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MODEL IDENTIFICATION CHART

Model Numbers	Television Chassis	FM-AM Radio Tuner	Power Supply Used
24A12, 24A125	20A1	—	4PA1
4H15A or B, 4H16A or B, 4H17A or B	20A1	4J1	*6PA1
24C15, 24C16	20B1	—	4PA1
4H145A or B, 4H146A or B, 4H147A or B, 4H155A or B, 4H156A or B, 4H157A or B, 4H165A or B, 4H166A or B, 4H167A or B, 30F15 30F16, 30F17	20B1	4J1	*6PA1
4H18C or CN, 4H19C or CN, 4H145C or CN, 4H146C, 4H156C or CN, 4H166C or CN, 4H167C or CN, 30F15A, 30F16A, 30F17A	20B1	4K1	6PA3
25A15, 25A16, 25A17	21A1	—	4PA2
4H137A or B, 4H126A or B	21A1	4J1	**6PA2
4H126C or CN	21A1	4K1	6PA4

* 6PA3 can also be used.

** 6PA4 can also be used.

SPECIFICATIONS

Picture Presentation

Direct View Electromagnetic Cathode Ray Tube

Picture Area:

- 10 inch tube: 62 square inches.
- 12 inch tube: 82 square inches.
- 16 inch tube: 125 square inches.

Input Impedance

300-ohm Balanced.

Intermediate Frequencies

Video 25.75 MC. Audio 21-25 MC.

Power Supplies

Low Voltage. High Voltage.
Second Anode Voltage.

Operating Voltage

110-120 volts. 60 cycles.

HIGH VOLTAGE WARNING

Operating or servicing this television receiver with cabinet removed involves shock hazard. Exercise normal High Voltage precautions while working with this set.

High voltages are present throughout the horizontal output and second anode supply circuits. No attempt should be made to make measurements from these points with ordinary test equipment.

Very carefully follow instructions given in this manual regarding location of test points for alignment, for taking voltage measurements, or in making oscilloscope waveform analysis. Do not connect test equipment across other points in the receiver unless you are thoroughly familiar with the circuit wiring and points at which high voltages are present.

CAUTION — PICTURE TUBE HANDLING

Due to the high vacuum and large surface area of the picture tubes, great care must be exercised when handling these tubes. The picture tube must not be scratched or subjected to excessive pressure as fracture of the glass will result in an explosion of considerable violence which may cause personal injury or property damage.

Television Frequency Ranges										
Channel Number	Channel Freq., MC	Wave Length Meters	Picture Carrier, MC	Sound Carrier, MC	Frequency		Reflector Length	Director Length	Half Wave Shorted Channel Trap*	
					Met. Osc. Freq., MC	Dipole Length				
2	54-60	5.55-5.0	55.25	59.75	81	98"	96"	103"	95"	84"
3	60-66	5.0-4.55	61.25	65.75	87	90"	88"	94"	86"	78"
4	66-72	4.55-4.17	67.25	71.75	93	82"	80"	86"	78"	70"
5	76-82	3.95-3.66	77.25	81.75	103	71"	69"	74"	68"	61"
6	82-88	3.66-3.41	83.25	87.75	109	66"	64"	69"	64"	53"
7	174-180	1.72-1.66	175.25	179.75	201	32"	30"	33"	30"	25"
8	180-186	1.66-1.61	181.25	185.75	207	31"	29"	32"	29½"	24"
9	186-192	1.61-1.56	187.25	191.75	213	30"	28"	31"	29"	24"
10	192-198	1.56-1.51	193.25	197.75	219	29"	27"	30"	28"	23"
11	198-204	1.51-1.47	199.25	203.75	225	28"	26"	29"	27"	22"
12	204-210	1.47-1.43	205.25	209.75	231	27"	25"	28"	26"	22"
13	210-216	1.43-1.39	211.25	215.75	237	26"	24"	27"	25"	21"

* CONSTRUCTING A CHANNEL TRAP

* Constructed of a piece of 300 ohm transmission line, shorted on one end to serve as a 1/2 wave length shorting stub. Cut a piece of line slightly longer than given under the "Half-wave Shorted Channel Trap" column and connect the two leads of one end across the receiver antenna terminals.

Using diagonal cutters or razor blade, "short" across the transmission line at a place slightly longer than the calculated length. *Care should be taken when "shorting" the line to cut through the plastic covering only; do not cut the conductors.* If the interference is not "trapped out", short the line in 1/8" intervals (working toward the terminals) until the critical point is reached. Cut the transmission line and place a carbon resistor across the line. The resistor should be approximately 60 ohms. For strong interference, it may be necessary to drop the resistance to 20 ohms, and for weak interference it may be possible to use a 150 ohm resistor. Do not use any lower value resistor than necessary to minimize the interference.

If the interference frequency is not that of a television station, the line may be cut and the leads shorted together without using the resistor. Generally, this will completely eliminate the interference frequency.

If the interference frequency being eliminated or "trapped-out" is that of another television station operating in the same band, the interference will also be eliminated. If the interference can not be attenuated by shorting the line, it will be necessary to use a single-throw switch to switch the "Channel Trap" is switched to this position.

If the interference frequency being eliminated or "trapped-out" is that of another television station operating in the same band, the interference will also be eliminated. If the interference can not be attenuated by shorting the line, it will be necessary to use a single-throw switch to switch the "Channel Trap" is switched to this position.

Half wave shorting

GENERAL CHASSIS DATA

This service manual includes all necessary service data for the 20A1, 20B1 and 21A1 television chassis, for the 4J1 and 4K1 AM-FM radio tuners, and for the 4 tube (4PA1, 4PA2) and 6 tube (6PA1, 6PA2, 6PA3, 6PA4) power supplies. This manual supersedes and includes all preliminary service data which has been published covering the chassis outlined above. Therefore, all preliminary data (Service Letter #84 and all Supplements) should be destroyed.

Model Numbers

Note that some model numbers in the "4H" series differ only in the suffix letter or letters; for example, 4H15A 4H15B, 4H15S, etc. Where the suffix letter is A, B, C, or CN (or no suffix), this manual should be used. If the model number is followed by the suffix letter "S" or "SN", the set has a 30A1, 30B1, 30C1 or 30D1 chassis and the "Television Service Manual for 30A1, 30B1, 30C1, 30D1 and 4H1 Chassis" (form number S233) must be used.

Run Numbers

A system of run numbers has been incorporated for these television chassis. The run number is rubber stamped on the rear of the chassis. Whenever a production change is made in the television chassis, the run number changes to the next higher number. At the time of publication, chassis are being stamped with run number "17".

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. Separate schematics for all sets with the 6AU6 Sync Separator, and for all sets with 12AU7 Sync Separator and Clipper are given at the back of this manual. Be sure to refer to the proper schematic when servicing. Additional information on this change is given on pages 27, 34 and 35.

At the time of publication, TV tuner #94C18-1 is used in all chassis. However, a modification of this tuner is contemplated for future use. Supplementary service literature will be published at that time.

Note that an AC power interlock is wired into the plugs and sockets connecting the deflection yoke, focus coil, television back and line cord to the 21A1 chassis. When making adjustments to a 21A1 television chassis with the cabinet back removed, it will be necessary to substitute a plug or wire jumper for the interlocking plug on the cabinet back.

4J1, 4K1

The 4J1 AM-FM radio tuner and 4K1 AM Radio Tuner are identified by their suffix letter or had ending in "C" or "AN". The difference between the 4J1 and 4K1 is the heater string in the radio tuner section. The 4J1 heater string is in the radio tuner section. The 4K1 heater string is in the television section. The 4J1 and 4K1 are used in the radio tuner section. The 4J1 and 4K1 are used in the television section. The 4J1 and 4K1 are used in the radio tuner section. The 4J1 and 4K1 are used in the television section.

A 3-speed record changer is used in these chassis. The record changer is used in these chassis. The record changer is used in these chassis.

Six different power supplies are used in these chassis. The power supplies are used in these chassis.

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 differ-

ence 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. The 6PA1 and 6PA2 power supplies can not be used with the 4K1 tuner.

OPERATING THE RECORD CHANGER

For instructions on the operation of the record changer, see the "RC221, RC222 Record Changer Manual", form #S256, or the RC221, RC222 customer instructions, form #41A17-44.

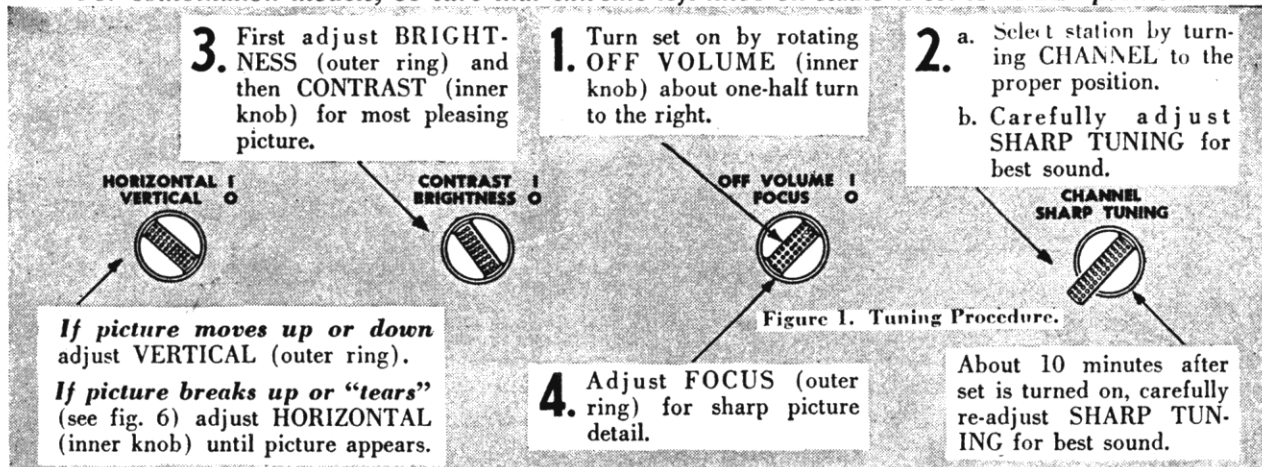
OPERATING THE RADIO RECEIVER

Operating the FM-AM radio receiver is conventional. Note that the OFF-VOLUME control on the television receiver is used to turn the radio receiver off and on.

OPERATING THE TELEVISION RECEIVER

Follow steps 1 through 4 in order. Also see the notes below the Horizontal-Vertical control and the Channel-Sharp Tuning control.

For combination models, be sure that extreme left knob on Radio is set to "TEL" position.



IMPROVING PICTURE QUALITY

After you have tuned in the picture as described in the chart above (Fig.1), it is sometimes possible to improve picture quality.

- Be sure the SHARP TUNING control has been carefully set by tuning for best sound. Do not try to tune for brightest picture. Never reduce sound volume with the SHARP TUNING control.
- Try readjusting the FOCUS control to improve picture detail.
- Better pictures may sometimes be obtained by changing the settings of the BRIGHTNESS and CONTRAST controls. See Figures 4, 5 and 7. Set the BRIGHTNESS control at a slightly different position and then adjust the CONTRAST control for best reception. Try several such control settings to deter-

mine the ones giving the most satisfactory picture.

- If picture breaks up or tears (as shown in Figure 6) when switching to a different channel, adjust HORIZONTAL control to the position where there is no tearing when switching from channel to channel.

SELECTING A DIFFERENT STATION

When correctly adjusted for reception of one television station, the receiver may be tuned to another station by merely setting the CHANNEL control to the desired station and carefully "touching-up" the SHARP TUNING control for best sound. Sometimes the picture can be improved by slight readjustment of the CONTRAST control.

SIMPLIFIED TUNING PROCEDURE

If controls have not been disturbed since set was used last, proceed as follows:

TURNING RECEIVER OFF

Merely turn the OFF VOLUME control fully to the left until the switch "clicks". To simplify tuning when set is to be used again, do not change other control settings.

- Follow steps 1, 2, and if necessary, step 3 in the chart above (Figure 1). Also see paragraph on "Improving Picture Quality."
- In about 10 minutes, carefully re-adjust SHARP TUNING control for best sound.

TEST PATTERN

A test pattern of the type shown in Figure 2 is usually broadcast for a short time before a television program begins. This convenience is offered to enable you to properly tune in your receiver before the actual program starts.

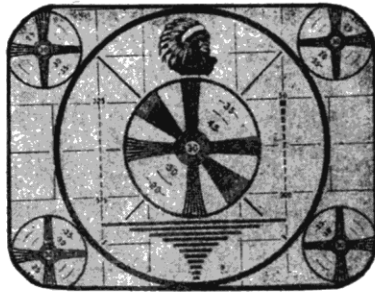


Figure 2. Correct Picture.

I

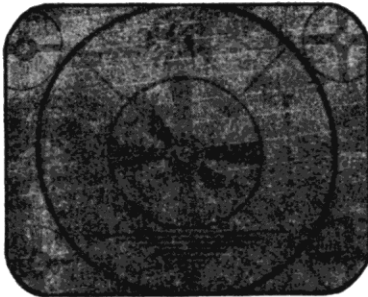


Figure 4. Insufficient contrast, readjust CONTRAST and BRIGHTNESS.

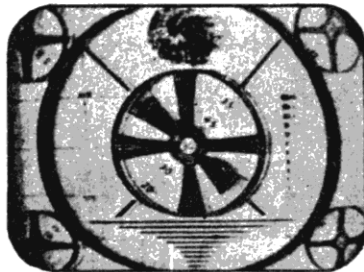


Figure 5. Excessive contrast; turn CONTRAST to the left.

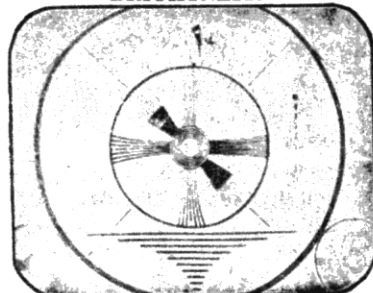


Figure 7. Excessive brightness; turn BRIGHTNESS to the left.

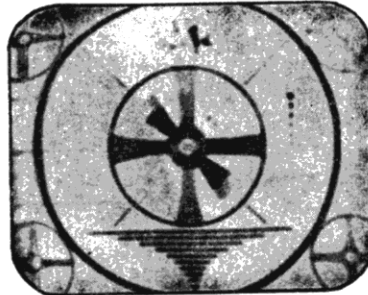


Figure 8. Improper focus; adjust FOCUS control.

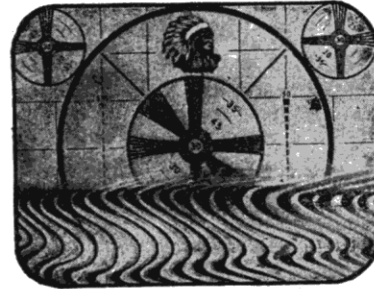


Figure 9. Interference from elec-

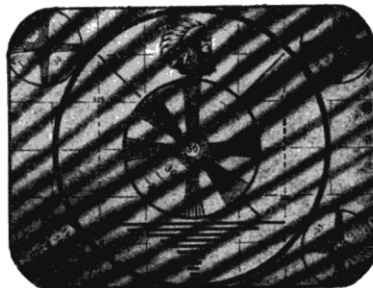


Figure 10. Short wave transmitter interference.

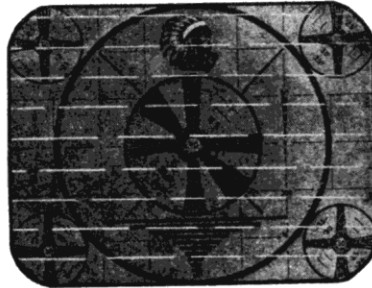


Figure 11. Automobile ignition interference.

INTERFERENCE

The operation of certain types of electrical equipment will often interfere with television reception. Some common "interference" patterns are shown in figures 9 to 12. Interference conditions should be considered when the television receiver is first installed and the proper antenna system installed to minimize interference effects. See "Installation and Service Adjustments" on pages 6 and 7. Sometimes a new source of interference will give trouble after an installation has been made and operating satisfactorily for some time.

INSTALLATION AND SERVICE ADJUSTMENTS

INDIVIDUAL CHANNEL OSCILLATOR ADJUSTMENT USING TELEVISION SIGNAL

The individual channel oscillator slugs of every TV set should be adjusted upon installation. If this adjustment is properly made, the Automatic Gain Control (AGC) action makes the selection of stations on the receiver practically a single control operation. If required at all, only slight readjustment of the Sharp Tuning control will complete the tuning in of a station.

The channel indicator escutcheon is made so it can be easily slid aside or removed from the cabinet, if necessary. The cabinet is drilled to make this adjustment accessible without removing the chassis from the cabinet. Follow the step by step procedure given below:

- a. Turn the set on and allow 15 minutes to warm up.
- b. Set the Channel Selector knob for a station and adjust controls for normal picture and sound.
- c. Remove the Channel Selector and Sharp Tuning control knobs.
- d. For sets with an all-plastic television panel, remove the channel indicating escutcheon by lifting the left side of the escutcheon and then sliding it to the left. The right side can then be pulled away from the cabinet.

For 10" and 12" sets with a wood television panel or for all plastic cabinets, slide the escutcheon to the left as far as it will go. Generally, this should allow access to the adjustment opening in the cabinet. However, if necessary, the escutcheon can be removed by sliding the escutcheon and the escutcheon retaining spring completely to the left and then lift the left side away from the cabinet.

For 16" sets, the same procedure can be used except that the escutcheon should be slid down as far as it will go. When necessary to remove, slide the escutcheon and spring up as far as possible, and then lift the bottom side away from the cabinet.

- e. Set Sharp Tuning control at electrical center by rotating approximately 150° or half rotation as shown in figure 33. Note position of dielectric rotor.
- f. Carefully insert a 1/8" blade, NON-METALLIC, alignment screwdriver in the 1/4" hole in the television panel. When the screwdriver blade engages the slot in the oscillator slug, carefully adjust the slug for best sound. Do this carefully since this adjustment generally requires only slight movement of the slug. Carelessly adjusting the slug may result in turning it in too far with the result the slug will fall into the coil. If this happens, see "Oscillator Slugs In Too Far" on page 36. **USE OF A METALLIC SCREWDRIVER WILL MAKE PROPER ADJUSTMENT IMPOSSIBLE.**
- g. Check the setting of the Sharp Tuning control per step "e" and repeat step "f" for each channel having a station in operation.

RECEIVER LOCATION

The Television Receiver should be placed so that sunlight or light from lamps does not fall on the face of the cathode ray tube and cause glare or reflections. See figure 13.

Do not install the receiver in front of a window or any other source of light. Remember to place the receiver a small distance from the wall to allow adequate ventilation.

When selecting a location, be sure to bear in mind the necessity for access to an electrical outlet, and the need for an external antenna and transmission line.

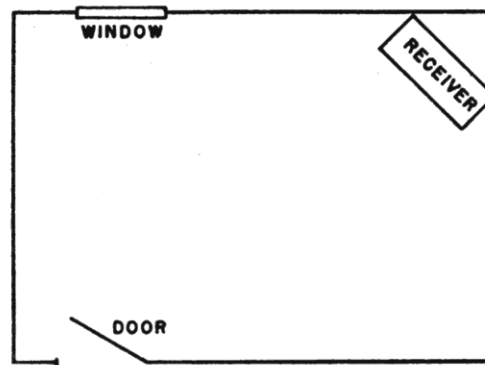


Figure 13. Receiver Location.

ANTENNA

The antenna and transmission line are the most important parts of the television receiver installation.

Television signals are transmitted on very high frequencies and unlike ordinary broadcast transmissions, the range of television transmission is restricted to line of sight.

