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1950

Television

Servicing Information

THEORY
PRACTICE EXPERIENCE

Compiled by

M. N. BEITMAN

SUPREME PUBLICATIONS

CHICAGO

VOLUME TV-4

PRICE $3

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SUPREME PUBLICATIONS
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PREFACE AND INTRODUCTION

Again in the year 1950, it is our pleasure to present a new television manual. The excellent reception given by the servicing profession to previous T-V volumes issued in 1948 and 1949, indicates the need for low priced material on television servicing. The new 1950 "Television Servicing Information" manual covers all popular models of leading manufacturers. There are more models covered in this new volume and there is more servicing instruction—and less circuit explanations. This manual will not only give you specific information on servicing all popular present day television sets, but is diversified enough to serve as your guide in servicing any other television receiver of this period.

To the television set manufacturers whose products are described in this manual, we extend our sincere thanks and appreciation for their fine cooperation and assistance that made this manual possible.

M. N. Beitman

March 1, 1950
Chicago.

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MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Table of Contents

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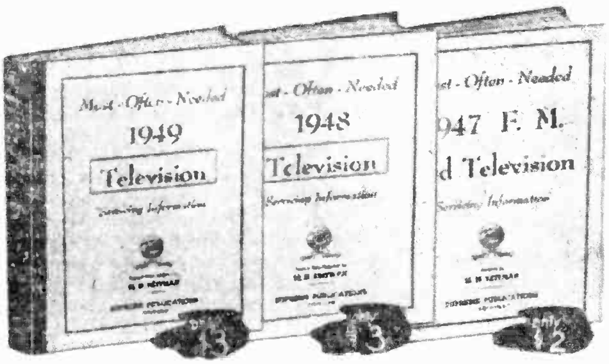

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Admiral models using

20A1, 20B1, 21A1, 4J1, and 4K1 CHASSIS

At time of publication, television chassis were being rubber-stamped with run number 17.

This manual applies to the following models:

4H15A or B	4H155A or B	4H137A or B	24A12	24A125	30F15
4H16A or B	4H156A or B, C	4H126A or B	24C15	24A126	30F16
4H17A or B	4H157A or B	4H126C or CN	24C16	24A127	30F17
4H145A or B, C	4H165A or B	4H18C	24C17	25A15	30F15A
4H146A or B, C	4H166A or B, C	4H19C		25A16	30F16A
4H147A or B	4H167A or B, C			25A17	30F17A

Above numbers may have suffix "N"

NOTE: Some models (not listed above) in the "4H" series have model numbers which are similar to those above, except that the suffix letters are "S" and "SN". These "4H" models with suffix letter "S" or "SN" have a 30A1, 30B1, 30C1 or 30D1 television chassis. which are described in detail in Supreme Publications "1949 Television Servicing Information" Manual.

20A1, 20B1, 21A1 Television Chassis

The 20A1 television chassis is designed for a 10″ picture tube, the 20B1 for a 12″ tube, and the 21A1 for a 16″ tube.

Early production 20A1, 20B1, 21A1 television chassis (run number "15" or lower) used a 6AU6 (V403) Sync Separator tube. Later production chassis (run number "16" or higher) use a 12AU7 (V403) in place of the 6AU6. The 12AU7 stage functions as a Sync Separator and Clipper. At the same time this change was made, the formerly unused section of the video detector (V304) was wired and functions as a sync limiter. The wiring of horizontal sync discriminator V404 (6AL5) was also changed.

Power Supplies

Six different power supplies are used.

All "television only" models having 10″ or 12″ picture tubes use a four tube power supply (4PA1) which has a 270 ohm (R505) cathode bias resistor in the 6V6 output tube circuit. ***"Television only" models having 16″ picture tubes*** use a different four tube power supply (4PA2). This power supply has a 150 ohm (R505) cathode bias resistor in the 6V6 output circuit.

All "combination models" which use the 4J1 AM-FM Radio Tuner, and have 10″ or 12″ picture tubes, use a six tube power supply (6PA1). This power supply has a 1500 ohm (R516) voltage dropping resistor in series with the B+ lead to the audio amplifiers.

"Combination models" which use the 4J1 AM-FM Radio Tuner and have 16″ picture tubes, use a different six tube power supply (6PA2). This power supply does not have the voltage dropping resistor (R516).

All "combination models" which use the 4K1 AM-FM Radio Tuner, and have 10″ or 12″ picture tubes, use a six tube power supply (6PA3) which is very similar to the 6PA1 power supply. The only difference between these power supplies is that the 6PA3 has an extra lead in the cable going to the 4K1 tuner. The extra lead connects to the heater winding on the power transformer since the heaters in the 4K1 tuner are not grounded to chassis.

Combination models, which use the 4K1 AM-FM Radio Tuner, and have 16″ picture tubes, use a different six tube power supply (6PA4). This power supply is identical with the 6PA2, except for the extra lead described in the paragraph above.

Note that the 6PA3 and 6PA4 power supplies **can be used** with either the 4J1 tuner or the 4K1 tuner.

Many facts of information on these 1950 Admiral television models are similar to material presented on the 30A1, etc. models in Supreme Publication "1949 Television Servicing Information" Manual. Such material will not be duplicated.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Admiral 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis

Admiral TELEVISION ALIGNMENT PROCEDURE

CONNECTIONS FOR TELEV-RADIO-PHONO COMBINATION MODELS

Set "Tel-Phono-Radio" switch on radio tuner for television operation.

The radio tuner must be connected to power supply during alignment unless a jumper is inserted in the power supply socket M514 to complete the heater circuit. See adjoining illustration. A special adapter plug is available from Admiral distributor under part #89A31.

FRONT VIEW OF SOCKET

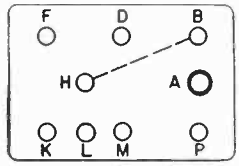


Figure 26.

MODELS WITH 16" PICTURE TUBE

For all models with 16" picture tube (21A1 television chassis), remove the complete picture tube and mounting board assembly. The picture tube including all connecting cables must be connected to the television chassis during alignment.

IF AMPLIFIER AND TRAP ALIGNMENT

- **Connect a 4½ volt battery; negative to AGC buss (junction of R303, R447 and C305), positive to chassis. Leave connected for all steps in this alignment.**
- Allow about 15 minutes for receiver and test equipment to warm up.
- Disconnect antenna from receiver.
- Set Channel Selector to channel 13 or other unassigned high channel (to prevent signal interference during IF alignment).
- Connect RC filter of 10,000 ohm resistor and 330 mmfd. condenser in series from point "X" to chassis. See figure 29. Leave connected for all steps in this alignment.
- For steps 1 to 8, connect signal generator high side to tube shield of 6J6 oscillator-mixer tube. Be sure to insulate tube shield from chassis. Connect generator low side to chassis close to 6J6 tube base.
- Set Contrast control at center of its rotation. Retain setting for all IF and trap adjustments.
- Use VTVM on lowest scale. (3 volts DC for steps 1 to 8 and 3 volts AC for step 9.) The AC range of VTVM must have response to 4.5 MC.
- Refer to figures 27, 28 and 29 for alignment adjustment and test point locations.

Step	Signal Gen. Frequency (MC)	Connect VTVM to	Test Connections and Instructions	Adjust
1	*21.25	High side to junction of resistor and condenser of RC filter connected to "X" (video amplifier V306 circuit); common to chassis. See figure 29.	Use lowest signal generator output for adequate meter indication, then gradually increase generator output as VTVM reading decreases. Use VTVM DC range.	**A1 for minimum.
2	*21.25	High side to "Y", common to chassis. See figure 29.	While peaking, keep reducing signal generator output so VTVM reading is approx. +1.5 volts DC.	A2, A3 and A4 for maximum.
3	*21.25	High side to "Z", common to "V" in ratio detector V203 circuit.	Use 3 volt zero center DC scale if available.	A5 for zero between pos. and neg. peak. If far off readjust A4.
4	25.3	Same as Step 1.	While peaking, keep reducing signal generator output so VTVM reading is approx. —1 volt DC.	**A6 for maximum.
5	23.5	"	"	A7 for maximum.
6	22.0	"	"	**A8 for maximum.
7	22.3	"	"	A9 for maximum.
8	*21.25	"	Same as Step 1.	Check A1; if off, readjust. Repeat step 6.
9	*4.5 AM unmodulated or 400~AM modulated	VTVM RF probe (3 volts range) to pin 8 of V306 video amplifier (6AC7); common to chassis. The frequency range of VTVM must have response to 4.5 MC.	Connect signal generator high side through a .005 mfd. condenser to pin 7 of V304 video detector (6AL5) with tube removed; low side to chassis close to tube base.	A10 for minimum.
10	To insure proper alignment, make Overall Video IF and Audio IF checks as indicated on pages 7 and 8.			

* Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

** See figures 27 and 28 for alternate locations.

§ In dealing with RF and IF response curves, it is well to remember that an inverted or mirror image may result, depending on the sweep generator and oscilloscope used. The general waveform should still be identical.

When using a wide band oscilloscope for alignment, marker pips will be more distinct if condenser from 100 to 1,000 mmfd. is connected across the oscilloscope input. Caution: Use the lowest capacity condenser possible.

Admiral 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis

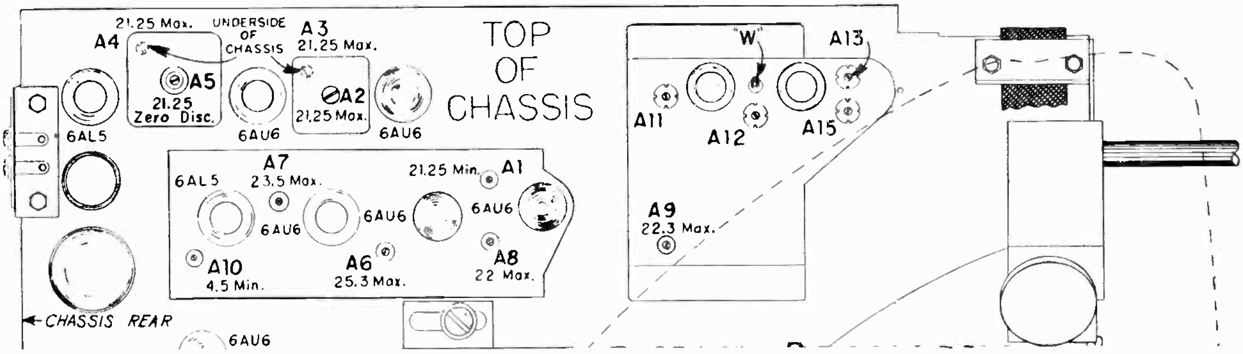


Figure 27. Alignment Locations and Frequencies, with late production Video IF strip.

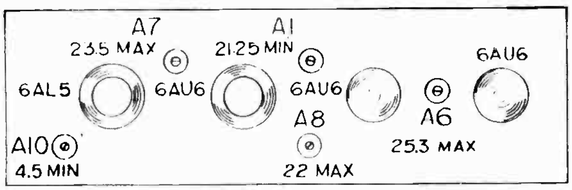


Figure 28. Video IF Alignment Locations in early production Video IF strip.

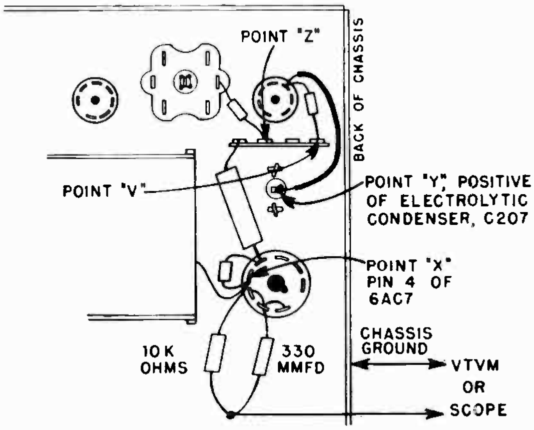


Figure 29. Alignment Connection Points.

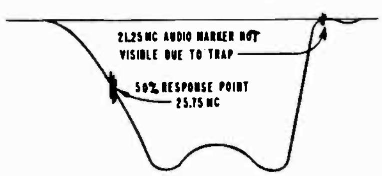


Figure 30. Overall Video IF Response Curve.

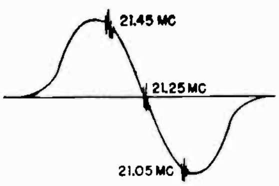


Figure 31. Ratio Detector Response Curve.

OVER-ALL VIDEO IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope with sweep input to mixer)

Differences in tube gain and component values affect video response. These differences are not apparent in alignment of video IFs using a signal generator and VTVM (single frequency alignment); hence it is preferable that a video IF response curve check be made after completion of alignments.

Since feeding the sweep signal through the entire RF and IF system provides a better overall response, this check should be made (after RF and HF Oscillator alignments) as indicated under "Overall RF and Video IF Response Curve Check" on page 9. However, a procedure is given below if it is desired to take video IF response curve as a check.

If the procedure given below is followed and the response curve obtained differs greatly from the curve shown in figure 30, repeat video IF alignment steps for adjustments A1, A6, A7, A8 and A9, making sure generator frequencies are precise and adjustments are accurately made. Note: Touch-up to correct the location of the 25.75 MC marker and adjustment for equal peaks of the response curve should be made only as instructed in "Overall RF and Video IF Response Curve" on page 9.

1. Disconnect signal generator and VTVM (if used in previous alignment). Set Contrast control fully clockwise. Connect a 4½ volt battery; negative to AGC buss (junction of R303, R447 and C305), positive to chassis.

§2. Connect oscilloscope between point "X" and chassis ground through a decoupling filter (see figure 29). Keep leads away from receiver.

3. Connect sweep generator high side to tube shield of 6J6 mixer tube. Be sure to insulate tube shield from chassis. Connect sweep generator low side to chassis close to 6J6 tube base. Set sweep generator to sweep the video IF pass band (19 to 29 MC).

4. Loosely couple marker generator high side to the sweep generator lead connected to tube shield on tuner; low side to chassis ground.

Important

To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum. Marker pips should be kept just barely visible. Setting sweep generator output for VTVM reading from .5 to 1 volt DC (measured from decoupling network at point "X" and chassis, figure 29) will avoid distortion of response curve.

SOUND IF ALIGNMENT CHECK

(Using sweep generator and oscilloscope)

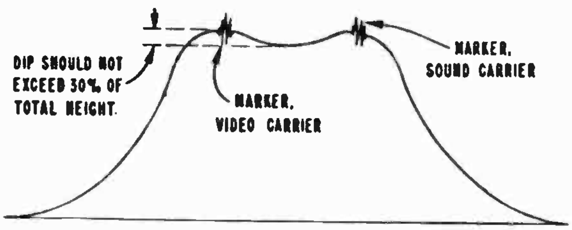
1. Disconnect signal generator and VTVM; if used in previous alignment.
2. Connect oscilloscope between point "Z" and chassis ground (see figure 29). Keep leads away from receiver.
3. Connect sweep generator high side to grid (pin 1) of V201 thru 500 mmfd. condenser; low side to chassis ground. Set sweep generator to sweep the sound IF pass band (20.25 to 22.25 MC).
4. Loosely couple marker generator high side to the sweep generator high side, low side to chassis ground.

   To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum.
5. Observe ratio detector response (figure 31). Since the sweep signal is fed through the entire audio IF system for this check, mis-alignment of the audio IF's will affect this curve. This provides an overall audio IF response check. The shape of the curve should be such as to provide a minimum vertical voltage slope of 50 KC to each side of the 21.25 MC marker (cross over point). Maximum size and linearity of the straight portion of the curve is ideal. Note that the ratio detector circuit used gives a symmetrical "S" pattern. Check for linearity between the markers indicated on the curve. The response curves obtained may appear inverted and/or reversed (end for end) depending on the sweep generator and oscilloscope used.
6. If correct response is not obtained, repeat alignment steps for slugs A2, A3, A4 and A5 under "IF Amplifier and Trap Alignment". Re-check response curve.

RF AND MIXER ALIGNMENT

- Disconnect 4½ volt battery, if used earlier.
- Connect a wire jumper from AGC buss (junction of R303, R447 and C305) to chassis. Leave connected for all steps in this alignment.
- For connecting combination models, see page 14.
- Disconnect antenna from receiver.
- Before starting alignment, allow about 15 minutes for receiver and test equipment to warm up.
- Connect sweep generator to antenna terminals.
- Loosely couple marker generator to antenna terminal (to obtain marker pips of video and sound RF carriers). To avoid distortion of the response curve, keep marker generator output at a minimum, marker pips just barely visible.
- Connect oscilloscope through 10,000 ohm resistor to point "W" (figure 27). Keep oscilloscope leads away from chassis.
- Set Contrast control at center of its rotation.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Adjust
1	*205.25 **209.75	Sweeping Channel 12	Check for curve resembling RF response curve shown in figure 32. If necessary, adjust A11, A12, and A13 (figure 27) as required. Consistent with proper band width and correct marker location, response curve should have maximum amplitude and flat top appearance.
2	211.25 215.75	13	Check each channel for curve resembling RF response curve shown in figure 32. In general, the adjustment performed in step 1 is sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for the weak channel as a compromise adjustment to favor this particular channel. If a compromise adjustment is made, other channels should be checked to make certain that they have not been appreciably affected.
3	199.25 203.75	11	
4	193.25 197.75	10	
5	187.25 191.75	9	
6	181.25 185.75	8	
7	175.25 179.75	7	
8	83.25 87.75	6	
9	77.25 81.75	5	
10	67.25 71.75	4	
11	61.25 65.75	3	
12	55.25 59.75	2	



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.

Figure 32. Response Curve.

* Picture Carrier Frequency (MC)   ** Sound Carrier Frequency (MC)

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Admiral 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis

OVER-ALL RF and VIDEO IF RESPONSE CURVE CHECK

(Using Sweep generator and oscilloscope with sweep input to antenna terminals)

1. Disconnect signal generator and VTVM (if used in previous alignment).
2. Connect a 4½ volt battery; negative to AGC buss (junction of R303, R447, C305), positive to chassis.

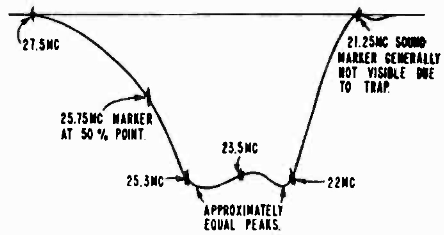


Figure 33A. Overall RF and Video IF Response Curve.

3. Set Contrast control fully clockwise.
§4. Connect oscilloscope between point "X" and chassis ground through a decoupling filter (see figure 29). Keep leads away from receiver.
5. Connect sweep generator to antenna terminals.
6. Connect IF marker generator high side to tube shield of 6J6 mixer tube (insulate tube shield from chassis). Connect low side of marker generator to chassis.
7. Sweeping the RF pass band for an unassigned high channel (see frequencies in "RF and Mixer Alignment"), check the overall response curve obtained against the ideal curve, figure 33A.

Important: To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum. Marker pips should be kept just barely visible. Setting sweep generator output put for VTVM reading from .5 to 1 volt DC (measured from decoupling network at point "X" and chassis, figure 29) will avoid distortion of response curve.

Check sound IF trap (21.25 MC) and video IF carrier (25.75 MC) points with marker generator. It is important that marker pips be in proper location on the response curve. Consistent with proper band width and correct location of markers, the response curve should have maximum amplitude and flat top appearance and peaks with approximately equal amplitudes, as shown in figure 33A.

If necessary to adjust for peaks with approximately equal amplitude, carefully adjust IF slug A7 (23.5 MC coil) while observing the response curve. Turn slug about ¼ to ½ turn in either direction until correct results are obtained. See figure 33A.

If 25.75 MC marker does not locate reasonably close to the 50% point on the slope of the response curve, carefully adjust A6 (25.3 MC coil) about ¼ to ½ turn in either direction until correct results are obtained.

REMOVING RADIO OR CHANGER FOR SERVICE

It will not be necessary to remove the complete radio-phono unit from the cabinet for servicing the radio tuner in combination models having a "Tilt-Out" Radio and Record Changer assembly. For removing the radio tuner chassis only, follow steps "a" through "h' below.

For combination models having the "Slide-Out" type record changer and radio tuner, first remove the complete Radio and Record Changer assembly by removing the four mounting screws which hold the unit to the "Slide-Out" shelf assembly. Then follow steps "a" through "h"

a. Disconnect all cable connectors from the television and power supply chassis.
b. Remove the two screws on each side and the three screws and washers along the bottom seam which hold the radio chassis front panel to the metal housing.
c. Remove the cable clamp on the under side of the metal housing.
d. Pull the radio chassis down and forward until you can reach in and unplug the phono plug. Then, pull the radio tuner forward as far as the FM antenna leads permit. **IMPORTANT:** At this point, the oscillator and antenna trimmers are accessible for "Touch-Up" adjustment.
   (1) Unscrew the two hex-head screws connecting the antenna to the metal housing.
   (2) Unsolder the antenna leads from AM loop.
   (3) Remove the metal shield and the wood spacer from between the AM loop antenna and shield.

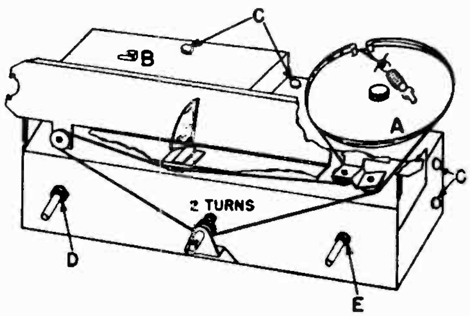


Figure 34. Radio Tuner Showing Chassis Cover and Dial Assembly.

   (4) Unsolder the FM antenna lead from the terminals on the rear of the cabinet. Then, remove the radio tuner chassis.
e. Remove the tuning knobs; remove the escutcheon and the front housing by removing the five screws at the bottom of the housing.
f. Position the dial drum as shown in figure 34; unhook spring at "A"; and keeping tension on dial cord, hook it to tab "B".
g. Remove the six hex-head screws "C" which hold chassis cover and dial scale to chassis.
h. After removing the pilot light brackets and hex nut "D" and "E", the chassis front can be pulled away from the chassis. All trimmers and parts are now accessible for adjustment or service.

AM-FM RADIO TUNER ALIGNMENT

4J1, 4K1

FM ALIGNMENT EQUIPMENT

This chassis should be aligned only with an AM signal generator and a vacuum tube voltmeter. Any standard brand vacuum tube voltmeter with a DC scale of not over 5 volts is suitable. A 3-volt zero center scale is desirable. A signal generator with a frequency range up to 110 MC is desirable. It is possible however, to align the receiver with a signal generator going up to 20 or 30 megacycles, by using the harmonics of these lower frequencies. To do this merely set the signal generator dial as follows and align exactly as explained in the alignment instructions.

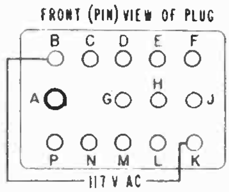
Where alignment chart specifies 109 MC, 106 MC, 90 MC or 87 MC, set generator to the highest available frequency shown in column under that frequency.

109. MC	106. MC	90. MC	87. MC
54.50MC	53. MC	45. MC	43.5 MC
36.33MC	35.33MC	30. MC	29. MC
27.25MC	26.5 MC	22.5 MC	21.75MC
21.80MC	21.2 MC	18. MC	17.4 MC
18.17MC	17.66MC	15. MC	14.5 MC

Generators which do not tune to 110MC or whose harmonics are not strong enough, cannot be used for FM alignment.

IMPORTANT PRELIMINARY ALIGNMENT STEPS

FRONT (PIN) VIEW OF PLUG



Under normal operating conditions or use, misalignment of RF or IF circuits with age will be slight. Lack of sensitivity and poor tone quality may be due to causes other than alignment. Do not attempt to realign the receiver until all other possible causes have first been thoroughly investigated.

Television chassis must be connected to power supply during alignment unless a 117-volt line cord is wired to pins of plug M515 to supply AC power; diagram shows pin view of plug M515. An adapter socket and line cord for this purpose, part number 89A30 is available from Admiral Distributor.

In FM alignment, it is essential that every step be followed. Especially important is picking the center of the IF curve (step 4 in the FM-IF alignment instructions). During this portion of the alignment it is necessary to tune the signal generator very carefully; it may necessitate having to estimate the dial readings to a tenth of a division.

When completely aligning the FM circuit, it is essential to follow the sequence of steps in the chart. If only a portion of the FM circuit is being aligned, be sure to follow all the remaining steps. AM and FM alignment may be made independently of each other.

For alignment of IF slug adjustments, it will be necessary to disassemble the radio chassis from the escutcheon and housing and also remove the chassis cover and dial scale assembly. See figure 34.

NOTE: AM and FM oscillator and antenna trimmers are accessible from top of chassis. Disassembly of chassis cover and dial scale will generally not be required for alignment of these trimmers.

Disconnect FM antenna from twin lead cable. Stretch twin lead cable to full length during FM RF alignment.

To avoid splitting the slotted head of iron core tuning slugs in the IF transformers, use an insulated alignment tool with a 1/8″ wide screwdriver blade. Do not exert undue pressure as threads of slugs may strip.

Be sure sure both the set and the signal generator are thoroughly warmed up before starting alignment.

AM ALIGNMENT PROCEDURE

- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on: Tone control fully clockwise.
- Band switch in AM position.
- "TEL-PHONO-RADIO" switch in Radio Position.
- AM loop antenna must be connected and placed in the same relative position to the chassis as when in the cabinet.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.

Step	Connect Signal Generator	Dummy Antenna Between Radio and Signal Generator	Signal Generator Frequency	Receiver Dial Setting	Adj. Trimmers in Following Order to Max.
Be sure to follow instructions under heading "Important Preliminary Alignment Steps".					
1	Gang condenser antenna stator	.1 MFD	455 KC	Tuning gang wide open	*A-B (2nd IF) *C-D (1st IF)
2	Lug on AM Antenna Stator	.1 MFD	1620 KC	Tuning gang wide open	E (oscillator)
3	Place generator lead close to loop of set to obtain adequate signal. No actual connection (signal by radiation).		1400 KC	Tune in signal	§F (antenna)

* Trimmer adjustments A and C made from underside of chassis. See figure 41.

§ AM antenna trimmed adjustment "F" in step 3 should be repeated after set and antenna have been installed in cabinet. Important: AM antenna trimmer may not peak if antenna leads are not routed or separated as originally made.

Admiral 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis

FM IF AND RATIO DETECTOR ALIGNMENT

- Keep output indicator leads well separated from signal generator leads and chassis wiring.
- Band switch in FM position.
- "TEL-PHONO-RADIO" switch in Radio position.
- While peaking IF's, keep reducing signal generator output so VTVM reading is approximately —1.5 volts DC with exception of Step #5.
- FM antenna disconnected during alignment.

Step	Connect Signal Generator	Generator Frequency	Receiver Dial Setting	Output Indicator and Special Connections	(Adj. as Follows very carefully)
1	Thru .001 cond. to pin #1 of 6BA6 2nd IF. (Ground to chassis, close to tube).	‡10.7 MC	Tuning gang wide open	Connect VTVM (DC probe) from point "P" to chassis. (See Fig. 41).	"G" (ratio detector Primary) for maximum reading on VTVM.
2	**Thru .001 cond. to pin #1 of 6BA6 1st IF. (Ground to chassis, close to tube).	"	"	"	"H" and "I" (2nd IF trans.) for maximum reading on VTVM.
3	Across ends of FM antenna twin lead.	"	"	"	"J" and "K" (1st IF trans.) for maximum on VTVM. Readjust G, H, I, J, K, for maximum. (Keep reducing generator output to keep VTVM at 1.5 volts)
4	"	a. Reduce output of signal generator until VTVM reads EXACTLY—1.5 volts DC. b. Tune generator frequency above 10.7 MC until VTVM reads EXACTLY —1.0 volt. Note EXACT generator frequency. Extreme care in reading this is essential. c. Tune generator frequency below 10.7 MC until VTVM reads EXACTLY —1.0 volt. Note EXACT generator frequency. Extreme care in reading this is essential. d. Add generator frequency in step c to generator frequency in step b and divide by 2. The result is the center frequency of the IF curve to be used in step 5. See example under heading "Setting Signal Generator to Center of IF Selectivity Curve." e. Tune generator frequency above and below 10.7 MC and note voltage reading on VTVM at different frequency points until you have a good impression of the shape of the selectivity curve. If you have two peaks as in Figures 38 or 39, note readings (voltage) of both peaks. If one peak is over 20% higher than the other one, it will be necessary to realign IF's. A selectivity curve that would require realignment is illustrated by Figure 40.			
5	"	Center of IF selectivity curve per step 4d above.	Tuning gang wide open	Connect VTVM (DC probe) from point "R" to chassis. (See Fig. 41).	"L" (ratio detector secondary) for zero voltage reading on VTVM (The correct zero point is located between a positive and a negative maximum.)

Note: Trimmer adjustments "G", "H" and "J" made from underside of chassis.

If any adjustments were very far off, it is desirable to repeat steps 3, 4 and 5.

**Do not feed IF signal into converter grid as this will cause mis-alignment.

‡Signal may be unmodulated or 400 cycle AM modulated.

SETTING SIGNAL GENERATOR TO CENTER OF I.F. SELECTIVITY CURVE

CAUTION: Due to the difficulty of setting a signal generator to the accuracy required by this operation, extreme care must be exercised in making each setting. Otherwise, improper alignment of the ratio detector and consequent audio distortion will result.

EXAMPLE: (See Figures 35 and 36)

Voltage reading in Step 4a is —1.5 volt.

Generator frequency on low side of 10.7 MC for a reading of —1 volt DC =10.640 MC.

Generator frequency on high side of 10.7 MC for a reading of —1 volt DC =10.800 MC.

Center frequency is obtained by adding 10.640 and 10.800, then dividing by 2. For these readings it will be 10.72 MC.

Set generator frequency to 10.72 MC as this is center of selectivity curve as shown in Figure 36.

Note: Numerical vernier dial readings may be used instead of MC.

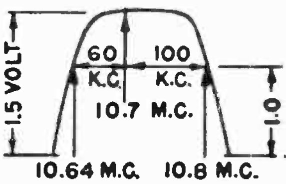


Fig. 35.

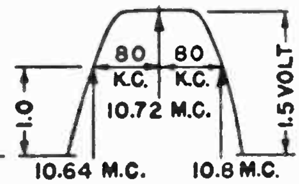


Fig. 36.

TYPICAL SELECTIVITY CURVES

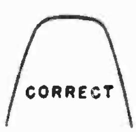


Fig. 37.

Fig. 38.

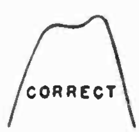


Fig. 39.

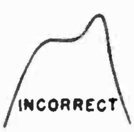


Fig. 40.

Admiral 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis

FM RF ALIGNMENT PROCEDURE

4J1, 4K1

Step	Connect Generator	Generator Frequency	Receiver Gang or Dial Setting	Output Connections	Adjust as follows (very carefully)
1	To ends of FM antenna twin lead thru 120 ohm carbon resistors in series with each generator lead.	†109 MC	Gang fully open	Connect VTVM (DC probe) from point "P" to chassis	*M (oscillator) for maximum
2		109 MC	"	"	*Adjust N (antenna) for maximum VTVM reading, while rocking signal generator. If trimmer does not peak, it will be necessary to squeeze or spread turns of FM antenna coil.
3		87 MC	Tune in Signal. (Gang should be closed or almost closed).	"	If signals in steps 1 and 3 will not tune in at gang tuning extreme (within 0.5 MC), it will be necessary to spread or squeeze oscillator coil turns and then repeat steps 1 and 3 until correct results are obtained.
4		106 MC	At 106 MC See Figs. 85 and 86	"	Readjust M (oscillator) for maximum.
5		109 MC	Gang fully open	"	Readjust N (antenna) for maximum VTVM reading, while rocking signal generator. Check tracking and calibration at 106 and 92 MC. See Figures 85 and 86. Calibration error should not exceed ±0.5 MC. If necessary, repeat alignment until correct results are obtained.

* It is advisable to adjust generator output so VTVM readings do not exceed approx. —1.5 V. DC while peaking.
† Signal may be unmodulated or 400 cycle AM modulated. If your signal generator does not reach this frequency, use harmonics.

After completing alignment, assemble chassis cover and dial scale to chassis. Set dial pointer as shown in Figure 85. Recheck dial calibration for AM and FM tuning. The AM and FM oscillator or antenna trimmer adjustments may be touched up for more accurate calibration and tracking.

AM antenna trimmer adjustment "F" in step 3 of "AM Alignment Procedure" should be repeated after receiver and antenna have been installed in cabinet. Note: AM antenna trimmer may not peak properly if antenna leads are not routed properly or separated as originally made.

Locating 109, 106 and 92 MC Settings With Gang Drum

Fully open the gang condenser. This is the 109 MC setting. Make a pencil line on the edge of the gang drum as shown by the arrow marked "109 MC" in Figure 86. Then to locate the 106 MC or 92 MC settings, merely rotate the gang drum until the pencil line corresponds to the dotted line positions (marked 106 MC and 92 MC) shown in Figure 86.

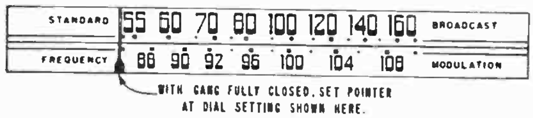


Figure 85. Pointer Setting.

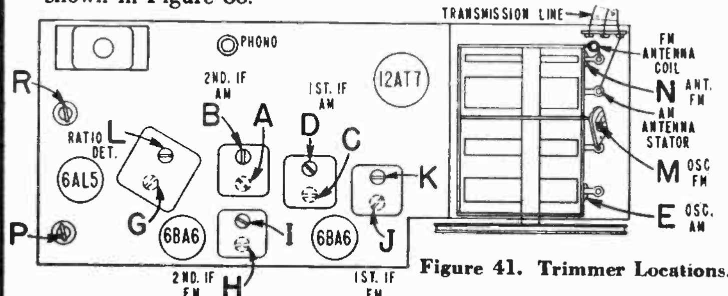


Figure 41. Trimmer Locations.

Trimmer adjustments A, C, G, H, J, made from underside of chassis.

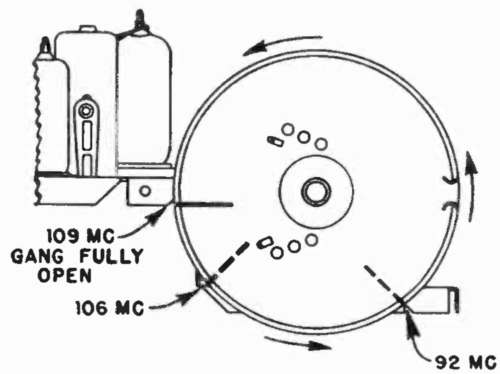


Figure 86. Locating Alignment Settings.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Service Hints on Admiral Models 20A1, 20B1, 21A1, 4J1, and 4K1.

HINTS ON AUTOMATIC GAIN CONTROL (AGC) CIRCUIT

A sharp cut-off pentode amplifier (V305, 6AU6) is used as a "triggered" AGC tube to supply a negative control bias to the RF amplifier and the first two video IF amplifiers. A positive sync pulse is applied to the control grid of the AGC tube through an isolating resistor R315. A pulsed plate voltage, supplied through the width control and developed during retrace time, is applied to the AGC tube plate through condenser C430. The AGC tube is biased to cut-off until the pulsed plate voltage is applied to condenser C430, and the positive sync pulse is applied to the control grid, simultaneously.

The current through the AGC tube V305 will charge the condenser C430 to a negative value in respect to chassis ground. AGC voltage is developed by the discharge of C430 through the filter network (R430, R447, C417 and C305) and the bias resistors (R303 and R308) to ground. Note: Under normal conditions, the AGC voltage measured at the control grid (pin 1) of the 1st video amplifier (V301) will be approximately —4.5 volts. This voltage will vary slightly with signal input and contrast control setting.

Since the AGC tube is dependent upon other circuits for its operation, it will be affected by defective components in the video amplifier V306, damper V408, and sync separator V403 circuits. The following hints are associated with these circuits:

No Sound; No Picture. AGC measured at pin 1 of V301 (6AU6) will read approximately —10 volts.

The voltage present at the junction of the video amplifier plate load resistors R340 and R341 is applied to the control grid of the AGC tube. If the video amplifier tube or circuit becomes defective and the voltage drop across R341 is decreased, an increased positive voltage is applied to the grid of the AGC tube. The AGC tube is no longer at cut-off between sync pulse intervals, and increased plate current results.

The AGC voltage developed will be of sufficient amplitude to cut-off the RF amplifier and 1st two video IF tubes. This will result in no sound or video.

Low or Varying 2nd Anode Voltage; Distortion in Sound. Plate voltage is applied to the AGC tube through the width control (T405), which is connected to the horizontal output transformer. If damper tube V408 becomes gassy, the pulsed voltage applied to condenser C430 may vary enough to cause distortion in the RF amplifier and 1st and 2nd video IF amplifier. This will affect both the sound and picture.

Weak Picture, No Sync; Or No Picture. This trouble can be identified by either a weak picture with loss of horizontal and vertical sync, or no picture at all. In most cases, the picture may be observed faintly by turning up the brightness and contrast controls. In any case, vertical and horizontal synchronization will be impossible. The AGC voltage measured at pin 1 of V301 (6AU6) will read approximately —.3 volts.

If C437 shorts in sets using a 12AU7 Sync Separator and Clipper, the Sync Separator section of the 12AU7 will draw grid current. This will bias the AGC tube (V305) to cut-off. Since no AGC voltage is developed, the 1st and 2nd video IF's are not controlled by AGC and their gain will be maximum. With a strong signal, enough negative voltage will be developed across video detector load resistor R319 to drive the video amplifier V306 to cut-off.

If this condition occurs, remove the 12AU7 (V403) tube. If the picture appears with brightness and contrast restored, but will still not sync either vertically or horizontally, replace C437 with a .05 mfd., 600 volt condenser, part number 64B5-7.

ARCING OR CORONA IN 21A1 (16") SETS

Arcing or corona in the 2nd anode supply circuit of the picture tube will generally produce a sharp crackling noise in the sound of the receiver, a faint hissing sound, or an odor of ozone. It can also cause the raster to vary in brightness. Arcing or corona is generally aggravated by conditions of high humidity.

If the noise in sound, hissing sound, or odor of ozone stops when the 2nd anode connector is disconnected from the chassis, the difficulty is in or at the picture tube mounting assembly. If these symptoms persist after disconnecting the 2nd anode connector, the difficulty will be found in the 2nd anode supply in the chassis.

In general, the exact spot of arcing or corona can be located by close observation under subdued light. However, if location or arcing or corona is not visible, it may be located by listening through a length of fibre or bakelite tubing (approx. 1" diameter, at least 18" long). The tubing is held close to the ear with the other end directed to suspected point of arcing or corona.

Caution: 2nd anode voltage is approximately 12,000 volts; extreme precaution should be exercised when making this test.

If the arcing or corona is located in or at the picture tube assembly (stops when 2nd anode lead is disconnected), the remedy may be found in the following:

Arcing or corona from the front of the picture tube (cone or screen) to the picture tube window. Clean picture window and picture tube screen.

Except for very early sets, a polyethylene insulating sheet is mounted in back of the picture window. Install a polyethylene insulating sheet if set does not have one or if original one is deteriorated, torn, or has deep scratches or holes in it. Plastic sheet part #32D122 is used in sets having a rectangular picture window and part #32D126 is used in sets having a rounded-end picture window. Important: To avoid arcing or corona to cabinet. mount the insulating sheet with short tacks or staples applied as far to the top or sides of the cabinet as possible.

GENERAL SERVICE HINTS

Horizontal Jitter, or Loss of Horizontal Sync. If filter condenser C413 (.01 mfd., 400 V, part number 64B5-25) opens up, it may be difficult to detect. The Horizontal Hold adjustment will be very critical, or will not hold sync at all. In some cases, adjustment of the Horizontal Lock L401 in rear of chassis, will not bring the picture into sync. If the picture will sync, horizontal "jitter" in the picture will result.

Shadows Or Rounded Corners In Picture When Ion Trap Is Adjusted For Maximum Brightness. Always adjust the Ion trap for maximum brightness. If shadows appears on the picture raster, adjust the deflection yoke until it is as far forward as possible. Then center the picture by carefully moving the focus coil forward or backward on the neck of the picture tube. If it is impossible to remove the shadows, try reversing the leads of the focus coil.

Vertical Line At Left Of Picture. If a white vertical line appears at the left side of the picture, it is probably due to misadjustment of the horizontal drive C421. Adjust the horizontal drive until the line disappears.

Interference From Electric Range Switches. If the Admiral Flex-O-Heat electric range switch or other electric range switches create an electrical disturbance in the television set, connect a .25 mfd. 1000 volt DC condenser across the line input terminals to the switch. If necessary, a smaller condenser should be used from each terminal to the range body or neutral.

Interference From Cash Registers. Television interference which is caused by operation of a cash register can be eliminated by installing an inductive-capacitive line filter (such as Tobe Filterette #1394). The line filter should be installed inside the cash register as close to the motor as possible, and should be mounted on clean surface of the metal frame. The connecting leads should be as short as possible (see instructions supplied with filter).

Tunable Audio Hum. If audio hum is present which is tunable, but may be "tuned out" at a particular setting of the Sharp Tuning control, try connecting a 2,200 ohm, ½ watt resistor and a .1 mfd, 400 volt condenser in series from the AGC tube plate (pin 5 of V305) to ground.

Sound Has Excessive Bass Response. If the bass response of the set seems over-emphasized, check the condenser which shunts the primary of the output transformer. If this condenser is .01 mfd, replace it with a .002 mfd, 600 volt (part number 64B5-14). Over-emphasized bass response can often be determined by mechanical vibrations such as rattle of the cabinet grille.

Weak Sound In High Signal Strength Areas. If the sound is weak in a high signal strength area, and all other possibilities of a defective sound system have been checked, disconnect the green AGC lead going to the tuner from the junction of R447 and R303. Then, reconnect this lead to the junction of R303 and R308. The decreased AGC will increase the gain of the RF amplifier (V101); and thus increase the gain of the sound as well as the video signal.

Tweets Heard on A.M. in 4J1, 4K1 Radio Tuners. If interference is present on the broadcast band in the 4J1 or 4K1 AM-FM radio tuner, first tune in the interference. Then, remove the horizontal oscillator tube (V405) in the television set. If the interference stops, disconnect the ground connection from pin 8 of the horizontal oscillator. Then connect a lead from pin 8 of V405 to pin 2 of V406. This will stop the horizontal oscillator from oscillating when the AM-FM tuner is used.

Audio Hum. Connect 25 inches of ½ inch bonding braid under the bracket holding the webbing for the picture tube, on the side nearest the audio lead; connect the other end of the braid under the power supply chassis, at the mounting screw nearest the audio lead.

Some of Recent Production Changes in ADMIRAL 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis.

BREAKDOWN OF C437

To prevent breakdown, the working voltage rating of coupling condenser C437 (.05 mfd.) was changed from 400 volts (DC) to 600 volts (DC). The new part number is 64B5-7. Chassis with this change are stamped run 17A or higher.

If C437 shorts in sets using a 12AU7 Sync Separator and Clipper, the Sync Separator section of the 12AU7 will draw grid current. This will bias the AGC tube (V305) to cut-off. Since no AGC voltage is developed, the 1st and 2nd video IF's are not controlled by AGC, and their gain will be maximum. With a strong signal, enough negative voltage will be developed across video detector load resistor R319 to drive the video amplifier V306 to cut-off.

This trouble can be identified by either a weak picture with loss of horizontal and vertical sync, or no picture at all. In most cases, the picture may be observed faintly by turning up the brightness and contrast controls. In any case, vertical and horizontal synchronization will be impossible.

If this condition appears, remove the 12AU7 (V403) tube. If the picture appears with brightness and contrast restored, but will still not sync either vertically or horizontally, replace C437 with a .05 mfd. 600 volt condenser, part number 64B5-7.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Admiral 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis

R436 DECREASED IN VALUE TO IMPROVE HORIZONTAL OSCILLATOR STABILITY

Chassis with this change stamped run "18" or higher.

Load resistor R436 was changed from a 270,000 ohm, ½ watt resistor to a 240,000 ohm, ½ watt, 5% resistor (part number 60B7-244).

R436 was changed to compensate for any increase in its resistance value that may occur during use of the receiver. If R436 does increase in value, horizontal sync will be affected, and a split-framed picture may result.

AM PEAKING COIL L606 CHANGED TO PREVENT EXCESSIVE REGENERATION IN 4K1, 4J1 RADIO TUNER

L606 was changed in value from 475 microhenrys to 120 microhenrys. The new part number is 73A5-10.

L606 is used to obtain positive feedback and eliminate the grid loading which is inherent in a triode mixer. This results in an increase in conversion gain. This change was made to prevent excessive feedback which resulted from an increase in value of loading resistor R605 beyond its specified tolerance. This difficulty can be identified by "motor boating" or "whistling" at the center of the band, when the AM-FM switch is on AM, and the loop antenna is connected. If the converter is oscillating at the center of the band, place your hand across the loop antenna. If the oscillations stop, replace L606 and damping resistor with the new part.

CHANGE IN LENGTH OF 300 OHM LINE FROM ANTENNA TO TUNER WHEN BUILT-IN "ROTO-SCOPE" ANTENNA IS USED

FOR 20A1, 20B1 CHASSIS: In these chassis, the length of antenna twin lead (300 ohm) connected from the antenna terminals to the TV Tuner (94C18-1), has been shortened from 18 inches (in early sets) to 13 inches (in later sets).

FOR 21A1 CHASSIS: In these chassis, the length of the antenna lead has been shortened as much as possible (between 4 and 5 inches).

This change was made to increase the signal pickup on the high channels ***in sets using the built-in Roto-Scope antenna.*** When necessary to make this change in a set having the built-in Roto-Scope antenna, unsolder the antenna lead from the antenna terminals and shorten as described above.

BREAKDOWN OF C311

Condenser C311 was changed from .05 mfd., 400 volt condenser to a .05 mfd., 600 volt condenser (part number 64B5-7).

A voltage divider network consisting of R323 and R324, supplies the proper bias voltage for the picture tube (V307). If C311 shorts, the total voltage is applied to the picture tube cathode, and the picture tube will be cut off. The symptom of this trouble would be: no raster, sound OK.

COUPLING CONDENSER (C214) ADDED TO ELIMINATE NOISE IN VOLUME CONTROL

A coupling condenser (C214, .05 mfd., 400 volts, part #64B5-22) was connected in series between junction of de-emphasis network (R207 and C204) and terminal of volume control R212A. Addition of this condenser blocks direct current into the volume control, thereby avoiding noise with rotation of volume control.

VERTICAL OUTPUT TRANSFORMER T402 LEAD LENGTH CHANGED

Lead length of vertical output transformer T402 has been increased to make this new part (part number 79B24-1) a universal replacement for the 20A1, 20B1 and 20X1 television chassis.

Operating the "Roto-Scope" Antenna: The Roto-Scope antenna is operated by the antenna control lever which extends from the back of the cabinet near the top (see figure 87). The antenna control lever can be set to any of three different positions which, in effect, allow the Roto-Scope to be oriented (rotated) for best possible reception on all channels operating in your area.

To determine the best position of the antenna control lever, first tune in a television station. Then, after tuning the set for best sound, move the antenna control lever to each of its three positions (extreme left, center and extreme right). As the lever is moved to the different positions, carefully watch for the position giving the clearest picture.

A good picture should have good contrast, sharp detail, and freedom from "ghosts", "snow" effect, and the various types of interference.

The antenna control lever should be left in the position which gives the most satisfactory picture on all channels.

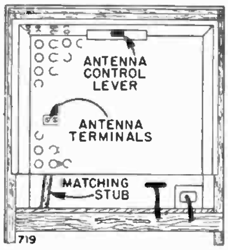


Figure 87

Note: Sometimes, rotating the set slightly will improve the picture. Sometimes moving the set to another location in the room, even as little as two or three feet away, will make an appreciable difference in the picture.

However, if it is not possible to find a setting which gives satisfactory reception on ALL channels, it may be desirable for the owner to reposition the antenna control lever for each particular station being tuned in.

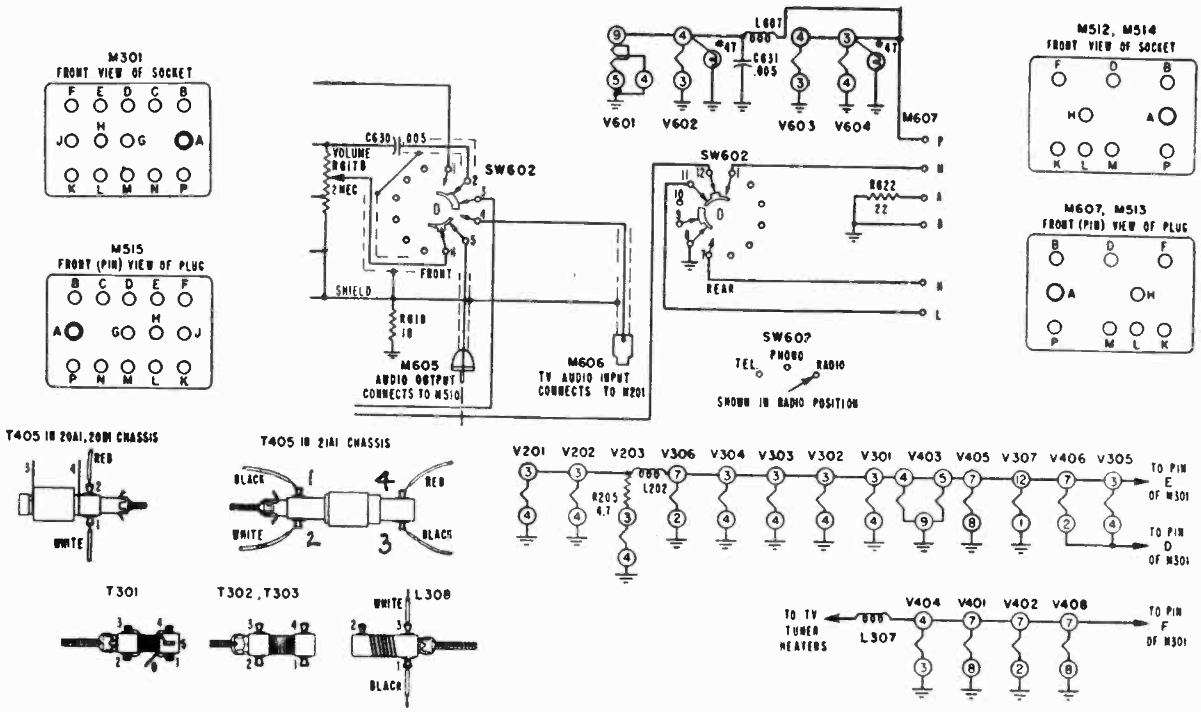
ADMIRAL CORPORATION 20A1, 20B1, 21A1, 4J1, 4K1

ALIGNMENT ADJUSTMENT IDENTIFICATION

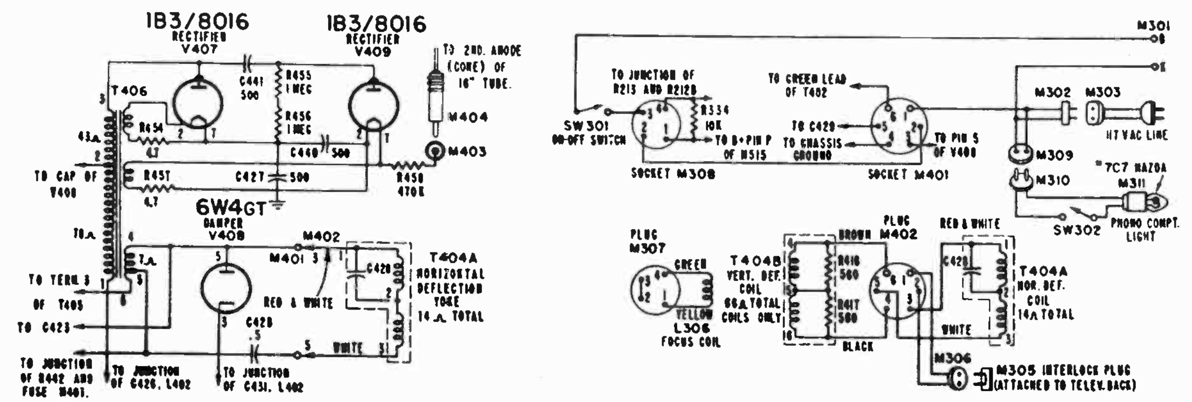
Adj.	Symbol	Function
†A1	L201	21.25 MC Sound Trap
A2	T201	1st IF Transformer (Sound)
A3	T201	1st IF Transformer (Sound)
A4	T202	Ratio Detector Transformer
A5	T202	Ratio Detector Transformer
†A6	T301	1st Video IF Transformer and Sound Link
A7	T303	3rd Video IF Transformer
†A8	T302	2nd Video IF Transformer
A9	L106	1st IF Coil
A10	L303	4.5 MC Trap Coil
A11	C102	Trimmer Condenser (RF Amp.)
A12	C104	Trimmer Condenser (RF Amp.)
A13	C107	Trimmer Condenser (Mixer)
A14	L102	HF Osc. Coils (All Channels)
A15	C110	Trimmer Condenser (Oscillator)

†Locations of A1, A6, and A8 were different in early production sets. See figures 27, 28.

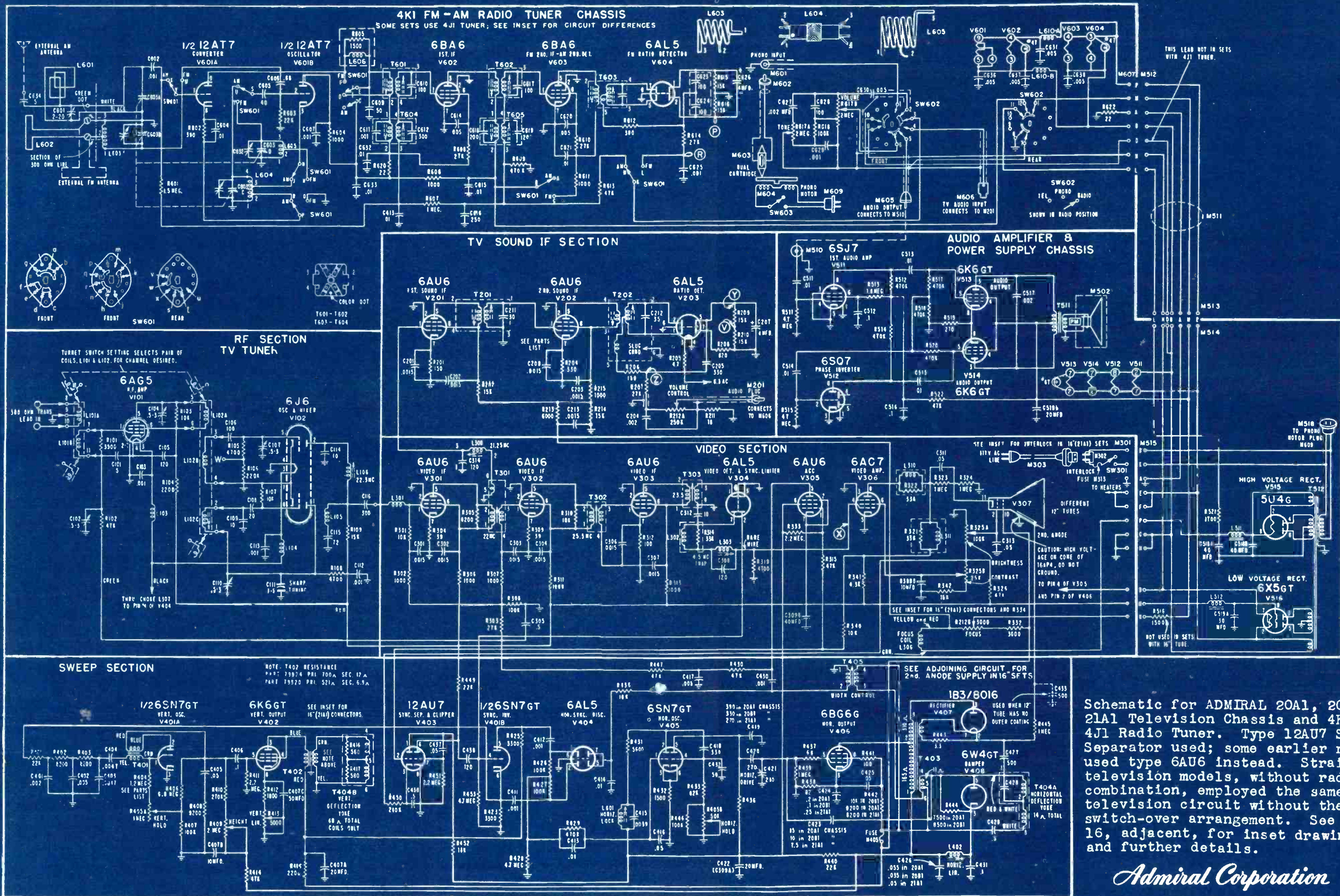
FILAMENT AND FUNCTION SWITCH CIRCUIT FOR 4J1



2nd. ANODE SUPPLY, DEFLECTION YOKE, and AC INTERLOCK CIRCUIT USED in 16"(21A1) SETS



See the large blueprint adjacent to this page for the complete schematic diagram of Admiral 20A1, 20B1, 21A1 Television Chassis and 4K1, 4J1 Tuner.



Schematic for ADMIRAL 20A1, 20B1, 21A1 Television Chassis and 4K1, 4J1 Radio Tuner. Type 12AU7 Sync Separator used; some earlier runs used type 6AU6 instead. Straight television models, without radio-combination, employed the same television circuit without the switch-over arrangement. See page 16, adjacent, for inset drawings and further details.

Admiral Corporation

CHICAGO, ILLINOIS

Admiral

20X1, 20Y1, and 4L1 CHASSIS

MODEL IDENTIFICATION CHART

Model Numbers	TV Chassis	TV Tuner	Record Changer	AM Radio Tuner	Power Supply
20X11, 20X12, 20X122, 24A125AN	20X1	94C21-1 or -2	.....	.....	.....
20X136, 20X145, 20X146, 20X147	20Y1	94C21-1 or -2	.....	.....	.....
24X15, 24X16, 24X15S, 24X16S, 24X17S	20X1	94C21-1 or -2	RC221 or RC321	4L1	1PA1

Note: Above model numbers may have suffix letter "N".

Admiral 20Z1 television chassis is similar to the 20Y1 chassis; the only difference is in the front panel operating controls. The 4S1 (AM) radio chassis (and 1PA2 power supply) used in combination models with 20Z1, are similar to 4L1 radio chassis and 1PA1 power supply covered in this manual. In the 4S1, switching the radio-phono switch to the center position shuts off the phono motor while the set stays "on." The 5B2 (AM-FM) radio chassis used in some combinations, is similar to chassis 4K1.

MODEL IDENTIFICATION CHART

Model Number	TV Chassis	TV Tuner	Changer	Radio	Power Supply
12X11, 12X12, 22X12, 22X25, 22X26, 22X27	20Z1	94C21-2	- - - -	- - -	- - -
32X15, 32X16	20Z1	94C21-2	RC500	4S1 (AM only)	1PA2
32X26, 32X27, 32X35, 32X36	20Z1	94C21-2	RC500	5B2 (AM-FM)	2PA1

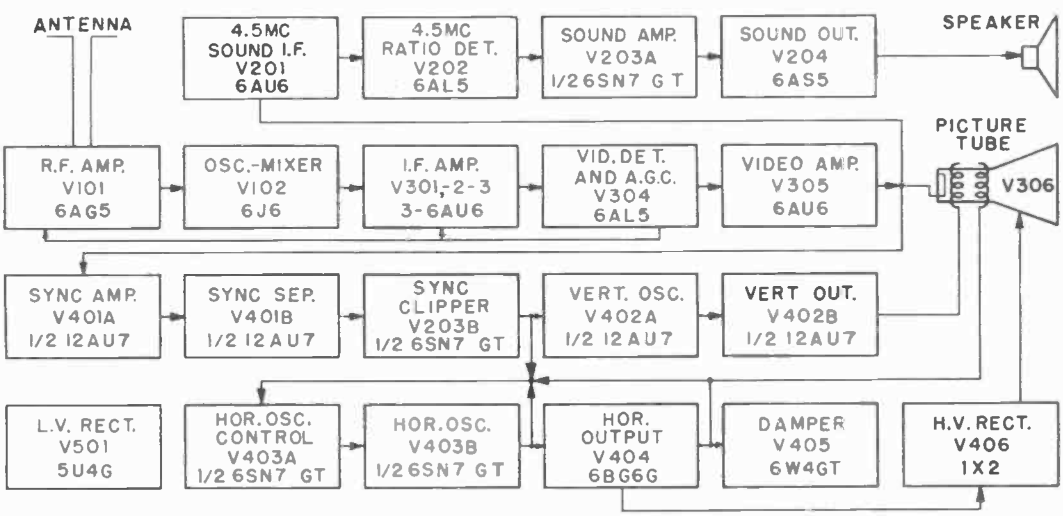


Figure 27. Functional Block Diagram.

Admiral Corporation

IF AMPLIFIER ALIGNMENT

20X1, 20Y1, 4L1

IMPORTANT: Before starting alignment, assemble the IF inspection plate (cover shield) to the chassis. In some early sets, the shield was spot soldered to the chassis and, if removed, it must be re-soldered.

- Allow about 15 minutes for receiver and test equipment to warm up.
- Disconnect antenna from receiver.
- Set Channel Selector to channel 13 or other unassigned high channel.
- Connect a wire jumper across antenna terminals (to prevent signal interference during IF alignment).
- Connect signal generator high side to tube shield of 6J6 oscillator-mixer tube. Be sure to insulate tube shield from chassis. Connect generator low side to chassis close to 6J6 tube base.
- Set Contrast control fully clockwise. Retain setting for all IF adjustments.
- Alignment adjustment and connection point locations are shown in Figures 30 and 29.
- Speaker must be connected to chassis.

Step	Signal Gen. Frequency	Connect VTVM to	Instructions	Adjust
1	25.3 MC	High side to point "T"; common to chassis.	Use VTVM 3 volt DC scale. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less.	A1 and A2 for maximum.
2	23.1 MC	"	"	A3 and A4 for maximum.
3	To insure proper alignment, make the "Over-all IF Response Curve Check" given below.			

OVERALL IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope with sweep input to RF mixer).

Differences in component values affect IF response. These differences are not apparent in alignment of IFs using a signal generator and VTVM (single frequency alignment); hence it is preferable that an IF response curve check be made after completion of the IF amplifier alignment.

Since feeding the sweep signal through the entire RF and IF system provides a better overall response, this check chould be made after RF and HF Oscillator alignments as indicated in step 1 of the alignment chart on page 19. However, the procedure is given below if it is desired to take video IF response curve as a check.

If the procedure given below is followed and the response curve obtained differs greatly from the curve shown in figure 28, repeat all IF amplifier alignment steps, making sure generator frequencies are precise and adjustments are accurately made.

a. Make all control settings and connections as given in the IF amplifier alignment chart.

b. Connect oscilloscope* between point "V" and chassis ground through a decoupling filter; see fig. 29. Keep leads away from receiver. Caution: Voltage at point "V" is approximately 130 volts DC.

c. Connect sweep generator high side to tube shield of 6J6 osc-mixer tube. Be sure to insulate tube shield from chassis. Connect sweep generator low side to chassis close to 6J6 tube base. Set sweep generator to sweep the IF pass band (19 to 29 MC).

d. Loosely couple marker generator high side to the sweep generator lead connected to tube shield on tuner; low side to chassis ground.

To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum. Marker pips should be just kept barely visible. Setting sweep generator output for VTVM reading from .5 to 1 volt DC, measured between AGC buss (point "T") and chassis, will avoid distortion of response curve. Connecting a 1½ volt battery (negative to point "T", positive to chassis) will allow greater signal input without distorting the response curve.

e. Check curve obtained against the ideal overall IF amplifier response curve shown in figure 28. Since it is not always possible to get ideal curves, it should be noted that the height of opposite peaks should be within 3db or 30% of each other. The dip or valley in the center of the curve should not be greater than 3db or 30% down the highest peak of the curve. Check video and sound IF carrier points by means of marker generator. It is important that marker pips be in the proper location on the response curve. The 25.75 MC marker, should be 6db below the highest peak (50% point on the high frequency side of the curve). The 22 MC marker should be at the opposite side of the response curve, located approximately 18db (85%) below the highest peak. The 21.25 MC marker should be located at least 26db (95%) below the highest peak, and may or may not be visible.

Consistent with proper band width and correct location of markers, the response curve should preferably have maximum amplitude, symmetry, and flat top appearance. If correct response is not obtained, repeat the "IF Amplifier Alignment."

f. Remove wire jumper from across antenna terminals.

*** In dealing with RF and IF response curves, it is well to remember that an inverted or mirror image may result, depending on the sweep generator and oscilloscope used. The general waveform should still be identical.**

Adj.	Symbol	Frequency	Function
A1	T303	25.3 MC	3rd IF Transformer
A2	T301	25.3 MC	1st IF Transformer
A3	T302	23.1 MC	2nd IF Transformer
A4	L105	23.1 MC	Mixer Plate Coil
A5	T201	4.5 MC	Primary of Ratio Detector Transformer
A6	L201	4.5 MC	1st Sound IF Transformer
A7	T201	4.5 MC	Secondary of Ratio Detector Transformer
A8	C102		Trimmer (RF Amplifier)
A9	C104		Trimmer (RF Amplifier)
A10	C107		Trimmer (Mixer)
A11	C109		Trimmer (HF Oscillator)
A12	L102		Slug, HF Oscillator Coils

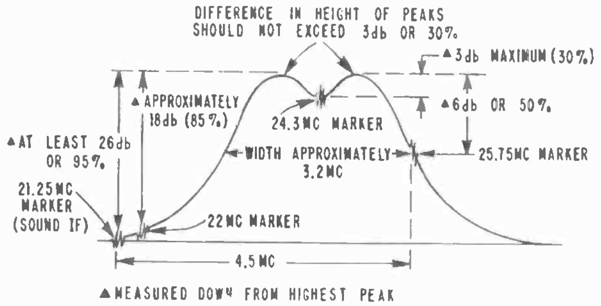


Figure 28. Overall IF Response Curve.

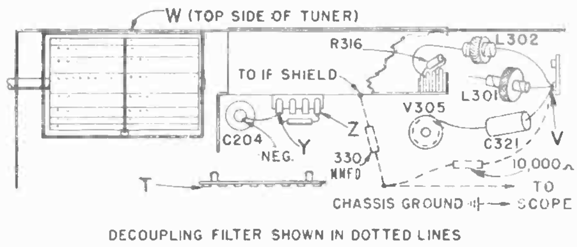


Figure 29. Bottom View of Chassis Showing Alignment Connection Points.

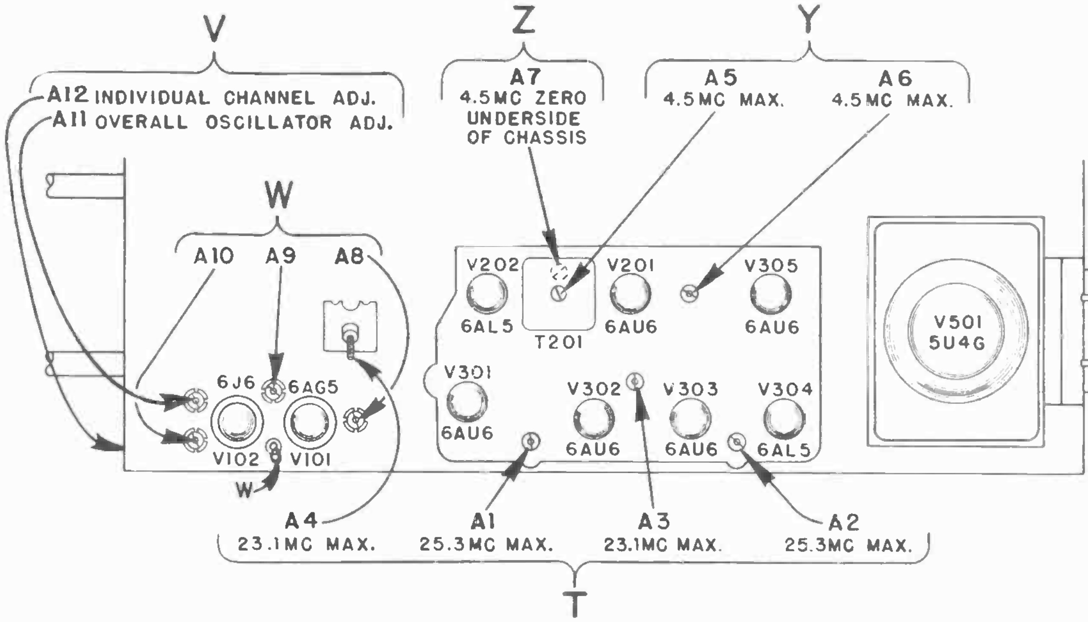


Figure 30. Top View of Chassis Showing Alignment Adjustment Locations.

4.5 MC SOUND IF ALIGNMENT

- Disconnect antenna from receiver.
- Set contrast control fully clockwise.
- Connect signal generator high side to point "V" through a .01 mfd. condenser.
- Before starting alignment, allow 15 minutes for receiver and test equipment to warm up.
- Speaker must be connected to chassis.
- Alignment adjustment and connection point are shown in figures 29 and 30.

Step	Signal Gen. Frequency	Connect VTVM to	Instructions	Adjust
	IMPORTANT: Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration at the 4.5 MC alignment point required for this operation. Accuracy required within one kilocycle. If a frequency standard is not available for a 4.5 MC frequency check, it is recommended that touch-up of zero setting adjustment A7 in step 2 be made using a television signal rather than the 4.5 MC signal from a signal generator.			
1	†4.5 MC	VTVM (3 volt DC scale) to point "Y".	Use 3 volt scale on VTVM. Keep VTVM leads well separated from signal generator and chassis wiring. A non-metallic screwdriver will be required for aligning slug adjustment A5.	A5 and A6 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
2	†4.5 MC	VTVM to point "Z".	Use 3 volt zero center scale on VTVM, if available. Keep VTVM leads well separated from signal generator and chassis wiring. A non-metallic screwdriver will be required for aligning slug adjustment A7.	**A7 for zero on VTVM (the correct zero point is located between a positive and a negative maximum).

† Signal may be unmodulated or 400 cycle AM modulated.

**** If A7 was far off, readjust A5 and repeat A7.**

When using a wide band oscilloscope for alignment, marker pips will be more distinct if condenser from 100 to 1,000 mmfd. is connected across the oscilloscope input. Caution: Use the lowest capacity condenser possible, since too high capacity will affect the shape of the response curve.

20X1, 20Y1, 4L1

HORIZONTAL FREQUENCY AND HORIZONTAL LOCK-IN RANGE ADJUSTMENT

NOTE: These adjustments can be made in the customers home, without removal of the chassis from the cabinet. Caution: Before proceeding, be sure that the picture will sync vertically, as lack of both vertical and horizontal sync indicates sync circuit trouble and not horizontal oscillator trouble.

a. With television signal properly tuned in (preferably to a test pattern), allow the receiver to warm up for a few minutes. Be sure CONTRAST control is set for normal picture.

b. Rotate the Horizontal Hold control (on front panel) fully clockwise.

c. Adjust Horizontal Frequency control slug T404 (on back of chassis) until the picture just falls in and then just out of sync. Then slowly rotate the control until a vertical or diagonal horizontal blanking bar is visible on the raster.

d. Rotate the Horizontal Hold control (on front panel) fully counter-clockwise. The picture will normally fall out of horizontal sync. If it does not, interrupt the television signal by switching the channel selector off and on channel.

e. Carefully adjust the Horizontal Lock-In Range trimmer C412A until 2, 3 or 4 diagonal blanking bars are seen; at this point, slight clockwise rotation of the Horizontal Hold control should pull the picture into sync.

If the above adjustments have been carefully made, but the horizontal sweep still does not sync properly, try replacing the horizontal oscillator tube (V403); then repeat the above steps.

If trouble is not eliminated, check for a gassy tube in the horizontal sweep circuit (V406, V407, V408). These tubes may cause horizontal sync trouble since an integrated voltage from the deflection yoke is applied to the horizontal oscillator control tube grid (pin 1 of V403A).

If horizontal sync difficulty still persists after carefully making these checks, remove the chassis from the cabinet and then check the following components:

(1) If R425 is 150,000 ohms, replace it with a 220,000 ohm, ½ watt resistor (part number 60B8-224).

(2) Check condenser C416 by substituting identical condenser (180 mmfd, ±5%) part number 65B6-59.

(3) Check C414 for either open or short.

(4) Check condenser C417 for short.

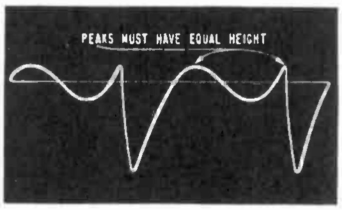


Figure 34. Horizontal Oscillator Waveform.

(5) Check resistance of R427. It should be 100,000 ohms.

If, after checking these components, the horizontal oscillator still will not sync, it will be necessary to proceed with "Complete Alignment of the Horizontal Oscillator" given.

COMPLETE ALIGNMENT OF HORIZONTAL OSCILLATOR

a. With television signal properly tuned in (preferably to a test pattern) allow the receiver to warm up for a few minutes.

b. Turn out fully Horizontal Lock L405 slug (underside of chassis). Turn out trimmer adjustment screws for Horizontal Lock-In Range C412A and Horizontal Drive C412B about ½ turn counter-clockwise from "full in" position.

c. Set Contrast control for normal picture and Horizontal Hold control (front panel) to the extreme counter-clockwise position. Adjust Horizontal Frequency slug T404 (rear of chassis) until picture falls into horizontal sync. **NOTE:** If it is impossible to sync the picture, sync can sometimes be obtained by re-setting the Horizontal Lock-In Range C412A to approximately one-quarter turn counter-clockwise from its tight position.

d. Connect oscilloscope between terminal "C" on T404 to chassis ground. Set oscilloscope sweep to horizontal frequency (15.75 KC) or a sub multiple of it. Oscilloscope leads must be of low capacity (unshielded) or the Horizontal Oscillator may not sync. It may be necessary to add a small capacitance in series with one lead. While holding picture in sync with Horizontal Hold control on front panel, adjust Horizontal Lock slug L405 (inside chassis) for oscilloscope waveform pattern illustrated. Note that slug L405 should be adjusted until the rounded peak of this waveform is equal in height to the pointed peak.

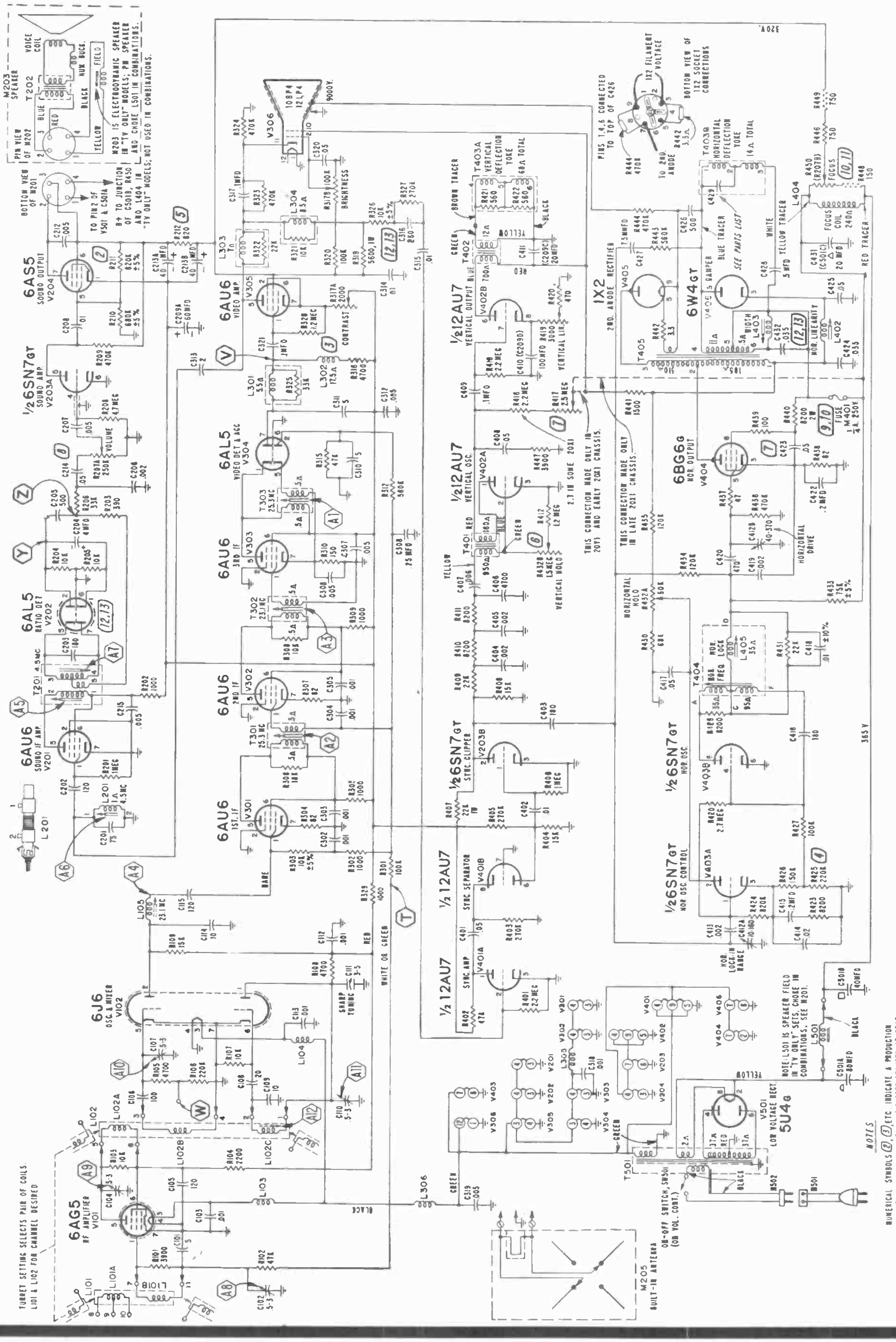
e. Disconnect oscilloscope from receiver. With the Horizontal Hold control (front panel) set fully clockwise, adjust the Horizontal Frequency slug T404 until the complete raster just starts to move across the screen appearing as a split-framed picture. The horizontal blanking should appear as a diagonal or vertical bar.

f. Rotate the Horizontal Hold control (front panel) fully counter-clockwise. The picture will normally fall out of horizontal sync, or if not, interrupt the television signal by switching the channel selector switch off and on channel. Carefully adjust the Horizontal Lock-In Range trimmer C412A so that three or four diagonal bars are seen just before the picture falls into horizontal sync as the Horizontal Hold control (front panel) is rotated in the clockwise direction.

g. Adjust Horizontal Drive trimmer C412B, Linearity control L402 and Width control L403 for best picture.

h. Set the Horizontal Hold control (front panel) to fully clockwise position. Carefully readjust the Horizontal Frequency slug T404 until a vertical or diagonal bar is seen, upon which very slight additional rotation of slug T404 will bring the picture fully into horizontal sync.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION



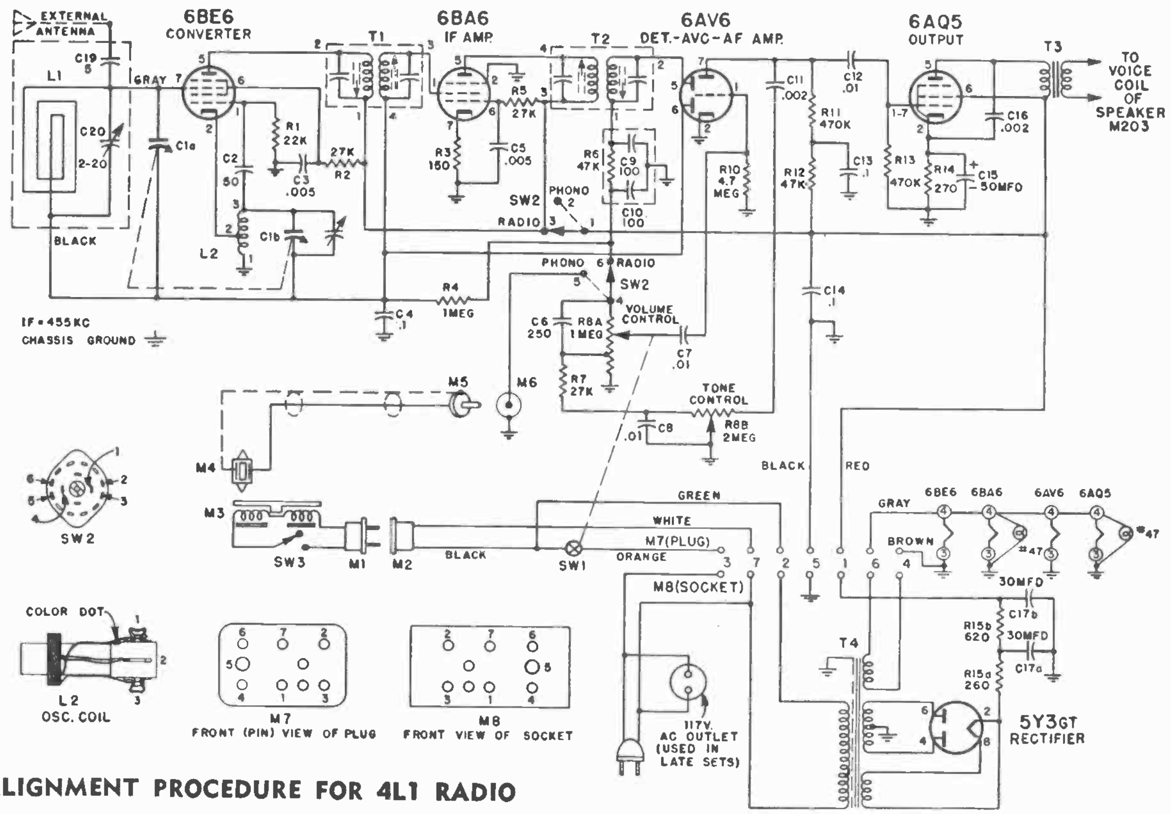
Schematic For 20X1, 20Y1 Television Chassis

Admiral Corp.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

20X1, 20Y1, 4L1

Schematic of 4L1 Radio.



ALIGNMENT PROCEDURE FOR 4L1 RADIO

Step	Connect Signal Generator	Dummy Antenna Between Radio and Signal General	Signal Generator Frequency	Receiver Dial Setting	Adj. Trimmers in Following Order to Max.
1	Gang condenser antenna stator	.1 MFD	455 KC	Tuning gang wide open	*A-B (2nd IF) *C-D (1st IF)
2	Gang condenser antenna stator	.1 MFD	1620 KC	Tuning gang wide open	E (oscillator)
3	Place generator lead close to loop of set to obtain adequate signal. No actual connection (signal by radiation).		1400 KC	Tune in signal	§F (antenna)

* Trimmer adjustments A and C made from underside of chassis.

§ AM antenna trimmer adjustment "F" in step 3 should be repeated after set and antenna have been installed in cabinet. Important: AM antenna trimmer may not peak if antenna leads are not routed or separated as originally made.

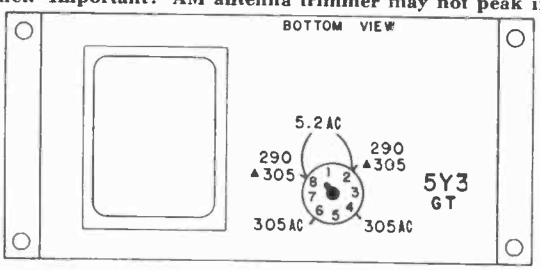


Figure 41. Voltage Chart for Radio Power Supply.

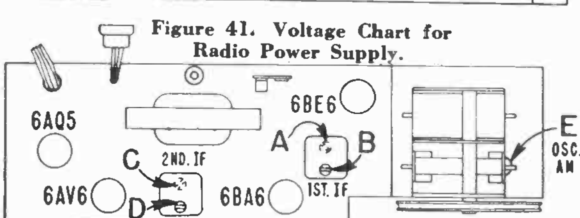


Figure 39. Radio Trimmer Locations.

4L1 VOLTAGE DATA

- Readings taken from tube socket terminals to chassis.
- Switch in Radio position. Voltages marked with ▲ taken on Phono position.
- Measured on 117 volt AC line.
- Volume control minimum; gang closed.
- Voltages measured with vacuum tube voltmeter.

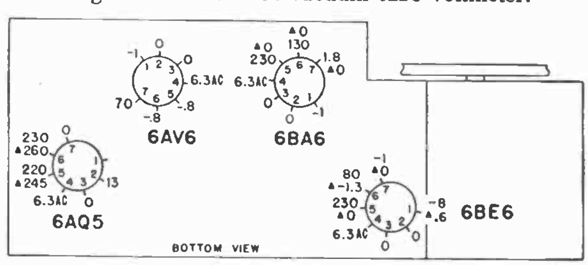


Figure 40. Voltage Chart for 4L1 Radio.

RAYTHEON BELMONT

BELMONT RADIO CORPORATION

A Subsidiary of Raytheon Manufacturing Company

MODEL M-1101 C-1102

12AX22 CHASSIS

VIDEO I-F ALIGNMENT

1. Connect the 3-volt bias battery from AGC to ground (positive to ground).
2. Connect the signal generator, thru a 1000-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 (fig. 7).
3. Connect the voltmeter across R32 (contrast control), positive to ground side.
4. Switch the tuner to any high band channel.
5. With the signal generator set at the specified alignment frequencies, tune the corresponding coils for maximum or minimum response on the output meter, as indicated below. All the coils are slug tuned.

Stage	Frequency (mc)	Adj.	Response
1st IF	26.3	L11	Maximum
2nd IF	23.4	L12	Maximum
3rd IF	26.3	L13	Maximum
4th IF	23.4	L14	Maximum
5th IF	25.5	T1	Maximum

6. Remove bias battery. Connect a sweep generator to the converter and an oscilloscope across contrast control R32 (fig. 5). Set R32 at maximum.
   Check the peaks of the response for symmetry. Readjust 5th IF slug if necessary. (The signal generator and meter may be used for this purpose.)

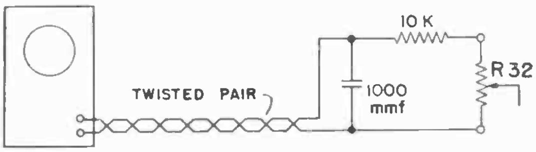


Fig. 5. Connection of the oscilloscope

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 1 volt. Next set the generator input to twice this sensitivity figure and detune the generator, in the high frequency direction, (to 26.75 mc. ±.2 mc.) until the meter reading returns to 1 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 one 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 AGC to ground by connecting a clip lead in shunt with capacitor C70. 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 2 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 ½ and ¼ volts which corresponds to a ratio of between 5:1 and 10:1.

