voltage which is a function of the average value of the signal. This potential is applied to the picture tube grid to re-insert the d-c component. Brightness control is accomplished by applying dc from a B+ bleeder (R48 and R49) thru isolation resistor R52 to the cathode of the picture tube.

The amplitude of the sync pulse on the plate of the sync separator tube 11 is quite high, approximately 60 volts peak to peak, so it is divided down thru resistors R44 and R67 to provide a small voltage for triggering the multivibrators.

The 4.5-megacycle sound carrier is also taken from the plate of the video amplifier tube by coil T9. The primary winding is in series with the plate lead and is tuned to 4.5 megacycles. Its effect upon the video response was taken into consideration and compensated for in coils L24 and L16.

Voltage and Resistance Readings from Tube-Socket Terminals to Ground

Tube	Terminal				
	1	2	5	6	7
10	1 max. 5000 max.	0 0	65 40K	125 30K	0 0
11	0 800K	4 20K	85 30K	125 30K	4 22K

MULTIVIBRATOR AND SWEEP CIRCUITS

The horizontal multivibrator uses a 12SN7 tube (12) and is of the conventional cathode-coupled type. Sync pulses at point A are differentiated by capacitor C90 and resistor R66 and trigger the multivibrator. Capacitor C94 and resistors R65 and R64 cause the second half of tube 12 to act as a discharge tube to form a sawtooth wave. The horizontal size control, R64, changes the amplitude of this sawtooth voltage by varying the plate load. The horizontal hold control, R69, changes the natural frequency of the multivibrator by varying the time constant of resistors R69 and R70 and capacitor C92.

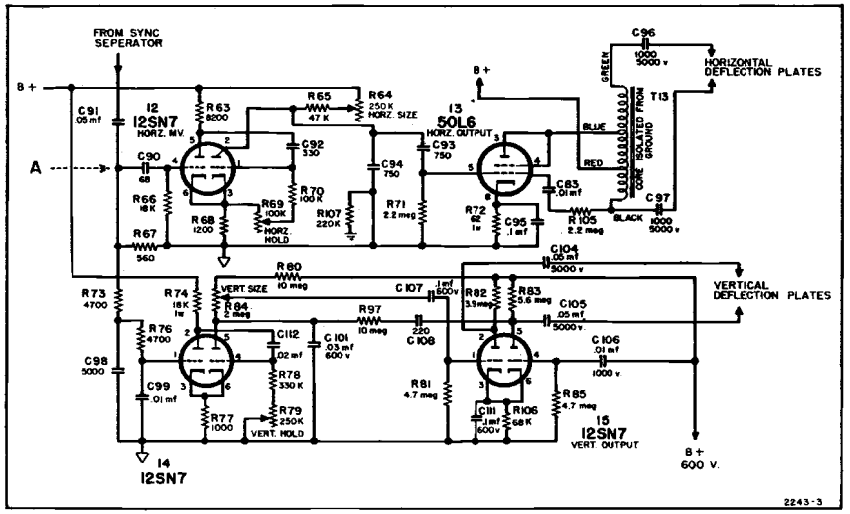


Figure 6. Multivibrator and Sweep Circuit

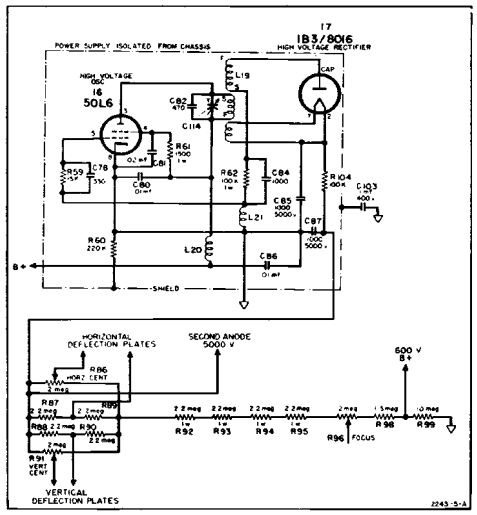


Figure 7. High-Voltage Power Supply

The multivibrator output is fed to the 50L6 output tube (13) which has a center-tapped auto-transformer in its plate circuit. This, in addition to the tube gain, provides a sufficient voltage step-up for horizontal deflection. Some distortion is introduced but is compensated for by the feedback network, capacitor C83 and resistor R105, giving a final output which is linear.

The vertical multivibrator also uses a cathode coupled 12SN7 tube (14). Sync voltage is fed to the first grid thru the integrating circuit made up of R73, C98, R76, and C99. The output is a discharge sawtooth voltage, across capacitor C101, whose amplitude is varied by vertical size control R84. The natural frequency of the multivibrator is varied by vertical hold control R79.

The discharge half of tube 14 gets its plate voltage from the high-voltage bleeder, giving a more linear discharge curve. The output of this half of the tube is fed to a 12SN7 paraphase amplifier (tube 15) which gets its phase inversion for the second grid by taking a small amount of voltage from the output of the first section thru capacitor C106. Some distortion is also introduced here which is compensated for by the feedback network consisting of resistor R97 and capacitor C108.

Voltage and Resistance Readings from Tube-Socket Terminals to Ground

Tube	Terminal						
	1	2	3	4	5	6	8
12	0 200K	50 200K	3 12K	0 18K	100 30K	3 12K	
13			120 30K	120 30K	0 2.2 Meg.		1 62
14	0 10K	80 30K	2 1000	0 400K	30 30K	2 1000	
15	0 4.7 Meg.	200 10 Meg.	15 68K	0 4.7 Meg.	200 10 Meg.	15 68K	

HIGH-VOLTAGE SUPPLY

The high-voltage supply combines the high-voltage oscillator, rectifier, and filter in a separate chassis mounted on the main chassis. This assembly uses a 50L6-GT/G tube (16) as an oscillator plate-tuned to approximately 250 kilocycles. The voltage is stepped up to 5000 by the secondary of coil L19 and is rectified by the 1B3/8016-GT rectifier. Filament voltage for the rectifier is obtained from a separate coil coupled to the oscillator tank. Since there is no way to measure the r-f current in the filament, a visual test must be used comparing the brilliance with that obtained by the use of a 1.2-volt battery on a similar tube.