Also the high frequencies used in television are subject to reflection from solid objects, thus a signal may be received over two or more paths: the signal direct from the transmitting antenna and one or more signals which have been reflected by objects such as buildings. Since there is a time difference in the arrival of the direct and reflected signals, multiple pictures or ghosts may appear on the cathode ray tube.

In order to prevent or lessen multi-path reception, special antennas are necessary, the most common type being a half-wave dipole consisting of two rods each a quarter wavelength long. Such an antenna will receive from two directions only. By fitting a reflector to the dipole, it can be made uni-directional. If multi-path reception or "ghosts" are still apparent, it will be necessary to sharpen the directivity of the antenna still further.

It is most important that the antenna be correctly oriented for a minimum of ghost signals.

The orientation or positioning of the antenna should be carried out by two persons equipped with telephones. One person should be stationed on the roof of the building to slowly orient the antenna, while the second person stationed alongside the television receiver can advise him when the most satisfactory picture is obtained.

The subject of antennas for television receivers is beyond the scope of this manual. However, a number of texts on the subject are available.

The following points should be closely observed with any type of antenna if clear pictures are to be obtained.

- The antenna should be placed as high as possible and in line of sight of the transmitting station.
- The antenna should be orientated for best picture with a minimum of ghost signals.
- On weak signals, the antenna should be cut accurately for the required frequency.

TRANSMISSION LINES

The Admiral television receiver is intended for use with 300-ohm transmission line. This line must be held away from any walls, metal, or the antenna mast by means of approved stand-off insulators. The line should be twisted about one turn each foot throughout its length to cancel out direct signal and/or noise pick-up by the transmission line. The transmission line should be firmly anchored to prevent a change in position during windy weather.

Also, 72-ohm coaxial cable may be used by connecting the outer conductor to the chassis and the inner conductor to either antenna terminal.

CHANNEL TRAP

Objectionable interference from another television station or from an unknown source may sometimes be apparent in the picture. To eliminate this type of interference, a channel trap can be constructed using a piece of 300 ohm transmission line. For details see "Constructing A Channel Trap" on page 2.

PICTURE TUBE INSTALLATION ADJUSTMENTS

Picture tube adjustments such as ion trap, focus coil and deflection yoke should be checked upon installation of the television set, since it is possible for these adjustments to become misaligned following rough handling in shipment. See instructions for adjustments on these pages.

ION TRAP ADJUSTMENT

The double magnet ion trap should be located with the black (sleeve) magnet toward the tube base.

The 16" picture tube uses a single magnet ion trap. For tubes with the single magnet ion trap, the blue (sleeve) end of the magnet should be located at the left side of the tube, viewing back of the chassis.

The ion trap should be positioned so that rear end of the ion trap magnet is opposite the metal flags located in the neck of the picture tube. The ion trap is adjusted by viewing its effect on a picture, pattern or raster. Move the trap assembly back and forth with a slight rotary motion. Adjust for brightest raster on the screen. Reduce the brightness control until the raster is barely visible. Adjust the focus control for clearest trace lines and readjust the ion trap for maximum brightness. The final adjustment should be made with the brightness control at the minimum position at which good trace line focus can be maintained.

Important: Be sure to tighten ion trap mounting screws since shifting of the ion trap will cause poor brilliance, or rounding off (shading) of corners of the raster pattern. The ion trap should be adjusted for the brightest raster possible with minimum setting of the brightness control. Should the corners of the raster become rounded off or shadowed after adjusting the ion trap, correct this condition by adjusting the focus coil.

FOCUS COIL ADJUSTMENT

If a corner of the raster is shadowed or if the picture is not centered on the screen (Figures 14 and 15), it may be corrected by adjusting the screws holding the focus coil assembly (see Figure 16). Should the focus coil require excessive tilting to obtain proper centering, it may be necessary to slightly reposition the deflection yoke bracket. The yoke mounting bracket should be moved forward until the rubber channel (cushion) firmly supports the flare of the picture tube. **WARNING:** When carrying out this adjustment, extreme care should be exercised so that no abnormal pressure is exerted on the neck of the picture tube, possibly causing the tube to break.

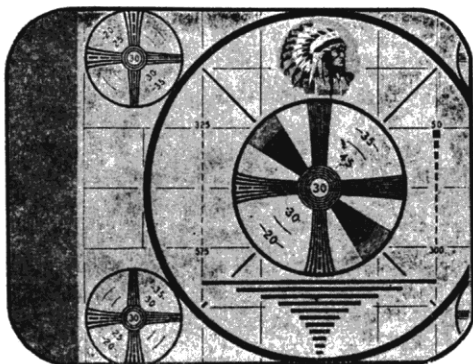


Fig. 14. Picture Too Far to Right or Left; Adjust Mechanical Position of Focus Coil.

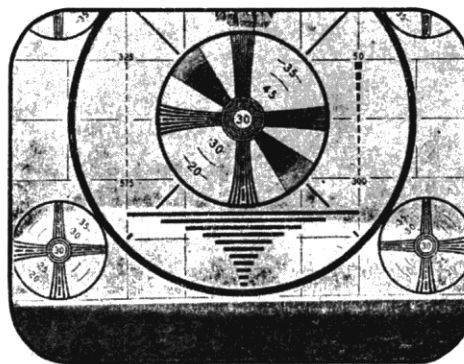


Fig. 15. Picture Too High or Too Low; Adjust Mechanical Position of Focus Coil.

TEST PATTERN ILLUSTRATIONS

The test pattern illustrations shown are for rectangular picture windows. For sets with rounded-end picture window, the large circle in the test pattern should be concentric with the circular contour at the ends of the picture window.

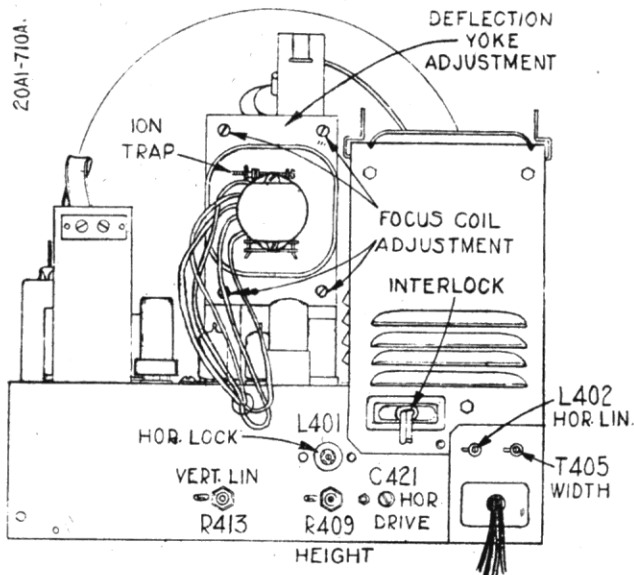


Figure 16. Rear View, Showing Adjustment Locations.
Note: 16" picture tubes are not mounted on chassis.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT

- Adjust height (Figures 18 and 19) control R409 (Figure 16) to just fill picture tube mask.
- Adjust vertical linearity (Figure 20) control R413 (Figure 16) for best vertical linearity. Distance AB should then equal DE; BC should equal CD (Figure 22).
- Alternate readjustment of these controls may be necessary to obtain best vertical linearity.

HORIZONTAL OSCILLATOR ADJUSTMENT

Perform this adjustment as follows:

- With television signal properly tuned in, allow the receiver to warm up for a few minutes.
- Rotate the contrast and horizontal hold controls fully clockwise. If the picture is not locked in, adjust the horizontal lock control until picture falls in sync.
- Very slowly turn the horizontal lock control clockwise until picture falls out of sync. Now very slowly turn the horizontal lock control counter-clockwise until the picture falls in sync.
- Adjustment should now be satisfactory, however, check adjustment by slowly rotating horizontal hold control almost fully in either direction and interrupting the television signal by switching the selector switch on and off channel. The picture should automatically fall in sync through at least three-fourths of the range of the horizontal hold control. If necessary repeat the above steps for best results.

DEFLECTION YOKE ADJUSTMENT "If picture appears tilted (Figure 17), loosen the wing nut on top of deflection yoke and rotate the deflection yoke coil for correct picture orientation while pushing the yoke coil forward as far as it will go".

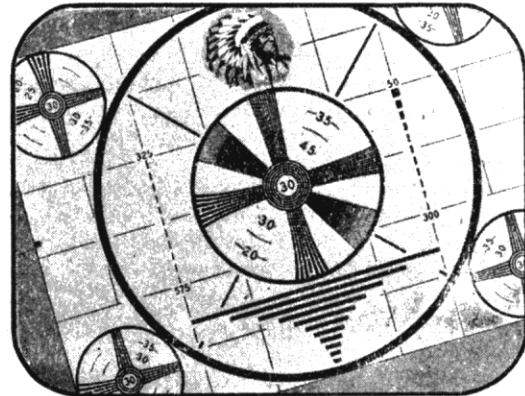


Fig. 17. Picture Tilted; Adjust Electromagnetic Deflection Yoke.

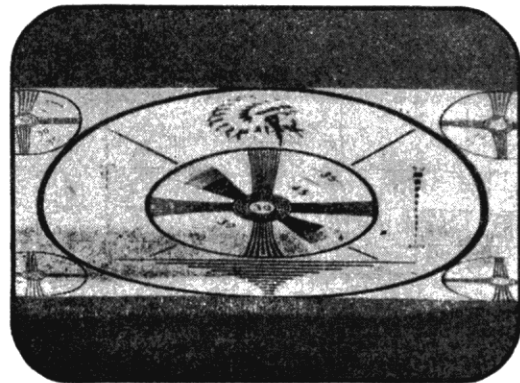


Fig. 18. Lack of Height; Adjust HEIGHT Control.

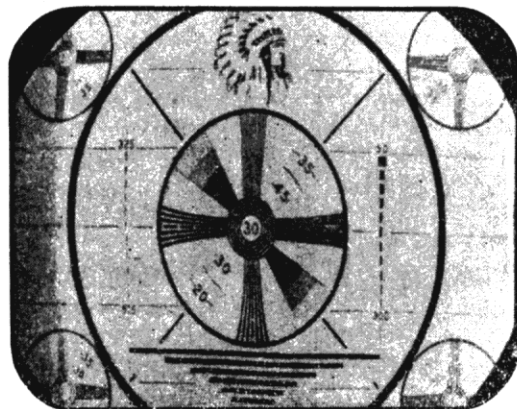


Fig. 19. Too Much Height; Adjust HEIGHT control.

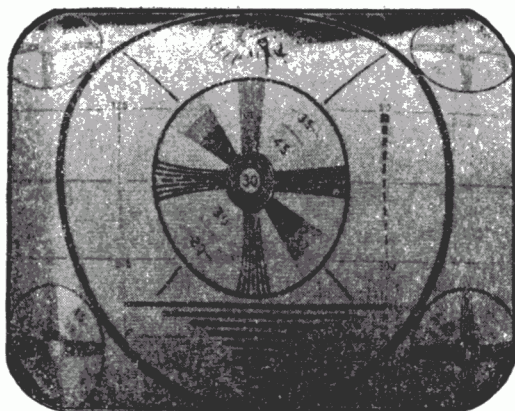


Fig 20. Non-Linear Vertically; Adjust
VERT. LIN. Control.

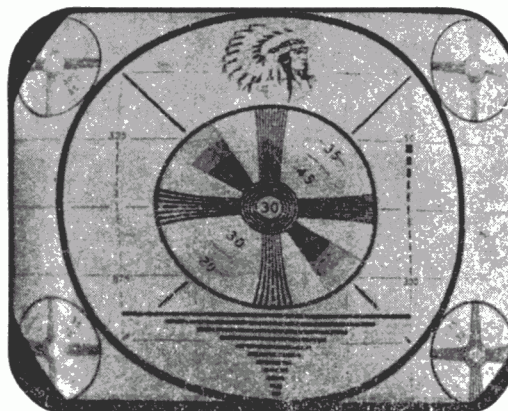


Fig. 21. Non-Linear Horizontally; Adjust
HOR. DRIVE Control.

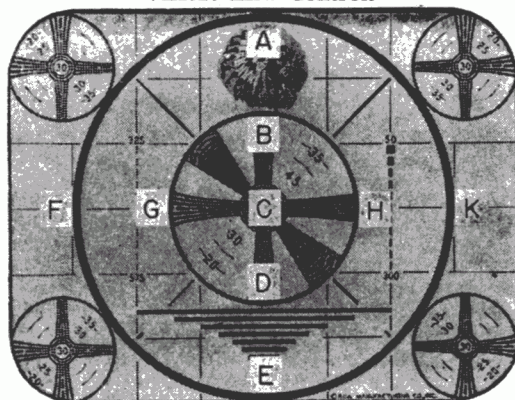


Fig. 22. Correct Width and Horizontal
Linearity.

WIDTH AND HORIZONTAL LINEARITY ADJUSTMENT

- Adjust horizontal drive control C421 (Figure 16) for best linearity. Distances FG should then equal HK; GC should equal CH (Figure 22). Horizontal drive control C421 should be as far counter-clockwise as possible, consistent with good linearity. Caution: Trimmer screw will fall out if C421 is turned out completely.
- If horizontal non-linearity (Figure 21) cannot be corrected by horizontal drive control adjustment, further adjustment can be obtained by means of horizontal linearity control L402 (Figure 16). (L402 has the greatest effect on the center of the pattern.)
- Alternate readjustment of these controls may be necessary to obtain best horizontal linearity.
- Adjust width (Figures 23 and 24) control T405 (Figure 16) until the test pattern just fills the picture tube mask.
- Center as per paragraph on "Focus Coil Adjustment".

With correct horizontal and vertical linearity and correct size adjustment, the circles in the test pattern should appear round. The test patterns used by different stations vary. For example, the outer circle may be cut off at A and E while points F and K are at the edges of the picture tube mask (Figure 22). The four small circles in the corners of the pattern illustrated are not always used. The test pattern illustrations shown are for rectangular

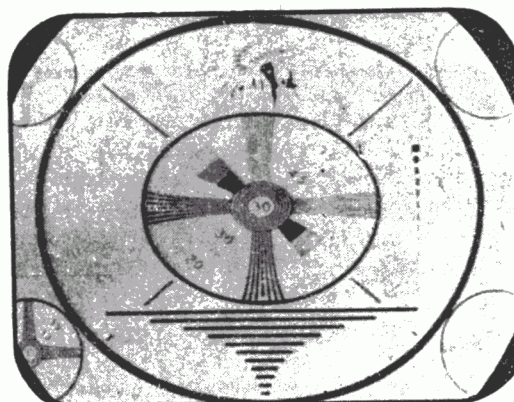


Fig. 23. Too Much Width.

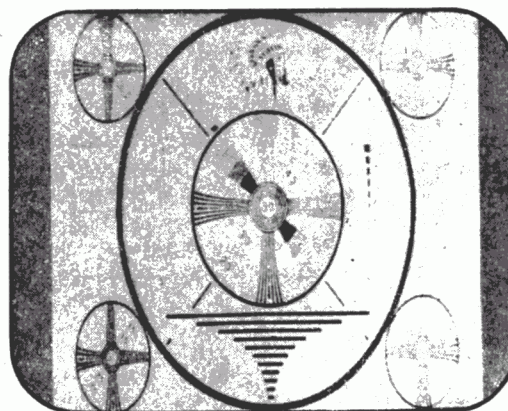
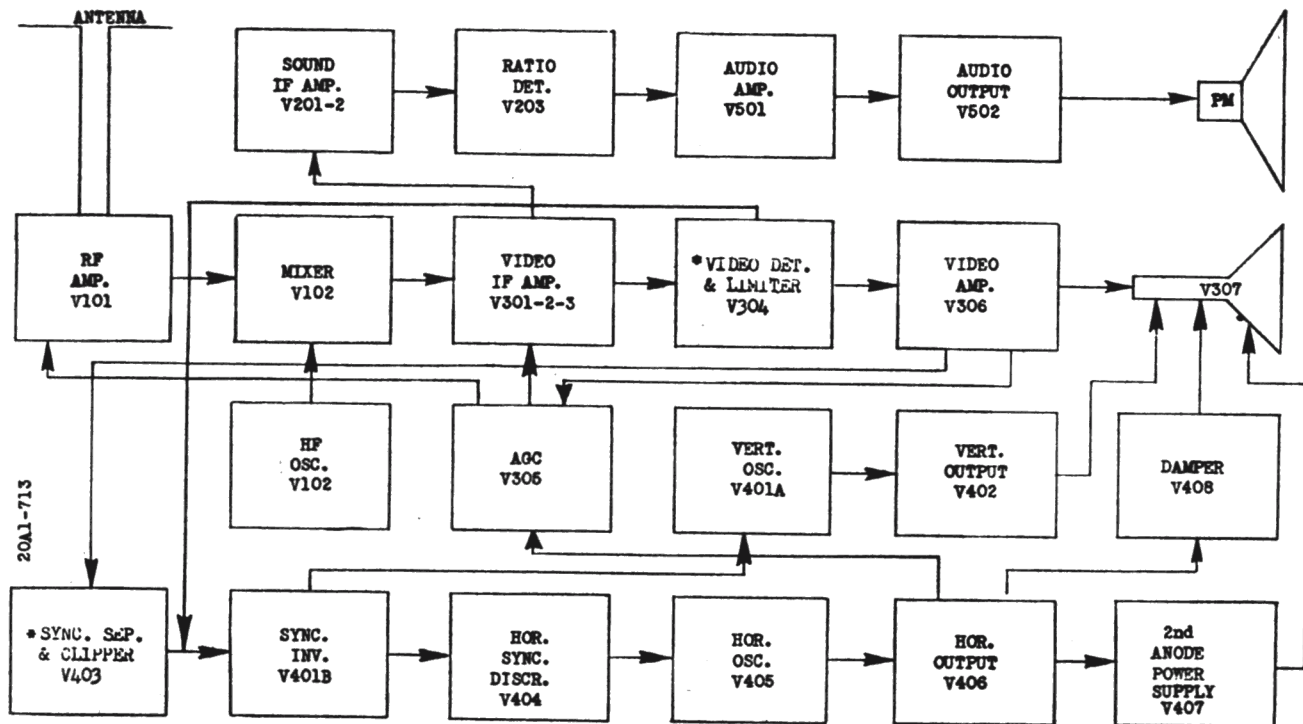


Fig. 24. Insufficient Width

picture windows. For sets with rounded-end picture window, the large circle in the test pattern should be concentric with the circular contour at the ends of the picture window.

If more than one station is on the air when making linearity, size and centering adjustments; check receiver adjustment on all stations. This is necessary since all TV stations are not perfectly linear at all times. If correct horizontal linearity (and width) cannot be obtained, refer to the trouble-shooting chart.

20A1, 20B1, 21A1 CIRCUIT DESCRIPTION



* In early sets, V403 was sync separator only; V304 was video detector only. See page 11; also see figure 83.
Figure 25. Functional Block Diagram.

RF TUNER SECTION

RF Amplifier (V101, 6AG5). Balanced 300 ohm and unbalanced 75 ohm (coaxial line) input impedances are provided by center-tapped primary winding L101A. (See schematic, Figure 81). Secondary winding L101B is tuned by V101 input capacity in series with the parallel combination of C101 and C102. Trimmer C102 is used for alignment. Loading of secondary L101B by R101 provides the required bandpass in this first tuned circuit.

Primary coil L102A is the plate load of RF amplifier V101. Trimmer C104 and tube output capacity tune L102A. C104 is an alignment adjustment. Damping resistor R103 provides the required bandpass.

Channel selection is accomplished by rotation of the turret assembly, a different set of coils (L101 and L102) being switched in for each channel.

Mixer, Late Circuit (½ V102, 6J6). Secondary coil L102B feeds the RF and oscillator injection voltages to the grid of the mixer stage, one triode section of V102. Secondary L102B is tuned by tube input capacity and trimmer C107. Trimmer C107 is also used for alignment adjustment. C106, R105 and R106 develop grid-leak bias for the mixer stage. The two resistors are used in this circuit in order that their junction can be brought out as an alignment test point. An oscilloscope can be connected to this test point "W" without materially affecting the operation of the circuit.