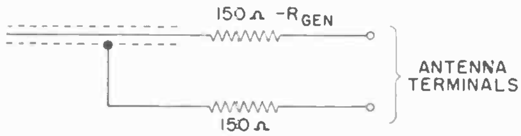


Fig. 6. Connection of generator

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 6.) 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 across diode load. If the set does not track properly, refer to step 8 of Tuner Alignment Procedure.
9. Connect the signal generator (see fig. 6) to the antenna terminals and the voltmeter across the diode load (R32 contrast control).
10. 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 5:1 to 15:1.

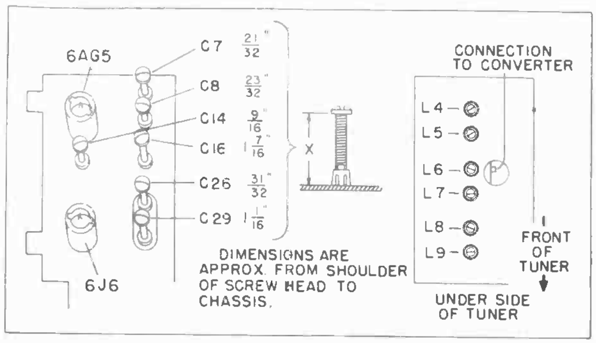
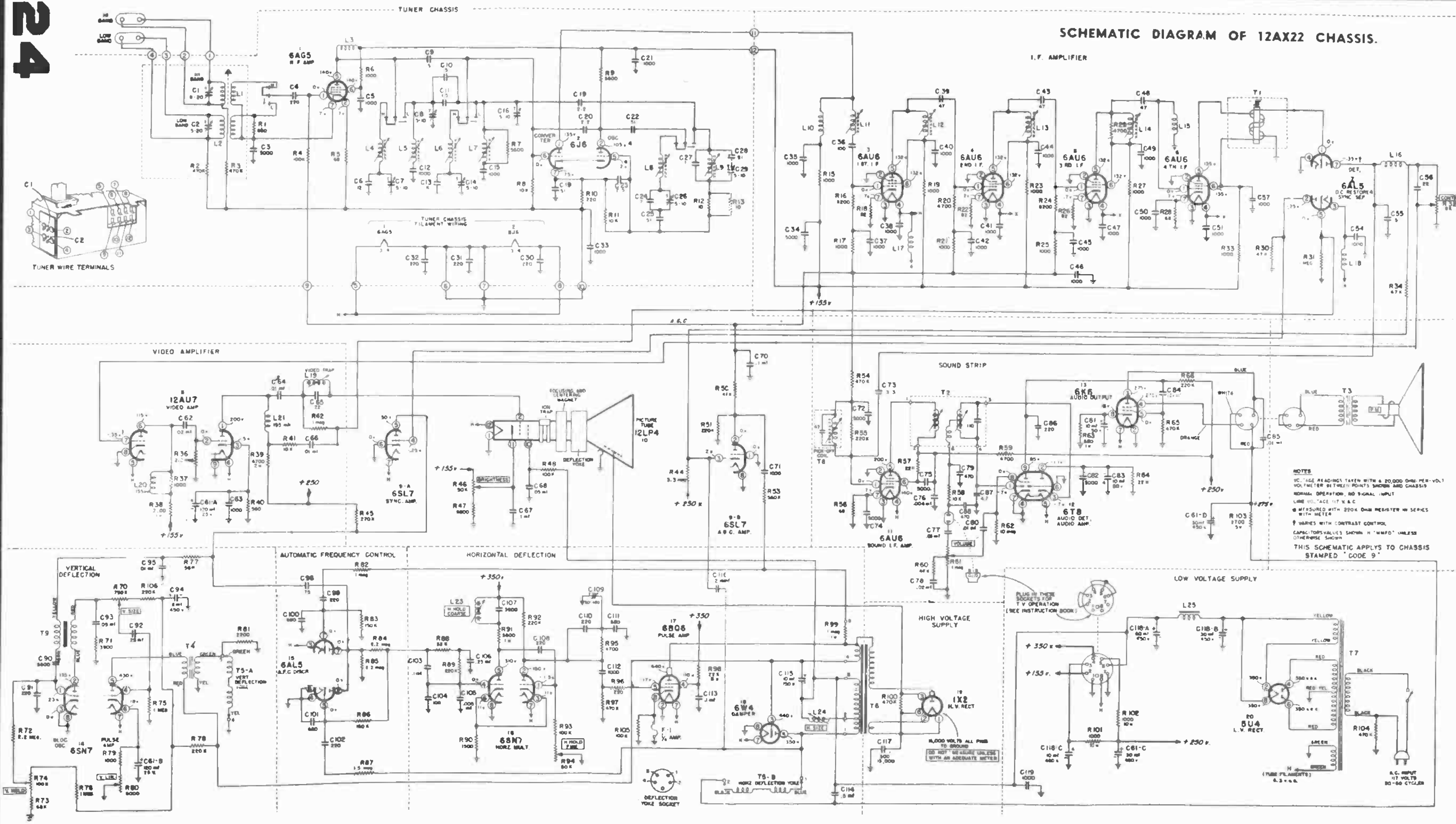


Fig. 7. Tuner Adjustment

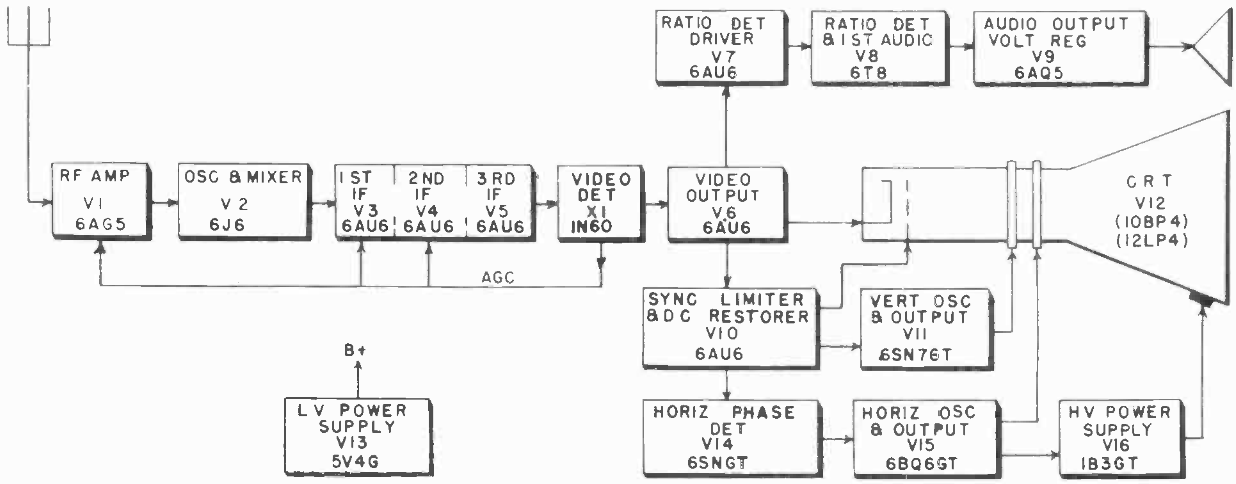


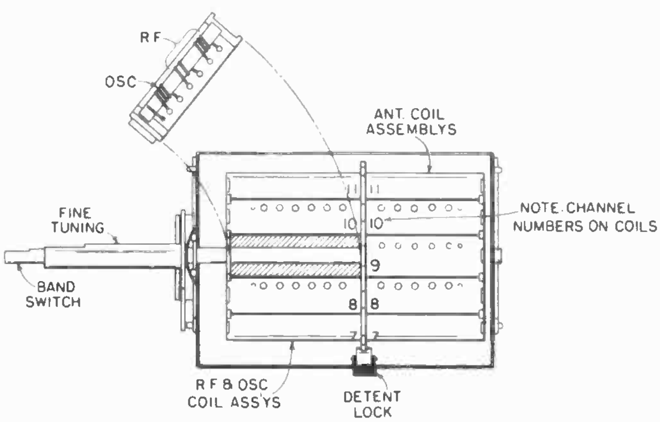
Raytheon-Belmont 12AX22 Chassis, Models M-1101, C-1102, is a 20 tube, A.C. operated, direct view 12-inch television receiver. Intercarrier sound system is used. Servicemen will observe that there is a safety interlock as well as a fuse in the high voltage power supply.

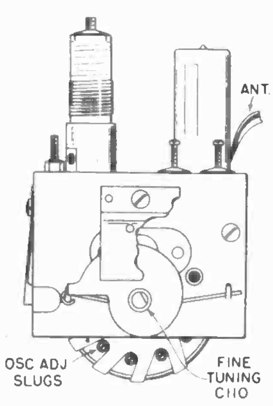
The schematic diagram above is for Raytheon-Belmont chassis 12AX22, Code 9. Code 8 chassis is the same except resistor R-73 is 100K ohms. Code 7 chassis also has this exception and also omits C-119. Code 1, 2, 3, 4, 5, and 6, differ in a minor manner from this schematic.

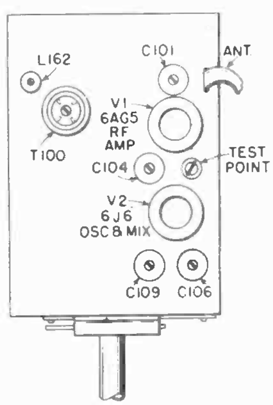
Bendix Radio
AND TELEVISION

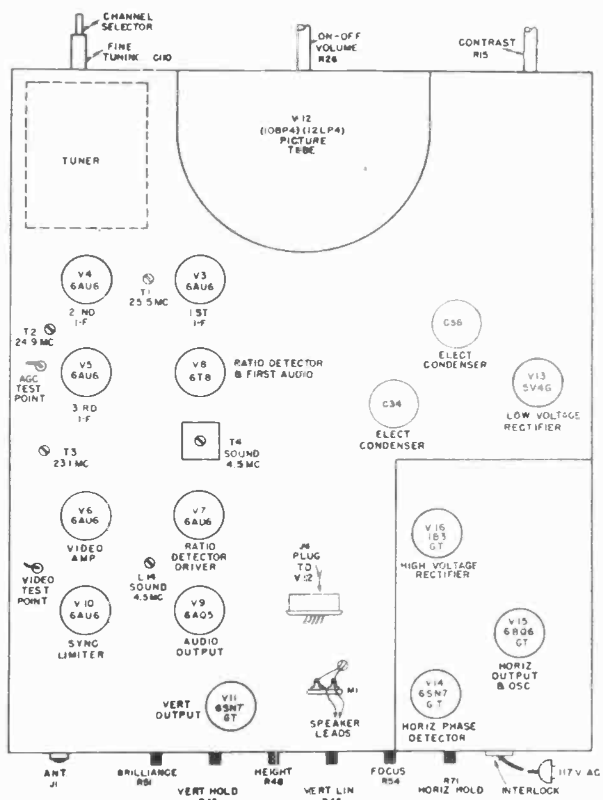
2000 AND 3000 SERIES TELEVISION RECEIVERS





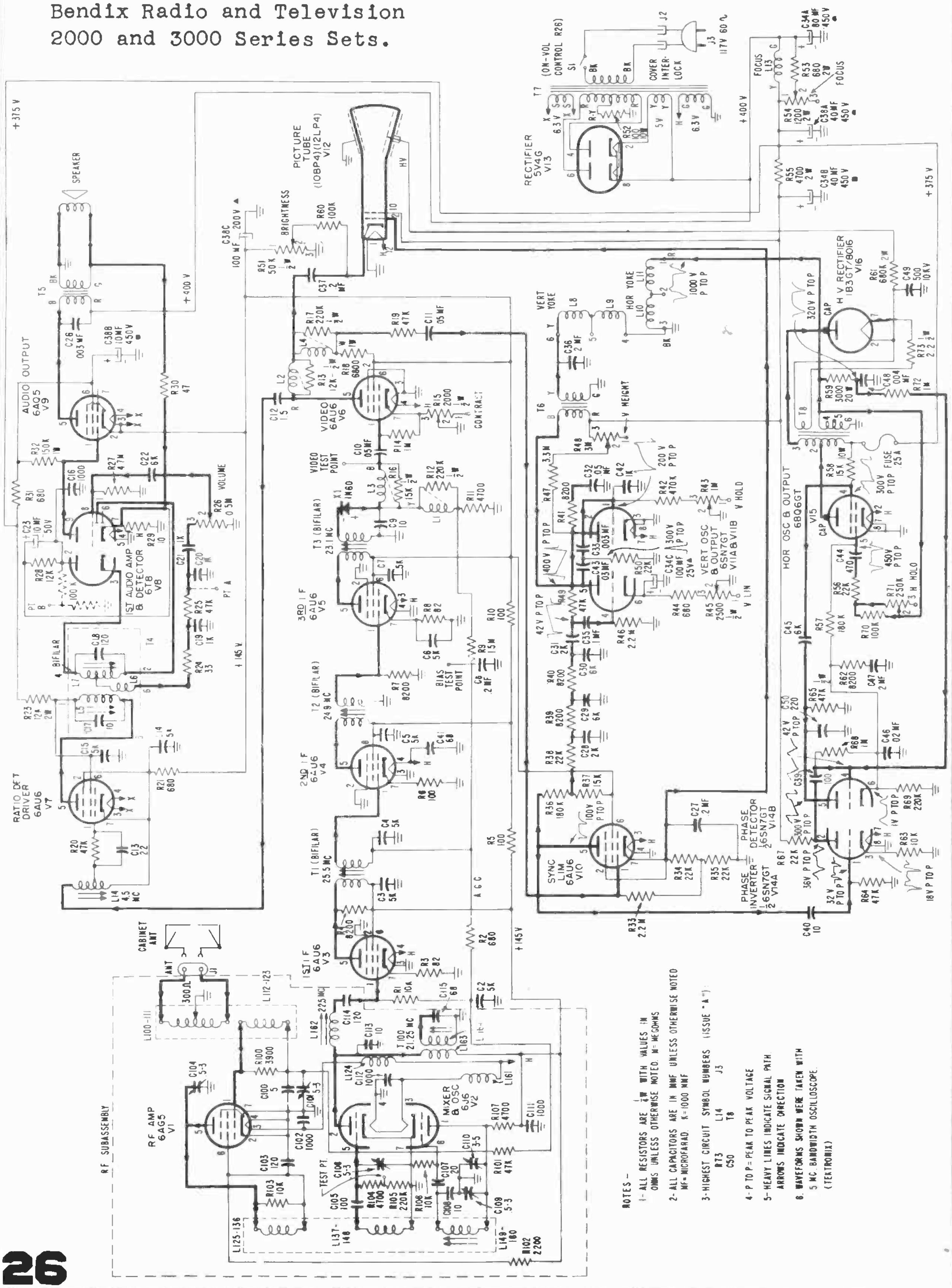






MOST-OFTEN-NEEDED **1950 TELEVISION INFORMATION**

Bendix Radio and Television
2000 and 3000 Series Sets.



ALLEN B. DU MONT LABORATORIES, INC.

TELESET MODELS

RA-103D RA-104A RA-110A

ALIGNMENT PROCEDURE

The alignment of a Television receiver is a procedure that must be followed very carefully in order that the end result is comparable to that obtained when aligned at the factory.

Before attempting to align, the serviceman must be sure that alignment is required.

If there is any doubt in the serviceman's mind regarding the need for alignment, a quick check can be made by viewing the overall response of the video IF strip. This is accomplished by performing step No. 6 in the alignment procedure.

EQUIPMENT NEEDED

Sweep Generator

This generator should be capable of putting out a band of frequencies from about 20 to 30 megacycles. Some means for identifying the frequency of various parts of the response curve must be available. To effect this, the sweep generator must either have an internal marker circuit or an external RF generator to perform the same function, will have to be used.

In the alignment table under the heading "Type of Input Signal Required," the description "Wobbulated and unmodulated RF" means that both the sweep generator output (wobbulator) and the unmodulated RF generator are to be fed into the point designated. It should be understood that both these units will have to be used if the sweep generator does not have an internal marker generator.

If, however, the sweep generator has an internal marker generator only the output from this one unit need be fed into the designated point.

Oscilloscope

An oscilloscope is used as a means of visually indicating the response of the stage or stages under observation.

All of this equipment must be securely grounded to the receiver being aligned. This grounding can be accomplished by using a metal top bench, preferably copper. If such a bench is not available, these units should be bonded together by the use of heavy metal braid between the chassis. Ordinary wire is not enough to effectively place all units at the same potential.

Once the equipment is set in place, the generators and receiver should be allowed to run at least 15 minutes before starting to align.

Additional equipment necessary for alignment is what is referred to as a 6AK5 adapter tube. This is simply a 6AK5 with a fine wire soldered to pin No. 1. It may be necessary to fasten this wire to the side of the tube with scotch tape to prevent it shortening against the bottom of the shield. This tube is used to permit feeding the generator output into the grid of the mixer stage without disturbing the Inputuner.

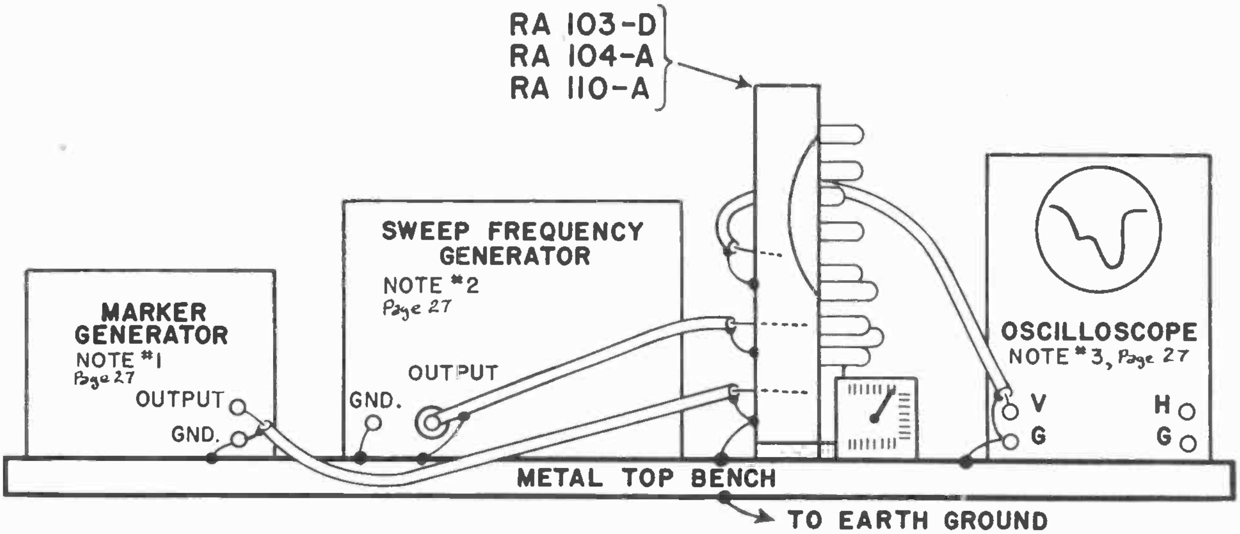
In the procedure, reference is made to the use of a "Probe Detector." This device is merely a crystal rectifier with the necessary filter. Its purpose is to permit the observation of the response of a single stage when viewed ahead of the video detector.

NOTES:

1. Unmodulated and amplitude modulated RF should cover 20 to 30 mc range. Also 4.5 mc. Not necessary if marker is built into sweep frequency generator.
2. Should have center frequency range from 20 to 30 mc. Sweep should be adjustable up to 6 mc at least.
3. We recommend use of internal saw-tooth sweep. Waveforms shown were taken using this sweep. External sweep from sweep frequency generator may be used if preferred.

ALIGNMENT SET-UP

1. Keep all coax cables as short and as well shielded as possible.
2. Ground metal bench to a good earth ground.
3. To test set-up feed signal into grid of mixer thru a 100 mmf condenser. If placing hand on any chassis or adding additional grounds at any point affects waveform or if Teleset has a tendency to oscillate, grounding must be added until these effects disappear.



VIDEO IF ALIGNMENT TABLE (RA-103D)

Notes:

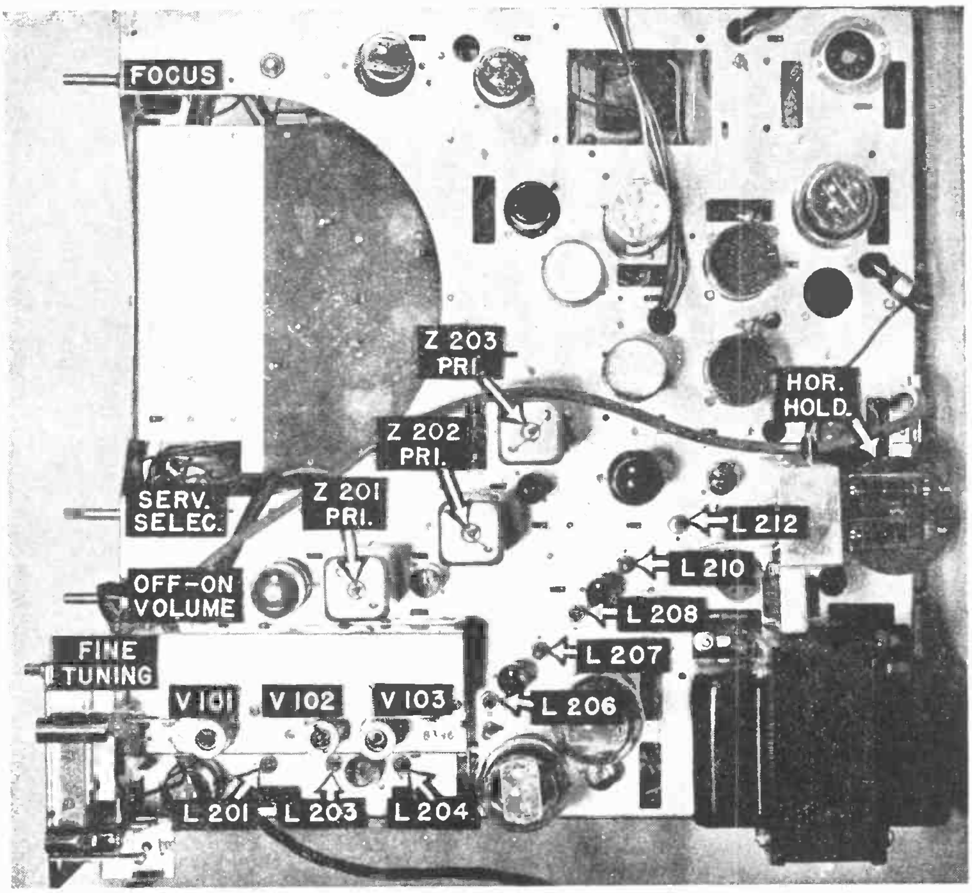
1. Remove 6AB4 oscillator V103 and 6J6 RF amplifier V101 from Inputuner before attempting to align set.
2. Place tuner at extreme high end of range.
3. Set R-232 to give –5V from center arm to ground on VTVM unless otherwise noted.

Step No.	To Adjust	Type of input signal required	Connect generator at point number	Scope thru crystal probe or direct	Remarks
1	L222 Z201 (top)	21.9 mc with 400 cycles AM	V1	Direct	Tune for minimum signal on scope.
2	L225	20.4 mc with 400 cycles AM	V1	Direct	Tune for minimum signal on scope.
3	L212 L210 C288	Wobbulated and unmodulated RF 6 mc sweep Set center frequency at about 25 mc	V2	Direct	Short L209 out. Contrast control off. L212 tunes left side of curve. L210 tunes right side of curve. C288 affects band-width. Peaks should be even. Carrier must not exceed 15% down from right peak. See Fig. 1.
4	L208 L207 L209	Wobbulated and unmodulated RF	V3	Direct	L208 positions center peak. L207 affects shoulder amplitude. L209 positions carrier on right shoulder. See Fig. 2.
5	L206 L204	Wobbulated and unmodulated RF	V1	Direct	Use 100 mmf in series with generator. See Fig. 3.
6	L203 L201 L204 L206	Wobbulated and unmodulated RF	V4 use 6AK5 with lead attached.	Direct	Use 100 mmf in series with generator. 22.9 mc marker slightly inside low frequency peak. 26.4 mc 50% down. See Fig. 4. If peak at 22.9 mc cannot be obtained, re-adjust L-208 slightly to get dashed curve of Fig. 2.
7	L216	4.5 mc with 400 cycles AM	V5	Probe detector	Tune for minimum signal on scope.

Du Mont Teleset Models RA-103D, RA-104A, and RA-110A, continued

SOUND IF ALIGNMENT TABLE

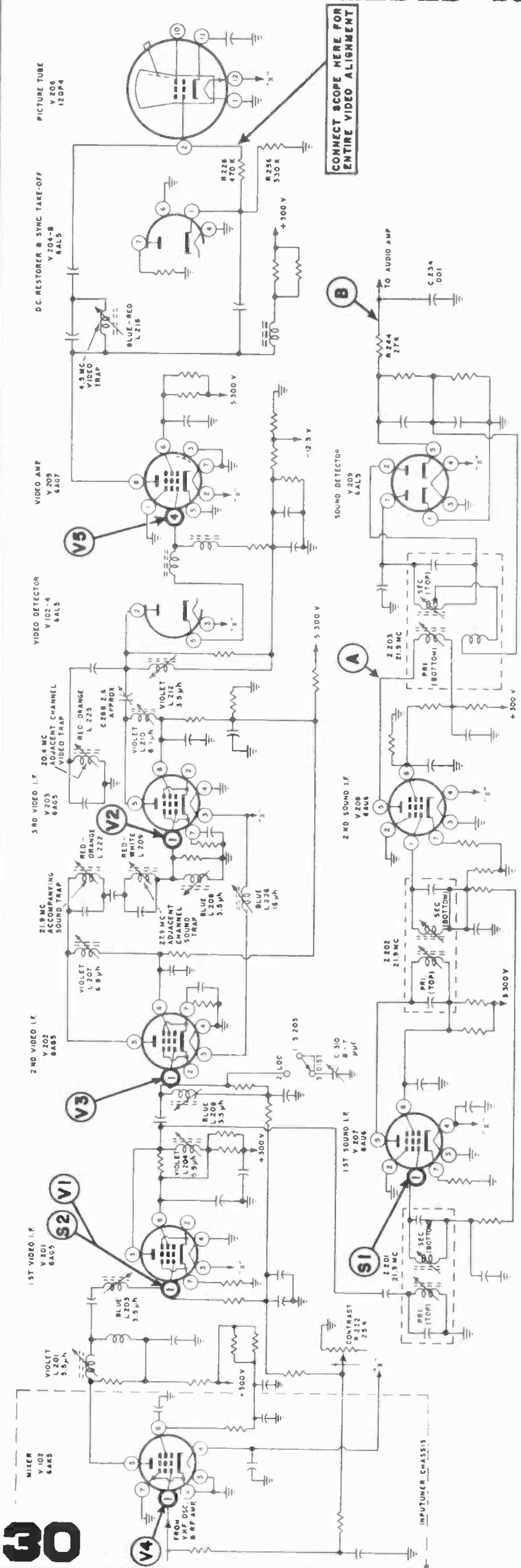
1	Z202	Wobbulated and unmodulated RF 500KC sweep Set center frequency at about 22 mc	S1	Probe detector at point A	Tune Z202 for maximum amplitude and symmetry. Primary (top) affects frequency. Secondary affects symmetry and amplitude. See Fig. 5.
2	Z201	Wobbulated and unmodulated RF 500KC sweep	S2	Probe detector at point A	Tune secondary (bottom) Z201 and Z202 for symmetry. Then primary (top) Z202 for frequency. See Fig. 5.
3	Z203	21.9 mc with 400 cycles modulation	S2	Direct at point B	Detune top Z203, tune bottom for maximum, then tune top for sharp minimum on scope.
4	Z203	Wobbulated and unmodulated RF 500KC sweep	S2	Direct at point B	If necessary, tune bottom for symmetry of curve.



ALIGNMENT OF TELESETS WITH LOCAL DISTANCE SWITCH

With L D switch in L position and the shunt capacitor set at approximately ½ of its total capacity, the receiver should be aligned using the normal alignment procedure. After set has been aligned place local-distance switch in distance position and turn contrast full on. Tune set to a very weak test pattern. Adjust L206 for maximum signal. Now place L-D switch in L position, tune set to a strong test pattern and adjust C310 for best picture quality. No other adjustment should have to be made.

Du Mont Teleset Models RA-103D, RA-104A, and RA-110A, continued



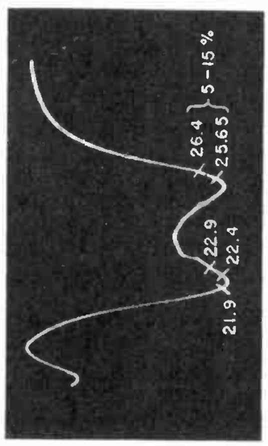


Fig. 1

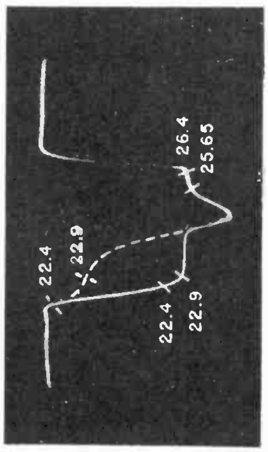


Fig. 2

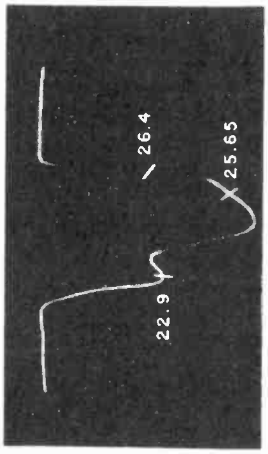


Fig. 3

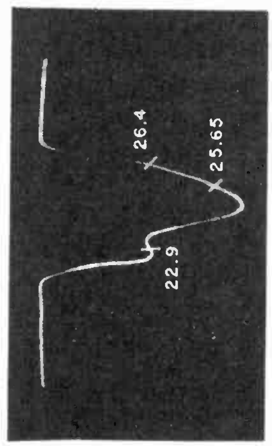


Fig. 4

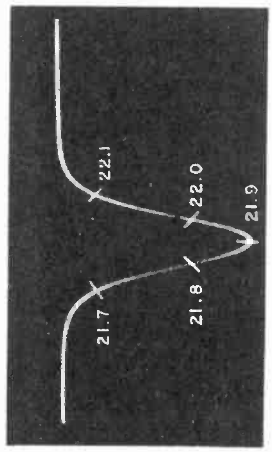


Fig. 5

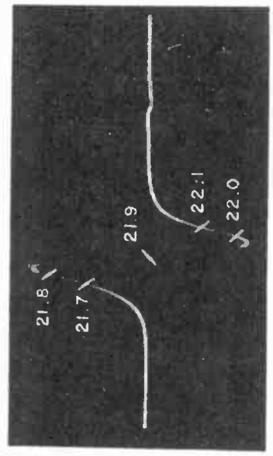
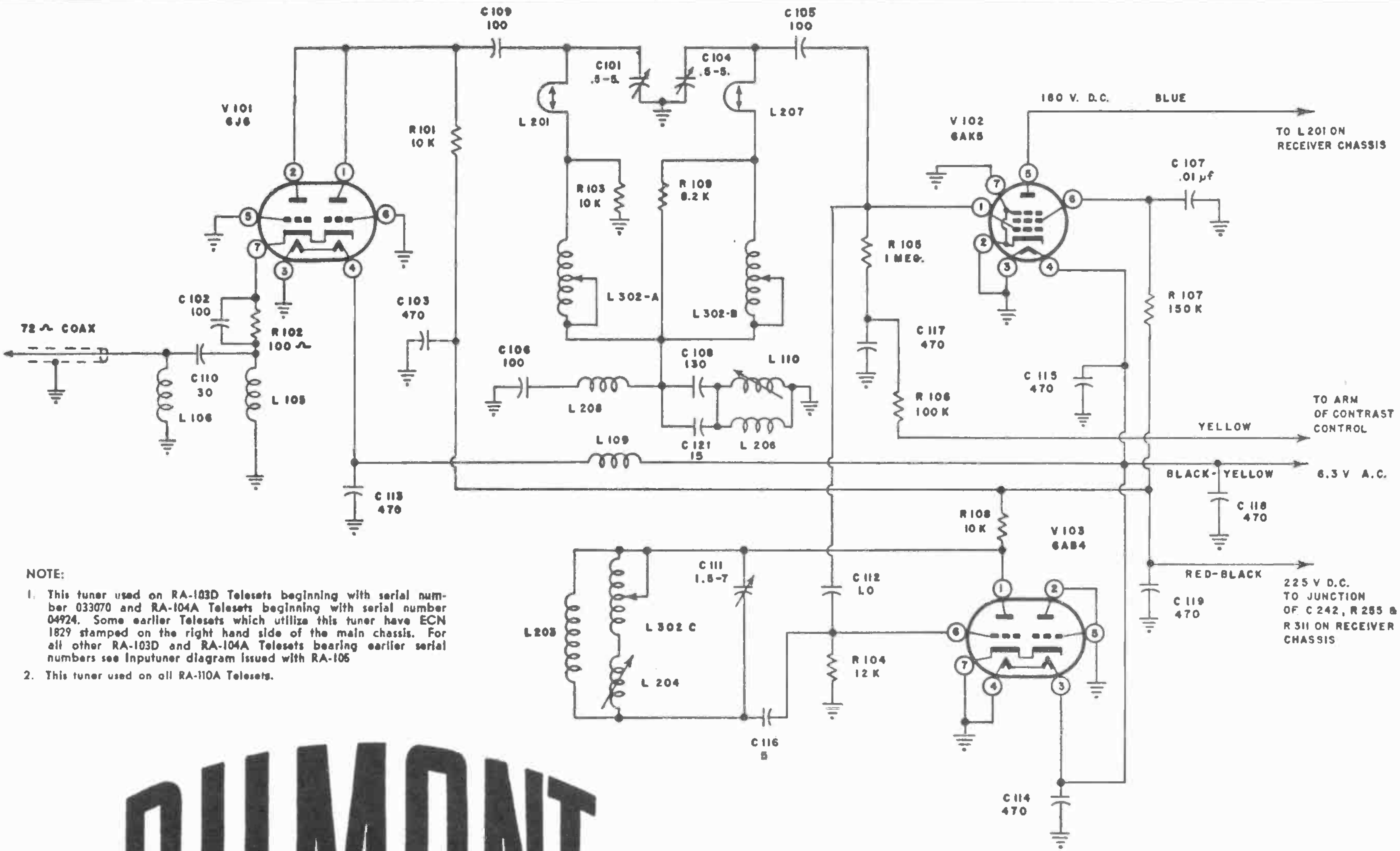


Fig. 6

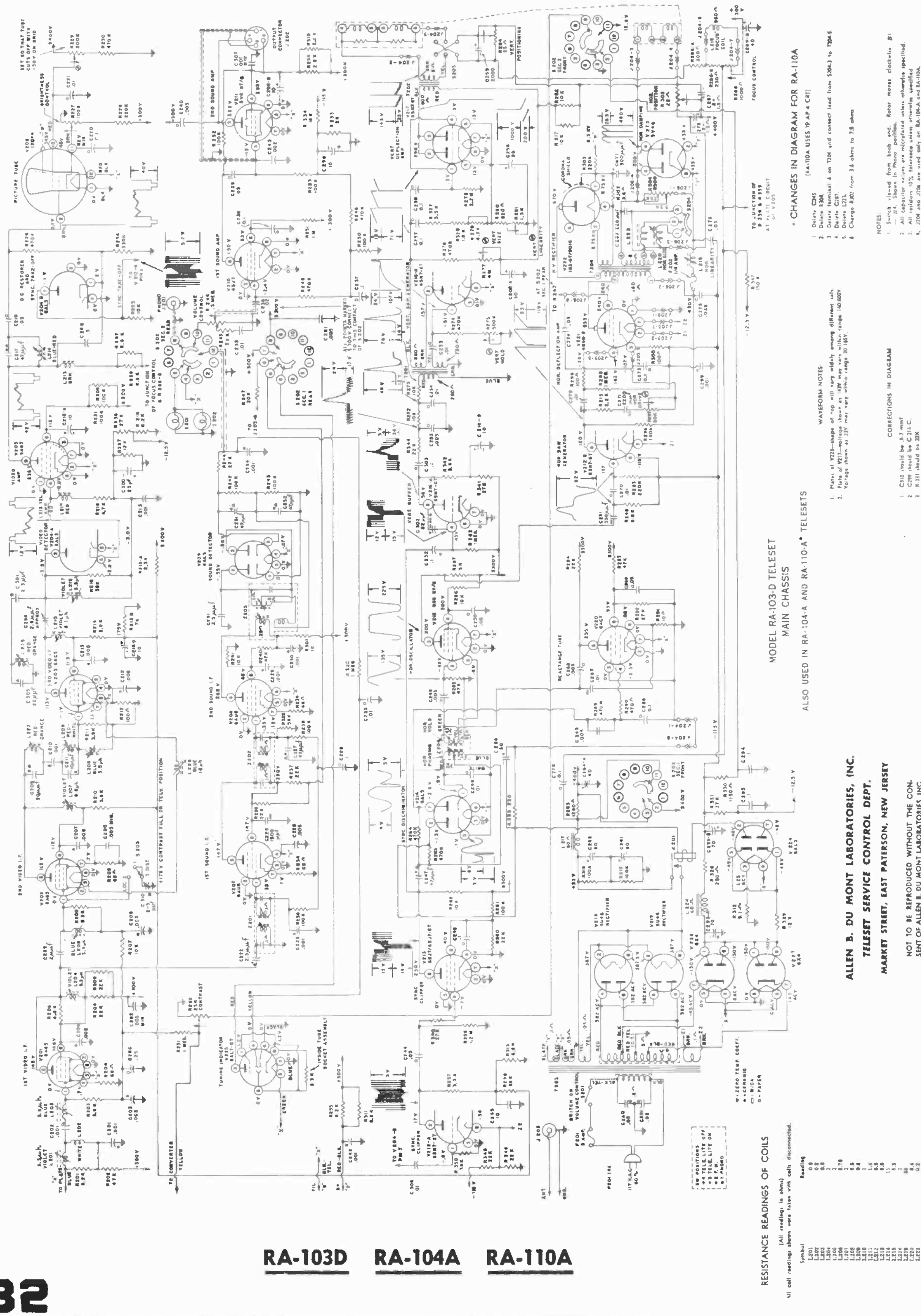


NOTE:

1. This tuner used on RA-103D Telesets beginning with serial number 033070 and RA-104A Telesets beginning with serial number 04924. Some earlier Telesets which utilize this tuner have ECN 1829 stamped on the right hand side of the main chassis. For all other RA-103D and RA-104A Telesets bearing earlier serial numbers see Inputuner diagram issued with RA-105
2. This tuner used on all RA-110A Telesets.

DUMONT

R.F. TUNING ASSEMBLY
(BOTTOM-COUPLED INPUTUNER)



RA-103D RA-104A RA-110A

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

EMERSON RADIO AND PHONOGRAPH CORPORATION

MODELS 631 AND 632

CHASSIS MODELS 120109B AND 120096B

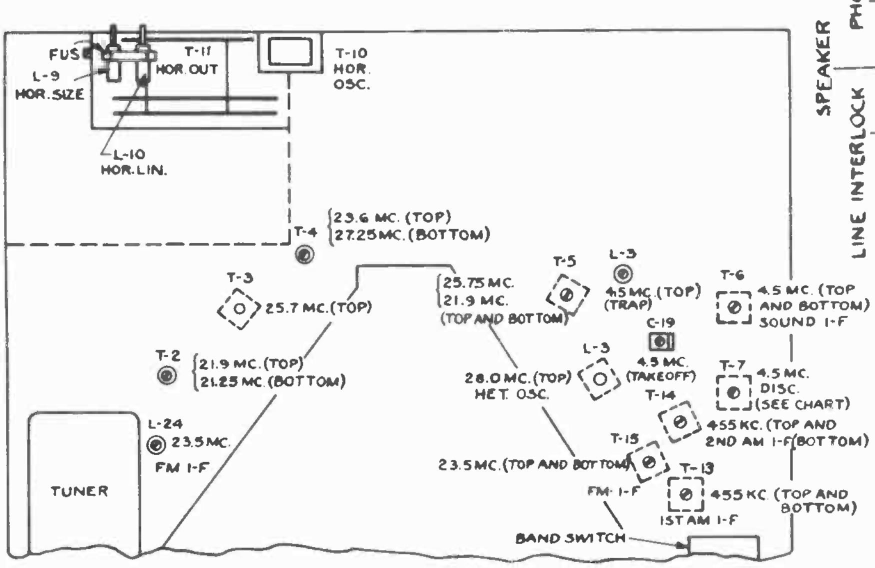
Models 631 and 632 are direct-view television receivers using metal-shell type 16AP4 kinescopes. Model 631 is a table model receiver providing television only, and uses chassis 120109B. Model 632 is a console receiver providing TV, AM, FM, and PHONO facilities. Separate 78 rpm and 45 rpm record changers are used in this model which employs chassis 120096B.

Both models contain advanced design features including keyed AGC, intercarrier sound, a.f.c. in the horizontal sync circuit, and a transformer-type cascade (series) low-voltage power supply. Model 632 uses a double conversion i-f system for FM reception.

a. The operation of chassis 120096B on FM involves a double conversion arrangement and makes use of the video i-f system, video detector, and sound i-f, discriminator, and audio amplifier circuits.

b. The input from the television antenna is fed through a matching coil (L22) and coaxial cable to the converter and oscillator (FV-1). Operation is controlled by a three-section switch which feeds the signal from the coaxial cable (Sec. 3-Rear) to a tuned circuit (L19, C106). A four-section variable condenser is used for FM and AM tuning. The r-f mixes with the oscillator (L18, C104) which is 23.5 MC. higher, and produces the first FM i-f of 23.5 MC. The signal is coupled through the first FM i-f transformer (T15) to the i-f amplifier (AV-1). The output of AV-1 is fed through the primary of T14 and the switch (Sec. 2-Rear) to a single tuned circuit (L24) which feeds the second video i-f (V2). Note that although T14 is an AM i-f transformer (456 KC.) the primary trimmer provides coupling for the FM signal to the switch.

c. The broadband characteristic of the video i-f stages provide amplification of the first FM i-f (23.5 MC.) up to the video detector (V5). A fixed frequency heterodyne oscillator (V10) produces a 28 MC. signal (L23, C46) which is coupled to V5 and produces a 4.5 MC. signal. The resulting second FM i-f (4.5 MC.) is amplified by the sound i-f channel as for normal intercarrier television operation.



BOTTOM VIEW OF CHASSIS

FIGURE 2 - LOCATION OF ALIGNMENT POINTS

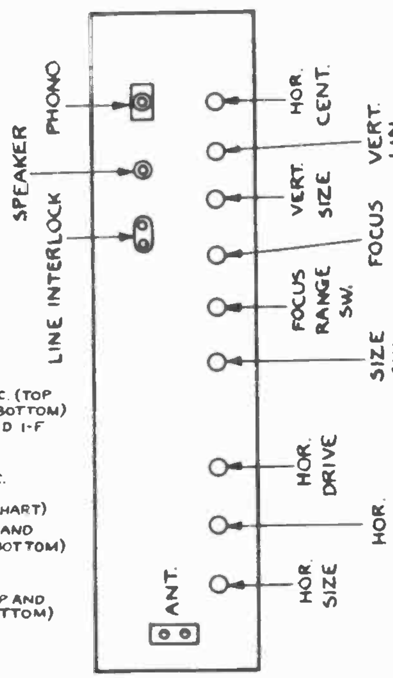


FIGURE 3 - REAR CHASSIS ADJUSTMENTS

ALIGNMENT

Emerson Radio

a. **Equipment Required** - A sweep generator, accurate marker generator, oscilloscope, and v.t.v.m. are required for alignment. The marker generator must be very accurate and supply frequencies of 4.5 MC., and 20 to 28 MC.

b. **Response Curves** - The i-f response curves for the video i-f stages are shown in figure 4.

c. **Alignment Points** - The location of all i-f transformers, tuned circuits, and trimmers is shown in figure 2.

d. **TV I-F Alignment** -

1) Tune receiver to Channel 3.

2) Connect 3 volt bias battery from junction of R46 and C50 (negative terminal) to ground (positive terminal).

3) Shape overall response curve, after individual peaking of stagger-tuned and over-coupled i-fs, as indicated in steps 1-8 below. See curves A and B.

STEP	SIGNAL GENERATOR INPUT		MEASURING INSTRUMENT	ADJUST	PROCEDURE
	CONNECTION	FREQUENCY			
1	Lightly couple marker generator to pin 1 (grid) of V4. Sweep gen. to be connected from grid to ground.	Sweep-23.5 MC. (10 MC. sweep) Markers-25.75 MC. and 21.9 MC.	Connect vertical input of scope through 10K resistor to junction of C21 and R17. Grid return of oscillator to be connected to B-.	T5 (Top and bottom)	Set markers as shown on response curve A, figure 4. Adjust sweep generator input to produce one volt at junction of C21 and R17. Markers should be 10% down on curve; peak-to-valley ratio should not exceed 10%.
2	Marker generator through .001 mfd to pin 1 (grid) of V1.	Marker-23.6 MC. 400 cycle mod.)	Replace scope with v.t.v.m.	T4 (Top)	Peak for maximum response.
3	"	Marker-27.25 MC. (400 cycle mod.)	"	T4 (Bottom)	Adjust trap for minimum response. Repeat step 2.
4	"	Marker-25.7 MC. (400 cycle mod.)	"	T3	Peak for maximum response.
5	"	Marker-21.9 MC. (400 cycle mod.)	"	T2 (Top)	Peak for maximum response.
6	"	Marker-21.25 MC. (400 cycle mod.)	"	T2 (Bottom)	Adjust trap for minimum response. Repeat steps 2-6.
7	Sweep generator coupled to converter (V26) input, using 3 turn loop slipped over tube. Marker gen. in parallel.	Sweep-23.5 MC. (10 MC. sweep) Markers-25.75 MC. and 21.9 MC.	Scope connected through detector network to pin 1 (grid) of V1 and to ground.	T1	Adjust T1 to set markers as in step 1, for response curve A.
8	"	"	Connect scope through 10K resistor to junction of C21 and R17 and B-.	T2, T3, T4	Adjust for overall response as shown on curve B. Adjust T3 to position 25.75 MC. marker accurately. Adjust T2 (Top) to position 21.9 MC. marker. Do not readjust trap. Equalize peaks of response curve B within 10% by adjusting T4 (Top).

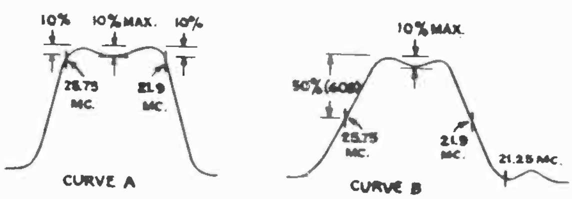


FIGURE 4 . I-F RESPONSE CURVES

MODELS 631 AND 632

CHASSIS MODELS 120109B AND 120096B

Emerson Radio

e. TV Sound Alignment -

1) Set receiver to Channel 3.

2) Use accurate, crystal-controlled, marker generator.

STEP	SIGNAL GENERATOR INPUT CONNECTION	SIGNAL GENERATOR INPUT FREQUENCY	MEASURING INSTRUMENT	ADJUST	PROCEDURE
1	Marker generator through .001 mfd. to pin 5 of V5. Low side to B-.	Marker-4.5 MC. (400 cycle mod.)	Connect v.t.v.m. through 10K resistor to pin 2 of V24 socket.	L3	Adjust for minimum output, with contrast control set at maximum.
2	"	Marker-4.5 MC. (400 cycle mod.)	Connect v.t.v.m. through 10K resistor to pin 1 (grid) of V7.	C19	Peak for maximum response. Adjust generator input to produce one volt at grid of V7.
3	"	Marker-4.5 MC. (400 cycle mod.)	"	T6 (Top and bottom)	Peak for maximum response.
4	Connect sweep generator in parallel with marker gen.	Sweep-4.5 MC. (450 KC.sweep) Marker-4.5 MC.	Replace v.t.v.m. with scope connected through 10K resistor to junction of R27 and C26.	T7 (Secondary)	Position 4.5 MC. marker at center of S-curve, by adjusting secondary. Trans. #708031 (Sickles); secondary is at bottom of chassis; Trans. #708031B (Automatic); secondary is at top of chassis.
5	"	"	"	T7 (Primary)	Peak primary for maximum amplitude and linearity. Repeat step 4.

f. TV R-F Alignment -

1) Set fine tuning control to mechanical center. Retain this setting for entire r-f alignment.
2) Use 300 ohm carbon resistor as dummy antenna.
3) Couple marker generator in parallel with sweep generator.
4) Use 10 MC. sweep for sweep generator. Couple generator to antenna terminals of receiver.
5) Connect vertical input of scope in series with 10K resistor to junction of C21 and R17, or to pin 1 (grid) of V12.

STEP	SIGNAL GENERATOR INPUT SWEEP GEN.	SIGNAL GENERATOR INPUT MARKER GEN.	CHANNEL	ADJUST	PROCEDURE
1	207.0 MC.	209.75 MC.	12	A12	Adjust for placement of 21.25 MC. marker as per response curve B.
2	"	"	12	A14, A15, A16	Adjust shape of response curve B for maximum amplitude and bandwidth.
3	213.0 MC.	215.75 MC.	13	A13	Adjust 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	"

9. VOLTAGE ANALYSIS

a. **Plate Voltages** - Voltages measured with voltohmyst and are d.c., with respect to chassis (ground). All controls at normal.

SYMBOL	TUBE TYPE	PIN NO.	TV	PHONO	AM	FM
V1	6AU6	5	130	140	115	110
V2	6AU6	5	125	94	80	100
V3	6AU6	5	190	220	195	195
V4	6AU6	5	205	240	222	215
V5	6AL5	2	-110	-125	-138	-150
V6	6AU6	5	0	0	0	0
V7	6AU6	5	130	150	122	120
V8	6T8	2	-4	-.8	-.8	-3.5
		9	52	55	53	55
V9	6V6GT	3	80	90	66	60
V10	12AU7	1	-1	-1	-1	90
V11*	6AU6	5	-2.4	-.8	-.8	-.8
V12	6AU6	5	60	12	-10	15
V13	6AR5	5	-20	0	0	0
V14	12AU7	6	-104	-114	-126	-135
		1	- 60	- 70	- 80	- 85
V15	6SN7	5	- 20	-125	-140	-147
		2	- 46	-125	-140	-147
V16	6K6GT	3	165	-125	-140	-147
V17	6W4	5	235	275	256	250
V19#	6BG6G	8	112	-125	-140	-147
V20	6SN7GT	5	85	-125	-140	-147
		2	-107	-125	-135	-145
V21	6AL5	2	-115	-125	-138	-148
		7	-107	-125	-138	-148
V22	6SN7GT	5	- 95	-125	-138	-148
		2	- 50	- 65	- 80	- 85
V23	5U4G	8	270	295	276	270
FV-1	6BA7	9	0	0	120	120
AV-1	6BA6	5	0	0	116	116

** The plate voltage to V11 is pulsed at 15,750 cps.*
 # Measured at screen.
NOTE - The plate to cathode voltage on the horizontal and vertical sweep circuits is about +5 volts in the PHONO, AM, and FM positions of the band switch.

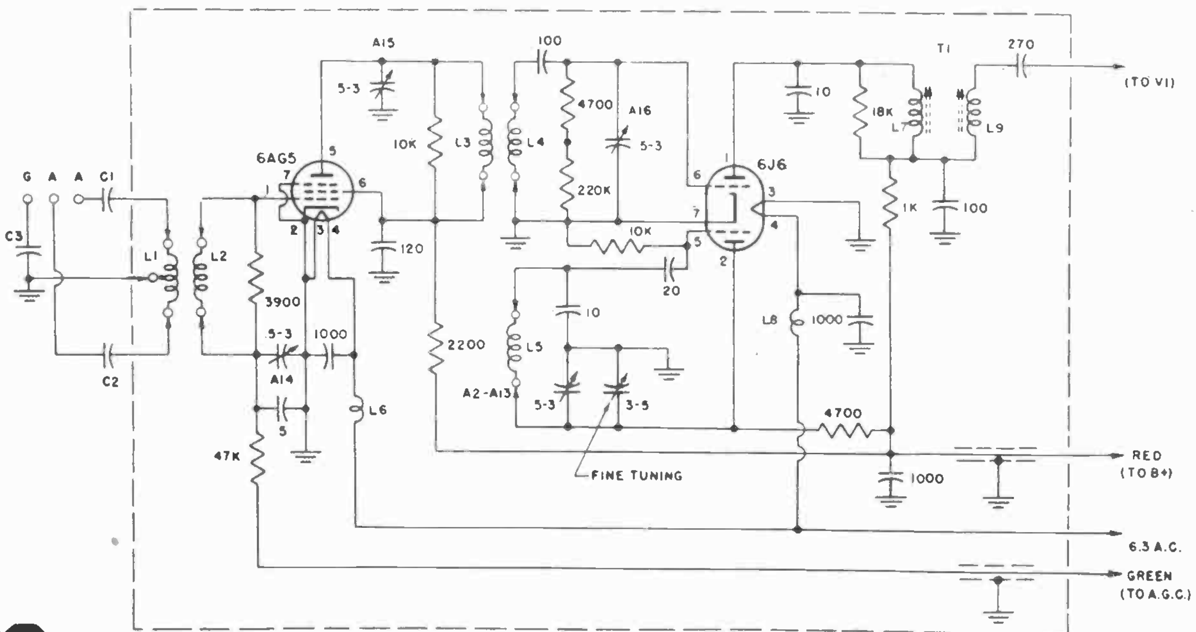


FIGURE 9 - TUNER SCHEMATIC DIAGRAM

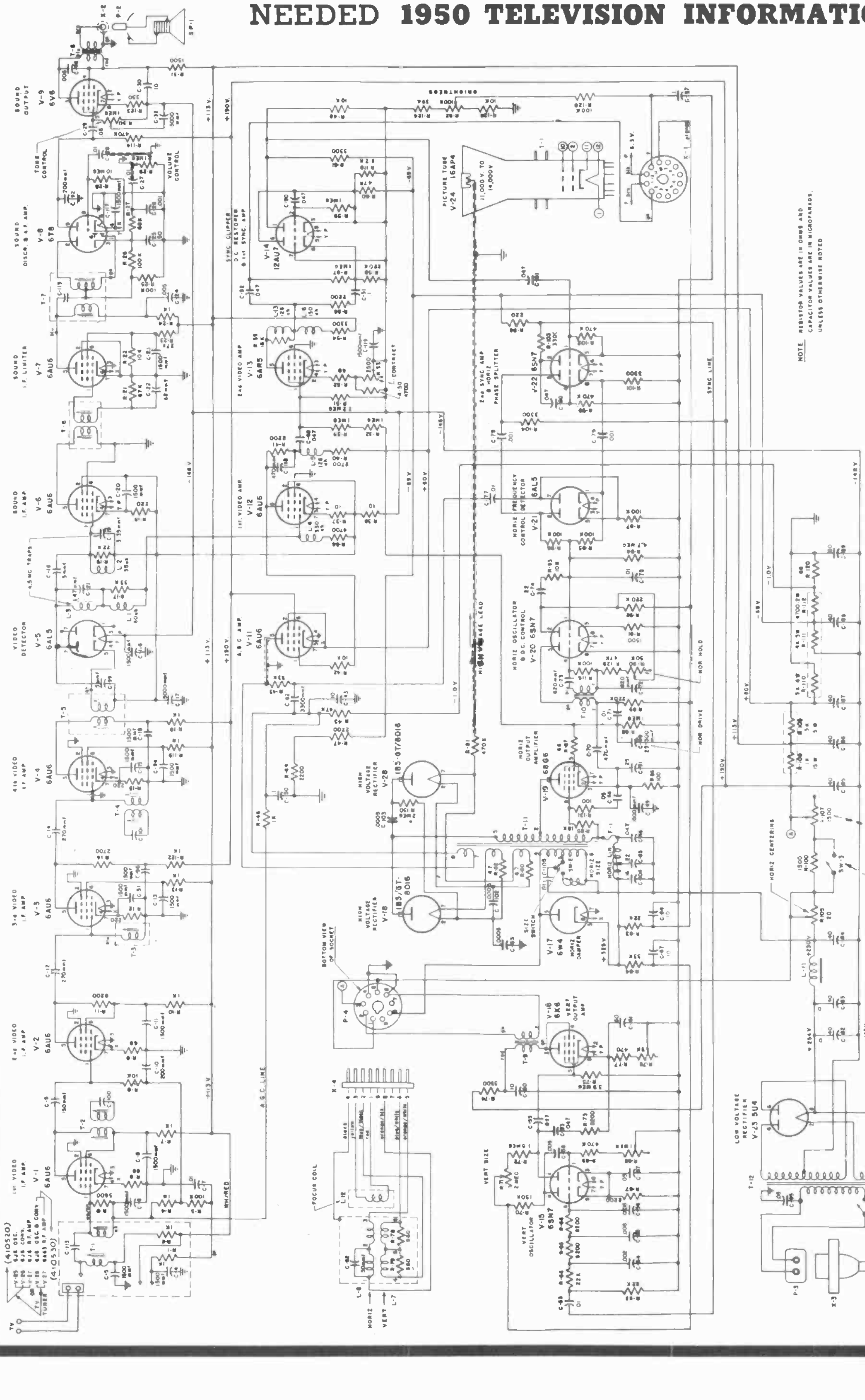


Figure 10 - MODEL 631 - SCHEMATIC DIAGRAM

Emerson Television Chassis 120109-B

g. FM-AM I-F Alignment - Model 632

1) Set variable condenser fully open.
2) Use accurate marker generator for heterodyne alignment (Step 1).
3) Use proper bandswitch setting for FM and AM alignment.(FM-Steps 1-3; AM-Step 4).

STEP	SIGNAL GENERATOR INPUT		MEASURING INSTRUMENT	ADJUST	PROCEDURE
	CONNECTION	FREQUENCY			
1	Connect marker generator to pin 1 (grid) of V2 through .001 mfd.	Marker-23.5 MC. (400 cycle mod.)	Connect v.t.v.m. to pin 1 (grid) of V7.	L23	Accurately peak L23 for maximum response at the limiter.(4.5 MC. beat with 28.0 MC. signal from V-10).
2	Connect marker generator to pin 2 (osc. grid) of FV-1 through .001 mfd.	Marker-23.5 MC. (400 cycle mod.)	"	L24	Peak for maximum response.
3	"	Marker-23.5 MC. (400 cycle mod.)	"	T15 (Top and bottom)	Peak for maximum response.
4	"	Marker-456 KC. (400 cycle mod.)	Connect v.t.v.m. across voice coil.	T14 and T13, (Top and bottom)	Peak for maximum response.

h. FM-AM R-F Alignment - Model 632

1) Steps 1 and 2 refer to FM alignment; Steps 3 and 4 refer to AM alignment. Use proper bandswitch settings.
2) To position pointer, set variable condenser fully closed and position pointer to reference mark at low frequency end of dial backplate.

STEP	SIGNAL GENERATOR INPUT		DIAL SETTING	MEASURING INSTRUMENT	ADJUST	PROCEDURE
	CONNECTION	FREQUENCY				
1	Connect marker generator through 300 ohm carbon dummy antenna to antenna terminals.	Marker-108.0 MC. (400 cycle mod.)	108.0 MC. (FM)	Connect v.t.v.m. to pin 1 (grid) of V7	C105	Peak for maximum response (osc. trimmer)
2	"	Marker-106.0 MC. (400 cycle mod.)	Tune for maximum response	"	C107	Peak for maximum response (Ant. trimmer)
3	Form loop of several turns and radiate signal into antenna loop	Marker-1600 KC. (400 cycle mod.)	1600 KC.	Connect v.t.v.m. across voice coil	C103	Peak for maximum response (Osc. trimmer)
4	"	Marker-1400 KC. (400 cycle mod.)	Tune for maximum response	"	C109	Peak for maximum response (Ant. trimmer)

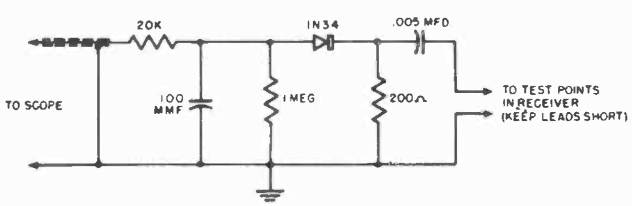


FIGURE 8 - SCOPE DETECTOR

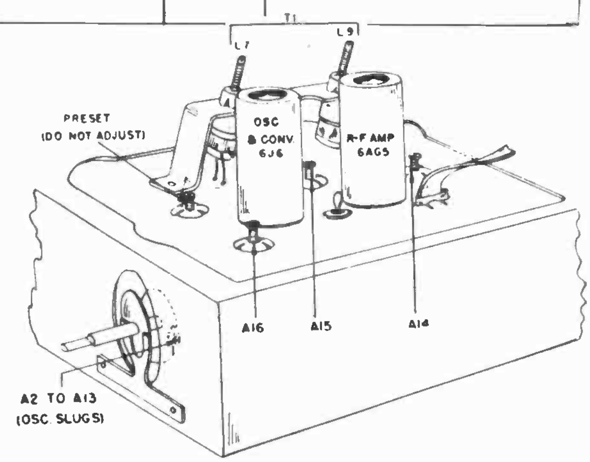


FIGURE 7 - TUNER ALIGNMENT POINTS

MOST-OFTEN-NEEDED **1950 TELEVISION INFORMATION**

Emerson Radio

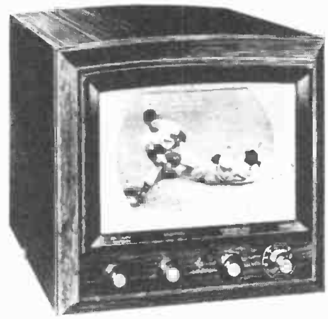
MODEL 571

MODELS

571-606-611-612

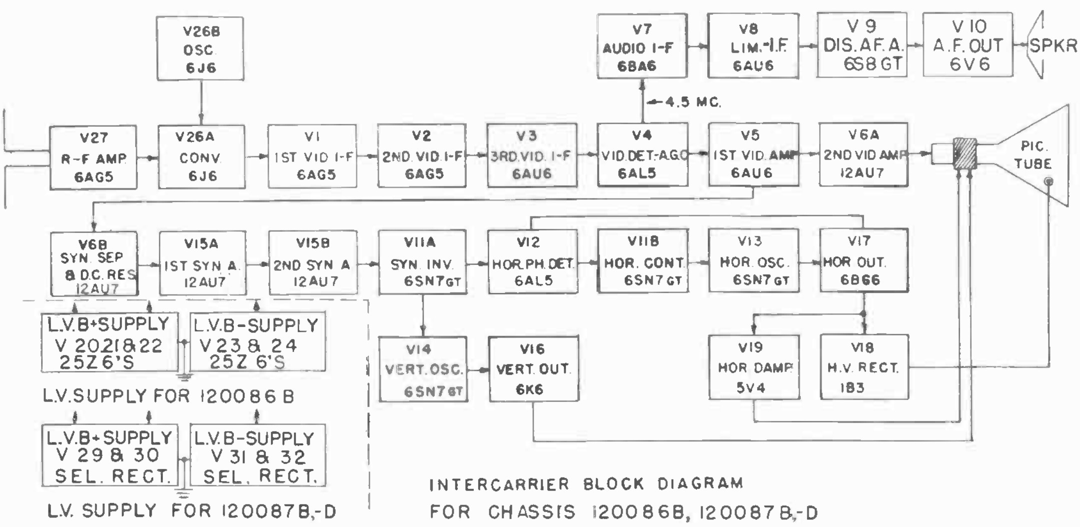
619-620-624-627

638



MODEL 627

The material on pages 39 to 48A covers the basic service information on Emerson models 571, 606, 611, 612, 619, 620, 624, 627, and 638. These sets have used several different chassis, three different tuners, and had other minor changes. The circuit in the blueprint on fold-out page 48A, is of the 120087 chassis. The suffix letters B and D indicate the use of different size raster masks, while chassis 120092B and 120107B indicates modification to accommodate a 12" tube, with 120092B used in console cabinets with larger speaker. Chassis 120086B is similar to the one illustrated, but does not use selenium rectifiers, but type 25Z6 tubes. All these chassis use intercarrier sound systems. The earlier chassis 120066, and also having suffix B, use separate video and audio I.F. channels, and while they are similar in many respects require different alignment and service instructions.



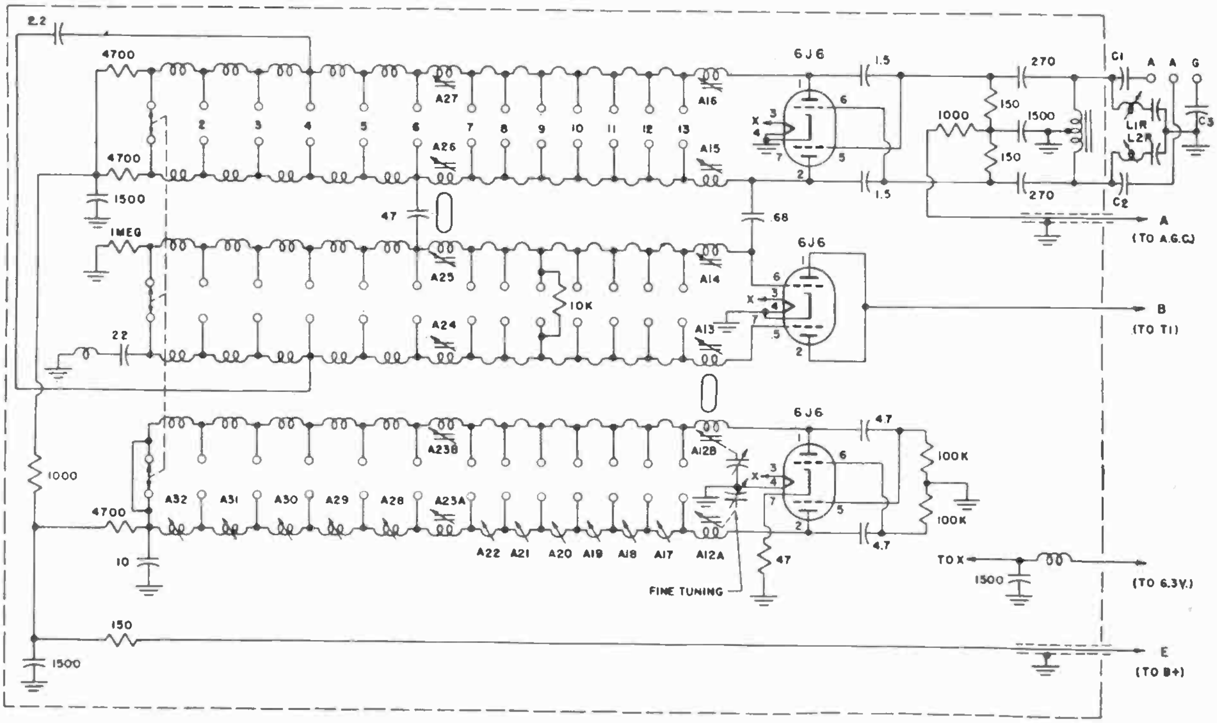
Block Diagram—Chassis 120086B, 120087B, D.

(Note—Chassis 120066 differs from the above in that the audio i-f is 21.25 mc. and is taken from V-1; the low voltage supply is similar to Chassis 120086B, but does not use a ballast tube; Chassis 120066B does use a ballast tube.)

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Emerson Radio

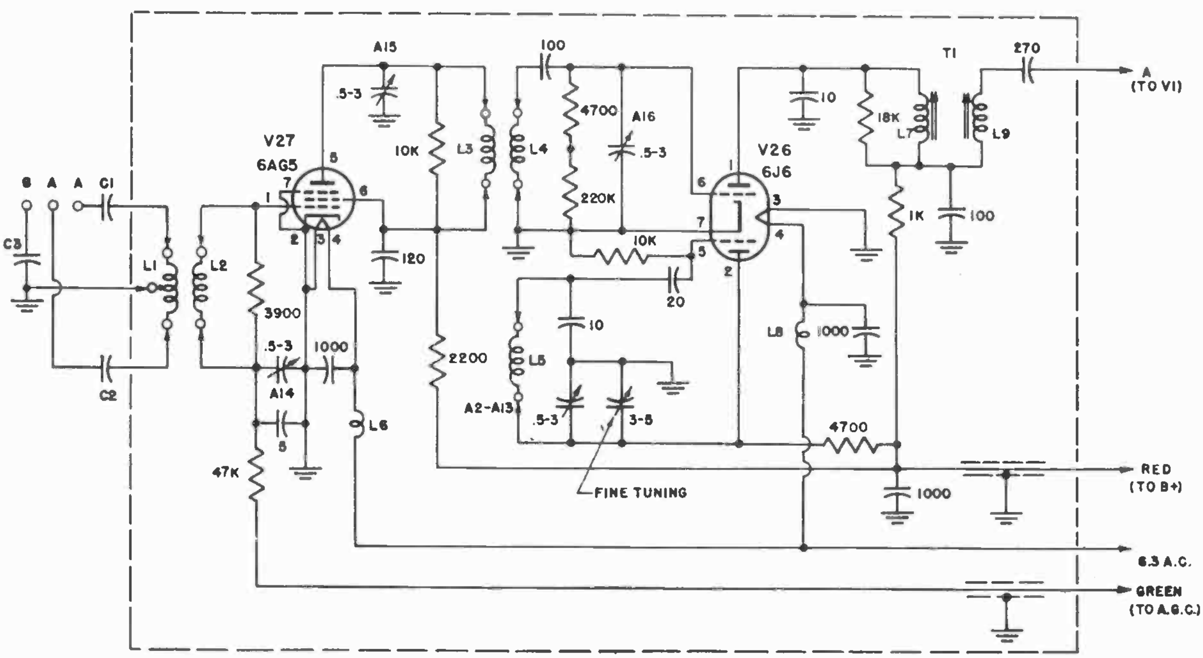
The television chassis used in the various receivers may be either of two types. Chassis 120066B employs a separate sound i-f system, operating at 21.25 mc., which is fed from the first video i-f amplifier. In addition, this chassis employs type 25Z6GT rectifiers in a voltage doubling circuit. Chassis 120086B, 120087B, and 120087D make use of the intercarrier type of sound separation, with the audio i-f stages operating at 4.5 mc. Chassis 120086B uses type 25Z6GT rectifiers; Chassis 120087B, D use selenium rectifiers in the low voltage power supply circuits. With the intercarrier type of circuit, the sound i-f is automatically maintained in synchronism with the video i-f since it is obtained by heterodyning the sound carrier with the video carrier prior to the video detector.



CAP. IN MMFD., RES. IN OHMS UNLESS OTHERWISE NOTED.

TUNER 470233

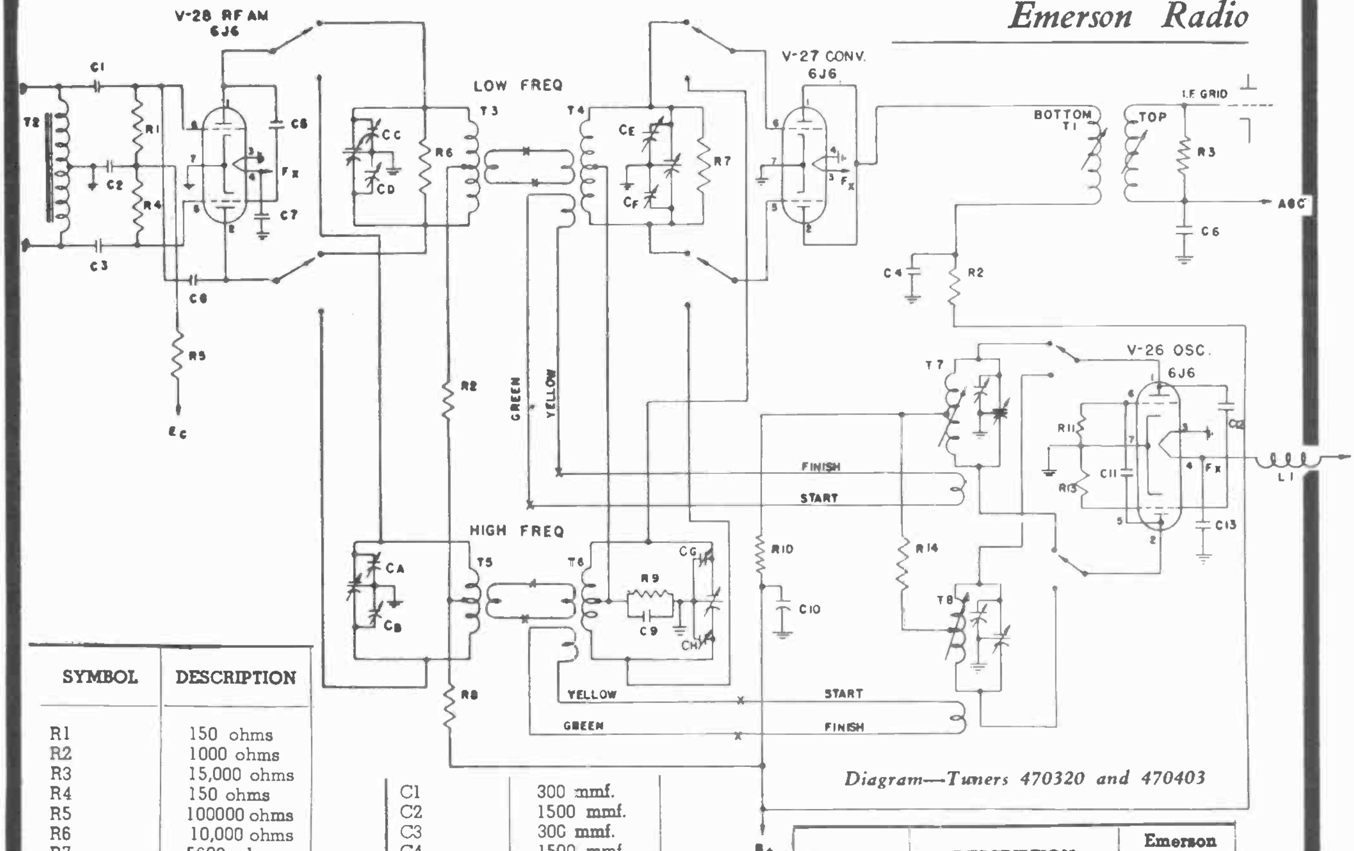
Schematic Diagram—Tuner 470233



ALL CAP. IN MMF., RES. IN OHMS

Schematic Diagram—Tuner 470452

Emerson Radio



Diagram—Tuners 470320 and 470403

SYMBOL	DESCRIPTION
R1	150 ohms
R2	1000 ohms
R3	15,000 ohms
R4	150 ohms
R5	100000 ohms
R6	10,000 ohms
R7	5600 ohms
R8	1000 ohms
R9	1 Meg.
R10	1000 ohms
R11	100000 ohms
R13	100000 ohms
R14	1000 ohms

C1	300 mmf.
C2	1500 mmf.
C3	300 mmf.
C4	1500 mmf.
C5	1.5 mmf.
C6	1500 mmf.
C7	500 mmf.
C8	1.5 mmf.
C9	1500 mmf.
C10	500 mmf.
C11	4.7 mmf.
C12	4.7 mmf.
C13	500 mmf.

SYMBOL	DESCRIPTION	Emerson Part No.
T1	Converter coil (I.F.)	720099
T2	Input coil	710022
T3	R.F.-L.F.	713004
T4	Mixer coil L.F.	713009
T5	R.F.-H.F.	713003
T6	Mixer H.F.	713005

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. For the intercarrier type receiver, no separation of these two intermediate frequencies is made, and the complete signal is fed to the first video i-f stage. Any one of three types of tuners may be used; type 470233 uses a rotary switch in conjunction with simulated quarter-wave tuned lines; type 470452 employs a rotary turret carrying individual coils for each tuned circuit; type 470320 uses a high-low band switch together with a variable capacitor.

a. TYPE 470233—This tuner uses three type 6J6 tubes as the r-f amplifier, oscillator, and converter respectively. Each tube is used in a push-pull circuit and employs the equivalent of a quarterwave line as the tuned circuit. The r-f amplifier, V-28, has an interference trap connected across the 300-ohm balanced input. The plate circuit of V-28 is tuned by the twelve position rotary switch to any desired channel. The converter, V-27, uses a similar tuned line in its grid circuit which is link coupled to the r-f amplifier. The output of V-27 is connected to the primary of the first video i-f transformer, T-1. The oscillator, V-26, uses a quarter-wave tune line in a Hartley circuit. A cylindrical-type condenser is used for the tuning adjustment. Slugs are used for oscillator alignment. The r-f, converter, and i-f stages use wide bandpass circuits to amplify the complete video and audio carriers.

b. TYPE 470452—This tuner uses a type 6AG5 as the r-f amplifier and a type 6J6 as the converter and oscillator. The r-f amplifier, V-28, is a wideband, tuned stage whose output is inductively coupled to the converter, V-27A. The r-f amplifier, converter, and oscillator are tuned by means of a twelve-position rotary turret, carrying separate coils for each channel. The oscillator, V-27B, operates in a Colpitts circuit. Individual slugs are used for alignment of the various channels. A variable-dielectric type of condenser is used for fine tuning of the oscillator. The output of the converter, V-27A, is connected to a double-tuned i-f transformer T-1 (L7 and L9). This video i-f transformer has wide bandpass characteristics to accommodate both the video and audio carriers.

c. TPYES 470320 and 470403—This tuner also uses three type 6J6 tubes as the r-f amplifier, oscillator, and converter respectively. Each tube is used in a push-pull circuit which is tuned by a split-stator type of variable capacitor. A cam-operated band-switch automatically operates for the high and low channels when the selector shaft is rotated. A fixed indent is provided for each channel.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Emerson Radio — MAINTENANCE AND ALIGNMENT

TEST EQUIPMENT REQUIRED—Alignment of circuits and diagnosis of faulty operation of a television receiver should not be attempted unless the service technician has available the proper test equipment.

a. SWEEP GENERATOR:

1) Frequency ranges of 18 to 30 mc., 50 to 90 mc., and 170 to 225 mc.
2) Sweep width variable to 10 mc.
3) Output of at least 0.1 volt, with an attenuator for adjustment of output.
4) Constant output over sweep width, with flat output on all ranges and at all attenuator positions.

b. MARKER GENERATOR:

1) 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 of 4.5 mc. for audio i-f alignment, and accurate frequencies from 21.25 mc. to 25.75 mc., for video i-f alignment.
2) Output of at least 0.1 volt, with an attenuator for adjustment of output.

c. VACUUM-TUBE VOLTMETER:

1) A diode probe for high-frequency measurements is desirable.
2) High input impedance, with provision for low-voltage measurement (three or five volt scale), and high-voltage multiplier probe for measurement of kinescope voltages.

d. OSCILLOSCOPE:

1) Vertical input should be provided with a calibrated attenuator and low capacity probe.
2) Flat vertical amplifier frequency response, with good low frequency response.
3) Adequate vertical sensitivity.

e. **DUMMY MIXER TUBE**—In preliminary alignment of the video i-f and sound traps, it is necessary to connect the sweep generator to the input of the mixer. The "tuned line" type input circuit would act as a vertual short circuit for the i-f frequency voltage. For this reason, it is necessary for the service technician to construct a dummy tube in which the cathode pin is bent out and does not make contact with the socket clips or chassis.

The components and wiring associated with this tube are shown in figure (5-1). The miniature size components can be fastened to the tube envelope with strips of cellulose Scotch tape. Care should be taken in bending tube pin 7 so that the glass header, or tube base, is not damaged.

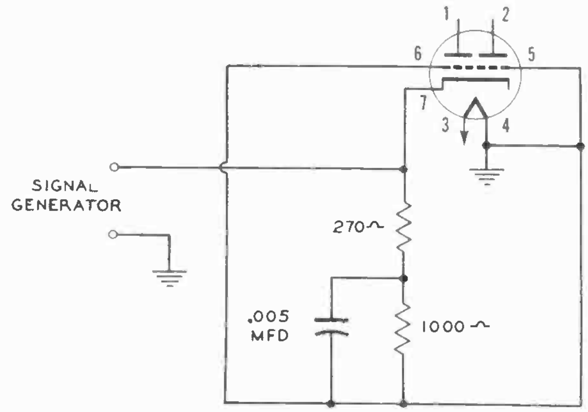


Fig. 5-1 Dummy Mixer Tube

NOTE—Carefully bend Pin 7 at right angle, connect Pin 5 and 6 to Pin 4 which is grounded at the socket. Connect other components as shown.

f. OSCILLOSCOPE DETECTOR—For alignment of T-1 on intercarrier chassis.

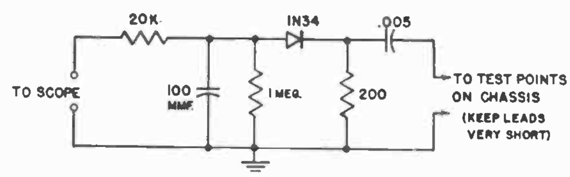
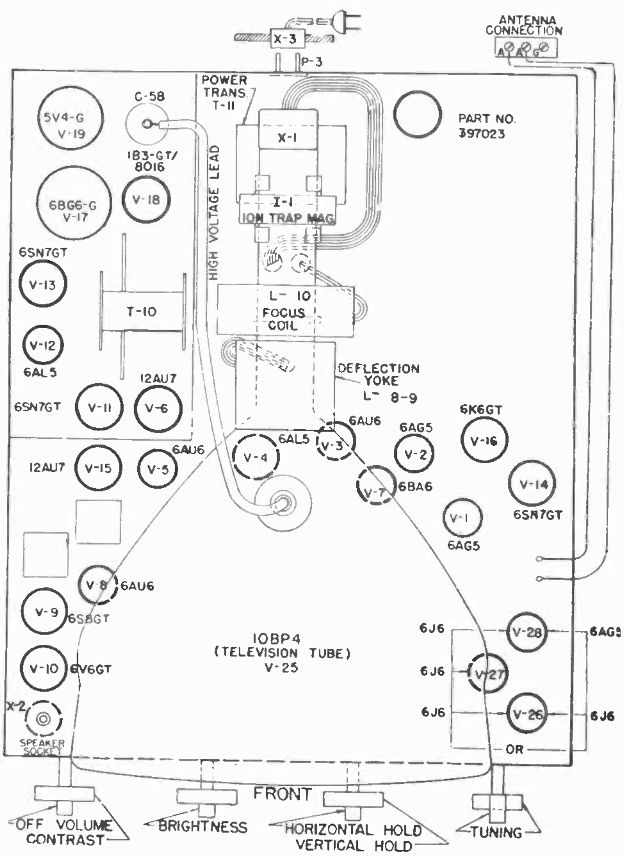


Fig. 5-2 Oscilloscope Detector

3.—ALIGNMENT—Alignment procedure for the various chassis used is the same, with the exception of Chassis 120066 and 120066B which do not use intercarrier sound.



Tube Location Diagram—Chassis 120087B, D

ALIGNMENT PROCEDURES FOR CHASSIS 120086B and 120087B, D—
a. SOUND IF ALIGNMENT: (Table XIII).

—Use marker generator in parallel with sweep generator for step 4.

STEP	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL SETTING	CONNECT SCOPE OR VTVM	ADJUST	REMARKS
1	.001 mfd.	Connect signal generator to pt. A pin No. 7 of V4 6AL5. Low side to chassis.	4.5 mc. unmod.	3	VTVM to pt. B. Low side to chassis.	C-79	Adjust for maximum response on VTVM.
2	.001 mfd.	"	"	"	"	T-5	Adjust both primary and secondary of T-5 for maximum response.
3	.001 mfd.	"	"	"	VTVM to pt. C. Low side to chassis.	T-6	Adjust secondary of T-6 for minimum response.
4	.001 mfd.	Connect signal generator to pt. A pin No. 7 of V4 6AL5. Low side to chassis.	Sweep 4.5 mc., 150 kc. deviation.	"	Oscilloscope to pt. C. Common to chassis.	T-6	Adjust primary of T-6 for maximum linear response as per Fig. 5-7F. (See waveform chart). Repeat Step No. 3

b. VIDEO IF ALIGNMENT: (Table XIV).

—Waveforms may be inverted depending on number of stages in the vertical amplifier of the particular scope being used.

—Sweep width is given. Some generators are calibrated in deviation. The frequency deviation is half the sweep width.

—Marker pip signal is coupled to one of the dipole terminals. This signal should be unmodulated and derived from an accurately calibrated signal generator. Alternate signal so that a small "pip" is visible. A strong marker signal will cause undesirable A.G.C. action and will distort or swamp the picture.

—Connect the synchronized sweep voltage from the signal generator to the horizontal input of the scope for horizontal deflection.

—All selectivity bandwiths measured 6db (50%) down unless otherwise specified.

STEP	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL SETTING	CONNECT SCOPE (Vertical Input)	ADJUST	REMARKS
1	.005 mfd.	Connect sweep generator to point D pin No. 1 of V3, 6AU6. Low side to chassis.	24.50 mc. 6 mc. sweep. 25.75 mc marker signal.	3	To point E in series with 20K ohm carbon resistor. Low side to chassis.	T4	Adjust cores for response as shown in Fig. 5-7A. Note: 25.75 mc. marker should appear approximately 10% from top of response curve.
2	.005 mfd.	Connect sweep generator to point F. pin No. 1 of V2-6AG5. Low side to chassis.	24.50 mc. 6mc sweep 25.25 mc. marker signal.	3	To point E. Low side to chassis.	T3	Adjust cores for response as shown in Fig. 5-7B. Note position of 25.25 mc. marker.
3	——	Loosely couple signal generator. Bring output leads near converter tube V-27-6J6.	24.50 mc. 6mc sweep. 25.75 mc. marker signal.	13	To point F. through detector network.	For 470320 tuner T1	Adjust top and bottom cores for response as shown in Fig. 5-7C. Observe 25.75 mc. marker position in response curve.
						For 470452 tuner L-8 & 9	Adjust same as above.
4	"	"	22.80 mc marker signal and 21.25 mc marker signal.	13	To point D. using network as above.	T2	Adjust primary of T2 (top slug of coil) so as to place 22.80 mc. marker as shown in Fig. 5-7D. Adjust secondary of T2 (bottom slug) so as to place 21.25 mc. marker as shown in Fig. 5-7D. Repeat step 3 to obtain desired response and placement of marker as per Fig. 5-7D.
5	"	" Connect a 2 volt dc. source to point G, and chassis; positive to chassis, negative to A.G.C.	24.50 mc., 6mc.sweep, 25.75 mc. marker signal and 22.25 mc. marker signal.	13	To point E. Common to chassis.	T2 T3	Adjust primary of T2 (top slug) and T3 to give overall response as shown in Fig. 5-7E. Note: Adjustment of T2 primary controls bandwidth and primary of T3 controls the placement of the picture carrier, depending on the accuracy of placement of the 25.75 mc. marker shown in Fig. 5-7C. Step 3.

c. RF ALIGNMENT, TUNERS 470320 and 470403: (Table XV).