The complete supply is mounted on insulated shoulder washers, isolating it from the main chassis and thus reducing r-f hum. B minus is connected to the shield thru 220,000 ohms (R60) to bleed off any static charge that may build up. The shield is connected to the main chassis thru capacitor C103; this helps to reduce r-f radiation from the high-voltage shield.

Resistor R104 and capacitors C85 and C87 constitute a filter network which removes the rf from the d-c output.

The power supply works into effectively a 13-megohm load and delivers approximately 400 microamperes, part of the load being the vertical output tube and one-half the vertical multivibrator. Trimmer C114 tunes the oscillator tank and can adjust the output to more than 5000 volts. For proper operation this should be reduced to 5000 volts by a clockwise rotation of the trimmer after peaking.

Voltage and Resistance Readings from Tube-Socket Terminals to Ground

Tube	Terminal					
	2	3	4	5	8	Cap.
16		127 3000	100 1500	0 15K	0 0	
17	5000 13 Meg.					0 100K

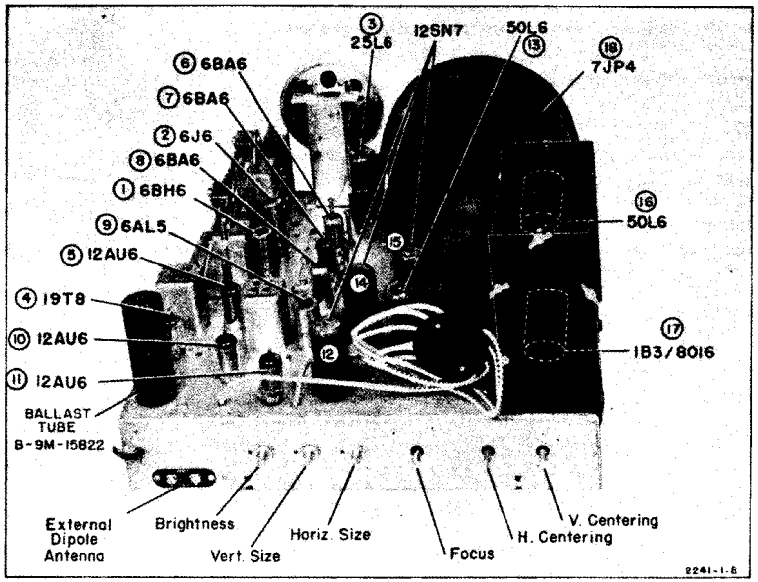


Figure 8. Location of Tubes and Rear Controls

ALIGNMENT PROCEDURES
VIDEO I-F ALIGNMENT

Equipment Required: DC vacuum-tube voltmeter (Volt-ohmyst or equivalent) equipped with high-frequency probe.
Signal generator (4.5 to 220 mc)
Sweep generator (4.5 to 220 mc with 10-mc sweep)
Oscilloscope (2.5-mc bandwidth)

1. Connect the signal generator, thru a 47-mmf capacitor, to the converter. Ground the generator to the tuner cover. The converter connection may be made thru a hole in the tuner cover (figure 9).
2. Connect the voltmeter across contrast control R41. Turn the contrast control full on.
3. Switch the tuner to the high band.
4. With the signal generator set at the specified alignment frequencies, tune the corresponding coils for maximum response on the output meter, as indicated below. All the coils are slug tuned. (See figure 9.)

Stage	Frequency (mc)	Adjustment
1st IF (Converter)	23.0	T15
2nd IF	24.0	T10
3rd IF	26.4	T11
4th IF (Diode)	25.45	T12

5. Connect a sweep generator to the converter and an oscilloscope in place of the meter. (See figure 10.) Check the peaks of the response for symmetry.

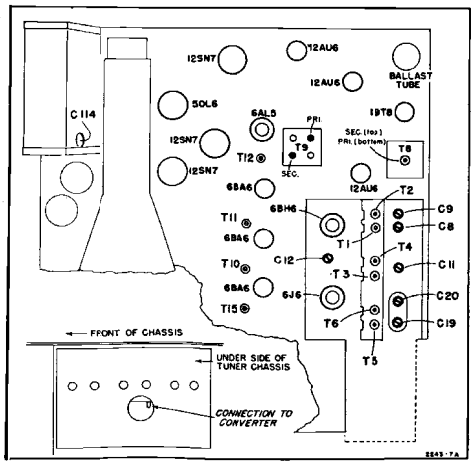


Figure 9

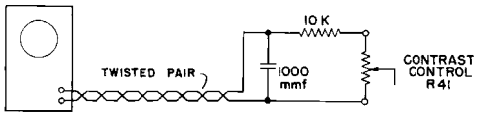


Figure 10

Re-adjust T12 if necessary. (The signal generator and meter may be used for this purpose.)

6. With the signal generator and meter, check the IF sensitivity. At peak response this should be 1000 microvolts ±50% for .5 volt dc on the meter.
7. Check the IF video-carrier to sound-carrier ratio. Make the measurement as follows: At maximum response, determine the average sensitivity between peaks and valley of the response curve, for an output of .5 volt. Next set the generator input to twice this sensitivity figure and detune the generator, in the high frequency direction, until the meter reading returns to .5 volt. Record this generator input, the "video carrier sensitivity." Now decrease the frequency of the signal generator 4.5 megacycles and again adjust the generator input to give a meter reading of .5 volt. This input is the "sound-carrier sensitivity." The ratio of sound carrier sensitivity to video-carrier sensitivity should be between 5:1 and 10:1.