The output of the mixer stage is coupled to the video amplifier by means of a network composed of C114, L106, C116, L301, L105 and C115. Condenser C116 is a blocking condenser. The remainder of the network com-

prises two tuned circuits and a trap. The plate of the mixer has the tuned circuit of L106 and C114 (in series with the trap—L105 and C115) which with the tube output and distributed capacities are resonated to the Video IF bandpass. The tuned circuit to which this is coupled is composed of L301 and the input capacity of the first Video IF amplifier. Over-coupling of these two tuned circuits is provided by the mutual reactance of the trap circuit. C115 and L105 comprise a trap, tuned to approximately 17.5 megacycles, which performs the function of adjacent channel picture rejection

H. F. Oscillator (½ V102, 6J6). Oscillator coil L102C is inductively coupled to mixer grid coil L102B for oscillator injection to the mixer. Condenser C109 is in series with the parallel combination of C110 and C111 to form the split-condenser of a Colpitts oscillator. Trimmer C110 is an alignment adjustment. Variable-dielectric type condenser C111 is the Sharp Tuning control. Grid-leak bias for the oscillator is developed by R107 and C108. The oscillator plate is shunt-fed by means of R108.

AUDIO SECTION

Audio IF Amplifiers V201, V202 (6AU6). Two high-mu sharp cut-off pentodes are used in a two-stage IF amplifier of conventional design. Cathode bias is used on both stages. The sound IF signal is taken from the video sub-chassis by a 21.25 MC series-tuned circuit which is link-coupled to the plate coil of the first video IF amplifier. (Early production video IF sub-chassis employ two stages of amplification before the sound signal is applied to the grid of the 1st sound IF V201.)

Ratio Detector (V203, 6AL5). A ratio detector is used for FM sound detection. The network between point

"Z" and ground (de-emphasis filter and volume control circuit) is the AF output load circuit. Condenser C205 is an IF bypass.

Ratio detector limiter action is provided by the filtering action of condenser C207. Condenser C207 is effectively connected across the tuned secondary of T202 through the two diode sections of V203. This tends to hold the IF signal amplitude at its average value and results in limiter action.

Since C207 charges to a value proportional to average IF signal amplitude and then limits at that level, the circuit will adjust itself to any signal level. As a result, limiter action is effective on weak as well as strong signals.

Audio Amplifiers V501 (6SQ7), V502 (6V6GT), For Straight Television Models. The television (only) audio amplifier system consists of voltage amplifier V501 (6SQ7) and power amplifier V502 (6V6GT). These two stages provide the necessary audio power to drive the speaker. The circuit is conventional.

Audio Amplifiers V511 (6SJ7), V512 (6SQ7), V513, V514 (6K6GT), For Radio-Phono-Television Models. Television combination models use a push-pull audio system in place of the single-ended system used in the straight television models. Tube V511 (6SJ7) functions as a voltage amplifier and V512 (6SQ7) phase inverter.

A pair of 6K6GT tubes (V513 and V514) are used in a cathode biased push-pull power amplifier stage.

VIDEO SECTION

Video IF Amplifiers V301, V302, V303 (6AU6).

Three stages of transformer coupled, stagger-tuned video IF amplification are mounted on a separate sub-chassis. Three self-resonant, slug-tuned transformers (T301, T302 and T303) are used as coupling devices between stages. Two accompanying sound traps are provided within the IF sub-chassis. One trap (L201 and C208) is inductively coupled to T301 and serves as the sound take-off point and audio absorption trap. A second trap (L303 and C308), is slug-tuned to parallel resonance at 4.5 MC and comprises part of the video detector load. This trap offers a high impedance to sound voltage (inter-carrier beat) appearing at the detector and prevents it from being passed on to the video amplifier grid. Automatic gain control bias developed across R308 is supplied to the control grids of V301 and V302 through RC decoupling networks.

Video Detector V304 (½ 6AL5). The video detector diode (one-half of V304) connections are such as to obtain positive picture phase across the diode load. Since one phase reversal occurs in the video amplifier V306, positive picture phase at the kinescope grid is achieved by feeding the kinescope cathode from the plate of V306. Series peaking is accomplished by L302 and a flat response is obtained over the entire video frequency range. Capacitor C312 is the usual RF bypass and removes the video IF carrier from the detected video signal. The detector load is direct-coupled to video amplifier V306 (6AC7).

Automatic Gain Control V305 (6AU6). A pentode pulsed-type amplifier provides an automatic bias voltage to the control grids of the RF amplifier and the first two video IF amplifiers based on the transmitted sync pulse level. The grid of this tube is supplied with signal voltage from the output circuit of the video amplifier V306. A secondary winding on T405 (width control) serves as a source of pulsed plate voltage (15.75 KC). This voltage is supplied to the plate of V305 (6AU6) through capacitor C430 and no DC flows through the secondary of T405. The application of the 15.75 KC pulsed plate voltage to the plate of V305 (6AU6) causes the tube to conduct only during positive half cycles, AGC voltage is therefore developed during this period only. Rectified voltage is developed across R430, R447, R303 and R308 and varies in accordance with the level of the sync pulses applied to the grid of V305. R447, R430 and C417 act as a filter to the pulse ripple. A DC bias voltage is developed across R308 (and R303) which is dependent upon the transmitted sync pulse level and this voltage is applied to the controlled stages through appropriate decoupling networks. Sync pulses are used to control the grid of the AGC tube, since they remain at a constant level with respect to the carrier. If the video signal were used, the AGC voltage would fluctuate with variations of black and white.

Video Amplifier V306 (6AC7). The video amplifier is a pentode voltage amplifier with a constant K filter (L304—R322, L305—R321, R316 and R317 in sets with 6AU6 sync separator; L310—R322, L311—R321, R341 in sets with 12AU7 sync separator) for a plate load. The gain of this stage is controlled by potentiometer R325B which serves as a contrast control by varying the voltage applied to the screen of the 6AC7. The plate load circuit is direct-coupled through R323 to the cathode of the picture tube, eliminating the need for DC reinsertion. Sync voltage is taken from the resistive branch of the plate load.

SWEEP AND SYNC SECTION

Sync Limiter V304 (½ of 6AL5 in sets using 12AU7 tube for V403). The second half of V304 (6AL5) dual diode functions as limiter on the grid of sync inverter V401B (½ 6SN7) limiting the level of the sync signal, thereby eliminating transient or impulse noise peaks.

Sync Separator and Clipper V403 (in sets using 12AU7 dual triode). The sync separator, ½ of 12AU7 tube separates the sync pulses from the composite video signal. The second half of this tube amplifies the sync pulse and also clips peaks off impulse noises.

Sync Separator V403 (in sets using 6AU6 tube). This is a sharp cut-off RC coupled pentode stage operated at comparatively low plate and screen voltage. The sync pulses, which are positive at the grid of this stage, develop grid leak bias across R418. Use of a sharp cut-off tube under these operating conditions results in clipping of the negative (video) portion of the input cycle and output voltage of the stage is made up of horizontal and vertical sync pulses. Signal input level is adjusted with the contrast control, which changes the screen voltage of video amplifier V306 (6AC7).

Sync Inverter V401B (1/2 6SN7). One-half of a dual triode serves as a phase inverter for providing a balanced voltage to the horizontal sync discriminator V405. Vertical sync pulses are taken from the plate circuit in sets using 6AU6 for V403 (cathode circuit in sets using 12AU7 tube for V403) of this stage and fed to the vertical integrating circuit.

Horizontal Sync Discriminator V404 (6AL5). Balanced horizontal sync voltage from the sync inverter is supplied through an RC coupling circuit to the sync discriminator. A reference voltage from the horizontal output circuit is fed from a secondary winding on T405 (width control) through an RC network made up of R435 and C414 to the junction of pins 5 and 7 (pins 1 and 2 in sets using 12AU7 tube for V403) of V405.

The discriminator develops a DC voltage across R428 that is proportional to the phase difference between the transmitted sync pulse voltage and the horizontal sweep voltage. When the frequency and phase relationship between these two voltages is correct, the sync discriminator supplies normal operating bias to the first triode section of the horizontal oscillator V406 (6SN7). When a change in the phase/frequency relationship between the transmitted sync pulse voltage and the horizontal sweep voltage occurs, the DC output voltage across R428 changes accordingly. This DC voltage is fed to the horizontal oscillator through an RC filter (R429, C413 and C416) which removes any noise or sync voltage.

The circuits of the 20A1, 20B1 and 21A1 are practically identical; the major difference between the 21A1 and the other models is in the picture tube second anode power supply. The circuit discussion which follows applies mainly to the 20A1, 20B1 chassis, except where the 21A1 is mentioned in the text.

Horizontal Oscillator V405 (6SN7). A dual triode combines the two functions of horizontal oscillator and control tube within one envelope. The circuit is that of a modified Franklin oscillator. Frequency of oscillation is largely controlled by L401—C415, R433, R446 and R405B. A slug adjustment L401 serves as the horizontal lock control while R405B is a vernier frequency adjustment which acts as the horizontal hold control. The circuit differs from the conventional Franklin oscillator in that the grid of the first triode section is isolated for control purposes and plate circuit feedback is through the common cathode resistor R432.

The DC output voltage of the horizontal sync discriminator supplies a bias voltage which is added to the normal operating bias of the first triode section of V405 provided by the drop across cathode resistor R432. The frequency of oscillation is determined not only by L401, C415, R433, R446 and R405B, but is also affected by the plate resistance of the first triode section. The plate resistance in turn is determined by the bias applied to the control grid (pin No. 1 of V405). A shift in phase or frequency between the transmitted sync pulse and the horizontal sweep voltage produces a change in the output voltage of the sync discriminator which is fed to pin No. 1 (grid) of V405. This voltage results in the required horizontal oscillator phase or frequency correction.

Horizontal Output V406 (6BG6). A beam tetrode in the horizontal output circuit has the dual function of providing driving power for the horizontal deflecting coils and a high potential pulse for the second anode rectifier V407 (1B3GT).

The output of the horizontal amplifier is transformer-coupled to T404A, the horizontal deflecting coils. T405 is shunted across a portion of T403 horizontal output transformer and, by means of a slug adjustment, functions as a width control. T405 has a secondary winding which supplies pulsed plate voltage to AGC tube V305 and an AC reference voltage to V404, horizontal sync discriminator.

Second Anode Supply for 20A1 and 20B1. Pulsed voltage developed by the horizontal output amplifier V406 is stepped up by the auto-transformer type primary of horizontal output transformer T403. A 1B3GT is connected as a conventional half-wave rectifier with filament power supplied by a separate secondary winding on T403. Filament current limiting for V407 is provided by R443.

Due to light loading and relatively high frequency voltage source, an RC filter provides adequate filtering for the second anode supply. The external coating of the kinescope V307 normally serves as the output filter capacitor. Certain 12" picture tubes do not have an external coating in which case C433 (500 mmfd. 10,000 volt) is used.

Second Anode Supply for 21A1. The horizontal output amplifier V406 (6BG6G) is the source of pulsed voltage for the second anode voltage rectifiers V407 and V409 (1B3GT/8016). This voltage is increased by auto-transformer action in T406 and rectified by a cascade rectifier arrangement (V407 and V409) having an output of 12,000 volts. The positive half-cycle of the T406 primary voltage is a short duration pulse of very high amplitude. The negative half-cycle has relatively low amplitude and is of longer duration. During the first positive half-cycle, V407 conducts, charging capacitor C427 to the peak value of the full T406 primary voltage pulse. V409 does not conduct during this period. During the negative half-cycle, neither rectifier conducts and the sum of T406 primary voltage plus the charge on C427 (acquired during the first positive half-cycle) charges C441 through R455 and R456. The next positive half-cycle causes both V407 and V409 to conduct. V409 conducts by virtue of the charge on C441 adding to the positive pulse of the primary of T406. Conduction through V407 recharges C427 to the peak value of the positive pulse. Conduction through V409 charges C440 through the T406 primary circuit to approximately half the potential of C441. The potential of C447 plus that of C440 produces a total of 12,000 volts.

Damper V408 (6W4). The damper is connected in a manner which provides an effective increase in plate voltage to the horizontal output amplifier V406. The plate current of V406 flows through V408 for the major portion of the horizontal trace. Capacitors C426 and C431 are fully charged during this period and supply current to V406 during the time that V408 is not conducting. An average voltage due to V408 current is de-

veloped at the network C426A, L402 and C426B which adds about 50-60 volts to the supply voltage. The network C426A, L402 and C426B provides linearity control by adjusting the cathode wave form (bias) of the damper tube. R444 and C426B give some RC damping in the output circuit in addition to the damping provided by V408.

Vertical Oscillator V401A (1/2 6SN7). Synchronizing pulses are fed from the plate of the sync inverter V404 through an integrating network (R401, C401, R402, C402, R403, C403) to the grid of the blocking oscillator V401 (1/2 6SN7). Vertical hold control is provided by potentiometer R405A. Height control is provided by varying the plate voltage on V401 by means of R408. Plate voltage changes caused by height control adjustment are prevented from affecting the vertical oscillator frequency by means of a DC correction voltage, applied to the grid of V401A through a divider network composed of R406 and R407.

Vertical Output V402 (6K6). A triode-connected pentode tube is used as the vertical output amplifier and

is transformer coupled to vertical deflection yoke T404B. R416 and R417 act as damping resistors to prevent transient oscillations. R413 provides linearity control by varying the cathode bias on V402.

POWER SUPPLY SECTION

Low Voltage Supply V503 (6X5). A full wave rectifier and pi-type filter supplies B plus voltage to the tuner, sync separator V403, sync inverter V401B, and the video section. A single winding on the power transformer supplies power to all heaters in the chassis.

High Voltage Supply V504 (5U4G). The audio section, vertical oscillator V401A, vertical output V402, horizontal oscillator V405, and horizontal output V406 are supplied with B plus voltage by full-wave rectifier and pi-type filter. Filament power for V504 is supplied by a separate winding on the power transformer.

The audio section plate current is used for focusing the picture tube. This plate current is used because it is relatively constant, the AGC circuit not being connected to the audio section.

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual procedures. Alignment should be performed in this sequence.

- IF Amplifier and Trap Alignment (Video and Sound IF).
- Tuner RF and Mixer Alignment.
- Tuner High Frequency Oscillator Alignment.
- Overall RF and Video IF Response Curve Check.

Under normal use or operating conditions, tuner misalignment with age will be slight. The RF and mixer stage components as well as coil assemblies have been designed for stable band-pass operation and under normal conditions will seldom require realignment. The HF oscillator however, may require some slight readjustment, if the oscillator-mixer tube or individual channel snap-in coils have been replaced. See discussion under "94C18-1 Tuner Service".

Do not attempt alignment until all possible causes of trouble have first been investigated. Do not attempt alignment unless suitable test equipment is available.

HIGH VOLTAGE WARNING

Operating or servicing television receivers with cabinet removed involves shock hazard. Exercise all normal High Voltage precautions.

Picture tube, including all cables, must be connected to television chassis for 21A1 models during alignment. Anode voltage for 16" picture tubes is approximately 12 KV.

ALIGNMENT TOOL KIT (#98A30-3)

An Alignment Tool Kit consisting of 2 screwdrivers is available. Order part #98A30-3 from Admiral Distributor.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available.

RF Sweep Generator

18 to 30 MC range: 10 MC sweep width.
50 to 90 MC range: 10 MC sweep width.
170 to 225 MC range: 10 MC sweep width.
Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground for RF ranges.

Marker Generator

18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.
Must be extremely accurate or have built-in crystal calibrator for checking accuracy of calibration.

Crystal Calibrator

Check points at 4.5 MC and from 18 to 225 MC. Not required for 18 to 225 MC if marker or sweep generators have built-in calibration crystals.

Signal Generator

Accurate signal generator, 4.5 MC range and of 18 to 225 MC, with low impedance output and calibrated attenuator.

Oscilloscope

Standard oscilloscope, preferably with a wide band vertical deflection, vertical sensitivity at least .5 volt peak-to-peak per inch, and input calibrator.

Vacuum-Tube Voltmeter

Vacuum-tube voltmeter with a detector probe (electronic or germanium crystal probe), response to 4.5 MC. Preferably VTVM with low range (3 volt) DC zero center scale.

ALIGNMENT ADJUSTMENT IDENTIFICATION

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

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.

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.

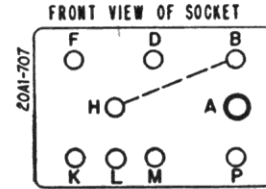


Figure 26.

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, re-adjust. Repeat step 6.
9	4.5 unmodulated or 400 cycle 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 15 and 16.			

* 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.

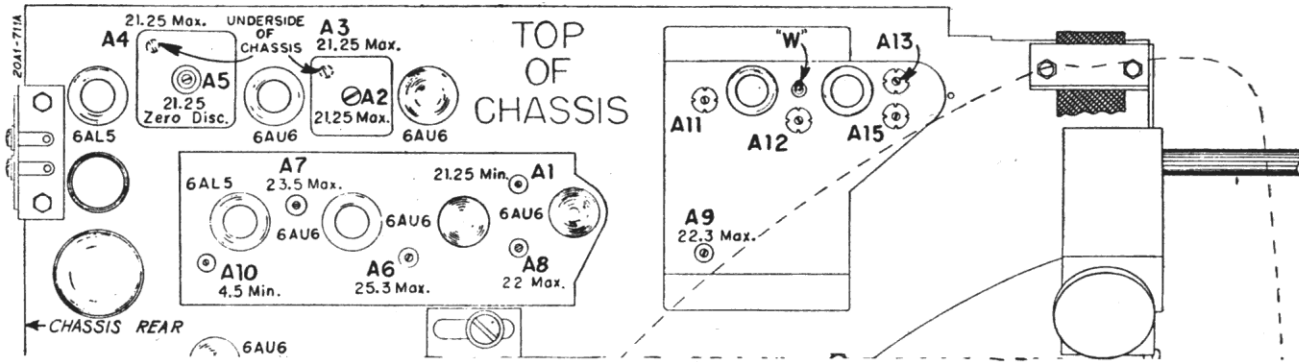


Figure 27. Alignment Locations and Frequencies, with late production Video IF strip.

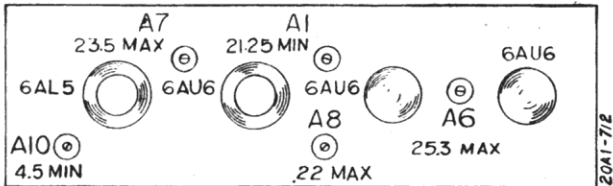


Figure 28. Video IF Alignment Locations in early production Video IF strip.

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 17. 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 17.

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

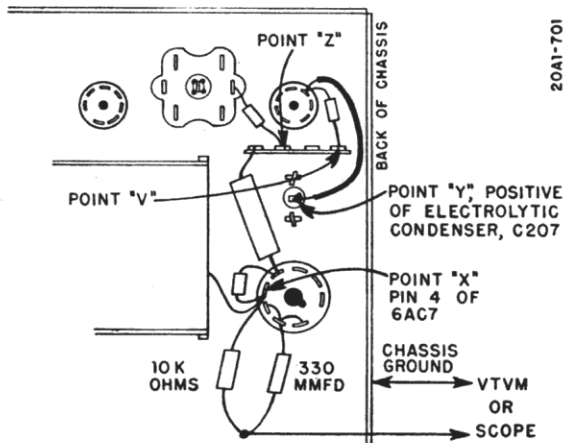


Figure 29. Alignment Connection Points.