—Set fine tuning control to its electrical zero by adjusting control so that the VTVM at point "C" indicates zero response to the respective channel marker generator signal.

—Attenuate signal from marker generator to give as small a "pip" as possible to avoid A.G.C. action.

STEP	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL SETTING	CONNECT SCOPE and VTVM	ADJUST	REMARKS
1	300 ohm carbon resistor.	Connect sweep generator to one of the antenna terminal. Low side to chassis. Marker generator to other antenna terminal. Low side to chassis.	216 mc. 6 mc sweep; marker generator at 25.75 mc. (unmod.)	13	VTVM to point C; vertical input scope to point E in series with 33K ohm resistor. Common to chassis.	T8	Adjust screw for zero indication on VTVM.
2	"	"	"	"	"	CA CB CG CH	Adjust all trimmers for maximum amplitude on oscilloscope while maintaining best symmetry of pattern of overall response curve as per Fig. 5-7E. Check channels 12, 11, 10, 9, 8 and 7 for overall response pattern symmetry on scope as per Fig. 5-7E, while maintaining fine tuning control response to marker signals at zero on VTVM.
3	"	"	88 mc. 6 mc sweep; marker generator at 25.75 mc. (unmod.)	6	"	T7	Adjust screw for zero indication on VTVM.
4	"	"	"	"	"	CC CD CE CF	Adjust all trimmers for maximum amplitude on oscilloscope while maintaining best symmetry of pattern of overall response curve as per Fig. 6. Check channels 5, 4, 3, and 2 for overall response pattern symmetry on scope as per Fig. 5-7E, while maintaining fine tuning control response to marker signals at zero on VTVM.

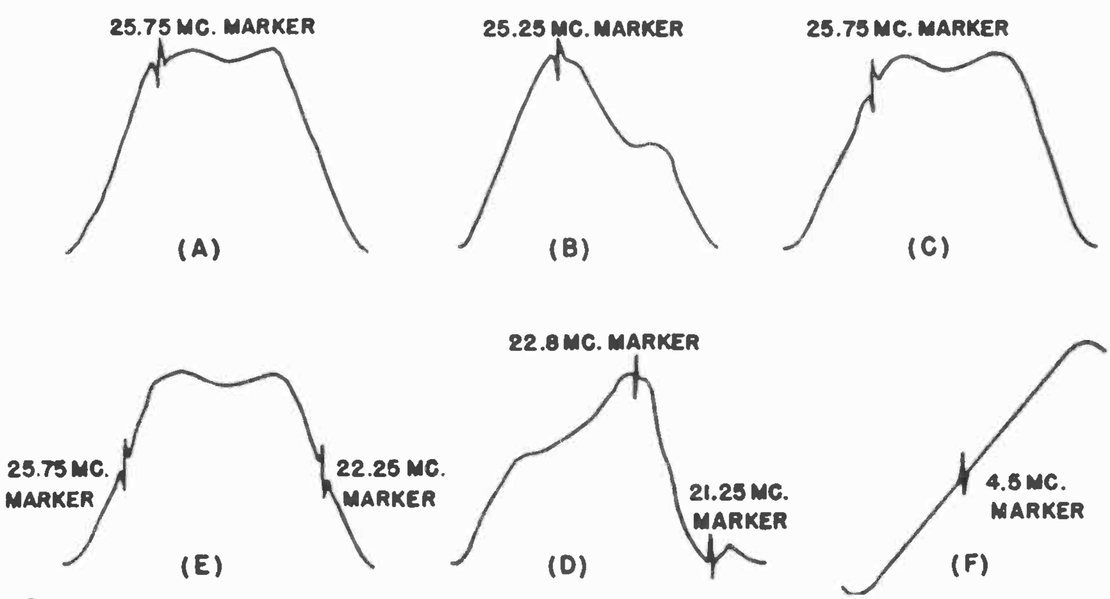


Fig. 5-7 IF Response Curves—Chassis 120086B, 120087B, D.

d. RF ALIGNMENT, TUNER 470452: (Table XVI).

—Set fine tuning control to maximum counter clockwise position for all channels. This will expose oscillator tuning slug for each channel positions.
—Attenuate signal from marker generator to give as small a pip as possible so as to prevent A.G.C. action.
—On late production 470452 tuners set fine tuning control to 50% rotation (approximately at center) to expose tuning slugs.

STEP	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL SETTING	CONNECT SCOPE	ADJUST	REMARKS
1	300 ohm carbon resistor	Connect sweep generator to one side of antenna terminal. Low side to ground marker generator to other side of antenna terminal. Low side to chassis.	207 mc. 6 mc. sweep; marker generator 25.75 mc. unmod.	12	Vertical input to Point "E" in series with 33K ohm resistor	A-12	Turn fine tuning control to maximum counter clockwise (See Note 3) position so as to expose oscillator slugs. Adjust A-12 so as to place marker pip in correct position as per response curve shown in Fig. 5-7E, by oscilloscope observation.
2	"	"	"	12	"	A-14 A-15 A-16 R.F. trimmers	Adjust all trimmers for maximum amplitude and bandwidth on oscilloscope while maintaining best symmetry of overall response curve as per Fig. 5-7E.
3	"	"	216 mc. 6 mc. sweep; marker generator at 25.75 mc. unmod.	13	"	A-13	Adjust to place marker pip in correct position on response curve, as shown in Fig. 5-7E.
4	After adjustment of A-14, A-15, and A-16, the r.f. trimmers as per Step 2, no further adjustments are required for the r.f. section. Proceed as in Step No. 3 for each channel in sequence from 13 to 2 adjusting the oscillator slugs, A13-A2, for each channel.						

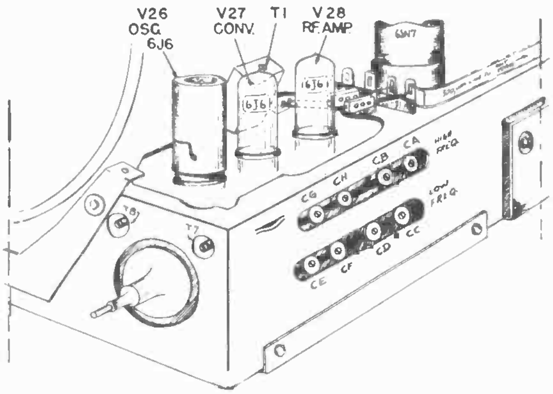


Fig. 5-8 Alignment Points—Tuners 470320, 470403

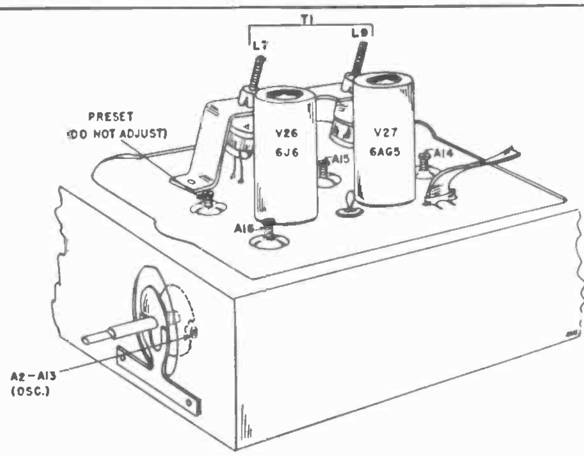


Fig. 5-9 Alignment Points—Tuner 470452

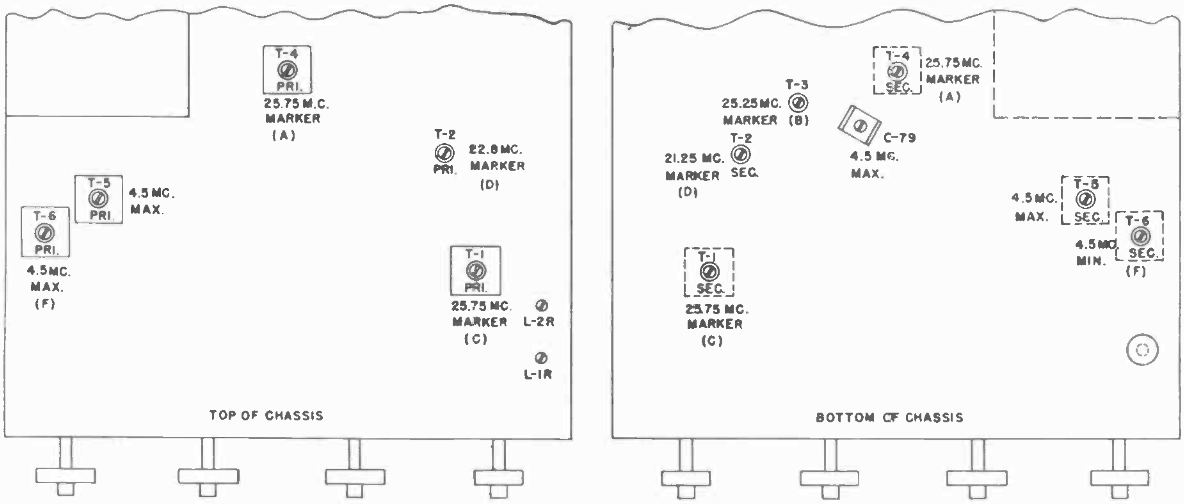


Fig. 5-10 Location of Alignment Points—Chassis 120086B, 120087B, D.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Emerson Radio

VOLTAGE AND RESISTANCE READINGS FOR CHASSIS 120087B, D.

1—DC Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1,000 ohms per volt.
2—Socket connections are shown as bottom views
3—Measured values are from socket pin to common negative, unless otherwise stated.
4—Line voltage maintained at 117 volts for voltage readings.
5—No signal applied for voltage measurements.
6—Minimum and maximum readings are given where two readings appear, depending on rear panel control settings.

a. VOLTAGE READINGS: (Table XIX).

ITEM	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	CAP
V1	6AG5	-.9	.6	0	6.3 AC	120	120	.6		
V2	6AG5	-.9	.4	0	6.3 AC	120	120	.4		
V3	6AU6	0	0	0	6.3 AC	160	160	1.65		
V4	6AL5	0	0	0	6.3 AC	165	0	0		
V5	6AU6	-1.2	.0	0	6.3 AC	114	126	0		
V6	*12AU7	205	-7.3	0	0	0	39	0	3.5	
V7	6BA6	0	0	0	6.3 AC	115	122	1.2		
V8	6AU6	-.37	0	0	6.3 AC	125	41	0		
V9	6S8-GT	-.36	0	-.36	-.8	-.15	68	6.3 AC	0	-1.0
V10	6V6	0	0	180	150	-7.7	-8.1	6.3 AC	0	
V11	6SN7GT	-100	125	-110	-120	-85	-120	6.3 AC	0	
V12	6AL5	-120	-120	0	6.3 AC	-105	-120	-124		
V13	6SN7GT	-180	145	-120	-180	-30	-120	6.3 AC	0	
V14	6SN7GT	-350	39	-200	-350	92	-200	6.3 AC	0	
V15	†12AU7	175	-23	0	0	0	54	0	0	
V16	6K6	0	0	53	53	-200	-175	6.3 AC	178	
V17	6BG6	0	0	-195	0	-210	0	6.3 AC	53	
V18	1B3-GT		DO	NOT		MEASURE				
V19	5V4	0	245	0	165	0	165	0	245	
V25	**10BP4	0	3.5	0	0	0	0	0	0	
V26	6J6	0	-.5	6.3 AC	0	†80	−80	0	With tuner	
V28	6AG5	80	100	6.3 AC	0	-1.7	-4.5	-1.7	No. 470452-S	

*PIN NO. 9—6.3 AC †PIN No. 9—6.3 AC **10BP4 (contd.) PIN No. 9—0, PIN No. 10—250, PIN No. 11—40, PIN No. 12—6.3AC.

b. RESISTANCE READINGS: (Table XX).

ITEM	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	CAP
V1	6AG5	3.2 Meg.	70	0	.1	1700	1700	70		
V2	6AG5	3.2 Meg.	33	0	.1	1700	1700	33		
V3	6AU6	2.5	0	0	.1	11500	11500	170		
V4	6AL5	1	2 Meg.	0	.1	100K	0	280		
V5	6AU6	1 Meg.	0	0	.1	2400	740	0		
V6	*12AU7	15K	1 Meg.	0	0	0	15K	0	500K	
V7	6BA6	3.7	0	0	.1	1800	1800	65		
V8	6AU6	100K	0	0	.1	1800	3500	0		
V9	6S8-GT	100K	0	100K	Inf.	200K	470K	.1	0	15 Meg.
V10	6V6	0	0	500	10K	470K	200	.1	0	
V11	6SN7GT	1 Meg.	6800	4000	Inf.	100K	4000	.1	0	
V12	6AL5	Inf.	Inf.	0	.1	140K	3000	140K		
V13	6SN7GT	100—200K	4500	2900	100—200K	470K	2900	.1	0	
V14	6SN7GT	1.5 2 Meg.	500K 2 Meg.	4K	1.5 2 Meg.	100K	4K	.1	0	
V15	†12AU7	11K	180K	0	0	0	13K	1 Meg.	0	—
V16	6K6	Inf.	0	15K	15K	4.7 Meg.	11K 17K	.1	4300 9300	
V17	6BG6	—	0	4500	—	470K	4400	—	11K	7500
V18	1B3-GT	—	—	—	—	—	—	—	—	7800
V19	5V4	—	7500	—	160	—	160	—	7500	
V25	**10BP4	0	700K	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.	
V26	6J6	6.6K	2600	.1	0	200K	10K	0	With Tuner	
V28	6AG5	3 Meg.	0	.1	0	38K	38K	0	No. 470452,-S	

*PIN No. 9—.1 †PIN No. 9—.1 ** 10BP4 (contd.) PIN No. 9—Inf. PIN No. 11—5K, 35K PIN No. 12—.1—

1—All resistances taken from pins to chassis with B+ shorted to ground at Pin No. 4 of Ballast Tube.
2—All resistance readings in ohms unless otherwise noted.

ADJUSTMENT OF DEFLECTION CIRCUITS. —

1—"Horizontal Drive":

Set control (R6) to counterclockwise position.

2—"Brightness Control":

Starting from a counterclockwise position, turn control (R2) until picture tube starts to brighten (appearance of the Raster).

3—"Contrast Control":

Turn control (R1A) closely (to avoid overload) until test pattern appears.

4—"Horizontal And Vertical Hold Controls":

Adjust horizontal (R3A) and vertical (R3B) hold controls for desired hold, keeping contrast control at minimum signal position. The horizontal control should then be turned rapidly to either side of hold position to ascertain positioning (near center). It should again be checked by slow rotation to determine control voltage capabilities (AFC). A 40° rotation to either side of hold position should be obtained. The vertical control should also hold near the central position.

5—"Focus Control":

Adjust control (R9) for best definition, making certain defocusing occurs to either side of optimum setting.

6—"Centering Control":

Adjust vertical (R4) and horizontal (R5) controls for best centering of test pattern.

7—"Horizontal Size Control":

Adjust control (L9) to obtain horizontal width one-half inch short of picture tube mask.

8—"Horizontal Drive":

Position control (R6) to obtain picture width to cover edge of mask.

9—"Horizontal Linearity":

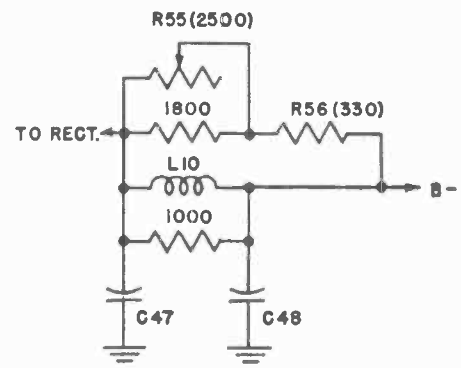
Adjust (L8) for best horizontal linearity of test pattern. This control will affect horizontal linearity at the left side of the test pattern.

10—"Vertical Linearity And Vertical Size:

Adjust (R7) for Vertical picture size and (R) for linearity. The linearity control will affect the top of the test pattern.

CHASSIS USING 12-INCH KINESCOPES —

Chassis 120091B and 120107B normally use type 12LP4 as the Kinescope. The schematic of these chassis, when using type 12QP4 tubes, is revised as shown in fig. 5-11. L-10 is the focus coil; R-55 is the focus control.



FOCUS COIL CONNECTIONS
TYPE 12QP4

Fig. 5-11 Use of Type 12QP4 Kinescope

PARTS LIST FOR CHASSIS 120087B, D (Models 606, 611, 612, 624, 638).—

P-2	505040	Connector plug speaker
	or 505048	Connector plug - speaker
P-3	505007	Plug - interlock switch
R-1 (3)	340492	1,000 ohm, ½W -10%
R-2	340492	1,000 ohm, carbon, ½W -10%
R-3 (3)	See Note	
R-4	340212	68 ohm, Carbon,½W -10%
R-5	340492	1,000 ohm, carbon, ½W -10%
R-6	340492	1,000 ohm, carbon, ½W -10%
R-7	340732	10,000 ohm, carbon, ½W -10%
R-8	340652	4,700 ohm, carbon, ½W -10%
R-9	340132	33 ohm, carbon, ½W -10%
R-10	340492	1,000 ohm, carbon, ½ W-10%
R-11	340492	1,000 ohm, carbon, ½W -10%
R-12	340632	3,900 ohm, carbon, ½W -10%
R-13	340292	150 ohm, carbon, ½W -10%
R-14	340492	1,000 ohm, carbon, ½W -10%
R-15	341292	2.2 megohm, carbon, ½W -10%
R-16	340972	100,000 ohm., carbon, ½W -10%
R-17	341212	1 megohm, carbon, ½W -10%
R-18	340732	10,000. ohm, carbon, ½W -10%
R-19	Pt. of R-46	10,000 ohm, cont. control front
R-20	341212	1 hegohm, carbon, ½W -10%
R-21	330532	1,500 ohm, carbon, ½W -5%
R-22	341212	1 megohm, carbon, ½W -10%
R-23	340812	22,000 ohm, carbon, ½W -10%
R-24	341132	470,000 ohm, carbon, ½W -10%
R-25	341052	220,000 ohm, carbon, ½W -10%
R-26	340632	3,800 ohm, carbon, ½W -10%
R-27	340612	3,300 ohm, carbon, ½W -10%
R-28	340892	47,000 ohm, carbon, ½W -10%
R-29	341212	1 mekohm, carbon, ½W -10%
R-30	341032	180,000 ohm, carbon, ½W -10%
R-31	340892	47,000 ohm, carbon, ½W -10%
R-32	370812	22,000 ohm, 1W -10%
R-33	370732	10,000 ohm, carbon, ½W -10%
R-34	340492	1,000 ohm, carbon, ½W -10%
R-35	340212	68 ohm, carbon, ½W -10%
R-36	340492	1,000 ohm, carbon, ½W -10%
R-37	340492	1,000 ohm, carbon, ½W -10%
R-38	340972	100,000 ohm, carbon, ½W -10%
R-39	340652	4,700 ohm, carbon, ½W -10%
R-40	397014	10,000 ohm, carbon, 2W -10%
R-41	340492	1,000 ohm, carbon, ½W -10%
R-42	330972	100,000 ohm, carbon, ½W -5%
R-43	340972	100,000 ohm, carbon, ½W -10%
R-44	340932	68,000 ohm, carbon, ½W -10%
R-45	351492	15 megohm, carbon, ½W -10%
R-46	390034	1 megohm, volume control and switch
R-47	341132	470,000 ohm, carbon, ½W -10%
R-48	341132	470,000 ohm, carbon, ½W -10%
R-49	340732	470,000 ohm, carbon, ½W -10%
R-50	PART	30 ohm, wirewound, 12W -10%
R-51	OF	30 ohm, wirewound, 20W -10%
R-52	BALLAST	75 ohm, wirewound, 5W -10%
R-53	TUBE	75 ohm, wirewound, 5W -10%
R-54	#397023	75 ohm, wirewound, 3W -10%
R-55	390037	1,500 ohm, W.W. focus cont. rear 4W
R-56	394035	330 ohm, wirewound, 3W -10%
R-57	394035	600 ohm, wirewound, 6W -10%
R-58	394043	1,550 ohm, wirewound 7W -10%
R-59	394043	3,100 ohm, wirewound, 7W -10%
R-60	370312	180 ohm, corbon, 1W -10%
R-61	340132	33 ohm, carbon, ½W -10%
R-62	340292	150 ohm, carbon, ½W -10%
R-63	341212	1 megohm, carbon, ½W -10%
R-64	330492	1,000 ohm, carbon, ½W -5%
R-65	330492	1,000 ohm, carbon, ½W -5%
R-66	330652	4,700 ohm, carbon, ½W -5%
R-67	330572	2,200 ohm, carbon, ½W -5%
R-68	397029	100,000 ohm, carbon, 2W -5%
R-69	340892	47,000 ohm, carbon, ½W -10%
R-70	341052	220,000 ohm, carbon, ½W 10%
R-71	341052	220,00 ohm, carbon, ½W -10%
R-72	330972	100,000 ohm, carbon, ½W -5%
R-73	330972	100,000 ohm, carbon, ½W -5%
R-74	370652	4,700 ohm, carbon, 1W -10%
R-75	390036	50,000ohm, horiz. hold control front
R-76	340892	47,000 ohm, carbon, ½W -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, ½W -5%
R-80	390035	20,000 ohm, horiz. drive control rear
R-81	340792	18,000 ohm, carbon, ½W -10%
R-82	341132	470,000 ohm, carbon, ½W -10%
R-83	370252	100 ohm, carbon, 1W -10%
R-84	397044	10,000 ohm, carbon, 4W -10%
R-85	397041	3.3 ohm w.w. or carbon, 1W -10%
R-86	394007	7,500 ohm, wirwound, 25W -5%
R-87	340652	4,700 ohm, carbon, ½W -10%
R-88	390032	100,000 ohm, brightness control front
R-89	371212	1 megohm, carbon, 1W -10%

Emerson Radio

PARTS LIST FOR CHASSIS 120087B, D (Models 606, 611, 612, 624, 638), (cont.)

ITEM	PART No.	DESCRIPTION
R-90	340812	22,000 ohm, carbon, ½W -10%
R-91	340812	22,000 ohm, carbon, ½W -10%
R-92	340652	4,700 ohm, carbon, ½W -10%
R-93	370972	100,000 ohm, carbon, 1W -10%
R-94	Pt. of R-75	1 megohm, vertical hold control
R-95	331252	1.5 megohm, carbon, ½W -5%
R-96	390038	2 megohm, vertical size cont. rear
R-97	341132	470,000 ohm, carbon, ½W -10%
R-98	340712	8,200 ohm, carbon, ½W -10%
R-99	341372	4.7 megohm, carbon, ½W -10%
R-100	390039	5,000 ohm, vert. linearity cont. rear
R-101	340352	270 ohm, carbon, ½W -10%
R-102	392043	10,000 ohm, carbon, 3W -10%
R-103	390054	30 ohm, horiz. cent. control rear
R-104	390033	30 ohm, vert. cent. control rear
R-105	340432	560 ohm, carbon, ½W -10%
R-106	340432	560 ohm, carbon, ½W -10%
R-108	340572	2,200 ohm, carbon, ½W -10%
R-109(3)	340932	68,000 ohm, carbon, ½W -10%
NOTE:		
R-3	340772	15,000 ohm, ½W -10% with 470320,403 tun.
R-3	340732	10,000 ohm, ½W -10% with 470233 tun.
R-3	340672	5,600 ohm, ½W -10% with 470452,55 tun.
SP-1	180041	Speaker 6"
SW-1	Pt. of R-46	On-off switch
T-1	720056	1st video I.F. transformer
T-2	720042	2nd video I.F. transformer
T-3	720073	3rd video I.F. transformer
T-4	720057	4th video I.F. transformer
T-5	720081	Sound I.F. transformer - 4.5 mc
T-6	708017	Discriminator coil - 4.5 mc
T-6	or 708018	Discriminator coil - 4.5 mc
T-7	734018	Sound output transformer
T-8	738008	Horiz. oscillator transformer
T-9	738000 or	Horiz. output transformer
	738009	Horiz. output transformer
	738015	Horiz. output trans. used with 120087D chassis for extended raster operation
T-10	738004	Vert. oscillator transformer
T-11	738010 or	Vert. output transformer
	738011	Vert. output transformer
T-12	730015	Power transformer
V-1	800535	Vacuum tube 6AG5
V-2	800535	Vacuum tube 6AG5
V-3	800533	Vacuum tube 6AU6
V-4	800541	Vacuum tube 6AL5
V-5	800533	Vacuum tube 66AU6
V-6	800026	Vacuum tube 12AU7
V-7	800531	Vacuum tube 6BA6
V-8	800533	Vacuum tube 6AU6
V-9	800015	Vacuum tube 6S8GT
V-10	800270	Vacuum tube 6V6GT
V-11	800380	Vacuum tube 6SN7GT
V-12	800541	Vacuum tube 6AL5
V-13	800380	Vacuum tube 6SN7GT
V-14	800380	Vacuum tube 6SN7GT
V-15	800026	Vacuum tube 12AU7
V-16	800016	Vacuum tube 6K6GT
V-18	800450	Vacuum tube 1B3-GT/8016
V-19	800011	Vacuum tube 5V4-G
V-25	810000	Television tube 10BP4
V-26	800536	Vacuum tube 6J6 } Used with tuners 470233 & 470403-320
V-27	800536	Vacuum tube 6J6 } Used with tuners 470233 & 470403-320
V-28	800536	Vacuum tube 6J6 } Used with tuners 470233 & 470403-320
V-27	800535	Vacuum tube 6AG5 -tuner - 470452,-S
V-29	817004	Selenium rectifier 250 ma
V-30	817004	Selenium rectifier 250 ma
V-31	817005	Selenium rectifier 200 ma
V-32	817005	Selenium rectifier 200 ma
X-1	470232	Socket — Cable assembly
X-2	508100	Socket — Speaker
X-3	470339	Socket — Shell holder assembly

ALTERNATE CONTRAST CONTROL PARTS

ITEM	PART No.	DESCRIPTION
C-13	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-80	923067	.1 mf, paper, 200V
C-84	910028	220 mmf, mica, -10%
C-85	910029	150 mmf, mica, -10%
C-86	923061	.01 mf, paper, 400V
L-1	708096	Peaking coil — 75 uh
R-13	340292	150 ohm, carbon, ½W -10%
R-15	341292	2 2 megohm, carbon, ½W -10%
R-17	341212	1 megohm, carbon, ½W -10%
R-111	340652	4,700 ohm, carbon, ½W -10%
*R-110	Pt. of R-46	1,000 ohm, cont. control front
R-20	341212	1 megohm, carbon, ½W -10%
R-109	340932	68,000 ohm, carbon, ½W -10%
T-4	720057	4th video I.F. transformer
*R-46	390068	1 megohm, volume control and switch
C-1	928006	1500 mmf., ceramic, 400V
C-2	928006	1500 mmf., ceramic, 400V
C-3	922101	.05 mf., paper molded, 400V
C-4	928006	1500 mmf., ceramic, 400V
C-6	928006	1500 mmf., ceramic, 400V

ITEM	PART No.	DESCRIPTION
C-7	928109	1500 mf., circ ceramic, 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	923062	.05 mf., paper, 400V
C-20	923064	.1 mf., paper, 400V
C-21	925114	8 mf., electrolytic, 350V
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, -120%
C-28	928006	1500 mmf., ceramic, 400V
C-29	928006	1500 mmf., ceramic, 400V
C-30	910010	110 mmf., mica, -20%
C-31	923079	.001 mf., paper, 600V
C-32	923078	.005 mf., paper, 400V
C-33 (3)	923061	.01 mf., paper, 400V
C-34 (3)	923061	.01 mf., paper, 400V
C-35	923062	.05 mf., paper, 400V
C-36	925111	8 mf., electrolytic, 250V
C-37	923078	.005 mf., paper, 400V
C-38	922101	.05 mf., paper molded, 400V
C-39	925099	80 mf., electrolytic, 150V
C-40	925128	80 mf., electrolytic, 150V
C-41	925129	80 mf., electrolytic, 300V
C-42	925129	80 mf., electrolytic, 300V
C-43	925131	80 mf., electrolytic, 300V
C-44	925131	80 mf., electrolytic, 300V
C-45	925134	60 mf., electrolytic, 300V
C-46	925132	80 mf., electrolytic, 300V
C-47	925133	80 mf., electrolytic, 300V
C-48	925133	80 mf., electrolytic, 300V
C-49	925114	8 mf., Electrolytic, 350V
C-50	910027	.001 mf., mica, 500V
C-51	923068	.05 mf., paper, 200V
C-52	923080	.25 mf., paper, 200V
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., electrolytic, 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	923067	.01 mf., paper, 200V
C-62	923073	.05 mf., paper, 600V
C-63	923003	.0005 mf., titanium oxide, 10K V
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 -10%, 600V
C-72	923073	.05 mf., paper, 600V
C-73	923073	.05 mf., paper, 600V
C-74	925072	10 mf., electrolytic, 50V
C-75	925111	8 mf., electrolytic, 250V
C-76	925097	1000 mf., electrolytic, 15V
C-77	925097	1000 mf., electrolytic, 15V
C-78	910090	50 mmf., mica, 500V
C-79	900044	3-35 mmf., trimmer
C-80	923067	.1 mf., paper, 200V
C-81	923062	.05 mf., paper, 400V
C-83	Pt. of T2	75 mmf., ceramic, 300V
F-1	808050	Fuse, ¼A, 250V, 3AG
I-1	708084	Ion trap - P.M.
	or 708075	
L-1	708096	Peaking coil - 75 uh
L-2	708097	Peaking coil - 45 uh — -10%
L-3	708095	Peaking coil - 180 uh
L-4	708095	Peaking coil - 180 uh
L-5	705009	R.F. choke - 3.0 mh — -10%
L-6	708082	Size coil
L-7	708003	Linearity coil
L-8	708130	Deflection yoke - vert. coils
L-9	708130	Deflection yoke - horiz. coils
L-10	708141	Focus coil
L-11	705014	R.F. choke - 20 uh
	140205	Cabinet for Model 606
	140264	Cabinet for Model 611 blonde
	140234	Cabinet for Model 606 mahogany
	140240A	Cabinet for Model 612
	635010	Safety glass for Model 606
	635011	Safety glass for Model 611
	635018	Safety glass for Model 612
	560059	Cabinet back for Model 606
	560071	Cabinet back for Model 611
	560072	Cabinet back for Model 612
	583014	Line cord and plug for all 3 models
	410352	Tube front mask for Model 606
	410660	Tube front mask for Model 611
	410670	Tube front mask for Model 612
	140281	Cabinet for Model 624 mahogany
	560083	Cabinet back for Model 624

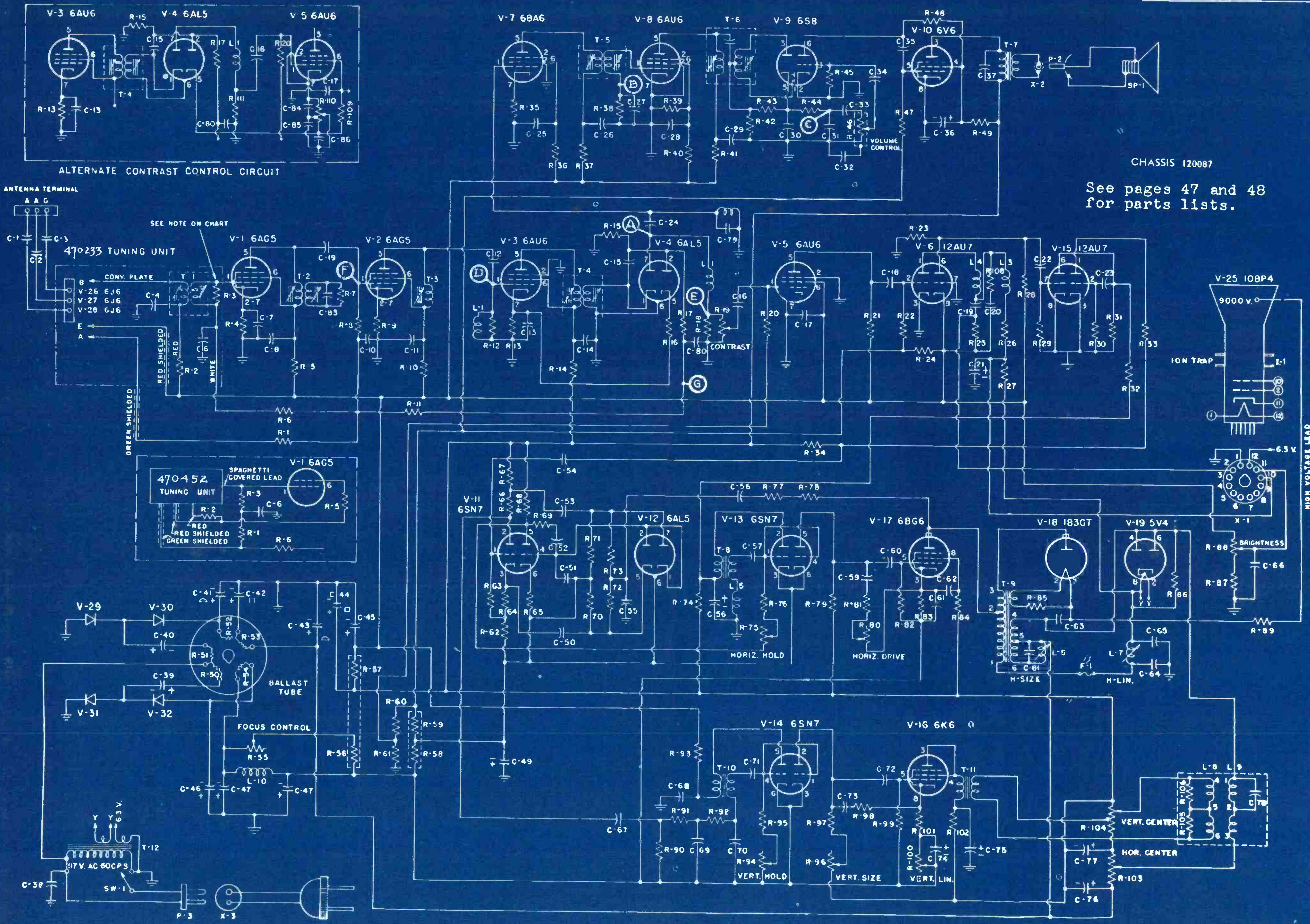


Fig. 5-16 Schematic Diagram—Chassis 120087D

GAROD ELECTRONICS CORP. Series 94 Television Receivers

Models 1142, 1143, 1344, 1345, 1646, 1647, 1648, 1649, D-1092, and 94GCB3023-C. (Circuit on page 52).

R.F. and Oscillator Alignment Procedure

R. F. ALIGNMENT

1. Connect TV Sweep Generator to Antenna Terminals.
2. Connect R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope through a 10,000 ohm ½w. resistor to Test Point (A) fig. 3.
4. Short A.G.C. Bus to ground on TV chassis (across C58 5000 MMF Discap condenser).
5. Set Station Selector switch to Channel 12.
6. Feed 207 mc at 10 mc sweep from Sweep Generator, and 205.25 mc & 209.75 mc fixed frequencies from R.F. Marker Generator.
7. Observe response curve on Scope. If necessary adjust C2, C3, or C4 (See fig. 3) so that response curve corresponds approximately to that shown in fig. 2, and has maximum gain.
8. Check markers on response curve of all remaining channels, setting Sweep and Marker Generators at corresponding frequencies for each channel. See Table II for convenient tabulation of proper frequencies. If the R.F. Markers do not fall in automatically in their proper places on all channels, a comprise must be made by slight readjustment of C2, C3, or C4.

OSCILLATOR ALIGNMENT

1. Connect TV Sweep Generator to Antenna Terminals.
2. Couple R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope across the video amplifier grid and ground (pin 4 of 6AC7, V11).
4. Couple 24.75 mc video I.F. Marker Generator loosely to first I.F. grid (pin 1 of 6AU6, V7).
5. Rotate Fine Tuning control to center of range.
6. Set Station Selector switch to Channel 12.
7. Set Sweep Generator to 207 mc at 10 mc sweep and Marker Generator to 205.25 mc (video carrier).
8. Observe response curve and adjust C5, (figs. 3 & 4) for Z ro-beat with 24.75 mc marker. *NOTE: Quality of response curve does not affect accuracy of oscillator alignment, so long as a zero-beat is obtained.*
9. Check for zero-beat on all channels in this manner, setting the Station Selector, Sweep Generator and Marker Generator at corresponding frequencies. (See Table II). It is not usually necessary to make any further adjustments. However, if the individual oscillator coils must be touched-up, the following procedure should be employed:
   a) Rotate Fine Tuning control to center of range.
   b) Set Station Selector to desired channel, Sweep Generator to its center frequency with 10 mc sweep, and Marker Generator to the corresponding video carrier frequency (See Table II).
   c) Place a non-metallic screwdriver through the opening marked 'Recessed Individual Osc. Adjustment', fig. 4, and adjust oscillator coil for zero-beat with 24.75 mc marker on response curve.
   d) This adjustment can be repeated on any single channel, or, if necessary, on all channels.
   e) If difficulty is encountered in tuning any particular channel well within limits of Fine Tuning control after these adjustments are made, readjust C5 slightly (as in Step 8) shifting the whole range of frequencies in the desired direction.

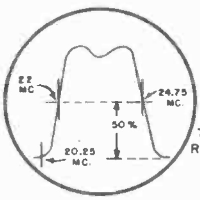


FIG. 1 TV I.F. RESPONSE

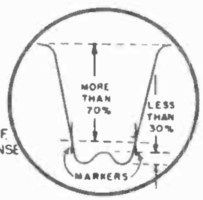


FIG. 2 TV R.F. RESPONSE

RECOMMENDED RESPONSE CURVES

R.F. TEST POINT (A)

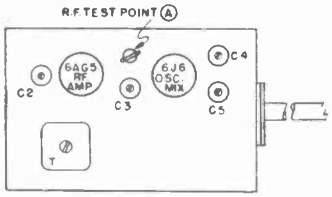
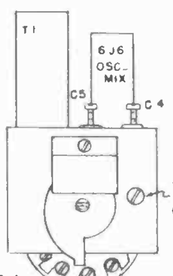


FIG. 3 — TOP VIEW



RECESSED INDIVIDUAL OSC. ADJ.

FIG. 4 FRONT VIEW

R.F. TUNER ADJUSTMENT POINTS

TABLE II - ALIGNMENT FREQUENCIES

CHANNEL NUMBER	SWEEP GEN. CENTER FREQ. (10 MC. SWEEP)	MARKER GENERATOR FREQUENCIES	
		VIDEO CARRIER	SOUND CARRIER
2	57 MC.	55.25 MC.	59.75 MC.
3	63 MC.	61.25 MC.	65.75 MC.
4	69 MC.	67.25 MC.	71.75 MC.
5	79 MC.	77.25 MC.	81.75 MC.
6	85 MC.	83.25 MC.	87.75 MC.
7	177 MC.	175.25 MC.	179.75 MC.
8	183 MC.	181.25 MC.	185.75 MC.
9	189 MC.	187.25 MC.	191.75 MC.
10	195 MC.	193.25 MC.	197.75 MC.
11	201 MC.	199.25 MC.	203.75 MC.
12	207 MC.	205.25 MC.	209.75 MC.
13	213 MC.	211.25 MC.	215.75 MC.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

GAROD ELECTRONICS CORP. Series 94, Alignment, continued,

CIRCUIT ALIGNED	STEP	SIGNAL GENERATOR CONNECTIONS	FREQ.	CONNECT D.C. V.T.V.M	ADJUST	REMARKS
	1	TUNE RECEIVER TO QUIET PORTION OF TV HIGH BAND SET CONTRAST CONTROL AT MINIMUM				
T V I. F.	2	THRU 1500 MMF. COND TO CONV. GRID & GROUND. POINT (A) IN FIG. 3	24.0 MC	ACROSS VIDEO DIODE LOAD - HIGH SIDE TO JUNCTION OF L5, L6 & R104, - LOW SIDE TO GROUND.	T 4	ADJUST FOR MAXIMUM DEFLECTION ON V.T.V.M.
	3	"	22.0 MC.	" " "	T 3	" " "
	4	"	24.3 MC.	" " "	T 2	" " "
	5	"	22.9 MC	" " "	T 1	* " " " VISUAL CHECK-UP DESIRABLE FOR TOUCH-UP OF BANDPASS CIRCUIT. SEE FIG. I FOR RESPONSE
SOUND TAKE-OFF	6	THRU 1500 MMFD. COND. ACROSS DIODE LOAD - HIGH SIDE TO JUNCTION OF L5, L6 & R104 - LOW SIDE TO GROUND	4.5 MC.	NEGATIVE LEAD TO JUNCTION OF R22 & R23 (LOCATED AT 6T8 RATIO DET.) POSITIVE LEAD TO EITHER SIDE OF C41 4 MF. CONDENSER.	T5 TOP & BOTTOM, T6 BOT. FOR TYPE "A" TRANS., OR T6 TOP FOR TYPE "B" TRANS. (SEE DIAG.)	ADJUST FOR MAXIMUM DEFLECTION ON V.T.V.M. SEE NOTE BELOW
RATIO DETECTOR	7	"	4.5 MC.	NEGATIVE LEAD TO JUNCTION OF R22 & R23 (LOCATED AT 6T8 RATIO DET.) POSITIVE LEAD TO JUNCTION OF C43, C45 & R24 (OUTPUT OF DEEMPHASIS NETWORK)	T6 TOP FOR TYPE "A" TRANS. OR T6 BOT. FOR TYPE "B" TRANS. (SEE DIAGRAM.)	ADJUST FOR ZERO OUTPUT ON V.T.V.M. BETWEEN A PLUS AND A MINUS PEAK. SEE NOTE BELOW

*For visual check-up of I.F. alignment, connect TV sweep generator across signal generator output. Set sweep generator to 10 MC. sweep from 20 MC. to 30MC. Replace V.T.V.M. with vertical input of oscilloscope. Use signal generator as marker.

NOTE: The Ratio Detector Transformer, T6, is one of three types, depending upon the period of production. In earlier sets, transformer types "A" and "B" are used, having the primary slug (the adjustment for maximum voltmeter deflection) on bottom, and the secondary slug (the adjustment for zero output between plus and minus peaks) on top. In later production receivers, a transformer of type "C" is used, having the position of the slugs reversed, the primary being on top and secondary on bottom. Type "A" can height is 1-5/16", type "B" height is 2½", and both types have straight lugs. Type "C" can is 3" high, and it has wire loops.

AFC and Picture Size Control Adjustments (Refer to 'CAUTION' Label For Location)

AFC: Set the Horizontal Hold control on the front midway, tune in a station, then adjust the AFC Coil at the rear of the chassis until the picture is 'locked in' on the screen.

If at a later time, the horizontal size controls are changed, it may be necessary to repeat the above.

HORIZONTAL: The Horizontal Size or width adjustment should be attempted only when it is possible to receive a test pattern.

Adjust the width control until the pattern fills the screen or extends just to the mask.

Correct for linearity using the Horizontal Linearity control until the center of pattern is in the center and both sides of the picture are the same width.

After this adjustment it may be necessary to readjust the size control because of some inter-locking action.

The process may be repeated several times until correct width with linearity is obtained.

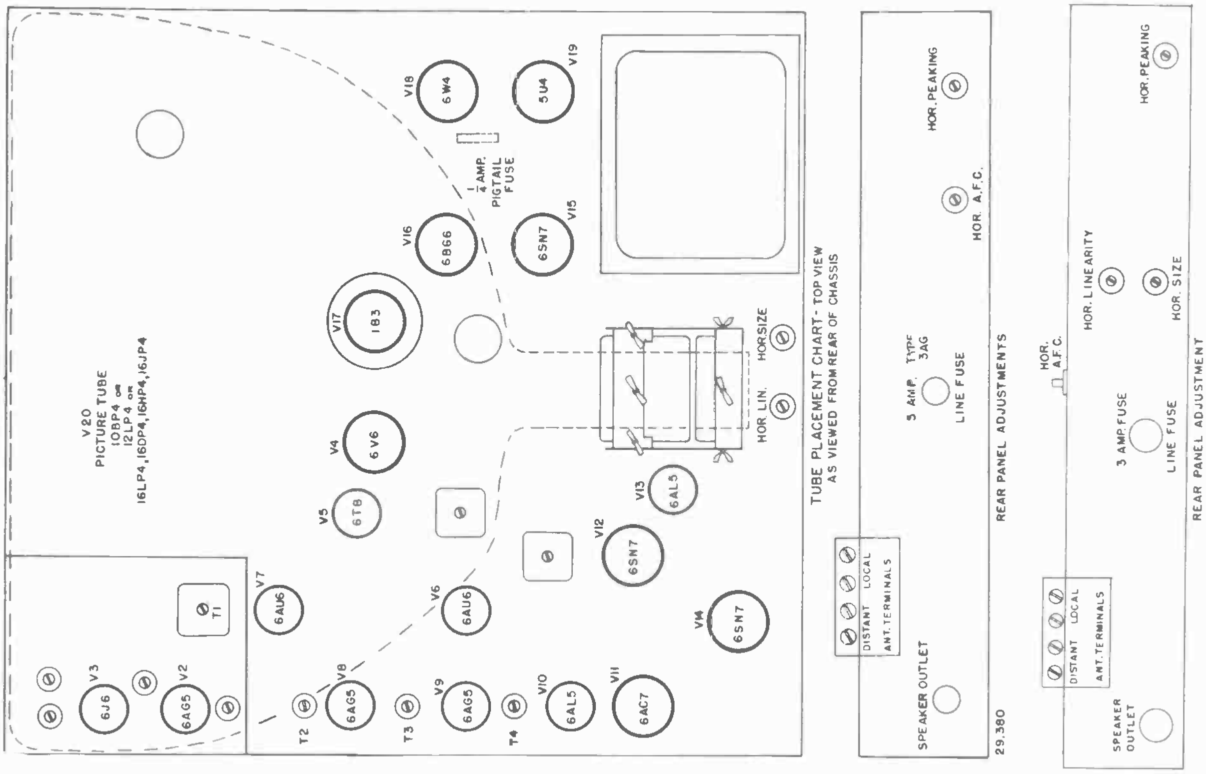
The Horizontal Peaking trimmer may be adjusted in conjunction with the above adjustments (adjust approximately midway).

VERTICAL SIZE: Vertical size or height may be adjusted by the use of the Vertical Size control on the front.

After the vertical size has been adjusted the linearity may be corrected by use of the Vertical Linearity control. It will then be necessary to readjust the height, etc., until a correct balance between the height and linearity adjustments is found.

It may be found that the vertical synchronization will 'fall out' during the above adjustment. This will require an occasional adjustment of the Vertical Hold control on the front during this process.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

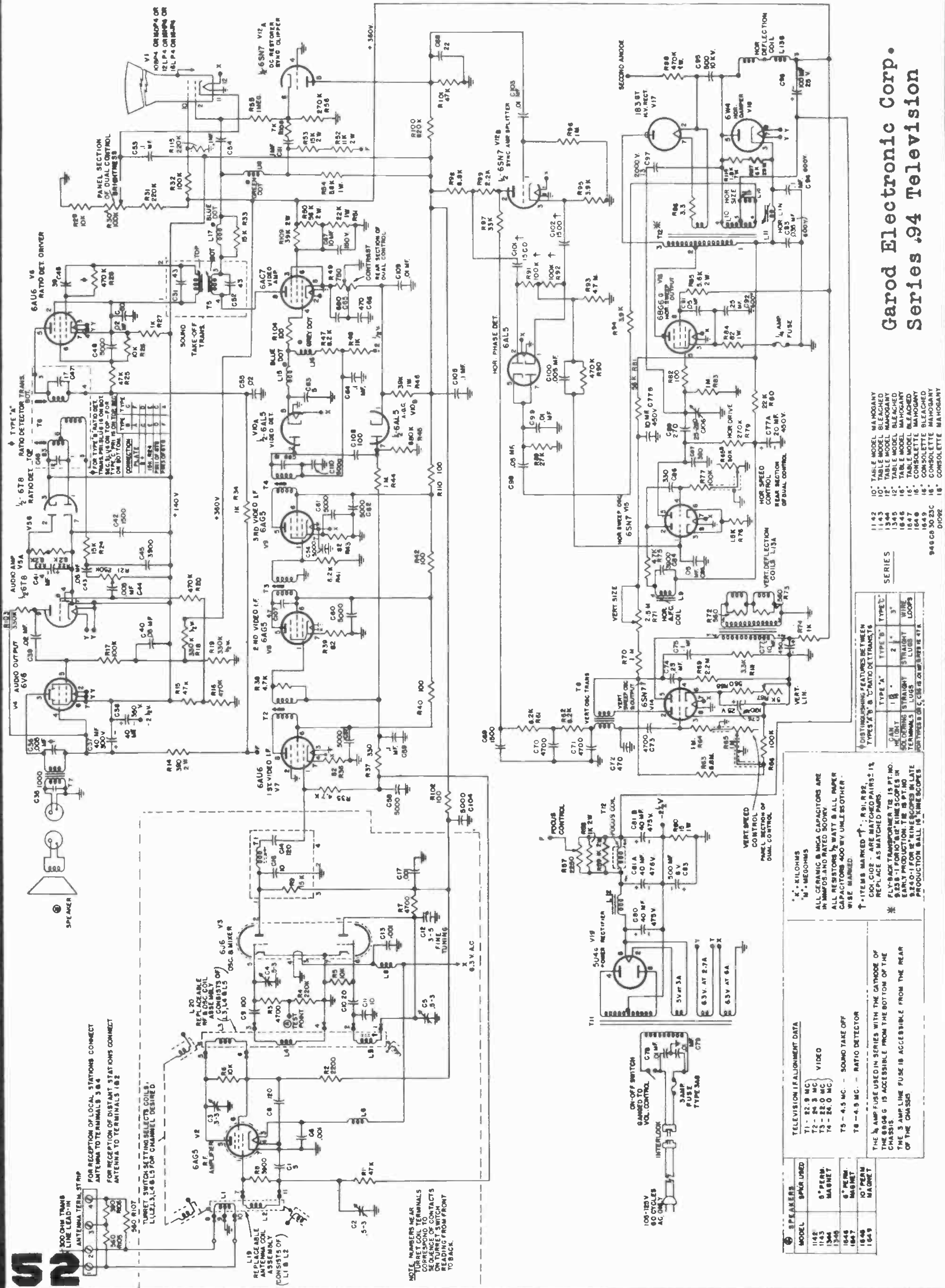


TUBE COMPLEMENT AND VOLTAGE READINGS

ITEM NO	FUNCTION	TUBE TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1	PICTURE TUBE	SEE DIAGRAM	0	2	PIN 10 — 245 V;		PIN 11 — 16 V;		PIN 12 — 6.3 AC		
V2	1 ST. R.F. AMPLIFIER	6AG5	-0.7	0	6.3AC	0	118	118	0	—	—
V3	OSCILLATOR-CONVERTER	6J6	105	77	6.3AC	0	↑ -3 TO -4.5	↑ -4 TO -9	0	—	—
V4	AUDIO OUTPUT	* 6V6	N.C.	6.3AC	160	180	-7.0	180	0	0	—
V5	RATIO DET. - AUDIO AMP.	* 6T8	-0.3	-0.5	-0.3	6.3AC	0	0	0	-1	75
V6	RATIO DETECTOR DRIVER	* 6AU6	3	4	130	130	72	35	4	—	—
V7	1 ST. VIDEO I.F.	6AU6	-0.8	0	0	6.3 AC	130	130	0.6	—	—
V8	2 ND VIDEO I.F.	6AG5	-0.8	0.8	0	6.3AC	130	130	0.8	—	—
V9	3 RD VIDEO I.F.	6AG5	0	1.2	0	6.3AC	130	130	1.2	—	—
V10	VIDEO DET. — A.G.C.	6AL5	2	-3	0	6.3AC	-3	0	-0.5	—	—
V11	VIDEO AMPLIFIER	6AC7	0	0	0.9	-3	0.9	170	6.3AC	170	—
V12	DC REST.—CLIP—SEP.—AMP.	6SN7	0	120	5	0	7	2	6.3AC	0	—
V13	HOR. PHASE DETECTOR	6AL5	2	-1.2	0	6.3 AC	0	0	0	—	—
V14	VERT. SWEEP OSCILLATOR-OUTPUT	6SN7	-35	125	0	0	340	15	6.3AC	0	—
V15	HOR. SWEEP OSCILLATOR	6SN7	0.4	250	10	-7	110	10	6.3AC	0	—
V16	HOR. SWEEP OUTPUT	6BG6G	-7.5	0	0.5	N.C.	-7.5	N.C.	6.3AC	260	—
V17	HIGH VOLTAGE RECTIFIER	♦ 1B3	—	Φ 10 KV. 8.5 KV.	—	—	—	Φ 10 KV. 8.5 KV.	Φ 10 KV. 8.5 KV.	—	—
V18	HORIZONTAL DAMPER	6W4	0.6	130	420	N.C.	350	N.C.	130	130	—
V19	POWER RECTIFIER	5U4G	N.C.	400	N.C.	385AC	N.C.	385AC	N.C.	400	—

NOTES

1 – D.C. VOLTAGES MEASURED WITH V.T.V.M., UNLESS OTHERWISE STATED.
2 – VALUES SHOWN ARE D.C. VOLTAGES, MEASURED FROM SOCKET PIN TO GROUND, UNLESS OTHERWISE STATED.
3 – LINE VOLTAGE MAINTAINED AT 117 V. A.C.
4 – ALL FRONT PANEL CONTROLS SET AT MAXIMUM CLOCKWISE POSITION.
5 – NO SIGNAL APPLIED; TUNE RECEIVER TO UNUSED CHANNEL.
* – MEASURED TO LOW B+ BUS, MARKED "+140 V" ON DIAGRAM.
♦ – USE HIGH VOLTAGE INSULATED PROBE AND 20,000 OHM/VOLT METER.
Φ – 10KV FOR FLY-BACK TRANS. MARKED PART NO. 9.240-1
8.5 KV FOR FLY-BACK TRANS. MARKED PART NO. 9.236-1
↑ – VARIES WITH CHANNEL SETTING.


Garod Electronic Corp.
Series 94 Television

GENERAL ELECTRIC

TELEVISION RECEIVER

MODEL 830

Material presented on pages 53 to 60 inclusive deals specifically with General Electric Television Receiver Model 830, and this material is reproduced through the courtesy of General Electric Co. However, servicemen will find that these service notes will apply, but with a few exceptions, to the television portion of the General Electric Model 820 combination. Of major difference is the switching arrangement of Model 820 to switch over to Radio and Phonograph use, and a different type audio output tube and type of circuit. The Model 840 combination is also very similar, in its television section, to Model 830 which is described in these pages. General Electric Model 835 is a straight television set and is also very similar to Model 830. However, Model 835 uses a 10FP4 (10-inch) picture tube.

TELEVISION ALIGNMENT

GENERAL—A complete alignment of the receiver tuned circuits consists of the following individual alignment procedures. These are listed below in the correct sequence of alignment. However, any one section alignment may be performed without the necessity of realignment of any one of the other sectional alignments.

1. Sound I-F Alignment.
2. Video I-F Alignment.
3. R-F Alignment.
4. Oscillator Adjustments.

TEST EQUIPMENT—To provide alignment as outlined above, the following test equipment is required:

1. R-F Sweep Generator.

(a) Frequency Requirements.
- 20 to 30 mc with 10 mc sweep width.
- 40 to 90 mc with 15 mc sweep width.
- 170 to 220 mc with 25 mc sweep width.

(b) Constant output over sweep width range.

(c) At least 0.1 volt output.

2. Signal Generator—Must have good frequency stability and be accurately calibrated. It should be capable of tone modulation over the following frequency ranges:
- 21.8 mc for sound i-f.
- 22.9 mc for video i-f marker.
- 23.4 mc for video i-f marker.
- 25.55 mc for video i-f marker.
- 26.3 mc for video i-f marker.

54–88 mc and 174–216 mc for oscillator adjustment and markers for the r-f channel bandwidth measurements.

3. Oscilloscope—This oscilloscope should preferably have a 5-inch screen and have good wide-band frequency response on the vertical deflection. Although the high frequency response is unnecessary for alignment, it will be useful when making the waveform measurements.

4. Crystal Calibrator—This unit is essential to establish calibration check points for the signal generator so as to provide good accuracy of calibration.

5. Wave Traps—Accurately calibrated wave traps may be used to supply markers in place of the signal generator for video i-f and r-f alignment purposes.

ALIGNMENT SUGGESTIONS—All alignment adjustments in the sound and video i-f amplifier are available from the top of the chassis with the exception of the 1st sound i-f secondary, discriminator secondary, and the last video i-f primary. The location of the adjustments is shown in Figure 37 and 38. Remove the chassis from the cabinet. *The deflection yoke and focus coil assembly must be connected to the circuit to obtain proper B+ voltages during alignment.* When it is necessary to make adjustment from the bottom of the chassis, the chassis may be rested on its side so that the power transformer is down. The following suggestions apply to each individual alignment procedure.

(1) SOUND I-F ALIGNMENT—The sweep generator is connected through a 500 mmf capacitor to the grid of the tube preceding the sound i-f coil to be aligned. Connect the oscilloscope through a 100,000-ohm resistor across the resistor, R104, in the limiter tube V18 grid. Insert a 21.8 mc marker signal from an unmodulated signal generator into the grid of V3. Keep the marker signal attenuated so that it just shows a marker on the sweep curve. Adjust L21 and T21, respectively, as you advance progressively one stage at a time, for maximum gain and symmetry of the response curve about the 21.8 mc marker. The curve should be similar to that shown in Figure 12-A. With input at the first audio i-f, V22, the bandwidth should be approximately 300 kc at the 70% response point.

Excessive sweep generator input will cause the sound i-f amplifier to overload and the response curve to broaden, resulting in slight misadjustment of the tuned circuits. During each alignment, keep the signal input to each stage limited at a value which develops not more than a ¾ volt peak at the limiter grid (junction of R104 and C100), as measured by a calibrated oscilloscope.

SOUND I-F ALIGNMENT CHART

STEP NO.	SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR FREQUENCY	SIGNAL INPUT	CONNECT OSCILLOSCOPE TO CHASSIS AND JUNCTION OF	CHANNEL SWITCH	ADJUST	REMARKS
1	21.8 MC marker	21.8 MC with 1 MC sweep	Grid (Pin 1) of V17 through 500 mmf			L21 for max. amplitude and symmetry about marker.	See Fig. 12(A) for resultant curve.
2	21.8 MC marker	21.8 MC with 1 MC sweep	Grid (Pin 1) of V22 through 500 mmf	Junction R104 and C100 through 100K-ohm resistor.	Channel No. 4	T21 pri. and sec. for max. amp. and symmetry about marker.	
3	21.8 MC with modulation	Not used	Grid (Pin 1) of V22 through 500 mmf			T19 secondary slug for min. amplitude.	Min. output can also be checked with vol. control advanced, and listening for speaker output.
4	Not used	21.8 MC with 1 MC sweep	Grid (Pin 1) of V22 through 500 mmf			T19 primary slug for max. peak-to-peak amplitude and symmetry of peaks about base line.	See Fig. 12(B) for resultant curve.
5	Recheck Steps 3 and 4.						

General Electric Model 830, cont.

For discriminator alignment, apply the signal generator output to the grid of V22 and connect the oscilloscope to the junction of C74 and R86. The secondary core of the discriminator transformer, T19, is aligned by using an amplitude-modulated signal. The adjustment is made for minimum output, as indicated visually at the oscilloscope or by merely listening for the tone modulation at the speaker. The discriminator primary slug is adjusted for a maximum peak-to-peak amplitude response curve of the sweep signal input, as shown in Figure 12-B.

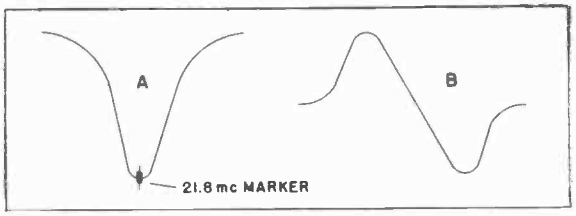


Fig. 12. Audio I-F Curves

2. *Video I-F Alignment*—The video i-f amplifier uses transformers which are coupled and loaded to give the proper band-pass characteristics.

IMPORTANT—On early production receivers, the contrast control should be set at −4 volts bias measured at the junction of R6, R8, and C14 with a vacuum tube voltmeter. For i-f alignment of receivers incorporating Automatic Gain Control, marked "R," or "T" it is necessary to apply a −4 volts battery bias to the 1st and 2nd video i-f tubes at the junction of R6 and R11. If a battery is not available, C42 may be shunted with a .1 mfd capacitor and the contrast control adjusted to produce the required −4 volts as measured with a vacuum tube voltmeter at the junction of R6 and R11.

Stage-by-stage alignment should be performed so as to duplicate as closely as possible the curves as shown in Figure 13A, B, C, and D. The markers supplied by an accurately calibrated signal generator are used to establish the correct bandwidth and frequency limits.

Connect the sweep generator to the tube grid preceding the transformer to be aligned and the oscilloscope to the junction of L16 and C27 in series with a 10,000 ohm resistor. Set the channel selector switch to channel #4. Adjust the sweep width for a minimum of 10 mc about the center frequency of the video response curve. The sweep output cable should be shielded and preferably terminated in its characteristic impedance and then connected with as short a lead as possible through a 500 mmf capacitor; the ground lead of the cable should be short and grounded to the chassis as near as possible to where the signal is applied. Sufficient marker signal may be supplied in most cases, except at the last stage, by merely connecting the high side of the signal generator to the television chassis. At the last stage, couple the marker generator through a small capacitor approximately 50 to 100 mmf in parallel with the sweep input; keep the input low enough so that it doesn't influence the shape of the response curve.

The primary of the transformer preceding the grid where the signal is applied will act as a tuned trap, placing a dip in the alignment curve as viewed on the scope, unless it is detuned sufficiently to throw it out of the video i-f pass-band. To detune this transformer merely remove the tube which feeds the primary windings, as indicated in Steps 6, 7 and 8. ***Be sure to replace the tube after the stage is aligned.*** Another method of detuning is to slip an iron core slug in the primary side of the i-f transformer. The audio take-off trap trimmer C17 should be aligned for minimum 21.8 mc audio i-f frequency in the video i-f amplifier, as in step 8 of video i-f alignment.

When making the video i-f alignment, the 26.3 mc marker should be at 50% or slightly lower than 50% for maximum picture detail. The 26.3 mc marker should never be more than 50% of the distance from the base line to the flat portion of the curve. Prior to the alignment of transformer T11 in step (10), turn the carrier set trimmer, C12, to its minimum capacity.

The response curves shown in Figure 13 are obtained on an oscilloscope connected at the junction of L16 and C27. Use a 10,000 ohm resistor in series with the input lead to the oscilloscope for isolation purposes. Set the Channel Selector switch to receive channel #4.

If the response is peaked on low frequency end of response curve and cannot be brought down to the proper relationship

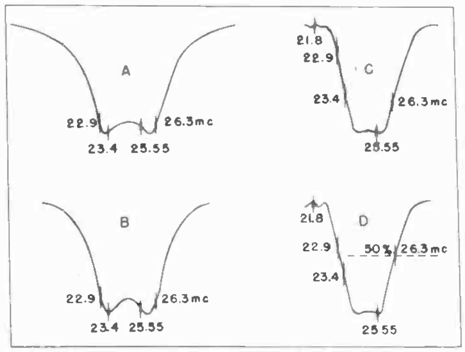


Fig. 13. Video I-F Curves

VIDEO I-F ALIGNMENT

STEP NO.	SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR FREQUENCY	SIGNAL INPUT	CONNECT OSCILLOSCOPE TO CHASSIS AND JUNCTION OF	CHANNEL SWITCH	ADJUST	REMARKS
6	22.9 MC 26.3 MC	20-30 MC	Grid (Pin 1) of V5 through 500 mmf			Adjust primary and secondary slugs of T14 for max. amplitude and flat response with markers as shown in Fig. 13(A).	Contrast control set at −4 volts bias. Steps 6 through 11. Bias measured with VTVM at junction of R6, C14, and R8. Remove tube V4. For "R" and "T" chassis, see text note "Important."
7	22.9 MC 25.55 MC 26.3 MC	20-30 MC	Grid (Pin 1) of V4 through 500 mmf			Adjust slug of T13 for max. amplitude and flat response with markers as shown in Fig. 13(B).	Remove tube V3 and replace V4.
8	21.8 MC with 400 cycle modulation		Grid (Pin 1) of V3 through 500 mmf	Junction L16 and C27 through 10K-ohm resistor.	Channel #4	Adjust C17 for min. 400 cycles amplitude.	Replace V3 and remove V2.
9	22.9 MC 23.4 MC 25.55 MC 26.3 MC	20-30 MC	Grid (Pin 1) of V3 through 500 mmf			Adjust slug of T12 for max. amplitude and flat response with markers as shown in Fig. 13(C).	
10	22.9 MC 23.4 MC 25.55 MC 26.3 MC	20-30 MC	Grid (Pin 7) of V2 through MC mmf			Adjust slug of T11 for max. amplitude and flat response with markers as shown in Fig. 13(C).	Turn carrier set trimmer C12 to min. capacity. Replace tube V2.
11	22.9 MC 23.4 MC 25.55 MC 26.3 MC	20-30 MC	Grid (Pin 7) of V2 through 500 mmf			Adjust C12 until 26.3 MC marker is at a point 50% along i-f slope. 25.55 and 22.9 MC should be as shown in Fig. 13(D).	

with high frequency end by means of the tuning slug, change the 6AU6 tube into which the signal is fed. It may be that the 6AU6 has an above average plate capacity which would cause this trouble.

3. R-F Alignment—The r-f coil and switch assembly is designed for stable band-pass operation and under normal conditions will seldom require adjustment. In cases where it is definitely known that alignment is necessary (such as when the present coil is damaged and has been changed), do not attempt the adjustment unless suitable equipment is available.

The minimum requirements for correct r-f alignment are (1) to provide the correct bandwidth, (2) for the response curve to be centered within the limit frequencies shown for each of the individual channels as in Figure 16, and (3) for the response curve to be adjusted for maximum amplitude consistent with correct bandwidth. To provide these minimum requirements, the r-f coils are overcoupled and loaded with resistance. Tuning of the coils is affected by changing inductance of the individual coils. Except for the Channels #2 and #3 coils, the coupling is fixed by the design of the coil and switch wafers.

The physical assembly of the coils in the band switch locates the r-f amplifier plate coil at the rear of the switch assembly, while the oscillator coil is switched by the front wafer. Three different types of coils are used. These are shown in Figure 14. On all channels except Channels #7 through #13, the r-f, converter, and oscillator coils are wound on a single coil form. Mutual inductance between turns of the converter and r-f coils provides the desired coupling. On Channel #2, the converter and r-f coils are spaced for loose coupling and the mutual is increased by inserting a tertiary link winding between the coils. By adjusting the link, the mutual can be changed and better image rejection of the FM band (88 to 108 mc) signals results. Tuning of the link circuit is accomplished by adjusting two movable copper rings. The Channel #3 plate and grid coils are overcoupled by spacing of the two coils in relationship to each other and are tuned by spacing of the component turns. The Channels #4 through #6 transformers are wound so that the converter and r-f coils are wound as a continuous winding, the a-c ground return for the two coils being a tapped turn on this winding. This tight spacing affords a good uniformity in mutual coupling. The tuning is accomplished by moving turns. The upper six channels, #7 through #13, are tuned by four sets of coils. Each converter and r-f coil is overcoupled to give adequate bandpass so that two channels may be covered by each set of coils except Channel #7. Instead of magnetically coupling the r-f and converter coils in relation to each other, they are physically located on the channel switch so that the only coupling is afforded by the common a-c ground return of each coil. This ground return is made through a special shaped metal wafer on the channel switch.

The input sweep signal is applied to the antenna terminal board at the r-f unit. Disconnect the 300-ohm cable between the antenna terminal board and the r-f amplifier input. To prevent distortion of the r-f response curve by standing waves, the unbalanced shielded cable of the signal generator should be termi-

General Electric Model 830, cont.

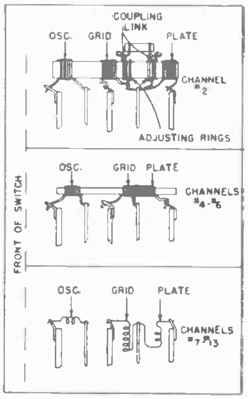


Fig. 14. R-F Coil Assembly

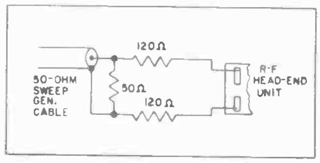


Fig. 15. Sweep Generator Termination

nated as shown in Figure 15. The resistors used should be non-inductive. The marker signal generator may be loosely coupled through a small capacitor to the same point of input as the sweep generator.

The output r-f response curve is taken off at the junction of R5 and C10 through a 10,000 ohm resistor. Disconnect C10. The Contrast control is set for a minimum at all r-f alignments.

For Channels #2 and #3, the r-f coils should be aligned to give approximately the curve shown in Figure 16-A and 16-B. The "P" marker represents the video carrier marker, while the "S" marker is the sound marker. The frequency of these markers is indicated for each step of the alignment procedure. Adjustment of the bandwidth is made by moving the plate coil closer to the grid coil or vice-versa. On Channel #2 the sliding of the copper rings will give both the required bandwidth and the frequency adjustment. Spread or squeeze turns in plate and grid coils to change frequency. Spreading turns results in a raising of the frequency; while squeezing turns lowers the frequency.

For Channels #4 through #6, the coupling is fixed by the tight coupling between the primary and secondary turns. However, this can be controlled to a certain degree along with the frequency by either spreading or squeezing the end turns of the combination converter and r-f coil. On the upper four coil assemblies covering the Channels #7 through #13, the coupling cannot be changed as it is fixed by the common ground wafer located between the r-f and converter coil switching wafer. This ground wafer is cut to give the proper amount of coupling at the time of manufacture. Tuning of these upper frequency coils is affected by the brass adjustment screws which form a shorted turn in the coil. The further the screw is introduced into the coil field, the higher will be the frequency and vice-versa.

R-F ALIGNMENT CHART

STEP NO.	SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR FREQUENCY	SIGNAL INPUT	CONNECT OSCILLOSCOPE TO CHASSIS AND JUNCTION OF	CHANNEL SWITCH	ADJUST	REMARKS
12	83.25 MC and 87.75 MC	85.5 MC with 15 MC sweep			Channel #6	C5 and C6 for max. amplitude and flat response with correct markers.	
13	77.25 MC and 81.75 MC	79.5 MC with 15 MC sweep			Channel #5		
14	67.25 MC and 71.75 MC	69.5 MC with 15 MC sweep	Primary of antenna input transformer T1	Junction R5 and C10 through 10K-ohm resistor. Disconnect C10.	Channel #4	Check and adjust inductance if necessary for max. amplitude and flat response with correct markers.	See Fig. 16(B) for resultant alignment curve.
15	61.25 MC and 67.75 MC	63.5 MC with 15 MC sweep			Channel #3		
16	55.25 MC and 59.75 MC	57.5 MC with 15 MC sweep			Channel #2		Adjust inductance by moving copper rings. See Fig. 16(A) for resultant alignment curve.
17	175.25 MC and 179.75 MC	177.5 MC with 15 MC sweep			Channel #7		Adjust inductance by brass screws in coils. See Fig. 16(B) for resultant curve.

General Electric Model 830, cont.

R-F ALIGNMENT CHART (Continued)

STEP NO.	SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR FREQUENCY	SIGNAL INPUT	CONNECT OSCILLOSCOPE TO CHASSIS AND JUNCTION OF	CHANNEL SWITCH	ADJUST	REMARKS
18	181.25 MC and 191.75 MC	186.5 MC with 25 MC sweep			Channels #8–#9		
19	193.25 MC and 203.75 MC	198.5 MC with 25 MC sweep	Primary of antenna input transformer T1	R5 and C10 through 10K-ohm resistor. Disconnect C10.	Channels #10–#11	Check and adjust inductance if necessary for max. amplitude and flat response with correct markers.	Adjust inductance by brass screws in coils. See Fig. 16(C) for resultant curve.
20	205.25 MC and 215.75 MC	210.5 MC with 25 MC sweep			Channels #12–#13		

OSCILLATOR ALIGNMENT CHART

STEP NO.	SIGNAL GENERATOR FREQUENCY	SIGNAL INPUT	CHANNEL SWITCH	ADJUST	REMARKS
21	59.75 MC with tone modulation		Channel #2	Squeeze or spread turns of osc. coil of T2.	
22	65.75 MC with tone modulation		Channel #3	Squeeze or spread turns of osc. coil of T3.	
23	71.75 MC with tone modulation		Channel #4	Squeeze or spread turns of osc. coil of T4.	
24	81.75 MC with tone modulation	Antenna dipole terminals	Channel #5	Squeeze or spread turns of osc. coil of T5.	Volume control at mid-position. Set Tuning control at mid-position of travel. Use sound output as indicator.
25	87.75 MC with tone modulation		Channel #6	Squeeze or spread turns of osc. coil of T6.	
26	179.75 MC with tone modulation		Channel #7	Squeeze or spread turns of osc. coil of L10.	
27	188.75 MC with tone modulation		Channels #8–#9	Squeeze or spread turns of osc. coil of L11.	
28	200.75 MC with tone modulation		Channels #10–#11	Squeeze or spread turns of osc. coil of L12.	
29	212.75 MC with tone modulation		Channels #12–13#	Squeeze or spread turns of osc. coil of L13.	

The variable capacitors C5 and C6 are used to compensate for the slight difference in tube capacities which affect tuning when it is necessary to change the r-f or converter tube in the field. These trimmers are adjusted for Channel #6, as indicated in the Alignment Table, and then are not readjusted until a new tube is substituted for either V1 or V2.

Note: When making r-f alignment, the tuning control should be set so that the oscillator frequency is approximately correct. This may be checked by tuning in the sound frequency for that particular channel for maximum audio output. A 200 to 300 ohm resistor should be shunted across the primary of T11 or R103. This is done to prevent the oscillator voltage from upsetting the r-f alignment curve.

4. *Oscillator Adjustments*—The oscillator coils for Channels #2 through #7 are adjusted so that the Tuning control, C80, will tune the station at the mid-rotation position for each of these channels. Since the other remaining six channels, #8 through #13, are combined so as to be covered by only three switching positions, the oscillator coils are adjusted so that the Tuning control will tune in the two channels assigned each switch position at two points equidistant from the two extremes of its rotation. With the Tuning control set to its mid-position, the oscillator coil is adjusted to give a maximum output when a modulated r-f signal at the test frequency specified is fed into the antenna terminals. The oscillator coils are adjusted by spreading turns to raise frequency or compressing turns to lower frequency.

Apply the signal generator with tone modulation to the antenna input terminals and set the generator to the frequency specified in the Alignment Table for each switch position. The signal generator must be very accurately calibrated. This can be done by beating its output against a known channel carrier, or use a station operating on the channel and then tune in the sound.

For output indication, advance the volume control about to mid-position so that the tone modulation or audio modulation on the station may be heard through the loudspeaker.

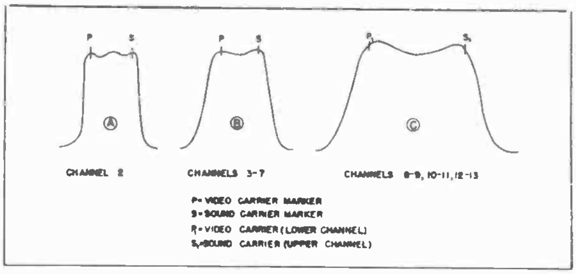


Fig. 16. R-F Alignment Curves

General Electric Model 830, cont.

TROUBLE SHOOTING

The following is a listing of possible troubles and their cures. This is not intended as a comprehensive coverage but will merely serve as a guide in locating some of the more difficult problems.

SYMPTOM	CHECK	REMARKS
1. No raster on picture.	a. Waveform at output of T17. b. V14, 1B3GT rectifier tube. c. Filter circuit of V14. d. V8 picture tube. e. For open circuit in second of T17 and R62. f. V13, 6B6-G tube and sawtooth generator V12B, 6SN7GT by oscilloscope waveform measurement. g. Contact of high voltage anode capacitor to terminal of V8, picture tube. h. Brightness control, R5, for open circuit, or R32 or R43. i. V7-B, 12AU7 tube. j. For continuity of deflection yoke or shorted turns. k. For continuity of Horizontal Size control in T17 circuit.	b. If filament glows orange high voltage is being generated. See step (d). f. If there is no waveform at T17. j. In case of anode voltage very low.
2. Raster normal. No picture or sound.	a. V2-A, 12AT7 oscillator tube. b. Oscillator coil resonates outside of channel. c. Antenna or lead-in. d. V2-B, 12AT7 converter tube or V1, 6AU6 r-f amplifier tube, or V3 6AU6 first video amplifier tube.	c. With contrast full-up if antenna system is working satisfactorily; noise pattern should be seen on screen and heard in speaker.
3. Picture normal. No sound.	a. Audio i-f amplifier. b. Speaker. c. V2-A, 12AT7 oscillator tube.	c. Oscillator off-frequency.
4. Raster normal. Sound normal. No picture.	a. 2nd, 3rd video i-f amplifier. b. V7, 12AU7 tube. c. Grid lead to picture tube.	
5. Normal picture and sound. No horizontal or vertical sync.	a. Signal waveform at grid (4) of V11A, 6SN7GT and grid (1) of V11B. b. V7A, 12AU7 plate circuit components.	
6. Picture normal. No vertical sync.	a. Grid (1) of V9, 6SN7GT. b. Frequency of vertical sweep generator (V9). c. Components of V9 circuit.	b. Free-running frequency slightly less than 60 cps.
7. Picture normal. No horizontal sync.	a. Grid (4) of V12A, 6SN7GT for horizontal sync. b. V12A—6SN7GT tube and its circuit components. c. V12B—6SN7GT tube and circuit components.	a. Disconnect leads from R54 and C57 to examine this.
8. Raster edge not straight, keystoning.	a. Deflecting yoke.	
9. Picture jumpy.	a. Contrast control. b. For gassy or noisy V13, 6BG6G. c. Noisy tubes of sweep or sync circuits. d. Excess noise over antenna system.	a. Probably too high setting.
10. Poor picture detail.	a. For mismatch maintenance and lead-in system. b. For misalignment of i-f and r-f circuits. c. For defective video chokes. d. Focus control. e. For overloading video amplifier. f. Contrast control.	d. Should go through focus.
11. Hum modulation.	a. Filter capacitor, C102. b. Rectifier, SR1.	
12. Audio motor boating.	a. V20 plate lead (blue wire).	a. Dress as far away as possible from V19B tube circuit components.
13. Audible click when tuning.	a. C115, V18 B + r-f by-pass (C113 was not used in some early production).	a. Connect a 5000 mmf ceramic capacitor from junction R81 and R82 to ground.
14. Low sensitivity "R" receivers.	a. R8 (R8 was 1000 ohms in early "R" chassis receivers)	a. If R8 is 1000 ohms, replace with 100 ohms.
15. Buzz modulation.	a. Excessive signal to converter grid. b. Sound i-f alignment of T21.	a. Reduce signal by antenna pad. b. Realign i-f circuit.

General Electric Model 830, cont.

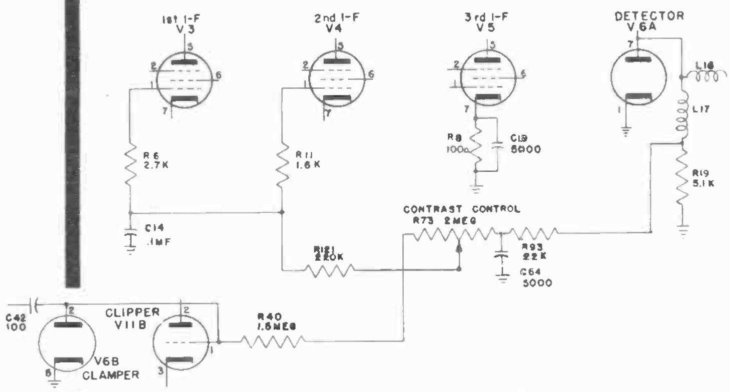
PRODUCTION CHANGES

The following production changes have taken place up to the time that this service data was compiled.

AUTOMATIC GAIN CONTROL (AGC)

This circuit is used to make for greater ease in operation, as it eliminates to a large extent the necessity of changing the Contrast control each time that a stronger or weaker station is selected. It always produces a picture even in the extreme minimum setting and does not tend to overload on strong signals when in the maximum contrast position.

Chassis using AGC will be identified by the letter "R" stamped in ink, located on the chassis front apron and adjacent to the Contrast-Brightness control shaft.



AGC Diagram (R-Chassis)

HORIZONTAL SWEEP OUTPUT CIRCUIT

The use of a new and improved sweep output transformer and associated circuit was introduced after the "R" chassis production change. All parts with the value indicated in Figure 35 are common to the "T" chassis only.

This new transformer is an open coil type assembly with a ceramic iron core, in contrast to the earlier type molded coil assembly with laminated core used in the early and "R" production chassis. The high voltage tertiary winding is placed over the primary and secondary so that its distance to the core is increased, thus minimizing the probability of insulation breakdown and corona effect. The special core, composed of iron oxides suspended in a ceramic material, is more efficient in reduction of power losses than the more conventional solid metallic transformer cores used in earlier sweep output circuits. In addition, the core itself is an insulator.

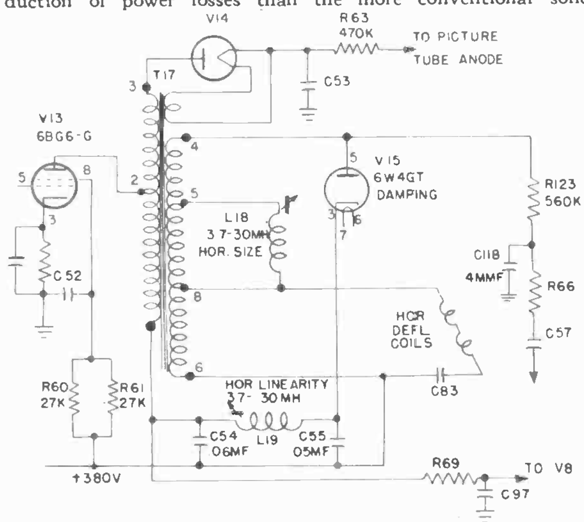


Fig. 35. Horizontal Sweep Output ("T" production)

ADDITION OF C117, R123, AND C118—The addition of these components were added in the greater part of "T" chassis production to improve horizontal sweep output phasing.

The components R123 and C118 are connected in the sweep output circuit at the damper tube, V15, plate as shown in the schematic of Figure 35.

The capacitor C117 is connected across the cathode resistor R109 of the Phase Inverter Tube, V11A.

PICTURE TUBE BRIGHTNESS—R53, part of the picture tube brightness control circuit in "T" chassis receivers, was changed during this production to fix the minimum bias on the picture tube. This resistor, shown in Figure 36 connected from the Brightness Control to ground, was changed to 220,000 ohms. This change prevents: blooming of the picture (excess brightness), and change in picture size, as the Brightness control is advanced to maximum at the clockwise position.

REMOVAL OF RETRACE LINES (R118, R119, C85 AND C110)—The components R118, R119, C85 and C110 were added during "T" chassis production and are connected as shown in Figure 36, Brightness Control Circuit for "T" Receivers. The addition of these components results in a relatively high positive voltage supplied to the picture tube cathode from the vertical sweep output circuit during vertical retrace. The picture tube is biased to cut-off, resulting in most of the retrace lines being eliminated from the screen. This is an operating advantage since it eliminates the need for readjustment of the Brightness or Contrast Control, to remove retrace lines which oftentimes accompany a change in cameras or program material that takes place at the transmitter.

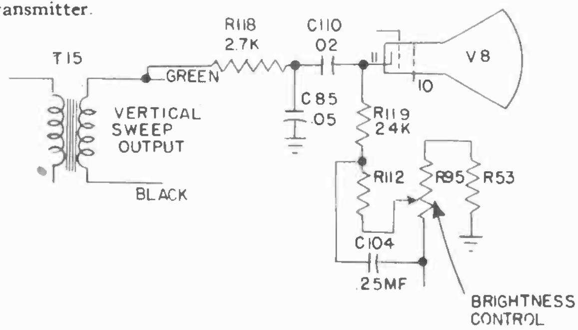


Fig. 36. Brightness Control and Vertical Retrace Blanking ("T" production)

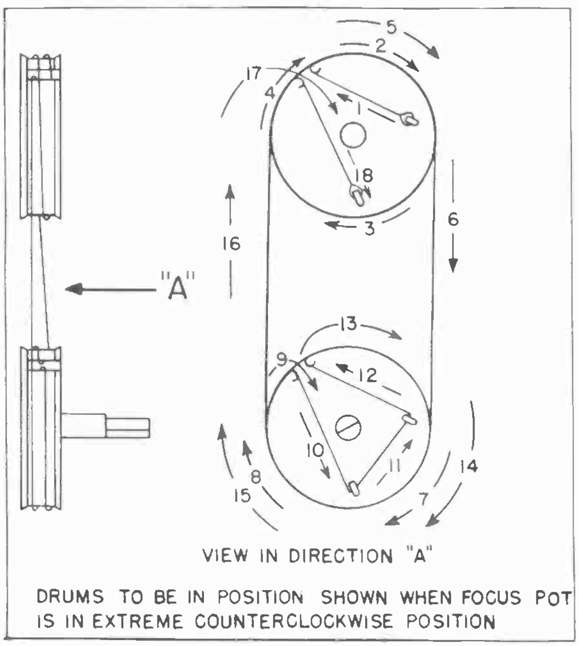


Fig. 33. Focus Control Stringing

General Electric

Model 830, cont.