   In the event the signal generator output is not calibrated in microvolts, the following procedure may be employed: Short the AVC to B- by connecting a clip lead in shunt with capacitor C61. Adjust the signal generator to a frequency corresponding to the average output level between the peaks and valley. Adjust the signal generator output level to produce 4 volts dc across the contrast control. Next detune the signal generator in the high frequency direction until the meter reading falls to 3.4 volts. Now decrease the frequency of the signal generator 4.5 megacycles and note the dc voltage across the contrast control. The dc voltage should be between 1-½ and 2-½ volts, which corresponds to a ratio of between 5:1 and 10:1.
8. Connect the sweep generator to the antenna terminals. (If the sweep generator available does not have a balanced output, connect it as shown in figure 11.) Check channels 2, 4, 6, 7, 9, 13 for overall response, keeping the generator output at a level which will provide approximately a 2-volt peak-to-peak output. If the set does not track properly,* refer to the tuner alignment procedure.
9. Connect the signal generator (see figure 11) to the antenna terminals and the voltmeter in place of the oscilloscope.
10. Check the overall sensitivity. At a frequency corresponding to the average response, the sensitivity, for a .5-volt output across the diode load, should be between 200 and 800 microvolts for the low band and between 200 and 1200 microvolts for the high band.
11. Check the overall video-carrier to sound-carrier ratio. Use the procedure described in step 7, except that the generator should be detuned in the *low* frequency direction for the video carrier and the frequency should be *increased* from there for the sound carrier. The overall ratio should be between 5:1 and 15:1.

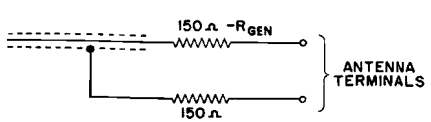


Figure 11

* See step 9 of tuner alignment procedure.

SOUND I-F ALIGNMENT

1. Connect the CW signal generator across the contrast control. Turn the contrast control on full. Turn volume control on full. Short the antenna input.
2. Connect the voltmeter from pin 8 of tube 19T8 to B- (negative side to B-).
3. With the generator apply a 4.5-megacycle CW signal. Adjust the input for a meter reading of approximately .5 volt.
4. Turn the slug in the secondary of ratio detector transformer T8 all the way out.
5. Tune primary and secondary of pick-off coil T9 for maximum reading on the meter.
6. Connect the oscilloscope in place of the meter and the sweep generator in place of the CW generator.
7. Apply a signal which will sweep 500 kilocycles above and below 4.5 megacycles. (The sound IF selectivity response curve of coil T9 will be seen.)
8. Turn in the slug of the ratio detector secondary (T8) until the ratio detector curve appears. Adjust this slug for maximum linearity.
9. Adjust the primary of ratio detector transformer T8 for symmetry of the ratio detector curve about the 4.5-megacycle center.

TUNER ALIGNMENT

1. Adjust the tuning cores to the positions shown in figure 12.
2. Pre-set the trimmers approximately to the dimensions shown in figure 13. Measurements are made from shoulder of screw head to chassis.
3. Switch to channel 6 on the low band and set the channel 6 station selector screw out 1 turn from its maximum "in" position.
4. Connect an oscilloscope across contrast control R41, as shown in figure 10. Turn the contrast control on full.
5. Connect a sweep generator to the antenna terminals and adjust the generator until a response curve (may vary considerably from figure 14) appears on the oscilloscope screen. The generator should have a balanced output; if it does not, connect it as shown in figure 11.
6. Alternately adjust r-f trimmers C8 and C11 for maximum response with symmetrical peaks.

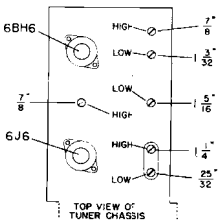


Figure 13

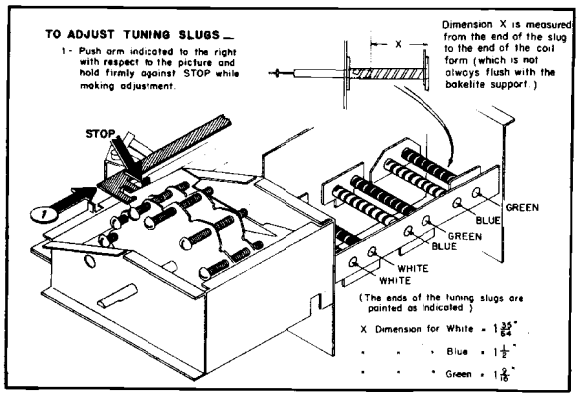


Figure 12. Tuner Core Adjustment
(On later models, green-painted cores have been changed to red.)

7. Connect a signal generator (see figure 11) to the antenna terminals and apply an 83.25-megacycle signal (channel 6 video-carrier frequency). A marker should appear on the oscilloscope (see figure 14).
8. Adjust oscillator trimmer C19 until the marker is 50% down on the low-frequency slope. It may be necessary to repeat step 6.
9. Switch to each of the other channels on the low band and check the symmetry of the response curve for each switch position. (The sweep generator will have to be reset for each channel). Use trimmers C8 and C11 to effect a compromise which will give the best overall response across the band. The important thing is that deviations from a flat top be kept to a minimum. This may mean that the response for some channels will have to be improved at the expense of others.
10. Switch to channel 2, apply a 55.25-megacycle signal, and note the position of the marker on the response curve. If the marker can be moved to the 50% point by adjustment of the channel 2 station-selector screw (with the screw still at least 2 turns in from its maximum "out" position , the alignment of the low band has been properly completed.
11. Switch to channel 13 on the high band and set the channel 13 station selector screw out ¾ turn from its maximum "in" position.
12. Re-adjust the sweep generator so that the response curve appears on the screen.
13. Adjust r-f trimmers C9 and C12 alternately for maximum response with symmetrical peaks.
14. With the signal generator, apply a 211.25-megacycle signal (channel 13 video-carrier frequency).
15. Adjust oscillator trimmer C20 until the marker is 50% down on the low-frequency slope. It may be necessary to repeat step 13.
16. Switch to each of the other channels on the high band and check the symmetry of the response curve for each switch position. (The sweep generator will have to be reset for each channel.) Use trimmers C9 and C12 to effect a compromise which will give the best overall response curve across the band. (See step 9 for definition of "best".)
17. Switch to channel 7, apply a 175.25-megacycle signal, and note the position of the marker on the response curve. If the marker can be moved to the 50% point by adjustment of the channel 7 station-selector screw (with the screw still at least one turn in from its maximum "out" position), the alignment of the high band has been properly completed.