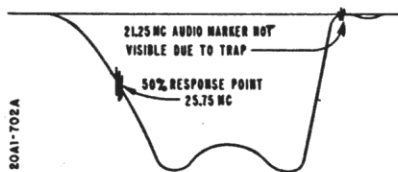


Figure 30. Overall Video IF Response Curve.

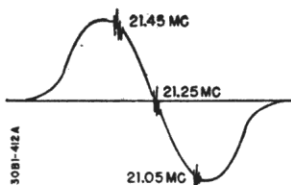


Figure 31. Ratio Detector Response Curve.

§ 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, since too high a capacity will affect the shape of the response curve.

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. See page 17 for "Overall RF and Video IF Response Curve Check."

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.

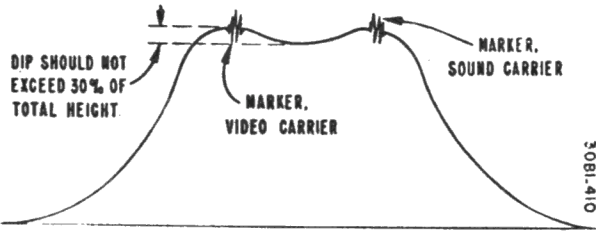
Important

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.

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	<p>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.</p>  <p>Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.</p> <p>Figure 32. Response Curve.</p>
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	

* Picture Carrier Frequency (MC)

** Sound Carrier Frequency (MC)

HF OSCILLATOR ALIGNMENT

See "Connections for Telev-Radio-Phono Combination Models" on page 14.

INDIVIDUAL CHANNEL OSCILLATOR ADJUSTMENT USING TELEVISION SIGNAL

See page 6 under above heading.

INDIVIDUAL CHANNEL ADJUSTMENTS USING SIGNAL GENERATOR & VTVM

- Allow about 15 minutes for receiver and test equipment to warm up. Disconnect antenna from receiver.
- Connect signal generator high side to one antenna terminal, ground to chassis.
- See Figure 29. Connect VTVM high side to "Z"; common to "V" in ratio detector V203 circuit. Use VTVM 3 volt zero center scale if available.
- Set Sharp Tuning control at half rotation by rotating it approximately 150° as shown in figure 33.
- Use a NON-METALLIC alignment screw driver with a 1/8 inch blade.
- For more accurate oscillator alignment, it is advisable to first check sound IF amplifier alignment (A2, A3, A4 and A5) before aligning HF oscillator. IF's and ratio detector must be accurately aligned to correct IF frequency. Retouch IF and ratio detector adjustments if necessary.
- Adjust as follow:

Channel	Generator Freq. (MC)	Adjust
13	215.75	A14 (Fig. 33) for zero VTVM reading between a positive and a negative peak with Sharp Tuning control at electrical center. Do this carefully as only a slight rotation of slug may be required.
12	209.75	
11	203.75	
10	197.75	
9	191.75	
8	185.75	Note that if mis-alignment is evident on a major number of channels, an over-all HF oscillator adjustment (A15) can be made.
7	179.75	
6	87.75	
5	81.75	
4	71.75	
3	65.75	
2	59.75	

OVER-ALL OSCILLATOR ADJUSTMENT (A15)

Over-all oscillator adjustment should only be necessary when tubes or other components in the oscillator circuit have been replaced. (When replacing the oscillator-mixer tube (6J6), it is recommended that several tubes be tried to select one which causes least frequency shift.)

This over-all adjustment can be made using a VTVM and signal generator, or using a television signal.

- Remove chassis from cabinet.
 - Set selector to channel 13 or other high channel.
 - When using a signal generator**, follow steps (a), (b), (c), (d) under "Individual Channel Adjustments Using Signal Generator and VTVM", then adjust A15 (figure 33) for zero VTVM reading between a positive and a negative peak.
- OR
- When using a television signal**, set the Channel Selector knob for a station and adjust controls for normal picture and sound. Set Sharp Tuning control at electrical center by rotating approximately 150° or half rotation as shown in figure 33. Note position of dielectric rotor. Then adjust A15 (figure 33) for best sound and clearly defined picture.
 - Recheck adjustment of individual channels and touch-up (A14) if necessary.

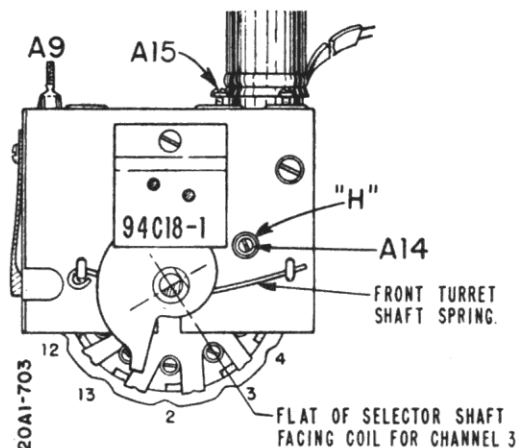


Figure 33. Front View of 94C18-1 Tuner.

OVER-ALL RF and VIDEO IF RESPONSE CURVE CHECK

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

- Disconnect signal generator and VTVM (if used in previous alignment).
- Connect a 4½ volt battery; negative to AGC buss (junction of R303, R447, C305), positive to chassis.
- Set Contrast control fully clockwise.
- Connect oscilloscope between point "X" and chassis ground through a decoupling filter (see figure 29). Keep leads away from receiver.
- Connect sweep generator to antenna terminals.
- 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.
- Sweeping the RF pass band for an unassigned 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

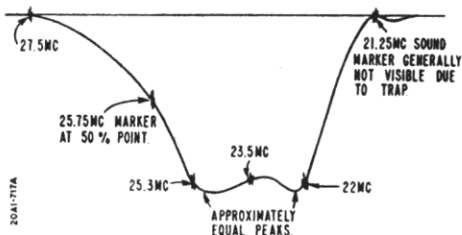


Figure 33A. Overall RF and Video IF Response Curve.

§ See footnote on page 15.

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.

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 $\frac{1}{4}$ to $\frac{1}{2}$ 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 $\frac{1}{4}$ to $\frac{1}{2}$ turn in either direction until correct results are obtained.

REMOVING RADIO OR CHANGER FOR SERVICE

REMOVING RADIO TUNER CHASSIS ONLY FOR SERVICING

It will not be necessary to remove the complete radio-phonograph 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. However, if complete cabinet disassembly is necessary, proceed as follows:
 - (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.
 - (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.
- i. Reassemble in the same manner.

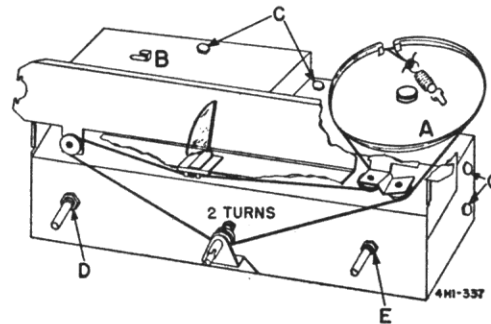


Figure 34. Radio Tuner Showing Chassis Cover and Dial Assembly.

REMOVING COMPLETE RADIO TUNER AND RECORD CHANGER ASSEMBLY

For Models with "Tilt-Out" Radio-Phono Unit

The complete Radio-Phono unit does not require complete removal for these models, unless the "Tilt-Out" mechanism requires repair. The radio tuner can be removed separately as explained under "Removing Radio Tuner Chassis Only for Servicing". The record changer can be removed separately by unscrewing the three screws on the top of the changer, unplugging the cable connectors, and then lifting the changer out.

If it is necessary to remove the complete Radio and Record Changer assembly, disconnect all cable connectors going to the television and power supply chassis. Remove the ground strap from the bottom cover of the changer, and unsolder the FM antenna lead from the terminal board on the rear of the cabinet. Disconnect one side of the tie-bar (or tie-bar spring) and one side of the tie-rod from a tilt-out bracket. Hold the radio-phonograph unit with one hand while springing each of the four tilt-out hinge arms away from the sides. As this is done, the four pivot studs will come out of their sockets and free the unit from the cabinet.

To reinstall, place the radio-phonograph unit back in the cabinet; spring the tilt-out arms out so that the unit will drop down between them; guide the studs back into their sockets; then reassemble the tie-bar (or tie-bar spring) and tie-rod to the tilt-out brackets. Reconnect all cable connectors and ground strap; resolder FM antenna leads.

For Models with "Slide-Out" Radio-Phono Unit

Remove the four mounting screws which hold the unit to the "Slide-Out" shelf assembly.

AM-FM RADIO TUNER ALIGNMENT

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.

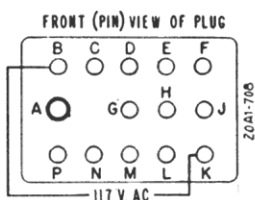
109. MC	106. MC	90. MC	87. MC
54.50MC	53. MC	45. MC	43.5 MC
36.33MC	35.33MC	30. MC	29. MC
27.25MC	26.5 MC	22.5 MC	21.75MC
21.80MC	21.2 MC	18. MC	17.4 MC
18.17MC	17.66MC	15. MC	14.5 MC

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

IMPORTANT PRELIMINARY ALIGNMENT STEPS

To remove the radio tuner chassis for alignment, read "Removing Radio Tuner Chassis Only for Servicing" on page 18.

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.



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

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.

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.

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.

Before proceeding, be sure to follow all steps listed under "Important Preliminary Alignment Steps."

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 "C", "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.

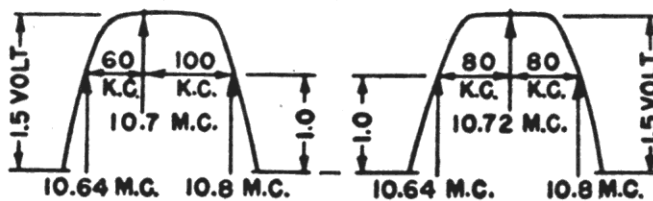


Fig. 35.

Fig. 36.

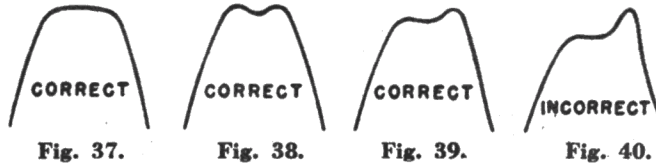
Generator frequency on high side of 10.7 MC for a reading of -1 volt DC = 10.800 MC.

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.

TYPICAL SELECTIVITY CURVES



FM RF ALIGNMENT PROCEDURE

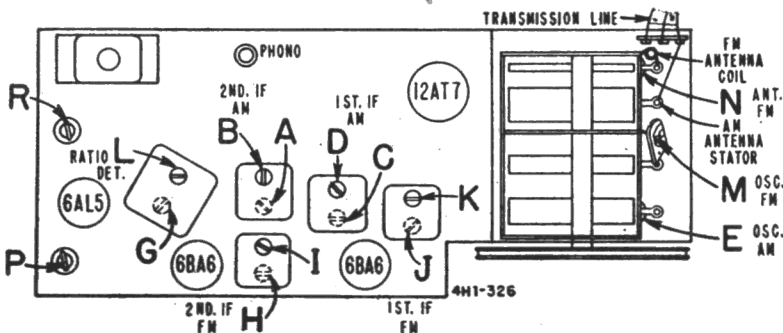
Step	Connect Generator	Generator Frequency	Receiver Gang or Dial Setting	Output Connections	Adjust as follows (very carefully)
1		†109 MC (unmodulated)	Gang fully open	Connect VTVM (DC probe) from point "P" to chassis	*M (oscillator) and N (antenna) for maximum
2	To ends of FM antenna twin lead thru 120 ohm carbon resistors in series with each generator lead.	87 MC (unmodulated)	Tune in Signal. (Gang should be closed or almost closed.)	"	If signals in steps 1 and 2 will not tune in at gang tuning extreme ±0.5 MC, it will be necessary to spread or squeeze oscillator coil turns and then repeat steps 1 and 2 until correct results are obtained.
3		106 MC (unmodulated)	Tune in Signal	"	Readjust N for maximum VTVM reading, while rocking gang. If trimmer does not peak, it will be necessary to squeeze or spread turns of FM antenna coil. Check tracking. Also check calibration at 90 MC if dial scale assembly is in place. Calibration error should not exceed ±0.5 MC. If necessary, repeat steps 1, 2, 3 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 as described in "FM Alignment Equipment."

IMPORTANT

After completing alignment, assemble chassis cover and dial scale to chassis. Set dial pointer travel and recheck dial calibration for AM and FM tuning. AM-FM oscillator and antenna trimmer adjustments may be repeated 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.



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

Figure 41. Trimmer Locations.

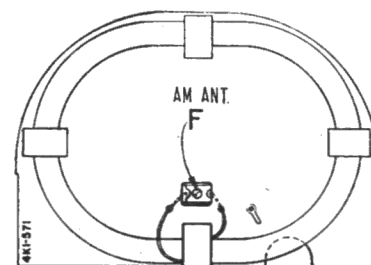


Figure 42. AM Antenna Trimmer Location.

WAVEFORM ANALYSIS

SERVICING BY WAVEFORM ANALYSIS

After a circuit defect has been localized to the video or sweep sections of a television receiver (see troubleshooting chart), localization to a single stage can be accomplished by use of the waveforms shown. Voltage or resistance measurements can then be used to locate the defective part in a conventional manner.

The waveforms shown for test points TP1 through TP8, TP13, TP13A and TP19 are obtained only with a transmitted picture signal input to the receiver. Since the remainder of the waveforms shown are taken from the sweep circuits of the receiver, a transmitted picture signal input is not necessary.

Two separate waveforms are shown for the first seven test points. Two different oscilloscope sweep frequencies were used in order to show up the vertical and horizontal pulses at each test point (both cannot be locked in at the same sweep frequency due to the great difference in, and non-integral relationship of, the vertical and horizontal pulse frequencies). The oscilloscope sweep is adjusted for one half of the frequency of the vertical or the horizontal frequency in order that two pulses will appear on the screen.

The peak-to-peak voltages indicated for the various test points were measured by calibrating the oscilloscope used to observe the waveforms. Such peak-to-peak voltage measurements provide a check on the voltage gain per stage. For example: the peak-to-peak voltage read-

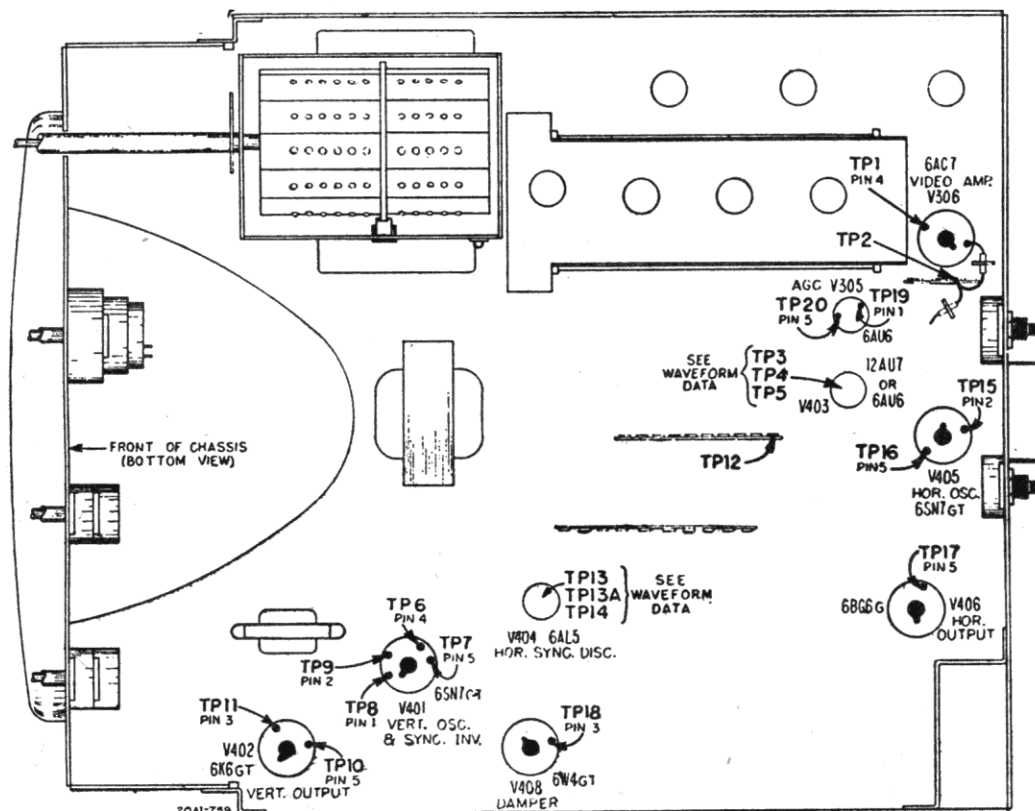
ings at test points TP1 and TP2 are 1 and 30 volts, respectively. A voltage gain of 30 is indicated for the video amplifier stage V306 (6AC7).

Turn contrast and brightness controls fully clockwise. Varying these controls will produce corresponding variations in peak-to-peak height of the test pattern.

A change in waveform may be noticed at the first two test points when the receiver is switched to a different television station. This is true since some variations in the transmitted waveform are tolerated at the television transmitter. All waveforms and peak-to-peak voltage readings are subject to modification due to the response of the oscilloscope used for test. Due to parts and manufacturing tolerances, variations in peak-to-peak voltages between television receivers are a normal condition. Hence, when using waveforms and peak-to-peak voltage readings for quick trouble shooting, these variations should be kept in mind to avoid erroneous conclusions.

WARNING

Waveform analysis of high voltage sections of the receiver is not recommended, extreme care should be taken to avoid contact with these circuits. Care should be exercised when taking measurements on the horizontal output stage. No connections should be made to the plate cap of the V406 (6BG6G) or to any connections on the rectifier tube (1B3GT/8016) as the high voltages at these points are dangerous.



NOTE: V403 is 6AU6 in early sets, 12AU7 in later sets. See schematics, figures 81 and 83.

Figure 44. Test Point Locations.