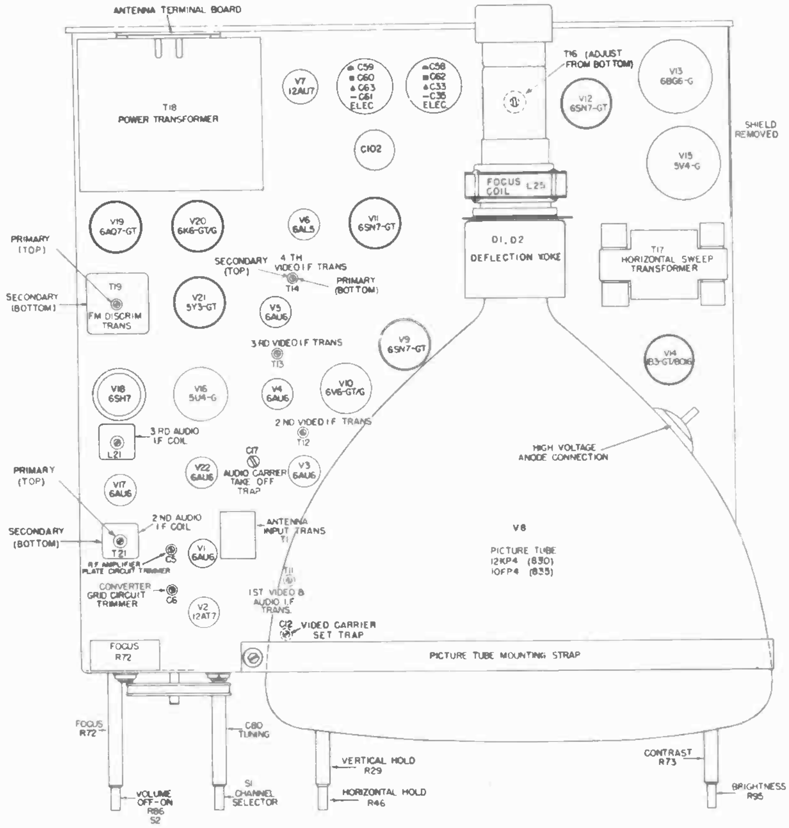


Fig. 37. Component and Trimmer Location (Top View)

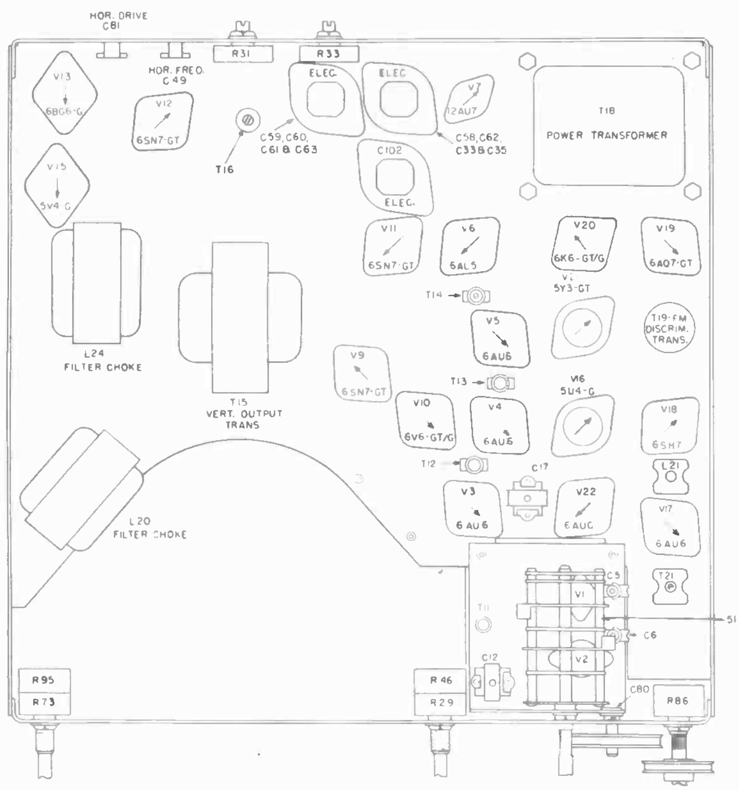


Fig. 38. Component and Trimmer Location (Bottom View)

CRITICAL LEAD DRESS AND COMPONENT REPLACEMENT

Since the operating frequencies are relatively high in a television receiver, it is essential that all components be replaced in exactly the same position they occupied when they left the factory, all leads be made as short as possible and exact replacement parts be used when service is required. Leads in wiring between components are usually critical as to placement against chassis or proximity to other components. Some of critical wiring precautions are listed below:

1. *Discriminator (T19) Leads*—Dress primary and secondary leads of the discriminator transformer close to chassis.

2. *Head-end Unit*—All leads which run between head-end unit coil assembly and front apron of chassis should be dressed as far as possible from the oscillator coils.

3. *Plate Lead of 6K6*—The plate lead (blue) of 6K6 should be dressed as far away from the 6AQ7GT 1st audio circuit as possible.

4. *Electrolytic C102*—When replacing this V2 filament rectifier electrolytic capacitor, C102, connect the ground lug of the capacitor as directly to chassis ground as possible.

5. *Picture Tube Anode Lead*—Lead must clear aquadag coating of picture tube and all objects for isolation to prevent corona, causing eventual breakdown in lead. Orient tube position to allow lead to be dressed away from all component parts.

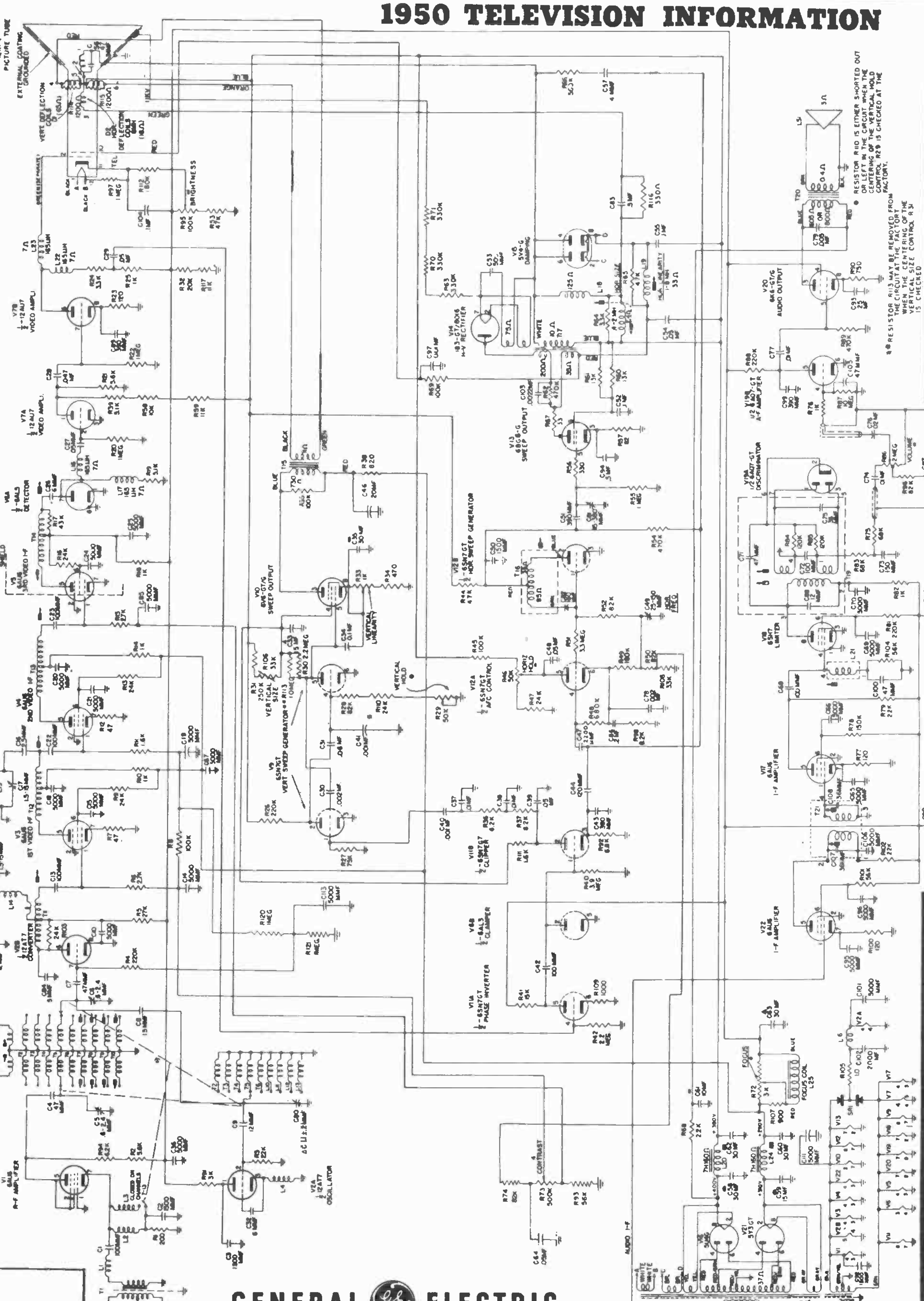


Fig. 40. Schematic Diagram, Early Production Receivers

GENERAL ELECTRIC

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MODELS 600, 601 & 602

RUN NO. 2
SEE CHASSIS
STAMP

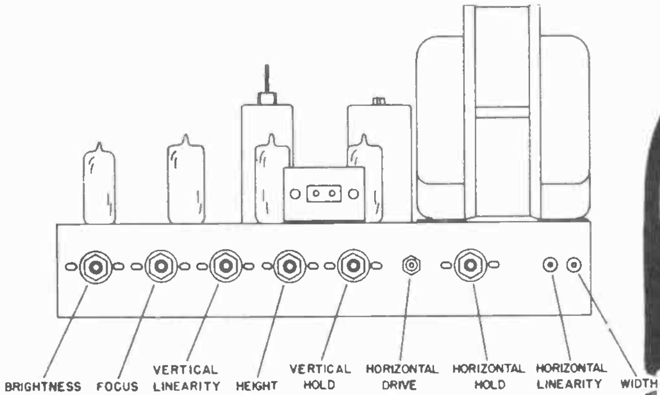
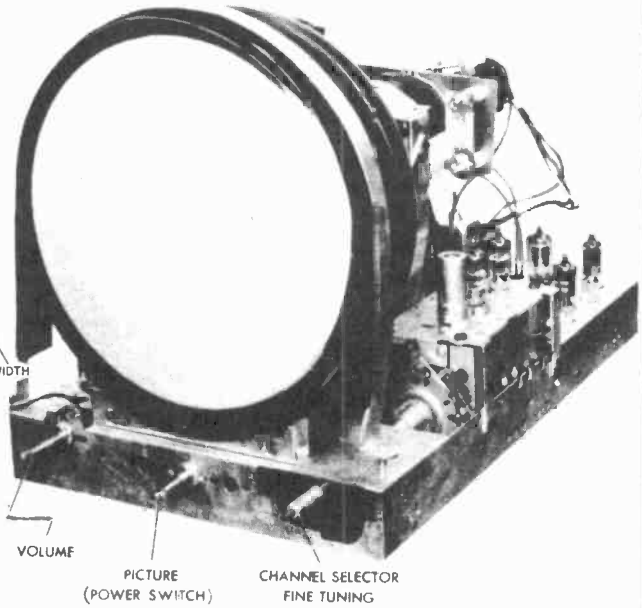


Fig. 2. Rear chassis view, location of "non-operating" controls.



NON-OPERATING CONTROL ADJUSTMENTS

The "non-operating" or screw-driver adjustments normally will require an occasional minor adjustment if any circuit work or tube changing is required. A test pattern, generated either locally in the shop or obtained from a television station is recommended for best results. Normal picture contrast and brightness should be maintained during the following adjustments for best results.

Intermediate Frequency
Picture carrier . . . . 26.25 mc
Sound carrier . . . . 21.75 mc
Intercarrier sound system 4.5 mc

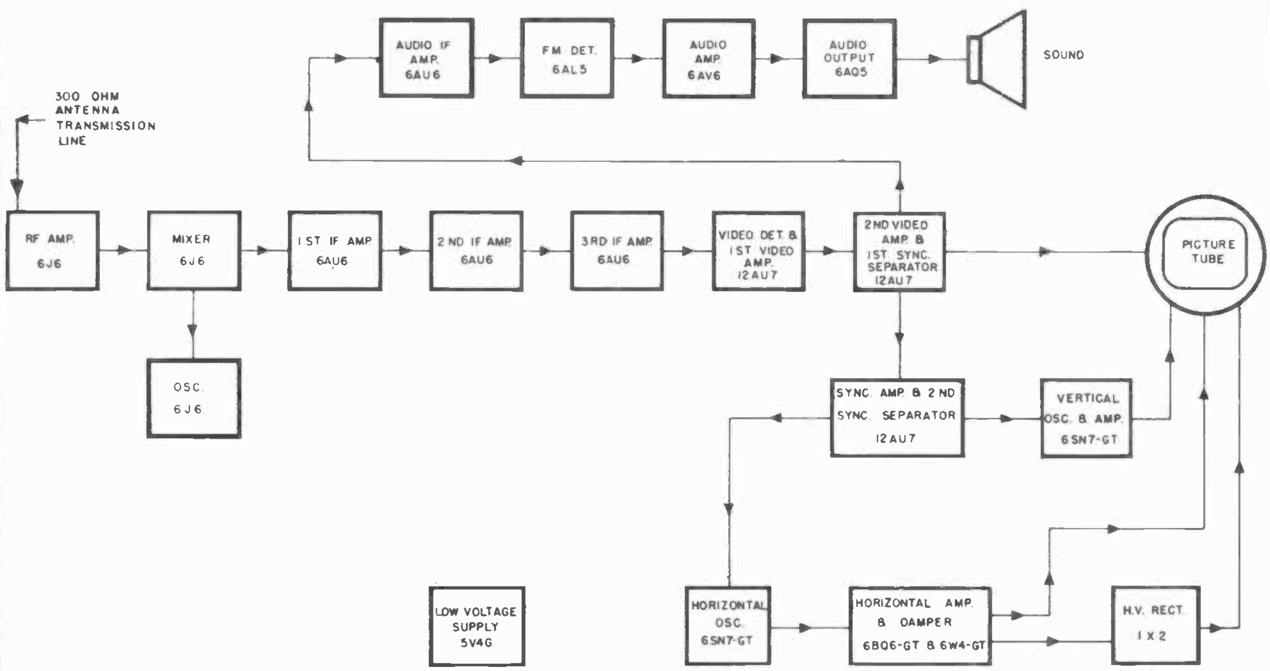


Fig. 1. Functional block diagram.

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HORIZONTAL HOLD, VERTICAL HOLD, BRIGHTNESS AND FOCUS ADJUSTMENTS

1. Set the HORIZONTAL and VERTICAL HOLD controls for a steady test pattern. Should the HORIZONTAL HOLD control fail to hold the test pattern in the normal manner, set the HORIZONTAL HOLD control in the center of its range and adjust the HORIZONTAL OSC. ADJ. screw for horizontal sync. (See Fig. 11 for location). Note that if horizontal sync. cannot be obtained by adjusting the top slug, turn the top screw apprcx. two turns down from its top limit and adjust the bottom slug (accessible from the under side of the chassis) for sync.

2. Set the PICTURE control at minimum (counter-clockwise) and advance the BRIGHTNESS control (clockwise) to the point where the retrace lines (widely spaced white lines) on the raster begin to show, then back off the adjustment slightly to eliminate the lines. Reset the PICTURE control for the desired picture brilliance and adjust the FOCUS control for best picture detail. Watch vertical wedges of test pattern for best definition.

MEASUREMENT OF H.V. POTENTIAL ON KINESCOPE ANODE

The second anode potential will be approx. 9,000 V. (10BP4) or 11,000 V. (12JP4), on a receiver that is functioning properly. Since the high potential for the kinescope anode is obtained from the horizontal output transformer, the "non-operating" control adjustments outlined above must be made or be known to be in proper adjustment before the H.V. measurement will have any meaning. Improper operation of the horizontal sweep circuit or circuit faults in the high voltage filter will generally account for an abnormal anode potential. If the anode potential is low, check the HORIZONTAL DRIVE adjustment outlined above.

CAUTION HIGH VOLTAGE

Do not use hand held flexible test leads when making the following measurement. Keep the hands clear of the circuit during measurement. A 9 to 11 KV. potential exists in this circuit. Exercise all normal high voltage precautions.

1. Connect a 50-megohm resistor string in series with a 300 microampere meter. Connect the free meter terminal to the chassis and the high side of the resistor string to the anode cap of the kinescope. The connection to the anode cap may be made with a fine wire slipped under the connector. Make up the resistor string with 5-megohm one or two watt resistors to provide a safety factor for voltage breakdown. If 5-megohm resistors are used, a total of ten will be required to obtain the 50 megohms. Make the setup self-supporting and allow adequate clearance between the resistor string and chassis parts to prevent high voltage breakdown.

2. Turn on the receiver and set the BRIGHTNESS and PICTURE controls at minimum. The microammeter will read approx. 180 microamperes for 9,000 V. or 220 microamperes for 11,000 V. at the kinescope anode. The anode potential is measured in this manner (PICTURE and BRIGHTNESS control at minimum; meter current approx. 200 microamperes) to simulate the kinescope load on the high voltage power supply.

ALIGNMENT PROCEDURE

Note - The following alignment adjustments do not require the use of the kinescope tube. It is recommended that the tube be removed if extensive alignment adjustments are to be made.

CAUTION - Removal of the kinescope tube exposes the HIGH VOLTAGE anode connector contact. Keep this lead and contact clear of personnel servicing equipment and grounded objects on the service bench. Exercise all normal high voltage precautions while working with the exposed units.

EQUIPMENT REQUIRED

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

F-M SOUND CHANNEL I-F ALIGNMENT

1. Connect the low frequency signal generator output across resistor (R-118) in the plate circuit of the 12AU7 VIDEO DET. tube (V-104). This resistor is located at the terminal strip near the tube socket.

2. Connect the electronic voltmeter between pin 7 of the 6AL5 FM DET. tube (V-109) and chassis ground.

3. With the signal generator (unmodulated) set at 4.5 mc. set the 4.5 MC LIMITER GRID ADJ. and FM DET PRI. ADJ. (See Fig. 11) for maximum d-c voltage as measured by the electronic voltmeter. Adjust the limiter grid transformer (T-105) before adjusting the f-m detector transformer (T-108) primary. Use just enough signal generator output to obtain approximately one volt at the electronic voltmeter.

4. Connect the electronic voltmeter across the 1000 mmf condenser (C-135) at the output of the f-m detector stage and adjust the FM DET. SEC. ADJ. of the f-m detector transformer (T-108) for the null.

5. Shift the frequency of the signal generator either side of 4.5 mc and touch up the FM DET. PRI. ADJ. for approximately equal peaks. Use just enough signal generator output to obtain one volt peaks for the best results.

6. After completing the alignment procedure and placing the receiver in operation again, carefully tune in a TV test pattern and adjust the 4.5 MC TRAP ADJ. for maximum vertical wedge definition. This adjustment is located on the under side of the chassis and on the same coil form as the 4.5 MC LIMITER GRID ADJ. shown in Fig. 11.

NOTE: The primary adjustment of T-108, the coarse frequency adjustment of T-111 and the 4.5 mc trap adjustment may all be made through the plugged holes in the cabinet bottom or chassis mtg. board.

I-F AMPLIFIER ALIGNMENT

1. Connect the electronic voltmeter across resistor R-118 in the plate circuit of the 12AU7 VIDEO DET. tube (V-104). This resistor is located on the terminal strip near the tube socket.

2. Couple the high side of the signal generator to the mixer tube (V-2) by slipping a tight fitting tube shield or length of copper braid over the bulb of the tube and connecting the generator lead to it. Connect the ground side of the signal generator to the frame of the tuning unit.

3. Set the channel selector at channel 2.

4. Set the signal generator output (unmodulated) to develop one or two volts at the electronic voltmeter and adjust the four i-f amplifier coils, according to the following chart, for maximum d-c voltage as measured by the electronic voltmeter. Readjust the signal generator output as required to maintain the two-volt potential at the electronic voltmeter.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment (Refer to Fig. 11)	Stage Adjusted
23.2 mc	23.2 MC IF ADJ.	1st IF amp
25.2 mc	25.2 MC IF ADJ.	2nd IF amp
26.1 mc	26.1 MC IF ADJ.	3rd IF amp
22.9 mc	22.9 MC IF ADJ.	Video detector

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

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

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If a sweep type signal generator and oscilliscope is available the problem of making the final adjustments will be much easier. Check the two carrier i-f responses, 21.75 mc and 26.25 mc. The 21.75 mc response will be approximately 20 db below the peak response (Approx. 0.15 volt) and the 26.25 mc response will fall approximately 6 db below the peak (Approx. 0.4 volt). Refer to Fig. 12.

The average i-f amplifier sensitivity, when feeding the signal generator output through the receiver as described in step 2, will run approx. 1500 to 3000 microvolts for the one volt d-c peak measured at resistor R-118. (Receiver's oscillator operating on channel 2.)

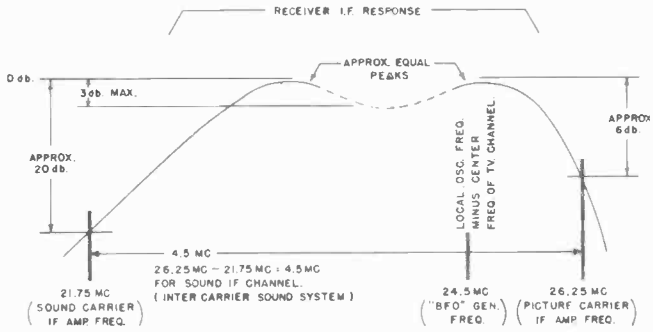


Fig. 12. I-F amplifier response

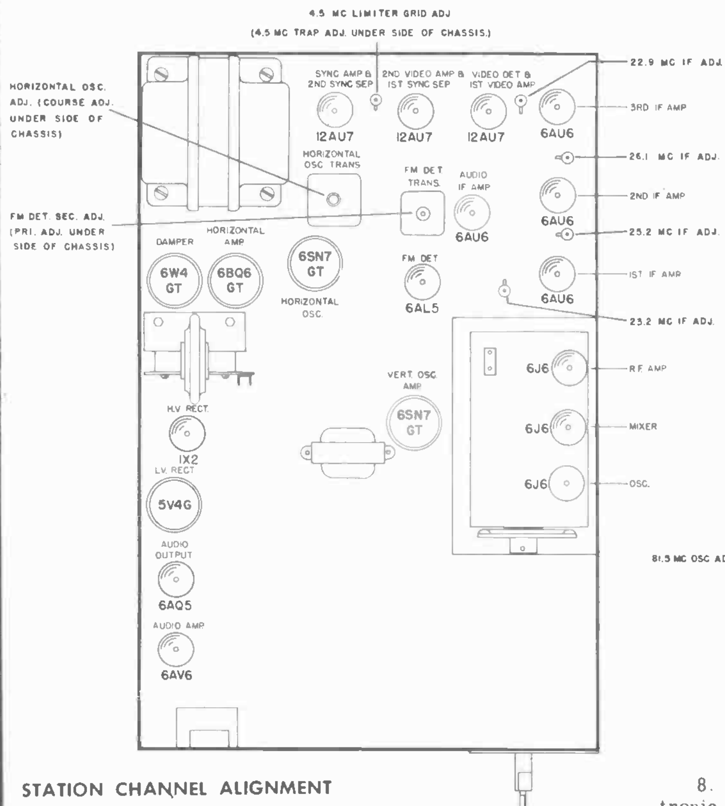
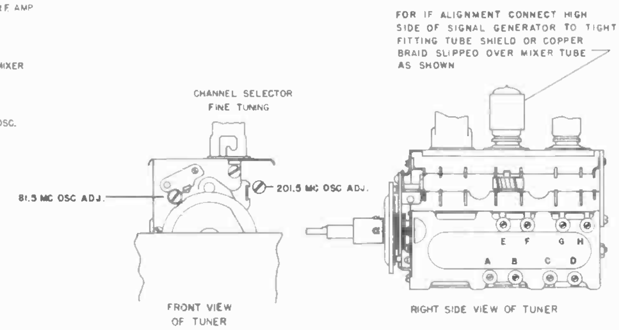


Fig. 11. Top view, alignment points.



STATION CHANNEL ALIGNMENT

1. Due to the broad frequency response of the i-f amplifier, it is necessary to use a 24.5 mc signal generator or oscillator (unmodulated) as a beat frequency oscillator (BFO) in order to locate the center frequency of the i-f amplifier response for the correct local oscillator adjustment. The "BFO" generator should be loosely coupled by means of a wire from the generator output placed in close proximity to the 12AU7 VIDEO DET. tube (V-104).

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

3 Clip on an .01 mfd condenser between pin 2 of the kinescope (V-117) and pin 1 of the 6AV6 AUDIO AMP tube (V-110). The connection at pin 2 of the kinescope can be made at the terminal strip under the chassis provided for the socket leads of this tube.

4. Set the "BFO" generator at 24.5 mc (No modulation).

5. Set the FINE TUNING control in the center of its range.

*6. Set the channel selector at channel number 2, the high frequency signal generator at 57 mc. and adjust the 81.5 mc OSC. ADJ. screw for a rough audio beat note, using the speaker as a detector.

*7. Set the channel selector at channel number 7, the high frequency signal generator at 177 mc. and adjust the 201.5 MC OSC. ADJ. screw for a rough audio beat note.

8. Disconnect the .01 mfd condenser and connect the electronic voltmeter across resistor R - 118 in the plate circuit of the 12AU7 VIDEO DET. tube (V-104) as for i-f amplifier alignment.

**9. Set the channel selector at channel 6, the high frequency signal generator at 85 mc and adjust trimmers A,B,C and D for maximum voltage as measured by the electronic voltmeter. Use just enough signal generator output to obtain approx. one volt at the electronic voltmeter. Note that trimmers A and B and trimmers C and D must be adjusted simultaneously since the mixer and amplifier tubes are operating in push-pull circuits.

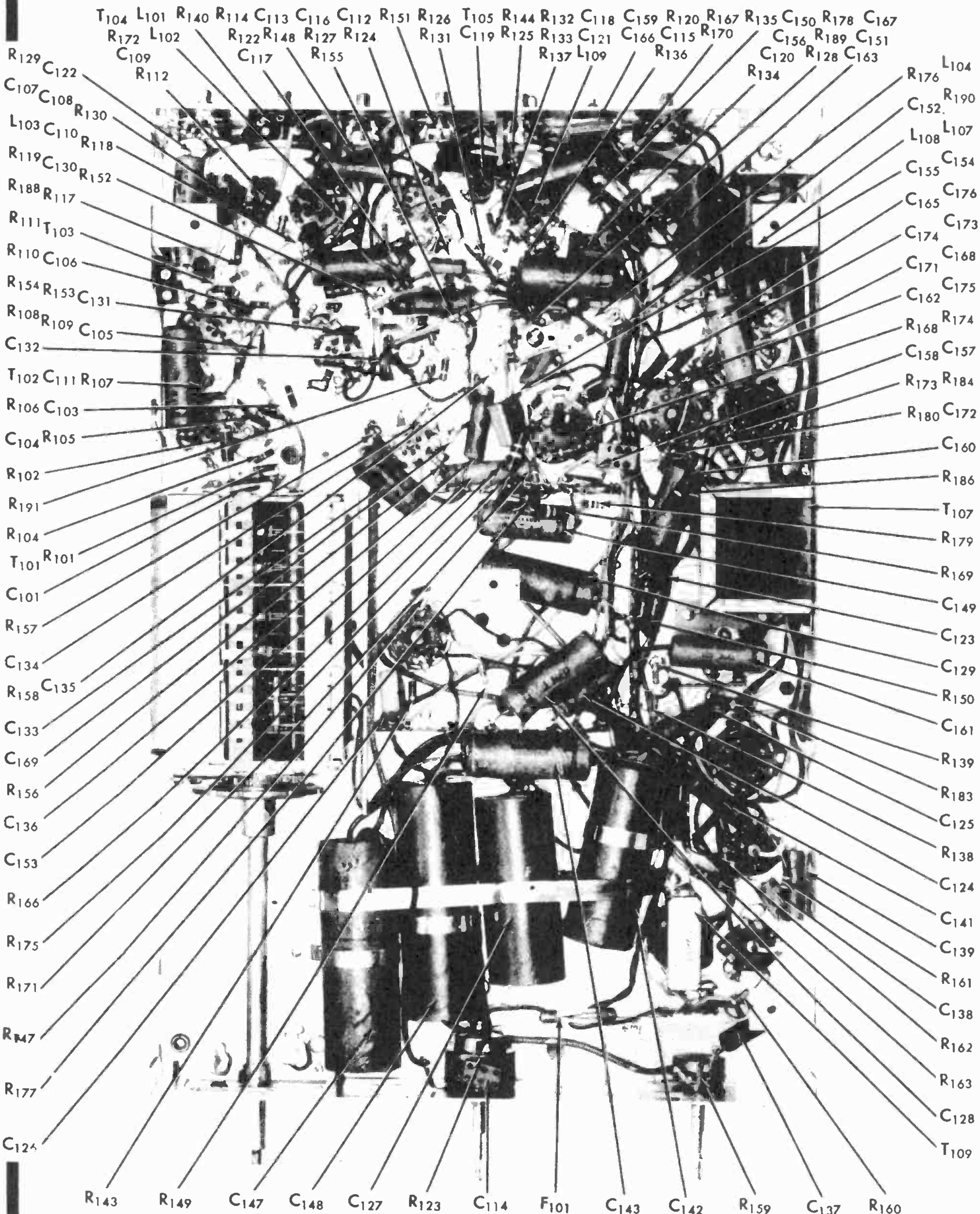
**10. Set the channel selector at channel 13, the high frequency signal generator at 213 mc. and adjust trimmers E,F,G, and H for maximum voltage following the same procedure used in step 9. This completes the alignment of the tuning unit.

The overall sensitivity for the receiver will run approximately 200 microvolts for one volt DC at resistor R-118 when measured in the above manner.

*Note - If local TV stations are operating on channels 2 and 7, the adjustments made in steps 6 and 7 may be made without the use of test equipment. Simply adjust the oscillator for best picture in each case.

**Note - Steps 9 and 10 are not ordinarily required. Adjustment of the trimmers should be undertaken only if the resonant circuits in the tuner have been serviced.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION



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Bottom chassis, view, component location.

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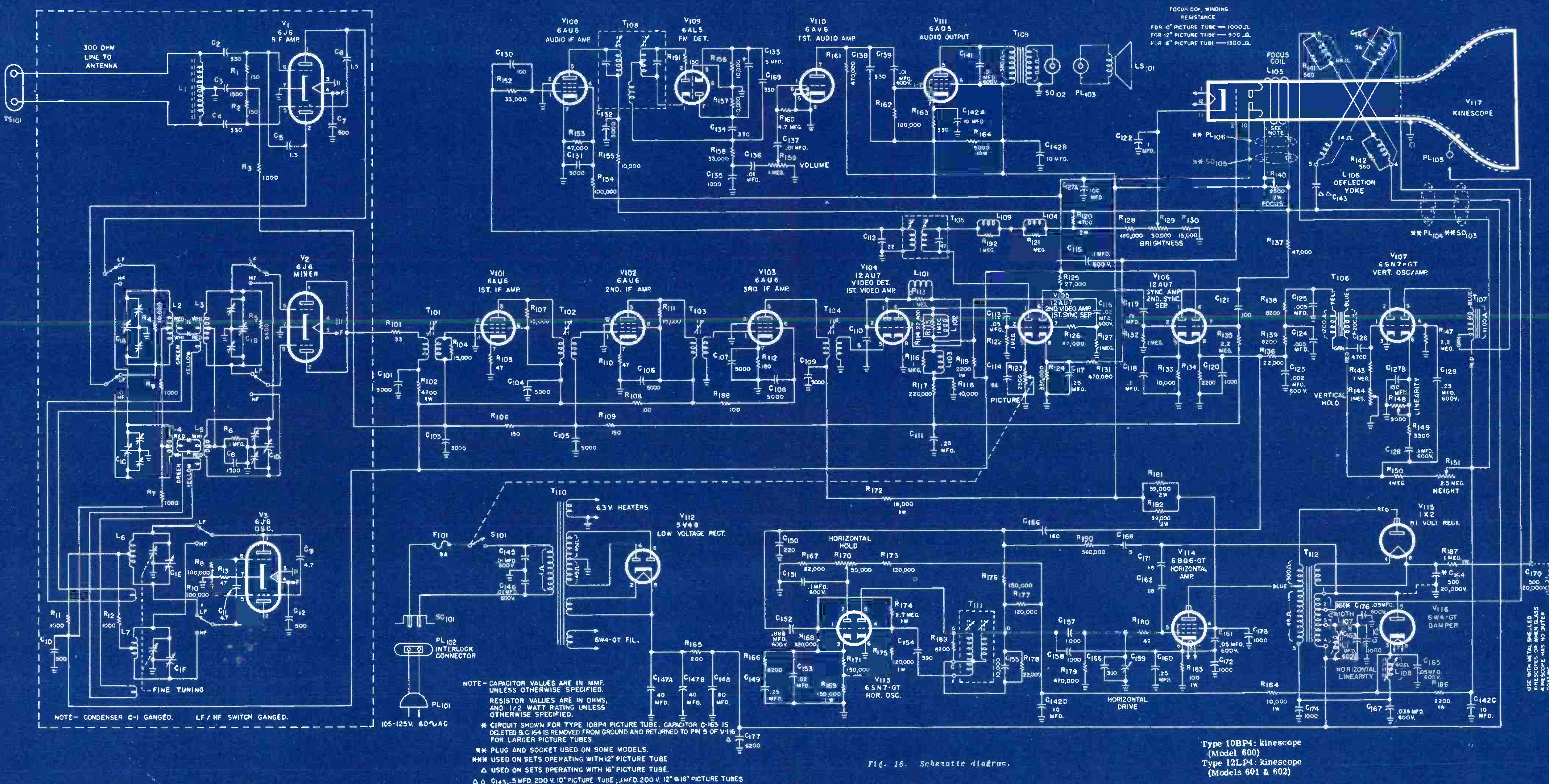


Fig. 16. Schematic diagram.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

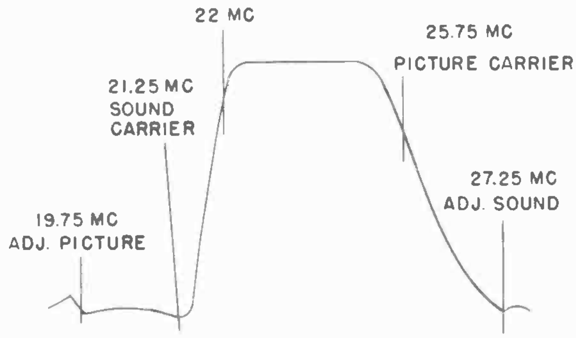
The Magnavox CT 219-220-222 chassis is a 24 tube receiver incorporating either a 10" or 12½" direct viewing picture tube, optional without electrical or mechanical modifications. The three chassis are identical excepting the R-F unit subassembly:

CT 219 Television chassis with 13 channel R-F unit, coil-selection of channels.

CT 220 Television chassis with 12 channel R-F unit, coil-selection of channels, adjustment of coils in the upper channels by compression of coils. Underside of unit is enclosed by a metallic shield.

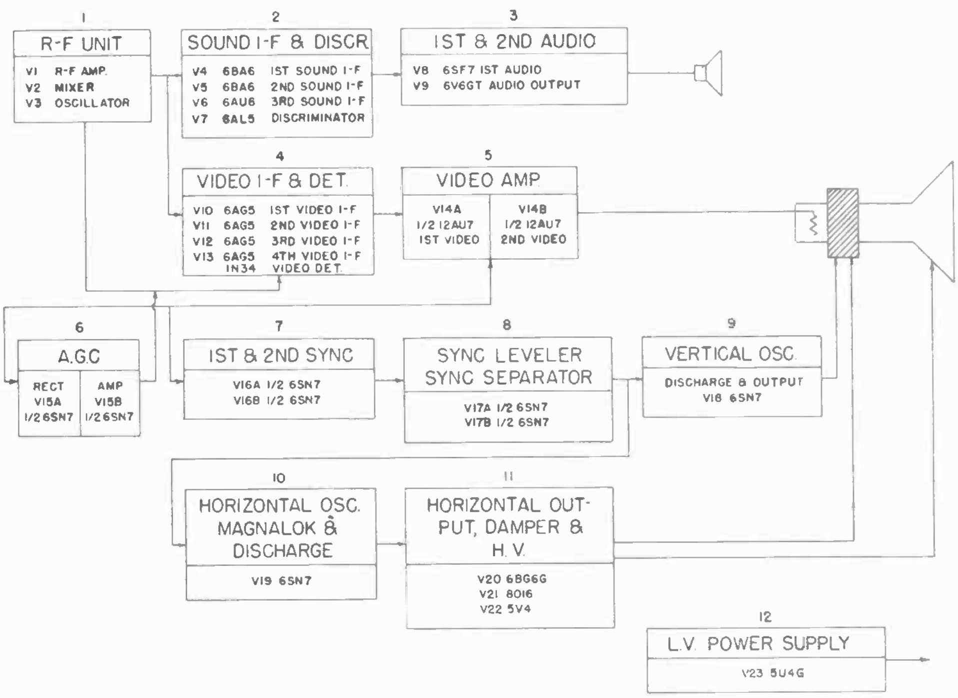
CT 222 Television chassis with 12 channel R-F unit, continuous condenser-tuning between channels in either group.

MAGNAVOX CT 219-220-222 TELEVISION



VIDEO-I-F SELECTIVITY CURVE AND OVERALL IF-RF CURVE

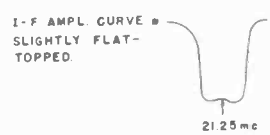
FUNCTIONAL DIAGRAM

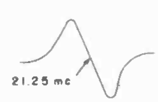


TABULATED ALIGNMENT

ALIGNMENT, SOUND I-F, DISCRIMINATOR

CONNECT SIG. GEN.	AM	CW	CONNECT SWEEP	GENERATOR FREQUENCY	CONNECT 'SCOPE	CONNECT V T METER	TUNE	FOR	COMMENTS
1. SOUND TAKEOFF, MIXER OUTPUT TRANS. (TAP)	√			STEP (1) MAKES FREQUENCY SAME AS TRAPS THEREFORE, TRAPS SHOULD BE PROPERLY SET.	VIDEO DET LOAD RESISTOR		GENERATOR	MIN. NEAR 21.25mc	BOTH 'SCOPE AND METER SERVE AS INDICATOR. AVOID OVERLOAD IN I-F AMPLIFIERS AS SHOWN BY FLATTENING OF PEAKS.
2. SAME	√				GRID RESISTOR, LAST I-F AMP. (LIMITER)	SAME AS 'SCOPE	SOUND I-F TRANSFORMERS	MAX.	
3.							RETOUCH I-F TRANSFORMERS	PROPER CURVE *	
4. SAME	√		WITH GEN. AT SOUND TAKEOFF, MIXER TRANS.		AUDIO TAKEOFF, DISCRIMINATOR	SAME AS 'SCOPE	a DETUNE SEC (BOTTOM) SLUG OF DISC. TRANS. b. PRI. (TOP) SLUG. c SEC SLUG.	 MAX. MIN.	
5. USE AS MARKER, LOOSELY COUPLED		√	SAME				RETOUCH DISC TRANS., PRI. AND SEC. AS REQUIRED	SYMMETRY OF "S" CURVE MARKER AT CENTER	





DISCRIMINATOR CURVE

MAGNAVOX CT 219-220-222 TELEVISION

ALIGNMENT, VIDEO I-F

SET BIAS ON GRID RETURN BUS TO NEGATIVE 3 VOLTS

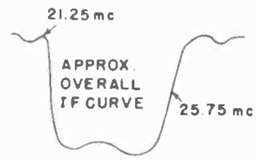
	CONNECT SIG. GEN.	AM	CW	CONNECT SWEEP	GENERATOR FREQUENCY	CONNECT 'SCOPE	CONNECT V.T. METER	TUNE	FOR	COMMENTS
1.	CONVERTER (MIXER) GRID	√			21.25	VIDEO DET. LOAD RESISTOR	VIDEO DETECTOR LOAD RESISTOR	(a) DETUNE MIXER TRANS. TOP SLUG (b) 21.25 mc TRAP (4th. I F CATHODE)	MIN.	AVOID OVER LOAD AS SHOWN BY FLATTENING OF CURVE ON 'SCOPE. STEP 4 MAY FOLLOW STEP 1.
2.		√			19.75			TRAP, 2nd. I F PLATE (TOP)	MIN.	
3.		√			27.25			TRAP, 1st. I F PLATE (TOP)	MIN.	
4.		√			21.25			MIXER OUTPUT TOP SLUG	MIN.	
5.		√			21.8		CONNECT ACROSS RESISTOR—NOT TO CHASSIS GROUND. METER WILL BE -100 VOLTS TO GROUND.	MIXER OUTPUT (BOTTOM SLUG)	MAX.	
6.		√			25.3			PLATE SLUG, 1st. I F AMPL.	MAX.	BOTTOM SLUG
7.		√		REPEAT STEP 2 AFTER STEP 7 IS COMPLETED	22.3			PLATE SLUG, 2nd. I F AMPL. (BOTTOM SLUG)	MAX.	2 PEAKS PRESENT. USE PEAK WITH SLUG IN.
8.		√			25.2			4th. I F AMPL. GRID.	MAX.	TOP-OF-CHASSIS SLUG
9.		√			23.4			4th. I F AMPL. PLATE	MAX.	TOP-OF-CHASSIS SLUG
10.	USE AS MARKER IF NECESSARY		√	MIXER GRID	AS NECESSARY			SLUGS AS REQUIRED, EXCEPT TRAPS (SEE NOTES)	PROPER CURVE	LOOSELY COUPLE MARKERS

NOTES

SLUG	TUNES	MOSTLY AFFECTS
21.8	SHARP	LOW FREQUENCY END OF CURVE
25.3	SHARP	HIGH FREQUENCY END OF CURVE
22.3	BROAD	LOW-CENTER END OF CURVE
25.2	BROAD	HIGH-CENTER END OF CURVE
23.4	VERY BROAD	MIDDLE OF CURVE

IN RETOUCHING, 23.4 SLUG IS USUALLY THE ONLY ONE REQUIRING ADJUSTMENT. THE 25.2 SLUG IS OF NEXT IMPORTANCE.

DO NOT RETOUCH 22.3 mc SLUG!



ALIGNMENT, R-F UNITS

IF ALL STATIONS TUNE NEAR ONE END OF DIAL, CHANGE OSCILLATOR TUBE OR ADJUST FINE TUNE DRIVE OF CT 220 UNIT

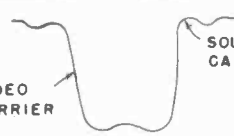
ADJUST BIAS LINE TO NEGATIVE $1\frac{1}{2}$ VOLTS FOR R-F ALIGNMENT

	CONNECT SIG. GEN.	AM	CW	CONNECT SWEEP	GENERATOR FREQUENCY	CONNECT 'SCOPE	CONNECT V.T. METER	TUNE	FOR	COMMENTS	
1.	ANTENNA		√		SOUND CARRIER CH. 13		AUDIO TAKEOFF DISCRIMINATOR	OSCILLATOR, * CH. 13 ADJUSTMENT	ZERO BETWEEN TWO PEAKS	OSCILLATOR ADJUSTMENT	COVER OF S-T UNIT INFLUENCES FREQUENCY.
2.			√		SAME, CH. 12-7			SAME, CH. 12-7 *	SAME		
3.			√		SAME, CH. 6			SAME, CH. 6 *	SAME		
4.			√		SAME, CH. 5-2			SAME, CH. 5-2 *	SAME		

* ADJUST OSC. OF CT 222 UNIT ON CH. 2 AND 7. OTHERS SHOULD FALL INTO LINE.

	CONNECT SIG. GEN.	AM	CW	CONNECT SWEEP	GENERATOR FREQUENCY	CONNECT 'SCOPE	CONNECT V.T. METER	TUNE	FOR	COMMENTS	
5.	USE AS MARKER IF NECESSARY			ANTENNA	AS REQUIRED FOR MARKER	VIDEO DET. LOAD RESISTOR.		R-F AMPL. ADJUSTMENTS, CH. 13	PROPER CURVE	R-F AMPL. ADJUSTMENT	R-F AMP. RARELY NEEDS ADJUSTMENT
6.			√					SAME, CH. 12-7 +	SAME		
7.			√					SAME, CH. 6	SAME		
8.			√					SAME, CH. 5-2 +	SAME		

+ ADJUSTMENT FOR CHANNELS 5-2 IS ONLY ON CT 220 UNIT. ON OTHERS, COMPROMISE IF NECESSARY, TO KEEP SOUND, VIDEO CARRIERS WITHIN LIMITS.



MAINTENANCE OF THE TELEVISION RECEIVER

In this section, there is not an enumeration of general complaints and their remedy, since this information is contained in the manual presenting a technical analysis of the television receivers. There are included, however, some items which will not be encountered in all receivers, and which are listed upon the basis of field-experience with the CT 219-220-222 chassis.

1. BURN OUT OF H.V. FILTER (LIMITING) RESISTOR

Should the H.V. plug be placed against the chassis, the H.V. filter resistor No. 194 will be damaged due to a high voltage across its extremities. To test for high voltage, do not draw an arc from the chassis; allow a spark discharge from the plug to the H.V. socket on the bell of the tube, or connect a H.V. meter (15KV scale).

2. INSUFFICIENT DEFLECTION AMPLITUDE

Some 6SN7 tubes have been found which, although they appear to be normal in the tube tester, afford too-little deflection pulse amplitude. Check by exchange, 6SN7 tubes in either horizontal or vertical deflection circuits, depending upon which is deficient.

3. 6BG6G TUBES

These tubes have in some cases, developed internal short-circuit which is capable of causing burnout of the deflection—H.V. transformer. For this reason, a .25 amp. fuse has been added in the plate circuit, in later production.

These tubes also have been known to develop spurious oscillation, causing the picture to show small segments, regularly-spaced, displaced from the main body of the picture.

A bluish glow on the inside surface of the glass envelope is caused by fluorescence of the glass and is not an indication of gas; gas is evidenced by a blue glow between the tube elements.

Another manifestation of improper 6BG6G tube operation is an elongation (stretching) of the picture on the left side, after about ten minutes operation. After the tube has cooled, proper linearity is restored. Under such operation, the adjustment of rear-chassis controls (especially the "speed" and "drive" controls) may cause the left-hand side of the picture to be "jumpy" or to move suddenly. The picture may in some cases move back and forth without adjustment of the controls.

In these cases, replacement of the tube is prescribed; the complaint is most evident with tubes of certain manufacture.

4. APPARENT POOR SENSITIVITY

Improper setting of the AGC Threshold control results in operation as though the receiver sensitivity were low. Check the control as in section III.

5. SMEARING OF PICTURE.

In addition to the usual causes of picture smear, it may result from incorrect value of R152, detector load resistor, or R148, grid resistor for V14B. These may also result in a negative picture reproduction.

6. BURNED OUT CRYSTALS.

Servicemen sometimes "probe" a chassis with a metal screwdriver. Note that shorting the circuit associated with the crystal detecor (conrol grid of V14A, for example) to ground will result in a damaged crystal and perhaps, 23.4 mc coil and R152.

7. VIDEO AMPLIFIER IS OVERLOADED OR OUTPUT IS TOO HIGH AND AGC ADJUSTMENT CANNOT HELP IT. POSSIBLY, NEGATIVE PICTURE.

In case the test scope shows an overload condition which cannot be adjusted, right reason suggests that the I-F bias is not high enough. The following may cause it:

a. 5.6K (156) shorted to circuit.
b. 18K (172) open or shorted to chassis.
c. 25 uf (104) shorted to chassis.
d. 270K (193) open or shorted to chassis.
e. 6SN7 (15B) not conducting, bad tube or back socket contacts.
f. 470K (197) or 200K pot (235) too low in resistance, causing the grid of 15B to be too negative.
g. 560K (200) too high in resistance causing the grid of 15B to be too negative.
h. 6SN7 (15A) not conducting, due to bad tube or bad socket contact.
i. .002 uf (69) open, causing proper adjustment of threshold to be unattainable.
j. No-90V. on P2 of V15, plate circuit of V16A open, 68K (181) open; these three may all cause the condition, just as 9 above. In general, they cause the threshold to need setting to a higher resistance value than it normally would be. So if the pot is on the low side of its tolerance or the 470K is low or both, the overload condition will exist regardless of threshold setting. It is suggested that where that condition exists, the faults of 9 and 10 be eliminated before it is assumed to be one of the more usual faults of 1 to 8.
k. Contrast pot shorted to chassis.

8. PIX SIGNAL OUTPUT IS TOO LOW OR ABSENT AND CANNOT BE ADJUSTED HIGH ENOUGH.

In case the test scope shows a pix signal of low amplitude or none at all, the following may cause it:

1. 5.6K (156) too high resistance.
2. 18K (172) too low resistance.
3. 270K (193) too low resistance.
4. 6SN7 (15B) shorted.
5. 470K (197) or 200K pot (235) too high resistance.
6. 560K (200) too low resistance.
7. No-100V. connection to threshold pot.
8. 10K (167) open or disconnected.
9. 4.7K (154) or green coil (17) open.
10. .05 uf (85) open.
11. Contrast pot (230) or 220 ohms (128) open.
12. Contrast pot (320) miswired.

9. AGC CONTROL HAS NO EFFECT.

In case the AGC control has no effect, many of the causes listed under A and B have this result. In addition, the threshold pot may be wired to both ends instead of one end and center.

10. PICTURE CONSISTS MOSTLY OF SYNC PULSES.

If the pix signal is mostly sync pulses and all the picture components are missing, red coil (19) is open.

11. AGC WILL WORK AT ONE SETTING OF CONTRAST AND NOT AT ANOTHER.

There is a rare case where AGC will work at one contrast setting and not at another. It occurs when the contrast pot is grounded at some point.

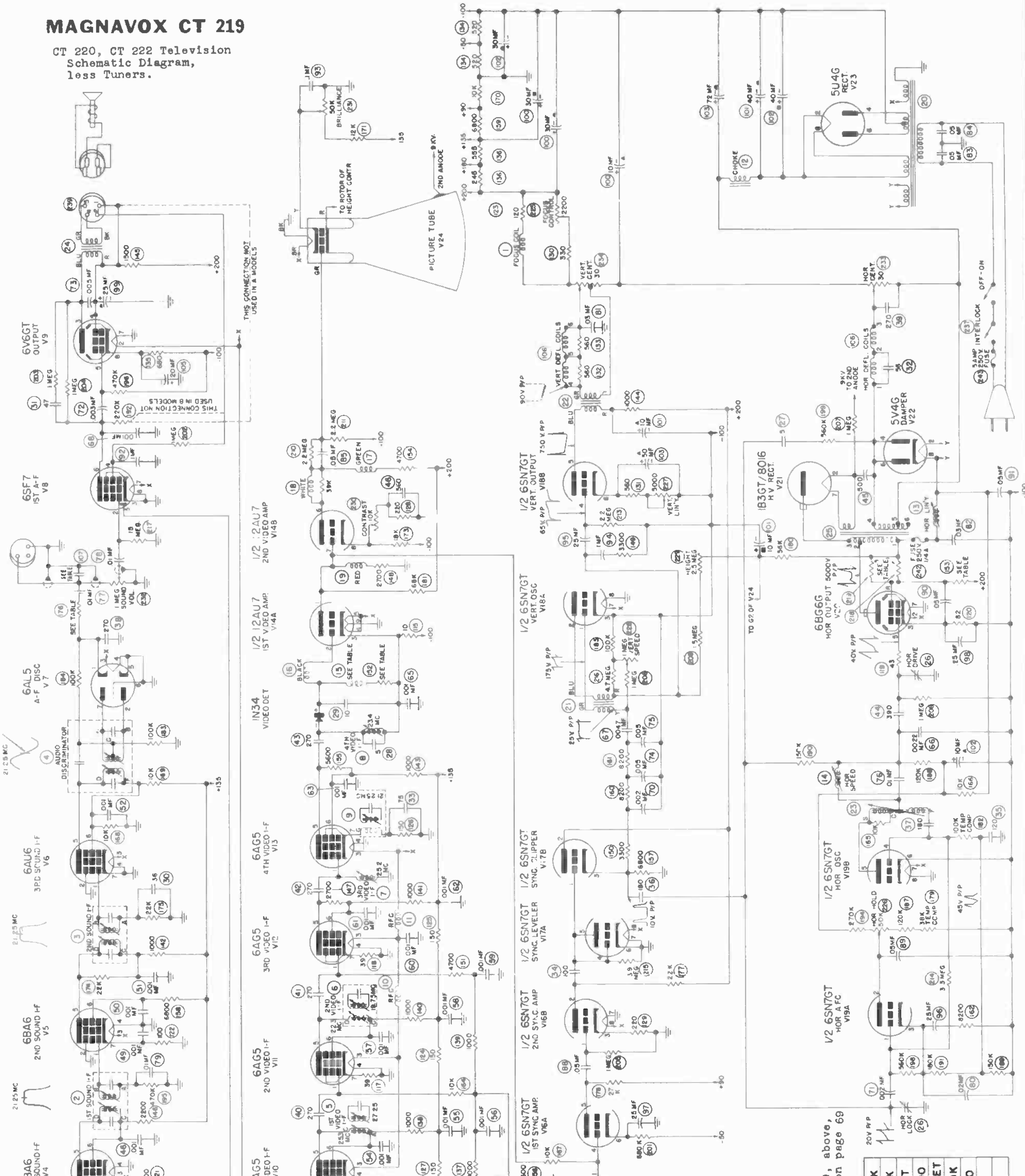
12. AGC WORKS PROPERLY, BUT THRESHOLD POT SETS TOO CLOSE TO ONE END OR THE OTHER.

Setting of a threshold pot at a spot too near one end has been covered rather thoroughly in 7 and 8. Be sure that none of the defect of 7i and j are present.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

MAGNAVOX CT 219

CT 220, CT 222 Television Schematic Diagram, less Tuners.

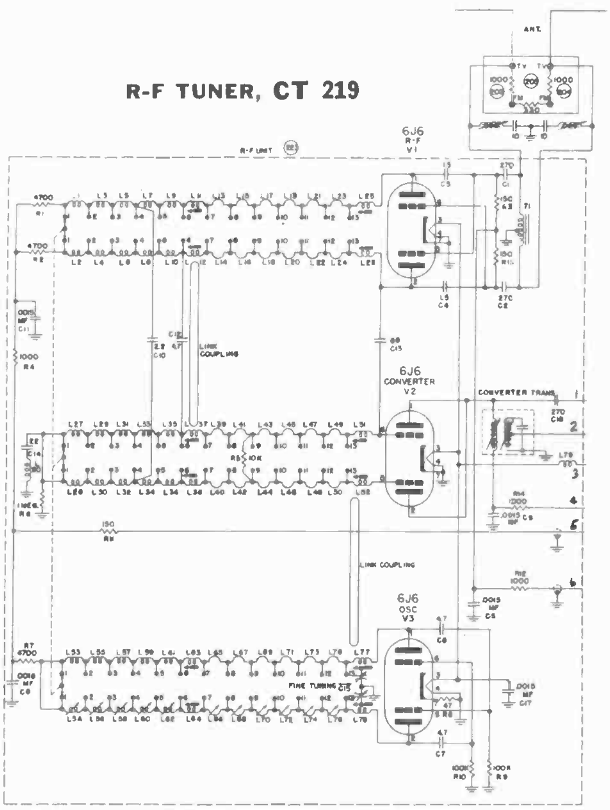


ALL ELECTRICAL VALUES SHOWN ARE IN OHMS OR MMF UNLESS OTHERWISE SPECIFIED.
⏚ INDICATES CHASSIS GROUND

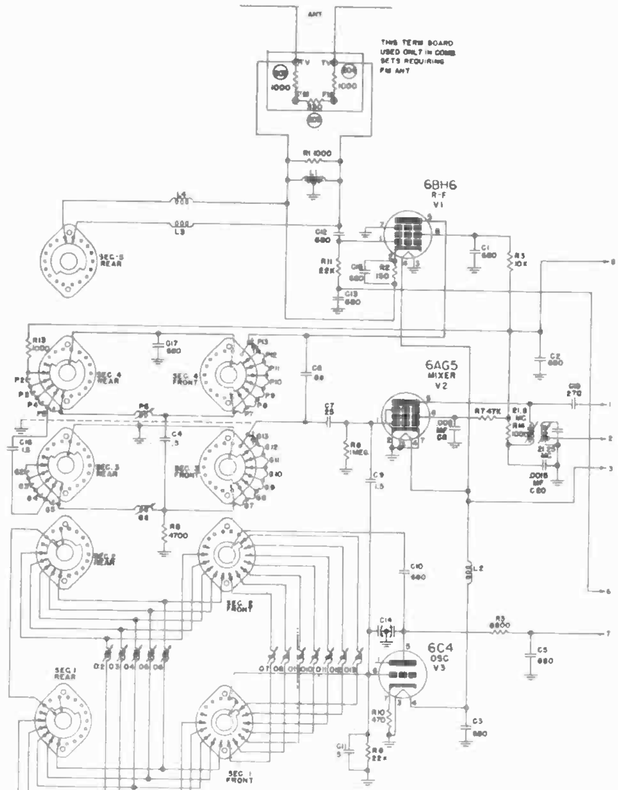
Wires marked with figures, 1 to 9, above, connect to various tuners shown on page 69

ITEM	A	B	C	D
	CT219-CT220-CT222			
219	OMIT	OMIT	OMIT	33K
218	OMIT	OMIT	OMIT	33K
153	4700	4700	4700	OMIT
152	4700	4700	3300	3300
15	BLACK	BLACK	VIOLET	VIOLET
176	22K	100K	100K	100K
107	OMIT	270	270	270

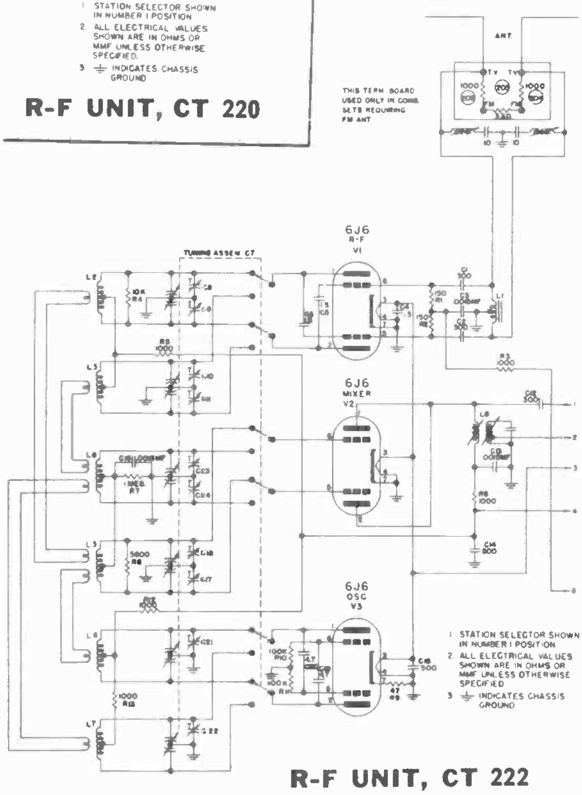
MAGNAVOX CT 219-220-222 TELEVISION



R-F TUNER, CT 219

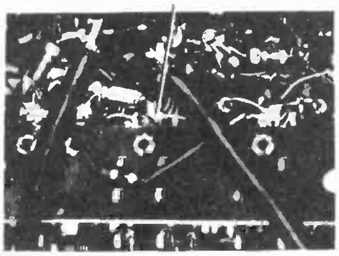


R-F UNIT, CT 220



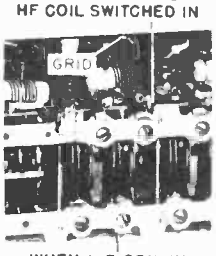
R-F UNIT, CT 222

GRID



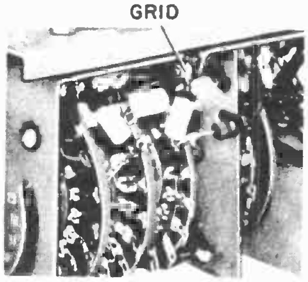
CT 219 TUNER

CONNECTION WHEN HF COIL SWITCHED IN



WHEN L-F COIL IN CT 222 TUNER

GRID



CT 220 TUNER

ACCESS TO CONVERTER GRID FOR ALIGNMENT

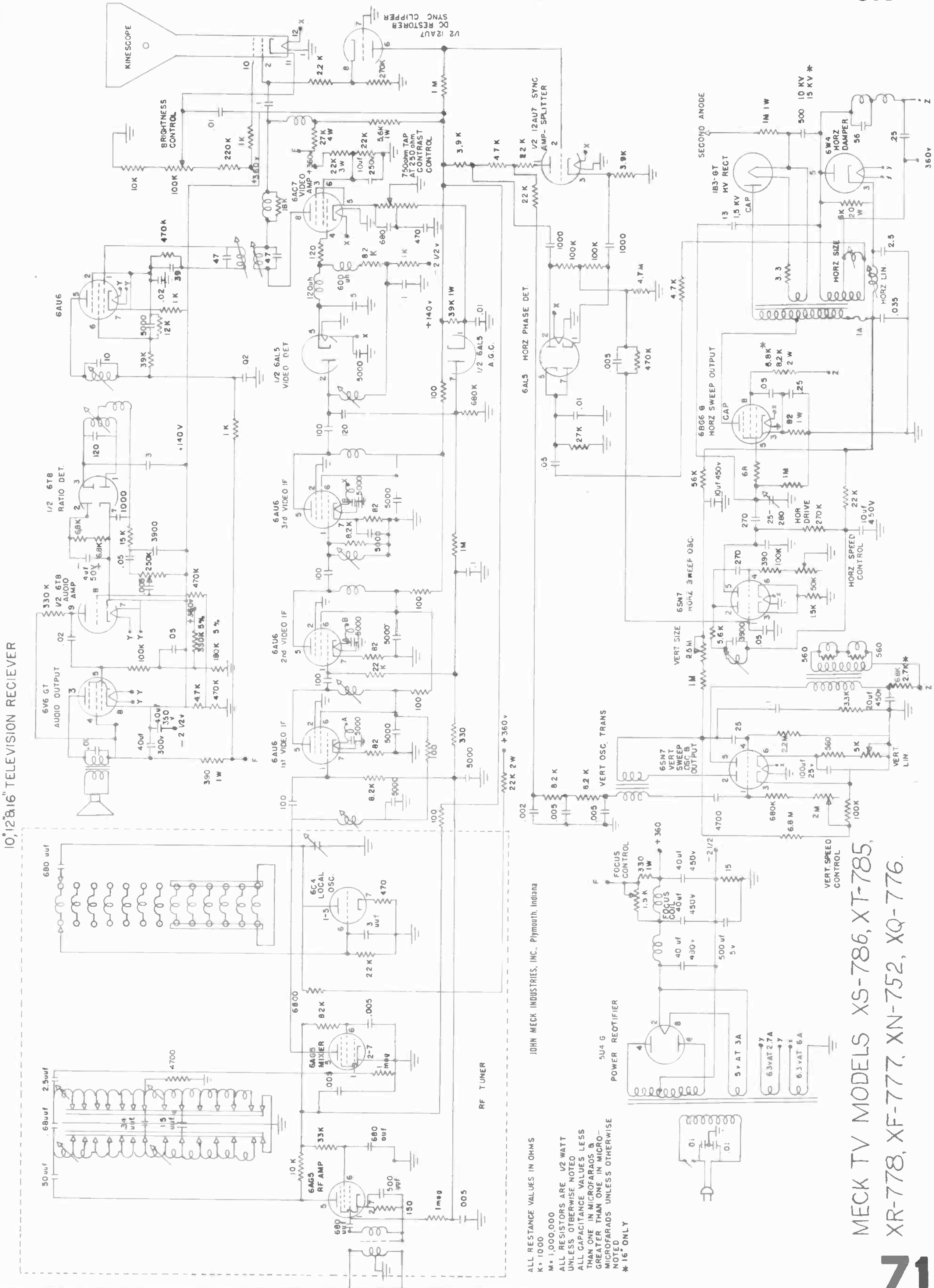
MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

MAGNAVOX CT 219-220-222 TELEVISION

VOLTAGE CHART

Measurements made with receiver operating on 117 volts 60 cycles a-c and with no signal input. Voltages shown are read with RCA VoltOhmyst Jr. between indicated terminal and chassis ground except where otherwise noted. Voltage and current readings are nominal values.

Tube No.	Tube Type	Function	Operating Condition	Plate		Screen		Cathode		Grid		Notes on Measurement
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V4	6BA6	1st Sound I-F		5	120	6	120	7	1.5	1	0	
V5	6BA6	2nd Sound I-F		5	140	6	115	7	1.5	1	0	
V6	6AU6	3rd Sound I-F		5	22	6	22	GND	—	1	−5	
V7	6AL5	Disc.		2 & 7	−.4	—	—	1 & 5	0	—	—	
V8	6SF7	1st A-F		6	40	4	19	GND	—	2	−1	
V9	6V6GT	Audio Out.		3	160	4	175	8	−88	5	−110	
V10	6AG5	1st Video I-F		5	.140	6	140	7	.35	1	.9-1.9*	*Variation with Threshold control varies .5 V. with picture control.
V11	6AG5	2nd Video I-F		5	140	6	140	7	.25	1	.9-2*	*Variation with Threshold control varies .4 V. with picture control.
V12	6AG5	3rd Video I-F		5	130	6	140	7	.35	1	.9-2*	*Variation with Threshold control varies .4 V. with picture control.
V13	6AG5	4th Video I-F		5	100	6	140	7	1.4	1	.9-1.9*	*Variation with Threshold control.
V14A	½12AU7	1st Video Amp.		1	−20	—	—	3	−110	2	−110	
V14B	½12AU7	2nd Video Amp.		6	170-210*	—	—	8	−1.5 to −12*	7	−20	*Variation with picture control.
V15A	½6SN7GT	AGC Rect.		2	80	—	—	3	−14	1	−20	
V15B	½6SN7GT	AGC Amp.		5	−4 to −7*	—	—	6	−50	4	−47 to −65*	*Variation with Threshold control.
V16A	½6SN7GT	1st Sync. Amp.		5	80	—	—	6	−15	4	−20	
V16B	½6SN7GT	2nd Sync. Amp.		2	90	—	—	3	1.2	.1	.1 to −.3*	*Variation with Threshold control.
V17A	½6SN7GT	Sync. Leveler		5	20-45*	—	—	6	GND	4	Tied to plate	*Variation with Threshold control.
V17B	½6SN7GT	Sync. Clipper		2	210	—	—	3	.5	1	20-45*	*Variation with Threshold control.
V18A	½6SN7GT	Vert. Osc.		2	37 to −12*	—	—	3	.110	1	−150	*Variation with Vertical control.
					−30 to −15"							"Variation with Height control.
V18B	½6SN7GT	Vert. Out.		5	200	—	—	6	−98	4	−110 to 88*−	*Variation with Height control.
V19A	½6SN7GT	Hor. A. F. C.		2	0-35*	—	—	3	−88 to −100*	1	−80	*Variation with Hor. control.
V19B	½6SN7GT	Hor. Osc.		5	78	—	—	6	−110	4	−180	
V20	6BG6G	Hor. Out.		Cap.	320	8	140	3	−100	5	−110	
V21	8016	H. V. Rect.		Cap.	*	—	—	2	7800"	—	—	*9200 volt pulse present. "Measured with electrostatic voltmeter.
V22	5V4G	Damper		4 & 6	260	—	—	8	340	—	—	
V23	5U4G	Rect.		4 & 6	380 A.C.	—	—	2	270	—	—	
V24		Pix. Tube		RED	340	—	—	YELLOW	0 to 110"	GREEN	27 to 39*	*Variation with picture control. "Variation with brightness control.


10",12"&16" TELEVISION RECIEVER
MECK TV MODELS XS-786, XT-785,
XR-778, XF-777, XN-752, XQ-776.
JOHN MECK INDUSTRIES, INC., Plymouth, Indiana
ALL RESTANCE VALUES IN OHMS
K= 1000
M= 1,000,000
ALL RESISTORS ARE 1/2 WATT
UNLESS OTBERWISE NOTED
ALL CAPACITANCE VALUES LESS
THAN ONE IN MICROFARADS &
GREATER THAN ONE IN MICRO-
MICROFARADS UNLESS OTHERWISE
NOTED
* 16" ONLY
RF TUNER
KINESCOPE
5U4 G POWER RECTIFIER
6AU6 1st VIDEO IF
6AU6 2nd VIDEO IF
6AU6 3rd VIDEO IF
6AC7 VIDEO AMP
6V6 GT AUDIO OUTPUT
6BG6 G HORZ SWEEP OUTPUT
1B3-GT HV RECT
6W4 HORZ DAMPER
6SN7 HORZ SWEEP OSC.
6SN7 VERT SWEEP OSC & OUTPUT
6AL5 HORZ PHASE DET
6C4 LOCAL OSC.
6AG5 MIXER
6AG5 RF AMP
SECOND ANODE

JOHN MECK INDUSTRIES, INC. Alignment Procedure for

Models: XS-786, XT-785, XR-778, XF-777, XN-752, XQ-776

Equipment required: Television Sweep Generator, Marker Frequency Generator, Vacuum Tube Voltmeter, Oscilloscope, 4.5 MC fixed frequency Generator or equivalent.

Instructions are presented for carrying out I.F. and Sound alignment. The R.F. Tuner in these receivers have been pre-aligned by the manufacturer and it is not recommended that adjustment be made in the field. The fine tuning control will move the oscillator frequency at least 3/4 MC on the low channels and 2 MC on the high channels.

I.F. Alignment

1. Connect VTVM and the input terminal of the scopes' vertical amplifier to the juncture of 8200 ohm resistor and 410 uh choke this is immediately following the video detector, the 8200 ohms being the resistor portion of the detector load. I.F. signal may be introduced by means of a miniature tube shield floated over the 6AG5 mixer tube.

2. With the sweep off and the marker freq. set to 23.3 mc, adjust the 1st and 3rd I.F. coils for maximum response, as indicated by VTVM. Generator should be attenuated so as not to provide more than threshold sensitivity (1 volt on VTVM at fixed freq., 1/2 volt on sweep).

3. Re-set marker frequency to 25.6 mc and adjust 2nd and 4th I.F. transformers for maximum VTVM indication, as above

4. With sweep turned on observe I.F. curve shape on oscilloscope - the knee of the curve should be at approximately 23.5 & 25.5 mc. If original alignment did not produce satisfactory curve, it may be modified by adjusting the I.F. tuning slightly, while observing the curve on the scope. Care must be taken that both peaks are approximately the same height and that the mid-portion of the curve is not down more than about 2db. The sound rides at 21.6 mc and this point should be checked to make sure that it is at least 26db below the flat top. The picture frequency rides the curve at 26.1 mc and should be 6db down on the opposite side of the curve. The curve should be about 3 mc wide at 6db down (1/2 way down).

Sound Alignment

1. Connect 4.5 mc generator to the grid of the video amplifier tube (There again, low signal level is important, so that limiting action does not occur.). Metering may be accomplished at the sound take-off point of the ratio detector (at the juncture of the 15,000 ohm resistor and the 3900 mmf capacitor).

2. Adjust the top and bottom slugs on the sound trans. for maximum response.

3. Adjust primary of ratio detector (top slug) to maximum.

4. Connect meter ground to the juncture of the two 6800 ohm resistors off the sound detector, and adjust bottom slug on ratio detector to Zero voltage.

Motorola Television

NOTE O INDICATES LARGE OUTER KNOB. ● INDICATES SMALL INNER KNOB.

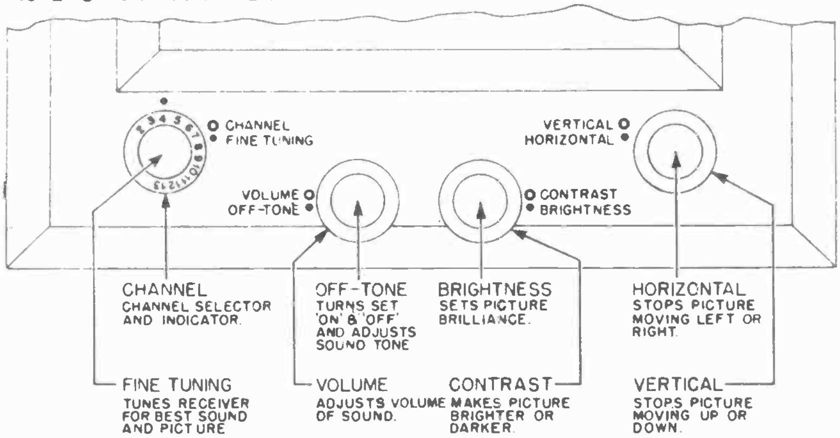


FIGURE 2 - OPERATING CONTROLS

MODELS

VT121 Series
12VT16 Series
12VK18 Series

CHASSIS

TS-15
TS-15A
TS-15B
TS-15C
TS-15C1

DESCRIPTION OF CHASSIS

Chassis TS-15. This television chassis contains 22 tubes, plus a 12", type 12LP4, picture tube. The circuit differs from the conventional one in that the vertical output transformer is eliminated, and high impedance vertical deflection coils are fed directly from a 6SN7GT output amplifier tube.

Chassis TS-15A. Same as Chassis TS-15, except that the 6V6GT vertical output amplifier tube was eliminated, and a vertical output transformer was added. In addition, provision is made to use either a 12LP4 or 12KP4 picture tube. As the two types of picture tubes require different focus coils, a plug and receptacle are provided to facilitate the change. This chassis uses 21 tubes, plus a 12LP4 picture tube. The 12KP4 type picture tube is not furnished in any of the receivers, but must be provided by the customer if he so desires.

Chassis TS-15B. New noise limiting, video amplifier, pulse stripping and horizontal sync systems were incorporated in this chassis. The third video IF amplifier tube, a 6BA6, was replaced by a 6AG5 type for greater IF gain. The receptacle on the TS-15A chassis, used for different focus coils, was removed from the TS-15B chassis. Two trimmer adjustments, "Horizontal Lock-in" and "Horizontal Fine Frequency" were eliminated from the rear of the chassis, and the "Horizontal Oscillator" coil was re-mounted to make its adjustment accessible from the rear. The tube total in this chassis is 23, plus a 12LP4 picture tube.

Chassis TS-15C. Similar to chassis TS-15B, except that a new RF tuner with variable antenna trimmers and new antenna coils is used, to improve overall sensitivity.

Chassis TS-15C1. Same as TS-15C, except that V-20, the 5V4G damping diode tube was replaced with a 6W4GT type, the 5 volt filament winding was eliminated from the power transformer and the video IF alignment frequencies were changed. This chassis uses 23 tubes, plus a 12" picture tube. This is the circuit illustrated on page 80.

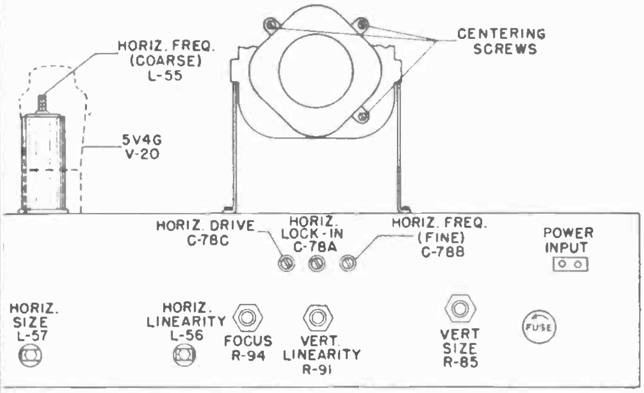


FIGURE 3 - CHASSIS TS-15 & TS-15A
SERVICE ADJUSTMENT CONTROL LOCATIONS

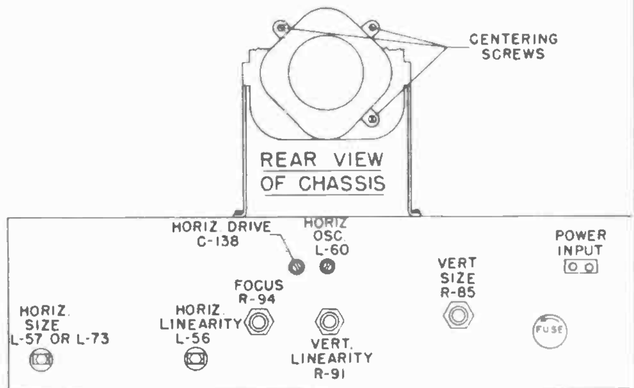


FIGURE 4 - CHASSIS TS-15B, C & C1
SERVICE ADJUSTMENT CONTROL LOCATIONS

Motorola Models VT121, 12VT16, 12VK18, Chassis TS-15, etc.

HORIZONTAL SIZE, DRIVE AND LINEARITY ADJUSTMENT

Turn HORIZONTAL SIZE control fully clockwise. Vary HORIZONTAL DRIVE trimmer for best compromise between brightness and horizontal linearity. Adjust the HORIZONTAL SIZE control until picture fills the mask horizontally. Clockwise rotation increases picture width. Adjust HORIZONTAL LINEARITY control for best horizontal linearity on right half of picture. Adjustment of the HORIZONTAL SIZE will require a readjustment of the HORIZONTAL LINEARITY control and vice-versa. Center picture with centering screws on focus coil.

HORIZONTAL OSCILLATOR CHECK (CHASSIS TS-15 & TS-15A)

Obtain a picture on the set with approximately normal contrast. Vary the HORIZONTAL HOLD control from one extreme to the other. The picture should remain in horizontal sync in all positions of the control except the extreme counterclockwise, and there the picture should show a marked tendency to slip to the right. This slippage serves as a reference point to insure the proper range of the hold control to give synchronization under all conditions. If picture fails to show this tendency to slip,

1. Leave the HORIZONTAL HOLD control in the extreme counterclockwise position.
2. Adjust the HORIZONTAL FREQUENCY trimmer until the picture tends to slip to the right.
3. Rotate the HORIZONTAL HOLD control clockwise until the picture falls into sync, then rotate an additional 10-15 degrees clockwise and leave in that position.

When the receiver has been adjusted in this manner, it should be possible to switch the receiver on and off or from station to station with the picture in synchronism at all times. If this is possible, the horizontal oscillator is properly aligned.

COMPLETE ALIGNMENT OF HORIZONTAL OSCILLATOR (CHASSIS TS-15 & TS-15A)

If, in the above check, the receiver failed to hold sync over the proper range of the HORIZONTAL HOLD control, the horizontal oscillator should be aligned as follows:

1. Turn CONTRAST CONTROL for about normal picture contrast.
2. Turn HORIZONTAL FREQUENCY trimmer tight.
3. Adjust HORIZONTAL LOCK-IN trimmer to about 2 turns from tight.
4. Adjust the horizontal oscillator coil L-55 so that the picture will lock-in over the whole range of the HORIZONTAL HOLD control.
5. If it is not possible to obtain proper syncing in Step 4, back off on HORIZONTAL LOCK-IN trimmer an additional turn, or until it is possible to adjust L-55 to make the picture sync over the whole range of the HORIZONTAL HOLD control.
6. Turn the HORIZONTAL HOLD control to its extreme counterclockwise position.
7. Adjust the HORIZONTAL FREQUENCY trimmer until the picture tends to slip to the right.
8. Rotate the HORIZONTAL HOLD control clockwise 10-15 degrees past the point at which the picture falls into sync and leave it in that position.

It should now be possible to change stations without losing synchronism.

ALIGNMENT OF HORIZONTAL OSCILLATOR (CHASSIS TS-15B, TS-15C & TS-15C1)

With normal contrast, adjust the HORIZONTAL OSCILLATOR coil on the rear of the chassis until the picture remains in sync throughout the entire range of the HORIZONTAL HOLD control.

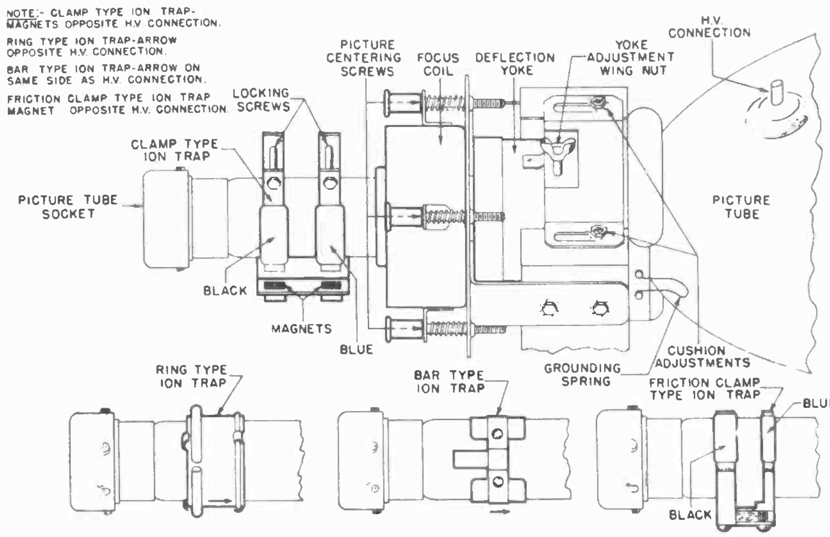


FIGURE 5 - PICTURE TUBE ADJUSTMENT LOCATIONS

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Motorola Models VT121, 12VT16, 12VK18, Chassis TS-15, etc.

ADJUSTMENT OF ION TRAP AND DEFLECTION YOKE

Under conditions of rough shipment, it is possible for these parts to become misaligned. The following instructions will enable the service man to bring the parts to their normal setting.

See Figure 5 for adjustment locations. A mirror placed in front of the receiver will help in making these adjustments.

ION TRAP

Four types of permanent magnet ion traps are used on the TS-15 series chassis. They are as follows:

1. One is held in place with two clamps, colored black and blue, and tightened onto the neck of the tube with two screws.
2. A large and a small circular magnet which slip over the neck of the tube.
3. Two square bar magnets which slip over the neck of the tube.
4. Another type consisting of black and blue clamps, but which slip over neck of the tube.

The function of each trap is the same, and its shifting will result in poor brilliancy or shadowing of the corners of the picture. The ion trap is mounted toward the rear of the tube neck, approximately over the "flags" of the tube's gun structure. The trap has a front and rear marking which must be observed. Figure 5 gives the proper positions.

While observing the raster on the screen, move the ion trap slightly backward or forward, simultaneously turning it slightly to and fro until the brightest raster is obtained, and one in which none of the four corners are cut off or shadowed. These adjustments should be made with the brightest picture obtainable, consistent with good line focus and a full, square raster. When adjustment is completed, make certain that the ion trap is held tightly in position.

DEFLECTION YOKE

If the deflection yoke shifts, the picture will be tilted. To correct, loosen the wing nut on top of the deflection yoke and rotate yoke till picture is straight. Before tightening wing nut, make certain that the deflection yoke is as far forward as possible.

ALIGNMENT

NOTE: The alignment procedure covers all chassis, through TS-15C1.

A metal screwdriver may be used for making video IF adjustments, but a plastic or fibre screwdriver is required for RF or sound IF alignment.

EQUIPMENT NECESSARY FOR ALIGNMENT

AM Signal Generator:	Frequency Range 4.5-220 mc Output 0-100,000 microvolts
Electronic Voltmeter	
Oscilloscope	
Sweep Frequency Generator:	Frequency Range 20-30 mc Sweep Width: 10 mc minimum

VIDEO IF ALIGNMENT PROCEDURE

It will be necessary to remove the picture tube to expose two video IF tuning cores. A short screwdriver of 2 to 3 inches in length is convenient for making the adjustments.

1. Turn the channel selector switch to a blank channel, e.g., the position which would correspond to channel 14 or 15 if there were such marking on the switch. This disables the local oscillator and prevents spurious responses in the IF amplifier.

2. Turn the receiver on, and adjust the contrast control R-69B, for -5 volts bias, as measured from the variable tap of the control to chassis.

3. Apply a -3 volt bias to the mixer grid by means of a dry battery. Connect the positive terminal of the battery to ground and the -3 volt terminal to the point at which the two 470,000 ohm resistors (R-6 & R-7) in the mixer grid are connected.

4. Connect the signal generator output lead, through a blocking capacitor of 100 mmf to .01 mf, to the grid of the mixer tube V-2 (6J6, pin 5). The low side of the signal generator should be connected to the oscillator coil mounting plate near the mixer tube socket. To avoid regeneration, keep the grid and ground leads to the signal generator as short as possible.

5. Connect the electronic voltmeter across the video detector load resistor*. With zero output from the generator, the meter should read less than 1 volt negative contact potential. A voltage appreciably greater than this indicates oscillation in the IF strip; and the generator lead connections, groundings, etc., should be checked.

6. Adjust the output of the signal generator throughout alignment for no more than 1 volt increase across the detector load resistor to prevent overdriving the IF amplifier. Use the 3 volt range on the electronic voltmeter.

* R-50 (1800 ohms) in chassis TS-15 & TS-15A.
R-147 (4700 ohms) in chassis TS-15B, TS-15C & TS-15C1.

Motorola Models VT121, 12VT16, 12VK18, Chassis TS-15, etc.

7. Refer to Figures 6, 7, 8 & 9 for location of alignment adjustments and to the following chart for procedure.

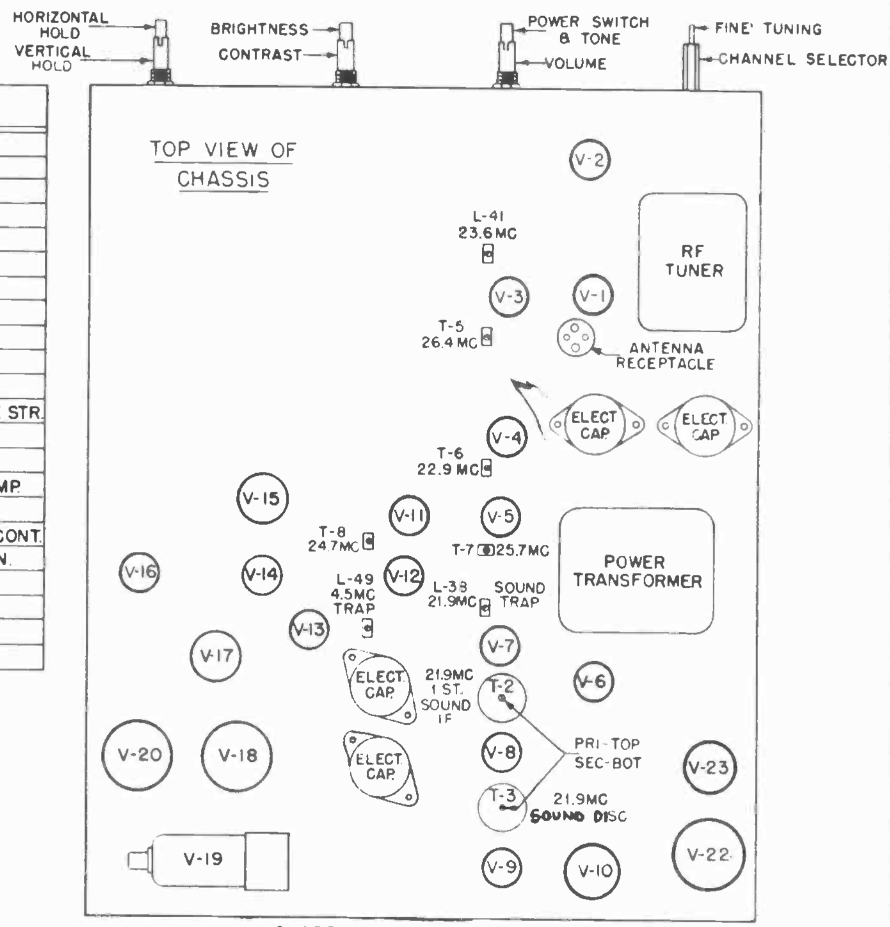
	SIG. GEN. FREQ.-Mc.			ADJUST				
STEP	TS-15	TS-15A, B, C	TS-15C1	TS-15	TS-15A	TS-15B, C	TS-15C1	REMARKS
1.	23.6	23.6	23.4	L-41	L-41	L-41	L-41	Adjust for maximum.
2.	26.4	26.4	22.9	T-5	T-5	T-5	T-5	Adjust for maximum.
3.	22.9	22.9	26.7	T-6	T-6	T-6	T-19	Adjust for maximum.
4.	25.7	25.7	25.5	T-7	T-13	T-16	T-16	Adjust for maximum.
5.	21.9	21.7	21.7	L-38	L-38	L-38	L-38	Increase generator output about 10 times and adjust for minimum. (Sound trap adjustment).
6.	25.7	25.7	25.7	T-7	T-13	T-16	T-16	Readjust for maximum, as in Step 4.
7.	24.7	24.7	24.7	T-8	T-8	T-8	T-8	Adjust for maximum.