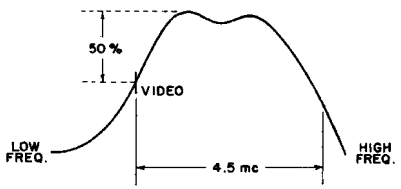


Figure 14. Ideal Response Curve

TROUBLE-SHOOTING

Trouble	Probable Location	Reference
No raster **Sound normal**	a. Improper high voltage (approximately 5000 volts is normal). b. Check voltage between grid and cathode of picture tube; should be only about 40 volts dc. c. Check output of tubes 13 an 15. d. Defective picture tube.	a. Fig. 7 c. Fig. 6
No picture **No sound** **Raster normal**	a. Defective antenna or lead-in connections. b. Defective tubes 1, 2, 5 thru 10. c. Defective band switch. d. Check resistances and voltages at sockets of tuner and i-f tubes. e. Check alignment.	a. Page 4 b. Fig. 8 c. Fig. 2 d. Pages 5, 6 e. Pages 10, 11, 12
No sound **Picture normal**	a. Defective tubes 3, 4, 5. b. Check coil T9 for continuity. c. Check alignment of ratio detector coil T8 and pick-off coil T9.	a. Fig. 8 b. Fig. 3 c. Page 11
No picture **Sound normal** **Raster normal**	a. Defective capacitor C69.	a. Fig. 5
No sync.	a. Defective tubes 11, 12, 14. b. Defective resistors R44, R46, R73, R76 or capacitor C91. c. Check voltages and resistances at sockets of tubes 11, 12, 14.	a. Fig. 8 b. Figs. 5, 6 c. Pages 7, 8

TROUBLE-SHOOTING, *continued*

Trouble	Probable Location	Reference
No vertical sync. **Picture normal**	a. Defective tube 14. b. Defective resistors R73, R76, R77 or capacitors C98, C99, C112. c. Check resistances and voltages at socket of tube 14.	a. Fig. 8 b. Fig. 6 c. Page 8
No horizontal sync.	a. Defective tube 12. b. Defective resistors R66, R67, R68 or capacitor C90. c. Check resistances and voltages at socket of tube 12.	a. Fig. 8 b. Fig. 6 c. Page 8
No vertical sweep	a. Improper high voltage (should be approximately 5000 volts). b. Defective tube 15. c. Check output of tube 14. d. Defective capacitors C104, C106, C107.	a. Fig. 7 b. Fig. 8 c. Fig. 6 d. Fig. 6
No horizontal sweep	a. Defective tube 13. b. Check output of tube 12. c. Defective capacitors C93, C96, C97.	a. Fig. 8 b. Fig. 6 c. Fig. 6
Bunching at side of picture	a. Defective tube 13. b. Defective capacitors C83, C95 or resistor R105.	a. Fig. 8 b. Fig. 6
Bunching at top or bottom of picture	a. Defective tube 15. b. Defective resistors R82, R83, R97 or capacitors C106, C108.	a. Fig. 8 b. Fig. 6
Audio in picture	a. Check ratio measurements. b. Check alignment.	a. Page 10 b. Pages 10,11, 12
Picture cannot be centered vertically	a. Check range of vertical centering control R91. b. Defective resistors R88, R90. c. Leakage in capacitors C104, C105.	a. Fig. 7 b. Fig. 7 c. Fig. 6
Picture cannot be centered horizontally	a. Check range of horizontal centering control R86. b. Defective resistors R87, R89. c. Leakage in capacitors C96, C97.	a. Fig. 7 b. Fig. 7 c. Fig. 6
Insufficient vertical sweep size	a. Check voltage at junction of resistors R98 and R99; should be between 600 and 700 volts. b. Defective tubes 14 and 15. c. Defective resistors R82, R83.	a. Fig. 7 b. Fig. 8 c. Fig. 6
Insufficient horizontal sweep size	a. Defective tubes 12 and 13. b. Defective capacitors C93, C96, C97. c. Check resistances and voltages at sockets of tubes 12 and 13.	a. Fig. 8 b. Fig. 6 c. Page 8
Inability to focus picture	a. Check voltage range on focus control; should be between 1500 and 2000 volts. b. Defective picture tube.	a. Fig. 7
Streaks in picture	a. Check lead dress in high-voltage supply to prevent corona or arcing. b. Check antenna system to minimize effects of external electrical disturbances. c. Noisy or gassy tubes. d. Check rubber insulation on rear picture-tube support.	a. Page 4
High voltage below normal	a. Defective tubes 16, 17. b. Defective capacitors C85, C87 or resistor R61.	a. Page 8 b. Fig. 7
RF in Picture	a. Check for short between r-f power supply shield and chassis.	a. Page 9