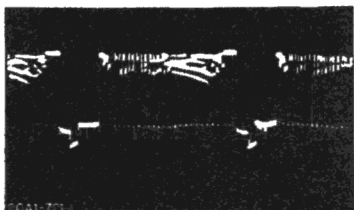


FIG. 45 VERTICAL PULSE
1 Volt PP

***TP1**
Input to Video Amplifier
Pin 4 of V306 (6AC7)

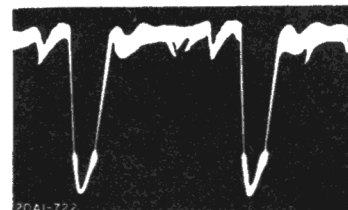


FIG. 46 HORIZONTAL PULSE
1 Volt PP

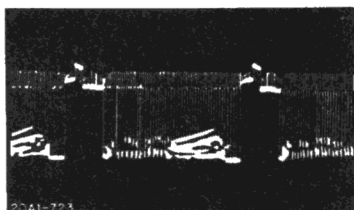


FIG. 47 VERTICAL PULSE
30 Volts PP

***TP2**
Output of Video Amplifier
Junction of L304 and L305

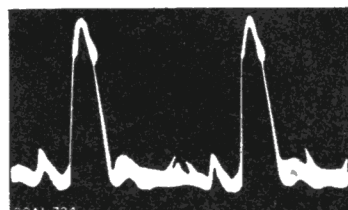


FIG. 48 HORIZONTAL PULSE
30 Volts PP

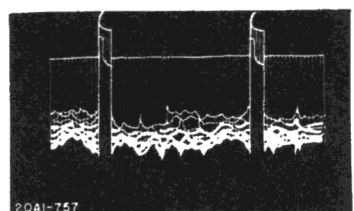


FIG. 49 VERTICAL PULSE
35 Volts PP

***TP3**
(Only in sets with 12AU7 Sync Separator)
Input to Sync Separator
Pin 2 of V403 (12AU7)

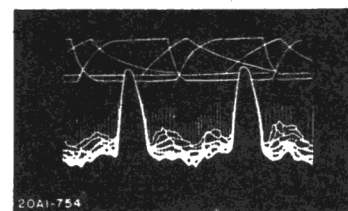


FIG. 50 HORIZONTAL PULSE
35 Volts PP

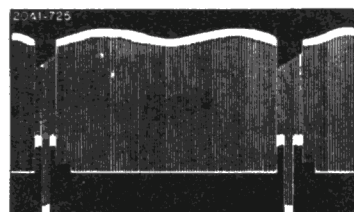


FIG. 51 VERTICAL PULSE
30 Volts PP

***TP4**
Output of Sync Separator
Pin 1 of V403 (12AU7)
or
Pin 5 of V403 (6AU6)

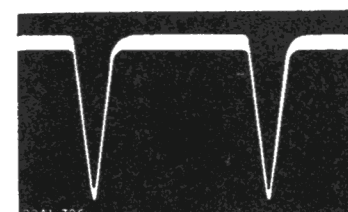


FIG. 52 HORIZONTAL PULSE
30 Volts PP

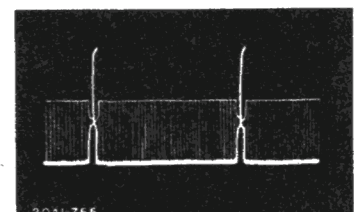


FIG. 53 VERTICAL PULSE
85 Volts PP

***TP5**
(Only in sets with 12AU7 Sync Separator)
Output of Clipper
Pin 6 of V403 (12AU7)

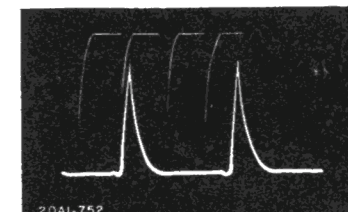


FIG. 54 HORIZONTAL PULSE
85 Volts PP

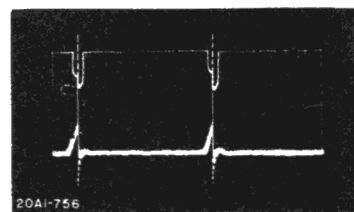


FIG. 55 VERTICAL PULSE
45 Volts PP

***TP6**
Input to Sync Inverter
Pin 4 of V401B (6SN7GT)

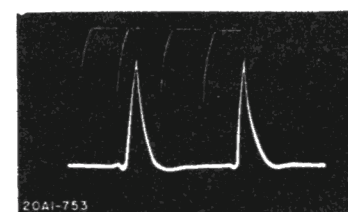


FIG. 56 HORIZONTAL PULSE
45 Volts PP

* Waveforms obtained only with transmitted picture signal input.

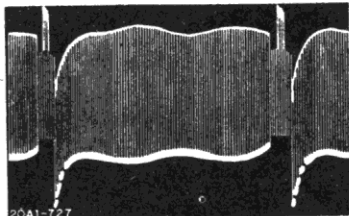


FIG. 57 VERTICAL PULSE
15 Volts PP

***TP7**
Output of Sync Inverter
Pin 5 of V401B (6SN7GT)

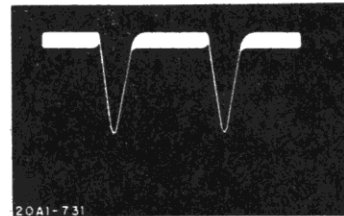


FIG. 58 HORIZONTAL PULSE
15 Volts PP

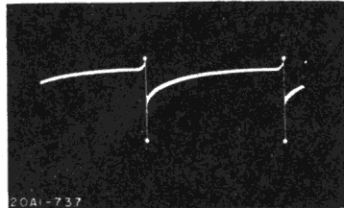


Fig. 59 160 Volts PP
***TP8**
Input to Vertical Osc.
Pin 1 of V401A (6SN7GT)

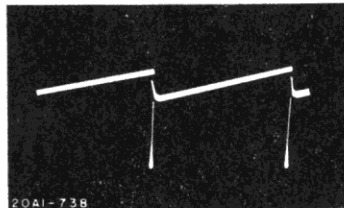


Fig. 60 170 Volts PP
TP9
Output of Vertical Osc.
Pin 2 of V401A (6SN7GT)

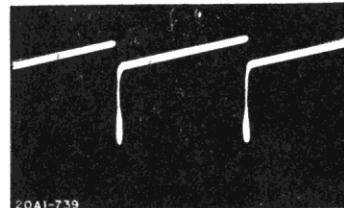


Fig. 61 160 Volts PP
TP10
Input to Vertical Output
Pin 5 of V402 (6K6GT)

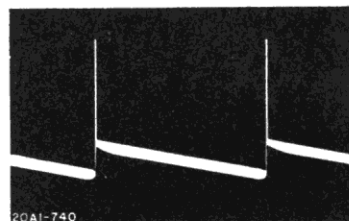


Fig. 62 900 Volts PP
TP11
Output of Vertical Output
Pin 3 of V402 (6K6GT)

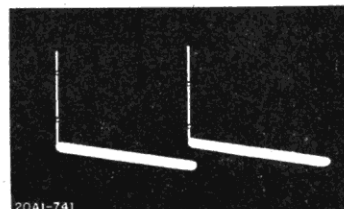


Fig. 63 65 Volts PP
TP12
Vertical Output
Junction of green lead of
T402 and brown lead of T404

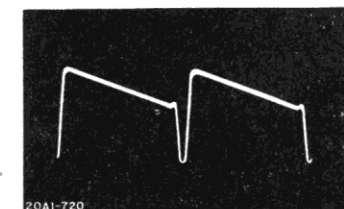


Fig. 64 9 Volts PP
***TP13** Cathode of Hor. Sync
Disc V404 (6AL5)
Pin 1 in sets with 12AU7 (V403)
Pin 5 in sets with 6AU6 (V403)



Fig. 64A 9 Volts PP
Plate of Hor. Sync
***TP13A** Disc V404 (6AL5)
Pin 2 in sets with 12AU7 (V403)
Pin 7 in sets with 6AU6 (V403)

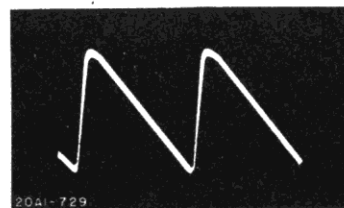


Fig. 65 6 Volts PP
TP14 Plate of Hor. Sync
Disc V404 (6AL5)
Pin 7 in sets with 12AU7 (V403)
Pin 2 in sets with 6AU7 (V403)

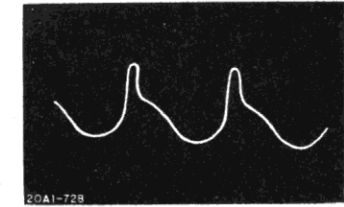


Fig. 66 35 Volts PP
TP15
Plate of Hor. Osc.
Pin 2 of V405 (6SN7GT)

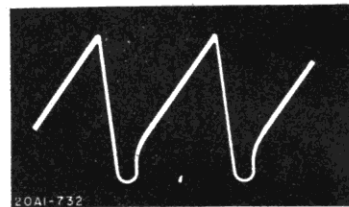


Fig. 67 55 Volts PP
TP16
Plate of Hor. Osc.
Pin 5 of V405 (6SN7GT)

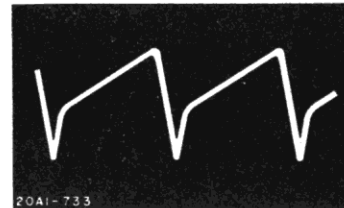


Fig. 68 45 Volts PP
TP17
Input to Hor. Output
Pin 5 of V406 (6BG6G)

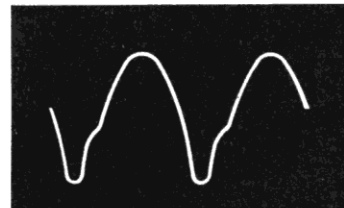


Fig. 69 25 Volts PP
Horizontal Pulse
TP18
Cathode of Damper
Pin 3 of V408 (6W4GT)

Fig. 70 30 Volts PP
Horizontal Pulse
***TP19**
Grid of AGC
Pin 1 of V305 (6AU6)

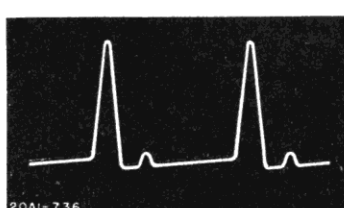
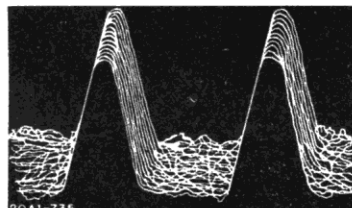


Fig. 71 200 Volts PP
Horizontal Pulse
TP20
Plate of AGC
Pin 5 of V305 (6AU6)

* Waveforms obtained only with transmitted picture signal input.

PRODUCTION CHANGES

A. VIDEO IF SUB-CHASSIS

Very early production IF sub-chassis may have a 6AG5 in the 2nd Video IF stage. In later production, a 6AU6 tube is used and may be substituted if pin No. 2 (suppressor) is grounded to the chassis.

Early production video IF sub-chassis employ two stages of amplification before the sound signal is applied to the grid of the 1st sound IF (V201). Early production sub-chassis can be identified by a RED color dot near the 2nd Video IF (V302) on the top of the chassis. In this early sub-chassis, T301 is part number 72A83-1 and is aligned at 25.3 MC. See figure 28. T302 is part number 72A84 and is aligned at 22MC. R305 is 10,000 ohms; R310 is 12,000 ohms.

Late production IF sub-chassis have only one stage (V301) of amplification before the sound signal is applied to the grid of V201. This change was made to prevent weak audio output, resulting from increased AGC voltage, on *strong* signals. In late sub-chassis, T301 is part number 72A84 and is aligned at 22 MC. See figure 27. T302 is part number 72A83-2 and is aligned at 25.3 MC. R310 is 10,000 ohms, R305 was 12,000 ohms; then changed to 8200 ohms. Changing R305 to 8200 ohms in later production sets, has improved the overall RF-Video IF response curve figure 33A.

B. 6AU6 SYNC SEPARATOR SCREEN RESISTOR

In early production, the sync separator screen (V403) was maintained at a constant voltage by a voltage dividing network made up of a 47,000 ohm resistor (part No. 60B8-473) from pin No. 6 to ground and an 82,000 ohm resistor (R421) from pin No. 6 to B+. In later production, the 47,000 ohm resistor was deleted and R421 was connected from pin No. 6 to the contrast control arm to simultaneously regulate the screen voltage on the sync separator (V403) and video amplifier (V306). This eliminates the possibility of over-driving the sync separator when the contrast is increased.

C. ALTERNATE DEFLECTION YOKE T404

Two alternate deflection yokes, part number 94B2-1 and 94B2-2 are currently being used. Condenser C428, which is part of the yoke assembly, is 56 mmfd., 5%, mica (65B1-54) when used with 94B2-1; it is 39 mmfd., 5%, mica (65B1-55) when used with 94B2-2. The two yokes are interchangeable when complete with the proper resistors, condenser and wire leads. Yoke 94B2-2 (correct parts and leads included) is supplied for service replacement.

D. R333 ADDED TO REDUCE PICTURE "FLUTTER"

Chassis with this change stamped run "9" or higher.

To reduce picture "flutter" caused by impulse noises or by weak or fading sync signals, resistor R333 (2.2 megohms, 1/2 watt, part number 60B8-225) is connected from the screen grid (pin 6) to the control grid (pin 1) of V305 (6AU6), AGC tube. This results in a higher amplitude sync signal with less suppression of sync pulse by the 6AC7 video amplifier tube.

E. CHANGE TO ELIMINATE INTERFERENCE FROM HARMONICS OF THE SOUND IF STRIP IN EARLY 20A1, 20B1, 21A1 CHASSIS

Chassis with this change stamped run "11" or higher.

In early production sets, the tenth harmonic of the sound IF channel can cause interference in the form of a herringbone pattern on channel 13. (Other harmonics may cause interference on channels 3, 6 and 9.)

A check, for early production sets, to determine whether the interference is actually due to harmonics of the sound IF, is made by removing the second sound IF tube V202 (6AU6) and noting if the interference pattern disappears. If the interference pattern remains, the trouble is due to some other cause.

Circuit changes (made in later production sets) to eliminate this interference are given below. Changes in early production sets to eliminate this interference can be made in the following sequence:

- Replace the wire lead between pin 6 of V202 (6AU6) tube and R213 (6000 ohms) resistor with a 1000 ohm, 1/2 watt resistor (R215). The resistor lead to pin 6 of V202 tube must be as short as possible.
- Connect a 1500 mmfd. min. ceramic condenser (C213) from the junction of R213 resistor and terminal of R212B focus control to the ground lug next to the socket of V202 (6AU6) tube.
- Mount a terminal board under the mounting nut of T202 (sound IF transformer) near the video IF shield. Locate the lead between pin 7 of V306 (6AC7) tube and pin 3 of V202 (6AU6) tube. Remove this lead from pin 3 of V202 (6AU6) tube and connect it to the insulated lug on the terminal board. Connect a filament RF choke (L202) from the insulated lug on the terminal board to pin 3 of V202 (6AU6) tube.
- Locate the ground lead wired from the socket of V203 (6AL5) tube to a terminal board. Clip this lead at the terminal board and solder it to the chassis near to the socket of V203 (6AL5) tube. This connection must be as short as possible.

Material Required For The Above Change

- | | | |
|---|---------------------------------------|----------|
| 1 | 1000 ohm, 1/2 watt resistor (R215) | 60B8-102 |
| 1 | 1500 mmfd. min. cer. condenser (C213) | 65A10-4 |
| 1 | Terminal board with 1 insulated lug | 10B1-43 |
| 1 | Filament RF choke (L202) | 73A2-1 |

F. CHANGES TO INCREASE THE SOUND LEVEL IN EARLY 20A1, 20B1 AND 21A1 CHASSIS

Chassis with this change stamped run "15" or higher.

The changes listed below were made in later production sets to increase the TV sound (audio) level. Chassis having these changes can be identified by a blue dot on top of the RF tuner, adjacent to L106 (1st IF coil) and on top of T201 (2nd sound IF transformer).

Important: Before adding these changes to an early chassis, check to determine if the cause of low sound level is due to misalignment or other possible causes shown in the trouble chart, page 28.

- Sound level can be increased by adjusting slug A9 (L106) 1st IF transformer. Turn slug A9 in while watching the picture to make sure that there is no

decrease in picture quality with increase in sound level. Note: If this adjustment is not sufficient to bring the sound to a satisfactory level, the following additional changes should be made.

2. Replace T201, 2nd sound IF transformer, part number 72B86-1 with new part number 72B86-2.
3. Remove damping resistor R203, (27,000 ohms).
4. Replace AGC voltage divider resistor R303, (47,000 ohms) with a 27,000 ohm, $\frac{1}{2}$ watt resistor (part number 60B8-275). R203 may be used as a replacement resistor for R303.
5. Realign all 21.25 MC sound IF and ratio detector trimmer adjustments. See "IF Amplifier and Trap Alignment", page 14.
6. Replace original choke coil L105, part number 98A45-68, located in TV tuner 94C18-1, with new choke coil part number 98A45-72.

Replacement of L105 may be difficult since it is located inside the RF tuner. Generally, coil L105 will not require changing, since making the changes in steps 2 thru 5 should usually increase audio sensitivity to the desired level. However, should it be desired to replace L105, part number 98A45-72 can be obtained. If L105 coil is replaced, it will be necessary to realign slug A9 of the 1st IF transformer L106 in the RF tuner to 22.3 MC.

G. CHANGE IN 10" (20A1) SETS FOR INCREASED SWEEP WIDTH

The changes listed below were made in later production 20A1 (10") sets for increased sweep width without loss of horizontal linearity. Note that both changes "a" and "b" must be made.

- a. Horizontal damping resistor R444, has been changed from 6,300 ohms, 50 watt to 7,500 ohms, 25 watt (part No. 61A12-2).
- b. Cathode by-pass C424 has been changed from .1 mfd., 200 volts to .2 mfd., 200 volts (part 64B5-29).

H. CENTERING OPERATING RANGE OF FOCUS CONTROL (R212B) IN 21A1 (16") SETS

Chassis with this change stamped run "13A" or higher.

In later 21A1 (16") sets, R334 resistor, 10,000 ohms, 2 watt (part No. 60B20-103) has been wired across the terminals of focus coil L306. When R334 is used, the terminal of C427 (500 mmfd) which goes to the plate of V408 (6W4) damper tube, should be connected to ground instead. See schematic.

This change was made in order to shift the operating point of focus control R212B reasonably close to the center point of rotation.

J. CENTERING OPERATING POINT OF VERTICAL HOLD CONTROL (R405A)

Grid resistor R404 of V401A (6SN7GT) vertical oscillator is generally 1.2 meg., $\frac{1}{2}$ watt, (part No. 60B8-125). However, when vertical hold control (R405A) will not

operate reasonably close to the center of its range, resistance value of R404 may be 1 meg., $\frac{1}{2}$ watt (part no. 60B8-105) or 1.5 meg., $\frac{1}{2}$ watt (part No. 60B8-155).

K. R332 WATTAGE RATING INCREASE IN 16" (21A1) SETS

In early 21A1 (16") sets, R332 focus coil shunt resistor was 3000 ohms, 5 watts. In later 21A1 (16") sets R332 was changed to 3000 ohms, 7.5 watts (61A1-16). This change was made to allow for greater heat dissipation under certain operating conditions.

L. SHIPPING BOLTS USED IN LATER PRODUCTION TELEVISION CHASSIS

Later production television chassis have been provided with shipping bolts to reduce the possibility of damage during shipment. Two of these shipping bolts are used, located between the four chassis mounting bolts, one on each side of the chassis.

To avoid the possibility of microphonics due to the chassis being bound down tightly to the mounting board by these bolts, it is necessary to remove these bolts upon installation of the set. This allows the TV chassis to "float" on its rubber shock mounts.

M. POWER TRANSFORMER FUSE IN 20A1, 20B1, 21A1 TV CHASSIS

Chassis with this change stamped run "16" or higher.

To protect the power transformer from damage due to the failure of either the 6X5GT or 5U4G rectifiers, a 3 ampere, 250 volt fuse M313 (part #84A1-14) has been wired in the primary circuit of the power transformer. This fuse, like the $\frac{1}{4}$ ampere horizontal output fuse M405 already in use, is located in the second anode supply housing. The fuse holder previously used to hold the $\frac{1}{4}$ ampere fuse M405, has been replaced with a double fuse holder (part No. 84A5-3) which holds both the $\frac{1}{4}$ ampere fuse and the 3 ampere fuse. A bracket (part No. 15A539) is used to mount the fuse holder.

If desired, the primary fuse can be added to early sets by clipping off the line cord plug and replacing with a fused plug.

N. MISCELLANEOUS CHANGES IN 16" TUBE MOUNTING

An insulating sheet (part No. 32D122) is stapled to the inside of the cabinet next to the tube mask in current production. A piece of aluminum foil, 8" in length (part No. 52A1-17) was also inserted under the two sections of the tube mounting bracket to insure a ground connection between the two. A metal screen (part No. 16C13) has also been inserted under the 16" tube mounting board and tacked to the cabinet for customer protection.

P. BRAIDED WIRE ADDED TO MINIMIZE HUM

In later production sets, the power supply chassis is grounded to the television chassis to minimize hum. In 10" and 12" sets, a 25" length of $\frac{3}{8}$ " copper braided wire (95A12-7), with lugs at both ends, is connected from the small hole in front of the TV tuner to a mounting bolt on the power supply. On 16" sets, the chassis connection is made at an unused hole at the right front (facing rear of chassis).