The normal video IF sensitivity at 24.5 mc., with -3 V. mixer bias and zero contrast bias, is as follows:

Chassis TS-15 & TS-15A: 400 microvolts for 1 V. increase across R-50.

Chassis TS-15B, C, C1: 200 microvolts for 1 V. increase across R-147.

NO	TYPE	FUNCTION
V-1	6AG5	RF AMP.
V-2	6J6	MIXER-OSC.
V-3	6BA6	1 ST. VIDEO IF
V-4	6BA6	2 ND. VIDEO IF
V-5	6BA6	3 RD. VIDEO IF
V-6	6AU6	SOUND IF
V-7	6AU6	SOUND IF
V-8	6AU6	SOUND IF
V-9	6T8	DISC. & 1ST. AUDIO AMP.
V-10	6V6GT	AUDIO AMP.
V-11	6AG5	4 TH. VIDEO IF
V-12	6T8	VIDEO DET. & AMP. & PULSE STR.
V-13	6AC7	2 ND VIDEO AMP.
V-14	6SN7GT	PULSE AMP. & STRIPPER
V-15	6SN7GT	V.B.O. & VERT. OUTPUT AMP.
V-16	6V6GT	VERT. OUTPUT AMP.
V-17	6SN7GT	HORIZ. OSC. & HORIZ. OSC. CONT.
V-18	6BG6G	HORIZ. OUTPUT & H.V. GEN.
V-19	1B3GT	H.V. RECT.
V-20	5V4G	DAMPING DIODE
V-22	5U4G	RECT.
V-23	5Y3GT	RECT.



CHASSIS TS-15

FIGURE 6 - CHASSIS TS-15 TUBE & IF ADJUSTMENT LOCATIONS

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Motorola Chassis TS-15, etc.

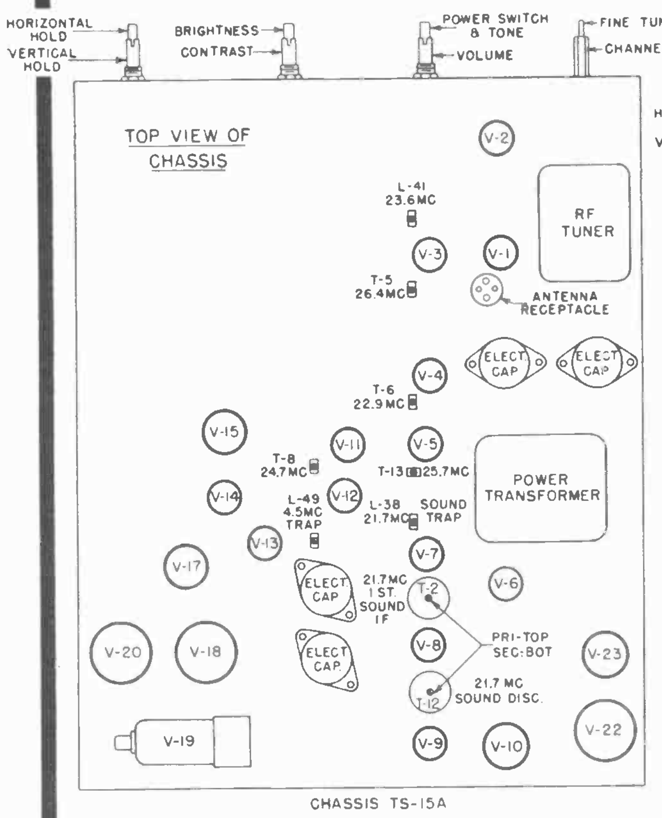


FIGURE 7 - CHASSIS TS-15A TUBE & IF ADJUSTMENT LOCATIONS

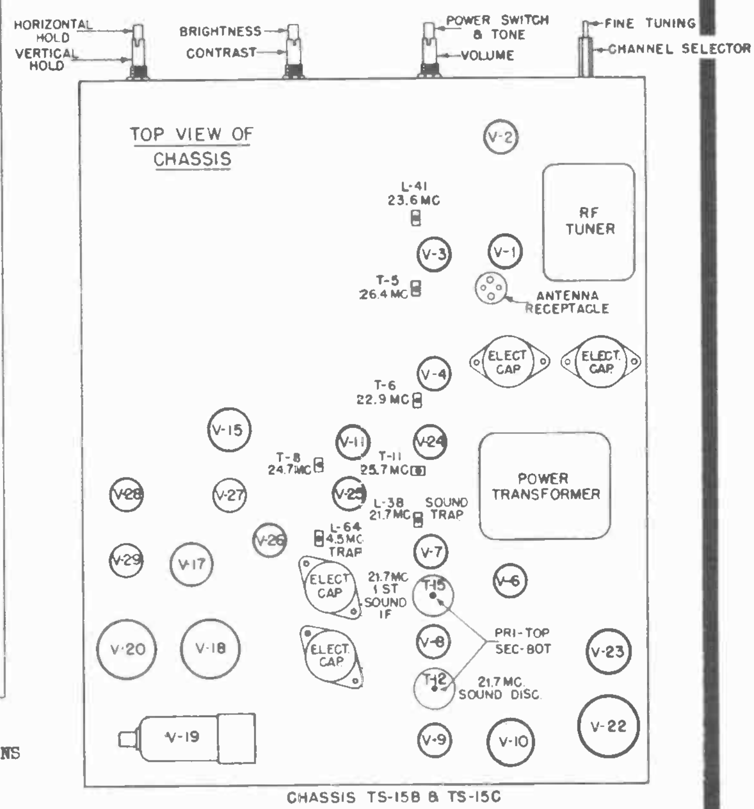


FIGURE 8 - CHASSIS TS-15B & TS-15C TUBE & IF ADJUSTMENT LOCATIONS

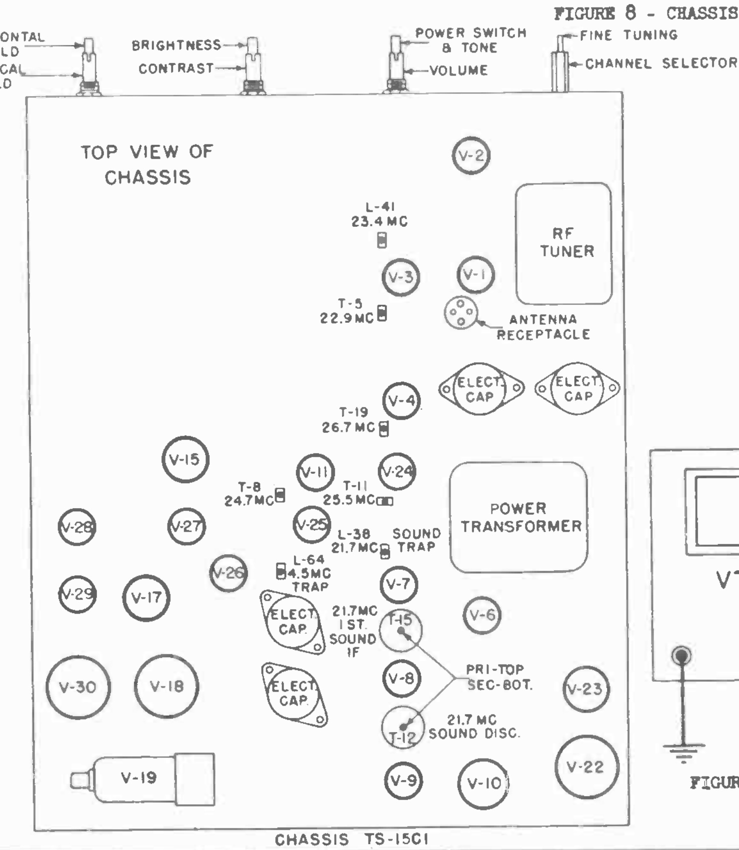
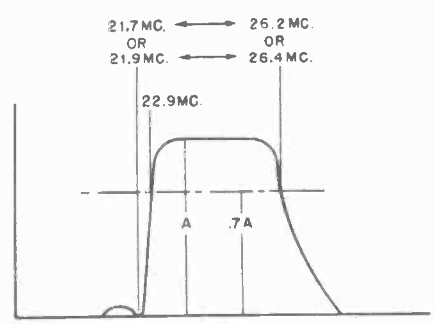


FIGURE 9 - CHASSIS TS-15C1 TUBE & IF ADJUSTMENT LOCATIONS



VIDEO IF RESPONSE CURVE

FIGURE 10 - VIDEO IF RESPONSE WAVEFORM

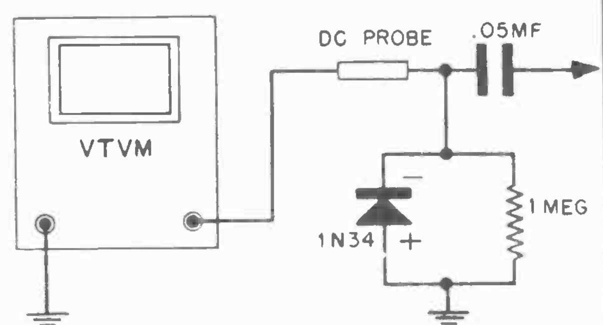


FIGURE 11 - ELECTRONIC VOLTMETER CONNECTIONS

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Motorola Models VT121, 12VT16, 12VK18, Chassis TS-15, etc.

The video IF amplifier response curve is shown in Figure 10. The bandwidth at the 3 db points should be approximately 3.5 mc. To check this with an AM generator, note the signal strength in microvolts necessary to produce an increase of approximately 1 volt above contact potential at 24.5 mc. Increase the generator input by 1.4 times and shift the generator frequency both sides of 24.5 mc until the original detector voltage reading is again obtained. These two new frequencies thus obtained are the 3db skirt frequencies and should correspond with the points shown in Figure 10. This measurement should be made with the -3 volt mixer bias and a -5 volt contrast bias.

4.5 MC TRAP ADJUSTMENT

1. Connect the signal generator to the plate of the video detector tube**.
2. Connect the electronic voltmeter and germanium crystal rectifier, as shown in Figure 11 to the plate of the 2nd video amplifier tube***. Use the lowest voltage scale on the meter.
3. With the signal generator set at 4.5 mc and maximum output, adjust the 4.5 mc. trap coil**** for minimum reading on the meter.

An alternate method is to tune in a normal picture and adjust the trap coil so that the strippled or half-tone effect in the picture is minimized or eliminated. Make sure the fine tuning control is set on center audio peak while this adjustment is being made. The RF portion of the receiver must, of course, be aligned first before this method of adjusting the sound trap is attempted.

CHECK OF VIDEO IF ALIGNMENT WITH SWEEP GENERATOR

Since variations in tube gain and component values cannot be taken into consideration in the single frequency alignment technique, whereas they can be compensated for in a sweep alignment, it is very desirable after AM alignment to check the shape of the IF response curve and to touch up the adjustments by using a sweep generator and an oscilloscope.

1. Turn the channel selector switch to a blank channel (a position corresponding to channels 14 or 15) to disable the local oscillator.
2. Adjust the contrast control for -5 volts bias.
3. Apply a -3V bias to the mixer grid, at the junction of the two 470,000 ohm resistors, R-6 & R-7.
4. Connect the sweep generator output lead, through a blocking capacitor of 100 mmf to .01 mf, to the grid of the mixer tube V-2 (6J6, pin 5). Ground the generator to the oscillator coil mounting plate, again keeping the leads as short as possible.
5. Connect the oscilloscope vertical input to the grid of the 1st video amplifier tube*****, or to the grid of the 2nd video amplifier tube****** if more gain is needed. Run a lead from the scope terminal on the sweep generator to the horizontal input on the oscilloscope; or use the built-in sawtooth, synchronized internally, whichever is preferred.
6. Set the sweep generator for a center frequency of about 24.0 mc, with a deviation of about 10 mc. At all times keep the output below the level at which the IF strip is over-driven, the point at which the response curve begins to change shape as the generator output is increased.
7. Turn on the marker in the sweep generator. If there is no built-in marker in the sweep generator, loosely couple the output of the AM generator to the IF strip, or feed the output to the mixer tube through a small capacitor. At all times, keep the marker output low enough to prevent the marker from distorting the response curve. If a wide band scope is used, the marker will be more distinct if a capacitor of 100 mmf to 1000 mmf is placed across the scope input. Use the smallest size possible, since too large a value will affect the shape of the curve.
8. Adjust the sweep and scope until one complete response curve appears on the screen.
9. Compare the curve with the ideal curve in Figure 10, using the marker to locate specific frequencies on the wave. If it is necessary to alter the shape of the curve, readjust the core closest in frequency to the point requiring correction.

SOUND IF ALIGNMENT

1. Make adjustments and connections as described for video IF alignment.
   a. Turn the channel selector switch to a blank channel.
   b. Adjust the contrast control for -5 volts bias.

** Pin 2, V-12 (6T8) in chassis TS-15 & TS-15A.
Pin 7, V-25 (6AL5) in chassis TS-15B, TS-15C & TS-15C1.

*** Pin 8, V-13 (6AC7) in chassis TS-15 & TS-15A.
Pin 6, V-26 (12AU7) in chassis TS-15B, TS-15C & TS-15C1.

**** L-49 in chassis TS-15 & TS-15A.
L-64 in chassis TS-15B, TS-15C & TS-15C1.

***** Pin 8, V-12 (6T8) in chassis TS-15 & TS-15A.
Pin 2, V-26 (12AU7) in chassis TS-15B, TS-15C & TS-15C1.

****** Pin 4, V-13 (6AC7) in chassis TS-15 & TS-15A.
Pin 7, V-26 (12AU7) in chassis TS-15B, TS-15C & TS-15C1.

c. Apply -3 volts bias to the mixer grid.

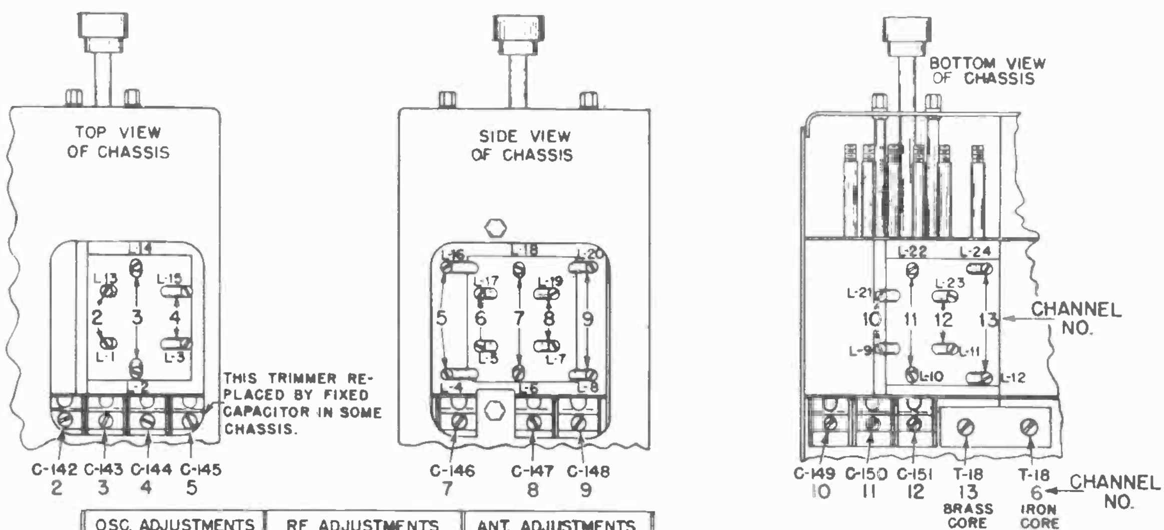
d. Connect the AM generator output lead, through a blocking capacitor, to the grid of V-2 (6J6, pin 5).

2. Refer to Figures 6, 7, 8 & 9 for location of alignment adjustments and to the following chart for procedure.

3. Except in step 1, keep the output of the signal generator low enough to prevent limiting during alignment.

	SIG. GEN. FREQ.-MC		ELECT. VOLT. CONN. TO		ADJUST			
STEP	TS-15	TS-15A,B,C,C1	TS-15 & TS-15A	TS-15B,C,C1	TS-15	TS-15A	TS-15B,C,C1	REMARKS
1	21.9	21.7	Across video.det.load R-50	R-147	L-38	L-38	L-38	Adjust for minimum. (This step not necessary if performed during video IF alignment.)
2	21.9	21.7	Across R-18 & R-19		T-2 Pri.	T-2 & Sec.	T-15	Adjust for maximum.
3	--	--			T-3 Sec.	T-12 (bottom)	T-12	Detune 2 turns counterclockwise.
4	21.9	21.7	High side of volume control		T-3 Pri.	T-12 (top)	T-12	Adjust for maximum.
5	21.9	21.7	High side of volume control		T-3 Sec.	T-12 (bottom)	T-12	Adjust so that the meter indicates zero output as the voltage swings from one polarity to the other.

R.F. Alignment is required only on rare occasions and outside of the data in Figure 13, will not be presented in this manual.



	OSC. ADJUSTMENTS		RF ADJUSTMENTS		ANT. ADJUSTMENTS	
CHANNEL	COILS	FREQ.	COILS	FREQ.	TRIMMER OR COIL	FREQ.
2	L-25	59.75MC	L-1 & L-13	58MC	C-142	58MC
3	L-26	65.75MC	L-2 & L-14	64MC	C-143	64MC
4	L-27	71.75 MC	L-3 & L-15	70MC	C-144	70MC
5	L-28	81.75MC	L-4 & L-16	80MC	C-145	80MC
6	L-29	87.75MC	L-5 & L-17	86MC	T-18 IRON	86MC
7	L-30	179.75MC	L-6 & L-18	178MC	C-146	178MC
8	L-31	185.75MC	L-7 & L-19	184MC	C-147	184MC
9	L-32	191.75MC	L-8 & L-20	190MC	C-148	190MC
10	L-33	197.75MC	L-9 & L-21	196MC	C-149	196MC
11	L-34	203.75MC	L-10 & L-22	202MC	C-150	202MC
12	L-35	209.75MC	L-11 & L-23	208MC	C-151	208MC
13	L-36	215.75MC	L-12 & L-24	214MC	T-18 BRASS	214MC

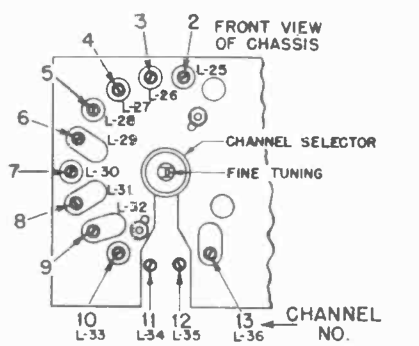


FIGURE 13 - CHASSIS TS-15C & TS-15C1 OSCILLATOR, RF & ANTENNA ADJUSTMENT LOCATIONS

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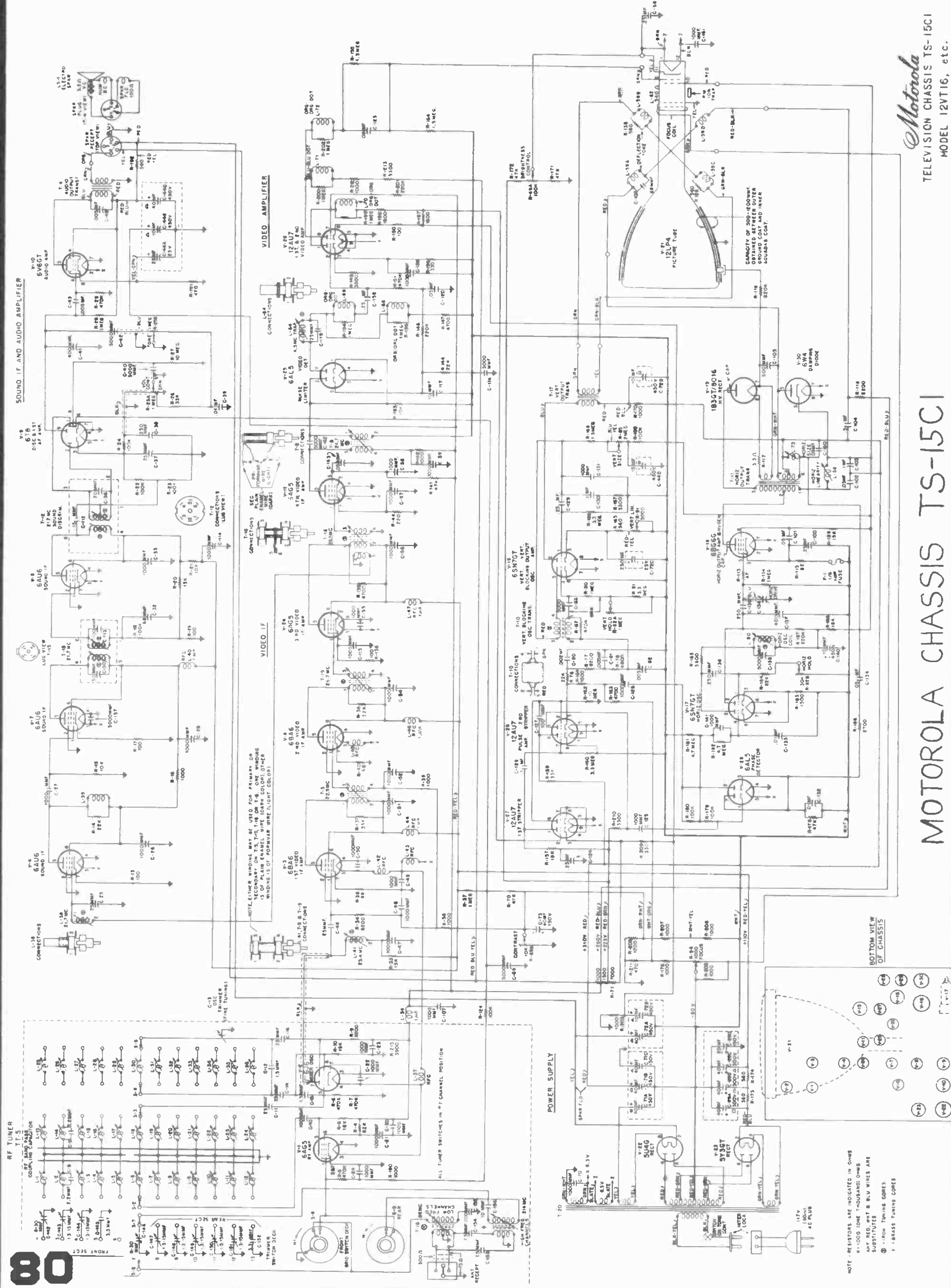
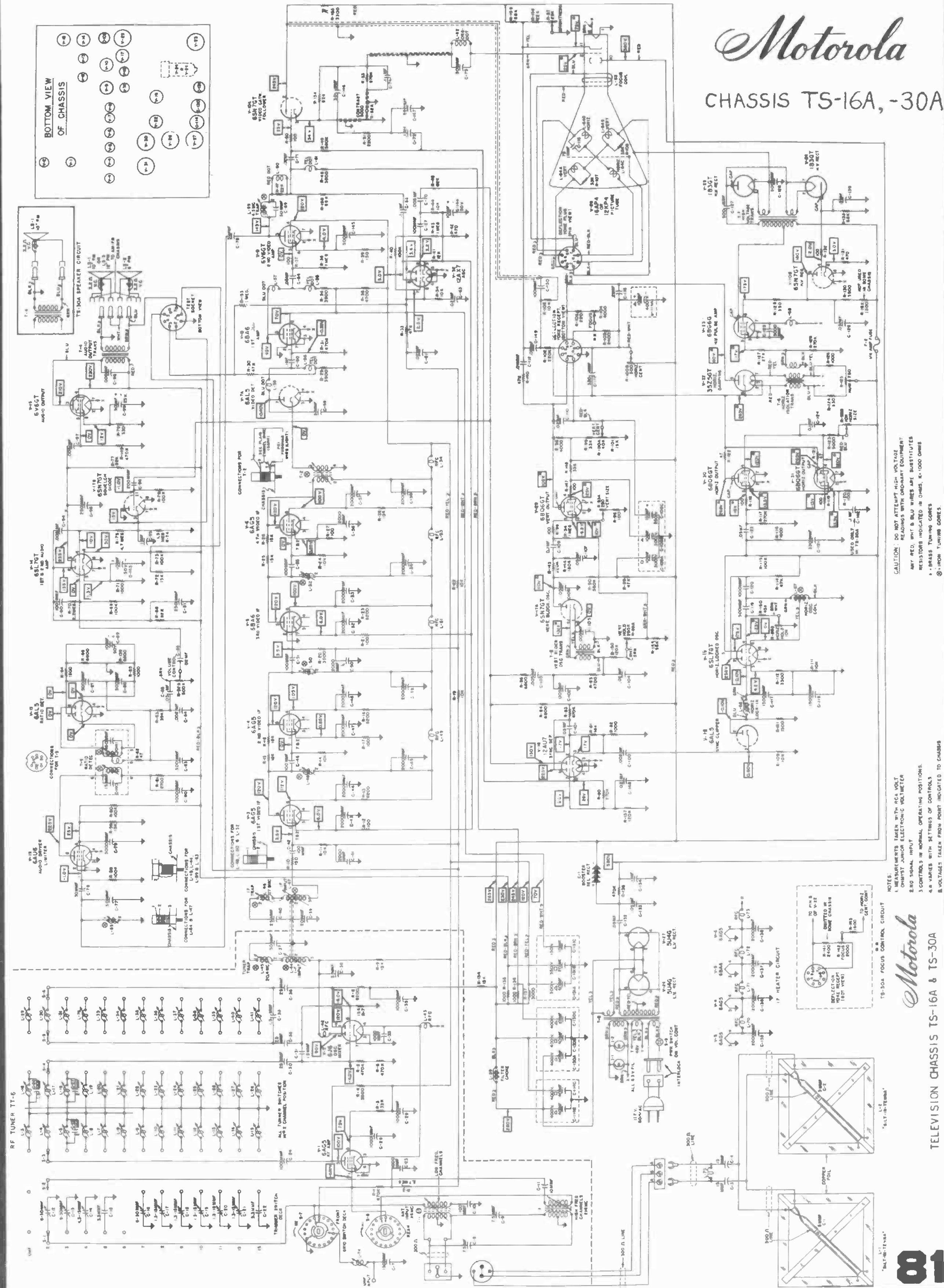


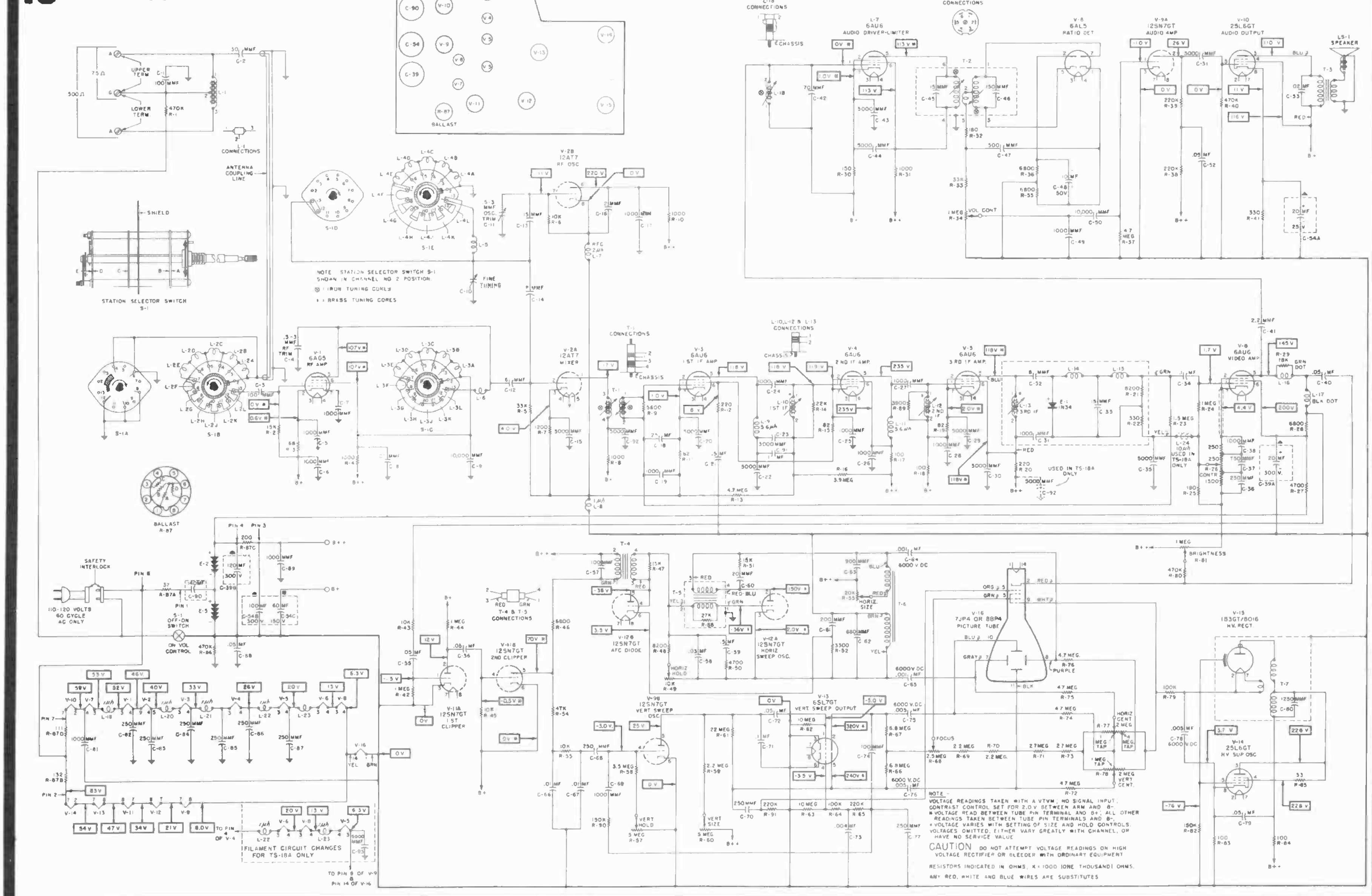
Motorola

CHASSIS TS-16A, -30A



Motorola CHASSIS TS-18 & TS-18-A

Motorola TELEVISION CHASSIS TS-18 & TS-18A



NOBLITT-SPARKS INDUSTRIES, Inc.

COLUMBUS, INDIANA

ARVIN TELEVISION

Models

Model	Chassis
3100 TM	10-Inch CHASSIS TE272-1
3100 TB	10-Inch CHASSIS TE272-1
3101 CM	10-Inch CHASSIS TE272-1
3120 CM CB	12½-Inch CHASSIS TE272-2
3121 TM	12½-Inch CHASSIS TE272-2
3160 CM	16-Inch CHASSIS TE276

ALIGNMENT

It is very important that the proper condition of R-f ground for the test equipment with respect to the receiver be had before attempting alignment. To accomplish this place the receiver and test equipment on a conductive sheet of metal and bond or by-pass the equipment to it. Touching the test leads, test equipment, or receiver chassis should have no effect on the scope pattern or meter reading.

SEQUENCE FOR COMPLETE ALIGNMENT.

1. Sound discriminator.
2. Sound I-f.
3. Picture I-f Traps.
4. Picture I-f.
5. R-f oscillator.
6. R-f and converter.
7. 4.5 Mc. Video Trap.

SOUND DISCRIMINATOR.

1. Signal Generator setting--21.25 Mc.--.1 volt output--connect to pin 1 of V2, 2nd sound I-f.

2. Detune T102 secondary (bottom).

3. Connect voltohmyst through a 1 meg. resistor to the junction of R109, R108 (Test Point A).

4. Adjust primary T102 (top) for maximum meter reading.

5. Connect voltohymst to junction of C114 and R109 (pin 5, V3) (Test Point B).

6. Adjusting T102 (bottom) will vary meter reading from a plus voltage to minus voltage. Adjust for zero (point where it swings from plus to minus).

7. Connect sweep to pin 1 of V2, 2nd sound I-f, -sweep bandwidth approximately 1 mc. with center frequency of 21.25 mc.,-1 volt output.

8. Connect oscilloscope to pin 5 of V3 through 33,000 ohm isolating resistor. If pattern is not symetrical, adjust primary of T102 (top). See Fig. 1.

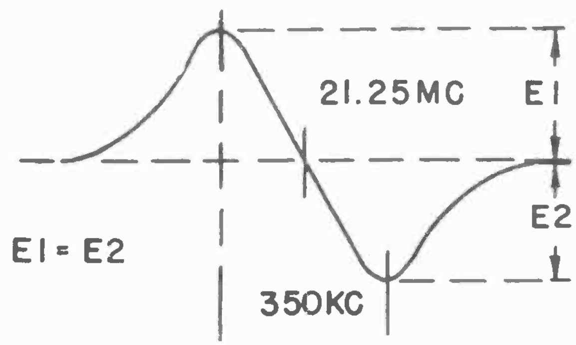


Figure 1

SOUND I-F. Switch Channel Selector to position 14 (kills oscillator).

1. Connect sweep to pin 1 of V1, 1st sound I-f. (Center frequency of 21.25 mc).

2. Connect oscilloscope to point A of T101 through a 33,000 ohm isolating resistor-(Test Point C). (If possible use sweep generator external sweep for oscilloscope horizontal sweep).

3. Insert a 21.25 mc. marker from signal generator into pin 1 of V2. (It is best to couple the marker signal generator loosely--for instance, clipping the generator lead to a chassis point near pin 1 of V2).

4. Adjust top and bottom of T101 for maximum gain and symmetry around marker.

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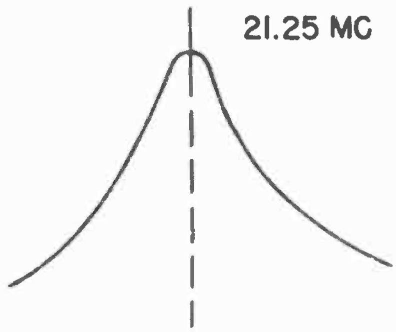

Figure 2

5. Final touch-up of curve should be with sweep input low enough so that the scope reading is not greater than .3 volt peak to peak or greater than .5 volt D-c.

PICTURE I-F TRAPS. Switch Channel Selector to position 14 (Kills oscillator).

1. Connect the voltohymst to junction of R155 and R156-(Test Point D).

2. Remove V12A, AGC Amplifier.

3. Connect a 250,000 ohm potentiometer between pins 5 and 6 of the V12A socket (Note-an old tube base with the 250,000 ohm pot soldered to its pin 5 and 6 is convenient since it can be plugged into the socket just like a tube.) (If the 250,000 ohm potentiometer isn't available, connect the minus terminal of a 4.5V battery to TEST POINT D and the plus terminal to ground).

4. Adjust potentiometer until meter reads (-4.5 volts).

5. Remove converter tube and twist one end of a small piece of wire around pin 1, the grid. Place tube back in socket and connect R-f generator to this wire clip through a small condenser (1500 MMFD).

6. Connect voltohmyst across R134, V10B load resistor (BETWEEN TEST POINTS E AND F). Since both meter leads are now at about minus 120 volts, do not ground meter case or touch it.

7. With a crystal calibrator check the generator setting for each of the following trap frequencies and then adjust each trap for minimum indication on meter:

21.25 mc. T106 (top)
21.25 mc. T108 (top)
27.25 mc. T105 (top)
27.25 mc. T107 (top)
19.75 mc. T104 (top)
19.75 mc. T109 (top)

The correct position of the cores is in the outside end of the form. The core can be run down through the coil for another dip, but in this position the coupling is wrong and overall response will be incorrect.

PICTURE I-F. Switch Channel Selector to position 14 (Kills oscillator).

1. Signal generator on converter grid as in trap adjustment.

2. Set generator to following and adjust transformers for peak reading on meter which is still across R134 (BETWEEN TEST POINTS E AND F).

22.65 mc.	T109 (bottom)	- - -	output of V9, 4th Pix I-F
24.8 mc.	T107 (bottom)	- - -	output of V8, 3rd Pix I-F
21.95 mc.	T106 (bottom)	- - -	output of V7, 2nd Pix I-F
26.3 mc.	T105 (bottom)	- - -	output of V6, 1st Pix I-F

3. Reduce input signal during alignment if overloading is indicated by very broad peak.

4. Overcoupled T1 and T104 (bottom) must be aligned by sweep.

5. Connect 330 ohm resistor (composition) across the primary coils of T105, T106, T107, T109.

6. Connect the oscilloscope to pin 1 of V11A, the 1st video amplifier plate, through 33,000 ohm isolating resistor (TEST POINT G).

7. Connect voltohmyst to the junction of R155 and R156 (TEST POINT D), and adjust the potentiometer (step 3 of trap adjustments) to minus 2 volts.

8. Connect a sweep generator (set to sweep from 20 mc. to 30 mc.) to the converter grid, through a 1500 MMFD condenser.

9. Adjust T1 and T104 for the following response:

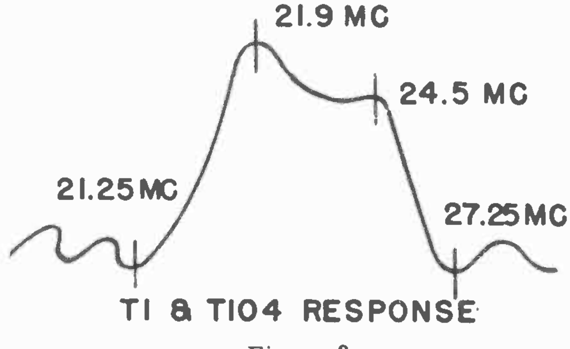

Figure 3

10. Remove the 330 ohm resistors.

11. It will be necessary to touch up the I-f adjustments to get the shown over-all response (Fig. 4).

NOTE: A defective V10B will cause a bad dip in the curve.

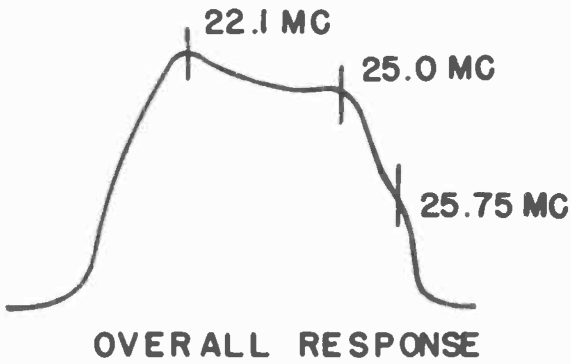

Figure 4

12. Adjust the bias pot for a 15 volt peak to peak signal on the scope (pin 1 of V11A). The measured bias should now be minus 4.5 volts or less.

NOTE: To see the response of any single stage, follow steps 5, 6, 7, 8 except remove the 330 ohm resistor on the particular stage to be observed.

13. Remove bias potentiomenter and replace V15.

14. Remove clip from converter grid and replace tube in socket.

NOTE: Picture I-f oscillation can occur in a receiver that is badly misaligned and will show up as a voltage across R134, the video detector load resistor, that is unaffected by R-f input. By approximating the core positions of T104, T105, T106, T107, T108, and T109 as compared to those in a correctly aligned receiver, the oscillation may stop. If still existing, try increasing the bias on V6 and V8. If these attempts fail, shunt the grids of V8, V7, V6 to ground with a 1,000 MMFD capacitor, connect the signal generator to the grid of V9, and align T109. Progressively remove the shunts and align each I-f stage working back to T104. If oscillation is still present, it is not due to misalignment--therefore, an individual component and voltage check must be made in the I-f section.

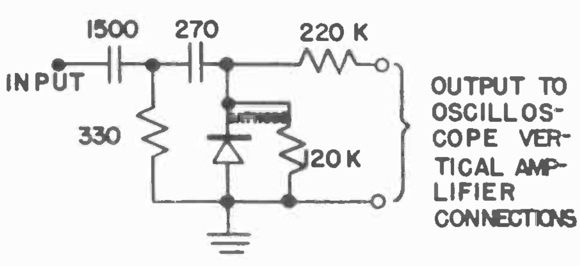

Figure 5

AN ALTERNATE METHOD OF SWEEP ALIGNMENT OF T1 AND T104 AND PICTURE I-F.

1. Adjust the bias at the junction of R155 and R156 (TEST POINT D) to minus 1.5 volts. (See bias adjustment of Step 3 on PICTURE I-F Traps).

2. Connect the detector input to pin 1 of V7 (See Figure 5).

3. Connect a sweep generator (sweep from 20 mc to 30 mc.) to the converter grid through a 1500 MMFD condenser.

4. Adjust T1 and T104 for the response of Fig. 3.

5. Remove the detector from the scope-input lead.

6. Connect the oscilloscope to pin 1 of V11A (TEST POINT G).

7. Overall I-f response should be as in Fig. 4. Markers should locate as shown.

NOTE: To see the response of any single stage, connect the sweep generator output to the input of the stage to be observed and the input terminal of Figure 5 to the output of the following stage.

FREQUENCY TABLE.

Channel No.	Band Width (mc.)	Picture Carrier (mc.)	Sound Carrier (mc.)	R-F Osc. (mc.)
2	54-60	55.25	59.75	81
3	60-66	61.25	65.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

R-F OSCILLATOR ALIGNMENT. Use non-metallic screw driver.

The oscillator adjustment screws are reached from the front of the tuner through the numbered holes around the channel switch. A few turns of the alignment screw on any channel can be made without concern for the effect on other channels, since for slight adjustments the channels are substantially independent. Channels 8 and 7 are affected by large screw displacement on channels 6 and 5.

The range of electrical effect for the screws is 7 turns from tight. Further turns may cause the coil sleeve to drop out on the high channels.

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The following is for complete R-F Oscillator alignment:

1. Set fine tuning trimmer at mid-point as accurately as possible.

2. Set all oscillator alignment screws 4 turns from tight.

3. Align channel 6 as follows:

   a. Connect a voltohmyst to pin 5 of V3 (discriminator output) (TEST POINT B).

   b. Feed channel 6 sound carrier (87.75 mc.) into antenna terminals. (See Frequency Table).

   c. Adjust channel 6 oscillator screw for zero voltage on voltohmyst. This actually indicates the center frequency of the "S" curve, so obviously the discriminator must first be known to be correctly aligned before R-F oscillator alignment can be made using this method.

4. Follow step 3 for channels 5 through 2 in that order.

5. Follow step 3 for channels 7 through 13 in that order.

6. Re-check channels 6 through 2 in that order -touch up if necessary.

7. Re-check channels 13 through 2 in that order-touch up if necessary.

NOTE: If on the high channels the adjustment screw has insufficient range, physical movement of the coils can be made with care for increasing or decreasing inductances.

R-F AND CONVERTER ALIGNMENT. Due to very close design these should require no future adjustments so no provisions have been made for such.

HORIZONTAL OSCILLATOR ALIGNMENT.

1. Turn the Channel Selector to a station.
2. Turn the Horizontal Hold Control Maximum clockwise.
3. Turn the Horizontal Lock Adjustment to almost tight.
4. Connect the oscilloscope to terminal "C" of T112.

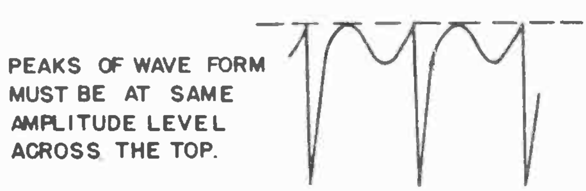


Figure 6

5. Turn the T112 Blocking Waveform Adjustment maximum counter-clockwise.
6. Sync the picture by adjusting the Horizontal Frequency Adjustment Screw of T112.
7. Turn the Blocking Waveform Adjustment until the waveform is correct as in Figure 6.
8. Adjust the T112 Frequency Adjustment so that the picture just breaks syncs (the ideal is to have a wide vertical black bar representing horizontal blanking showing somewhere in the picture).
9. Turn the Horizontal Hold maximum counter-clockwise. If picture doewn't break sync, turn the Station Selector off-channel and then back. Picture will now be out-of-sync.
10. Turn the Horizontal Hold Control slowly clockwise and count the diagonal black bars just before "pull-in."
11. There should be 3 bars---adjust Horizontal Locking Range until only 3 bars are present before "pull-in".
12. Turn Horizontal Hold Control maximum clockwise. Picture should just break sync as in Step 8.
13. Adjust T112 Frequency Adjustment to obtain condition of Step 8.
14. Repeat steps 8 thru 12 if necessary to obtain conditions of Steps 8 and 11.

DRIVE, LINEARITY, WIDTH ADJUSTMENTS.
The Drive Control, C186A, will have greatest effect on the left side of the picture---stretching or compressing.

The Linearity Control, L116, will have greatest effect on the right side of the picture.

The Width Control L115, adjusts the horizontal width of the raster to compensate for line voltage variations. On the 12 1/2 in. and 16 in. chassis a switch is provided for disconnecting the Width Control, L115, for the condition of maximum width.

4.5 MC. TRAP ADJUSTMENT

1. Tune in a strong station.
2. De-tune the Fine Tuning slightly from best sound.
3. Adjust L105 to eliminate any 4.5 Mc. beat pattern that may appear in the picture.

CRITICAL LEAD DRESS ON CHASSIS TE-272-1 AND TE-272-2 AND TE-276.

1. All by-pass condenser leads on the I-f strip as short as possible.
2. Short lead between body of R111 and pin 5 of V3.
3. Do not re-route bus wire from pin 2 of V2.

4. Filament leads between V3, V4, V5 keep down to chassis and away from grid and plate leads.

5. All leads crossing I-f circuits should be held close to chassis. Movement of such leads could change alignment.

6. Pix I-f coupling capacitors must be away from the chassis. Moving these will affect alignment.

7. All peaking coils should be held away from chassis.

8. Green lead from pin 2 of V11, white-orange lead from pin 8 of V11 away from chassis.

9. Blue lead from pin 5 of V4 close to chassis.

10. C124, C125 away from chassis.

11. R213, R214, R220, R221, R222, R219 should have long leads and held up and away from tube sockets and chassis.

12. Keep leads from L115 (width control) away from transformer frame.

13. Dress filament leads from horizontal transformer T113 away from chassis.

14. Dress lead from top cap of 6BG6 tube away from frame of transformer.

15. Dress lead from top cap of 1B3GT away from chassis.

16. Dress red lead from lug 4 of T113 down against chassis underneath bus wire from chassis to terminal strip to hold it in place.

17. C203 leads should be as short as possible (parasitic oscillations can occur with long leads).

18. White-orange lead from pin 8 of V11 dressed away from the volume control terminals and components.

NOTES ON SERVICING

No Raster.
1. Check ion trap adjustment.
2. Check Brightness Control, R120.
3. Check Hi-Voltage.
   a. Defective V16, V17, V18, or V19.
   b. Open Horizontal Deflection Coils.
   c. Defective C181.
   d. Defective picture tube.

One Vertical Line Only On Picture Tube.
1. No horizontal sweep.
   a. Defective Horizontal Deflection Coils.

Picture Very Narrow (1/2 in. wide or so) in the Center of Tube.
1. Defective Horizontal Output Transformer, T113.

One Horizontal Line Only On the Picture Tube.
1. No vertical sweep.
   a. Defective V14 or V15 or circuits.
   b. Defective Vertical Deflection Coils.

Not Enough Width.
1. Low line voltage.
2. Change V17.
3. Check C188.

Horizontal Linearity Poor Beyond Adjustment.
1. Change V17.
2. Check C183, L116, C182, C184, C185.
3. Check T113.

Vertical Linearity Poor Beyond Adjustment.
1. Check C176B, C175.
2. Defective T111.

Vertical Retrace Lines Showing (Brightness Control Does Not Correct.)
1. Defective T111.

Bright Horizontal Line In the Picture Which Is Moved By the Height Control.
1. Defective V15.

Wide Vertical Black Bar Dividing Picture.
1. High Resistance Short of C167.

No AGC--Possible Negative Picture.
1. Shorted C160.

Very Snowy Picture - No AGC.
1. Shorted C157.

Sound and Raster But No Picture.
1. Check I-F String.
2. Check V10B, V11.

Picture But No Sound.
1. Check T106 Trap.
2. Check V1, V2, V3, V4, V5.
3. Check Speaker.

No Vertical Sync.
1. Check R177, C170, R178, C171, R179, C172.
2. Check C173.

No Horizontal Sync.
1. Check C169.
2. Check V16A and Horizontal Alignment.

Poor Resolution.
1. Check L103, L104, L107, L106.
2. Check I-F Alignment.
3. Check C138, C139.
4. Check D-C Voltages in Video Circuit.

Black Horizontal Bars Moving With Sound.
1. Microphonic tube in tuner.
2. Check sound trap alignment.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Noblitt-Sparks, ARVIN

TE 272-1 TE 272-2

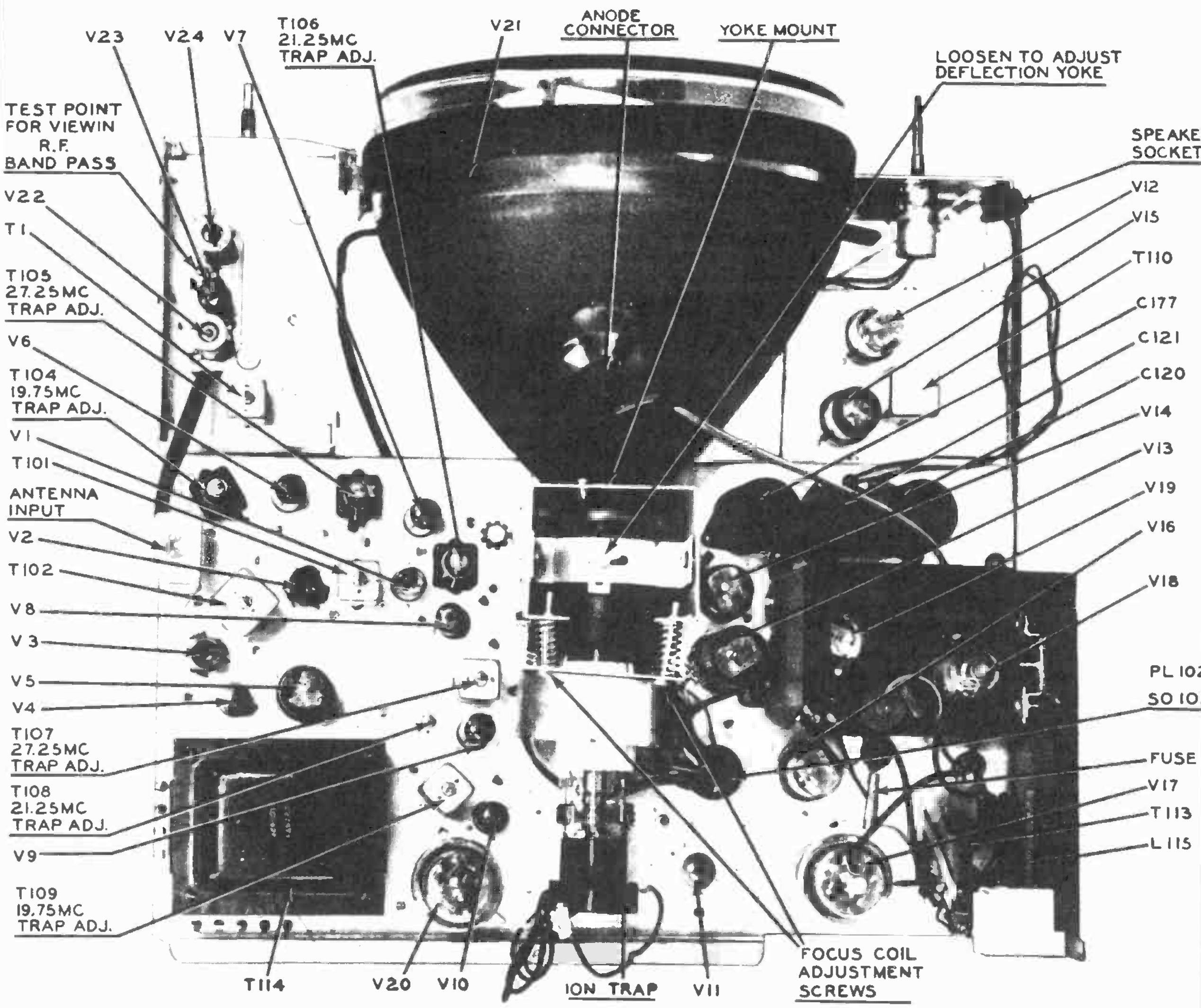
RESISTANCE CHART

	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
V1	0	0	0	0	6 K	5.6K	82	—
V2	22 K	0	0	0	5.5 K	18 K	0	—
V3	—	100 K	2.0	0	200 K	0	100 K	—
V4	10 MEG	0	0	0	140K	140K	350 K	—
V5	—	0	6.5 K	6.2 K	500K	—	0	1.7 K
V6	6.7 K	39	0	0	6 K	6 K	39	—
V7	10K	68	0	0	6 K	6 K	68	—
V8	5.5 K	39	0	0	11.5 K	5.5 K	39	—
V9	0	150	0	0	14 K	5.5K	150	—
V10	1 K	3.9MEG	0	0	540	0	6.8 K	—
V11	5.6 K	6.8 K	1.2 K	0	0	19 K	3.2 K	5.7K
V12	2.1MEG	1 MEG	1.1 K	350 K	19 K	540	0	0
V13	200K	30 K	350 K	11 K	8 K	93 K	0	0
V14	900 K	20 K	0	3.9MEG	5.5 K	7.5 K	0	0
V15	—	0	7 K	7K	2.2MEG		0	
V16	900K		300 K	250 K	300K	1.1 K	0	0
V17	CAP 220K	0	1.2K	—	1 MEG	12 K	0	12.5K
V18	CAP 220K	INF.	—	INF.	—	—	INF.	—
V19	—	—	220 K	—	5.5K	—	0	0
V20	—	5.5 K	—	1.1 K	—	1.1 K	—	5.5 K
V21	0	1.1MEG	PIN 10 300 K	PIN 11 3.5 K	PIN 12 0	—	—	—
V22	140 K	0	0	0	15 K	38 K	0	—
V23	1.1 MEG	0	0	0	5.8 K	87 K	0	—
V24	13 K	—	0	0	13 K	22K	470	—

TE 276

RESISTANCE CHART

	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
V1	0	0	0	0	6 K	5.6 K	82	—
V2	22 K	0	0	0	5.5 K	18 K	0	—
V3	—	100K	2.0	0	200K	0	100K	—
V4	10MEG	0	0	0	140K	140K	350K	—
V5	1700	0	6.5K	6.2K	500K	—	0	1.7 K
V6	6.7 K	39	0	0	6 K	6 K	39	—
V7	10 K	68	0	0	6 K	6 K	68	—
V8	5.5 K	39	0	0	11.5 K	5.5 K	39	—
V9	0	150	0	0	14 K	5.5K	150	—
V10	1 K	3.9MEG	0	0	540	0	6.8 K	—
V11	5.6 K	6.8 K	1.2 K	0	0	19 K	3.2 K	5.7 K
V12	2.1MEG	1 MEG	1.1 K	350K	19K	540	0	0
V13	200K	30 K	350 K	11 K	8 K	93K	0	0
V14	900K	20K	0	3.9MEG	5.5K	7.5K	0	0
V15	—	0	7 K	7 K	2.2MEG		0	
V16	900K		300K	250K	300K	1.1 K	0	0
V17	CAP 220 K	0	1.2K	—	1 MEG	1.2K	0	12.5K
V18	CAP 220K	INF.	—	INF.	—	—	INF.	—
V19	—	—	220 K	—	5.5 K	—	0	0
V20	—	5.5K	—	1.1 K	—	1.1 K	—	5.5 K
V21	0	1.1MEG	PIN 10 300K	PIN 11 13 K	PIN 12 0	—	—	—
V22	140K	0	0	0	15 K	39 K	0	—
V23	1.1MEG	0	0	0	5.8 K	87 K	0	—
V24	13 K	—	0	0	13 K	22 K	470	—
V25	—	5.5 K	—	1.1K	—	1.1K	—	5.5 K
V26	CAP INF	INF	—	INF	—	—	INF	—



Chassis Top View TE 272-1, TE 272 -2

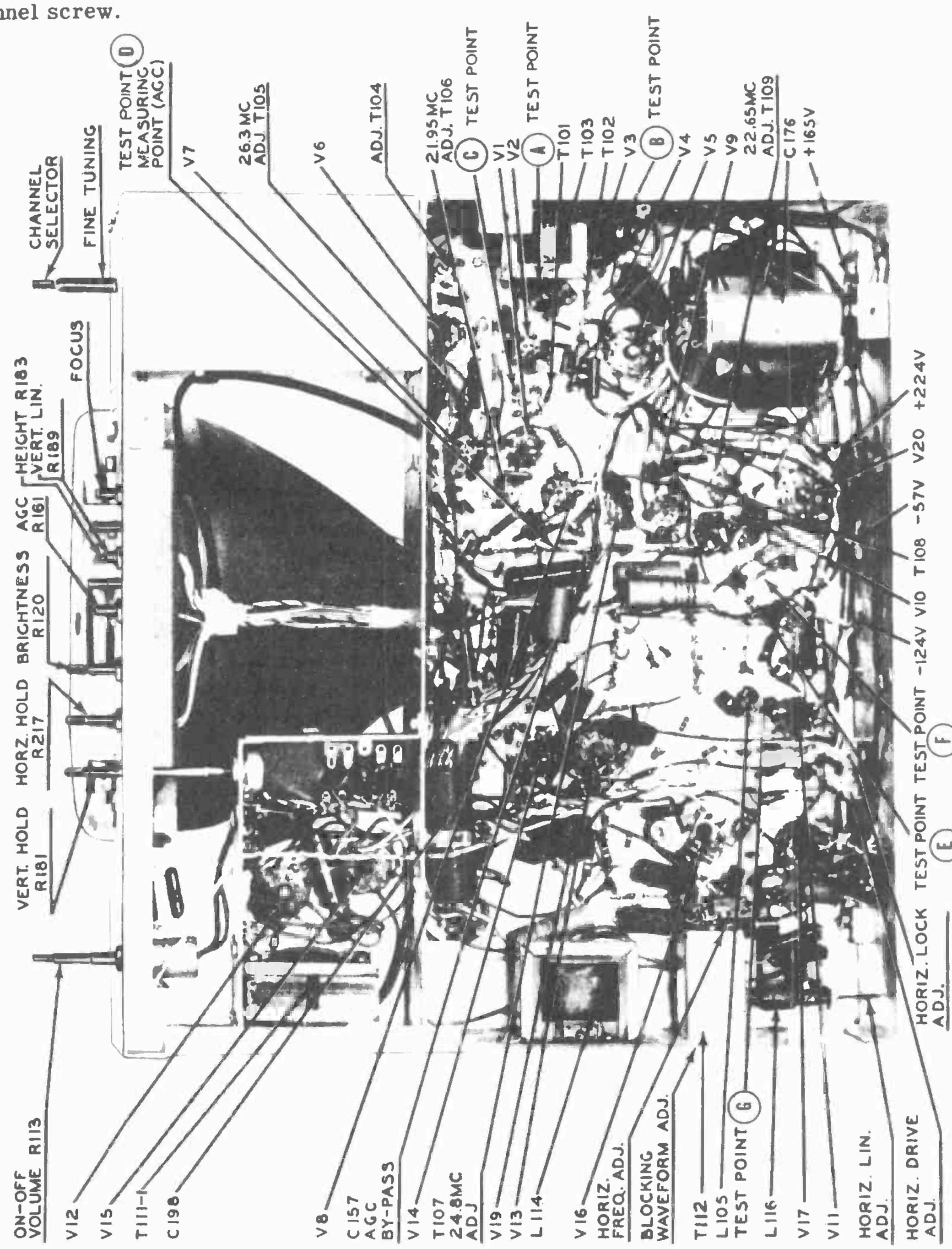
Noblitt-Sparks, ARVIN

OSCILLATOR TOUCH-UP. All channels should come in best with the same approximate setting of the Fine Tuning Control.

If necessary, improvement of the setting on any channel can be made by slight adjustment of the oscillator screw for the particular channel. Remove the Station Selector Knob, Fine Tuning Knob, and Channel Escutcheon (slide the Escutcheon Spring to one side to free the Escutcheon). The numbered oscillator adjustment screws in the tuner can now be seen. Use an insulated screw driver and adjust the desired channel screw.

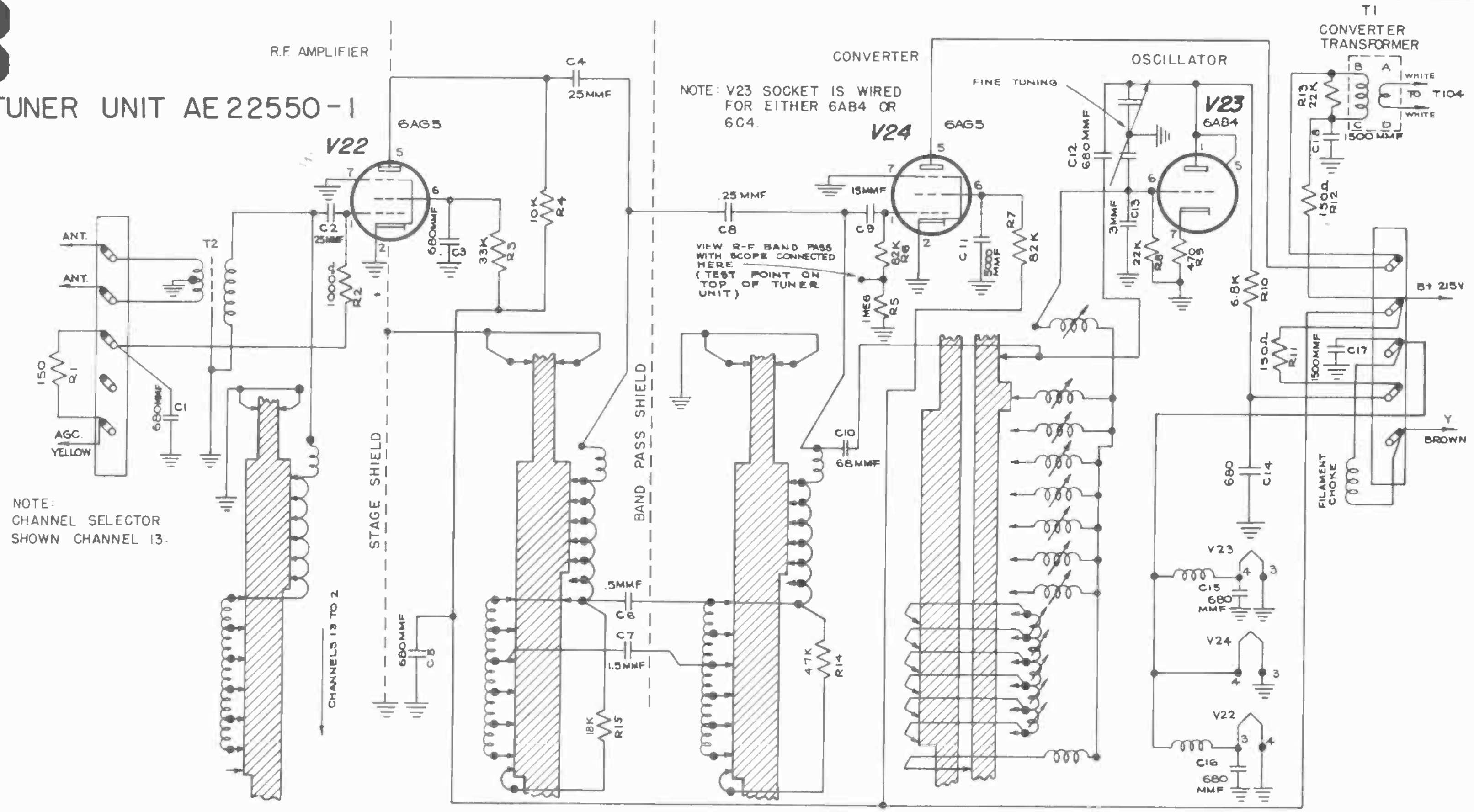
16" PICTURE TUBE WARNING

THE METAL CONE OF THE 16 IN. PICTURE TUBE SERVES AS THE HI-VOLTAGE ANODE HAVING 12.5 KV ON IT. USE EXTREME CAUTION WHEN OPERATING OUTSIDE OF CABINET AND DO NOT REMOVE THE PROTECTIVE HI-VOLTAGE SLEEVE COVER.



Chassis Bottom View TE 272-1, TE 272-2

TUNER UNIT AE 22550-1



CIRCUIT DIAGRAM NOTES

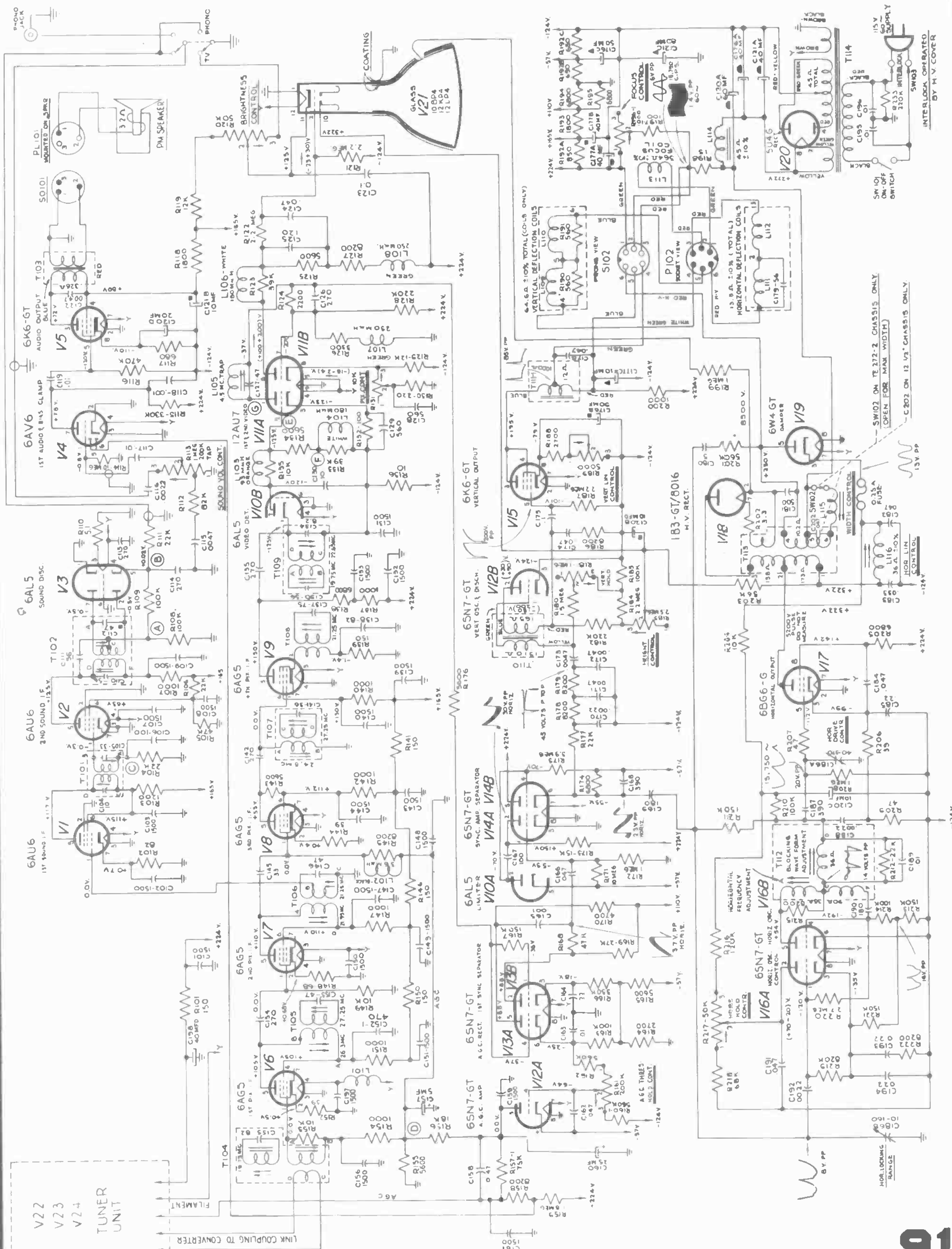
1 ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
2 FOR RESISTANCE AND DC VOLTAGE MEASUREMENTS SET THE AGC THRESHOLD AND BRIGHTNESS CONTROLS MAXIMUM COUNTERCLOCKWISE AND VOLUME CONTROL CLOCKWISE.
3 RESISTANCES SHOWN ARE IN OHMS K=1000.
4 CAPACITANCE VALUES LESS THAN 1 ARE IN MFD AND MORE THAN 1 IN MMFD.
5 DC VOLTAGES BETWEEN TUBE PINS AND CHASSIS ARE READ WITH VOLTOHMYST USING A 100 K OHM ISOLATING RESISTOR ON THE PROBE - ANTENNA TERMINALS SHORTED - LINE VOLTAGE 117V, 60~.
6 PIN VOLTAGES AFFECTED BY HORIZONTAL AND VERTICAL CONTROLS ARE TYPICAL FOR A PICTURE ADJUSTED TO SYNC AND LINEARITY.
7 PIN VOLTAGES AFFECTED BY PICTURE CONTROL, R131, ARE SHOWN WITH ARROWS GIVING APPROXIMATE RANGE OF VOLTAGE EFFECTED.
8 OSCILLATOR INJECTION VOLTAGE MEASURED FROM THE TUNER TEST POINT TO CHASSIS IS APPROXIMATE 1.8 V ON ALL CHANNELS.
9 WITH THE CONDITION OF A SNOWFREE PICTURE, AGC SET PROPERLY, AND PICTURE IN SYNC THE BIAS ON PIN 2, V11A, SHOULD BE ABOUT -2.4 V, THE DETECTED VIDEO SIGNAL SHOULD BE ABOUT 3.7 V PP, AND FOR WAVESHAPES USE OSCILLOSCOPE WITH 100,000 CYCLE VERTICAL RESPONSE AND USE A 100K OHMS ISOLATING RESISTOR ON SCOPE LEAD.

NOTED CHASSIS DIFFERENCES IN EARLY PRODUCTION-IN SOME CHASSIS.

1 C152 WAS 1500 MMFD.
2 R160 WAS 470K OHMS.
3 T111 WAS A 4 TERMINAL TRANSFORMER AND C178 CONNECTED TO GROUND.
4 R157 WAS 120K OHMS.
5 R198 WAS 10 OHMS (15 OHMS IMPROVES CENTERING)
6 NO PHONO JACK AND PHONO SWITCH WAS USED.
7 R197 WAS 330 OHMS AND R196 WAS 2250 OHMS (10"& 12" CHASSIS ONLY)

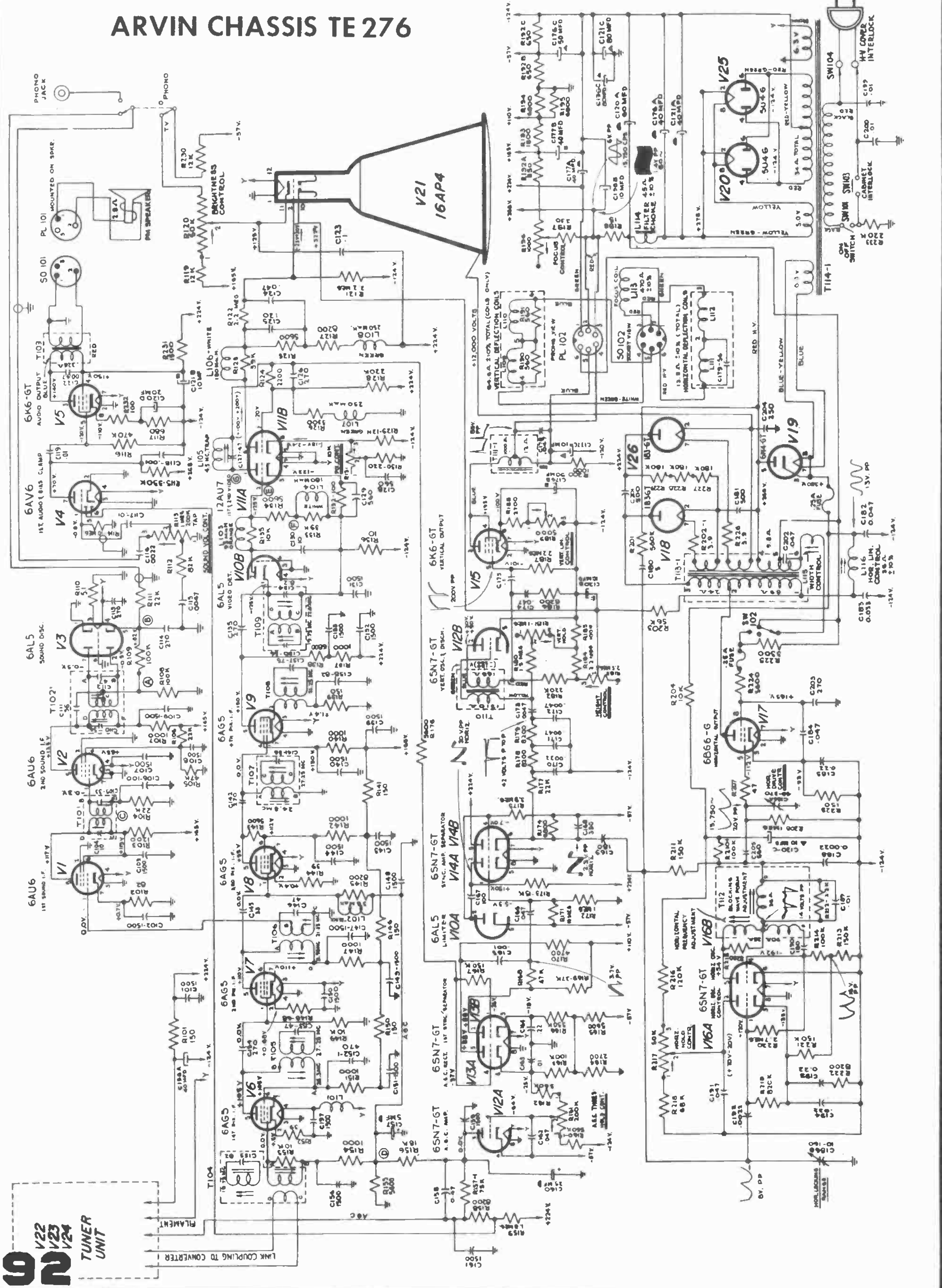
MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

ARVIN CHASSIS TE 272-1 TE 272-2



MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

ARVIN CHASSIS TE 276



MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

PHILCO TELEVISION RECEIVER MODELS

50-T1104, 50-T1105, 50-T1106, 50-T1400, 50-T1401, 50-T1402, 50-T1430

The various Philco Television receiver models listed above differ somewhat from each other. In some cases the differences may be in the cabinet style, in others there may be minor circuit changes. Of some models there may have been several production runs with minor changes. The circuit diagram on page 96A is absolutely correct for Models 50-T1400, 50-T1401, 50-T1402, and 50-T1430, all of run 5, but will be useful when servicing any of the above listed models. At the time of publication, material on additional models 50-T1403, 50-T1404, 50-T1405, and 50-T1406, has not been released, but we understand that these models also will be similar. The data on Philco Television receivers presented in this manual is presented through the courtesy of the Philco Corporation, and is reproduced from various manuals published by the Philco Corporation.

I-F ALIGNMENT

During alignment, the signal-generator output should be attenuated to keep the video-output indication below 2 volts, peak-to-peak, and the FM-detector-output indication below .5 volt, peak-to-peak.

Never disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.

Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.

Insert a 10,000-ohm resistor in series with the oscilloscope lead.

If additional attenuation of the marker signal is required when using Model 7008 Visual Alignment Generator, insert a 10,000-ohm resistor in series with the output lead.

Set the CONTRAST control fully counterclockwise, set the VOLUME control for an audible signal, set the BRIGHTNESS control to give a dim raster, and set the FINE TUNING control to the center of its range.

Preset the adjustments as follows:

(a) C32A and C32B fully clockwise.

(b) TC27 fully counterclockwise.

(c) TC20, TC19, and TC14 so that the top of the adjusting screw is approximately 5/8 inch from the top of the coil mount.

It is possible to achieve optimum adjustment of all tuning cores when the tops of the adjusting screws are approximately 1/4 inch above the coil mounts, and also when the tops of the adjusting screws are approximately 3/4 inch above the coil mounts. When aligning the receiver, the tuning cores should be adjusted so that the tops of the adjusting screws are approximately 3/4 inch above the coil mounts.

NOTE: When using a separate AM r-f signal generator to obtain marker pips, couple the output lead of this generator to the output lead of the FM generator, using just sufficient coupling to obtain a suitable pip.

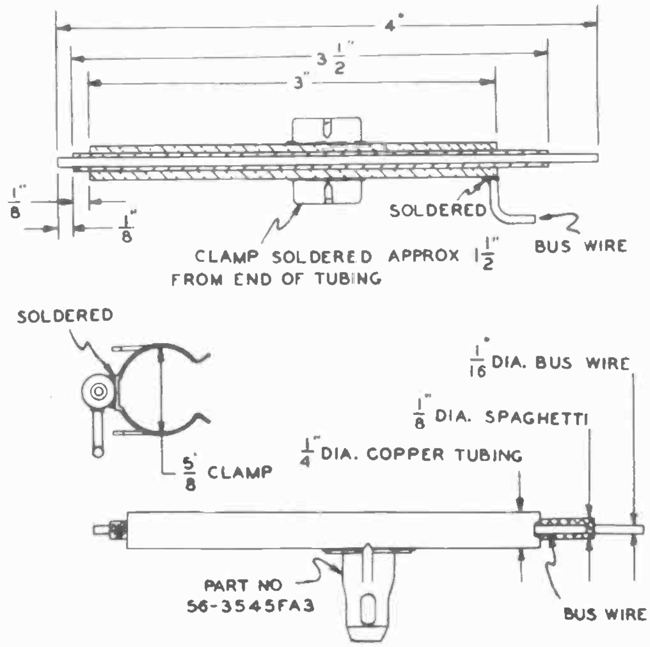


Figure 2. I-F Alignment Jig

FREQUENCY RANGE—Television Channels 2 to 13 inclusive

INTERMEDIATE FREQUENCY

Video Carrier — 26.6 mc.

Sound Carrier — 22.1 mc.

AERIAL—Provisions for either single-aerial or dual-aerial installation. (Either single dipole, with or without reflector, or stacked array, depending upon location and signal strength, may be used.)

TRANSMISSION LINE—300-ohm, twin-wire leadin (balanced) or 72-ohm coaxial cable (unbalanced) in areas of high interference.

Philco 50-T1104, -T1105, -T1106, -T1400, -T1401, -T1402, -1430

I-F ALIGNMENT CHART

STEP	SIGNAL-GENERATOR CONNECTION	OUTPUT-INDICATOR CONNECTION	SIGNAL-GENERATOR SETTING	ADJUSTMENT INSTRUCTIONS
1	Connect output of AM signal generator through i-f jig to grid (pin 1) of 4th video-i-f tube.	Connect vertical input of oscilloscope through ALIGN TEST jack adaptor (figure 3) to ALIGN TEST jack J4.	Set AM signal generator (modulated) to 26.25 mc.	Adjust TC22 for maximum indication on oscilloscope.
2	Connect output of AM signal generator through i-f jig to grid (pin 1) of 3rd video-i-f tube.	Same as step 1.	Set AM signal generator (modulated) to 24 mc.	Adjust TC21 for maximum indication on oscilloscope.
3	Same as step 2.	Same as step 1.	Set AM signal generator (modulated) to 25.5 mc.	Adjust TC19 for maximum indication on oscilloscope.
4	Connect output of AM signal generator through i-f jig to grid (pin 1) of 2nd video-i-f tube.	Same as step 1.	Set AM signal generator (modulated) to 23.25 mc.	Adjust TC18 for maximum indication on oscilloscope.
5	Connect output of AM signal generator through i-f jig to grid (pin 1) of 1st video-i-f tube.	Same as step 1.	Set AM signal generator (modulated) to 26 mc.	Adjust TC17 for maximum indication on oscilloscope.
6	Connect output of AM signal generator through mixer jig to grid (pin 1) of mixer tube.	Same as step 1.	Set AM signal generator (modulated) to 28.1 mc. (See Note 1.)	Turn CHANNEL SELECTOR to Channel 3. Adjust TC23 for minimum indication on oscilloscope.
7	Same as step 6.	Same as step 1.	Set AM signal generator (modulated) to 22.1 mc. (See Note 1.)	Turn CHANNEL SELECTOR to Channel 3. Adjust TC14 for minimum indication on oscilloscope. If no minimum is apparent, turn TC14 counterclockwise until the response increases rapidly. Turn TC14 clockwise to the point just before the response increases; then adjust TC20 for minimum indication on oscilloscope.
8	Same as step 6.	Same as step 1.	Set AM signal generator (modulated) to 25 mc.	Adjust TC13 for maximum indication on oscilloscope.
9	Connect outputs of AM and FM signal generators through mixer jig to grid (pin 1) of mixer tube.	Same as step 1.	Set FM signal generator to 25 mc. ±4 mc. deviation. Set AM signal generator (unmodulated) to 23.25 mc., 23.7 mc., 25.8 mc., and 26.6 mc., as required, to produce marker pips.	Turn CHANNEL SELECTOR to Channel 3. Adjust TC27 for response curve within limits of curve in figure 5. It may be necessary to readjust TC13, TC27, TC17, TC18, TC21, TC19, and TC22, in order to obtain this curve. (See Note 2.)
10	Same as step 9.	Connect vertical input of oscilloscope to pin 1 of FM TEST jack J3.	Set FM signal generator to 22.1 mc. ±1 mc. deviation. Set AM signal generator (modulated) to 22.1 mc.	Adjust C32A and C32B slightly counterclockwise until indication is observed on oscilloscope.

11	Same as step 9.	Same as step 10.	Same as step 10.	Adjust TC16 for minimum amount of AM indication. (See Note 3.) Adjust TC15 for symmetrical pattern (equal peaks) within limits of curve in figure 6.
12	Connect output of FM signal generator through mixer jig to grid (pin 1) of mixer tube.	Same as step 10.	Set FM signal generator to 22.1 mc. ±1 mc. deviation.	Adjust C32A and C32B for maximum peaks and symmetry of pattern.
13	Connect output of AM signal generator through mixer jig to grid (pin 1) of mixer tube.	Connect vertical input of oscilloscope through ALIGN TEST jack adaptor (figure 3) to ALIGN TEST jack J4. Connect v.t.v.m. (0—10v range) through FM TEST jack adaptor (figure 4) to FM TEST jack J3.	Set AM signal generator (modulated) to 22.1 mc. (minimum indication on oscilloscope).	When indication on oscilloscope is minimum, v-t-v-m reading should be zero. If reading is not zero, adjust TC16. If adjustment requires more than one-half turn, repeat step 11.

NOTE 1: When adjusting TC23, TC14, and TC20, the vertical gain control of the oscilloscope should be set at maximum and the input signal should be as low as possible.

NOTE 2: If readjustment of the tuning cores is necessary to obtain a response curve within the limits of figure 5, the following information may be used to find the adjustment required.

TC13 affects the low-frequency slope.
TC27 affects the high-frequency slope.
TC17 affects the bandwidth and carrier setting.
TC18 affects the amplitude and the low-frequency slope.

TC21 affects the flat-top response.
TC19 affects the amplitude of the high-frequency slope.
TC22 affects the high-frequency slope.
TC23, TC20, and TC14 should not be readjusted.

NOTE 3: The AM signal will appear as a series of sine waves superimposed on the FM-detector curve.