REPLACEABLE PARTS LIST

TUNER

Capacitors

Ref. Symbol	Part No.	Description
C1-2-14-15-16-17	C-8G-16045	220 mmf, 70%
C3-4-5-7-10-24-25-109	C-8G-13201	1000 mmf
C6 *	A-8G-12495-2	1.0 mmf
C8-9-11-12-19-20	B-201-15142	Trimmer capacitor
C13	A-8G-12495-4	2.2 mmf
C18	C-8G-15224	7 mmf, ±1/2 mmf
C21-79	C-8G-11891	51 mmf, ±5%
C22	C-8G-11789	10 mmf, ±10%
C23	C-8G-15737	2.5 mmf, ±20%
C117-118	A-8G-12495-7	.5 mmf

Resistors

R1	C-9B1-86	100,000 ohms, 1/2 watt, 10%
R2	C-9B1-48	68 ohms, 1/2 watt, 10%
R3-5-8-109	C-9B1-71	5600 ohms, 1/2 watt, 10%
R4	C-9B1-13	1000 ohms, 1/2 watt, 20%
R6-7-11	C-9B1-74	10,000 ohms, 1/2 watt, 10%
R9-10	C-9B1-38	10 ohms, 1/2 watt, 10%
R12	C-9B1-54	220 ohms, 1/2 watt, 10%

Coils

L1	A-201-15676	Antenna coil
L2-3		No. 18 tinned copper wire, straight, bare
L4-5-6-7-8	A-16A-16637	RF choke
T1-3	B-13E-12046	RF coil, low band
T2-4	A-201-15675 or B-13D-12155	RF coil, high band (uses core with green end) / RF coil, high band (uses core with red end)
T5	B-13D-12155	Oscillator coil, low band
T6	A-13D-12045	Oscillator coil, high band

Miscellaneous

	A-15C-10717	Tube socket, 7-prong, miniature
	A-51A-15713	Iron core, for coils T5, T6
*	A-51A-15714	Iron core, for coils T2, T4 (green end)
*	A-51A-16391	Iron core, for coils T2, T4 (red end)
	A-51A-15715	Iron core, for coils T1, T3
	A-2M-16276	Core mounting clip
	A-2J-11593	Switch contact, sliding
	B-5F-11592	Contact holder, Bakelite
	B-2L-15894	Switch lever (shipped assembled to stud, part number A-3C-15505)
	A-2M-15504	Leaf spring
	A-49A-15977	Coil spring
	C-5M-15487	Treadle bar, Bakelite
	B-200-15987	Tuner shaft assembly
	A-49A-15837	Detent spring

MAIN CHASSIS

Capacitors

C26	C-8D-10992	.03 mf, 200 volts, 20%
C27-A, -B, -C	B-8C-15948	Electrolytic, 20 mf-25 volts, 120 mf-150 volts, 60 mf-150 volts
C28-115	A-8C-11495	Electrolytic, 10 mf-150 volts
C29-31-32-62-71-83-89-99-110	C-8D-11738	.01 mf, 200 volts, 20%
C30	C-8G-11733	220 mmf, ceramic
C33-72	A-8C-13132	Electrolytic, 10 mf-50 volts
C34-38	C-8G-11731	1500 mmf, ceramic
C35-43-45-46-48-49-51-52-54-55-56-57-58-60-66-68-88-100-113-116-119	C-8G-13201	1000 mmf, ceramic
C36	C-8D-10778	.002 mf, 600 volts +40—15%
C37-92	C-8F3-119	330 mmf, 500 volts, 10%, mica
C39		See transformer T8
C40-44-50-53	C-8F3-109	47 mmf, 500 volts, 10%
C41-42		See coil assembly T9
C59	C-8G-12198	47 mmf (part of coil T14)
C61-95	C-8D-10771	.1 mf, 200 volts, +30%—10%
C64-103	C-8D-10760	.1 mf, 400 volts, +30%—10%
C65	A-8G-13962	.005 mf, ceramic
C67	C-8G-12166	5 mmf, ceramic
C69	C-8D-10775	.25 mf, 200 volts, +30—10%
C70-91	C-8D-10770	.05 mf, 200 volts, 20%
C73	B-8C-15664	Electrolytic, 120 mf, 150 volts
C74-75-76-102	C-8G-11734	100 mmf, ceramic
C77		See transformer T8
C90	C-8F3-111	68 mmf, 500 volts, 10%, mica
C93-94	C-8F3-246	750 mmf, 300 volts, 5%, mica
C96-97	B-8D-13523	.001 mf, 6000 volts
C98	C-8D-10935	.005 mf, 600 volts, +40%—10%
C101	C-8D-16249	.03 mf, 600 volts, 10%
C104-105	B-8D-13549	.05 mf, 6000 volts
C106	B-8D-13693	.01 mf, 1000 volts
C107-111	C-8D-10983	.1 mf, 600 volts, +30%—10%
C108	C-8F3-117	220 mmf, 500 volts, 10%
C112	C-8D-11304	.02 mf, 200 volts, 20%