Q. SYNC CIRCUIT MODIFICATION

Chassis with this change stamped run "16" or higher.

To improve sync stability in weak signal areas having high level impulse type noise interference, the sync circuits of later production 20A1, 20B1, and 21A1 chassis have been modified. See Figures 81 and 83.

The original sync separator tube V403 (6AU6) has been replaced by a 12AU7 dual-triode. One section of this tube functions as a sync separator and separates the sync pulses from the composite video signal. The second half of this tube functions mainly as a clipper. The sync pulse is amplified and noise peaks are clipped off.

In addition to using the 12AU7, the second section of the video detector V304 (6AL5) which formerly was not used, has been wired into the circuit and functions as a

limiter on the grid of the sync inverter V401B ($\frac{1}{2}$ 6SN7). This limits the level of the sync signal, thereby eliminating transient or impulse noise peaks.

Also note that the wiring of horizontal sync discriminator V404 (6AL5) was changed.

If it is necessary to modify an early set to include the 12AU7 sync separator and clipper, see page 34.

R. BUILT IN ANTENNA ADDED

Late sets are equipped with a built-in (internal) antenna (part number AD 205), which is mounted to the inside top of the cabinet. Use this antenna in strong signal areas only. Adjust the antenna by moving the control on the back of the set from left to right to determine the best picture. Remove it before attaching another antenna.

TROUBLE SHOOTING

For additional information, be sure to read "Production Changes" on pages 25, 26 and 27.

The logical procedure in trouble shooting is to (1) localize the trouble to a particular functional section or circuit group, (2) isolate the particular circuit or stage at fault, (3) locate the circuit defect or component at fault. Note that this chassis uses Automatic Gain Control (AGC); therefore the symptoms of a fault in one circuit may be caused by trouble in some other circuit. This fact should be kept in mind when trouble shooting.

If possible, analyze trouble by an operational check. Test patterns shown on page 5 will be of help.

"Checking Waveforms" (page 22) will also be helpful.

HINTS ON SERVICE DIFFERENCES BETWEEN 20A1, 20B1, 21A1 CHASSIS AND 30A1, 30B1, 30C1, 30D1 CHASSIS

These hints are provided to make it easier to locate trouble in the 20A1, 20B1, 21A1 chassis after becoming accustomed to trouble shooting the 30A1, 30B1, 30C1 and 30D1 chassis. Note that the same symptom in the two chassis types does not mean that the trouble is in the same circuit. The following information should be kept in mind when servicing the 20A1, 20B1, 21A1 chassis.

AGC Circuit Employed. The 20A1, 20B1, 21A1 chassis employ an AGC circuit; see page 11 for a description of its operation.

Note that the negative bias on the AGC tube (V305) is obtained from the voltage drop across a part of the plate load of the video amplifier V306 (6AC7). Therefore, a fault in the video amplifier circuit will affect the AGC tube which in turn will affect other circuits.

Since the AGC voltage is used for controlling other stages, defects in the AGC circuit often appear as faults in other circuits.

Raster But No Sound Or Picture. In the 30A1, 30B1, 30C1, 30D1 chassis this trouble is usually located in the RF tuner if the B+ and filament voltages are normal.

However, in the 20A1, 20B1, 21A1 chassis, since the sound is taken off at the first video IF amplifier stage, (in early production, the sound was taken off at the 2nd video IF) loss of the sound or picture could be caused by

trouble in the tuner, audio channel or the first or second video IF stages.

Also, in the 20A1, 20B1, 21A1 chassis a fault in the V306 (6AC7) video amplifier circuit, such as a defective tube or an open peaking coil, will cause the AGC tube to draw excessive plate current and develop a high voltage (approximately 15 volts, at pin 1 of V301) across the plate resistors of the AGC tube V305 (6AU6). This voltage will bias the RF amplifier and 1st and 2nd video IF'S to cut-off.

Raster But No Picture. No picture in the 30A1, 30B1, 30C1, 30D1 chassis usually indicates a trouble in the tuner or the video circuits, if the B+ and filament voltages are normal.

In the 20A1, 20B1, 21A1 chassis, since the AGC circuit controls the RF stage in the tuner and the video IF channel, a defect in the AGC circuit may cause a loss of picture.

If the AGC circuit becomes inoperative, lack of control bias will cause the picture signal to develop a negative voltage across the video detector load resistor which may be high enough to cut off the video amplifier V306 (6AC7). A defect of this nature may be checked by reducing the input to the receiver by removing the antenna from the set. Under these conditions, a picture will appear with a weak signal.

Sync Circuits. The sync circuits in the 20A1, 20B1, 21A1 chassis are similar to those in the 30A1, 30B1, 30C1, 30D1 chassis but the AGC circuit can cause trouble which may not be readily recognized.

If the AGC circuit is only partly operative due to a weak AGC tube or a defective component, the video amplifier may operate near cut-off due to the high negative voltage developed across the video detector load resistor. Under these conditions a picture may be received, but the sync pulses at the video amplifier plate may not have sufficient amplitude to synchronize the sweep circuits.

If the above faults are encountered, the AGC voltage should be measured from the junction of R303 and C305 to chassis. This voltage should read approximately —5

volts with the AGC tube (V305) operating properly and with average signal input. A defective AGC circuit will cause this voltage to be less negative.

Horizontal Oscillator Circuit. In the 30A1, 30B1, 30C1, 30D1 chassis, the vertical oscillator is connected to the "boot-strap" B plus circuit but the horizontal oscillator is not.

In the 20A1, 20B1, 21A1 chassis, both vertical and horizontal oscillators obtain B plus from the "boot-strap"

circuit. Therefore, a fault in the "boot-strap" circuit can affect both height and width of the picture.

Except for the differences discussed above, trouble in the 20A1, 20B1, 21A1 chassis will appear with indications similar to those in the 30A1, 30B1, 30C1, 30D1 chassis, and faulty components should be located by using the usual trouble shooting procedure.

Refer to the following Trouble Shooting Chart for these and other troubles.

TELEVISION TROUBLE-SHOOTING CHART

Symptoms	Check	Remarks
Dead receiver.	a. Power line circuit (cable and interlocking connectors). b. Fuse M407 (late sets only; see production change "M").	b. Fuse located in 2nd anode supply housing.
*No sound or picture. Raster OK.	a. RF tuner circuit (V101, V102). b. IF stage (V301). c. Low voltage power supply. d. Video amplifier circuit (V306). e. AGC circuit.	Dead tube or defective circuit component. e. Failure of the video amp. (6AC7) will cause the RF amp. and 1st and 2nd video IF to cut-off.
*No sound. (Insufficient contrast). Weak Video.	a. RF tuner circuit (V101, V102). b. IF stage (V301). c. AGC stage (V305). d. Weak video amp. (V306).	a. Alignment. b. Alignment. c. Defective tube or other circuit component.
*No sound. Picture OK.	a. Sound IF stages (V201 and V202). b. Ratio detector circuit (V203). c. Audio amplifier circuit. d. Audio output circuit. e. Speaker.	Alignment; defective tube or other circuit component. e. Open speaker voice coil.
*Weak sound. Picture OK.	a. Sound IF stages (V201 and V202). b. Ratio detector circuit (V203). c. Audio amplifier circuit. d. Audio output circuit. e. Check channel coil (L101 and L102).	See production changes "A" and "F". a. Alignment. b. Alignment. e. Try different coil if weak on one channel.
Noisy sound. Picture OK.	a. Sound IF stages (V201 and V202). b. Ratio detector circuit (V203). c. Audio amplifier circuit. d. Audio output circuit. e. Speaker.	a. Tube. b. Tube, alignment. c. Tube, volume control. d. Tube. e. Intermittent speaker voice coil.
Intermittent sound. Picture OK.	a. Sound IF stages (V201 and V202). b. Ratio detector circuit (V203). c. Audio amplifier circuit. d. Audio output circuit. e. Speaker.	a. Tube. b. Tube. c. Tube. d. Tube. e. Intermittent speaker voice coil.
No raster. Sound OK.	a. Tubes V307, V405, V406, V407, V408, and V409. b. Ion trap reversed or needs adjustment. c. Second Anode power supply (V407, V408). d. Horizontal Oscillator (V405). e. Horizontal output trans. (open). f. Horizontal output (V406). g. Damper (V408). h. Focus coil circuit (open). i. Picture tube cathode res. (open). j. Fuse M401.	2nd anode voltage (rectified by 1B3 rectifier's) is obtained by the auto transformer action of the primary circuit of the horizontal output-transformer. Failure of the horizontal oscillator (V405) or horizontal output tube (V406) will cause no voltage to be developed in the 2nd anode supply circuit, since no sweep voltage is introduced in the primary of the horizontal output transformer. Check waveforms at TP15 to TP18 (Figures 66 to 69).

* If on one channel only, individual channel oscillator slug may be misaligned. See page 6.

TELEVISION TROUBLE-SHOOTING CHART (Cont'd)

Symptoms	Check	Remarks
Intermittent raster. Sound OK.	a. Tubes V307, V405, V406, V407, V408 and V409. b. High voltage power supply. c. Second Anode power supply (V407, V408) d. Horizontal oscillator (V405). e. Horizontal output (V406). f. Damper (V408). g. Focus coil circuit (intermittent open). h. Picture tube (V307) circuit.	Check for arc-over or corona discharge in the second anode power supply. Check waveforms at TP15 to TP18 (Figures 66 to 69).
Audio hum.		See production change "P".
Insufficient raster brilliance.	a. Ion trap adjustment. b. Picture Tube (V307). c. High voltage power supply. d. Low AC line voltage.	b. Check by substitution. c. Weak tube, open filter condenser.
Rounded corners on raster. Brilliance OK.	a. Deflection yoke (too far back on picture tube neck). b. Focus coil (too far back on picture tube neck). c. Ion trap adjustment.	
Rounded corners on raster. Insufficient brilliance.	a. Ion trap adjustment. b. Focus coil adjustment.	
Tilted raster.	a. Position adjustment of deflection yoke.	
Raster not centered.	a. Position adjustment of focus coil.	
Excessive raster size (too large a picture for the picture tube mask).	a. Height and width adjustments (R409 and T405). b. Second anode power supply. c. Horizontal drive control (C421) setting. See Installation and Service Adjustments.	Low second anode potential increases the deflection sensitivity of the picture tube (V407). Check 1B3/8016 tubes by substitution.
Trapezoidal or non-symmetrical raster.	a. Deflection yoke. b. Position adjustment of focus coil. c. Ion trap adjustment.	
Insufficient raster width.	a. Width adjustment (T405). b. Tubes V405 and V406. c. Horizontal oscillator (V405). d. Horizontal output (V406).	See production change "C".
Insufficient raster height.	a. Height adjustment (R409). b. Tubes V401 and V402. c. Vertical oscillator (V401). d. Vertical output (V402).	c. Defective component. d. Defective T402 or T405.
Bright horizontal line. No vertical deflection, no raster.	a. Tubes V401 and V402. b. Vertical oscillator (V401). c. Vertical output (V402).	Check waveforms at TP9 and TP11 (Figures 60 to 62).
Bright vertical line. No horizontal deflection, no raster.	a. Open deflection yoke (T404). b. Horizontal output transformer secondary circuit (T403 or T406).	

TELEVISION TROUBLE-SHOOTING CHART (Cont'd)

Symptoms	Check	Remarks
Raster too small (insufficient height and width).	<ul style="list-style-type: none"> a. Height and width adjustments (R409 and T405). b. Tubes V307 and V504. c. High voltage power supply (V504). d. AC line voltage (low). e. Low 2nd anode voltage. 	Gas content will decrease the deflection sensitivity of the picture tube V307 (improper focus will also result).
Excessive raster brilliance. Brightness control has no effect.	<ul style="list-style-type: none"> a. Picture tube (V307). b. Picture tube circuit. 	a. Check by substitution.
Bunching of several trace lines appearing as a white band across raster.	<ul style="list-style-type: none"> a. Vertical output tube (V402). 	Replace tube.
Improper focus (focus at one end of control).		See production change "H".
Shaded left-hand portion of picture. Picture will sync. with Hor. Lock.	<ul style="list-style-type: none"> a. Open filter condenser (C417). 	
Vertical lines or "wrinkles" on left side of raster.	<ul style="list-style-type: none"> a. Spurious oscillations in horizontal output (V406). b. Deflection yoke. c. Horizontal drive (C421) setting. 	If trouble is "a", replace tube V406.
Light and dark vertical bars. Bad horizontal linearity.	<ul style="list-style-type: none"> a. Damper tube (V408). 	Replace tube V408; if defective.
Two heavy black horizontal bars covering picture tube screen.	<ul style="list-style-type: none"> a. High voltage power supply for open filter. b. Short in B+ circuit. 	<ul style="list-style-type: none"> a. Open or leaky filter capacitor. b. Shorted capacitor.
No picture. Raster and sound OK.	<ul style="list-style-type: none"> a. Video section tubes (V302 to V305). b. Video IF's (V302 and V303). c. Video detector (V304). d. Open AGC circuit. 	<ul style="list-style-type: none"> Check waveforms at TP1 and TP2 (Figures 45 to 48). d. Check for shorted cond. (C417).
Intermittent video. Sound and raster OK.	<ul style="list-style-type: none"> a. Video section tubes (V302 to V305). b. Video IF's (V302 to V303). c. Video detector (V304). 	Check for open peaking coil.
Intermittent video and sound. Raster OK.	<ul style="list-style-type: none"> a. Tubes: Tuner; low voltage rectifier. b. RF tuner. <ul style="list-style-type: none"> (1) RF amplifier circuit. (2) Mixer circuit. (3) Oscillator circuit. c. Low voltage power supply. d. AGC circuit (V306). 	<ul style="list-style-type: none"> b. Poor contact in turret assembly. d. Intermittent.
Weak video (insufficient contrast). Sound and raster OK.	<ul style="list-style-type: none"> a. Video section tubes (V301 to V307). b. Video IF alignment. c. Video IF's (V301 to V303). d. Video detector (V304). e. Video amplifier (V306). 	<ul style="list-style-type: none"> Check waveforms at TP1 and TP2 (Figures 45 to 48). c. Weak tube. d. Weak tube. e. Weak tube, open peaking coil L304.

TELEVISION TROUBLE-SHOOTING CHART (Cont'd)

Symptoms	Check	Remarks
"Snow" in picture background.	<ul style="list-style-type: none"> a. For weak signal input. b. Noisy tubes in RF tuner. c. 2nd anode power supply (V407 or V409) for corona discharge. d. Antenna and transmission line. 	<ul style="list-style-type: none"> a. Beyond normal service area of a station. b. V102 most likely cause. d. Be sure transmission line is not loose or mismatched.
No vertical sync. Horizontal sync. OK.	<ul style="list-style-type: none"> a. Integrator network. b. Value of R404. 	Check waveform at TP8 (Figure 59). <ul style="list-style-type: none"> a. Defective component. b. See production change "J".
Improper vertical sync. Split-framed picture.	<ul style="list-style-type: none"> a. Leaky sync inverter (V401B) coupling condensers (C411, C412). b. Sync inverter (V401B) coupling condensers (C411, C412) connections switched. 	
No horizontal sync. Vertical sync. OK.	<ul style="list-style-type: none"> a. Tube V404. b. Horizontal sync discriminator circuit V404). 	Check waveforms at TP7, TP13 and TP14 (Figures 57, 58, 64, 64A and 65).
No horizontal or vertical sync. Picture signal OK.	<ul style="list-style-type: none"> a. Tubes V401 and V403. b. Sync separator (V403). c. Sync inverter (V401B). d. AGC circuit (V305). 	Check waveforms at TP4 to TP8 (Figures 51 to 59).
No horizontal or vert. sync. Weak or no picture.	<ul style="list-style-type: none"> a. Sync separator (V403). b. Shorted condenser (C437). 	
Picture "locks in" only at center of Hor. Hold control. Falls out on both sides.	<ul style="list-style-type: none"> a. Hor. Sync. disc. Tube (V404). b. Hor. Sync disc. circuit. 	<ul style="list-style-type: none"> b. Check tolerance of condensers and resistors. R428 is common cause.
Picture flutter.		See production change "D".
Picture jitter.	<ul style="list-style-type: none"> a. Horizontal hold and/or lock adjustment. b. Change horizontal output (V406) if regular sections of the picture are displaced. c. For noisy tube(s) in the RF, video and sweep section of the receiver. 	
Horizontal non-linearity.	<ul style="list-style-type: none"> a. Horizontal drive control setting (C421). b. Horizontal Linearity control setting (L402). c. Horizontal output (V406). d. Damper (V408). 	Check waveforms at TP16 and TP17 (Figures 67 and 68).
Vertical non-linearity.	<ul style="list-style-type: none"> a. Vertical linearity control setting (R413). b. Vertical oscillator (V401). c. Vertical output (V402). 	Check waveforms at TP9, TP10 and TP11 (Figures 60, 61 and 62).
Improper focus (best at extreme control position).	<ul style="list-style-type: none"> a. Focus coil. b. Focus control circuit. c. For circuit defect causing either excessive or low current drain from power supply. 	For 21A1 sets, see production change "H". c. Audio output tubes.
Improper focus (control has no effect).	<ul style="list-style-type: none"> a. Focus coil. b. Focus control circuit. c. Picture tube (V307). d. Audio output tubes. 	If trouble is "a", check for open, shorted turns or incorrect position adjustment. If trouble is "c", picture tube (V307) may be gassy. See production change "H".
Engraved or bas-relief effect in picture.	<ul style="list-style-type: none"> a. Video amplifier (V306). b. Video detector (V304). c. Peaking coils. 	Output load and coupling circuit is common source of this difficulty.

TELEVISION TROUBLE-SHOOTING CHART (Cont'd)

Symptoms	Check	Remarks
Smeared effect in picture (poor low frequency video response).	a. Video detector (V304). b. Video amplifier (V306). c. Video IF stages. d. Open cond. (C310).	c. Alignment.
Poor picture detail (poor definition).	a. Sharp tuning adjustment. b. Alignment, RF and IF. c. Video detector circuit (V304). d. Video amplifier circuit (V306).	c. Check peaking coils. d. Check peaking coils. (May have shorted turns)
Vertical bars on right side of picture.	a. Horizontal oscillator tube (V405). b. Orientation of antenna.	
Sound bars in picture.	a. Sharp tuning adj. b. Microphonic tubes. c. Oscillator alignment. d. Alignment of ratio detector secondary. e. Alignment of 21.25 MC trap.	See production change "L".
Herringbone pattern super-imposed on picture.	a. FM, diathermy or other forms of RF interference. b. Oscillation in the IF system.	See production change "E". a. Can best be cured at source. Traps may also be used at the receiver. See page 2. b. Re-route transmission line from ant. terminals to tuner. See production change "E".
Brown or yellowish-brown spot on picture tube screen.	a. Picture tube (V307) by substitution.	Burned phosphor on picture tube screen. Replace tube if objectionable.

SERVICING NOTES

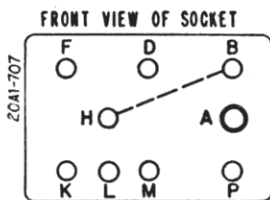


Figure A.

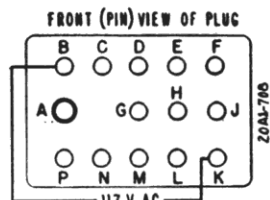


Figure B.

OPERATING TELEVISION CHASSIS OR RADIO TUNER CHASSIS WITH EITHER UNIT DISCONNECTED FROM POWER SUPPLY

For combination models, the Radio Tuner and Television chassis cannot be operated with either unit disconnected from power supply, unless interconnecting circuits are completed.