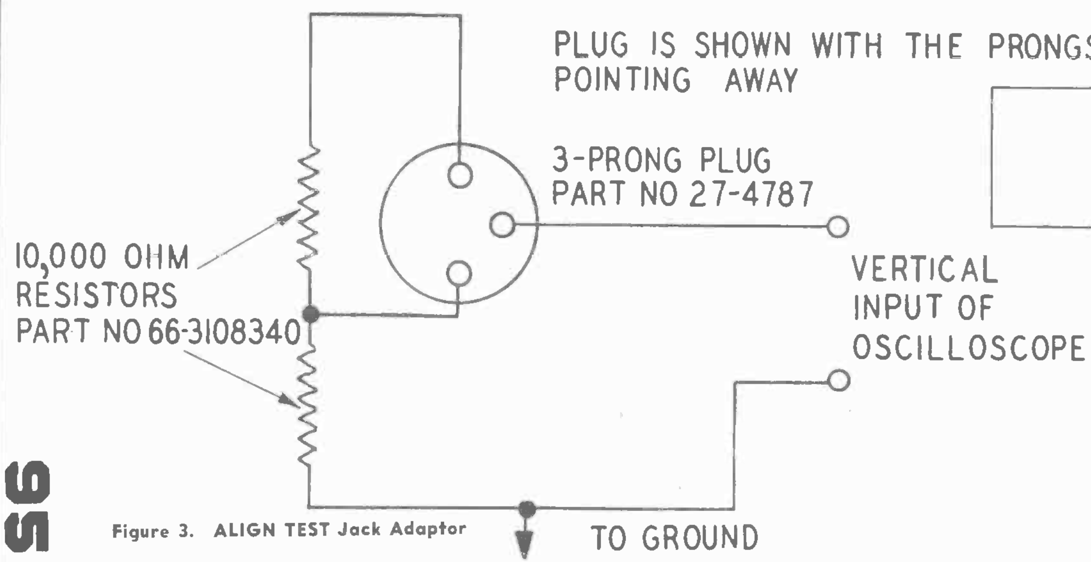


Figure 3. ALIGN TEST Jack Adaptor

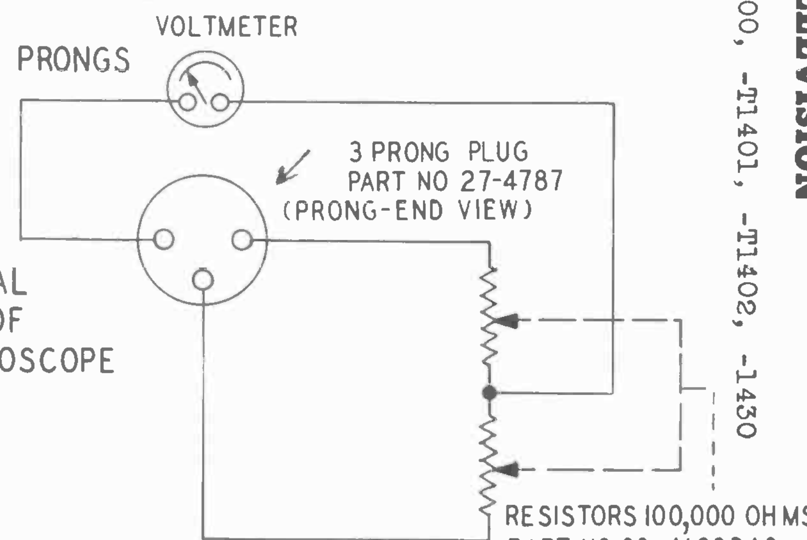


Figure 4. FM TEST Jack Adaptor

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Philco 50-T1104, -T1105, -T1106, -T1400, -T1401, -T1402, -1430

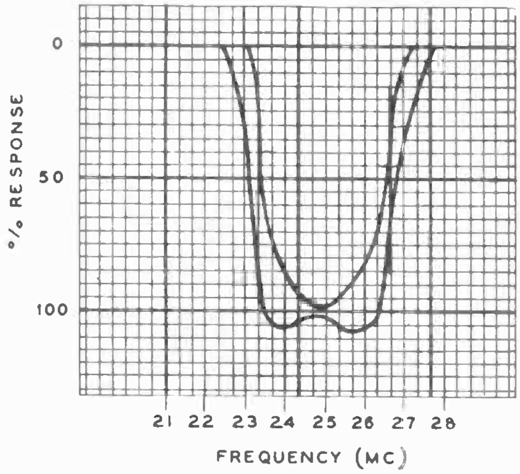


Figure 5. Over-all Video-I-F Response Curve

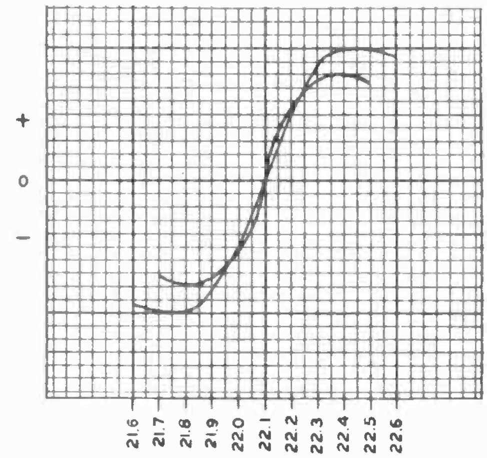


Figure 6. FM-Detector Curve

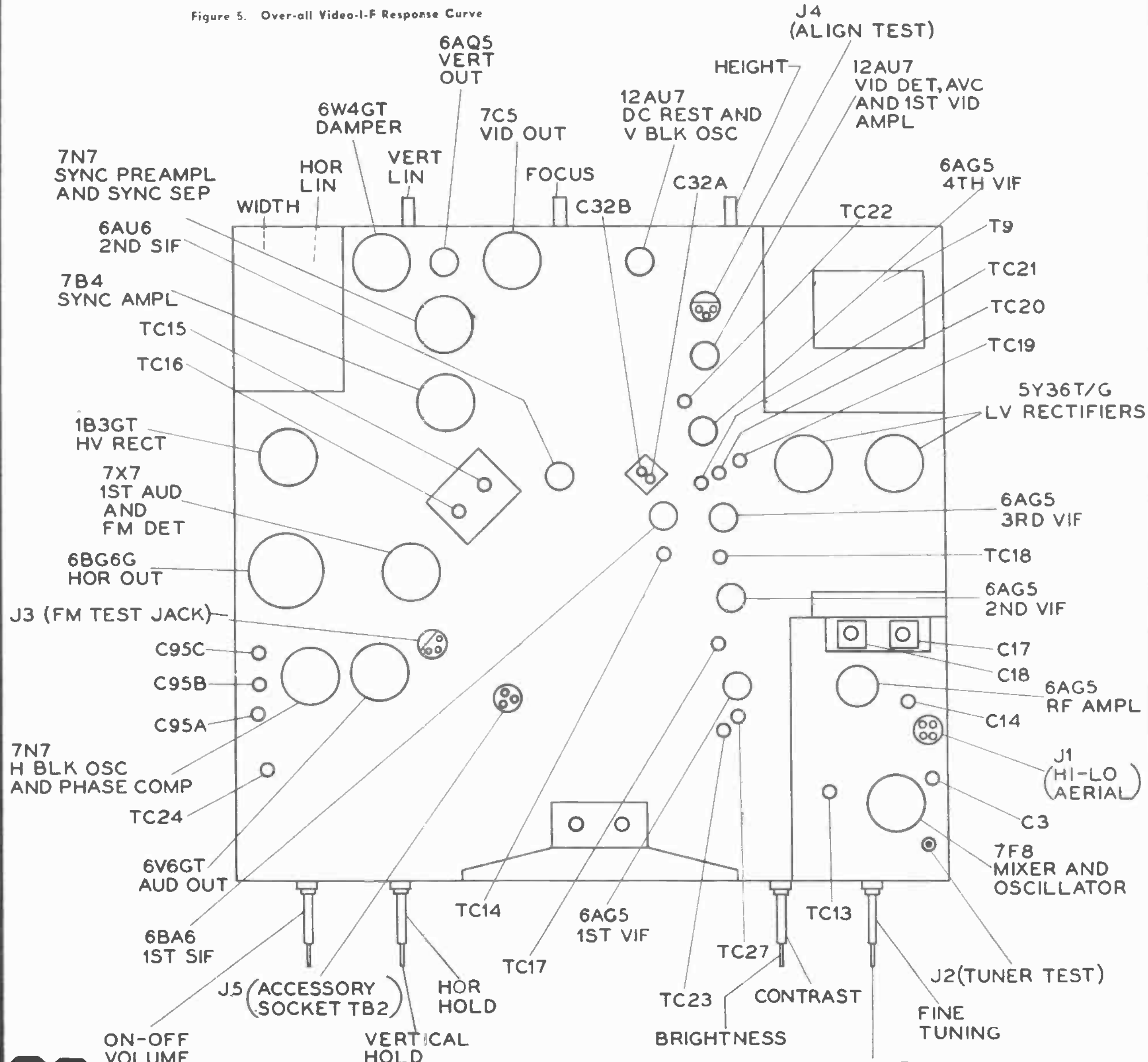
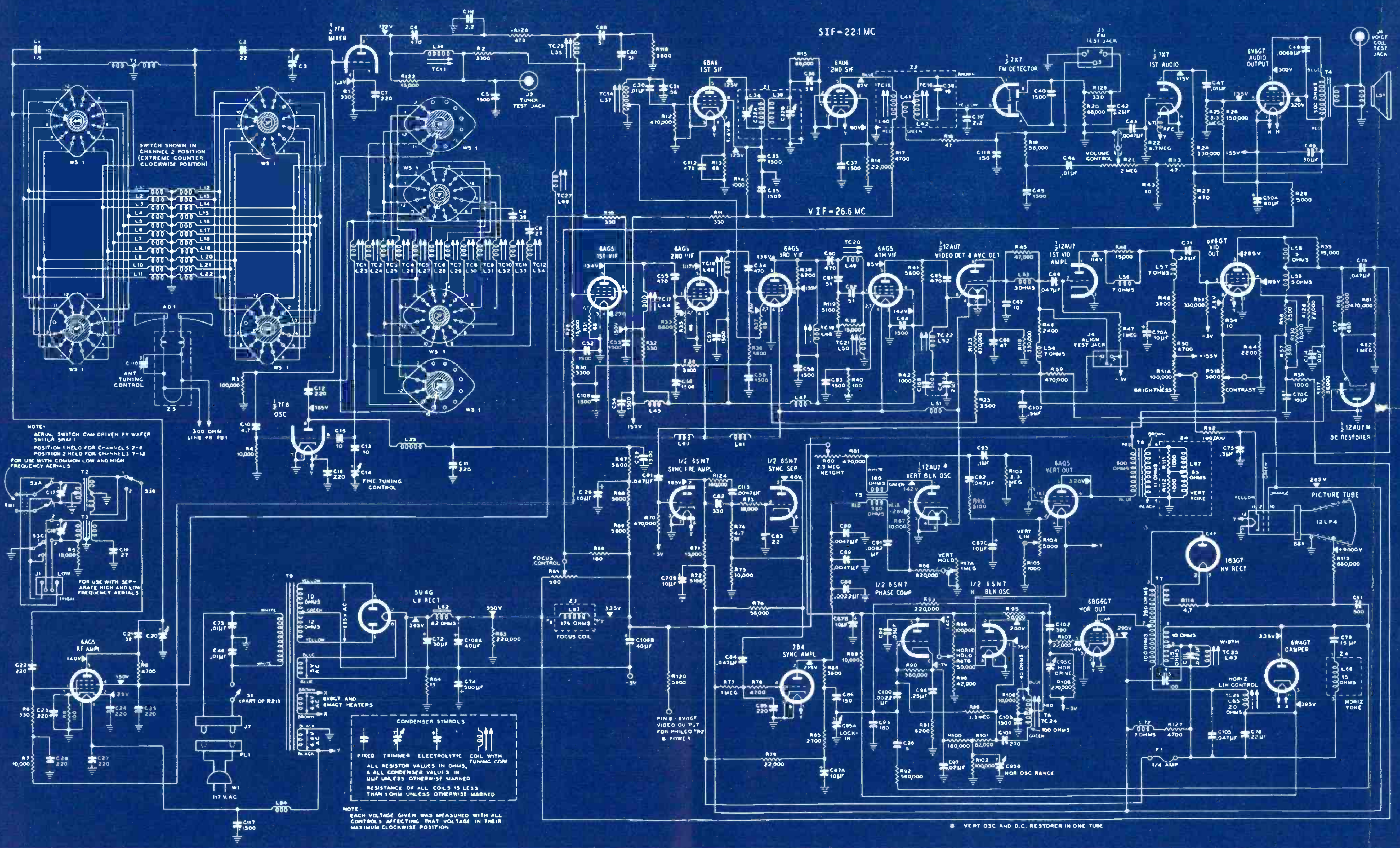
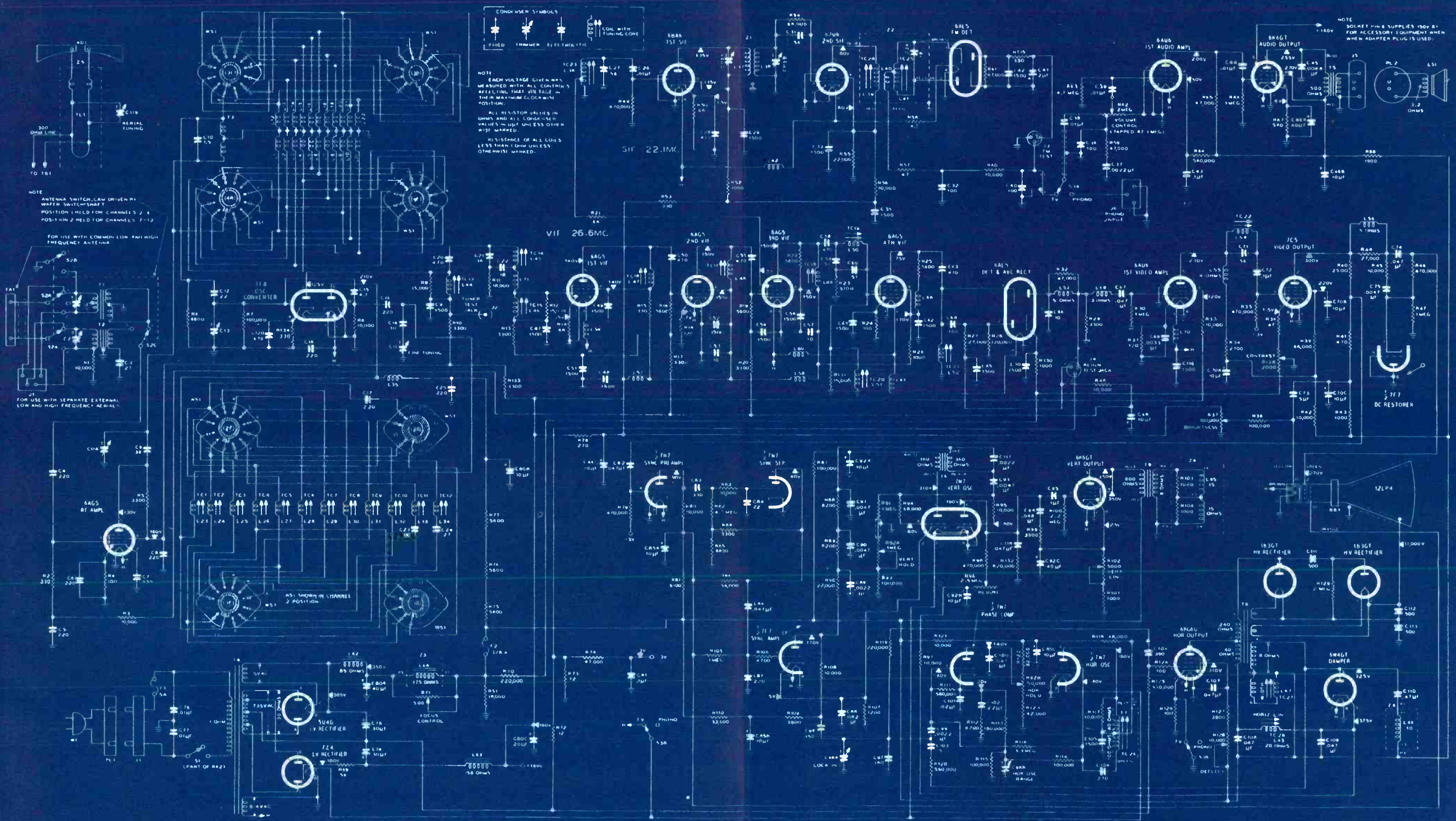


Figure 9. Trimmer and Tube Locations



Philco Television Receiver Models 50-T1400, 50-T1401, 50-T1402, and 50-T1430 (All Run 5), Complete Schematic Diagram



Philco Television Receiver Model 50-T1443, Code 122, Complete Schematic Diagram

PHILCO TELEVISION RECEIVER MODEL 50-T1443, CODE 122

INTERMEDIATE FREQUENCY
Video Carrier—26.6 mc.
Sound Carrier—22.1 mc.

AERIAL—Built-in broad-band dipole and provisions for external single-aerial or dual-aerial installations

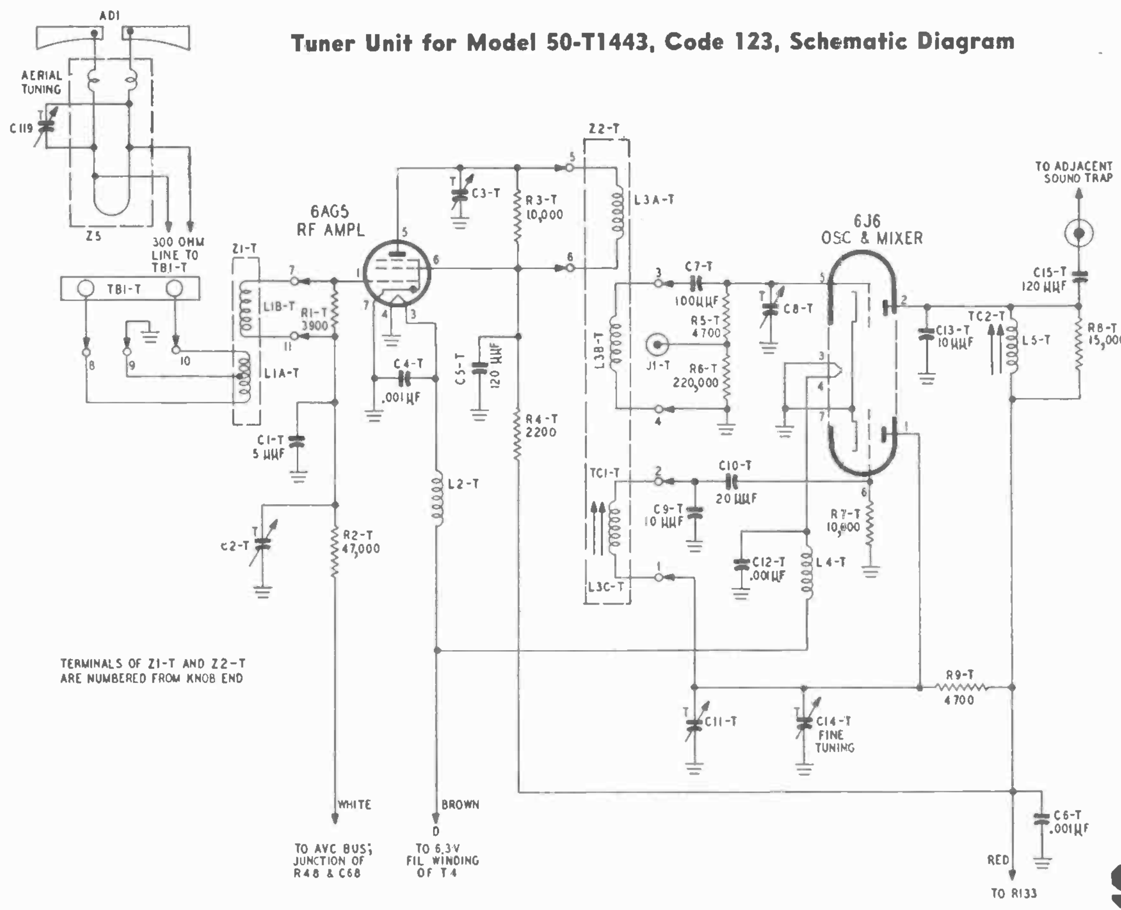
TRANSMISSION LINE—300-ohm, twin-wire leadin (balanced), or 72-ohm coaxial cable (unbalanced) in areas of high interference

TUBE COMPLEMENT

LOKTAL	OCTAL	MINIATURE	C.R.T.
1—7Z4	2—1B3GT	5—6AG5	1—12LP4
1—7F8	1—6BG6G	2—6AL5	
3—7N7	2—6K6GT	3—6AU6	
1—7F7	1—5U4G	1—6BA6	
1—7C5	1—6W4GT		

The complete circuit diagram of Philco Model 50-T1443, Code 122, is presented on the blueprint page 96B, and waveforms of sync and sweep circuits are shown on page 98. The television section of Philco Model 50-T1483 is very similar to the circuit shown. Philco Model 50-T1443, Code 123, is the same as this model, Code 122, but uses a different tuner and has some minor circuit changes. The schematic diagram of the new tuner is shown below. Other circuit differences between the two codes are as follows: R133 is changed from 3300 ohms to 330 ohms; A 470 mmfd. condenser is added between the AVC lead to the tuner and ground; C80B, R75, R76, and R77 are removed; Pin 6 of the audio output tube is connected to pin 4 instead of the 150 volt B+ supply.

Tuner Unit for Model 50-T1443, Code 123, Schematic Diagram



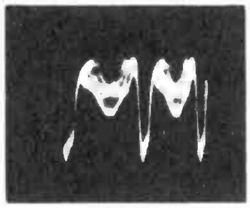
WAVEFORMS OF SYNC and SWEEP CIRCUITS

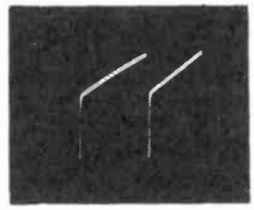
The waveforms in figure 1 are sized for clarity, and are not intended to illustrate relative amplitudes. Approximate peak-to-peak voltages are given in each case. These voltages are the approximate values when the CONTRAST control is adjusted to give 35 volts peak-to-peak, at the grid of the picture tube, and when all other controls are in their normal positions.

For viewing waveforms in the vertical sync and sweep circuits, adjust the oscilloscope sweep to 30 c.p.s. (one-half the vertical-sweep rate).

For viewing waveforms in the horizontal sync and sweep circuits, adjust the oscilloscope sweep to 7875 c.p.s. (one-half the horizontal sweep rate).

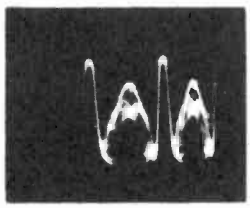
GRID, PIN 4
SYNC PREAMPL.
7 V





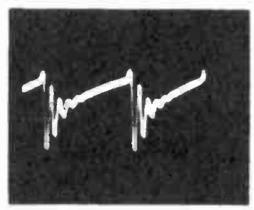
GRID, PIN 5
VERT. OUTPUT
280 V

GRID, PIN 5
SYNC SEP.
40 V



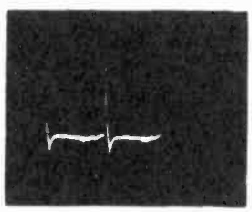
PIN 4 OF J8, DE-
FLECTION-CABLE
SOCKET
(Remove horiz. blk.
osc. tube)
70 V

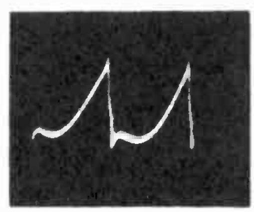
GRID, PIN 4
SYNC AMPL.
16 V



GRID, PIN 5
HORIZ. BLK. OSC.
170 V

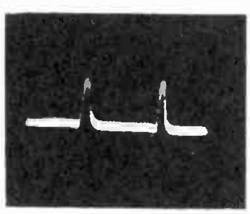
ACROSS C91
(Remove vert. blk.
osc. tube)
14 V

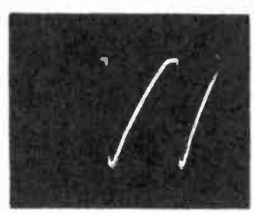




GRID, PIN 4
PHASE COMP.
10 V

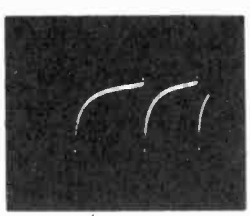
ACROSS C98A
(Remove horiz. blk.
osc. tube)
3 V

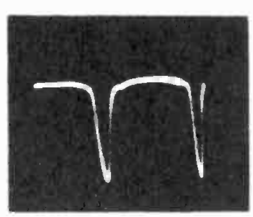




GRID, PIN 5
HORIZ. OUTPUT
60 V

GRID, PIN 5
VERT. BLK. OSC.
280 V





PIN 1 OF J8, DE-
FLECTION-CABLE
SOCKET
290 V

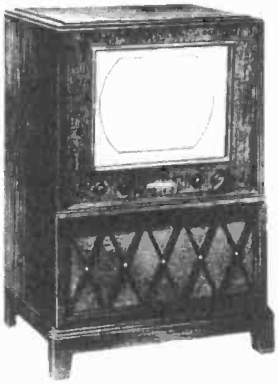
RCA VICTOR

TELEVISION RECEIVERS

MODELS 9T270, 9TC272, 9TC275

Chassis Nos. KCS29, KCS29C

RCA Victor Models 8T270, 8TC270, and 8TC271 use chassis which are similar in almost all respects to the models described on these pages.



Model 9TC272

Model 9TC275

ION TRAP MAGNET ADJUSTMENT. — Looking at the kinescope gun structure, it will be observed that the second cylinder from the base inside the glass neck is provided with two small metal flags, as shown in Figure 5.

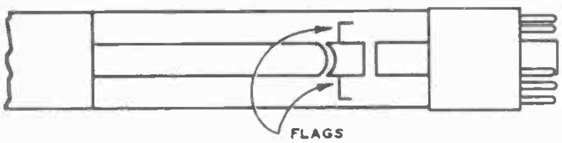


Figure 5—Ion Trap Flags

The ion trap rear magnet poles should be approximately over the ion trap flags. Starting from this position adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust the focus control (R201 on the chassis rear apron) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

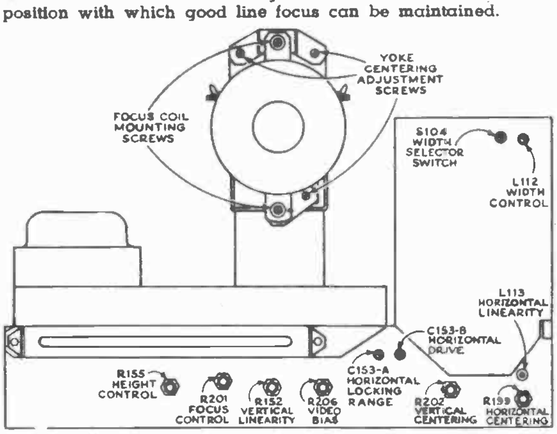


Figure 6—Rear Chassis Adjustments

DEFLECTION YOKE ADJUSTMENT. — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT. — Turn the horizontal hold control to the extreme counterclockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 3 bars sloping downward to the

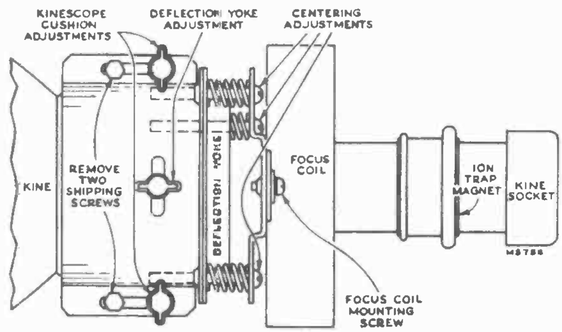


Figure 3—Yoke and Focus Coil Adjustments

left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull in should occur when the control is approximately 90 degrees from the extreme counterclockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should be out of sync and should show 1 vertical or diagonal black bar in the raster.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Centering Adjustment."

ALIGNMENT OF HORIZONTAL OSCILLATOR. — If in the above check the receiver failed to hold sync with the hold control at the extreme counterclockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment. — Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T109 horizontal frequency adjustment (under the chassis) until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster.

Horizontal Lock in Range Adjustment. — Set the horizontal hold control to the full counterclockwise position. Momentarily remove the signal by switching off channel then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C153A slightly clockwise. If less than 3 bars are present, adjust C153A slightly counterclockwise. Turn the picture control counterclockwise, momentarily remove the signal and recheck the number of bars present at the pull in point. Repeat this procedure until 3 bars are present.

9T270, 9TC272, 9TC275

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is operating properly it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure.

CENTERING ADJUSTMENTS. — Centering is obtained by adjustment of the centering controls and by mechanically orienting the focus coil with three adjustment screws shown in Figure 3. The focus coil should be concentric around the neck of the kinescope to prevent curvature of the raster.

Adjust the focus coil until it is at right angles to the neck of the kinescope. Center the picture with the electrical centering controls. If a shadow appears on a corner of the picture, adjust the focus coil centering screws to eliminate the shadow and re-center the picture with the electrical centering controls.

FOCUS COIL ADJUSTMENTS. — If, after making the centering adjustments in the above paragraph, a corner of the picture is shadowed, it will be necessary to loosen the focus coil mounting screws (shown in Figure 3) and change the position of the coil to eliminate the shadow. Re-center the picture by adjustment of the electrical centering controls and the focus coil centering adjustments.

Recheck the position of the ion trap magnet to insure that maximum brilliance is obtained.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS. — Adjust the height control (R155 on chassis rear apron) until the picture fills the mask vertically. Adjust vertical linearity (R162 on rear apron) until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust vertical centering to align the picture with the mask.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS. — Adjust the horizontal drive control C153B to give a picture of maximum width within the limits of good linearity. Adjust the horizontal linearity control L113 to provide best linearity.

A width control coil and a width selector switch are provided. With the switch in position 1 (fully counterclockwise), adjust the width coil until the picture fills the mask. On low line voltages it may not be possible to get sufficient width by adjustment of the width coil. In this case turn the width selector switch clockwise to position 2. In this position the width coil is disconnected, and adjustment of the width coil will have no effect. For still greater width, turn the width selector switch fully clockwise to position 3. In this position, the 6BG6G screen voltage is increased as well as disconnecting the width control coil.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

FOCUS. — Adjust the focus control (R201 on chassis rear apron) for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

CHECK TO SEE THAT THE CUSHION AND YOKE THUMBSCREWS AND THE FOCUS COIL MOUNTING SCREWS ARE TIGHT.

VIDEO BIAS CONTROL. — Normally the video bias control (R206) should be in the fully clockwise position. To check to see if this is the correct position, turn the picture control clockwise and adjust the brightness control until the retrace lines just disappear. If the whites are compressed as indicated by a "washed out" appearance in light areas, turn the video bias control counterclockwise until the picture appears normal.

CHECK OF R-F OSCILLATOR ADJUSTMENTS. — Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure. The adjustments for channels 2 through 5 and 7 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 7. Adjustment for channel 13 is on top of the chassis and channel 6 adjustment is in the kinescope well. See Figures 11 and 12 for their location.

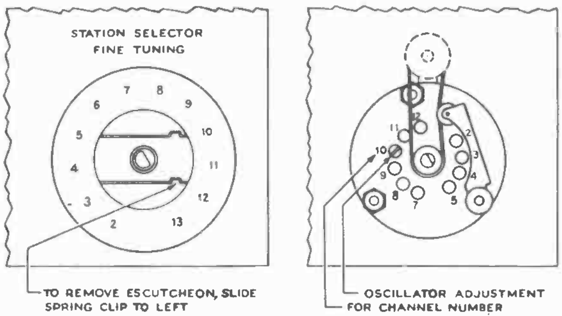


Figure 7—R-F Oscillator Adjustments

ALIGNMENT PROCEDURE

TEST EQUIPMENT. — To properly service the television chassis of this receiver, it is recommended that the following test equipment be available:

R-F Sweep Generator meeting the following requirements:

(a) Frequency Ranges

20 to 30 mc., 1 mc. and 10 mc. sweep width
50 to 90 mc., 10 mc. sweep width
170 to 225 mc., 10 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

Cathode-Ray Oscilloscope, preferably one with a wide band vertical deflection amplifier, an input calibrating source, and a low capacity probe.

For alignment purposes, the oscilloscope employed must have excellent low frequency and phase response, and must be capable of passing a 60 cycle square wave without noticeable distortion. While many commercial oscilloscopes do not meet this requirement, RCA oscilloscopes, types WO 55A, WO 58A, WO 60C and WO 79A fill this requirement and any of these may be employed.

For video and sync waveform observations, the oscilloscope must have excellent frequency and phase response from 10 cycles to at least 2 megacycles and in all positions of the gain controls. The RCA types WO 58A and WO 79A are ideally suited for this purpose.

Signal Generator to provide the following frequencies with "crystal" accuracy.

(a) I-F frequencies

19.75 mc. adjacent channel picture trap
21.25 mc. sound i-f and sound traps
22.05 and 24.75 mc. converter and first pix i-f transformer
25.9 mc. second picture i-f transformer
24.6 mc. fourth picture i-f transformer
22.0 mc. third picture i-f transformer
22.5 mc. fifth picture i-f transformer
25.75 mc. picture carrier
27.25 mc. adjacent channel sound trap

9T270, 9TC272, 9TC275

(b) R-F frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
2	55.25	59.75	8	181.25	185.75
3	61.25	65.75	9	187.25	191.75
4	67.25	71.75	10	193.25	197.75
5	77.25	81.75	11	199.25	203.75
6	83.25	87.75	12	205.25	209.75
7	175.25	179.75	13	211.25	215.75

(c) Output on these ranges should be adjustable and at least .1 volt maximum.

Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

Electronic Voltmeter of Junior "VoltOhmyst" type and a high voltage multiplier probe for use with this meter to permit measurements up to 15 kv.

Adjustments Required. — Normally, only the r-f oscillator line will require the attention of the service technician. All other circuits are either broad or very stable and hence will seldom require readjustment.

The oscillator line is relatively non critical. When oscillator tubes are changed, in all probability it will be necessary to adjust only C6 in order to bring the entire line into adjustment.

ORDER OF ALIGNMENT. — When a complete receiver alignment is necessary, it can be most conveniently performed in the following order:

(1) Sound discriminator
(2) Sound i-f transformers
(3) Picture i-f traps
(4) Picture i-f transformers
(5) R-F and converter lines
(6) R-F oscillator line
(7) 4.5 mc. video trap
(8) Sensitivity check

SOUND DISCRIMINATOR ALIGNMENT. — Set the signal generator for approximately .1 volt output at 21.25 mc. and connect it to the second sound i-f grid.

Detune T113 secondary (bottom).

Set the "VoltOhmyst" on the 10 volt scale.

Connect the meter in series with a one megohm resistor to the junction of diode resistors R215 and R216.

Adjust the primary of T113 (top) for maximum output on the meter.

Connect the "VoltOhmyst" to the junction of C183 and R215. Adjust T113 secondary (bottom). It will be found that it is possible to produce a positive or negative voltage on the meter dependent upon this adjustment. Obviously to pass from a positive to a negative voltage, the voltage must go through zero. T113 (bottom) should be adjusted so that the meter indicates zero output as the voltage swings from positive to negative. This point will be called discriminator zero output.

Connect the sweep oscillator to the grid of the second sound i-f amplifier.

Adjust the sweep band width to approximately 1 mc. with the center frequency at approximately 21.25 mc. and with an output of approximately .1 volt.

Connect the oscilloscope to the junction of C183 and R215. The pattern obtained should be similar to that shown in Figure 15. If it is not, adjust the T113 (top) until the wave form is symmetrical.

The peak to peak band width of the discriminator should be approximately 350 kc. and it should be linear from 21.175 mc. to 21.325 mc.

SOUND I-F ALIGNMENT. — Connect the sweep oscillator to the first sound i-f amplifier grid.

Connect the oscilloscope to the second sound i-f grid return (terminal "A" of T112) in series with a 33,000 ohm isolating resistor.

Insert a 21.25 mc. marker signal from the signal generator into the first sound i-f grid.

Adjust T112 (top and bottom) for maximum gain and symmetry about the 21.25 mc. marker. The pattern obtained should be similar to that shown in Figure 16.

The output level from the sweep should be set to produce approximately .3 volt peak-to-peak at the second sound i-f grid return when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

The band width at 70% response from the first sound i-f grid to the second i-f grid should be approximately 200 kc.

PICTURE I-F TRAP ADJUSTMENT. — Connect the "VoltOhmyst" to the junction of R135 and R136.

Remove the 6SN7GT AGC Amplifier tube V108. Connect a 250,000 ohm potentiometer between pins 5 and 6 of the V108 socket. Adjust the potentiometer until the "VoltOhmyst" reads approximately −4.5 volts.

Set the channel switch to the blank position between channel numbers 2 and 13.

Connect the "VoltOhmyst" across the picture detector load resistor R120. Under this condition, both leads of the meter are at approximately −125 volts. In making this measurement, care should be taken not to touch the case of the meter or to permit the meter case to become grounded.

Connect the output of the signal generator to the grid of the converter tube V2. To do this, remove the tube from the socket and fashion a clip by twisting one end of a small piece of wire around pin number 1. Replace the tube in the socket leaving the end of the wire protruding from under the tube. Connect the signal generator to this wire through a 1,500 mmf capacitor keeping the leads as short as possible.

Set the generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for minimum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is exactly on frequency.

(1) 21.25 mc.—T103 (top)
(2) 21.25 mc.—T105 (top)
(3) 27.25 mc.—T102 (top)
(4) 27.25 mc.—T104 (top)
(5) 19.75 mc.—T106 (top)
(6) 19.75 mc.—T101 (top)

In the above transformers using threaded cores, it is possible to run the cores completely through the coils and secure two peaks or nulls. The correct position is with the cores in the outside ends of the coils. If the cores are not in the correct position, the coupling will be incorrect and it will be impossible to secure the correct response.

PICTURE I-F TRANSFORMER ADJUSTMENTS. — Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary to prevent overloading.

22.5 mc.—T106 (bottom)
24.6 mc.—T104 (bottom)
22.0 mc.—T103 (bottom)
25.9 mc.—T102 (bottom)

T1 and T101 are coupled by a link and in combination constitute an overcoupled transformer. The characteristics of such a transformer are such that it is impossible to adjust it to a single frequency.

To sweep align T1 and T101, connect a 330 ohm composition resistor across the primary coils of T102, T103, T104 and T106.

9T270, 9TC272, 9TC275

CHASSIS TOP VIEW

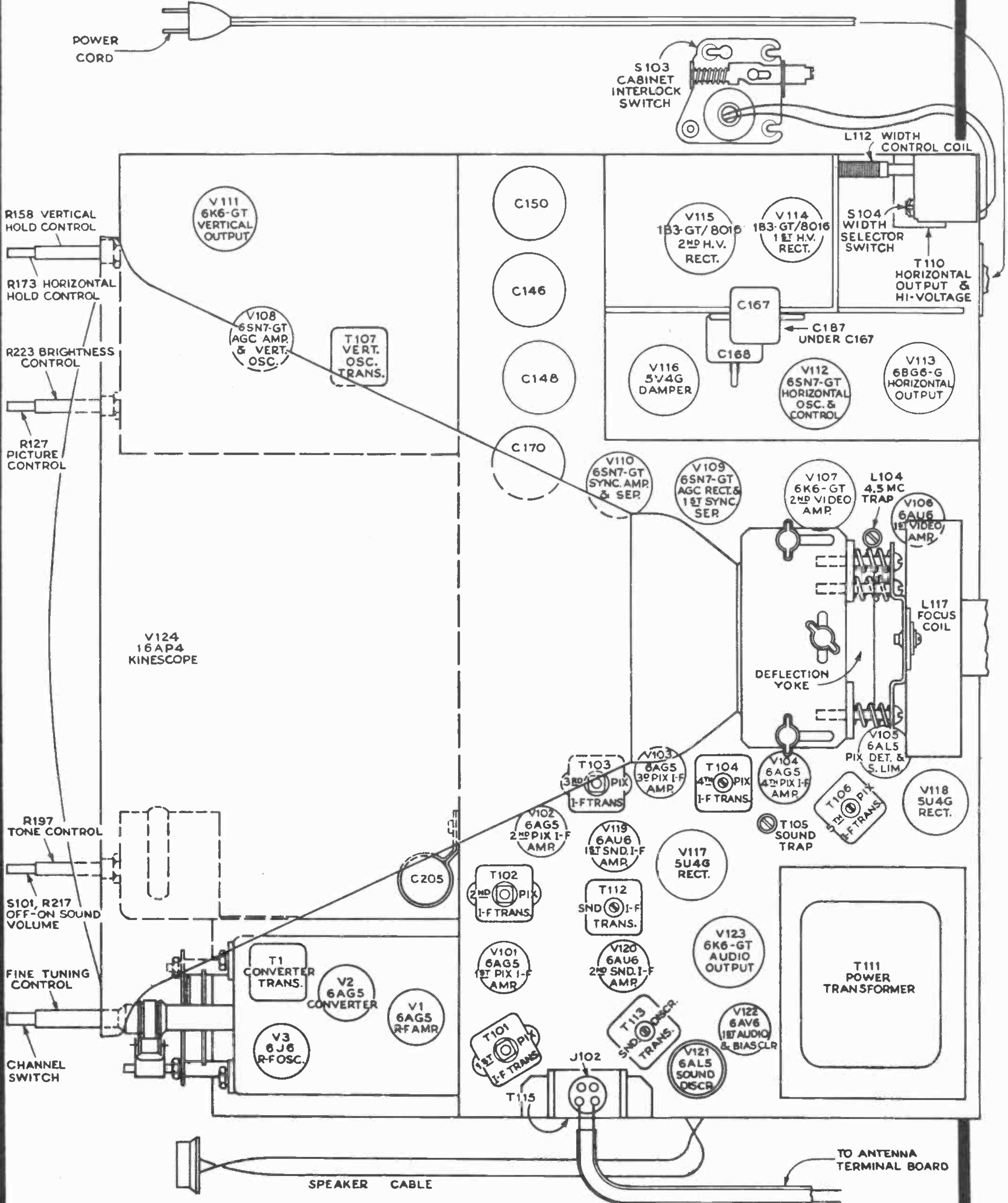


Figure 8—Chassis Top View

CHASSIS BOTTOM VIEW 9T270, 9TC272, 9TC275

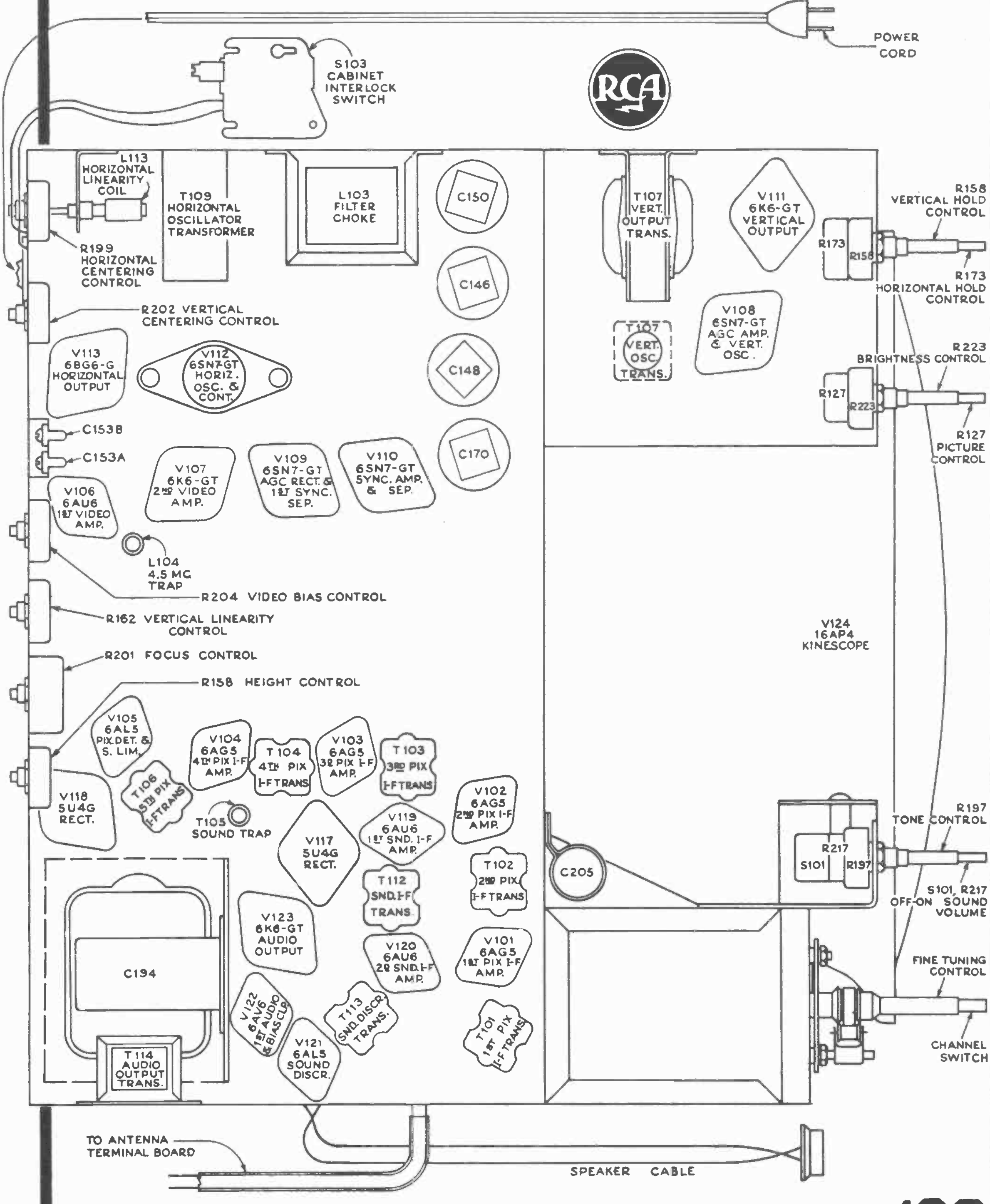


Figure 9—Chassis Bottom View

RCA Victor 9T270, 9TC272, 9TC275
Alignment Procedure, continued

Connect the "VoltOhmyst" to the junction of R135 and R136. Adjust the 250,000 ohm potentiometer for -2.0 volts on the meter.

Connect the oscilloscope to the plate of the first video amplifier pin 5 of V106.

Connect a sweep generator to the converter grid through a 1,500 mmf capacitor. Set the generator to sweep from 20.0 mc. to 30.0 mc. and adjust the output to provide a 4 volt peak-to-peak signal on the scope.

Connect the signal generator loosely to the converter grid and adjust to provide markers at 22.05 mc. and 24.75 mc.

Adjust T1 (top) and T101 (bottom) to obtain the response shown in Figure 17. The T1 core must penetrate to the terminal board end of the coil in order to obtain the correct response.

Remove the 330 ohm resistors from across T102, T103, T104 and T106.

Adjust the 250,000 ohm potentiometer for a 15 volt peak-to-peak signal at the plate of the first video amplifier. The bias as measured by the "VoltOhmyst" should be -4.5 volts or less.

Observe and analyze the response curve obtained. The response will not be ideal and the i-f adjustments must be retouched in order to obtain the desired curve. See Figure 18.

On final adjustment the picture carrier marker must be at approximately 45% response. The curve must be approximately flat topped, with the 22.1 mc. marker at approximately 95% response, the 25.0 mc. marker below 90% and the 26.5 mc. marker between 5% and 10% on the response curve.

The most important consideration in making the i-f adjustments is to get the picture carrier at the 45% response point. If the picture carrier operates too low on the response curve, loss of low frequency video response, of picture brilliance, of blanking, and of sync may occur. If the picture carrier operates too high on the response curve, the picture becomes smeared. In making these adjustments, care should be taken that no two transformers are tuned to the same frequency as i-f oscillation may result.

Remove the converter tube and take off the clip to pin number 1. Replace the tube in the socket.

Picture I-F Oscillation. — If the receiver will operate without oscillating with the test equipment disconnected but breaks into oscillation or becomes unstable with the equipment connected, it may become necessary to establish a ground plane. Cover the test bench with a sheet of copper and set the chassis on the sheet. Set all the test equipment except the "VoltOhmyst" on the sheet and bond or bypass them to it. A Junior "VoltOhmyst" should not be bonded to the sheet since the negative test probe is not always connected to ground during alignment.

If the receiver is badly misaligned and two or more of the i-f transformers are tuned to the same frequency, the receiver may fall into i-f oscillation. I-F oscillation shows up as a voltage across the picture detector load resistor that is unaffected by r-f signal input. If such a condition is encountered, it is sometimes possible to stop oscillation by adjusting the transformers approximately to frequency by setting the adjustment cores of T101, T102, T103, T104, T105 and T106 to be approximately equal to those of another receiver known to be in proper alignment. If this does not have the desired effect, it may now be possible to stop oscillation by increasing the grid bias. If so, it should then be possible to align the transformers by the usual method. Once aligned in this manner, the i-f should be stable with reduced bias.

If the oscillation cannot be stopped in the above manner, shunt the grids of the first three pix i-f amplifiers to ground with 1,000 mmf. capacitors. Connect the signal generator to the fourth pix i-f grid and align T106 to frequency. Progressively remove the shunt from each grid and align the plate coil of that stage to frequency.

If this does not stop the oscillation, the difficulty is not due to i-f misalignment as the i-f section is stable when properly aligned. Check all i-f by-pass condensers, transformer shunting resistors, tubes, socket voltages, etc.

ANTENNA, R-F AND CONVERTER LINE ADJUSTMENT. — In order to align the r-f tuner, it will first be necessary to set the channel 13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.

The channel 13 oscillator may be aligned by adjusting it to beat with a crystal calibrated heterodyne frequency meter, or by feeding a signal into the receiver at the r-f sound carrier frequency and adjusting the oscillator for zero output from the sound discriminator. In this latter case the sound discriminator must first have been aligned to exact frequency. Either method of adjustment will produce the same results. The method used will depend upon the type of test equipment available. Regardless of which method of oscillator alignment is used, the frequency standard must be crystal controlled or calibrated.

If the receiver oscillator is to be adjusted by the heterodyne frequency meter method, couple the meter probe loosely to the receiver oscillator.

If the receiver oscillator is adjusted by feeding in the r-f sound carrier signal, connect the signal generator to the receiver antenna terminals. Connect the "VoltOhmyst" to the sound discriminator output (junction of C183 and R215).

Set the receiver channel switch to 13.

Adjust the frequency standard to the correct frequency (237 mc. for heterodyne frequency meter or 215.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range while making the adjustment.

Adjust C6 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator.

Now that the channel 13 oscillator is set to frequency, we may procede with the r-f alignment.

Connect the oscilloscope to the test connection at R13 in the r-f tuning unit.

Connect the "VoltOhmyst" to the junction of R133 and R134. Adjust the bias potentiometer for -3.5 volts on the meter.

Remove the first picture i-f amplifier tube V101.

Connect the r-f sweep oscillator to the receiver antenna terminals. The method of connection depends upon the output impedance of the sweep. The P102 connection for 300 ohm balanced or 72 ohm single-ended input are shown in the circuit diagram in Figure 80. If the sweep oscillator has a 50 ohm single-ended output, 300 ohm balanced output can be obtained by connecting as shown in Figure 10.

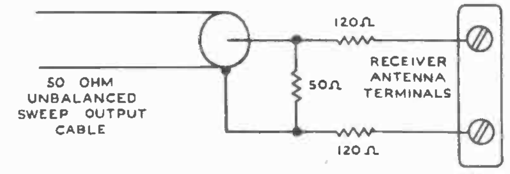


Figure 10—Unbalanced Sweep Cable Termination

Connect the signal generator loosely to the receiver antenna terminals.

Since channel 7 has the narrowest response of any of the high frequency channels, it should be adjusted first.

Set the receiver channel switch to channel 7.

Set the sweep oscillator to cover channel 7.

Insert markers of channel 7 picture carrier and sound carrier 175.25 mc. and 179.75 mc.

Adjust C10 and C14 until the curve falls symmetrically with the sound and picture carrier markers. Adjust C11 to give the proper bandwidth. Roughly peak L6 in conjunction with slight adjustments of C10 and C14 for a flat-topped, response curve with the sound and picture carriers at 90% to 95% response points on this curve. See Figure 19, channel 7.

Switch to channel 12 and adjust L6 for maximum response and minimum top slope of the curve.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep oscillator and marker oscillator to each of these channels and observe the response obtained. See Figure 19 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response. If the markers do not fall within this requirement on one or more high frequency channels, since there are no individual channel adjustments, it will be necessary to readjust L6, C10, C11 and C14, and possibly compromise some channels slightly in order to get the markers up on other channels. Normally, however, no difficulty of this type should be experienced since the higher frequency channels become comparatively broad and the markers easily fall within the required range.

Channel 6 is next aligned in the same manner.

Set the receiver to channel 6.

Set the sweep oscillator to cover channel 6.

Set the marker oscillator to channel 6 picture and sound carrier frequencies.

Adjust L9, L13, L66 and C12 for an approximately flat-topped response curve located symmetrically between the markers. L9, L13 and L66 are the center frequency adjustments. C12 is the band width adjustment.

Check channels 5 down through channel 2 by switching the receiver, sweep oscillator and marker oscillator to each channel and observing the response obtained. In all cases, the markers should be above the 80% response point. If this is not the case, L9, L13, L66 and C12 should be retouched. On final adjustment, all channels must be within the 80% specification.

Disconnect the bias potentiometer and replace V108. Replace V101.

Following an r-f alignment, the oscillator alignment must be checked.

R-F OSCILLATOR LINE ADJUSTMENT. — The r-f oscillator line may be aligned by adjusting it to beat with a crystal calibrated heterodyne frequency meter, or by feeding a signal into the receiver at the r-f sound carrier frequency and adjusting the oscillator for zero output from the sound discriminator. In this latter case the sound discriminator must first have been aligned to exact frequency. Either method of adjustment will produce the same results. The method used will depend upon the type of test equipment available.

Regardless of which method of oscillator alignment is used, the frequency standard must be crystal controlled or calibrated. If the receiver oscillator is to be adjusted by the heterodyne frequency meter method, the calibration frequency listed under R-F Osc. Freq. must be available.

If the receiver oscillator is adjusted by feeding in the r-f sound carrier frequency, the frequencies listed under Sound Carrier Freq. must be available.

Channel Number	Receiver R-F Osc. Freq. Mc.	R-F Sound Carrier Freq. Mc.	Channel Oscillator Adjustment
2	81	59.75	L24
3	87	65.75	L23
4	93	71.75	L22
5	103	81.75	L21
6	109	87.75	L31
7	201	179.75	L19
8	207	185.75	L18
9	213	191.75	L17
10	219	197.75	L16
11	225	203.75	L15
12	231	209.75	L14
13	237	215.75	C6

If the heterodyne frequency meter method is used, couple the meter probe loosely to the receiver oscillator.

9T270, 9TC272, 9TC275

If the r-f sound carrier method is used, connect the "Volt-Ohmyst" to the sound discriminator output (junction of C183 and R215.

Connect the signal generator to the receiver antenna terminals. The order of alignment remains the same regardless of which method is used.

The shield over the bottom of the r-f unit must be in place when making adjustments.

Since lower frequencies are obtained by adding steps of inductance, it is necessary to align channel 13 first and continue in reverse numerical order.

Set the receiver channel switch to 13.

Adjust the frequency standard to the correct frequency (237 mc. for heterodyne frequency meter or 215.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range while making the adjustment.

Adjust C6 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator. Oscillator adjustments L1 and L2 shown on the schematic are factory control adjustments and should not be touched in the field.

Switch the receiver to channel 12.

Set the frequency standard to the proper frequency as listed in the alignment table.

Adjust L14 for indications as above.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator trimmer for the specified indication. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control in the middle third of its range.

After the oscillator has been set on all channels, start back at channel 13 and recheck to make sure that all adjustments are correct.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment requires the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment. — With a clip lead, short circuit the coil between terminals C and D of the horizontal oscillator transformer T109. Tune in a television station and sync the picture if possible.

A.—Turn the horizontal hold control R173 to the extreme clockwise position. Adjust the T109 Frequency Adjustment (under the chassis) so that the picture is just out of sync and the horizontal blanking appears in the picture as a vertical bar. The position of the bar is unimportant.

B.—Turn the hold control approximately one quarter of a turn from the extreme clockwise position and examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C153B, the width control L112 and the linearity control L113 until the picture is correct. If C153B, L112 or L113 was adjusted, repeat step A above.

Horizontal Locking Range Adjustment. — Turn the horizontal hold control fully counterclockwise. Momentarily remove the signal by switching off channel then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 9 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C153A

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

9T270, 9TC272, 9TC275

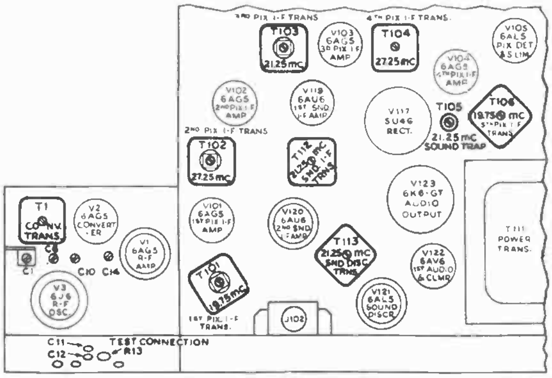


Figure 11—Top Chassis Adjustments

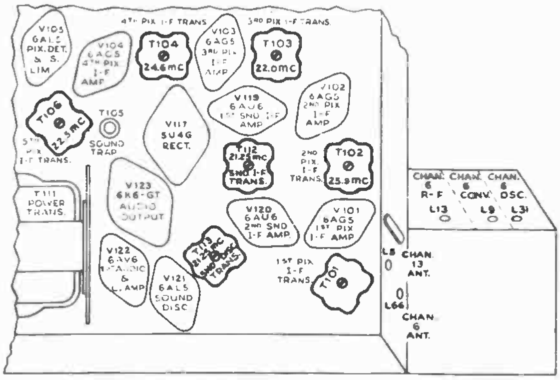


Figure 12—Bottom Chassis Adjustments

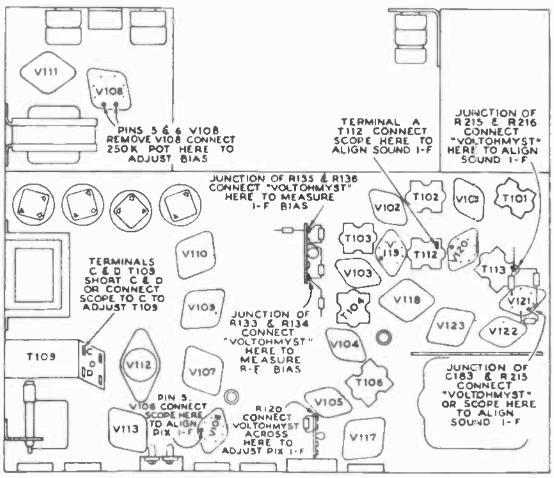
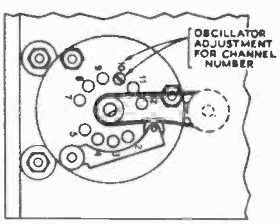


Figure 13—Test Connection Points



OSCILLATOR ADJUSTMENT FOR CHANNEL 13 IS ON TOP OF R-F UNIT AND CHANNEL 6 IS ON SIDE.

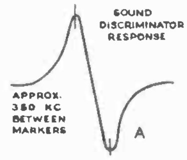


Figure 15
Discriminator
Response

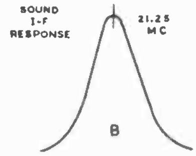


Figure 16
Sound I-F
Response

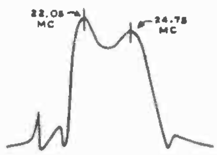


Figure 17
T1 and T101
Response

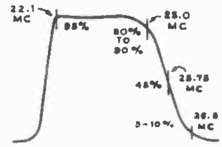


Figure 18
Overall I-F
R-F Response

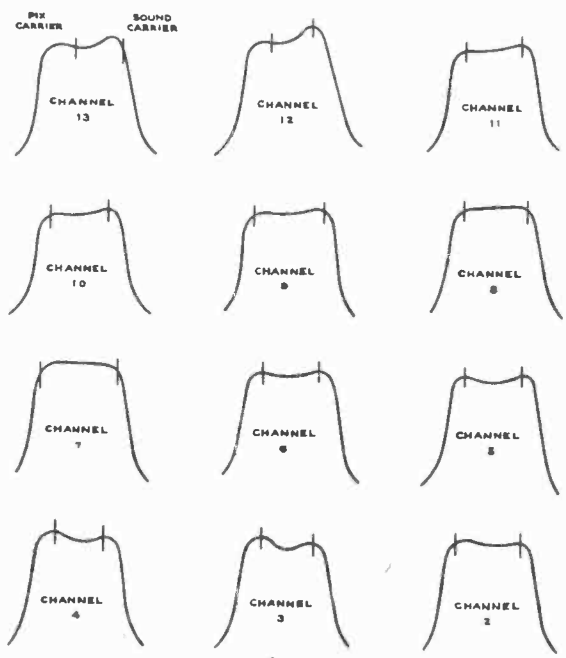


Figure 19—R-F Response

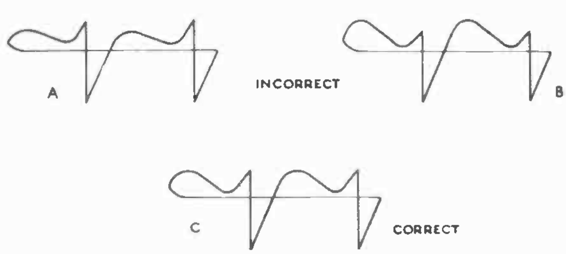
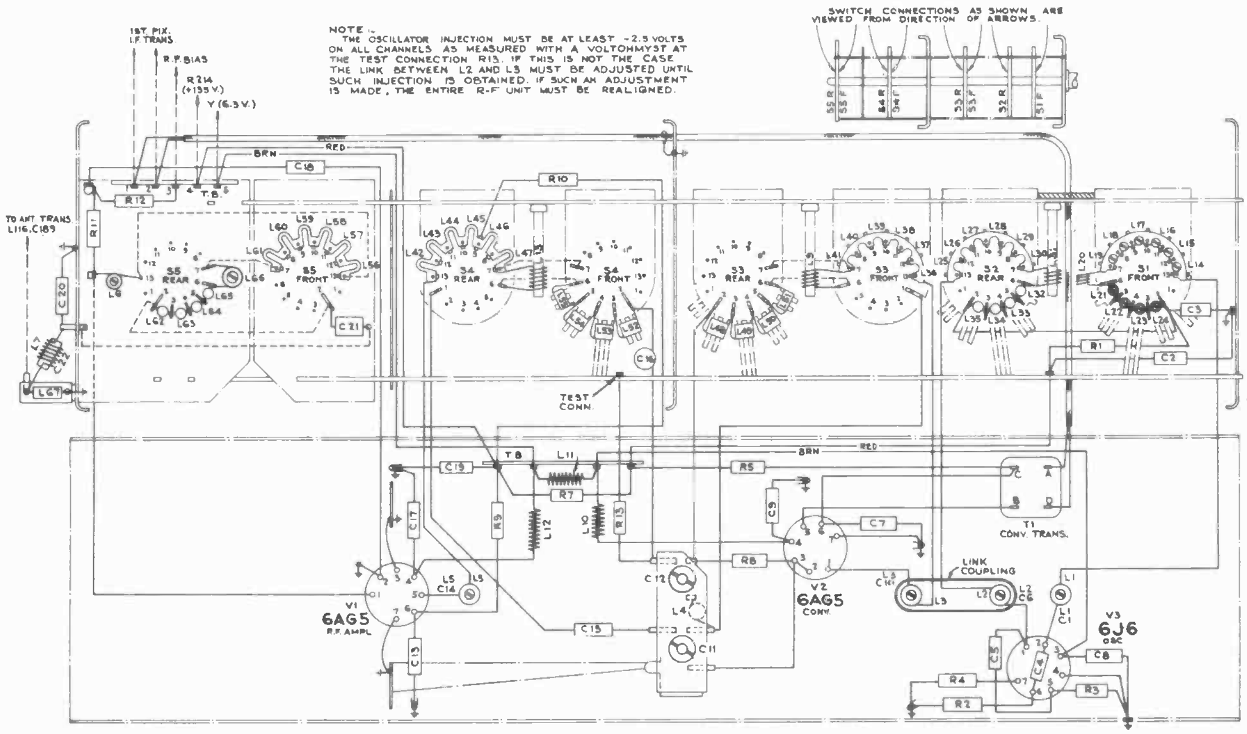


Figure 14—R-F Oscillator Adjustments

Figure 20—Horizontal Oscillator Waveforms

R-F UNIT WIRING DIAGRAM 9T270, 9TC272, 9TC275



ALIGNMENT PROCEDURE, cont.

slightly clockwise. If less than 7 bars are present, adjust C153A slightly counterclockwise. Turn the horizontal hold control counterclockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 7 to 9 bars are present.

Horizontal Oscillator Waveform Adjustment. — Remove the shorting clip from terminals C and D of T109. Turn the horizontal hold control to the extreme clockwise position. With a thin fibre screwdriver, adjust the Oscillator Waveform Adjustment Core of T109 (on the outside of the chassis) until the horizontal blanking bar appears in the raster.

A.—Connect the low capacity probe of an oscilloscope to terminal C of T109. Turn the horizontal hold control one quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 20. Adjust the Oscillator Waveform Adjustment Core of T109 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Check of Horizontal Oscillator Adjustments. — Set the horizontal hold control to the full counterclockwise position. Momentarily remove the signal by switching off channel then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C153A slightly clockwise. If less than 3 bars are present, adjust C153A slightly counterclockwise. Turn the horizontal hold control counterclockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. The picture should be just out of sync to the extent that the horizontal blanking bar appears as a single vertical or diagonal bar in the picture. Adjust the T109 Frequency Adjustment until this condition is fulfilled.

4.5 MC. VIDEO TRAP. — Tune in a strong station. With a very short clip lead, short circuit the trap winding of T103. Observe the picture for the appearance of a 4.5 mc. beat. If the beat appears in the picture, adjust L104 until the beat is eliminated. Remove the clip lead.

SENSITIVITY CHECK. — A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

9T270, 9TC272, 9TC275

SERVICE SUGGESTIONS

Following is a list of symptoms of possible failures and an indication of some of the possible faults.

NO RASTER ON KINESCOPE:

(1) Incorrect adjustment of ion trap magnet—Magnets reversed either front to back or top to bottom, front magnet incorrectly oriented.

(2) V113, V114 or V115 inoperative—check voltage and waveform on grids and plates.

(3) No high voltage—If horizontal deflection is operating as evidenced by the correct waveform on terminal 4 of horizontal output transformer, the trouble can be isolated to the 8016 circuit. Either the T110 high voltage winding is open (points 2 to 3), an 8016 tube is defective, its filament circuit is open, C167, C168 or C187 is shorted or R189, R190, R191, R192 or R193 is open.

(4) V112 circuit inoperative—Refer to schematic and waveform chart.

(5) Damper tube (V116) inoperative.

(6) Defective kinescope.

(7) R223 open (terminal 3 to R224).

(8) No receiver plate voltage—filter capacitor or filter choke shorted—bleeder or filter choke open.

NO VERTICAL DEFLECTION:

(1) V108B or V111 inoperative—check voltage and waveforms on grids and plates.

(2) T107 or T108 open.

(3) Vertical deflection coils open.

SMALL RASTER:

(1) Low Plus B or low line voltage.

(2) V113 defective.

POOR VERTICAL LINEARITY:

(1) If adjustment cannot correct, change V111.

(2) Vertical output transformer defective.

(3) V108B defective—check voltage and waveforms on grid and plate.

(4) C147, R164, C148B or C150C defective.

(5) Low bias or plate voltage—check rectifiers and capacitors in supply circuits.

POOR HORIZONTAL LINEARITY:

(1) If adjustments do not correct, change V113 or V116.

(2) T110 or L113 defective.

(3) C164 or C165 defective.

WRINKLES ON LEFT SIDE OF RASTER:

(1) R166, R167 or C169 defective.

(2) Defective yoke.

PICTURE OUT OF SYNC HORIZONTALLY:

(1) T109 incorrectly tuned.

(2) R172, R173, R174, R176 or R178 defective.

TRAPEZOIDAL OR NON-SYMMETRICAL RASTER:

(1) Improper adjustment of focus coil or ion trap magnet.

(2) Defective yoke.

RASTER AND SIGNAL ON KINESCOPE BUT NO SOUND:

(1) R-F oscillator off frequency.

(2) Sound i-f, discriminator or audio amplifier inoperative—check V119, V120, V121, V122, V123 and their socket voltages.

(3) T114 or C186 defective.

(4) Speaker defective.

SIGNAL AT KINESCOPE GRID BUT NO SYNC:

(1) V105A, V106, V108A, V109 or V111 inoperative—check voltage and waveforms at their grids and plates.

(2) Check V104. Try another tube.

SIGNAL ON KINESCOPE GRID BUT NO VERTICAL SYNC:

(1) Check V108B and associated circuit—C145, T107, etc.

(2) Integrating network inoperative—check.

(3) R154, R155, R157, R158 or R159 defective.

SIGNAL ON KINESCOPE GRID BUT NO HORIZONTAL SYNC:

(1) T109 misadjusted—readjust as instructed on page 11.

(2) V112 inoperative—check socket voltages and waveforms.

(3) T109 defective.

(4) C140, C153A, C154, C155, C157 or C166 defective.

(5) If horizontal speed is completely off and cannot be adjusted check C158, C159, R172, R173, R174, R179 and R182.

SOUND AND RASTER BUT NO PICTURE OR SYNC:

(1) Picture i-f, detector or video amplifier inoperative—check V103, V104, V105, V106 and V107—check socket voltages.

(2) Bad contact to kinescope grid

PICTURE STABLE BUT POOR RESOLUTION:

(1) V105A, V106 or V107 defective.

(2) Peaking coils defective—check for specified resistance.

(3) Make sure that the focus control operates on both sides of proper focus.

(4) R-F and I-F circuits misaligned.

PICTURE SMEAR:

(1) R-F or I-F circuits misaligned.

(2) Open peaking coil.

(3) This trouble can originate at the transmitter—check on another station.

PICTURE JITTER:

(1) Check for proper operation of hold controls.

(2) If regular sections at the left picture are displaced change V113.

(3) Vertical instability may be due to loose connections or noise.

(4) Horizontal instability may be due to unstable transmitted sync.

RASTER BUT NO SOUND, PICTURE OR SYNC:

(1) Defective antenna or transmission line.

(2) R-F oscillator off frequency.

(3) R-F unit inoperative—check V1, V2, V3.

PICTURE I-F RESPONSE. — At times it may be desirable to observe the individual i-f stage response. This can be achieved by the following method:

Shunt all i-f transformers and coils with a 330 ohm carbon resistor except the one whose response is to be observed.

Connect a wide band sweep generator to the converter grid and adjust it to sweep from 18 mc. to 30 mc.

DARK VERTICAL LINE ON LEFT OF PICTURE:

(1) Reduce horizontal drive and readjust width and horizontal linearity.

(2) Replace V113.

LIGHT VERTICAL LINE ON LEFT OF PICTURE:

(1) C169 defective.

(2) V116 defective.

Connect the oscilloscope across the picture detector load resistor and observe the overall response. The response obtained will be essentially that of the unshunted stage. The effects of the various traps are also visible on the stage response.

Figures 29 through 33 show the response of the various stages obtained in the above manner. The curves shown are typical although some variation between receivers can be expected. Relative stage gain is not shown.

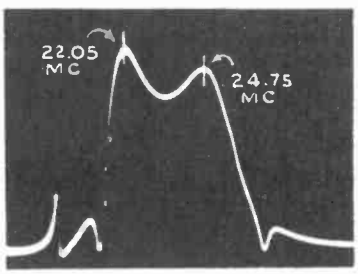


Figure 29—Response of Converter and First Pix I-F Transformer

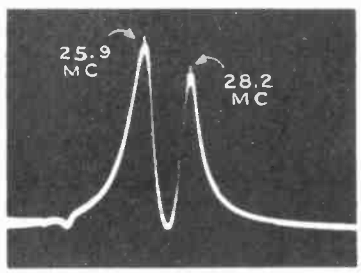


Figure 30—Response of Second Pix I-F Transformer

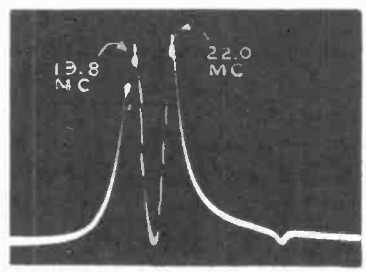


Figure 31—Response of Third Pix I-F Transformer

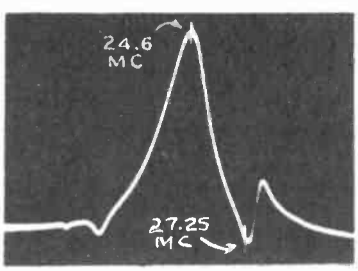


Figure 32—Response of Fourth Pix I-F Transformer

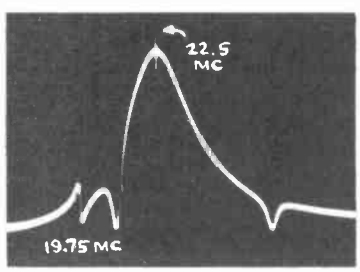


Figure 33—Response of Fifth Pix I-F Transformer

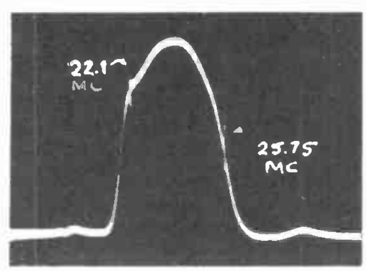


Figure 34—Response from First Pix I-F Grid to Pix Det.

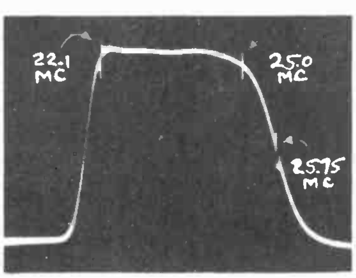


Figure 35—Overall Pix I-F Response

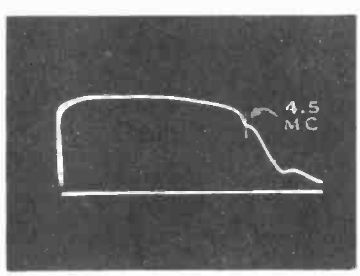


Figure 36—Video Response at Average Contrast

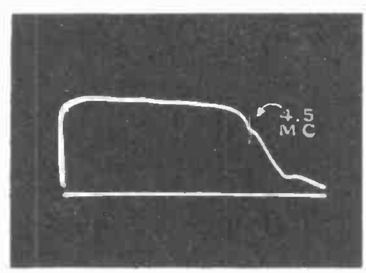
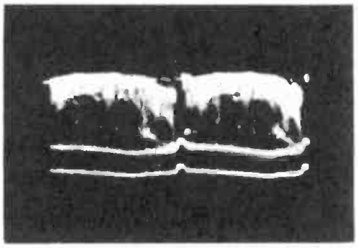


Figure 37—Video Response at Maximum Contrast

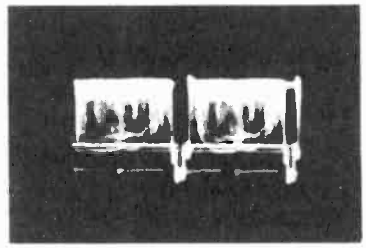
WAVEFORM PHOTOGRAPHS

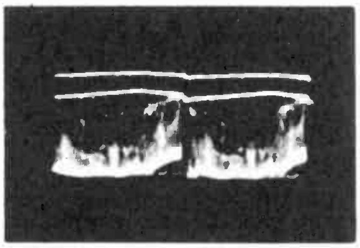


Video Signal Input to 1st Video Amplifier (Pin 1 of V106) (6AU6)

Figure 38—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (2.1 Volts PP) ←◄◄◄

Figure 39—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (2.1 Volts PP) ►►►→

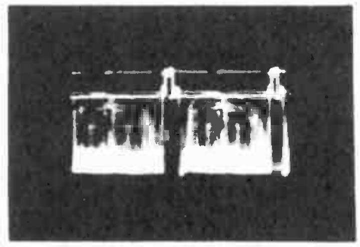


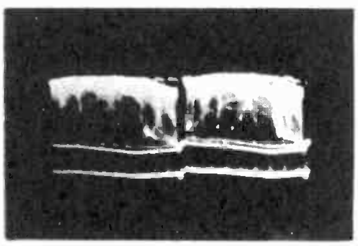


Input to 2nd Video Amplifier (Pin 5 of V107) (6K6GT)

Figure 40—Vertical (15 Volts PP) ←◄◄◄

Figure 41—Horizontal (15 Volts PP) ►►►→

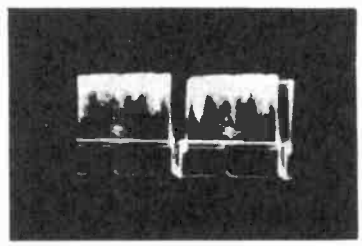


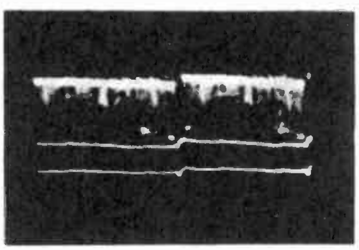


Output of 2nd Video Amplifier (Pin 3 of V107) (6K6GT) (Picture Max.)

Figure 42—Vertical (130 Volts PP) ←◄◄◄

Figure 43—Horizontal (130 Volts PP) ►►►→

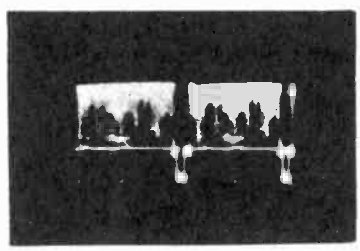


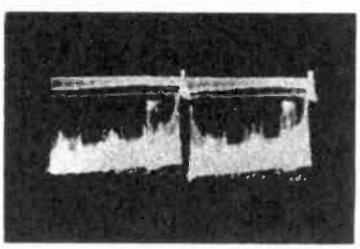


Input to Kinescope (Junction of R131 and R132) (Picture Max.)

Figure 44—Vertical (65 Volts PP) ←◄◄◄

Figure 45—Horizontal (65 Volts PP) ►►►→

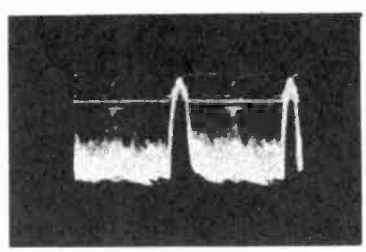


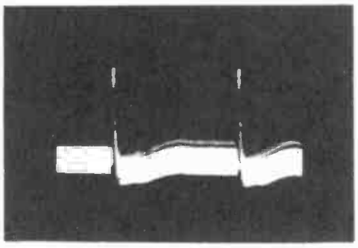


Input to 1st Sync Separator (Pin 1 of V109) (6SN7GT)

Figure 46—Vertical (24 Volts PP) ←◄◄◄

Figure 47—Horizontal (24 Volts PP) ►►►→

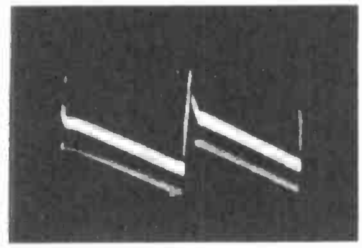


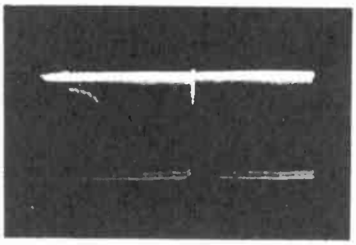


AGC Rectifier Cathode (Pin 6 of V109) (6SN7GT)

Figure 48—Vertical (4.3 Volts PP) ←

Figure 49—Horizontal (2.2 Volts PP) →

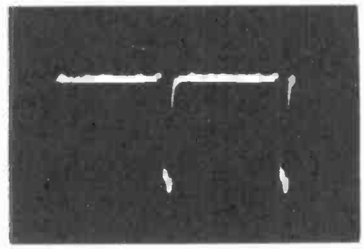


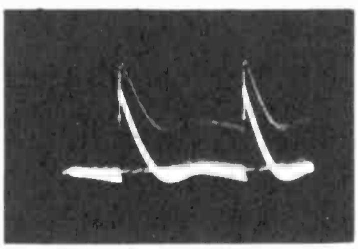


Output of AGC Rectifier (Pin 5 of V109) (6SN7GT)

Figure 50—Vertical (19 Volts PP) ←

Figure 51—Horizontal (19 Volts PP) →

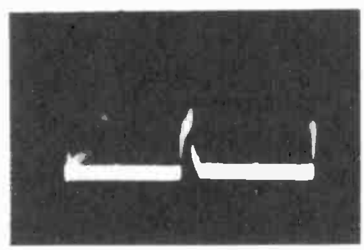


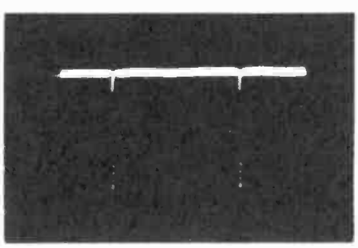


Cathode of 1st Sync Separator (Pin 3 of V109) (6SN7GT)

Figure 52—Vertical (1.3 Volts PP) ←

Figure 53—Horizontal (0.9 Volts PP) →

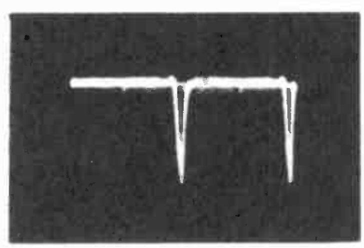


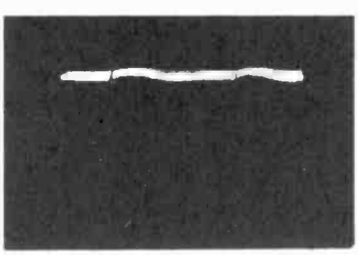


Output of 1st Sync Separator (Pin 2 of V109) (6SN7GT)

Figure 54—Vertical (48 Volts PP) ←

Figure 55—Horizontal (38 Volts PP) →

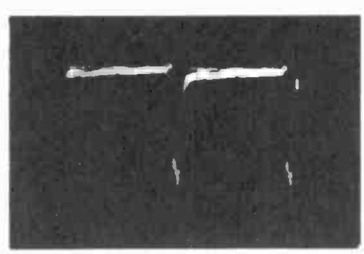




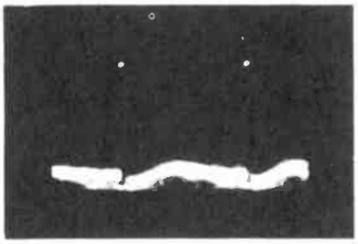
Input to Sync Amplifier (Junction of C137, C139 and R144)

Figure 56—Vertical (30 Volts PP) ←

Figure 57—Horizontal (17 Volts PP) →



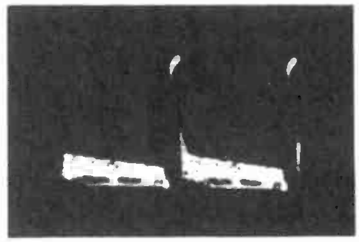
WAVEFORM PHOTOGRAPHS

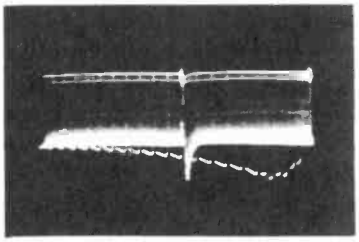


Output of Sync Amplifier (Pin 2 of V110) (6SN7GT)

Figure 58—Vertical (150 Volts PP)
←

Figure 59—Horizontal (145 Volts PP)
→

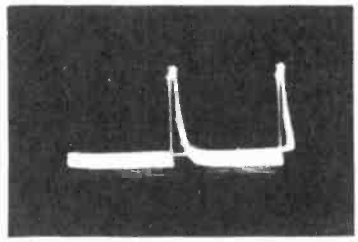




Cathode of 2nd Sync Separator (Pin 6 of V110) (6SN7GT)

Figure 60—Vertical (17 Volts PP)
←

Figure 61—Horizontal (11 Volts PP)
→



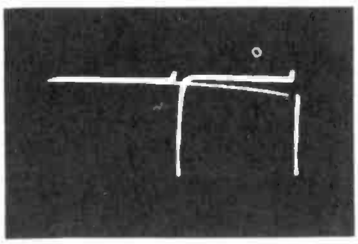
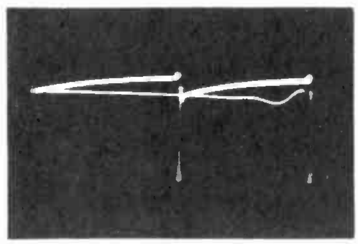


Figure 62—Output of Integrating Network (Junction of C144, C145 and R153) (38 Volts PP)
←

Figure 63—Grid of Vertical Oscillator (480 Volts PP) (Pin 1 of V108) (6SN7GT)
→



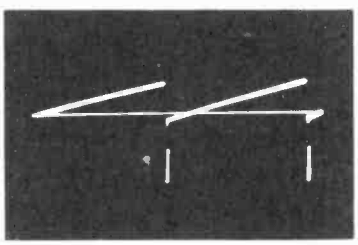
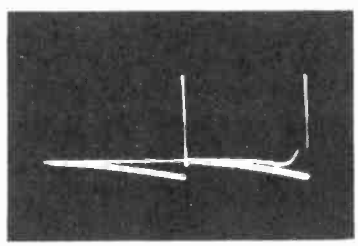


Figure 64—Grid of Vertical Output (140 Volts PP) (Pin 5 of V111) (6K6GT)
←

Figure 65—Plate of Vertical Output (925 Volts PP) (Pin 3 of V111) (6K6GT)
→



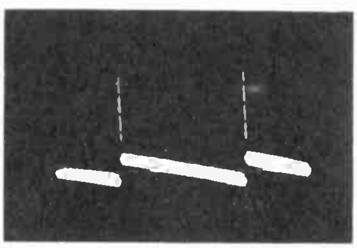
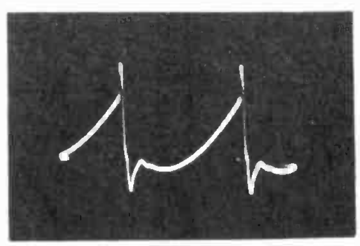
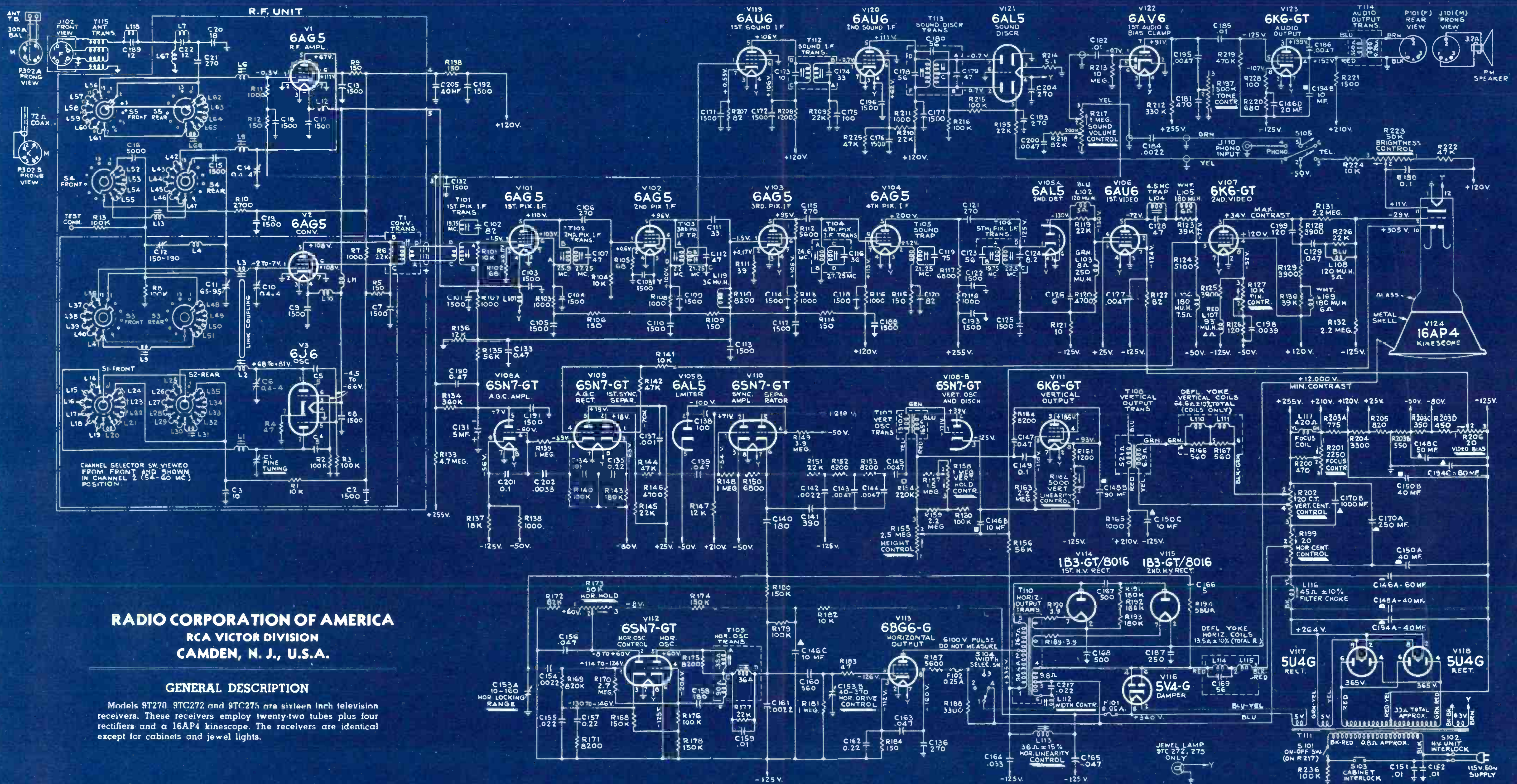


Figure 66—Input of Vertical Deflection Coils (75 Volts PP) (Junction of Green Lead of T108 and Green Lead of Yoke)
←

Figure 67—Input to Horizontal Oscillator (25 Volts PP) (Junction of C153A and C154)
→





RADIO CORPORATION OF AMERICA
RCA VICTOR DIVISION
CAMDEN, N. J., U.S.A.