Resistors

R13	C-9B2-59	560 ohms, 1 watt, 10%
R14	C-9B2-53	180 ohms, 1 watt, 10%
R15-16-22-38	C-9B1-94	470,000 ohms, 1/2 watt, 10%
R17-80-97-99	C-9B1-37	10 megohms, 1/2 watt, 20%
R18-108	C-9B1-80	33,000 ohms, 1/2 watt, 10%
R19	A-10A-15666	Volume control and switch (1 megohm)
R20-51	C-9B1-78	22,000 ohms, 1/2 watt, 10%
R21-23-29-30-33	C-9B1-13	1000 ohms, 1/2 watt, 20%
R24-75	C-9B1-19	10,000 ohms, 1/2 watt, 20%
R25-37-46-107	C-9B1-27	220,000 ohms, 1/2 watt, 20%
R26-34	C-9B1-133	82 ohms, 1/2 watt, 5%
R27-32-36	C-9B1-71	5600 ohms, 1/2 watt, 10%
R28-34-49-65	C-9B1-82	47,000 ohms, 1/2 watt, 10%
R35	C-9B1-131	68 ohms, 1/2 watt, 5%
R39-42-70	C-9B1-86	100,000 ohms, 1/2 watt, 10%
R40	C-9B1-68	3300 ohms, 1/2 watt, 10%
R41	A-10B-15272	Contrast control (5000 ohms)
R43-52	C-9B1-26	150,000 ohms, 1/2 watt, 20%
R44	C-9B1-89	180,000 ohms, 1/2 watt, 10%
R45-63	C-9B1-73	8200 ohms, 1/2 watt, 10%
R47	C-9B1-31	1 megohm, 1/2 watt, 20%
R48	A-10B-15672	Brilliance control (50,000 ohms)
R50	C-9B1-55	270 ohms, 1/2 watt, 10%
R53 thru R57		See "Ballast tube" under "Miscellaneous"
R58	C-9B2-8	150 ohms, 1 watt, 20%
R64	A-10B-15614	Horizontal size control (250,000 ohms)
R66	C-9B1-77	18,000 ohms, 1/2 watt, 10%
R67	C-9B1-59	560 ohms, 1/2 watt, 10%
R68	C-9B1-161	1200 ohms, 1/2 watt, 5%
R69	B-10B-15670	Horizontal hold control (100,000 ohms)
R71-87-88-89-90-105	C-9B1-102	2.2 megohms, 1/2 watt, 10%
R72	C-9B2-130	62 ohms, 1 watt, 5%
R73-76	C-9B1-70	4700 ohms, 1/2 watt, 10%
R74	C-9B2-77	18,000 ohms, 1 watt, 10%
R77	C-9B1-159	1000 ohms, 1/2 watt, 5%
R78	C-9B1-92	330,000 ohms, 1/2 watt, 10%
R79	B-10B-15671	Vertical hold control (250,000 ohms)
R81-85-100-101-102-103	C-9B1-35	4.7 megohms, 1/2 watt, 20%
R82	C-9B1-245	3.9 megohms, 1/2 watt, 5%
R83	C-9B1-249	5.6 megohms, 1/2 watt, 5%
R84	A-10B-16250	Vertical size control (2 megohms)
R86-91-96	B-10B-15627	Horizontal centering, vertical centering, and focus controls (2 megohms each)
R92-93-94-95	C-9B2-239	2.2 megohms, 1 watt, 5%
R98	C-9B2-235	1.5 megohms, 1 watt, 5%
R106	C-9B1-84	68,000 ohms, 1/2 watt, 10%
R112	C-9B2-130	62 ohms, 1 watt, 10%
R112	C-9B4-5	47 ohms, 2 watts, 20%

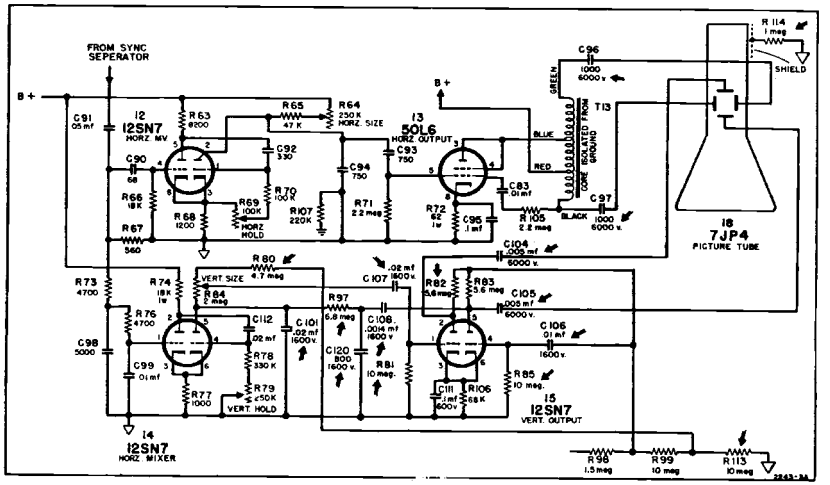
* Order core with same color end as the one being replaced.

Coils and Transformers

Ref. No.	Part No.	Description
L9	A-201-16379	Choke coil
L10-11-14-18-22-23	A-16A-16637	Filament choke coil
L12	A-201-15608	Plate choke coil
L13	A-201-15608	Plate choke coil (part of coil T14)
L15	A-201-16170	Peaking coil No. 1
L16	A-201-16172	Peaking coil No. 3
L17	C-16A-15624	Filter choke
L24	A-201-16171	Peaking coil No. 2
T7	B-12C-10074-4	Output transformer
T8	C-201-15717	IF transformer assembly (includes capacitor C39 (120 mmf) and C77 (10 mmf))
T9	C-201-16155	Sound pick-off coil assembly (includes capacitors C41 and C42, 47 mmf each)
T10-11-15	B-201-15612	Stagger tuned coil assembly
T12	B-201-15612	Stagger tuned coil (part of coil T14)
T13	B-12M-15662	Horizontal deflection transformer
*T14	B-201-15945	Last IF coil assembly

Miscellaneous

Ref. No.	Part No.	Description
	A-15B-10440	Tube socket, 8-prong
	A-15C-13174	Tube socket, 7-prong, miniature
	A-15C-16297	Tube socket, 9-prong, miniature
	B-15B-13785	Electrolytic mounting plate
	B-14M-11085-1	Line cord and plug
	B-21J-15661	Selenium rectifier
	B-18A-15618	Speaker, 4-inch, P.M.
	A-200-15732	Strap assembly for front of picture tube
	B-200-16300	Strap assembly for rear of picture tube
	B-15B-15622	Cable assembly and socket for picture tube
	B-9M-15822	Ballast tube (includes resistors R53 thru R57)
	A-51A-16693	Iron core for stagger tuned coil assembly (part No. B-201-15612)
	A-25B-10736	Rubber foot for cabinet
	C-2M-15904-2	Escutcheon mask
	C-30M-15905	Safety glass
	B-5B-15782-57	Knob (4 used on front)
	B-5B-15759-57	Knob for station selector