To operate the television chassis with the Radio Tuner disconnected, a jumper is inserted into the power supply socket (M514) to complete the heater circuit: See figure "A". A special adapter plug is available from the Admiral Distributor under part number 89A31.

To operate the Radio Tuner chassis with the television chassis disconnected, an AC line cord must be wired to plug M515 to supply line voltage. See figure "B". A special adapter socket and line cord is available from the Admiral Distributor under part number 89A30.

REMOVING AM-FM RADIO TUNER

The procedure for removing the AM-FM Radio Tuner for alignment and service is given on page 18.

CLEANING PLASTIC PICTURE TUBE WINDOW

The picture tube window should be cleaned only with a dampened chamois or a soft lint-free cloth, with as little rubbing as possible. If necessary, use Dust-Ded (part #98A11-2; 1/2 oz. bottle) as a plastic cleaner and dust repellent. Caution: Do not use other cleaners or solvents. Cleaners and solvents such as kerosene, carbon tetrachloride and most of the kitchen-type cleaners may be injurious.

REMEDY FOR CRACKED RIBS IN 24A12 PLASTIC CABINET

A few very early production plastic television cabinets (24A12) were reported to have cracked ribs where the cabinet back is screwed to the cabinet. The ribs on these early cabinets are 3/8" wide. The mold was modified in later production to increase the width of the rib to almost 5/8".

Early cabinets with cracked ribs can usually be repaired. Drill into the rib with a #32 drill, then tap the hole with a 6-32 tap. This will allow you to use a longer 6-32 machine screw to mount the cabinet back. In some cases it may be necessary to file away the broken section and put a spacer around the screw. When tightening the screw, leave it slightly loose to decrease the strain on the rib.

PICTURE TUBE REPLACEMENT

IMPORTANT: When replacing picture tubes, be sure to keep in mind the information regarding Ion Trap, Focus Coil and Deflection Yoke adjustments given on pages 7 and 8.

REPLACING 10" or 12" PICTURE TUBE

WARNING: Before handling a 10" or 12" tube, remove the static charge on the second anode as follows: Connect an insulated test lead to the receiver chassis and insert the free end into the well connector of the picture tube.

Remove the defective picture tube in the following manner:

- Remove the high voltage lead from the connector on the top of the picture tube (see Fig. 78).
- Remove the socket from base of picture tube.
- Remove the ion trap.
- Loosen webbing band holding the front of the picture tube.
- Remove bumper plate from face of picture tube.
- Withdraw the picture tube through the deflection yoke and focus coil towards the front of the chassis.

To install a new picture tube, the above procedure should be reversed, making sure that the picture tube is fitted closely against the deflection yoke housing and that the high voltage connector is on top of the picture tube.

REPLACING 16" PICTURE TUBE

WARNING: Extra precaution is necessary when handling this tube. The metal cone of the 16" picture tube is directly connected to the 12,000 volt supply and is dangerous unless correctly handled. An insulated cover is fitted around this tube for protection from the 12,000 volts.

In order to replace the picture tube (16AP4) in the 21A1 chassis, it is necessary to first disconnect all connecting cables, remove the television chassis, and then remove the complete picture tube mounting assembly, including its wooden shelf, from the cabinet. Proceed as follows:

- Disconnect the plug and socket on the second anode

DIFFERENT 12" PICTURE TUBES USED IN 20B1 CHASSIS

Different 12" picture (listed below) are used in the 20B1 chassis. The tube used in a particular chassis is indicated by the "WIRED FOR —" stamp on the rear of the chassis. The various tube types may require an additional 2nd anode filter

NOTE: All 12LP4 and 12BP4 tubes can be used without circuit change in sets wired for 12TP4.

Tube	Ion Trap	C433	2nd Anode Connector
†12LP4 12BP4	Dual Type 94B6	†Not used	Male Connector 88A 16-4
12TP4	Same as above	See note * below	Same as above

* Add condenser C433, part 65A 11-1 (500 mmfd., 10,000 volt) to the second anode supply filter circuit. See schematic. Locate C433 inside the second anode supply housing. Mount it through the hole located at the terminal of the fuse clip. Connect a wire lead from the remaining ungrounded end of C433 to the tie point connecting the second anode lead to the corona ring under the 1B3/8016 tube socket.

† Some brands of type 12LP4 tubes do not have the outer conductive coating which functions as a second anode supply filter condenser. Type 12LP4 tubes which do not have the outer

lead. Touch the metal end of the plug (male) to the television chassis to discharge second anode of picture tube.

- Place one end of an insulated lead into the "well" in the socket on the second anode lead and contact the chassis with the other end to remove the charge on the high-voltage condensers.
- Remove the two plugs connecting the focus coil and the deflection yoke to the chassis.
- Remove the ground leads from the back of the chassis.
- Remove the tube socket and ion trap.
- Remove the power cable and bracket and the phono compartment light plug.
- Remove the audio leads from the power supply and record changer, the knobs on the front of the cabinet, and the four chassis mounting screws. Withdraw the chassis from the cabinet.
- Remove the three screws holding the wooden shelf to the cabinet and slide the tube assembly out from the rear of the cabinet.
- Remove the insulating cover from the picture tube.
- Remove the two nuts on the tube clamp at the front of the tube, loosen the four screws on the base of the deflection bracket, and then remove the clamp and plastic ring.
- Withdraw the tube, being careful to handle the tube at the metal cone and neck only, or at the metal cone only.

Finger prints or dust on the surface of the insulating coating between the cone and the neck of the tube may cause electrical breakdown during humid weather.

To install a new tube, the above procedure should be reversed, making sure that the picture tube is fitted closely against the deflection yoke housing, and that the contact spring is connected to the metal cone under the plastic ring.

condenser (C433). **IMPORTANT:** When replacing a 12" picture tube with another type, be sure to check the table below for proper components.

conductive coating require the addition of C433 (500 mmfd., 10,000 volt; part number 65A 11-1) to the second anode power supply filter circuit, same as for type 12TP4 tube. To add condenser C433, see asterisk * note above.

Type 12LP4 tubes which have the outerconductive coating are directly interchangeable with the 12BP4.

Chassis wired for 12LP4 *without* outer conductive coating are stamped at the rear of chassis "Wired for 12LP4-IC"; chassis wired for 12LP4 *with* outer conductive coating are stamped "Wired for 12LP4-OC".

PROCEDURE FOR REPLACING 6AU6 SYNC SEPARATOR (V403) CIRCUIT WITH 12AU7 SYNC SEPARATOR CIRCUIT

To improve sync stability in weak signal areas having high level impulse type noise interference, the sync circuits of later production 20A1, 20B1, and 21A1 chassis have been modified.

The original sync separator tube V403 (6AU6) has been replaced by a 12AU7 dual-triode. One section of this tube functions as a sync separator and separates the sync pulses from the composite video signal. The second half of this tube functions mainly as a clipper. The sync pulse is amplified and noise peaks are clipped off.

In addition to using the 12AU7, the second section of the video detector V304 (6AL5) which formerly was not used, has been wired into the circuit and functions as a limiter on the grid of the sync inverter V401B (½ 6SN7). This limits the level of the sync signal, thereby eliminating transient or impulse noise peaks.

Where an early production chassis is in use (or is to be used) in an area having weak signals and a high impulse type noise level, the following chassis modification will eliminate sync instability. **IMPORTANT: Do not attempt modification of the sync circuit, until all other possible causes of trouble have first been thoroughly investigated.** Sync instability (vertical and horizontal) may be due to poor antenna installation or a defective component in the receiver. Refer to trouble shooting chart, page 31.

PARTS REQUIRED

Sym.	Description	Part No.
R333	2.2 megohms, ½ watt.....	60B 8-225
	(Some sets already use this resistor. Do not add to these chassis.)	
R340	10,000 ohms, ½ watt.....	60B 8-103
R341	4,300 ohms, 1 watt.....	60B 13-432
R342	15,000 ohms, ½ watt.....	60B 8-153
R343	10,000 ohms, ½ watt.....	60B 8-103
R449	22,000 ohms, ½ watt.....	60B 8-223
R450	270,000 ohms, ½ watt.....	60B 8-274
R451	2.2 megohms, ½ watt.....	60B 8-225
R452	18,000 ohms, ½ watt.....	60B 8-183
R453	4.7 megohms, ½ watt.....	60B 8-475
C436	.5 mfd., 200 volts, Paper.....	64B 6-27
C437	.05 mfd., 400 volts, Paper.....	64B 5-22
C438	120 mmfd., Mica.....	65B 1-10
L310	Coil, 250 microhy (wound on R322).....	73A 5-5
L311	Coil, 250 microhy (wound on R321).....	73A 5-5
	Hook-up Wire, 30" length	
	No. 18 Tinned Copper Wire, 6" length	
	Terminal Board, 5 Lug.....	10B 1-55
	Twin-Triode Tube	12AU7
	Tube Socket, 7 Pin Miniature.....	87A 3-7
	Tube Socket, 9 Pin Miniature.....	87A 25-1

Carefully study figure 72 before proceeding. Look over the layout drawing to get a clear idea of the physical location of the sockets, component parts and wiring. (See schematic with modified sync circuit, figure 81.) Proceed as follows:

1. Remove tubes V307 (picture tube), V403 (6AU6) and V404 (6AL5) from the chassis.

2. Use diagonal cutters to remove the following components from the chassis:

C408	R420	R316	C310	R322**
R418	C409*	R317	R326	L304**
C410	R422	R318	R328	L305**
R421	R423	R320	R321**	

*Do not remove completely. Leave the lead connected to the terminal board lug for future use.

**Peaking coils L304 and L305 are wound on these damping resistors R321 and R322.

3. Use diagonal cutters to cut all the lugs from the sockets of V403 (6AU6) sync separator and V404 (6AL5) horizontal sync discriminator. Drill out the tube socket mounting rivets and remove both sockets.

4. Use pipe (taper) reamer to enlarge V403 socket hole for mounting a 9-pin miniature socket (part #87A25-1). Drill mounting holes for this socket so that pins 1 and 9 are toward the front of the chassis. Mount the socket with #4 round head machine screws and nuts.

5. Using #4 round head machine screws and nuts, mount a new 7-pin miniature socket (part #87A3-7) for V404 so that pins 1 and 7 are toward the 6W4GT (V408) tube socket.

6. Remove the leads from the tube socket lugs which were cut in step 3 and clean these leads. Also, carefully unsolder and remove R424 and C412 and save for future use.

7. Disconnect all leads and parts from the 3-lug terminal board located between front of chassis and vertical output transformer T402. Remove this terminal board by drilling out the mounting rivet. Using a #6 round head machine screw and nut, mount the new 5-lug terminal board (part #10B1-55) in its place. Restore all connections formerly on the old terminal board using the two insulated lugs on either side of the grounded lug on the new 5-lug terminal board.

8. Locate and remove the 47,000 ohm resistor (R326) connected between one terminal of the contrast control and one terminal of the brightness control. Caution: Do not confuse this resistor with the 27,000 ohm resistor connected between two other terminals of the same controls. Transfer the lead connected to the same lug of the contrast control to the free end terminal of the new 5-lug terminal board.

9. Connect together the 2 lugs of the contrast and brightness controls (which you just cleared of wiring). Then connect a 10,000 ohm resistor (R343, part #60B8-103) from these lugs to the end lug of the 5-lug terminal board.

10. Connect a 270,000 ohm resistor (R450, part #60B8-274) between the same two lugs of the contrast and brightness controls and the remaining free lug of the 5-lug terminal board.

11. Then bypass this lug of the terminal board to ground using a .5 mfd. condenser (C436, part #64B6-27). Mount the condenser on the chassis between the terminal board and vertical output transformer T402 by soldering its mounting strap to the chassis.

12. Connect a lead between this same tie-lug (with the .5 mfd. condenser and 270,000 ohm resistor) and pin 3 of the new 9-pin miniature socket V403 (12AU7).

13. Remove the 27,000 ohm resistor (R328) connected between one lug of the contrast control and one lug of the brightness control and replace it with a 15,000 ohm resistor (R342, part #60B8-153).

14. Unsolder R401 (22,000 ohm resistor) from pin 5 of sync inverter 6SN7GT (V401B) and lift it away from the socket.

15. Connect a 4.7 megohm resistor (R453, part #60B8-475) between a ground lug on the socket saddle and pin 4 of V401B.

16. Remove the cover from the video IF strip. Carefully remove all connections from pin 2 of video detector 6AL5 (V304) and transfer them to pin 4. Handle C312 very carefully, avoiding too much heat when soldering, since the leads on this condenser are quite short. The ground connection on the socket, and the ground lead to T303, should be made with new, tinned copper wire.

17. Connect a lead from pin 2 of V304 (6AL5) to pin 4 of V401B (6SN7GT). Dress lead to use opening in IF strip cover toward front of chassis.

18. Connect a 120 mmfd. condenser (C438, part #65B1-10) from pin 4 of V401B to the end lug (toward rear of chassis) of the 10-lug terminal board located between V401B and vertical output transformer T402. This is former location of .01 mfd. coupling condenser C409. Connect the free end of the lead connected to this plug to pin 6 of the 9-pin miniature socket V403 (12AU7). C438 is then between pin 4 of V401B and pin 6 of V403.

19. Reconnect the heater leads to pin 3 of the horizontal discriminator V404 (6AL5). Reconnect the ground lead from the terminal board (third lug from front of chassis) to pin 4 of V404 (6AL5) and use tinned copper wire to tie the inter-pin shield and pins 4 and 6 together. All these connections are then grounded.
20. Connect pins 5 and 7 of V404 (6AL5) together with tinned copper wire. Connect the free ends of R435 (18,000 ohm resistor) and C414 (.01 mfd. condenser) to pin 5 of V404.
21. Connect C412 (.001 mfd. mica condenser) from pin 5 of V401B (6SN7GT) to pin 1 of V404. Connect R424 (3,300 ohm resistor) from pin 5 of V401B to the closest lug of the 3 section electrolytic condenser C407A. This condenser is located between V401B and the side of the chassis.
22. Connect free end of C411 (.001 mfd. mica condenser with one end still connected to pin 6 of V401B) to pin 2 of V404. (Keep C411 and C412 separated from each other as much as possible.) Connect the free end of R401 (22,000 ohm resistor with one end still connected to 10-lug terminal board) to pin 6 of V401B.
23. Connect the free ends of R427 and R428 (100,000 ohm resistors connected to lug toward front of chassis on 10-lug terminal board) to pins 1 and 2 of V404, respectively.
24. Connect pins 4 and 5 of V403 (12AU7) together and reconnect the heater circuit to these pins. Ground pins 8 and 9 (along with the inter-pin shield) with a piece of tinned copper wire soldered to a ground lug on C309 (3 section electrolytic condenser near V403).
25. Ground the free end of R432 (1,500 ohm cathode resistor for V405, disconnected when old V403 socket was removed) to a ground lug on C309 or a ground lug on the socket saddle of horizontal oscillator V405.
26. Ground pin 5 of video amplifier V306 (6AC7) to a lug on the socket saddle by means of a piece of tinned copper wire.
27. Connect a 250 microhenry peaking coil (L310, wound on 33,000 ohm resistor) part #73A5-5, from pin 8 of V306 to the

- second lug from rear of chassis on closest 5-lug terminal board (L310 replaces L304). Connect another 250 microhenry peaking coil assembly L311, part #73A5-5) from this same tie-lug to the center tie-lug of 5-lug terminal board adjacent to V403 (12AU7). (L311 replaces L305.)
28. Add a 2.2 megohm resistor (R333, part #60B8-225) between pins 1 and 6 on AGC tube V305 (6AU6) if this resistor is not already in the circuit.
29. Clip the lead on R315 (47,000 ohm resistor) from the tie-lug on the 5-lug terminal board adjacent to V305 and V306. Transfer this lead on R315 to pin 2 of V403 (12AU7).
30. Connect a 10,000 ohm resistor R340 (part #60B8-103) from pin 2 of V403 to the center lug of the 5-lug terminal board adjacent to V403. Peaking coil L311 is also connected to this lug.
31. Connect a 4,300 ohm resistor (R341, part #60B13-432) between this same lug (junction of R340 and L311) and the adjacent lug toward V403.
32. Connect a 2.2 megohm resistor (R451, part #60B8-225) between pins 7 and 9 of V403.
33. Connect a .05 mfd. condenser (C437, part #64B5-22) between pins 1 and 7 of V403.
34. Connect an 18,000 ohm resistor (R452, part #60B8-183) from pin 1 of V403 to C422 (C309A). This is the farthest terminal of a 3 section electrolytic condenser adjacent to V403 and can be identified by a lead running to pin 6 of AGC tube V305 (6AU6).
35. Connect a 22,000 ohm resistor (R449, part #60B8-223) from pin 6 of V403 to C309B. This section of the electrolytic condenser can be identified by a lead connecting it to pins 6 and 2 of V305.
36. Check wiring against schematic, figure 81 and pictorial diagram figure 72. Replace IF strip shield cover, picture tube, V403 (12AU7) and V404 (6AL5). Check for normal operation.

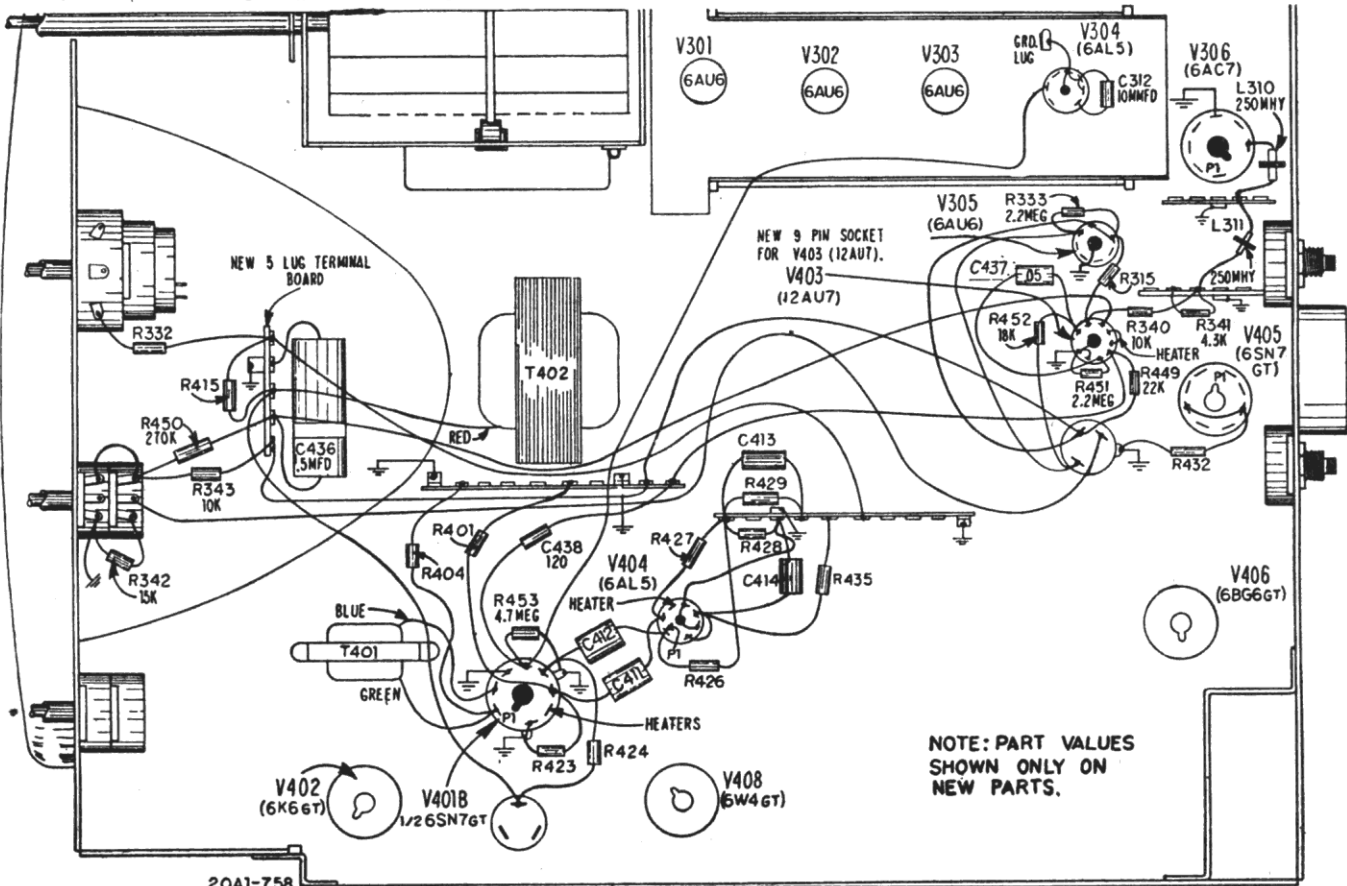


Figure 72. Bottom View of TV Chassis Showing Wiring with 12AU7 Sync Separator.