GENERAL DESCRIPTION

Models 9T270, 9TC272 and 9TC275 are sixteen inch television receivers. These receivers employ twenty-two tubes plus four rectifiers and a 16AP4 kinescope. The receivers are identical except for cabinets and jewel lights.

All resistance values in ohms. K = 1000.
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.
Coil resistance values less than 1 ohm are not shown.

Direction of arrows at controls indicates clockwise rotation.

In some receivers, substitutions have caused changes in component lead color codes, in electrolytic capacitor values and their lug identification markings.

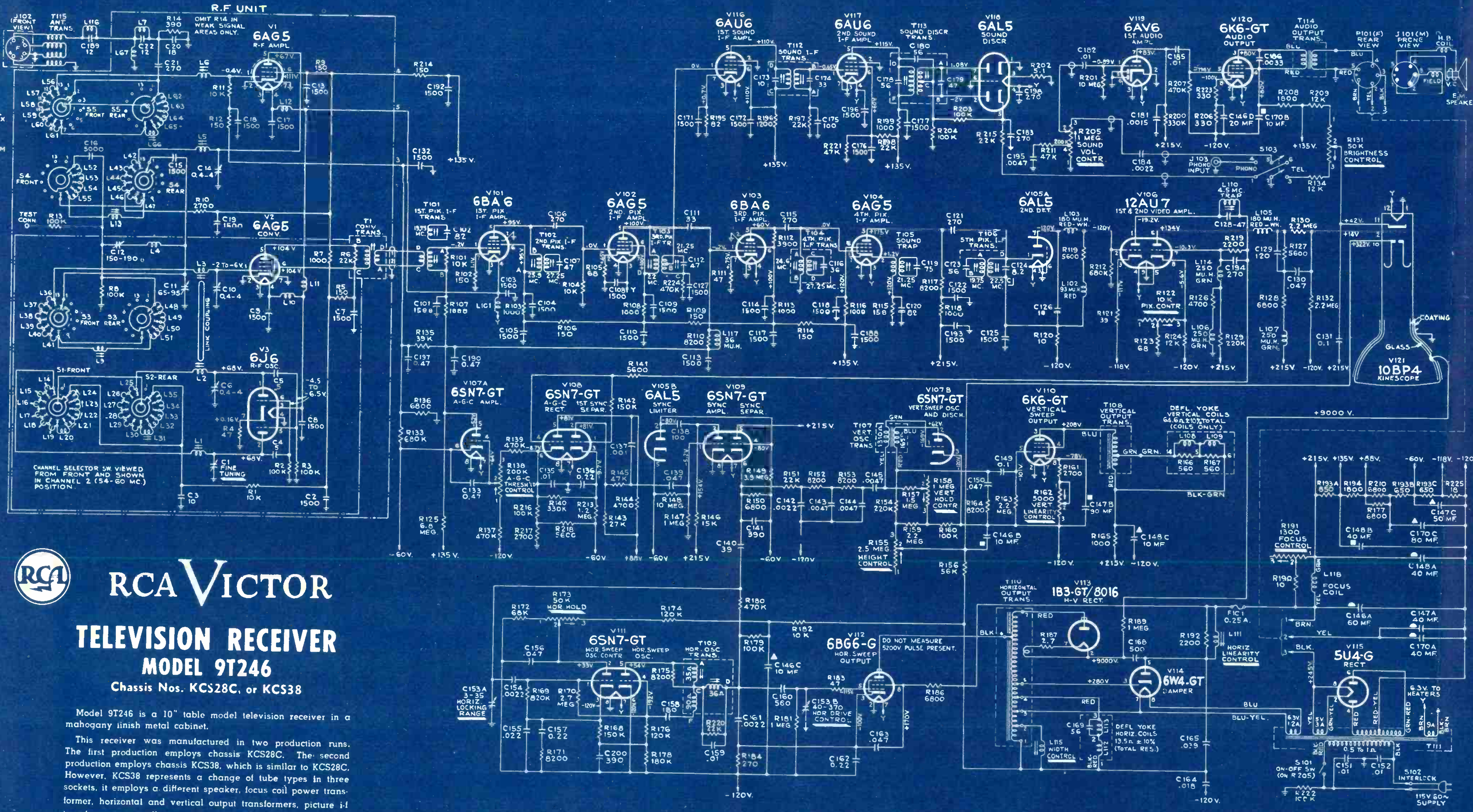
All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

In some receivers C148B was 10 MF and a 60 MF tubular condenser was connected in parallel with it.

In some receivers, R102 was 39 ohms.

Figure 80—Circuit Schematic Diagram

CIRCUIT SCHEMATIC DIAGRAM FOR KCS38



RCA VICTOR

TELEVISION RECEIVER

MODEL 9T246

Chassis Nos. KCS28C, or KCS38

Model 9T246 is a 10" table model television receiver in a mahogany finish metal cabinet.

This receiver was manufactured in two production runs. The first production employs chassis KCS28C. The second production employs chassis KCS38, which is similar to KCS28C. However, KCS38 represents a change of tube types in three sockets, it employs a different speaker, focus coil power transformer, horizontal and vertical output transformers, picture i-f transformers as well as circuit changes.

All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Coil resistance values less than 1 ohm are not shown.

Direction of arrows at controls indicates clockwise rotation.

In some receivers, substitutions have caused changes in component lead color codes, in electrolytic capacitor values and their lug identification markings.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

In some receivers R212 was 560K.

Figure 80—Circuit Schematic Diagram for KCS38

Silvertone

Sears, Roebuck and Co.

Television Model 9131,
Chassis 478.210

VIDEO IF ALIGNMENT

An adequate signal may be fed through the I.F. string by feeding the output of the signal generator into a tube shield placed over the mixer tube 6AG5. Care should be taken that this shield is NOT grounded. The ground side of the generator output can be conveniently grounded to the shield of the adjacent oscillator tube.

The contrast control should be set to produce minus 2 volts on the AGC bus (Pin 7 6AL5 — AGC tube).

The vacuum tube voltmeter should be connected across the 5600 ohm detector load resistor, (R43) and should be set on the minus 3 Volt scale. Set channel selector to an unused low band channel.

The Signal generator should be set to a frequency of 34.45 Mc. The output of the generator should be adjusted to the point where the reading on the VTVM is between minus 1 to minus 1.5 volts.

The First (A) and Third (B) I.F. Coils should be peaked for a maximum reading on the VTVM. As the voltage reading increases with tuning, the generator should be attenuated to maintain a maximum of minus 1.5 volts.

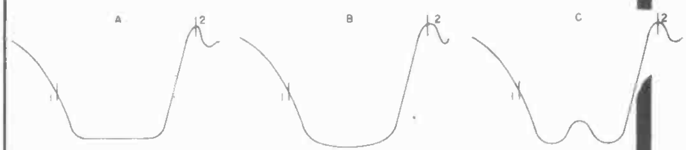
Set the Signal Generator to a Frequency of 37.0 Mc and tune the Second (C) and Fourth (D) I.F. coils in the same manner as above.

Set the Signal Generator to a frequency of 32.8 and tune the trap (E) for a MINIMUM reading on the VTVM.

The third (B) I.F. coil should then be readjusted as described previously.

The Generator should now be shut off (or tuned to different band) and the VTVM should read no more than minus 0.20 volts. If there is a higher voltage reading, check for regeneration in the I.F. stages.

By shunting the signal generator with a sweep generator (30 to 40 Mc) and substituting a Cathode Ray Oscilloscope for the Vacuum tube Voltmeter in the above procedure the actual pass band of the Video I.F. circuits may be studied. Ideally the response curve should appear on the face of the oscilloscope in the form indicated in Figure (5) A. A slight slope of the top of the curve in either direction or a small dip in the center are acceptable as indicated in Figure (5) B, and C.



A IDEAL RF-IF WAVESHAPE B & C ACCEPTABLE WAVESHAPES
1- PICTURE CARRIER
2- SOUND CARRIER

FIG. 5

RF ALIGNMENT

In the alignment of the RF section of this receiver three pieces of test equipment are necessary: a sweep generator, a signal generator and a cathode Ray Oscilloscope.

The output of the Sweep Generator should be fed into the antenna. The signal generator (C.W.) should be connected to the antenna terminals of the receiver. The sweeper will provide the overall response curve with the oscilloscope properly connected. The signal generator is used as a marker as described below. Some Sweep generators made today contain their own marker oscillator.

The "hot" or "high" side of the Oscilloscope input should be connected to the junction point of the 5600 ohm detector load resistor and the peaking coil. The "low" or ground side should be connected to the nearest convenient ground point on the receiver chassis. Care shoud be taken that the generator and the scope leads are well separated to avoid regeneration.

The R.F. section of the receiver is tuned channel by channel. The proper frequency settings for any given channel can be determined by consulting the Frequency Chart. For example in aligning channel 2 the sweep generator should be set to some mid frequency between 54 and 60 megacycles. This adjustment is not a fine one. After setting the sweeper in the general vicinity of the desired frequency it should be tuned to center the response curve on the Oscilloscope face. For pic-

ALIGNMENT PROCEDURE (Continued)

ture and sound markers the signal generator should carefully be adjusted to the frequencies indicated in the Frequency chart. For example in the case of channel 2 the picture marker frequency is 55.25 Mc. and the Sound 59.75 Mc.

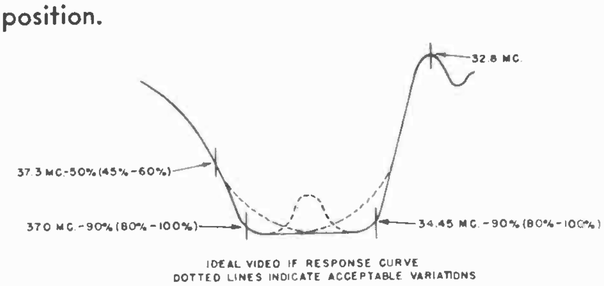
It is important to note at this point that the oscillator coil for channel 2 is in parallel with every other oscillator coil from 3 to 13. It is therefor imperative that channel 2 be aligned first and the others in any desired order thereafter.

Starting with channel 2 and applying the proper frequencies as indicated above, the output of the sweeper should be attenuated to the point where further attenuation will not affect the wave shape.

The Oscillator should then be adjusted to bring the sound carrier into the 32.8 Mc. trap valley. With the oscillator so adjusted the picture carrier should fall at a point approximatey 50% up on the slope of the opposite side of the band pass curve Certain variations in the waveshape and the location of the picture carrier are acceptable. The picture carrier may vary in position from a point between 45% and 60% of the slope and the overall waveshape may differ from the ideal, flat-topped response by being either slightly rounded or slightly dipped in the center. See figure (6).

If the position of the picture carrier varies beyond the 45% to 60% points on all channels correction may be made by turning to channel 6, applying the proper input signals and slightly realigning the I.F. transformers.

Care should be used not to push slug through coil form. If slug is pushed through, it may be replaced by reinserting slug through bottom of coil form and carefully threaded back to its normal position.



IDEAL VIDEO IF RESPONSE CURVE
DOTTED LINES INDICATE ACCEPTABLE VARIATIONS

FIG. 6

D — SOUND ALIGNMENT

Sound alignment of the receiver is best accomplished with the AM Signal Generator and a vacuum tube volt meter. By feeding a 4.5 Megacycle signal thru a .01 mfd blocking condenser into the grid (pin 7) of the second section of the 12AU7 Video amplifier and placing the vacuum tube voltmeter between pin 2 of the ratio detector (6AL5) and ground, the primary (F) (Fig. 10) of the ratio detector and the 4.5 megacycle trap (G) (Fig. 10) may be adjusted. The signal generator should be attenuated so that the VTVM does not read more than minus 3 or minus 4 volts. These two slugs should be tuned for maximum deflection of the VTVM and the generator attenuated as needed to keep the above mentioned level. The VTVM (set for zero center operation) should then be placed at the junction of the 47,000 ohm resistor (R19) and the .0015 condenser (C22) and the secondary (H) of the ratio detector should be tuned through a sharp dip between positive and negative voltage. Adjust secondary for exact setting at lowest point of dip.

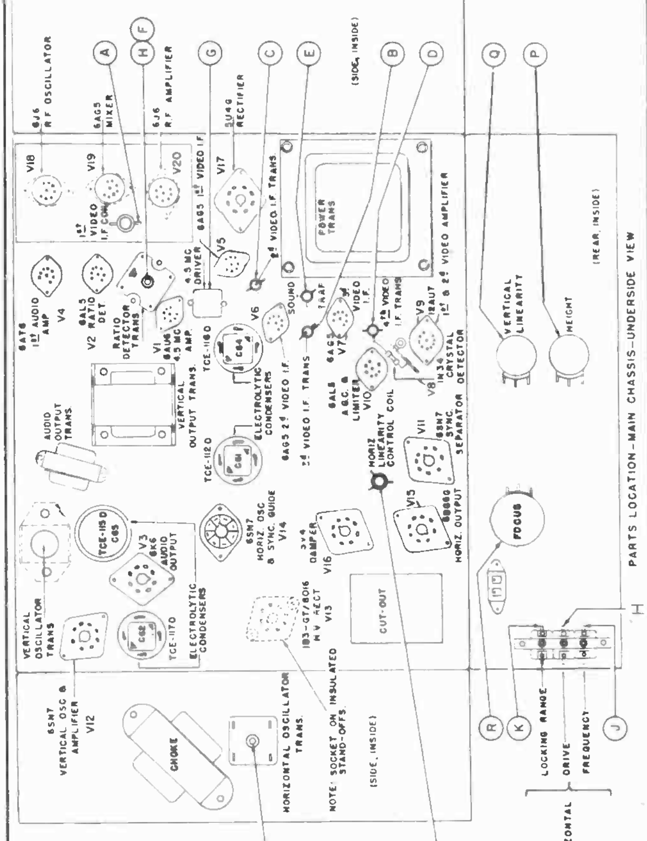


FIG. 12

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

Sears, Roebuck and Co.
Silvertone Model 9131.

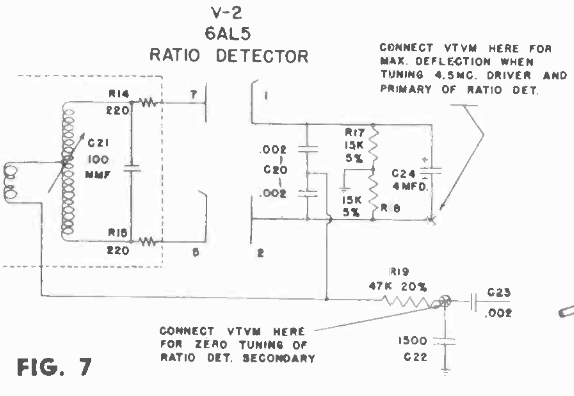


FIG. 7

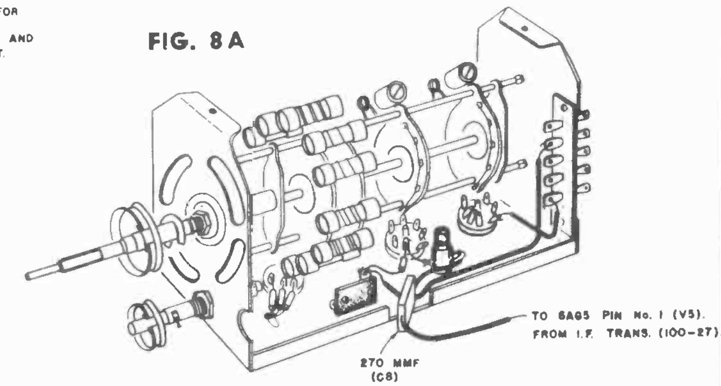
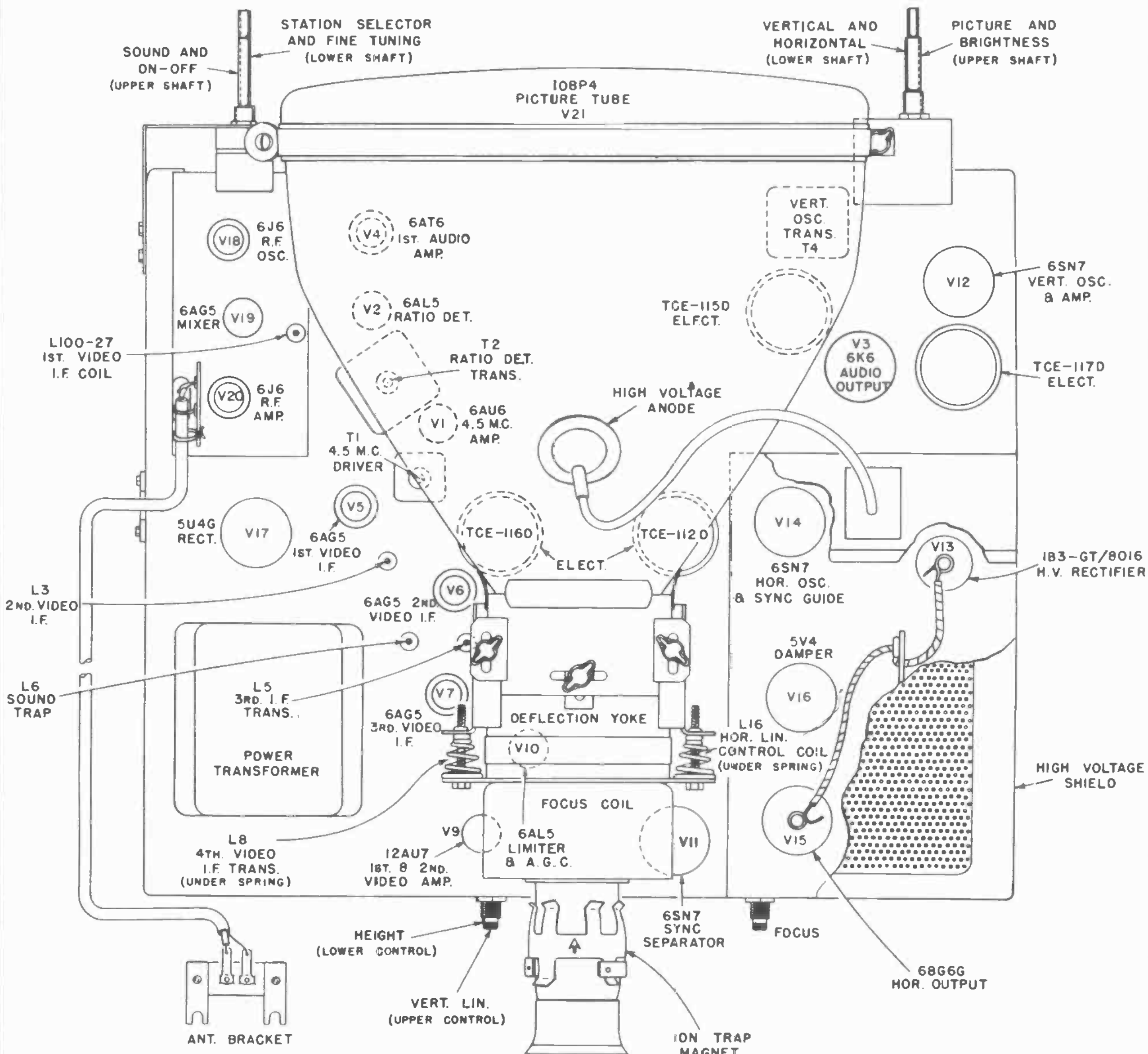


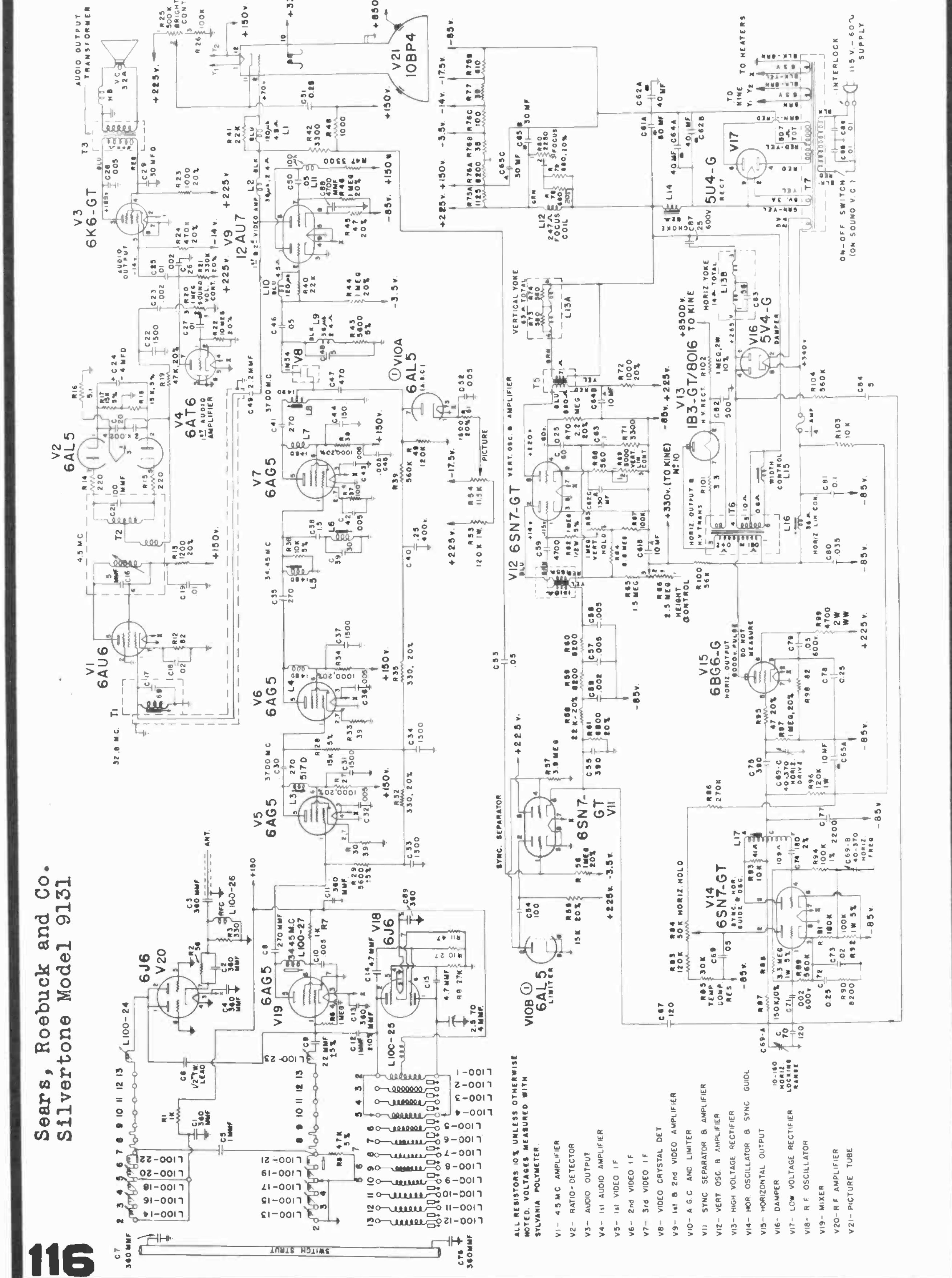
FIG. 8A



TOP VIEW OF TELEVISION CHASSIS

FIG. 10

1950 TELEVISION INFORMATION



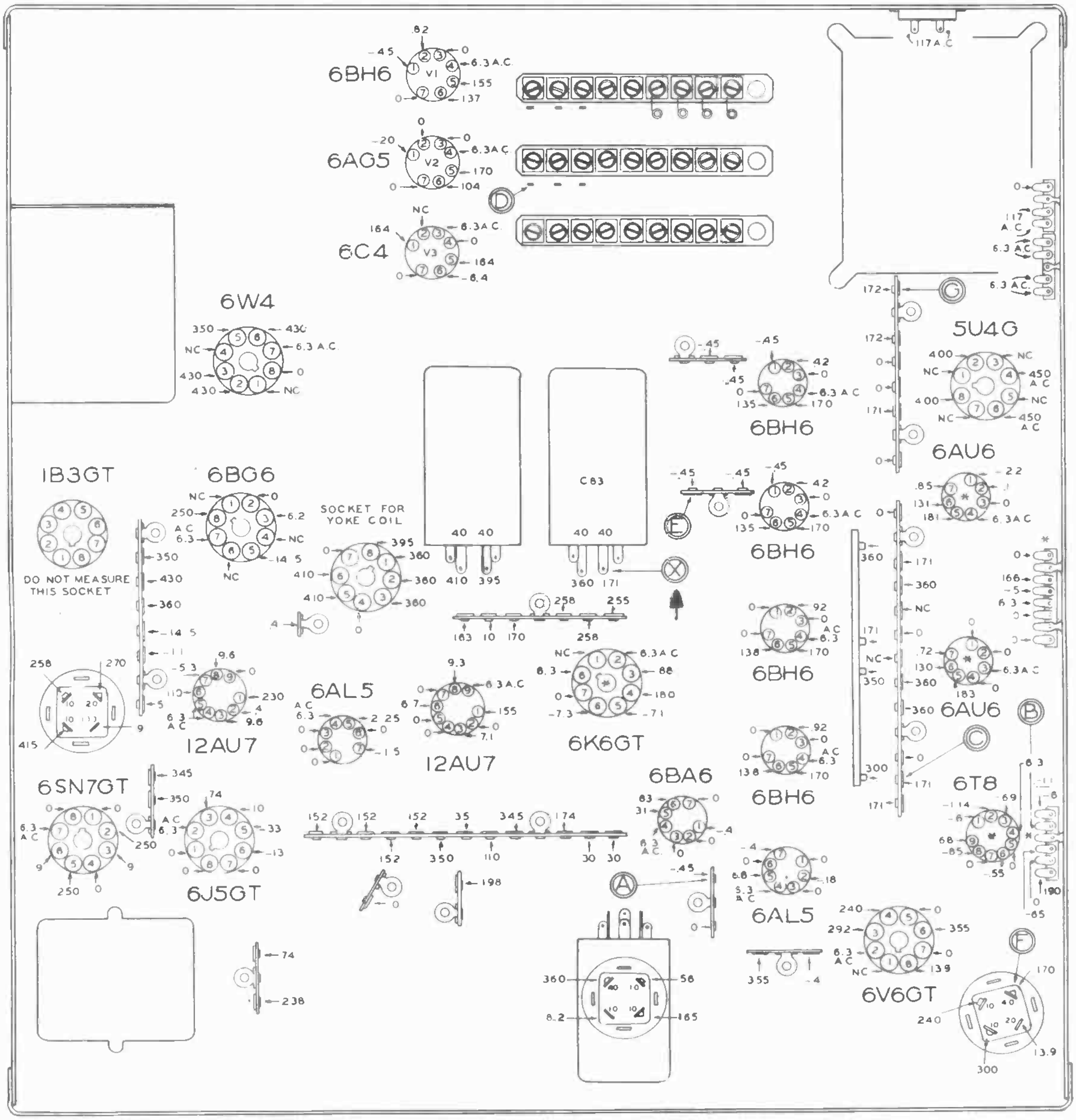
ALL RESISTORS 10% UNLESS OTHERWISE NOTED. VOLTAGES MEASURED WITH SYLVANIA POLYMETER.

- V1- 4.5 MC AMPLIFIER
- V2- RATIO-DETECTOR
- V3- AUDIO OUTPUT
- V4- 1st AUDIO AMPLIFIER
- V5- 1st VIDEO IF
- V6- 2nd VIDEO IF
- V7- 3rd VIDEO IF
- V8- VIDEO CRYSTAL DET
- V9- 1st & 2nd VIDEO AMPLIFIER
- V10- A.G.C. AND LIMITER
- V11 SYNC SEPARATOR & AMPLIFIER
- V12- VERT OSC & AMPLIFIER
- V13- HIGH VOLTAGE RECTIFIER
- V14- HOR OSCILLATOR & SYNC GUIDE
- V15- HORIZONTAL OUTPUT
- V16- DAMPER
- V17- LOW VOLTAGE RECTIFIER
- V18- R F OSCILLATOR
- V19- MIXER
- V20- R F AMPLIFIER
- V21- PICTURE TUBE

Sparton RADIO-TELEVISION
DIVISION OF
THE SPARKS-WITHINGTON COMPANY - JACKSON, MICHIGAN

CHASSIS TYPE 23TC10

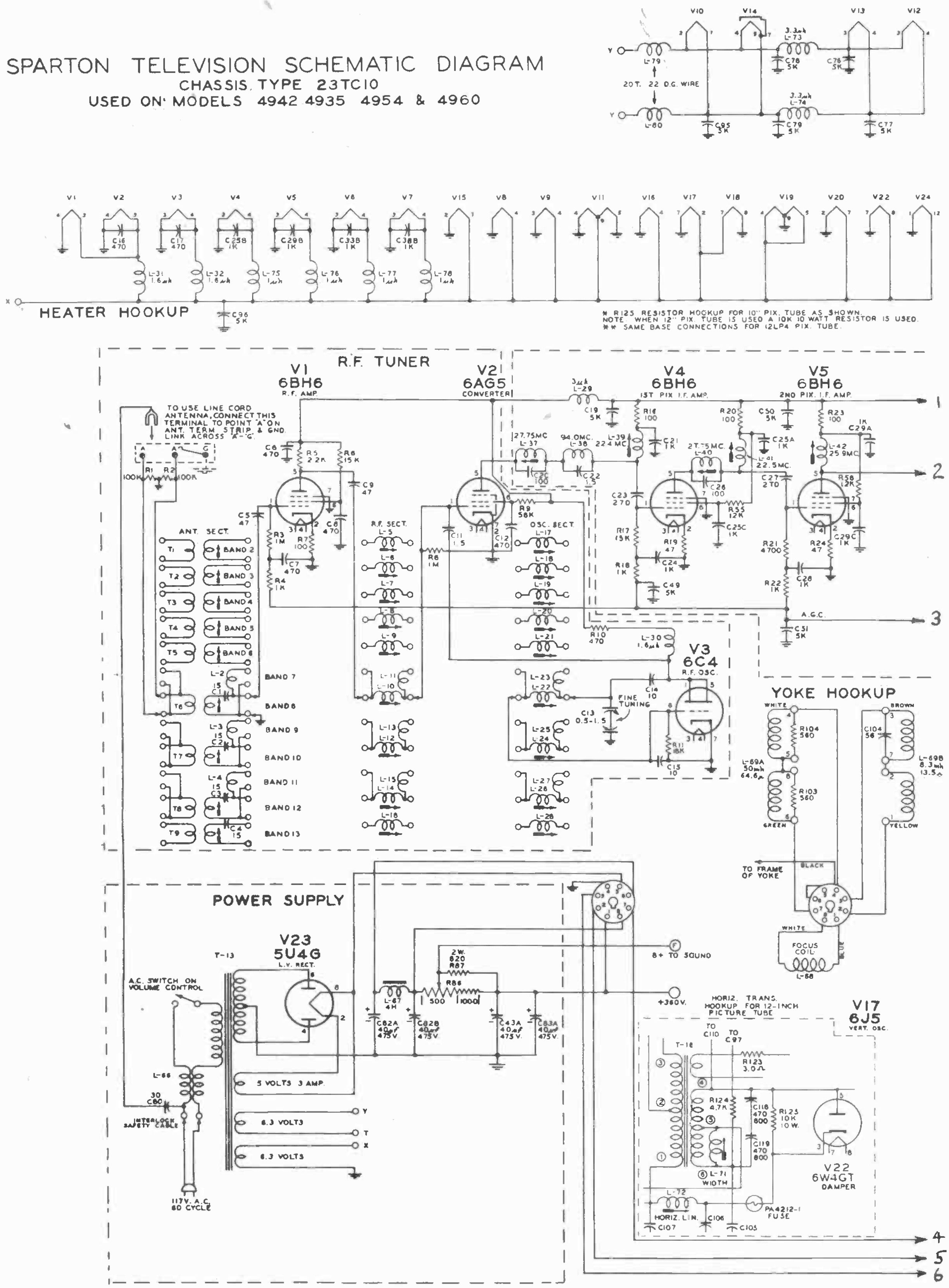
MODELS 4935 & 4942 (CONSOLES)
MODELS 4954 & 4960 (TABLES)



VOLTAGE CHART & ALIGNMENT TEST POINTS
FIG. 13
CHASSIS BOTTOM VIEW

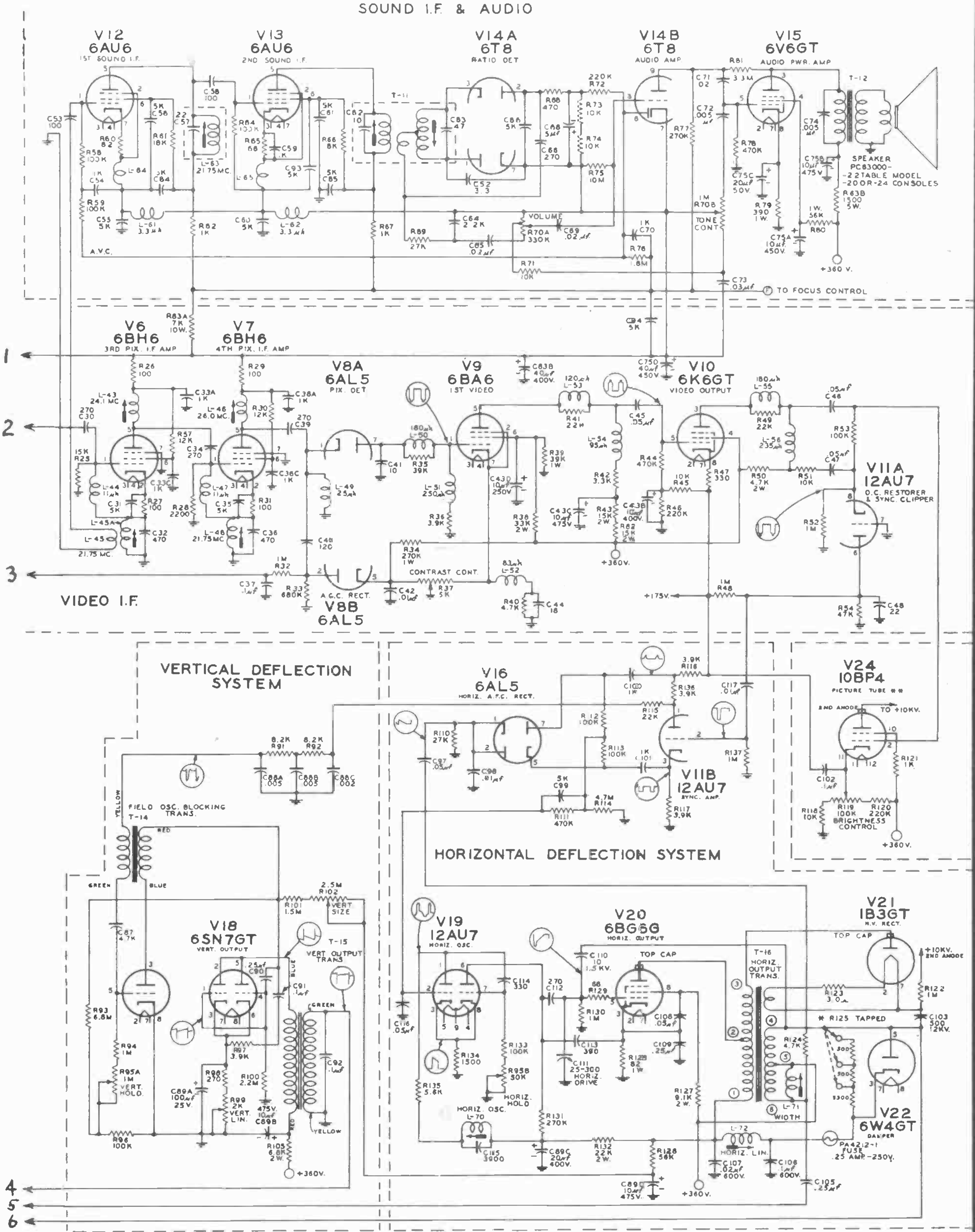
Voltages indicated in drawing secured with line voltage at 117 v., Channel #2 setting, Brightness Control for average brilliance, Contrast Control maximum (clockwise), Horizontal and Vertical Hold Controls set to lock in picture, Raster correct size, 8X10", Best linearity, correct focus, volume control maximum counter-clockwise, same for Tone control, all measurements made with a Vacuum Tube Voltmeter with respect to chassis ground, except those values marked with an (*) asterisk which are measured from point X in the above figure.

SPARTON TELEVISION SCHEMATIC DIAGRAM
CHASSIS TYPE 23TC10
USED ON MODELS 4942 4935 4954 & 4960



Circuit diagram continued across to page 119.

SPARTON TELEVISION



Circuit diagram continued from page 118.

SPARTON TELEVISION RECEIVERS

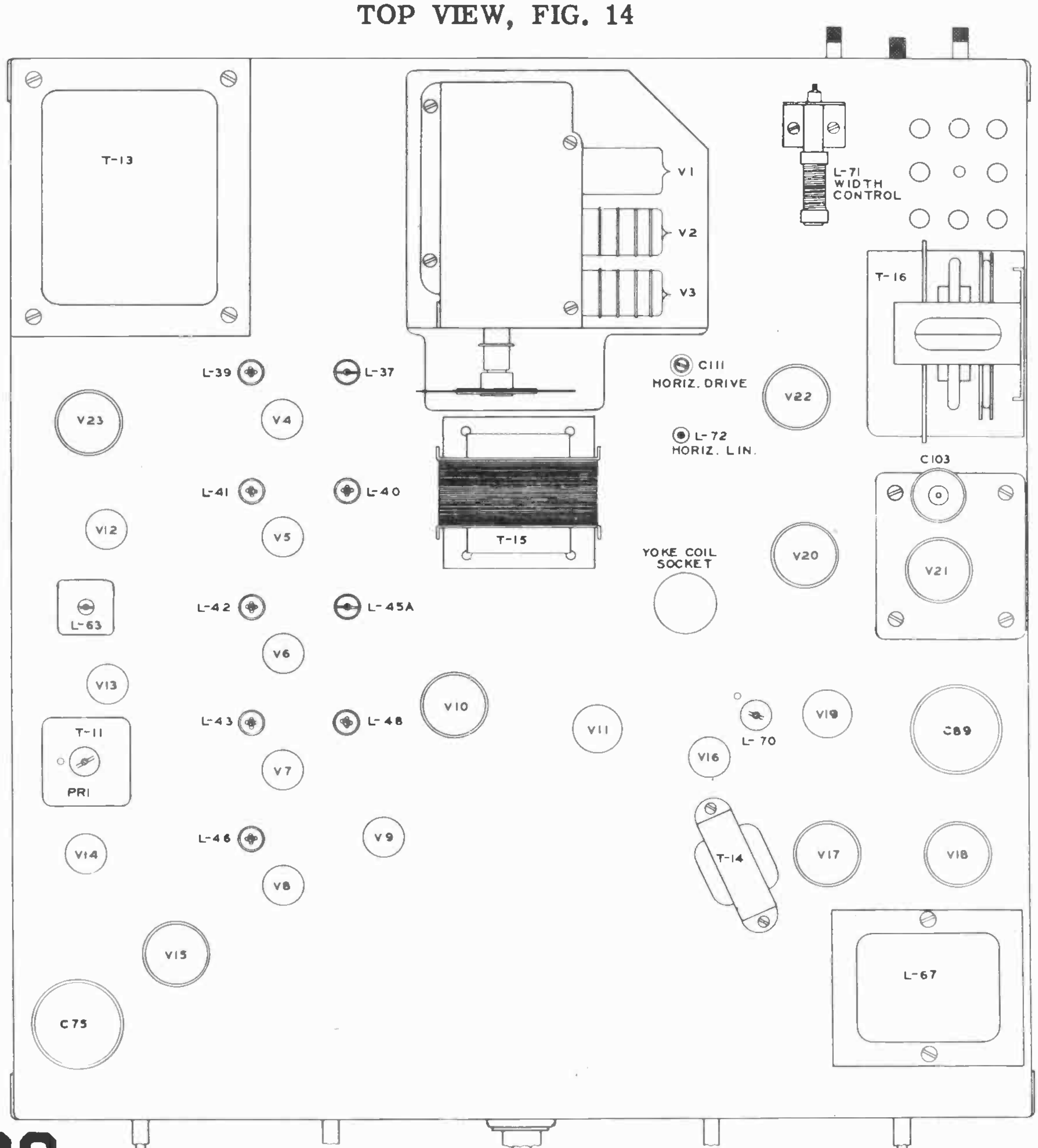
CHASSIS TYPE 23TC10

MODELS 4935 & 4942 (CONSOLES)
MODELS 4954 & 4960 (TABLES)

EFFECTS OF TUBE REPLACEMENT ON THE ALIGNMENT OF R.F. TUNER CIRCUITS: The alignment of the R.F. and converter circutis of the R.F. tuner is critical and may be affected by a tube change. In cases where these tubes (6BH6 or 6AG5) are replaced it will be necessary for the service engineer to check for satisfactory receiver operation. If realignment is indicated it can usually be avoided by selection of replacement tubes until receiver operation is realized.

Replacement of the 6C4 local oscillator can usually be made with little or no effect on the alignment and operation of the oscillator ciruits. However, when a replacement is made, a check should be performed to make certain that the vernier capacitor range is sufficient to tune in the sound carriers on all channels.

TRIMMER & SLUG LOCATION
TOP VIEW, FIG. 14



SPARTON TELEVISION RECEIVERS

CHASSIS TYPE 23TC10

MODELS 4935 & 4942 (CONSOLES)
MODELS 4954 & 4960 (TABLES)

ALIGNMENT PROCEDURE

PRELIMINARY ADJUSTMENTS: Before alignment the receiver controls should be adjusted to the approximated operating positions specified in the table below. The controls should remain in these positions for all checks unless otherwise specified.

- Contrast Control - to center position
- Brightness Control - to position where raster is visible on the kinescope
- Focus Control - to position where focus is obtained
- Vertical Hold - to center position
- Vertical Linerity - to center position
- Vertical Size - adjusted to give normal raster height
- Horizontal Hold - to center position
- Horizontal Size - adjusted to give normal raster width

TEST EQUIPMENT SET UP: A certain amount of experimntation must be employed to secure a stable test set up before alignment or service of the receiver is attempted. It is recommended that the top of the test bench be covered with a sheet of aluminum to insure good grounds between the various pieces of test equipment and the receiver chassis. In general all test signal input leads should be kept away from output leads as much as possible.

PICTURE I.F. INSTABILITY: If the picture I.F. strip is badly out of alignment it may become unstable and fall into oscillation. When this condition occurs a comparatively large voltage is developed across the picture detector load resistor. This voltage is independent of I.F. signal input at the converter grid.

It is usually possible to stop I.F. oscillation due to misalignment by adjusting the iron cores in the various picture I.F. coils and traps according to the information given in the table below:

L37	Slug out	(Min. L)
L39	Slug in	(Max. L.)
L40	Slug out	
L41	Slug in	
L42	Slug out	
L43	Slug out	
L45A	Slug in	
L46	Slug out	
L48	Slug in	

The actual physical location of the various coils and traps is shown in Figure 14.

SOUND TRAP ALIGNMENT: First, remove V1 (6BH6 R.F. amplifier) and V-3 (6C4 local oscillator tubes) from the R.F. tuner, and connect an 8000 ohm, 5 watt resistor between the ⨍ 175 volt buss (point G Fig. 13, page 117) and chassis ground. This resistor prevents the voltage on the ⨍ 175 volt buss from rising when V-1 and V-3 are removed. Connect the R.F. signal generator to the grid of V-2 (point D Fig. 13, page 117) by means of the I.F. input adapter as shown in Fig. 17.

SECOND: Set the R.F. tuner to channel #2.

THIRD: Connect a 3 volt bias battery between the A.G.C. buss (point E Fig. 13) and chassis ground so that the voltage on the A.G.C. buss is -3 volts in respect to the chassis.

FOURTH: Connect the electronic voltmeter across the picture detector load resistor R36, point A Fig. 13 and set the voltmeter on the low D.C. volt scale.

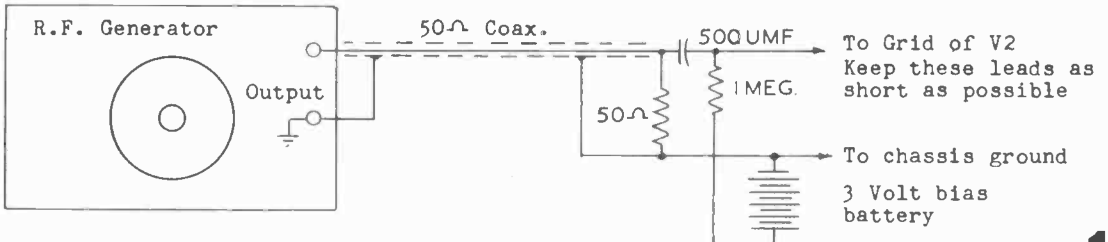


Figure 17 I.F. Input Adapter

SPARTON TELEVISION

ALIGNMENT PROCEDURE (CON'T)

FIFTH: Set the R.F. signal generator to each of the frequencies shown in the table below and in each case tune the specified adjustment for minimum indication on the voltmeter. It is advisable to check the output of the generator with the crystal calibrator to make certain that it is exactly on frequency in each case.

27.75 Mc.	L-37	(Top of chassis as shown in Fig. 14)
27.75 Mc.	L-40	(Top of chassis as shown in Fig. 14)
21.75 Mc.	L45A	(Top of chassis as shown in Fig. 14)
21.75 Mc.	L-48	(Top of chassis as shown in Fig. 14)

PICTURE I.F. ALIGNMENT: FIRST: Connect the R.F. signal generator, voltmeter and bias battery to the receiver as described in steps 1,2,3 and 4 of the sound trap alignment instructions.

SECOND: Set the signal generator to each of the following frequencies and peak the specified adjustments for maximum indication on the voltmeter.

22.4 Mc.	L-39	(Top of chassis as shown in Fig. 14)
22.5 Mc.	L-41	(Top of chassis as shown in Fig. 14)
25.9 Mc.	L-42	(Top of chassis as shown in Fig. 14)
24.1 Mc.	L-43	(Top of chassis as shown in Fig. 14)
26.0 Mc.	L-46	(Top of chassis as shown in Fig. 14)

NOTE: On some receivers it is possible to tune through resonance on L-42 and set the I.F. strip in oscillation. When this occurs the voltage across the picture detector load resistor will increase to a point where the effects of the oscillation may be mistaken for the actual resonance peak of L-42. If trouble of this nature is encountered tune L-42 to the point where I.F. oscillation ceases and go on to peak L-43 and L-46 at their respective frequencies and then return to peak L-42.

SOUND I.F. ALIGNMENT: FIRST: Connect the R.F. signal generator and bias battery to the receiver as described in steps 1,2 and 3 of sound trap alignment instructions.

SECOND: Connect the electronic voltmeter across C68 (from point B to point F) as shown in Fig. 13. Set the voltmeter on the low D.C. volt scale.

CAUTION: In instances where the common input lead of the voltmeter is grounded to the meter case it will be necessary to keep the case insulated from the receiver chassis or the + 175 volt buss will be shorted out. By the same token a shock hazard exists between the meter case and chassis ground. Because of these conditions a reasonable amount of care should be exercised by the service engineer when handling the equipment. In order to avoid these difficulties it is recommended that the voltmeter used be constructed in such manner that the input leads are well insulated from the meter case.

THIRD: Set the R.F. signal generator to 21.75 Mc. and peak the following coils for maximum indication on the voltmeter.

L-63	(Top of chassis as shown in Fig. 14)
T-11	(Primary (Ratio Det.) top of chassis as shown in Fig. 14.)

RATIO DETECTOR TRANSFORMER ALIGNMENT: FIRST: Connect the R.F. signal generator and bias battery to the receiver as described in steps 1,2 and 3 of the sound trap alignment instructions.

SECOND: Connect the electronic voltmeter from the junction of R73 and R74 to the junction of R69, C64 and C65. Point C as shown in Fig. 13.

THIRD: Set the signal generator output to 21.75 Mc. Adjust the secondary of T-11. (Bottom of chassis as shown in Fig. 14). Notice that it is possible to produce a positive or negative voltage indication on the meter by varying this adjustment. As the voltage swings from positive to negative, adjust T-11 for zero output as indicated by the voltmeter. This point is called zero ratio detector output and indicates correct alignment of T-11 transformer.
If the secondary of T-11 is found to be way out of alignment it will be necessary to re-peak the primary as described in the preceeding section on sound I.F. alignment.

PICTURE I.F. TOUCH UP: FIRST: Connect the R.F. sweep generator output to the grid of V-2 point D Fig. 13 by means of the I.F. input adapter shown in Fig. 17.

SECOND: Remove V-1 and V-2 from the R.F. tuner and connect the 8000 ohm, 5 watt resistor between + 175 volt buss (point G, Fig. 13) and chassis. Set R.F. Selector to channel #2.

THIRD: Connect the oscilloscope across the picture detector load resistor R36 (point A, Fig. 13) by means of the shielded cable and the filter system shown in Fig. 18.

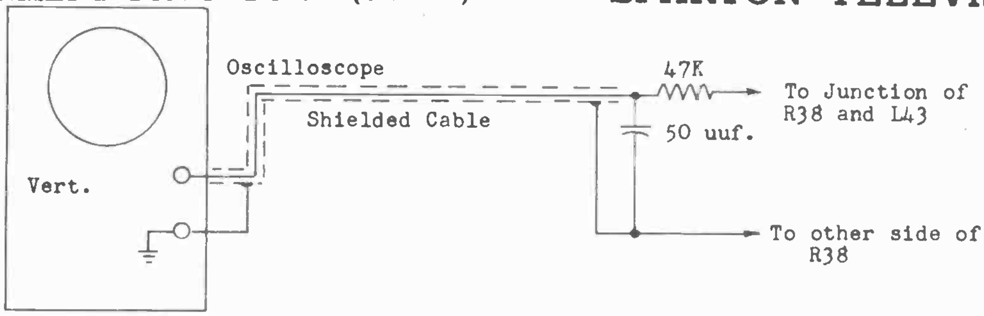


Fig. 18 FILTER SYSTEM FOR SCOPE CONNECTION

FOURTH: Set the R.F. sweep generator so that it sweeps from approximately 20 to 30 Mc.

FIFTH: Adjust the oscilloscope so that the swept I.F. response is visible on the cathode-ray tube screen.

SIXTH: Loosely couple the output of the R.F. signal generator to the grid of V-2 so that marker signals of proper frequency can be mixed in with the R.F. sweep signal.

SEVENTH: Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary slightly vary the tuning of the picture I.F. coils L-39,L-41,L-42,L-43 and L-46 until the picture I.F. response shown in Figure 19 is obtained. The solid curve in Figure 19 depicts the ideal I.F. response while the dotted curves show permissable variations.

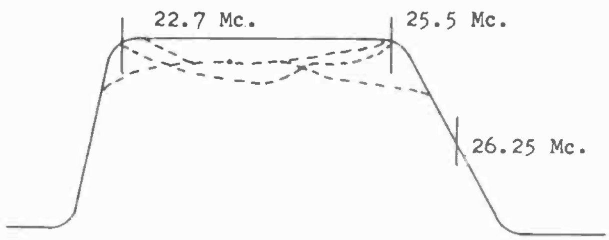


Fig. 19 IDEAL I.F. RESPONSE WITH PERMISSABLE VARIATIONS

The picture I.F. carrier should appear approximately half way down the I.F. response curve as shown in Figure 19. Variation in the pix carrier position should not exceed ≠ 10% from the half way point.

PICTURE I.F. SENSITIVITY CHECK: FIRST: Connect the R.F. signal generator to the receiver as specified in steps 1 and 2 of the sound trap alignment instructions. (When making sensitivity checks no bias battery is connected to the A.G.C. buss.)

SECOND: Connect the electronic voltmeter across the picture detector load resistor R36 and set the meter on the low D.C. volts scale.

THIRD: Set the generator output frequency at approximately 23 Mc. Adjust the generator output until the voltmeter reads approximately 1.0 volt. Record the R.F. signal input in microvolts. Repeat the procedure with the generator output frequency set at 24.2 and 25.4 Mc. In all cases the I.F. input voltage should be 200 Microvolts or less. The sensitivity at the I.F. picture carrier 26.25 Mc., should be approximately half of the I.F. sensitivity between 24.2 Mc. (Maximum of 400 microvolts.).
If the generator output is not calibrated in microvolts, comparative sensitivity measurements can be made by using another receiver that is known to be in good operating condition as a standard. This applies to all sensitivity measurements and good results can be obtained if sufficient care is used.

SOUND I.F. SENSITIVITY: FIRST: Connect the R.F. signal generator to the receiver chassis as specified in steps 1 and 2 of the sound trap alignment instructions.

SECOND: Connect the electronic voltmeter across C68 (from point B to point F) as shown in Figure 13. Set the meter on the low D.C. volts scale.

THIRD: Set the generator output frequency at 21.75 Mc. Adjust the output signal level until the voltmeter indicates 8 volts across C68. The generator output signal should then be 250 microvolts or less.

R.F. OSCILLATOR ALIGNMENT: The R.F. oscillator circuits may be aligned by feeding signals at the R.F. sound carrier frequencies into the receiver antenna terminals and adjusting the oscillator frequency on each channel for zero output from the ratio detector. The ratio detector should be aligned exactly before this method of R.F. oscillator adjustment is attempted.

Since incremental inductances are placed in series with the tuned circuits for channels 8,10 and 12 to form the tuned circuits for channels 7,9 and 11, the order in which these channels are aligned becomes important. In these cases it is necessary to align the higher channel of each connected pair before the alignment of the lower channel is attempted. For example, L22 forms the tuned circuit for channel 8 but with the additional series inductance L23 also forms the tuned circuit for channel 7. Note that the tuning of L22 not only affects oscillator operation on channel 8 but also on channel 7 since L22 is common to both circuits. L23, however, affects only channel 7 since it is switched out of circuit when the tuner operates on channel 8. For these reasons it is necessary to first tune L22 for correct oscillator frequency on channel 8, and then to adjust L23 for correct oscillator frequency on channel 7. In practice the inductane ofthe incremental coils is adjusted by actual mechanical distortion of the incremental coils themselves.

The following description gives a step by step procedure that simplifies oscillator circuit alignment.

FIRST: Insert V-1 and V-3 in the R.F. tuner, and remove the 8000 ohm resistor which had been added for sound trap alignment. (Step 1). Connect the signal generator to the receiver antenna terminals.

SECOND: Set the oscillator vernier capacitor (fine tuning) at approximately the center of its effective capacity range. This can best be determined by finding the maximum and minimum capacity settings of the vernier and then interpolating between the two extremes for the center position.

THIRD: Connect the electronic voltmeter from the junction of R73 and R74 to the junction of R69, C64 and C65. (Point C as shown in Fig. 13).

FOURTH: Set the R.F. signal generator to each of the following sound R.F. carrier frequencies, the tuner to the corresponding R.F. channel, and peak the specified adjustment for zero output of the ratio detector as observed on the voltmeter. (Zero output of the ratio detector is explained in the section on ratio detector alignment).

ADJUST R.F. GENERATOR FREQUENCY TO	SET TUNER TO CHANNEL	ADJUST INDUCTANCE OF COIL NO.
215.75 Mc.	13	L28 (Slug tuned)
209.75 Mc.	12	L26 (Slug tuned)
203.75 Mc.	11	L27 (Incremental)
197.75 Mc.	10	L24 (Slug tuned)
191.75 Mc.	9	L25 (Incremental)
185.75 Mc.	8	L22 (Slug tuned)
179.75 Mc.	7	L23 (Incremental)
87.75 Mc.	6	L21 (Slug tuned)
81.75 Mc.	5	L20 (Slug tuned)
71.75 Mc.	4	L19 (Slug tuned)
65.75 Mc.	3	L18 (Slug tuned)
59.75 Mc.	2	L17 (Slug tuned)

The physical location of all coils and adjustments is shown in Figure 14. The output of the R.F. generator should be checked by means of the crystal calibrator to make certain that it is exactly on frequency in all cases.

CAUTION: In manufacture the slugs in the R.F. tuner coils are firmly held in place by means of wax which is put into the forms after alignment. This wax must be removed before tuning of the coils is attempted and must be replaced after re-alignment is completed.

R.F. AND CONVERTER CIRCUIT ALIGNMENT: The alignment of the R.F. and converter circuits of the tuner is a difficult and tedious task when it must be performed without benefit of special factory test equipment. For this reason it is not recommended that the complete re-alignment of these circuits be attemped by the service engineer.

MOST-OFTEN-NEEDED **1950 TELEVISION INFORMATION**

SYLVANIA

Service Information on Sylvania Television Chassis 1-139, Models 1-075, 1-113, 1-114, 1-124, and 1-125, is presented on pages 125 to 128, with the circuit diagram on blueprint page 128A. Model 1-210 supersedes Model 1-124, and is electrically the same as the models here covered. Chassis 1-186 making up Model 1-177 very closely resembles the 1-139 chassis here described. The only differences being the deletion of the tone control circuit, a revised volume control tone network, and a change in placement of the front panel controls.

Test Equipment Requirements

1. R.F. sweep generator or generators with frequency range from 4-220 Mc. having sweep width adjustable from 50 KC. to 10 Mc., with an output of at least 0.1 volt, with a marker system built in or external type and flat within ± 1 Db.
2. Signal generator or generators with a frequency range from 4-222 Mc. with adjustable output of at least 0.1 volt.
3. Cathode ray oscilloscope capable of passing a 60 cycle square wave.
4. Sylvania Polymeter or equivalent vacuum tube voltmeter (V.T.V.M.) with high voltage probe adapter, range 0 to 15,000 volts and 0 to 25,000 volts D.C.
5. Tube checker capable of testing shorts with proper voltages and performance under dynamic conditions.
6. Jig Tube. This test instrument should be made from a 6J6 tube. See Figure 8.

ALIGNMENT PROCEDURE

Should any chassis under service require complete realignment, the alignment procedure should be carried out in the following listed order.

PRE-ALIGNMENT INSTRUCTIONS - READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Lay chassis on either of its sides for under chassis adjustments.
Remove the H.V. Osc. tube (6SN7GT) to disable the high voltage.
Use an insulated alignment screw driver for all adjustments except where otherwise specified.

VIDEO IF ALIGNMENT

1. Connect the negative lead of a 3 volt battery to the AGC line, the positive lead to ground.
2. Connect oscilloscope across 3900 ohm video detector diode return resistor R161 using shielded leads. This resistor is 125 volts below ground.
3. Connect the sweep generator through a .005 mfd. capacitor to pin 1 of the 6AG5 fourth video IF tube. Loosely couple the signal generator to this point for use as a marker.

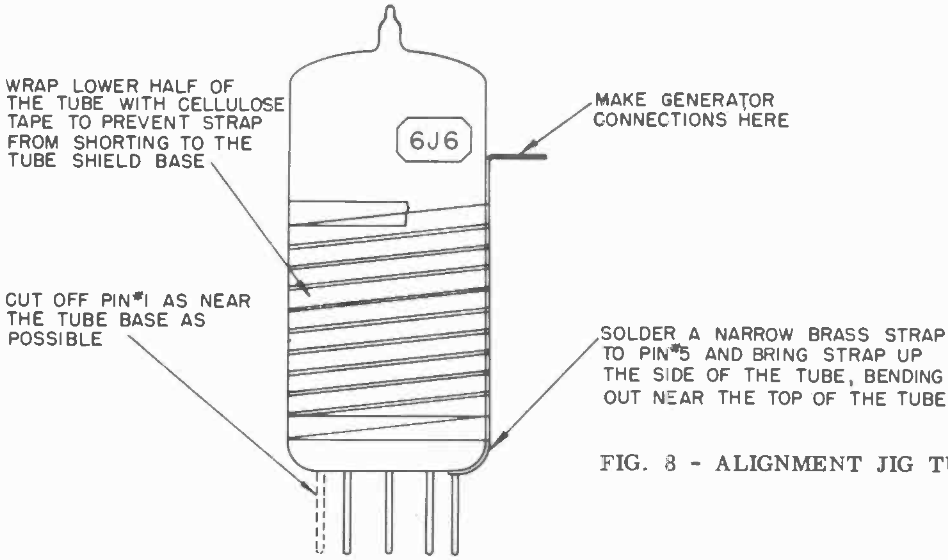


FIG. 8 - ALIGNMENT JIG TUBE

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

SYLVANIA Chassis 1-139

4. Calibrate the oscilloscope for 2.8 volts peak to peak in the following manner:
   A. Feed 1 volt RMS into the vertical input of the scope.
   B. Adjust vertical gain on scope so as to obtain a sine wave large enough for viewing (approximately 2").
   C. At the desired size, draw two horizontal lines on the face of the cathode ray tube, each designating the extremes of the sine wave.
   D. Make no further adjustment of the vertical gain while measuring output at video detector. Note where gain control is set for future reference to eliminate unnecessary setups for obtaining this scope calibration.
5. Tune sweep generator to 24 Mc. with a 10 Mc. sweep and adjust slugs on video IF transformer T57 for a symmetrical response curve as shown in Figure 11.
6. Disconnect oscilloscope and connect the VTVM across 3900 ohm video detector diode return resistor R161.
7. Remove the sweep generator from pin 1 of the 6AG5 fourth video IF tube.
8. Remove the 6J6 RF Oscillator-Mixer tube from its socket and replace with jig tube.
9. Connect signal generator through a .005 mfd. capacitor to the lead on the jig tube (pin 5).
10. For the following trap alignment, the generator output should be increased as required to get a satisfactory dip indication on the meter. For peaking coil alignment, the generator output should be decreased as required to keep the meter reading less than 3 volts. Select the first peak that occurs when the slugs are turning in from the fully out position. Align the following adjustment in sequence:

Set Signal Generator At:	Adjust:
20.4 Mc.	Slug on trap coil L53 for minimum output
21.9 Mc.	Slug on trap coil L58 for minimum output
27.9 Mc.	Slug on trap coil L59 for minimum output
26.3 Mc.	Slug on video IF coil T56 for maximum output
23.4 Mc.	Slug on video IF coil T52 for maximum output
25.0 Mc.	Slug on video IF coil T51 for maximum output
24.3 Mc.	Slug on tuner output coil L10 for maximum output

Repeat the above procedure until adjustments do not change.

ALIGNMENT RESPONSE CURVES

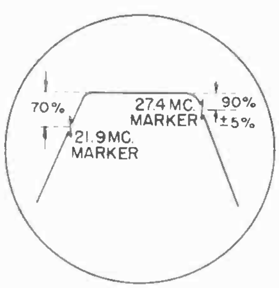


FIG. 11

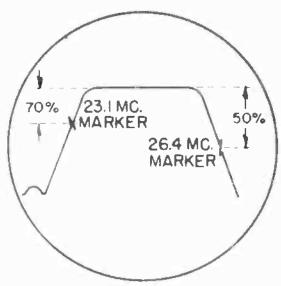


FIG. 12

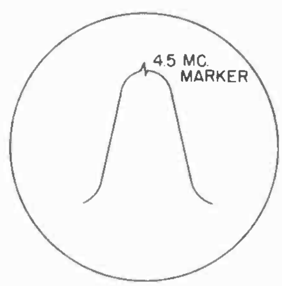


FIG. 13

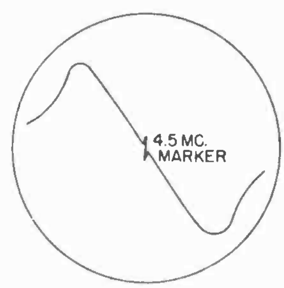


FIG. 14

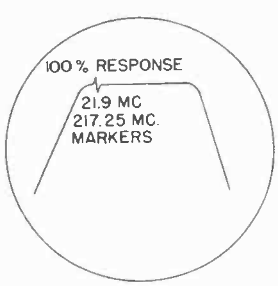


FIG. 15

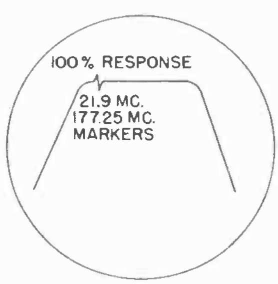


FIG. 16

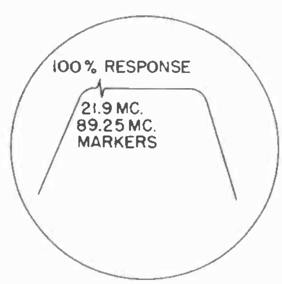


FIG. 17

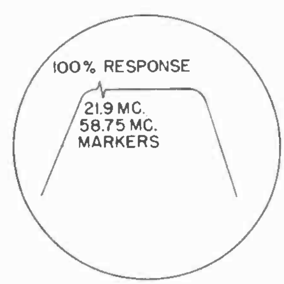


FIG. 18

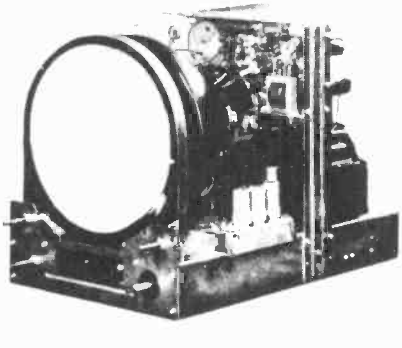
11. Disconnect the VTVM from across the 3900 ohm video detector diode return resistor R161 and connect cathode ray oscilloscope to the same point. Disconnect signal generator from jig tube and connect sweep generator to the same point through a .005 mfd. condenser. Loosely couple the signal generator for use as a marker.
12. Tune sweep generator to 24 Mc. with a 10 Mc. sweep and view response curve of the video IF transformers on oscilloscope. See Figure 12 for desired over-all response curve. The video carrier (26.4 Mc.) should be at 50% response as shown in Figure 12. Re-adjust T56 slightly to obtain this result, if necessary. The band width may be checked by varying the frequency of the marker signal from the high side of the curve until it indicates 70% response on the opposite side of the curve. The difference between this frequency and 26.4 should be approximately 3.3 Mc. Re-adjust T52 to obtain this band width if necessary. Slight re-adjustment of slugs on tuner output transformer L10 and video IF transformer T51 may be necessary to obtain the symmetrical characteristics as shown in Figure 12.

4.5 MC. TRAPS AND SOUND INTER-STAGE ALIGNMENT

1. Connect the high frequency probe of the V.T.V.M. across picture tube cathode and ground.
2. Connect signal generator through a .005 mfd. capacitor to pin 7 of the 6AQ5 video amplifier tube.
3. Tune signal generator to 4.1 Mc.
4. Adjust the screw on the sound take-off trap coil L63 to the full out (counterclockwise) position, and adjust the slug on the bottom trap coil L64 to give maximum indication on the V.T.V.M.
5. Tune signal generator to 4.5 Mc. with sufficient output to give a readable indication on the V.T.V.M.
6. Adjust the screw on sound take-off trap coil L63 for a sharp dip on the meter. Note meter reading and tune signal generator to approximately 2.0 Mc. Reduce signal output until meter reading is the same as obtained with 4.5 Mc. signal. The signal generator output at 2.0 Mc. must be at least ten times down from the 4.5 Mc. signal generator output.
7. Remove the signal generator and connect sweep generator to the same point, loosely coupling the signal generator for use as a marker.
8. Remove the V.T.V.M. from across the picture tube cathode and connect the oscilloscope through a 39,000 ohm isolation resistor to the 47,000 ohm sound IF limiter grid return resistor R128.
9. Tune sweep generator to 4.5 Mc. with a 500 KC. sweep and tune slugs on sound IF transformer T54 for response shown in Figure 13.
10. Repeat procedure until adjustments do not change. After proper adjustment, the band width at the 50% point should be approximately 175 KC.

SOUND DISCRIMINATOR ALIGNMENT

1. Leave the sweep generator connected and the signal generator loosely coupled as in the above alignment.
2. Disconnect the oscilloscope from across the 47,000 ohm limiter grid return resistor R128 and connect across the volume control R166.
3. Reduce the generator sweep to 300 Kc. and adjust discriminator trimmers C141, C142 and C143 so that (1) the 4.5 Mc. marker is exactly in the center of the curve, (2) the curve is linear between 4.55 Mc. and 4.45 Mc. and (3) the amplitude is the greatest obtainable. See Figure 14 for desired response.



CHASSIS 1-139

Deflection Yoke Adjustment

The deflection yoke must be positioned against the flare of the picture tube. To do this, loosen the wing screw located underneath the yoke and push the yoke as far forward as possible. If the picture is not square with the mask, rotate the yoke. Loosen the two side wing screws to raise or lower the yoke so that the neck of the picture tube will seat parallel with the chassis.

SYLVANIA Chassis 1-139

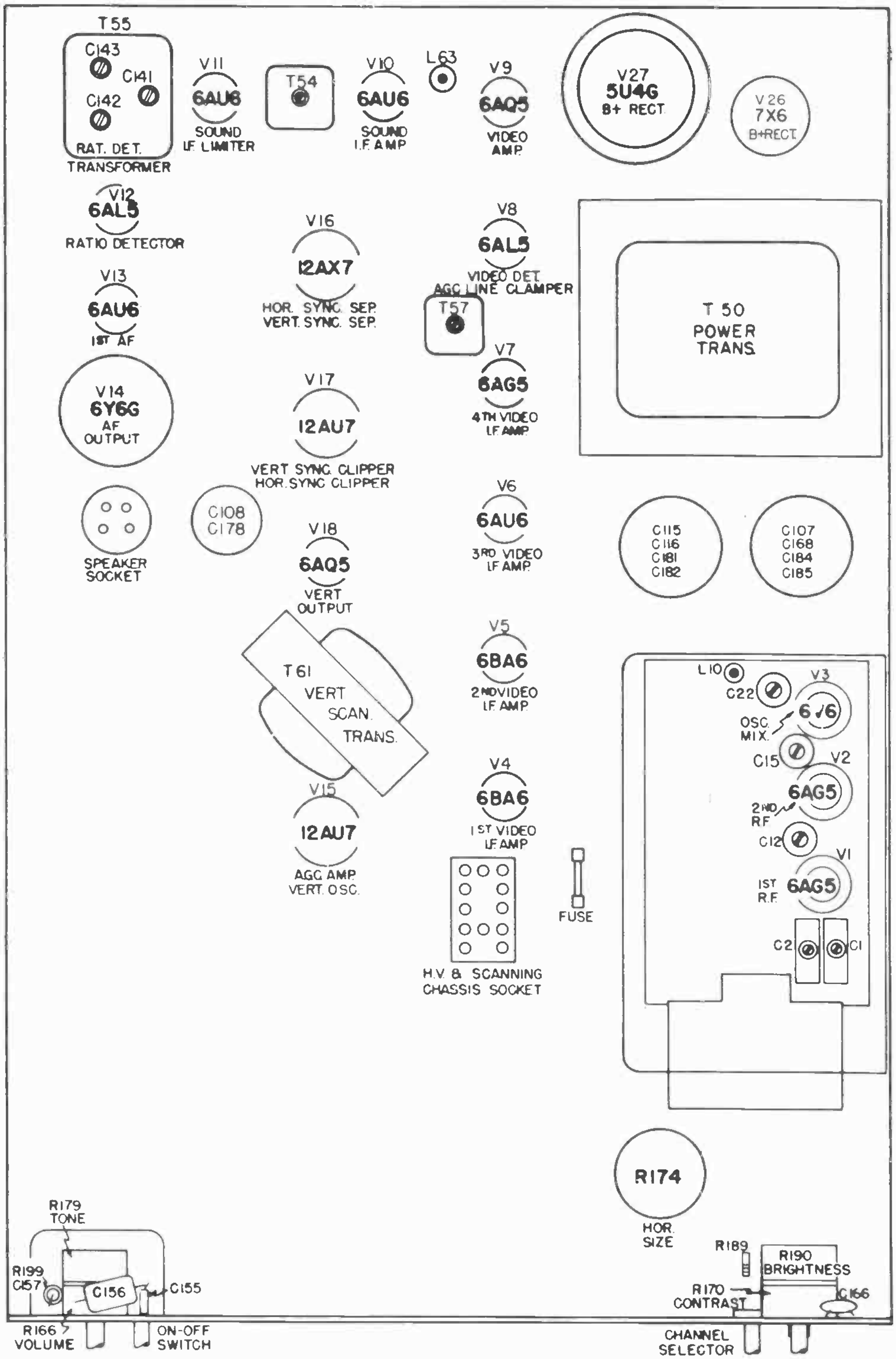
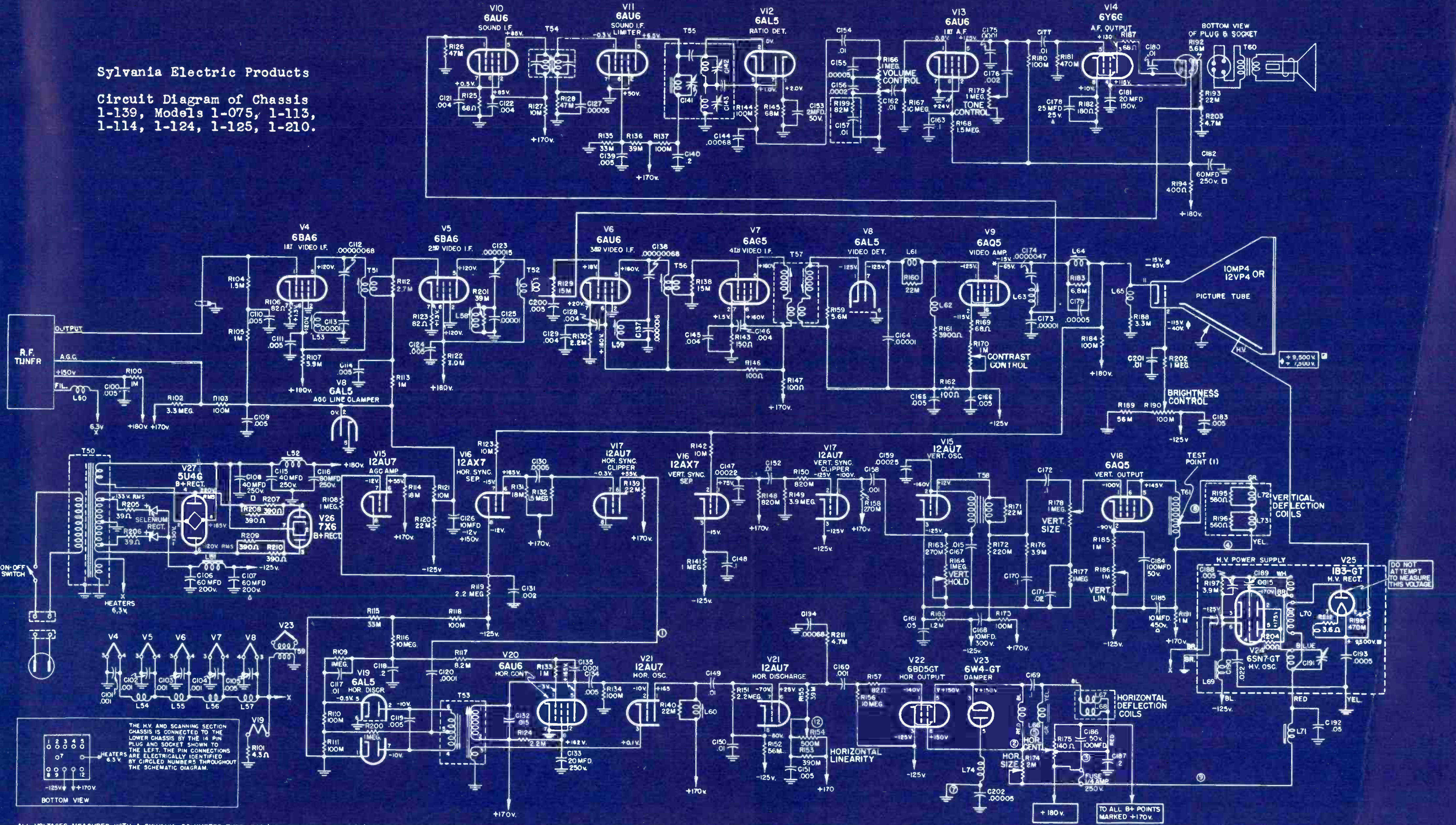


FIG. 5 - CHASSIS TOP LAYOUT

Sylvania Electric Products

Circuit Diagram of Chassis 1-139, Models 1-075, 1-113, 1-114, 1-124, 1-125, 1-210.



ALL VOLTAGES MEASURED WITH A SYLVANIA POLYMETER TYPE 1342 (VACUUM TUBE VOLTMETER) UNLESS OTHERWISE STATED. ANTENNA DISCONNECTED & NO SIGNAL INPUT. LINE POTENTIAL 117 VOLTS 60 CYCLES AC SUPPLY. BRIGHTNESS & CONTRAST CONTROLS AT MINIMUM UNLESS OTHERWISE STATED.

* CONTRAST CONTROL AT MAXIMUM

◊ BRIGHTNESS CONTROL AT MAXIMUM

▼ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 2,000 V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT

■ USE HIGH VOLTAGE MULTIPLIER PROBE WITH SYLVANIA POLYMETER FOR ALL HIGH VOLTAGE MEASUREMENTS.

FIG. 21 - SCHEMATIC DIAGRAM

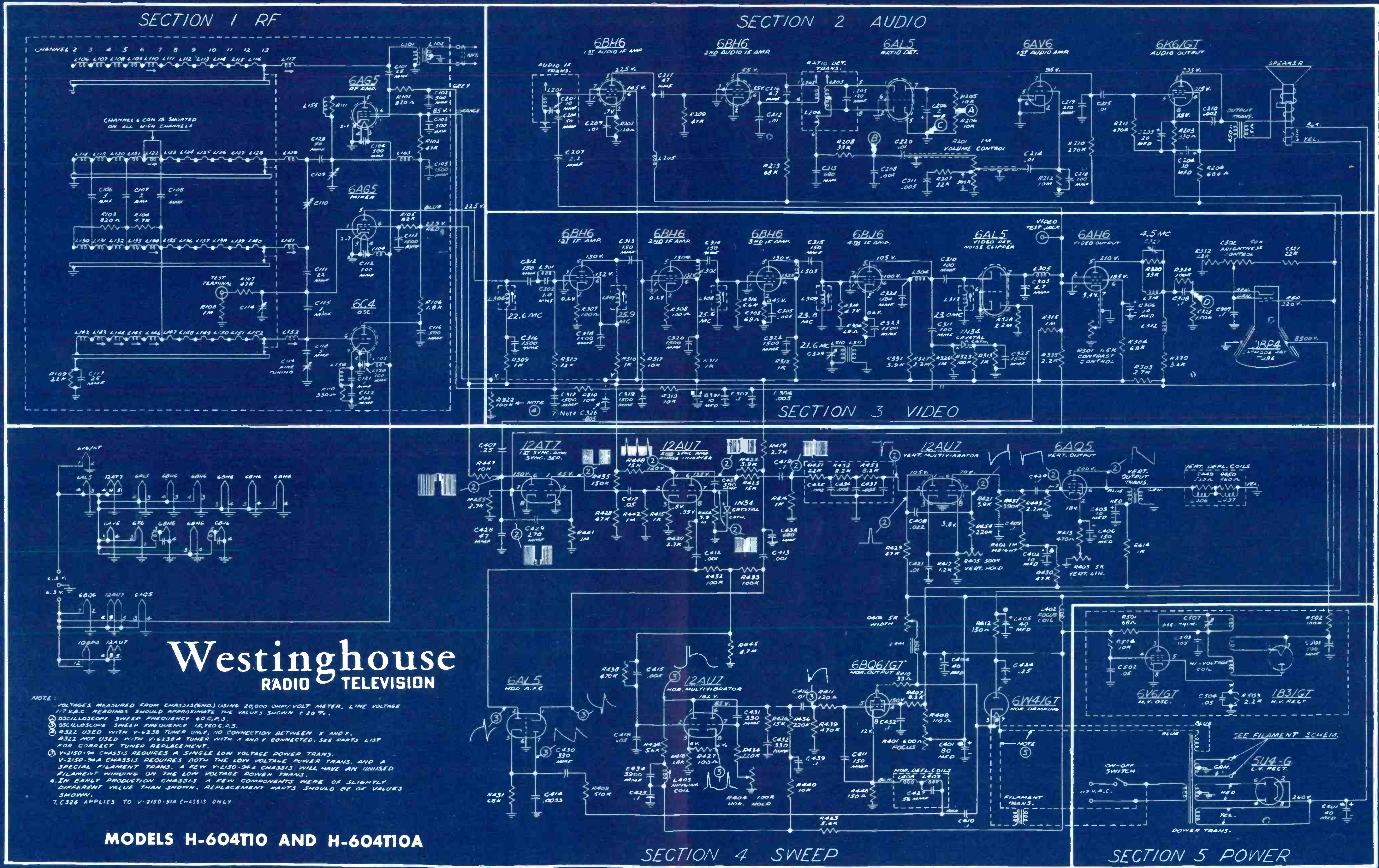


FIG. 9—SCHEMATIC DIAGRAM OF V-2150-94 AND V-2150-94A CHASSIS

NOTE—The V-2150-91A chassis is the same as the V-2150-94A chassis except that a different R-F tuner is used. Therefore, this schematic with the exception of the R-F section applies also to chassis V-2150-91A.

Westinghouse Electric Corporation

MODELS H-604T10 AND H-604T10A

CHASSIS V-2150-94, V-2150-91A, AND V-2150-94A

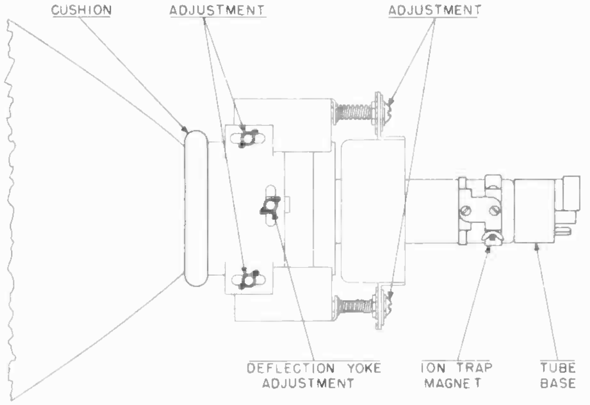


Fig. 1—Top View of C. R. T.

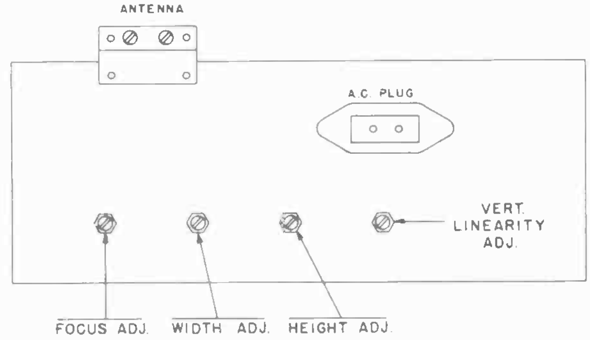


Fig. 2—Rear View of Chassis

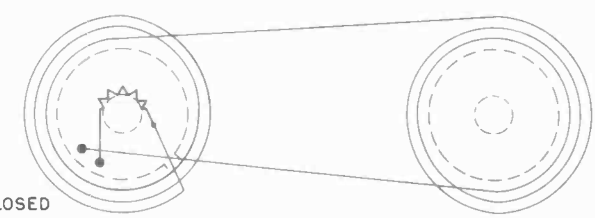


Fig. 3—Drive String Arrangement

BUILT-IN ANTENNA MECHANISM

SIDE VIEW—TRIMMER CLOSED

— MODEL H-604T10A

The antenna trimmer control is designed to rotate through a range of 2½ turns. At one extreme of rotation the trimmer is completely closed, thus serving as a stop. A collar locked on the threaded portion of the trimmer shaft serves as a stop at the other extreme of rotation. When the trimmer shaft is rotated 2½ turns from the completely closed position, the collar on the shaft should bear against the metal shoulder on the trimmer and stop rotation in that direction.

If the collar becomes loosened and no longer stops the trimmer rotation at 2½ turns, it should be re-positioned on the shaft. Loosen the set screw in the collar, completely close the trimmer, and then open the trimmer 2½ turns. Position the collar so that it bears tightly against the metal shoulder of the trimmer, and tighten the set screw in the collar.

The drive string arrangement for the built-in antenna trimmer is shown in Fig 3.

CHASSIS REMOVAL — MODEL H-604T10A

Removal of the chassis from Model H-604T10A is complicated somewhat by the built-in antenna. The recommended procedure is as follows:

1. Remove the control knobs from the front of the receiver.

2. Remove the wood screws that secure the back cover, and remove the back cover by pulling it away from the cabinet.

3. Remove the built-in antenna feeder from the antenna terminals on the rear of the chassis.

4. Remove the thumb tack that secures the end of the antenna tuning stub to the top of the cabinet.

5. Remove the two screws that secure the antenna trimmer brackets to the top of the cabinet.

6. Using care to avoid bending the antenna tuning stub, pull the trimmer shaft and rubber coupling off the pulley shaft thus detaching the trimmer and tuning stub assembly.

7. Remove the hex-head chassis mounting bolts from the bottom of the cabinet.

8. Remove the chassis from the cabinet. The pulley shaft is sufficiently flexible to allow passage of the chassis.

Westinghouse Electric Corp

H. F. OSCILLATOR ALIGNMENT PROCEDURE FOR V-2150-91A CHASSIS

The -91A chassis utilizes a V-6771-2 tuner assembly: If the 6C4 H-F oscillator tube is replaced in this tuner, the different inter-electrode capacitance of the new tube may change the oscillator frequency enough to necessitate re-alignment of the oscillator.