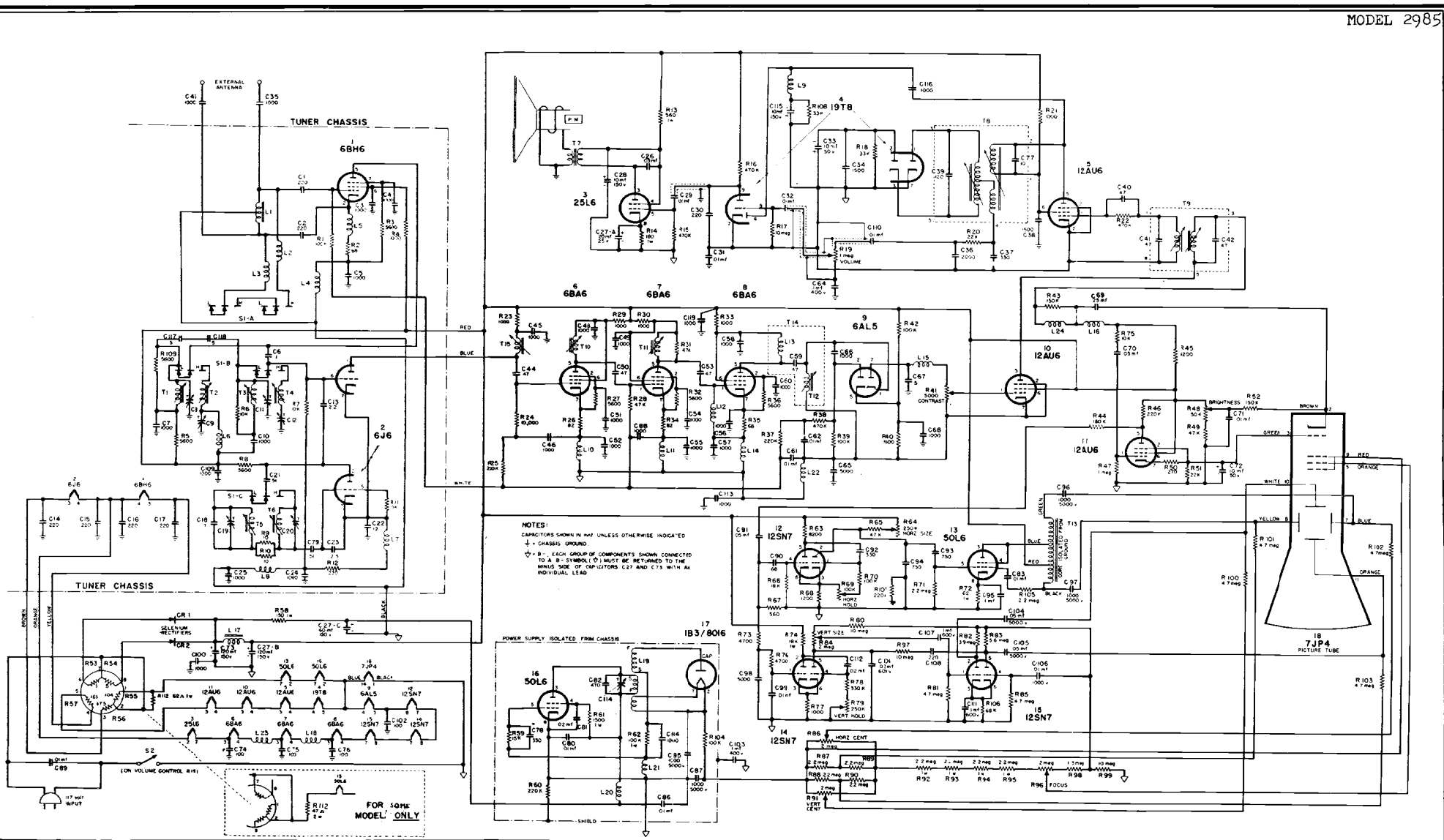
COMPONENTS CHANGED

Resistor R80 from 10 megohms to 4.7 megohms
Resistor R81 from 4.7 megohms to 10 megohms
Resistor R82 from 3.9 megohms to 5.6 megohms
Resistor R85 from 4.7 megohms to 10 megohms
Resistor R97 from 10 megohms to 6.8 megohms
Resistor R113 (10 megohms) added.

Capacitor C101 from .03 mf, 600 volts to .02 mf, 1600 volts
Capacitor C104 from .05 mf, 6000 volts to .005 mf, 6000 volts
Capacitor C105 from .05 mf, 6000 volts to .005 mf, 6000 volts
Capacitor C106 from 1000 to 1600 volts
Capacitor C107 from .1 mf, 600 volts to .02 mf, 1600 volts
Capacitor C108 from 220 mmf to .0014 mf
Capacitor C120 (800 mmf, 1600 volts) added

REPLACEMENT LIST

Ref. No.	Part No.	Description
R80	C-9B1-35	Resistor, 4.7 megohms, 1/2 w., 20%
R81-85-113	C-9B1-37	Resistor, 10 megohms, 1/2 w., 20%
R82	C-9B1-249	Resistor, 5.6 megohms, 1/2 w., 5%
R97	C-9B1-108	Resistor, 6.8 megohms, 1/2 w., 10%
C101-107	B-8D-16578	Capacitor, .02 mf, 1600 volts
C104-105	B-8D-16574	Capacitor, .005 mf, 6000 volts
C106	B-8D-16577	Capacitor, .01 mf, 1600 volts
C108	B-8D-16576	Capacitor, .0014 mf, 1600 volts
C120	B-8D-16575	Capacitor, 800 mmf, 1600 volts



POWER SUPPLY

Schematic Diagram

2243-B
11-4-44

Capacitors

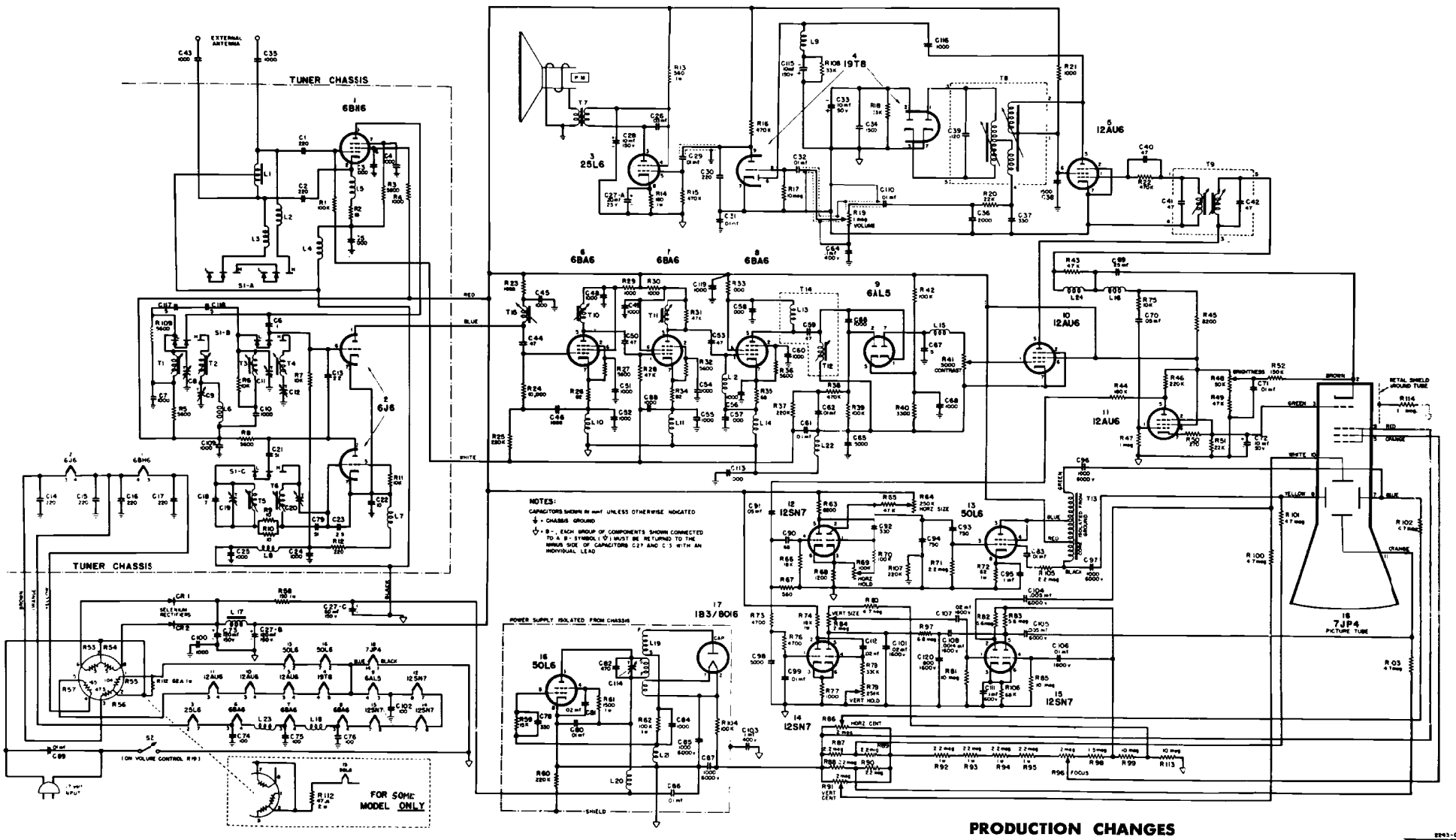
C78	C-8F3-119	330 mmf, 500 volts, 10%, mica
C80	C-8D-11738	.01 mf, 200 volts
C81	C-8D-11304	.02 mf, 200 volts
C82	C-8F3-121	470 mmf, 500 volts, 10%, mica
C84	C-8G-13201	1000 mmf, ceramic
C85-87	B-8D-13523	1000 mmf, 6000 volts
C86	A-8G-16019	.01 mf, ceramic
C114	A-8E-15555	Trimmer

Miscellaneous

L19	B-201-15557	High-voltage oscillator coil
L20	B-16A-13524	RF choke coil
L21	A-201-15556	Grid choke coil assembly
	A-158-10440	Tube socket, octal

Resistors

R59	C-9B1-76	15,000 ohms, ½ watt, 10%
R60	C-9B1-27	220,000 ohms, ½ watt, 20%
R61	C-9B2-66	2200 ohms, 1 watt, 10%
R62	C-9B2-25	100,000 ohms, 1 watt, 20%
R104	C-9B1-25	100,000 ohms, ½ watt, 20%



PRODUCTION CHANGES

In later production of the Model D2985 receiver, the vertical multivibrator and vertical sweep circuits were modified to improve the vertical linearity and to provide greater vertical capabilities.

Chassis incorporating this change have been marked "Series B".

Below is the schematic diagram of the modified portion of the receiver and a list of the components involved in the change. (Compare this diagram with Figure 6, page 8, of the service manual.)

The following changes also are incorporated in the "Series B" chassis:

R43 was changed from 150,000 ohms to 47,000 ohms (part C-9B1-82) to improve the video response.

R114 (1 megohm, part C-9B1-31) was added between the picture-tube shield and B- to bleed off static charges.