The oscillator adjusting screws are located on the front of the tuner assembly, and this procedure should be followed for their adjustment:

1. Remove the channel selector and fine tuning knobs. Remove the selector escutcheon plate and escutcheon mounting plate by removing the Phillips head screws securing them to the cabinet. The adjustments are accessible through the hole in the cabinet.

2. Set the fine tuning control to the middle of its range, and leave it in this position during the following adjustments.

3. Set the channel selector switch to the highest of the low band (channels 2 through 6) stations operating in your locality.

4. Peak the appropriate oscillator slug for the best picture detail.

5. Repeat step 4 for each progressively lower channel on which a station transmits in your area.

6. Set the channel selector switch to the highest of the high band (channels 7 through 13) stations operating in your locality.

7. Peak the appropriate oscillator slug for the best picture detail.

8. Repeat step 7 for each progressively lower channel in the high band on which a nearby station transmits.

9. Check the previously made low band adjustments, and if the tuning has changed repeat steps 3 through 8.

H. F. OSCILLATOR ALIGNMENT PROCEDURE FOR V-2150-94 AND V-2150-94A CHASSIS

The V-6238 and V-6238A tuner assemblies used in the -94 and -94A chassis have several screw-adjusted slugs and trimmers located on the top and rear of the tuner. These adjustments affect the R-F band-pass of the tuner and are provided for production purposes only. They should not be used by the service technician. The H-F oscillator slugs are accessible through the front of the tuner and are the only adjustments that should be used when servicing the tuner.

Replacement of the 6C4 H-F oscillator tube may in some instances necessitate readjustment of the H-F oscillator slugs. All of the channels should be checked, and if the stations cannot be tuned-in correctly within the range of the fine tuning control, the oscillator slugs on the front of the tuner assembly should be adjusted as follows:

1. Remove the channel selector and fine tuning knobs. Remove the selector escutcheon plate and escutcheon mounting plate by removing the Phillips head screws that secure them to the cabinet. The adjustments are then accessible through the hole in the cabinet.

2. Set the fine tuning control to the middle of its range, and leave it in this position during the following adjustments.

3. Set the channel selector switch to the highest channel on which a station transmits in your area.

4. If in the preceding step the channel selector was set to a high band (channels 7 through 13) station, adjust the slug marked "13" for best picture detail. *NOTE: If stations in your locality transmit on more than one of the high-band channels, a compromise setting of slug "13" must be made that will allow all high-band stations to be tuned-in using the fine tuning control. Slug "13" is the only adjustment for high-band stations.*

If in the preceding step the channel selector was set to a low band (channels 2 through 6) station, adjust the appropriate (3, 4, 5, or 6) slug for best picture detail.

5. Set the channel selector to the next lower channel on which a station transmits in your area, and adjust the appropriate oscillator slug for best picture detail. *NOTE: Since there is no adjustment labeled "2", a compromise setting of slug "3" must be made to allow channels 2 and 3 to be tuned in using the fine tuning control.*

6. Repeat step 5 for each progressively lower channel used in your area.

7. Check back at the highest channel and then each progressively lower channel to make certain that the slugs are still correctly adjusted. There is some interaction between coils, and "touch up" adjustments may be required during the checking procedure.

Replacement of the 6AG5 R-F amplifier tube may change the characteristics of the tuner. To compensate for this, different tubes should be tried until one is found that matches the characteristics of the original tube and functions normally.

I-F ALIGNMENT CHART

Westinghouse Models H-604T10 & -A, Chassis V-2150-91A, -94, -94A

Turn the channel selector to channel 3 to avoid undesirable beat response during alignment.

COMMON I-F SECTION

Couple the sweep and marker generators to the mixer tube as shown in Fig. 4.

Step	*Sweep Gen. Frequency*	*Marker Gen. Frequency*	*Remarks*	*Indicator Connection*	*Adjust*
1.	Not used	21.6 mc. unmodulated	Use a strong signal	Connect VTVM to video test jack	C329 for *minimum* voltage
2.	Not used	22.6 mc. unmodulated	Keep marker output adjusted so VTVM reading does not exceed 2 v.	Same as step 1	L306 for maximum voltage
3.	Not used	25.9 mc. unmodulated	Same as step 2	Same as step 1	L307 for maximum voltage
4.	Not used	25.6 mc. unmodulated	Same as step 2	Same as step 1	L308 for maximum voltage
5.	Not used	23.8 mc. unmodulated	Same as step 2	Same as step 1	L309 for maximum voltage
6.	Not used	23.0 mc. unmodulated	Same as step 2	Same as step 1	L313 for maximum voltage
7.	25.3 mc. with 10 mc. deviation	check at: 21.6 mc. 22.5 mc. 23.5 mc. 25.3 mc. 26.1 mc.	Keep sweep output low enough so that very little noise appears on the oscilloscope trace	Connect oscilloscope to video test jack. See Fig. 5.	If necessary, adjust L306, L307, L308, L309, and L313 to obtain correct response curve. See Fig. 6.

AUDIO I-F SECTION AND 4.5 MC. TRAP

Connect the signal generator to the video test jack through a .001 mfd mica capacitor.

Step	*Signal Gen. Frequency*	*VTVM Connection*	*Remarks*	*Adjust*
1.	4.5 mc. unmodulated	See Fig. 8. Common lead to point "C" and high lead to point "A".	Use 5 v. (−DC) scale on meter. Set sig. gen. output accordingly.	L201 and L202 for maximum voltage
2.	4.5 mc. unmodulated	See Fig. 8. Common lead to point "A" and high lead to point "B".	Use same sig. gen. output as in step 1.	L203 for *zero* voltage
3.	4.5 mc. unmodulated	See Fig. 8. R-F probe to point "D" and common lead to chassis	Use strong signal from generator	C321 for *minimum* voltage

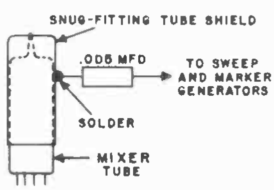


FIG. 4—COUPLING SIGNAL GENERATORS TO MIXER TUBE

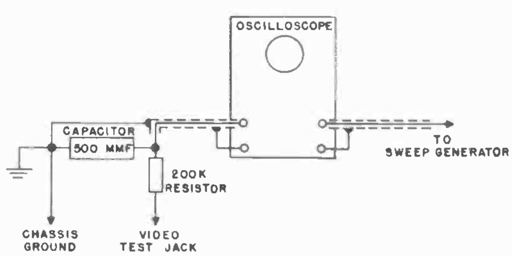


FIG. 5—OSCILLOSCOPE ISOLATION NETWORK

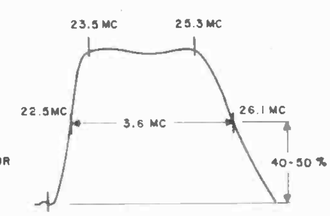


FIG. 6—I-F RESPONSE CURVE

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

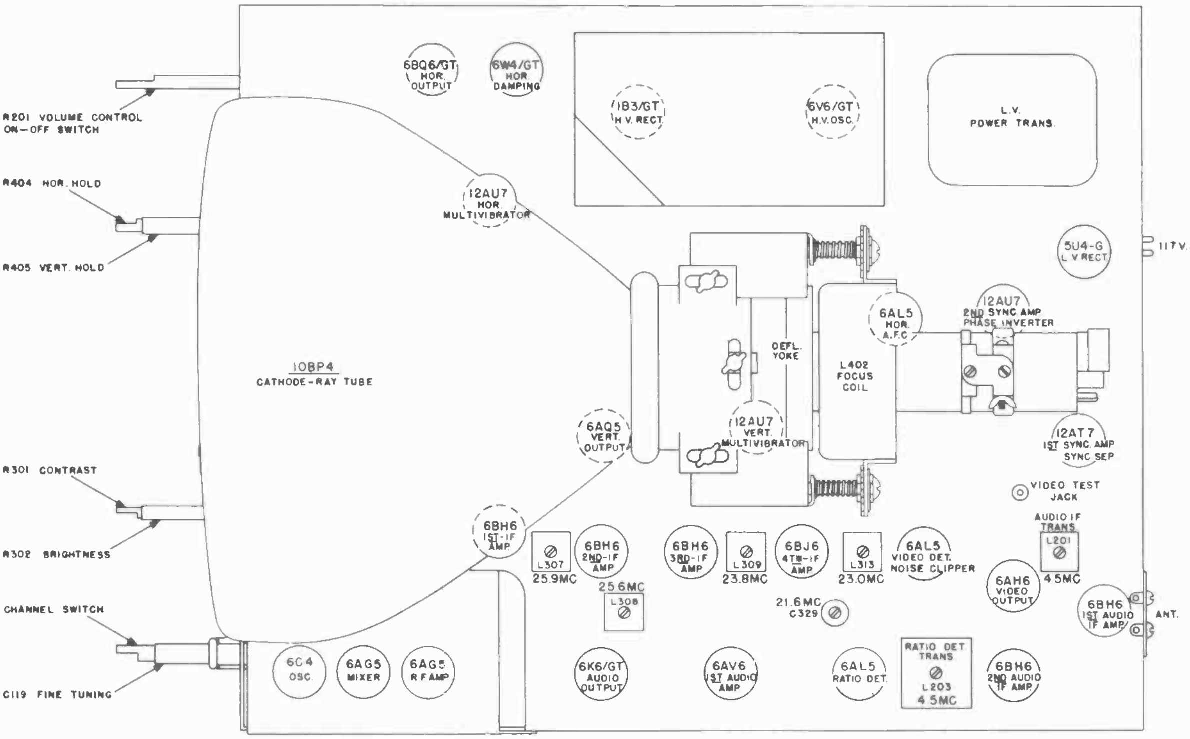


FIG. 7—TOP VIEW OF CHASSIS

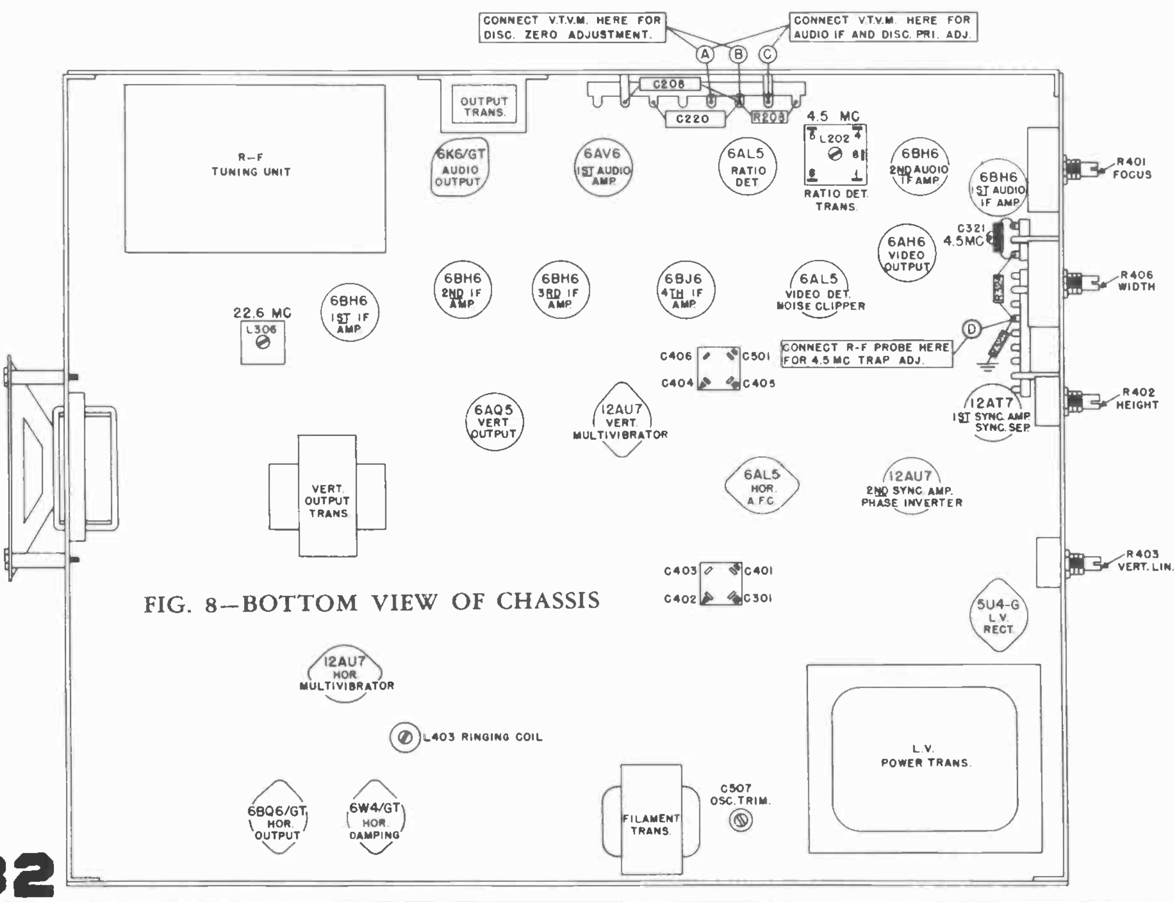


FIG. 8—BOTTOM VIEW OF CHASSIS

ZENITH RADIO CORPORATION

ZENITH
REG. U. S. PAT. OFF.

1950 — 23G22/23, 24G22/23/24/25 SERIES

1950 --- 23G24 and 24G26 SERIES

TELEVISION RECEIVERS

The Zenith 1950 television receivers are covered by the service notes which begin on this page and continue to page 144B. Under the chassis numbers listed in the upper right hand corner, there have been manufactured a great many different models in various cabinet styles, using different screens, and some in combination styles using a separate radio chassis. Almost all these models have a number with a prefix "G", for example G2441Z. We will not take up space to list all these model numbers since a serviceman can always find the chassis number stamped on the chassis of the set he may be servicing. The diagram on page 144B is for Chassis 24G26, using a 16EP4 picture tube. Chassis 23G24 has but a single horizontal output tube (V18), the power supply is not separate, and this chassis uses a 12-inch picture tube. The other chassis series, see list in heading, were made earlier and used a series filament circuit with the A.C. line returned to chassis. As you can see from the circuit diagram, the newer chassis use parallel connections with a power transformer that isolates the A.C. line from chassis.

THE 6BN6 GATED BEAM FM SOUND LIMITER-DETECTOR

Study of Fig.16 shows that the new tube is highly unconventional in structural design as its operation is based on electron-optical principles.

The rectangular cathode is surrounded on three sides by a grounded focusing electrode and faces a positive accelerator plate on its only open side. Electrons emerging from the cathode are shaped into a compact sheet-like beam which is projected against the limiter grid through the narrow slot in the accelerator.

The limiter grid acts like a gate. With zero or a positive potential applied, it passes the beam; with a negative potential of a few volts or more on the grid, the beam is stopped, the electrons turn around, diverge like a fountain falling back on the accelerator.

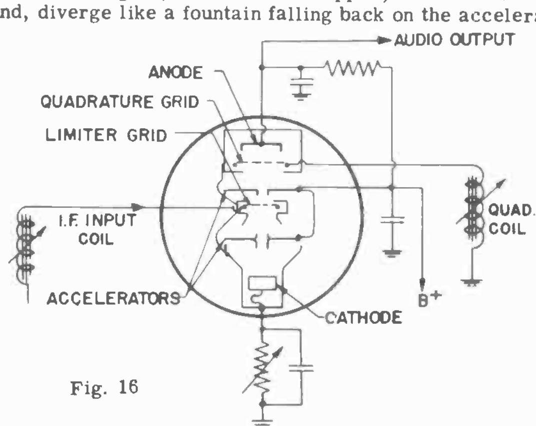


Fig. 16

If a sine-wave signal of 1 volt RMS or more is applied to the limiter grid, the beam is alternately passed and stopped, so that the beam current behind the input grid has the form of a square wave. As long as the input signal remains over 1 volt RMS, variations in its strength does not affect the intensity of this square wave; in other words, limiting takes place right at the first grid.

IF AMPLIFIER

The 40 Mc IF amplifier uses four 6AU6 tubes and a 1N64 germanium diode crystal detector. The transformers consist of bifiler windings with a single slug which tunes both primary and secondary inductances. Because intercarrier sound is used, both

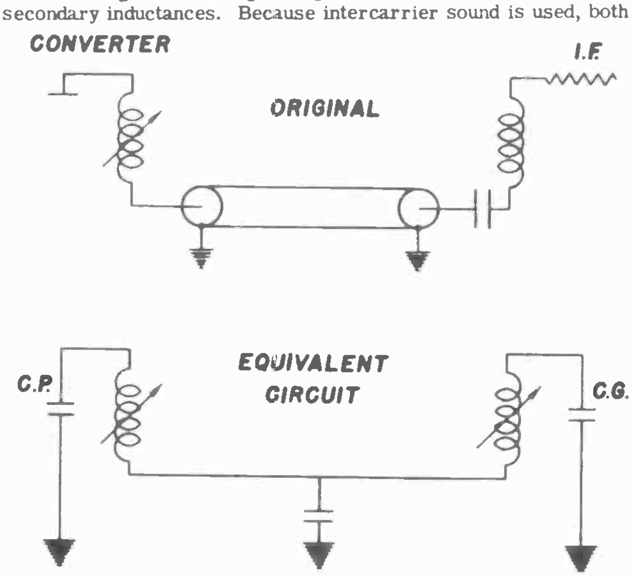


Fig. 18 Converter Coupling Into The IF.

the video and sound carriers pass through the IF amplifier. The video IF carrier is placed 2X down on the response curve and the sound carrier 20X down. Fig. 18 shows the method of coupling

Zenith 1950 Television

the converter into the 1st IF. It can be seen that the cable capacity is common to the converter plate and the 1st IF grid by virtue of the inherent inter-electrode and stray capacities.

INTERCARRIER SOUND

The video and sound carrier frequencies are 4.5 Mc apart. When these carrier frequencies beat, a 4.5 Mc difference frequency is produced which contains the original sound modulation. This 4.5 Mc IF is taken from the plate of the 12AU7 1st video amplifier V8A by the take-off coil L78, amplified by the 12AT7 intercarrier sound amplifier V10A and applied to the grid of the 6BN6 Gated Beam Limiter-Detector tube where limiting and detection occurs. The output from the detector is fed to the grid of the 6AG7 power amplifier tube and reproduced by the speaker.

GATED AGC

The purpose of the automatic gain control is to feed back a negative voltage, proportional to the strength of the received signal, to the grids of the RF-IF amplifier tubes in order to automatically control their amplification. It is for this reason that strong signals do not overload the receiver because they cause the development of a considerable feedback voltage which reduces the sensitivity of the receiver. On the contrary, very little feedback voltage is developed by weak signals and as a result the receiver operates at its maximum sensitivity.

With ordinary AVC circuits, such as used in broadcast receivers, the average of the rectified signal voltage is taken from the detector and fed back to the RF-IF grids. With a television receiver it is impossible to use the average signal because the amplitude is constantly changing with picture content. However, the components in a composite video signal which do have a relatively constant amplitude are the sync pulses. These are maintained at a level approximately 20 to 25% above the blanking and video level (See fig. 19) Therefore, it is the sync pulses which are used to control the gain of television receivers.

Ordinary methods of AGC have certain disadvantages which have been overcome by using the gated system. If the automatic gain control is not gated, it remains open to noise impulses which can have an amplitude as great, and in some cases, greater than the sync pulses. The average voltage developed by these noise pulses creates a false AGC voltage where the noise rather than the signal can be the controlling factor. Another disadvantage in conventional circuits is the long time constant which must be used. The long time constant prevents the AGC from following rapid changes in the amplitude of the received signal and undesirable effects such as picture "breathing" result.

An IF signal (before detection) is applied to the grid of the AGC amplifier V10B through a 200 MMFD capacitor C26. The intensity of this alternating voltage is proportional to the strength of the received signal and causes plate current conduction of V10B during its positive half cycles.

The plate voltage for the AGC amplifier is a 15.75 Kc pulse taken from the horizontal oscillator V17A. Since the frequency of the plate voltage is the same as the horizontal sync pulses (15.75 Kc)

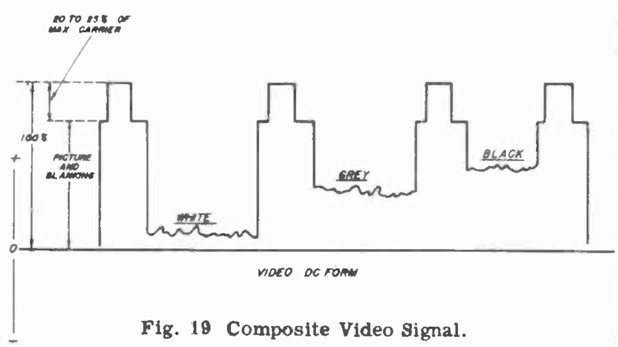


Fig. 19 Composite Video Signal.

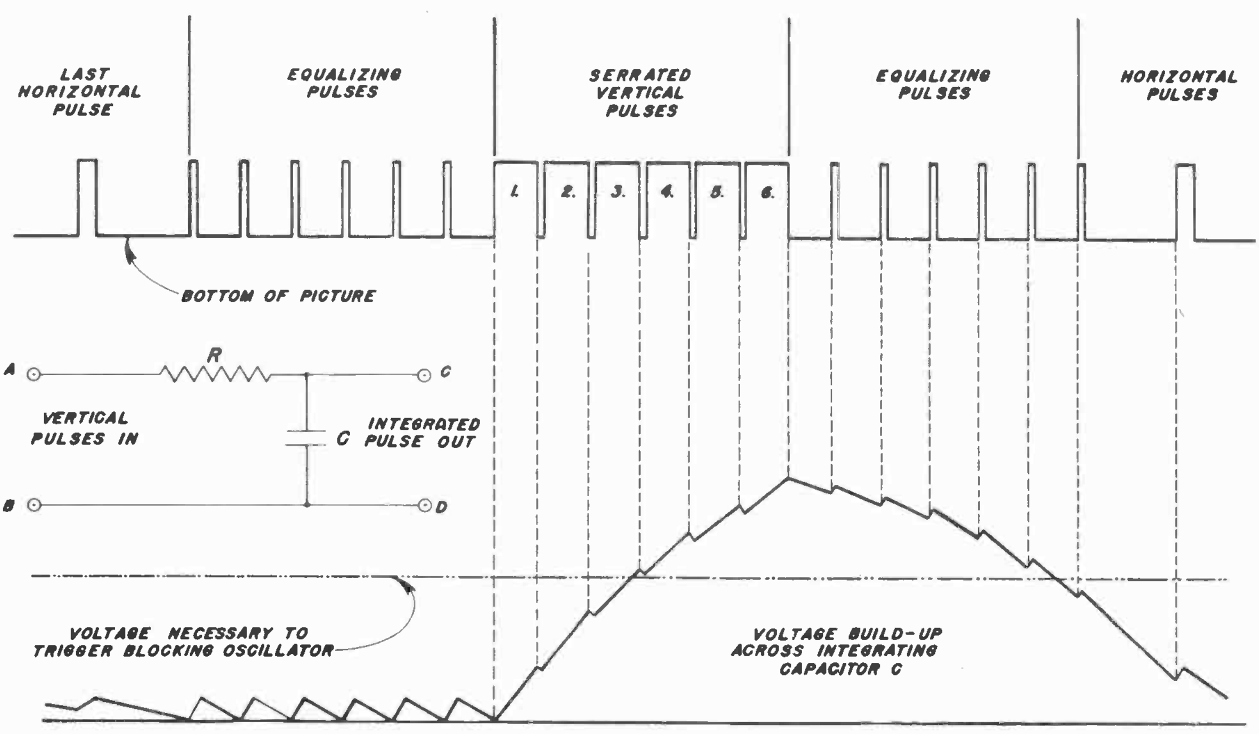


Fig. 20 The Effect of Vertical Synchronizing Pulses on the Integrator.

V10B can only conduct (open gate condition) during the time of the sync pulses and is non-conductive (gate closed) during the relatively long period of time between pulses when noise could develop a false AGC voltage.

During plate current conduction of V10B, a DC voltage is developed across the plate load resistor R53, in a manner similar to a half wave rectifier. The magnitude of this voltage depends on the IF input voltage which is applied to the grid of the AGC amplifier V10B. The period of conduction and delay is determined by the setting of the AGC delay control R25. The developed AGC voltage, is filtered by the RC filter R28, C33, C56 and fed back to the RF-IF grids.

The primary advantages of the gated AGC system is the relative immunity to noise, and the fact that short time constants are used which enable the AGC to follow much faster changes in amplitude such as those developed by airplane reflections, etc.

SYNC SEPARATOR CIRCUIT

The purpose of the sync separator circuit is to strip the vertical and horizontal sync pulses from the composite video signal. These pulses are then applied to their respective sweep circuits for triggering.

The composite video signal from the 1N64 detector is fed to the grid of the 6AB4 sync amplifier (V9) where it is amplified and coupled to the grid of the 6BN6 sync separator V13. The sync pulses, which are more positive than the picture component (See Fig.19), drive the grid of the 6BN6 and produce a step function in the plate current which results in clipping the top of the pulses and noise. The lower amplitude picture component does not have sufficient drive to produce plate current flow and does not appear in the output. The clipping and slicing action of the 6BN6 tube results in a sync pulse output relatively free from picture and noise.

THE VIDEO AMPLIFIER

The output from the video detector ranges in frequency from 30 cycles to approximately 4 Mc. Since the output is very low, it must be amplified by the video amplifier without appreciable loss to the higher video frequencies. The high frequency response of a video amplifier is limited by the impedance which the inter-electrode and stray capacities of tubes and circuits produce. Since the capacitive reactance decreases as the frequency increases, the higher frequencies could be relatively "shorted out" unless the effect of the undesirable capacities is removed. This is accomplished by inserting peaking coils L61, L65, L67, L68 and L69 to cancel the effect of the distributed capacities. The peaking coils form a resonant circuit in which the capacitive reactance is cancelled by the inductive reactance. In addition to the peaking coils, the plate load resistors are of low value so that their impedance at the highest video frequencies is approximately that introduced by the stray capacities. Use of peaking coils and low plate load resistors allows the video amplifier to have a reasonably flat frequency response to 4 Mc.

VERTICAL BLANKING CIRCUIT

A blanking circuit which eliminates the vertical retrace lines is incorporated in these receivers. The sweep voltage is taken from the plate of the vertical output tube V15, shaped into a sharp positive pulse and applied to the cathode of the picture tube. This pulse blanks out the picture tube during the retrace period.

THE VERTICAL SWEEP

The purpose of the vertical sweep is to gradually move the electron beam from the top of the picture tube to the bottom as it is swept from left to right by the horizontal sweep. It requires approximately 15,500 microseconds for the beam to move from the top of the picture tube to the bottom and approximately 1,166 microseconds to again return to the top and unblank for the next field. This period of time is the retrace and is blanked out. The frequency of the vertical sweep is 60 cycles. Because the 15.75 Kc horizontal triggering must never stop, even during the vertical retrace, the vertical pulses are serrated so that they continue triggering the horizontal oscillator. Since the horizontal sweep continues, the beam does not go directly from the bottom of the picture tube to the top during the retrace. It is zig-zagged back to the top by action of the horizontal sweep. Six equalizing pulses precede and follow the serrated vertical pulse. These stabilize the circuits before and after the vertical sync pulse and make interlacing practical. The circuits must be arranged so that the oscillator is triggered solely by the vertical synchronizing pulses and not from any other source such as noise, etc.

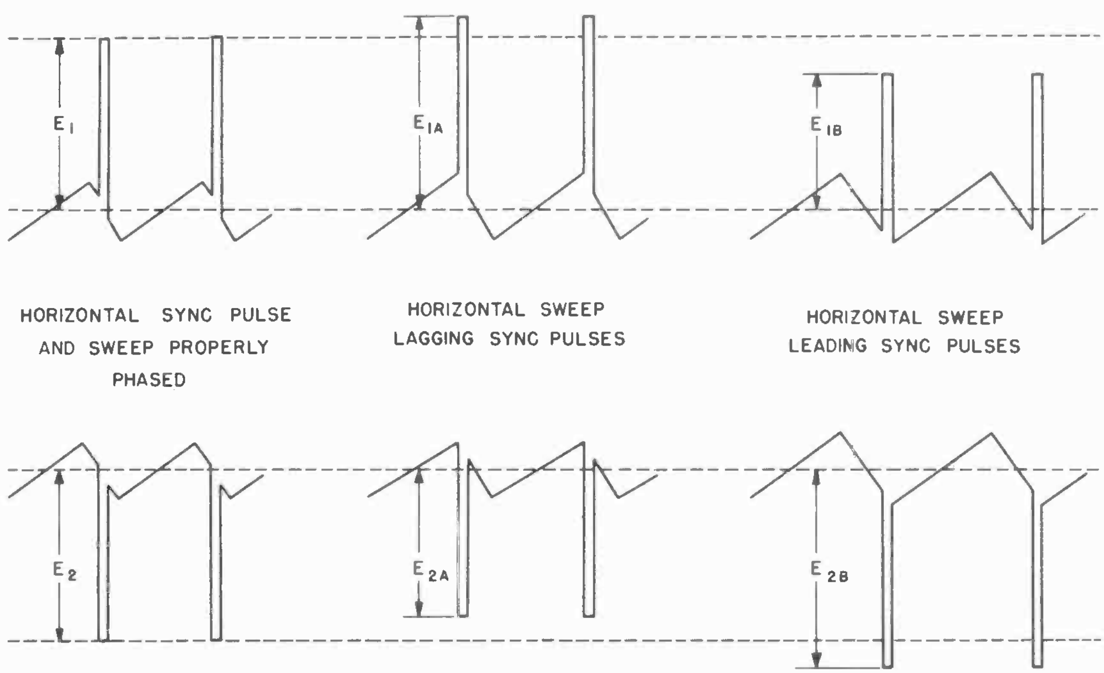


Fig. 21 Combined 15.75 Kc.Sync Pulse and Sweep Voltage Applied to the Phase Detector Plates.

Zenith 1950 Television

Both the horizontal and vertical pulses enter the integrator A2. Because of the long time constant in the integrating circuit, the short duration horizontal sync and vertical equalizing pulses have very little effect on developing a charge across the integrator (See fig.20). The slight charge that does develop leaks off during the comparatively long interval of time between pulses and for all practical purposes, has no effect. The serrated vertical pulse, on the other hand, has a time duration of approximately 190 microseconds and very little time interval between pulses. Each pulse charges the integrating capacitor to a higher potential until the voltage becomes high enough, and properly shaped, to trigger the blocking oscillator.

The vertical saw-tooth voltage is developed across the .01 MFD vertical charge discharge capacitor C62. When plate current cut-off occurs, there is no appreciable voltage drop across the plate load resistor, which consists of the HEIGHT CONTROL R95 and 3.3 Megohm series resistor R57. Because there is very little voltage drop, the capacitor charges to nearly full plate potential in approximately 15,500 microseconds. This is the sweep portion of the saw-tooth voltage. When the vertical sync pulse causes the vertical oscillator tube to conduct again, the capacitor discharges through the internal resistance of V14A. This is the retrace and occurs in approximately 1,166 microseconds. The 33K resistor R49, in series with the charge discharge capacitor, shapes the voltage so that it will have a combination of saw-tooth and pulse which is necessary to produce a saw-tooth current through the deflection coils (See fig.22). The 6V6GT-G serves as one leg of multivibrator and as the vertical amplifier which develops the relatively high current for deflecting the beam.

Because the impedance of the vertical deflection coils is high at the 15.75 Kc horizontal frequency, two 560 ohm damping resistors R61, are shunted with the windings to prevent interaction between the two sweep voltages.

The 5,000 ohm VERTICAL LINEARITY CONTROL R58, shifts the operating point of the tube so that the sweep is amplified along that portion of the plate current curve which results in a linear output.

HORIZONTAL SWEEP

The purpose of the combined horizontal sweep circuits is to develop a saw-tooth current through the horizontal deflection coils which develops a magnetic field that moves the electron beam horizontally across the picture tube screen. The saw-tooth voltage originates in the plate circuit of the 12SN7GT horizontal discharge tube V14B. Although the horizontal tube could normally be triggered by noise as well as sync pulses, the sweep is designed so that the frequency, which is unaffected by noise, is the controlling factor.

The frequency control circuit consists of a 6SN7GT 15.75 Kc horizontal oscillator V17A, a 6AL5 phase detector V16 and a 6SN7GT horizontal control tube V17B.

In order to maintain horizontal synchronization, the 15.75 Kc horizontal oscillator must be properly phased with the transmitted synchronizing pulses. In order to accomplish proper phasing, the use of a horizontal control tube and a phase detector is required.

The phase detector compares the transmitted sync pulses with the sweep voltage which is removed from the secondary of the horizontal sweep transformer T10 Fig.21 shows the combined sync pulse and sweep voltages which are applied to the plates of the phase detector.

It can be seen that when the sync and sweep voltages are in phase,

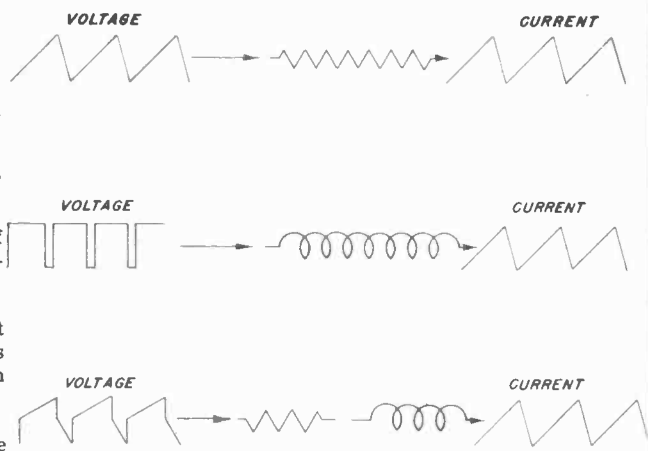


Fig. 22 Type of Voltage Necessary to Produce Saw-Tooth Current Through a Resistance, Inductance and the Combination of Resistance and Inductance.

E1 and E2 are equal in amplitude and each diode in the 6AL5 tube conducts equally. This results in equal DC voltages of opposite polarity developed across the load resistors R67 and the resultant voltage applied to the grid of the horizontal control tube is zero. When the horizontal sweep lags the sync pulses, E1A is greater in amplitude than E2A and the top diode conducts more current resulting in a negative difference voltage applied to the grid of the horizontal control tube which increases the frequency of oscilla-

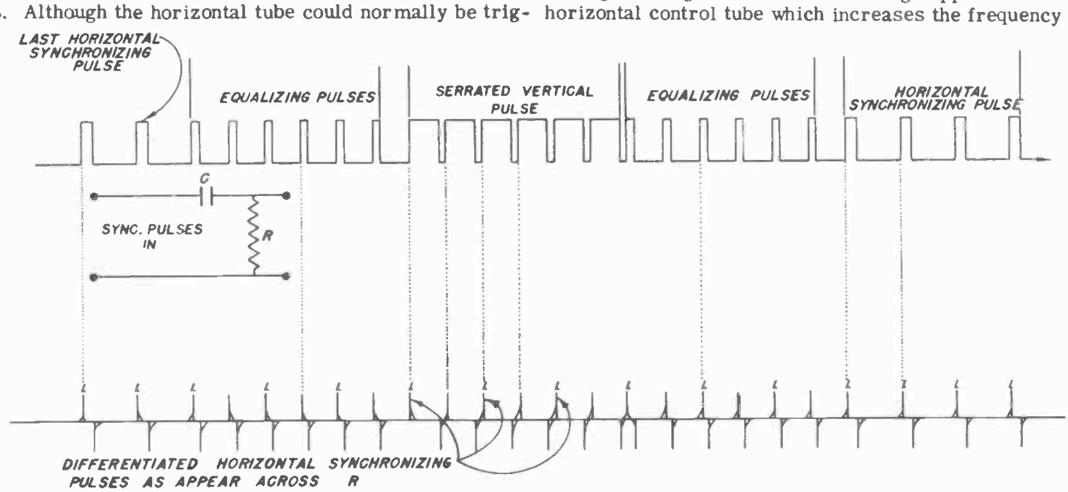


Fig. 23 Horizontal Sweep Triggered by the Vertical Sync Pulse During the Vertical Retrace Period.

tion. Conversely when the horizontal sweep leads the sync pulses, E2B is greater than E1B and the bottom diode conducts more current which results in a positive difference voltage which lowers the frequency of the horizontal oscillator.

The horizontal control tube functions as a variable resistance which is in series with capacitor C60. This series combination shunts the horizontal oscillator coil L75 and is used to shift the oscillator frequency in the same manner as is done by the combination of C72 and the Horizontal Hold Control. The resistance of the horizontal control tube, however, is automatically controlled by the difference voltage from the phase detector which is applied to its control grid. A more negative voltage increases the tube resistance and the frequency of oscillation while a more positive voltage lowers the frequency. In either case, the frequency of the horizontal oscillator is corrected so that it remains in the proper phase relationship with the transmitted synchronizing pulses where voltage E1 is equal to E2.

The Horizontal Hold Control R70, is used to adjust the oscillator frequency to approximately that of the sync pulses after which the phase detector and the Horizontal Control tube assume control.

The output from the plate of the horizontal oscillator is a flat topped wave which is differentiated for triggering the discharge tube. A saw-tooth voltage is developed by charging and discharging the 680 MMFD capacitor C77. The capacitor charges when the grid of the V14A becomes highly negative cutting off plate current flow. Since the tube does not draw plate current when cut off, there is no appreciable voltage drop across the 560 K ohm plate load resistor R76 and capacitor C77 charges to approximately full plate potential. It is the linear charge of this capacitor which produces the trace portion of the saw-tooth voltage. When the positive half of the pulse appears at the grid, V14B conducts heavily and C77 discharges through it. The charge of the capacitor is the trace, and the discharge is the retrace.

Study of fig.22 shows the type of pulses necessary to produce a saw-tooth current through an inductance. The voltage and current through a resistance are in phase and a saw-tooth voltage is necessary to produce a saw-tooth current. Since an inductance has inherent resistance, the voltage wave form must be a combination of saw-tooth and pulse to produce a saw-tooth current through the deflection coils. This wave is formed by the 4700 ohm resistor R5 which is in series with the charge discharge capacitor C77 and the 25,000 ohm Horizontal Drive Control R74.

HIGH VOLTAGE POWER SUPPLY

The 10,000 volt DC supply for the second anode of the picture tube is developed by the 19BG6 horizontal sweep amplifier V18, and its associated output transformer and high voltage rectifier. The power supply is the kick-back type in which the high voltage is developed during the 7 microsecond retrace of the horizontal sweep when the deflection coil current suddenly collapses.

The saw-tooth current which produces the sweep, flows for approximately 53 microseconds. This is the approximate time required to move the beam from the left to the right side of the picture tube. After the sweep reaches the right side of the tube, the current suddenly collapses and this sudden collapse of current through the deflection coils, generates a voltage which is "kicked back" into the output transformer and stepped up.

A two turn low voltage winding supplies filament current for the 1B3GT high voltage rectifier V20, where rectification develops the 10,000 volts DC for the second anode of the picture tube. Because of the 15.75 Kc frequency, very little filtering is necessary. The 500 MMFD 12 Kv capacitor, the 470,000 ohm resistor and the capacity formed by the picture tube metal cone and chassis adequately filters the high voltage.

When servicing the high voltage power supply, extreme care must be exercised to avoid contact with the second anode high potential. A well insulated vacuum tube voltmeter, which has a 10 Kv range, or higher, may be used to measure the high potential. Failure in any section of the 15.75 Kc horizontal sweep circuit may cause the supply to be inoperative. If the difficulty is not obvious, circuit tracing should begin at the 6SN7GT horizontal oscillator V17A, through the 12SN7GT horizontal discharge tube V14B, and the 19BG6G horizontal amplifier. The 19BG6G plate voltage must be measured at terminal 4 on T10. Do not measure the voltage at the plate of the tube because the voltage at this point is extremely high due to the inductive build-up through the transformer. The 25W4 damping tube V19, adds an additional 125 volts to the plate voltage of the 19BG6G horizontal amplifier. Failure of this tube will also cause the high voltage to be inoperative.

THE DAMPING TUBE

The linear rise of current through the horizontal deflection coils moves the electron beam from the left to the right side of the picture tube in approximately 53 microseconds. The current must then return to its starting value in approximately 7 microseconds. The sudden collapse of current through an inductance during the retrace produces an oscillatory condition (See fig.24). This oscillating condition would destroy the linearity of the sweep and must be removed by the damping tube V19. When the plate of the damping tube becomes more positive than the cathode, conduction occurs which loads the circuit and prevents the undesirable oscillation. As a result of the conduction, a DC potential of approximately 125 volts is developed and stored in the .22 MFD capacitor C81. This voltage is added to the plate voltage of the 19BG6G horizontal amplifier and raises its potential from 360 to 485 volts for greater output and better performance.

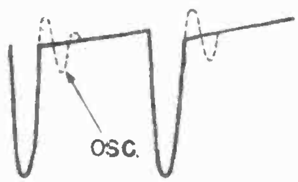


Fig. 24 Undesirable Oscillation Removed By Damping Tube.

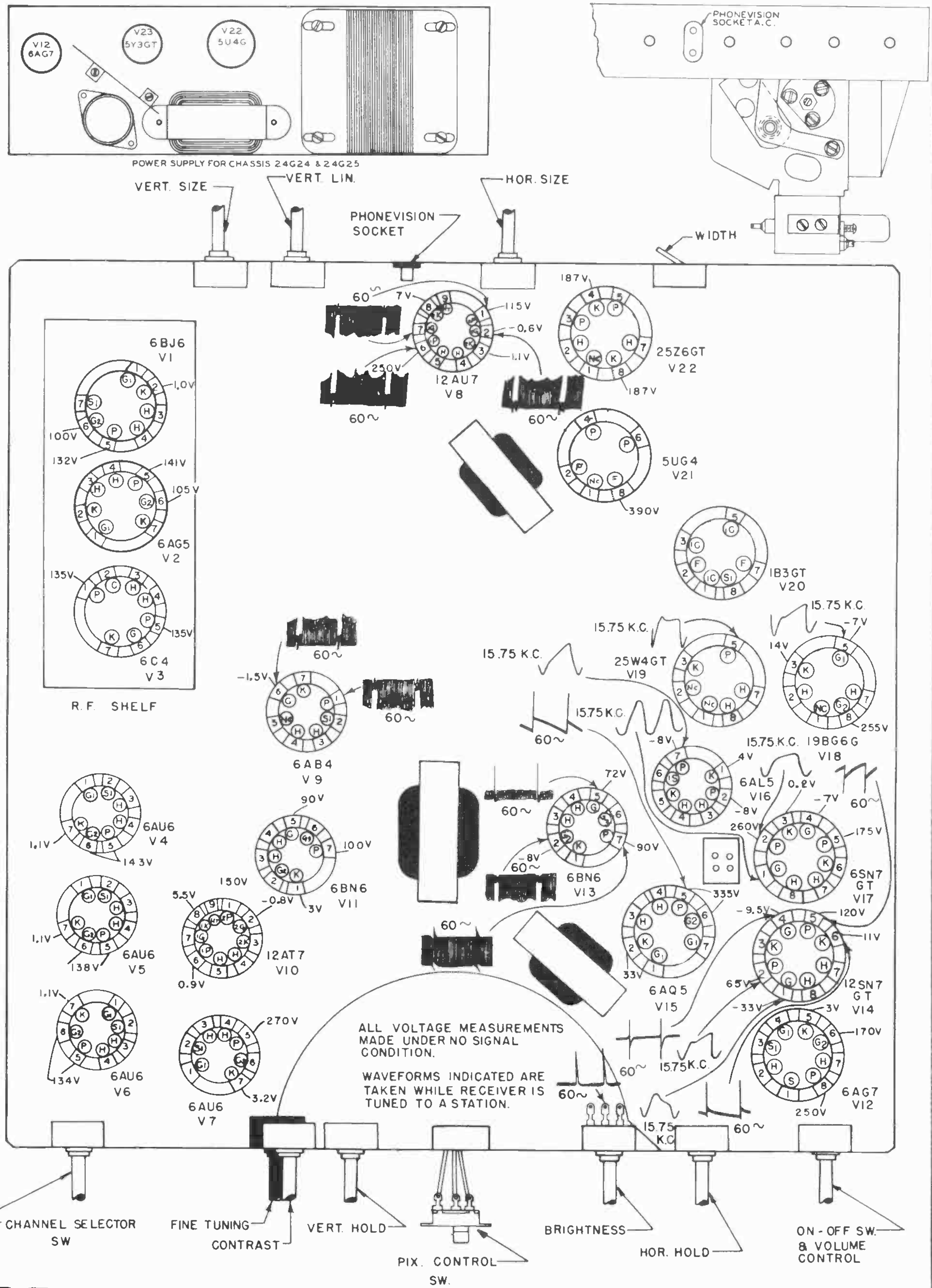
THE BEAM BENDER

The electron gun of a picture tube emits both electrons and ions. The ions are much heavier than the electrons and if allowed to bombard the picture tube fluorescent screen, damage in the form of a burn could occur. To prevent this condition, the electron gun of these tubes is slightly bent so that the ion and electron stream is directed at the neck rather than at the screen of the tube. The beam bender, which is a permanent magnet fitted around the neck of the tube, bends the electrons back into their proper axis so that they strike the screen. The heavier ions are not affected by the magnetic field and do not reach the screen.

The beam bender has an identifying arrow stamped on it. When it is installed, the arrow must point towards the face of the picture tube. On a double ring type beam bender the air gaps should be 180° out and the heavier ring must be nearest the picture tube socket. (See fig.29). To make the adjustment, move and rotate the beam bender along the neck of the tube until the brightest picture with least shadow appears. It may be necessary to readjust the focus and intensity controls during the adjustment.

WIDTH CONTROL

The horizontal output voltage appears between terminals 1 and 3 on the output transformer T10. A portion of the secondary winding is shunted by a variable inductance L76 which is the width control. Varying the position of the slug changes the shunt inductance and results in changing the magnitude of sweep voltage across the horizontal deflection coils. As the shunt inductance increases, the output voltage increases and the pattern widens horizontally. When the slug is removed from the coil, the shunt inductance is at minimum and the voltage and pattern width is minimum.



Wave Forms and Voltage Chart.

ZENITH ADJUSTMENTS AND ALIGNMENT

AGC ADJUSTMENTS

Connect the calibrated oscilloscope to test point "C" (pin 2 of the 12AU7 video amplifier). This test point is on top of the chassis near the 12AU7 tube. Select the strongest TV signal and observe the detector output on the scope. Adjust the AGC Delay Control R25 for a 3.5V peak output. In extreme fringe areas it will be impossible to obtain a 3.5V indication on any signal, and the AGC Delay Control should be adjusted for best signal with least noise.

AFC ADJUSTMENT

To adjust the AFC use a zero center meter set to the 10 V range, An ordinary VTVM may also be used by setting the pointer to mid-scale or flipping the polarity switch during adjustment.
Connect the common lead of the VTVM to the AFC terminal "I" and the "hot" lead to terminal "H". (Be certain that the meter case is not grounded to the chassis). Rotate the Horizontal Hold control from one extremity to the other while adjusting L75 for an equal swing of opposite polarity on the VTVM. The Horizontal Hold Control should be permanently set for best "bulls eye" action near this zero midpoint.

BULLS EYE TUNER ADJUSTMENT

With an inter-carrier receiver of this type, a meter cannot be used to indicate oscillator resonance. Two methods may be used for aligning the strip oscillators; one is to observe a test pattern on a station, and adjust for the best picture within the range of best sound. If the wedges on the test pattern are closely observed it will be noticed that tuning to one side of resonance produces a faded, washed-out picture with the spacings between the wedge lines fogged. Tuning in the opposite direction will cause the spaces between the lines to clear up. Tuning beyond this point will produce a wormy appearance. The wormy effect is due to sound getting into the picture. Correct adjustment is a point just prior to the wormy appearance. Before adjusting be sure the Fine Tuning control is set in the center of its range.

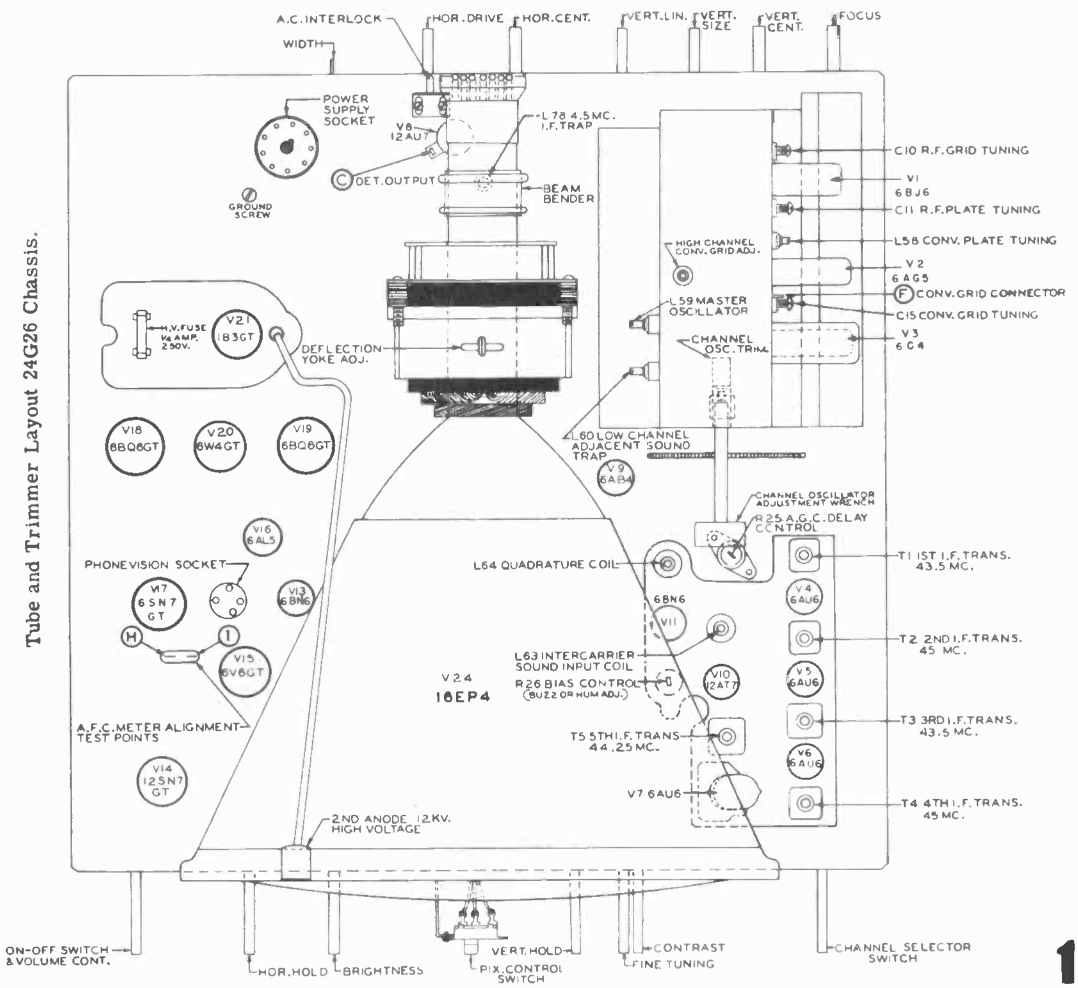
FOCUS AND CENTERING ADJUSTMENTS

On the 24G22-24 TV receivers, focus and centering of the picture is accomplished by the use of screwdriver adjustments at the rear of the chassis.

Unlike the 24G22-24 receivers, the focus and centering system in the 23G22-23 receivers incorporates a permanent magnet with mechanical adjustments which regulate the density and position of the magnetic field.

The centering control lever positions the magnetic field and is used to center the picture both vertically and horizontally.

Focusing is accomplished by turning the brass focus adjustment shunt ring. The position of this ring regulates the density of the magnetic field which is parallel to the electron beam in the picture tube. As long as this parallel condition exists, the magnetic field



Tube and Trimmer Layout 24G26 Chassis.

is not cut by the electrons. When the electrons diverge from the parallel path, the magnetic field is cut and it forces the electron stream back into the proper axis.

An improperly adjusted focus and centering assembly causes the electron beam to hit the neck rather than the screen of the picture tube, causing the outer extremities of the tube to be shadowed.

The complete focus, centering and beam bender adjustments are as follows:

1. Adjust the magnet positioning screws (See fig. 29) until the assembly is approximately 1/8 inch from the deflection yoke with the neck of the picture tube centered inside the focus shunt ring.

2. Set the centering lever so that its locking screw is approximately centered vertically and horizontally inside the slot.

3. Adjust the beam bender for a full raster of maximum brightness.

4. Adjust the focus shunt ring for sharpest focus of the picture.

5. With the centering lever, center the picture vertically and horizontally. It will be noted that the up-down movement of the lever moves the picture horizontally while the left-right movement moves the picture vertically.

If it is impossible to get a full raster free from shadows, readjustment of the magnet positioning screws may be necessary.

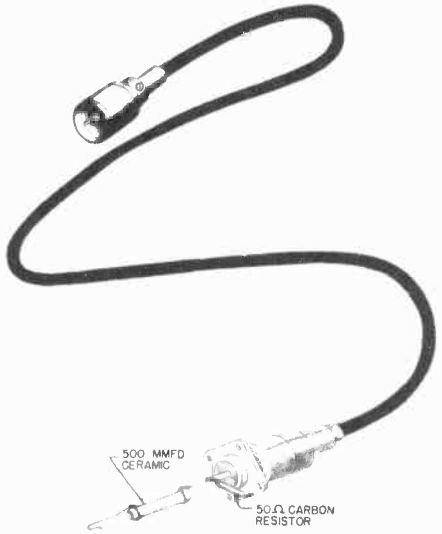
TEST EQUIPMENT AND GENERAL ALIGNMENT INFORMATION

In order to make satisfactory IF and RF alignment and to reproduce the response curves illustrated in this manual special care must be exercised when setting up the test equipment.

Fig. 28 shows the recommended method of connecting the test equipment. A bond should be connected between each unit and to the receiver under test. In order to prevent damage to the Mega-Sweep crystal, always connect this common bond lead to the receiver chassis before the output cable connections are made to the receiver alignment points.

Special care must be exercised to make cable No. 1 as shown. No ground lead should be used. Hook the capacitor to the alignment point and lay the coaxial connector on the chassis for the ground connection.

The 3V bias battery which is necessary to apply a fixed bias during alignment should have leads with clips for easy connection between the bias string and top chassis.



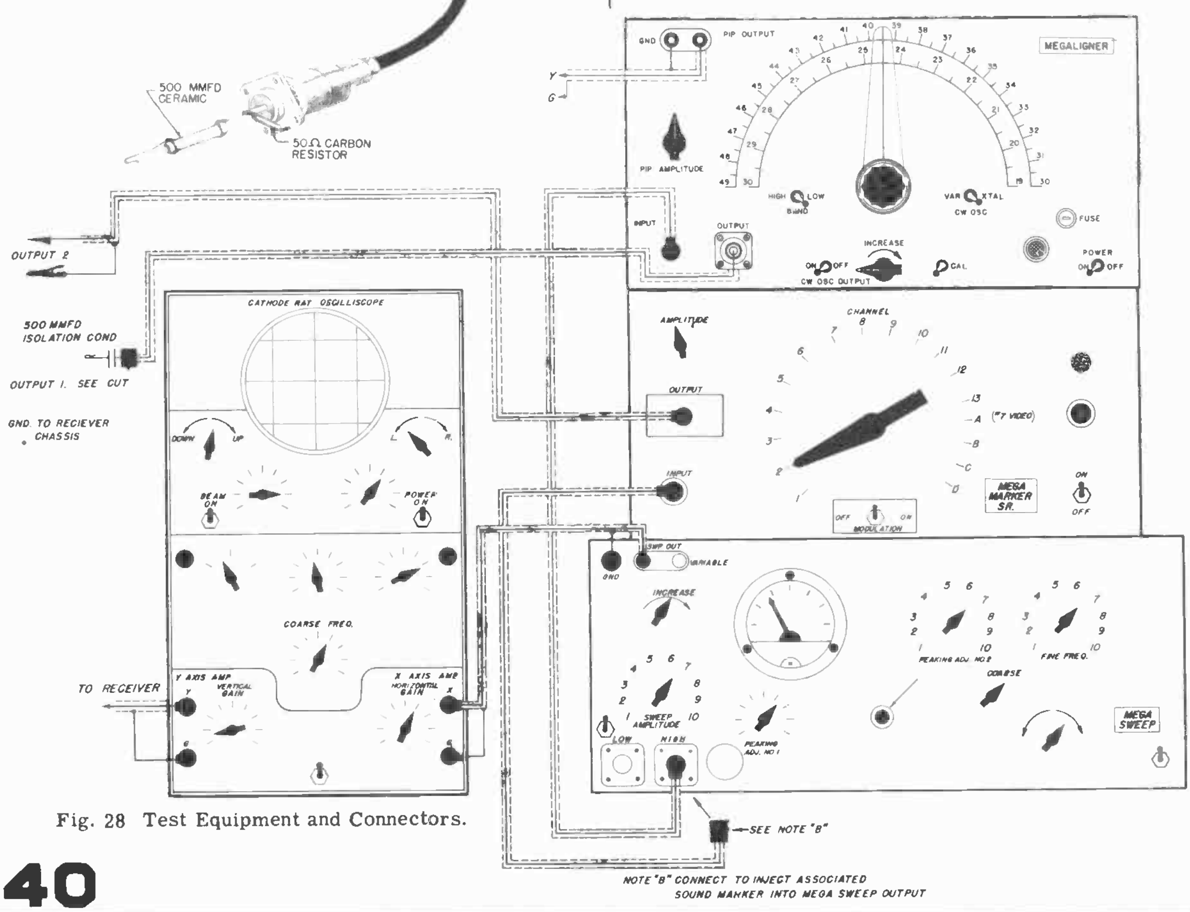


Fig. 28 Test Equipment and Connectors.

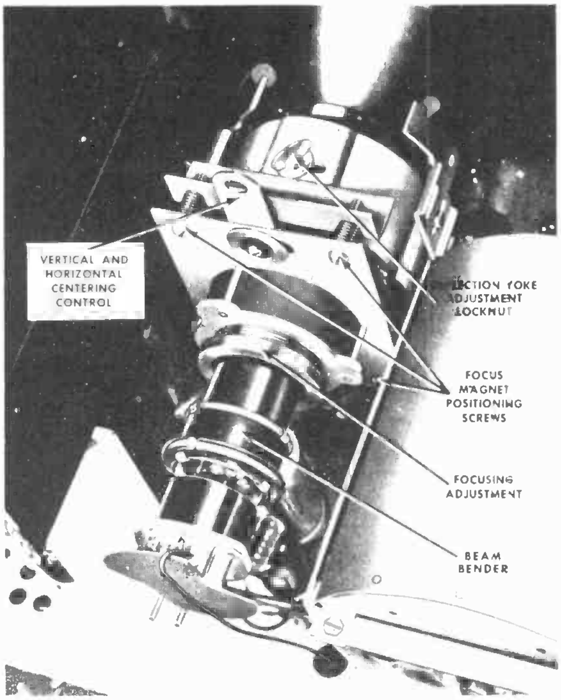


Fig. 29 Mechanical Focus and Centering Adjustments.

IF ALIGNMENT

When aligning the 40 Mc IF, it is of utmost importance to keep the sweep generator connections as short as possible. Clip the negative lead of a 3V battery to test point "A" and the positive lead to top chassis. The oscilloscope should be connected to terminal "C". During alignment keep output from the sweep generator at a level which develops approximately 3V peak output at the detector.

After the bias and scope connections are made, proceed as follows:

1. Feed the Mega-Sweep signal to point "D" (pin 5 of the 6AU6 3rd video IF) and adjust T5 until the 44.25 Mc peak appears symmetrically between the 43.5 and 45 Mc markers. See Fig.30 .

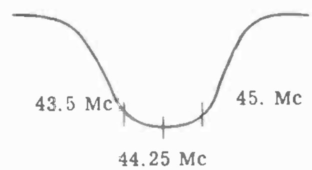


Fig. 30

2. Connect the sweep generator to point "E" (pin 1 of the 6AU6 2nd IF) and adjust T4 at 45 Mc and T3 at 43.5 Mc until a symmetrical curve shown in Fig. 31 is obtained.
If T3 and T4 are properly adjusted, rocking adjustment T5 from one side to the other should increase the amplitude of the 43.5 Mc and 45 Mc peaks as indicated in Fig. 32 .

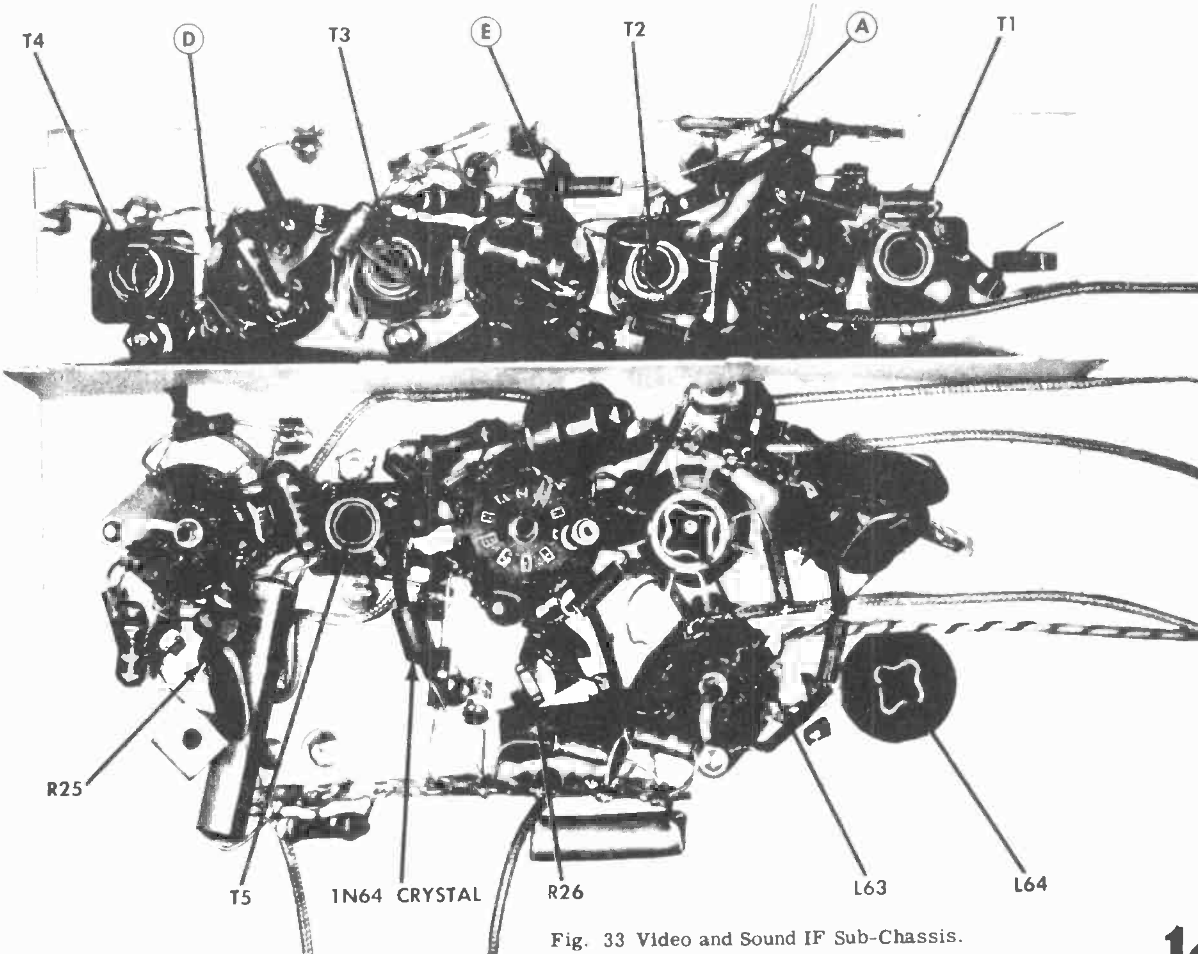


Fig. 33 Video and Sound IF Sub-Chassis.

Zenith 1950 Television

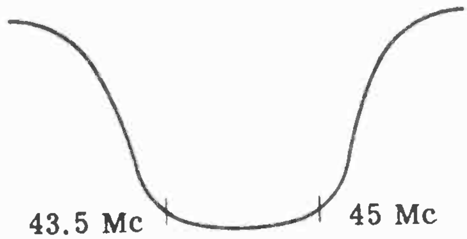


Fig. 31

The 43.5 and 45 Mc markers should fall slightly inside the peaks. It may be necessary to readjust T3 or T4, or both if the peaks do not increase approximately the same when T5 is rocked. After the peaks are checked, T5 should be adjusted for symmetry. See Fig. 31.

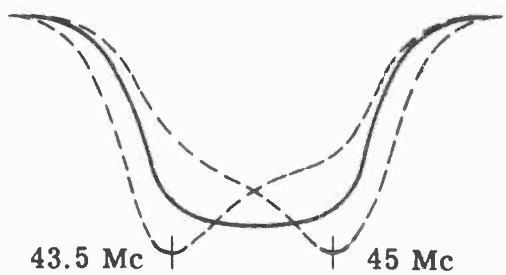


Fig. 32

3. Feed the sweep generator to the converter grid (terminal "F"). This terminal is near the 6AG5 converter tube. Adjust T2 at 45 Mc and T1 and L58 at 43.5 Mc until a symmetrical overall response curve shown in Fig. 34 is obtained. The 42.75 Mc and 45.75 Mc carrier frequencies should fall at the 50% point on the response curve. A slight readjustment of one or more IF transformers may be necessary if the overall response curve is not similar to the one shown in Fig. 34.

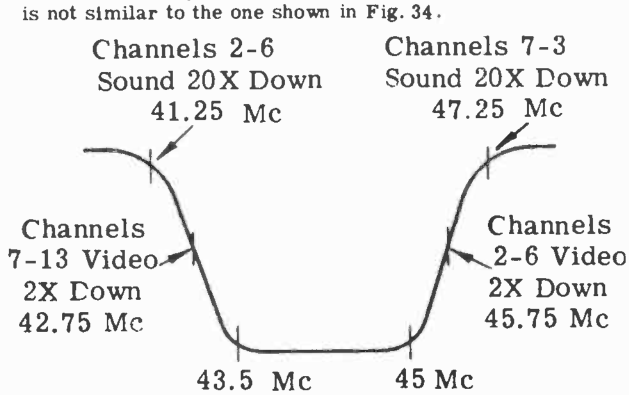


Fig. 34. Over-All Video IF Response.

Inject a 47.25 marker and adjust trap L60 for minimum indication on the scope or on a VTVM connected to the video detector.

INTER-CARRIER SOUND ALIGNMENT

Tune in a tone modulated TV signal and adjust the quadrature coil L64 for best sound. Insert a step attenuator between the antenna and receiver and reduce the received signal to a level where hiss is heard with the sound. Adjust the sound take-off coil L78, input coil L63 and buzz control R26 for cleanest sound and least buzz.

During any of the adjustments, the hiss may disappear. If this occurs, the input signal must be further reduced so that the hiss never disappears during alignment.

In some cases, it may be difficult to attenuate the signal to a level below the limiting point of the Gated Beam Detector and the adjustments can be made as follows:

1. Connect an oscilloscope to point "B" (See Fig. 40) and feed a 4.5 Mc frequency modulated signal through a 500 MMFD isolation capacitor to point "C". Turn the receiver volume control fully counter-clockwise and adjust the sweep generator for an "S" curve, similar to a discriminator response, on the oscilloscope screen.

2. Increase the sweep output for maximum indication on the oscilloscope and then back off the attenuator until a drop in the amplitude of the response curve is noted. When this drop in amplitude is noted, it is an indication that the Gated Beam Detector is not limiting.

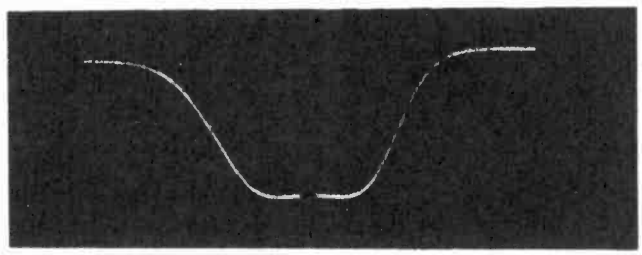


Fig. 35. Unretouched Photograph of Over-All IF Response With 44.25 Mc Marker.

3. Adjust L78 for maximum response. With a 68-7 wrench in the core of L63 and a screwdriver in the potentiometer R26, adjust the two simultaneously for maximum amplitude and best linearity of the "S" curve, being careful that with an increase in amplitude the Gated Beam Detector does not re-enter its limiting range.

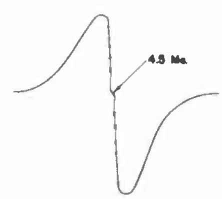


Fig. 36 Intercarrier Sound Response.

It will be noted that the negative leg of the "S" curve is approximately twice as long as the positive leg and that the adjustment of L63 causes the positive leg to broaden. Proper adjustment is indicated when the "S" curve is of maximum amplitude and the top portion of the curve is at its narrowest point.

4. Inject a 4.5 Mc marker into the sweep and adjust the quadrature coil L64 until the marker falls at the base reference line (See Fig. 36).

Because the response curve is not linear, care must be exercised when adjusting the quadrature coil to place the 4.5 Mc marker at the base reference line. The reference line can be easily found by reducing the oscilloscope horizontal amplification until a single vertical line is seen, the break in the line is the reference point.

After the sound channel has been aligned, a check should be made on a TV station. A slight readjustment of the buzz control R26 and the quadrature coil L64 may be necessary.

MASTER OSCILLATOR ALIGNMENT

The 6C4 master oscillator operates above the incoming frequency on the low channels (2-6) and below on the high channels (7-13). Slug L59 is used to pre-set the master oscillator on channel 7 (Channel 7 strip does not have an oscillator adjustment).

The master oscillator adjustment is to be made only if resonance cannot be obtained with the strip oscillator adjustment wrench when the fine tuning control is in its center position (open end of pulley on the RF shelf facing up) and after it has been determined that the channel strip itself is not at fault.

Although it is possible to set the L59 master oscillator by tuning in a station and alternately adjust the master and strip oscillator adjustments until proper tuning results, the use of the Mega-Sweep and Mega-Marker Sr. is preferred. The Mega-Marker Sr. is provided with crystals for the sound carrier frequencies of all 12 existing channels. The sound carrier frequencies can be used in adjusting the master oscillators, however, it is recommended that the Mega-Marker Sr. be equipped with a crystal for the picture carrier frequencies for channel 7 (175.25 Mc). This crystal may be inserted into one of the extra positions and adjustments made as follows:

1. Connect the negative lead of a 3V battery to point "A" (See Fig. 33) and the positive lead to top chassis.

2. Feed output #2 (See Fig. 28) through a S-15369 matching transformer to the antenna terminals of the receiver.

3. Set the channel selector to channel 7 and turn the fine tuning control until the open end of the pulley on the RF shelf shaft faces upward.

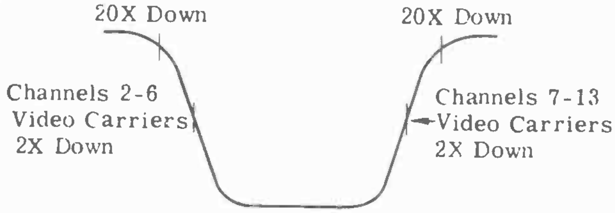


Fig. 37 RF Response.

4. Adjust the Mega-Sweep for an RF response curve (See Fig. 37). Set the Mega-Marker Sr. on channel 7 and observe the picture marker on the response curve. Adjust L59 until the channel 7 picture marker falls at approximately 50% down on the response curve.

In adjusting the master oscillator on the sound carrier frequency for channel 7, the above procedure is followed, with the exception that the sound marker is placed at approximately 20 times down on the response curve.

TURRET TUNER AND RF SHELF ALIGNMENT

The adjustments on the RF shelf are made at the factory and normally do not require readjustment unless the unit has been tampered with. If adjustment is necessary it is made as follows:

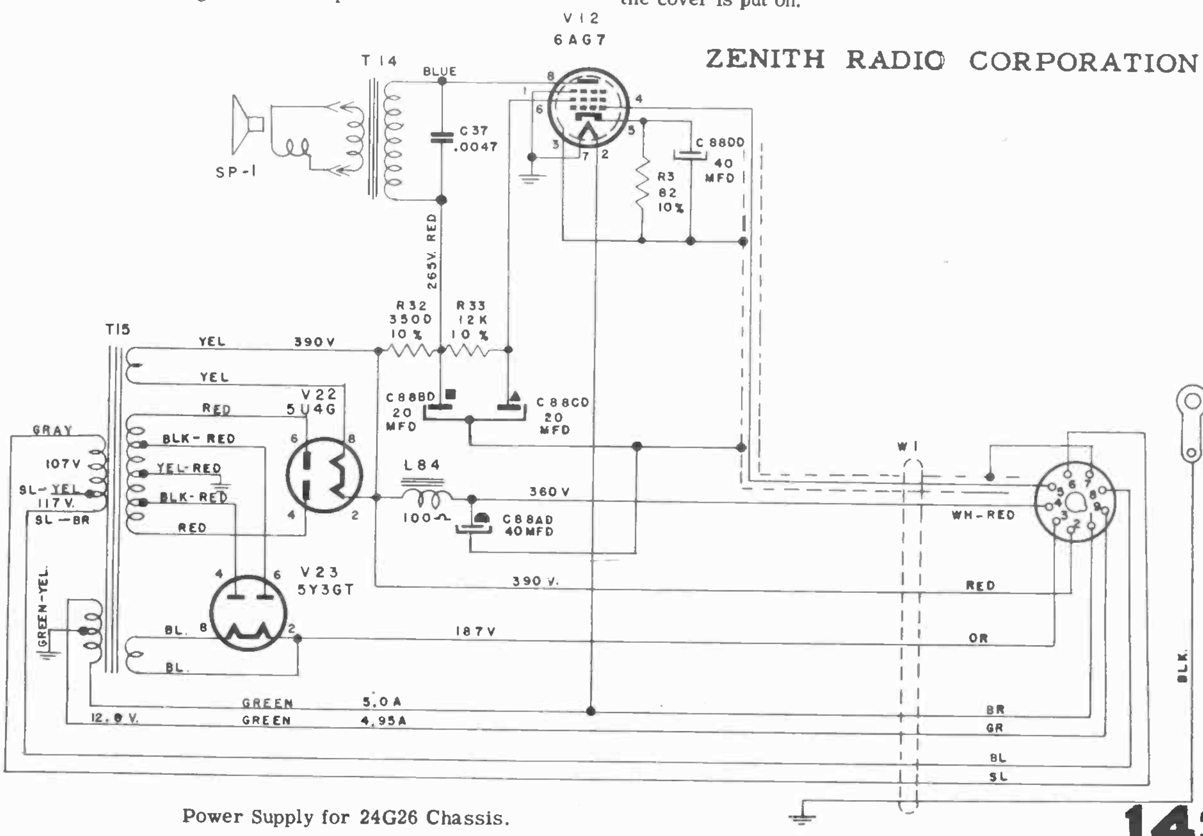
1. Connect the negative lead of a 3 V bias supply to point "A" (See Fig. 33) and the positive lead to chassis. Connect the oscilloscope between terminal "C" and chassis.

2. Feed the output of the Mega-Sweep through a S-15369 matching transformer to the antenna terminals of the receivers.

3. Adjust the Mega-Sweep and check the RF response curve (See Fig. 37) on each channel. If all the response curves are tilted approximately the same amount, first check the IF response to see that it has a reasonably flat top (See Fig. 34) before an attempt is made to adjust the RF trimmers. If the IF response is correct, set the channel selector switch to channel 4 and adjust the RF grid (C10), RF plate (C11), converter grid (C15) for symmetry and amplitude.

4. If the receiver sensitivity is satisfactory on the low channels (2 to 6) and is down on the high channels, remove the RF shelf cover and adjust the high channel peaking trimmer (C17) for maximum sensitivity with band pass. It must be remembered that the removal of the cover detunes the converter plate coil and that the converter must be adjusted with the cover off and readjusted after the cover is put on.

ZENITH RADIO CORPORATION



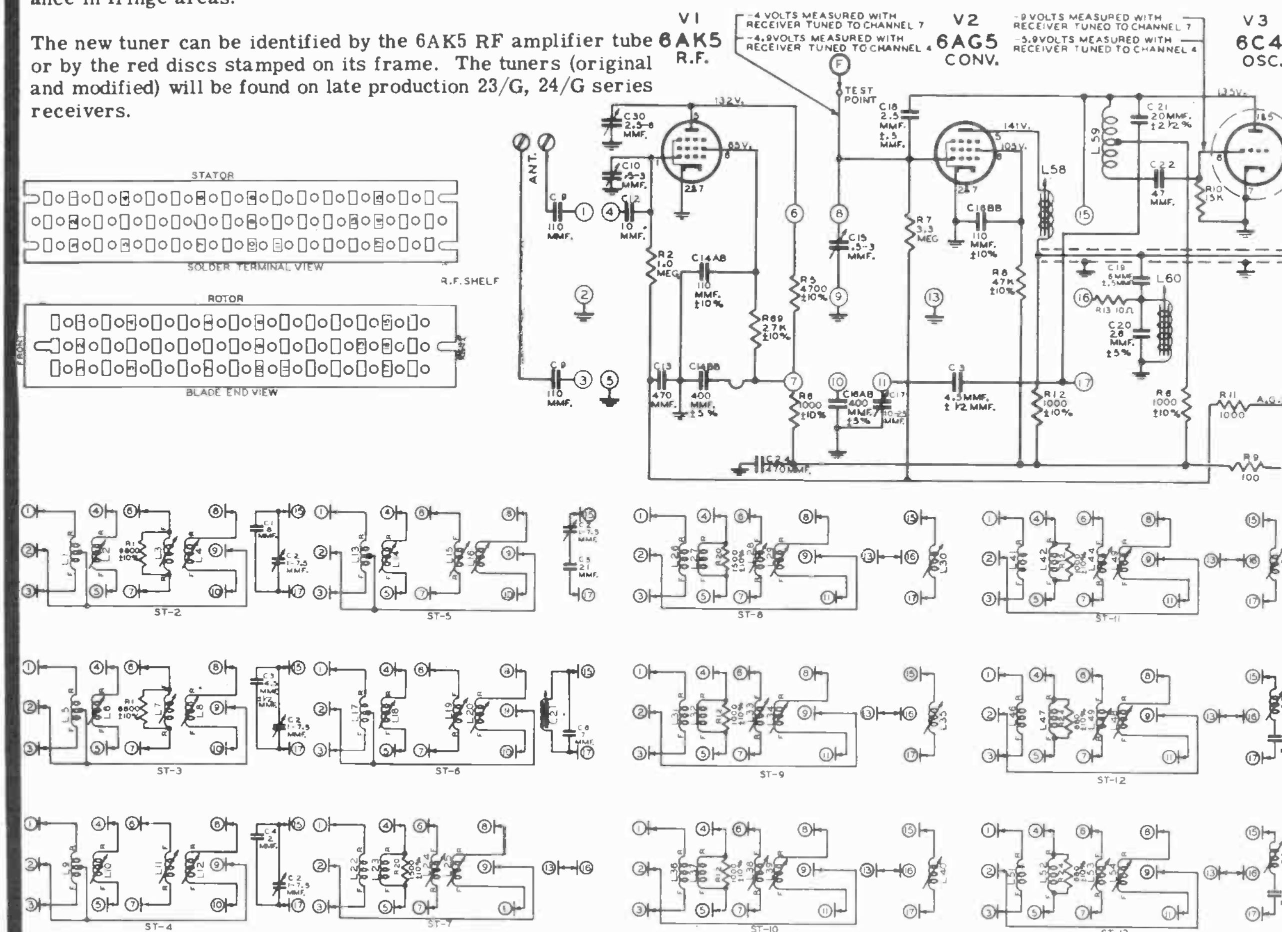
Power Supply for 24G26 Chassis.

MOST-OFTEN-NEEDED 1950 TELEVISION INFORMATION

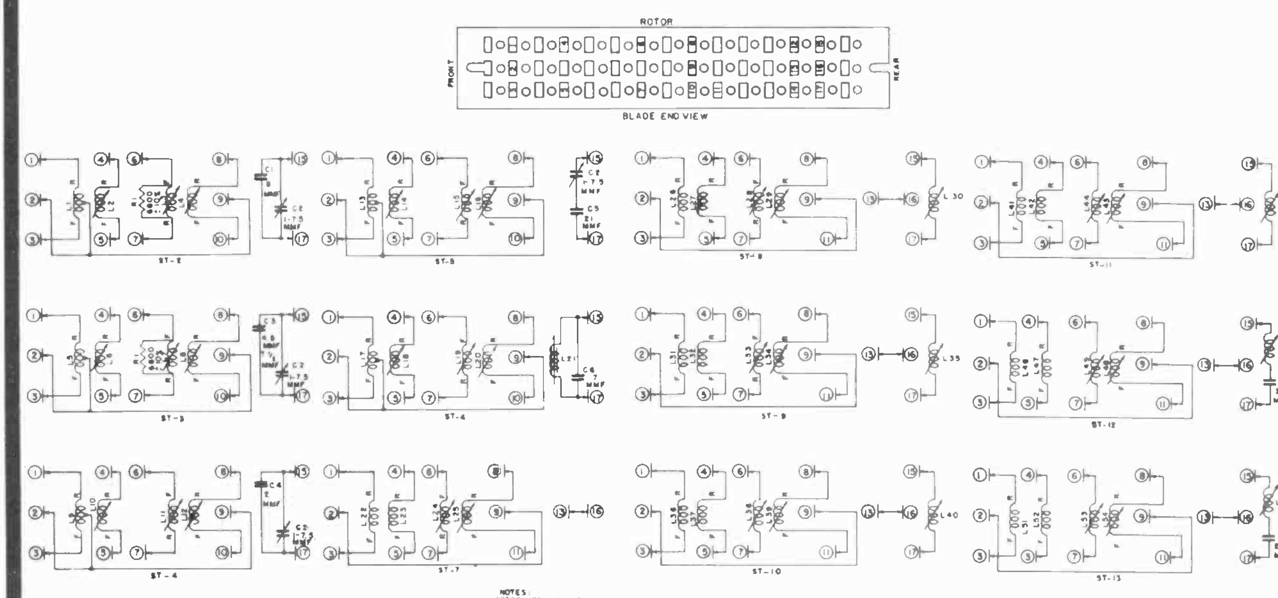
Zenith 1950 Television

The S-16960 tuner is a modified S-16203 unit. The new tuner utilizes a 6AK5 RF amplifier tube, with minor circuit revisions, which result in improved signal to noise ratio and better performance in fringe areas.

The new tuner can be identified by the 6AK5 RF amplifier tube or by the red discs stamped on its frame. The tuners (original and modified) will be found on late production 23/G, 24/G series receivers.



S-16960 Turret Tuner and Channel Strips.



Channel Strips for S-16203 Turret Tuner.

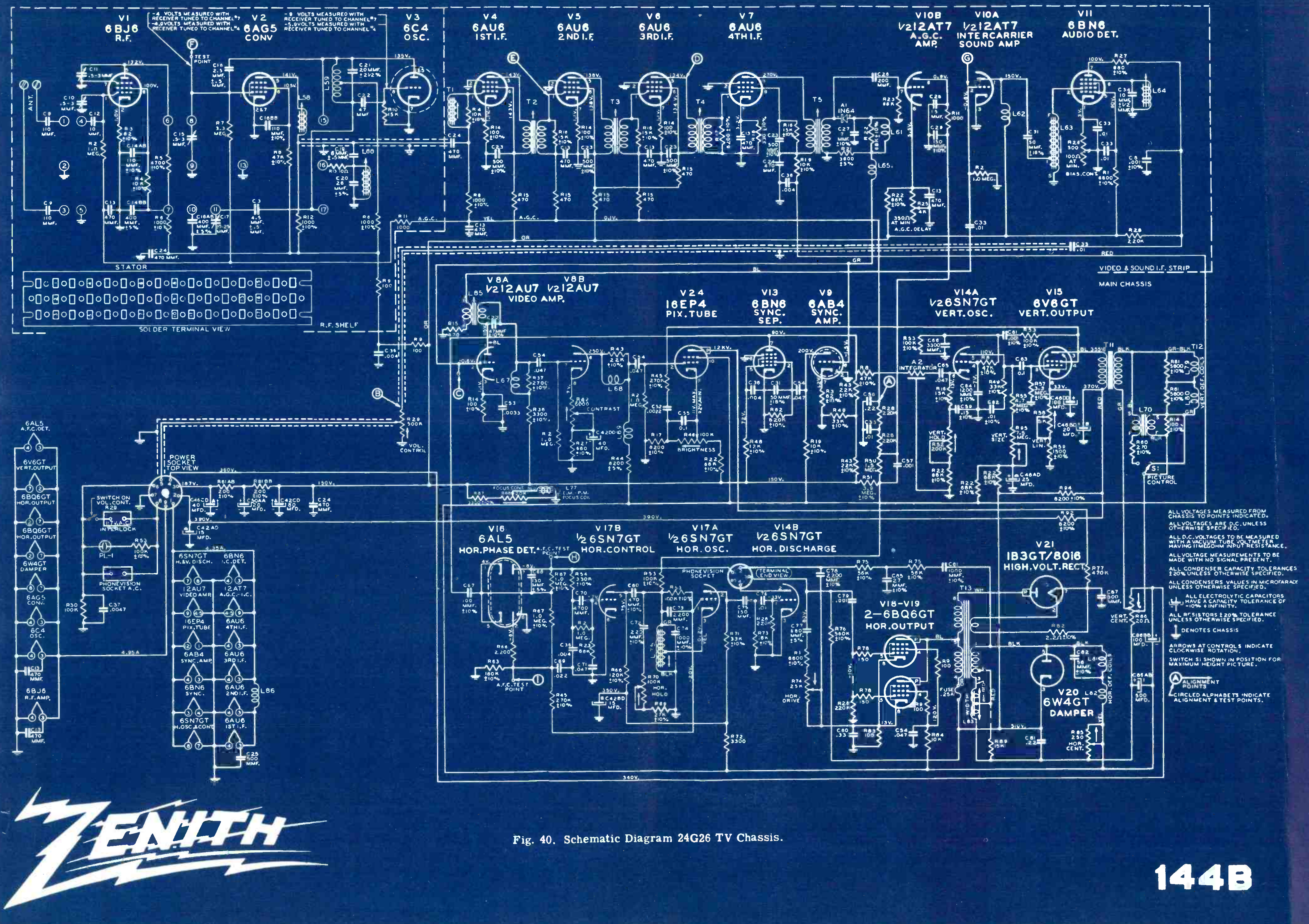


Fig. 40. Schematic Diagram 24G26 TV Chassis.

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