94C18-1 TELEVISION TUNER SERVICE

Future production chassis may have a slightly modified tuner with different part number stamped on front of tuner. If used, additional service literature will be published.

GENERAL

The 94C18-1 Tuner is a sub-chassis consisting of an RF Amplifier (6AG5) and a Mixer-Oscillator (6J6) dual triode.

Channel selection is accomplished by rotation of the tuner turret assembly, which has a separate set of two coils for each of the 12 television channels. Each set consists of an antenna coil in one assembly, and a mixer-oscillator coil in another. Coils are the snap-in type. Coils can be identified as to channel by the number stamped on the outside of the coil assembly. A Sharp Tuning control, having a tuning range of plus or minus 1.5 MC for low channels, and plus or minus 3 MC for high channels, permits fine adjustment of oscillator frequency.

The high frequencies used in television make it necessary that extreme care be exercised in handling or servicing tuners.

Location and lead dress of components and wiring are usually very critical. At high frequencies, wiring leads tend to act as small inductances or capacities and consequently may appreciably alter electrical characteristics of critical circuits.

Parts location and ground connections should be as originally made. When replacing components, *it is important that they be replaced with parts of identical electrical characteristics and physical size.* Refer to parts list for temperature coefficients, tolerances, and other essential description.

Note resemblance between some ceramic condensers and resistors. If in doubt, check Schematic and Parts List.

Also note that replacement of tubes (especially 6J6 oscillator-mixer tube) may cause some slight detuning of tuner circuits. This is due to the inherent differences of interelectrode capacitances. When replacing 6J6 tube, it is recommended that several tubes be tried in order to select a tube which will cause least oscillator frequency shift. This is easily checked by noting whether the oscillator Sharp Tuning control will tune in the sound carrier of the television signal at, or reasonably close to, the middle of its range.

Channel snap-in coils must be handled with care. Do not disturb coil windings. Also be sure the coils are properly paired for the indicated channel number, and that coils follow proper sequence when reassembled in the turret drum. For proper reference of tuner shaft in relation to coil position, refer to figure 33.

TUNER REPLACEMENT

Replacement of the complete tuner should generally never become necessary since electrical and mechanical parts are easily replaceable.

Service data covering parts replacement and tuner alignment are given in this manual. Minor adjustments can easily be made in the field.

SHARP TUNING CONTROL

The Sharp Tuning control is a variable dielectric type condenser. The normal tuning range of the Sharp Tuning control for high channels is plus or minus 3 MC, for low channels plus or minus 1.5 MC.

Slight rubbing of the dielectric rotor (M104) against the grounded stator plate (M107) is intentional, in order to avoid vibration with resulting microphonics. However, the dielectric rotor should not be allowed to rub or contact the circular disc riveted to the body of the tuner.

The Sharp Tuning control is permanently set at the factory and cannot be readjusted for frequency tuning range.

REMOVING CHANNEL COILS

Insert a screwdriver blade between the coil retaining spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward and remove.

CLEANING CONTACT POINTS

Remove several sets of coils from turret and rotate turret to position making contact points of contact plate accessible for cleaning.

Using a small, stiff brush and carbon tetrachloride, clean contact surfaces and shafts of stationary contacts.

Remove accumulated dust or grease from contact plate with a light canvas cloth dampened with carbon tetrachloride.

Clean contact surfaces of rotating coils in same manner.

OSCILLATOR SLUGS IN TOO FAR

If HF oscillator slugs "fall into" coil form, remove the channel coil, move the slug retaining spring aside, and tap the coil assembly until the slug slips forward. Set the coil retaining spring into position; it should rest firmly against the slug. See figure 73.

REMOVING TUNER TURRET ASSEMBLY

- a. Remove retaining bracket in front of the tuner. See figure 73.
- b. Remove rotor shaft assembly, rotor contact spring and fibre washer. For reassembly, note order of parts removal.
- c. Remove front and rear turret retaining springs by depressing straight end of spring from tab on chassis.
- d. Using a screwdriver blade at the side of the tuner, press the detent spring M102 and roller M101 away from the turret detent plate.
- e. Grasp tuner shaft and slip out of end plate bearings.

REMOVING CONTACT PLATE ASSEMBLY M103

- Remove turret as indicated under "Removing Tuner Turret Assembly".
- Remove the mounting screws at the front and rear of Contact Plate and Bracket Assembly M103. See figure 73.
- Press outward the front and rear tuner chassis end plates.
- To free M103, release the contact plate tabs by pushing them away from the slots in the end plates.
- Unsolder all connections to contact plate. Unsolder the solder joint holding contact plate to the center partition of the tuner chassis.
- Reassemble in the same manner.

NOTE

When reassembling Contact Plate and Bracket Assembly M103, it will be necessary to reposition M103 as indicated in the next paragraph; it will also be necessary to reset the Detent Spring M102 as indicated under "Resetting The Detent Spring".

REPOSITIONING CONTACT PLATE ASSEMBLY M103

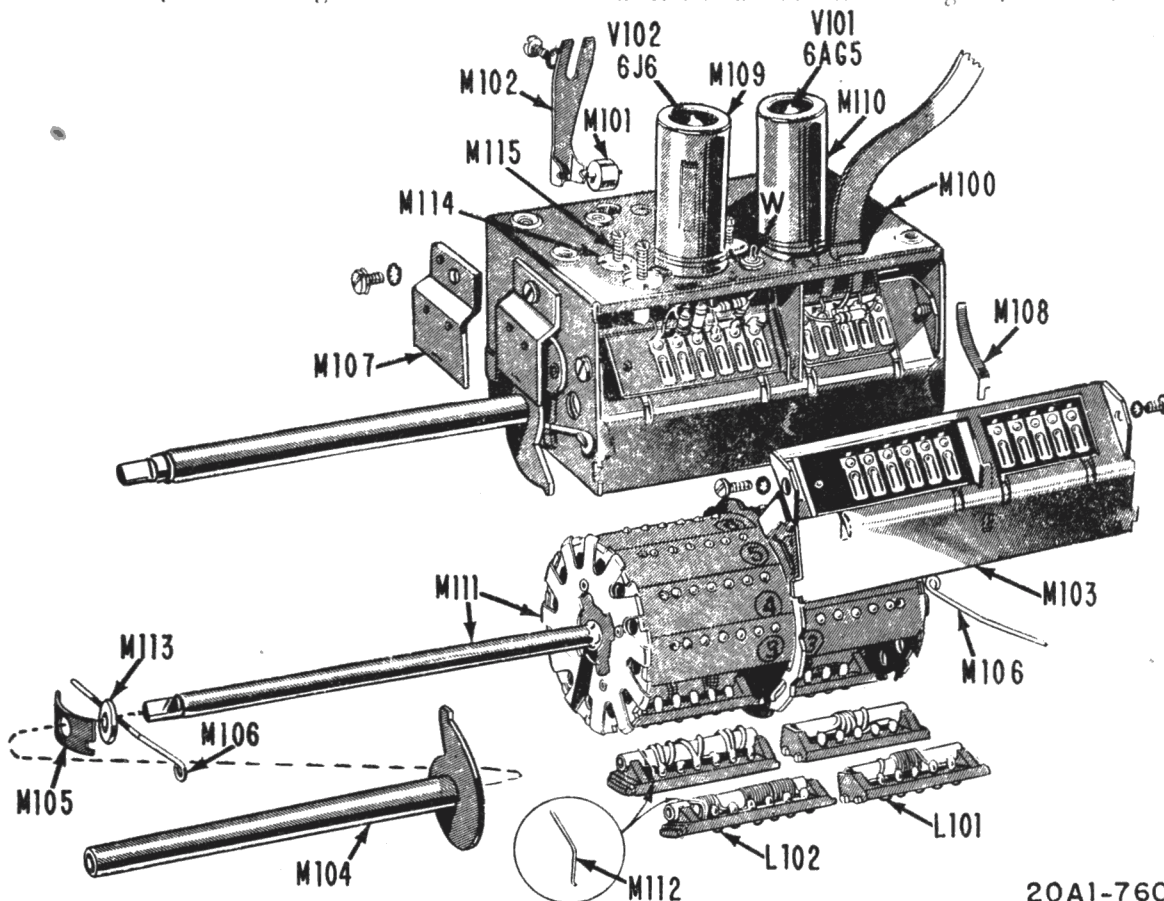
- Loosen the contact plate mounting screws.

- With thumb pressure of right and left hands, press the upper end of the contact plate toward the turret.
- The contacts on the contact plate should clear the plastic surface of turret coils by about 1/64 of an inch. Clearance can be observed by removing several sets of coils from the turret and slowly rotating turret.
- After setting the contact plate for proper clearance, tighten the contact plate mounting screws.
- Resolder wiring connections and solder joint. See figure 73.

RESETTING DETENT SPRING M102

When servicing the Detent Spring M102, the Detent Roller M101, or when replacing the Contact Plate and Bracket Assembly M103, the detent spring should be reset as follows:

- Loosen the detent spring mounting screw.
- Observing the contacts on the contact plate, grasp the turret and the roller end of the detent spring. Rotate the drum slightly in one direction and then the other, until a point is reached where the contacts appear to have the greatest rise.
- Check to see that the detent roller is set in the center of the depression on the edge of the turret detent plate. If setting is correct, tighten the detent spring mounting screw.
- Rotate the turret, checking contacts on all channels.



20A1-760

Figure 73. 94C18-1 TV Tuner, Exploded View.

VOLTAGE CHARTS

- To operate the television chassis with the Radio Tuner disconnected, a jumper must be inserted into the power supply socket (M514) to complete the heater circuit. See adjoining illustration. A special adapter plug is available from the Admiral Distributor under part number 89A31.

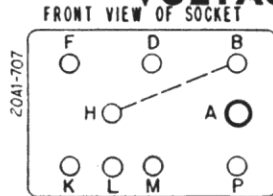


Figure 74.

- Line voltage, 117 volts AC.
- Antenna disconnected from receiver.
- Contrast and focus control set fully counter-clockwise, all other front chassis controls set at approximately half rotation.
- All rear chassis controls, except HOR. LOCK, HOR. LIN. and WIDTH controls, set at approximately half rotation: Do not disturb HOR. LOCK, HOR. LIN. or WIDTH control settings.

- Channel selector set on an unused low channel (preferably channel 2).
- Some tube socket terminals are used as tie-points and a voltage reading may be present.
- Voltage measured with a vacuum tube voltmeter, between tube socket terminals and chassis, unless otherwise indicated. Measure heater voltages between tube socket terminals.

CAUTION

Pulsed high voltages are present on the the cap of 6BG6G tube, and on the filament terminals and cap of 1B3/8016 tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS UNLESS SUITABLE TEST EQUIPMENT IS AVAILABLE.

Picture tube 2nd anode voltage can be measured at the high voltage cap of picture tube and should be taken only with a high voltage instrument such as a kilovoltmeter. Voltage for 2nd anode of 10" or 12" tube is approximately 9KV., for 16" tubes, 12KV. Proper filament voltage check of 1B3/8016 tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

20A1, 20B1, AND 21A1 TELEVISION CHASSIS VOLTAGE CHART

Sym.	Tube	Function	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Remarks
V101	6AG5	RF Amp.	-.3	0	6.3 AC	0	150	150	0		Point "W" (Fig. 27) is -4 volts measured with tubes in sockets.
V102	6J6	Osc. and Mixer	160	160	6.3 AC	0	0	0	0		
Voltages at V101 and V102 measured from top of chassis with tubes removed.											
V201	6AU6	1st Sound IF	0	0	6.3 AC	0	80	80	.9		
V202	6AU6	2nd Sound IF	0	0	6.3 AC	0	145	145	2.4		
V203	6AL5	Ratio Det.	0	0	5 AC	0	.3	0	0		
V301	6AU6	1st Video IF	-1.5	0	6.3 AC	0	140	140	.6		
V302	6AU6	2nd Video IF	-1.5	0	6.3 AC	0	140	140	.6		
V303	6AU6	3rd Video IF	0	0	6.3 AC	0	142	142	1.3		
V304	6AL5	Video Det.	0	0	6.3 AC	0	0	0	-.4		
		Vid. Det. & Lim.	0	-8	6.3 AC	0	0	0	-.4		
V305	6AU6	AGC	(a)135 (b)155	(a)145 (b)160	6.3 AC	0	200V P.toP.	(a)275 (b)270	(a)145 (b)160		
V306	6AC7	Video Amp.	0	0	0	-1	(a).4 (b) 0	(a)60 (b)45	6.3 AC	(a)120 (b)150	
V401	6SN7GT	Vert. Osc. and Sync. Inv.	-55	200	0	(a).2 (b)-8	(a)135 (b)315	(a)5 (b)8	6.3 AC	0	
V402	6K6GT	Vert. Output	NC	0	325	325	-5	38 (c)20	6.3 AC	50 (c)40	
V403	6AU6	Sync Sep.	-1	0	6.3 AC	0	150	60	0		
	12AU7	Sync Sep. and Clipper	270	152	165	6.3 AC	6.3 AC	65 (c)75	-.6	0	Pin 9: Zero volts.
V404	6AL5	Hor. Sync Disc.	(a).2 (b) 8	(a).2 (b)-4	0	6.3 AC	(a) 5 (b).8	0	(a)-3 (b).8		
V405	6SN7GT	Hor. Osc.	.9	255	9.5	-4.5	100	9.5	6.3 AC	0	
V406	6BG6G	Hor. Output	NC	0	9	NC	-16 (c)-6	NC	6.3 AC	245 (c)270	Cap: See "Caution" note above.
V407 and V409	1B3GT	Rectifier	See "CAUTION" note above on 1B3GT/8016 voltages.								
V408	6W4GT	Damper	NC	NC	420	NC	360	NC	6.3 AC	NC	
V307	Picture Tube		0	70	NC	NC	NC	NC	NC	NC	Pin 9 Pin 10 Pin 11 Pin 12 NC 365 60 6.3 AC
Voltages taken at picture tube socket (removed from tube. For 2nd anode, see "CAUTION" above.											

- (a) Indicates voltage for sets with 6AU6 sync separator circuit.
- (b) Indicates voltage for sets with 12AU7 sync separator and clipper circuit.
- (c) Indicates voltages for 21A1 chassis.
- NC Indicates no connection to tube element.

VOLTAGE CHART FOR 4 TUBE POWER SUPPLY (TELEVISION ONLY SETS)

See previous page for conditions for taking measurements

Sym.	Tube	Function	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Remarks
V501	6SQ7	Audio Amp.	0	-.7	0	NC	NC	78	6.3 AC	0	
V502	6V6GT	Audio Output	NC	6.3 AC	255 (c)205	265 (c)221	.2	NC	0	12 (c)2.5	
V503	6X5GT	L.V. Rectifier	NC	6.3 AC	160 AC	NC	160 AC	NC	0	160	
V504	5U4G	H.V. Rectifier	NC	380	NC	375 AC	NC	375 AC	NC	380	Pin 2 to pin 8: 5v. AC.

(c) Indicates voltage for 21A1 chassis.
NC Indicates no connection to tube element.

VOLTAGE CHART FOR 6 TUBE POWER SUPPLY (COMBINATION MODELS)

Sym.	Tube	Function	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Remarks
V511	6SJ7	1st Audio Amp.	0	0	0	-.7	0	16	6.3 AC	24	
V512	6SQ7	Phase Inverter	0	-.7	0	NC	NC	62	6.3 AC	0	
V513	6K6GT	Audio Output	0	6.3 AC	185	190	0	0	0	12	
V514	6K6GT	Audio Output	0	6.3 AC	185	190	0	0	0	12	
V515	5U4G	H.V. Rectifier	NC	370	NC	365 AC	NC	365 AC	NC	370	Pin 2 to pin 8: 5v. AC.
V516	6X5GT	L.V. Rectifier	NC	6.3 AC	160 AC	NC	160 AC	NC	0	160	See "NOTE" below.

NOTE: Heater of 6X5GT (V516) disconnected unless "Tel-Phono-Radio" switch on Radio Tuner is in the "Tel" position.
NC Indicates no connection to tube element.

VOLTAGE CHART FOR 4J1 AND 4K1 AM-FM RADIO TUNER

- Line voltage 117 volts AC.
- Voltages measured with a vacuum tube voltmeter, between tube terminals and chassis. Heater voltages on the 4K1 Radio Tuner must be made **ACROSS** the heater.
- Voltages measured with band switch on FM position, unless otherwise indicated; an AM reading is given where difference is significant.
- "Tel-Phono-Rad" switch in "Rad" position.
- Volume control set at minimum.
- Dial turned to low frequency end.
- Antennas disconnected.

- Voltages measured with television chassis disconnected from power supply. (Voltages indicated will be slightly higher if the television chassis is connected to power supply.)

To operate the Radio Tuner chassis with the television chassis disconnected, an AC line cord must be wired to plug M515 to supply line voltage. See adjoining illustration. A special adapter socket and line cord is available from the Admiral Distributor under part number 89A30.

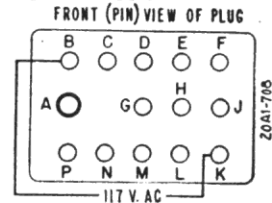
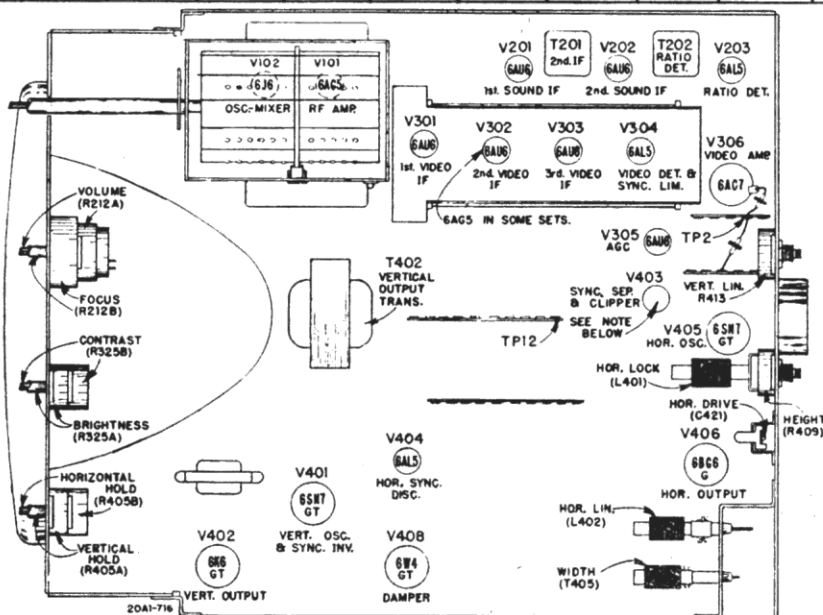


Figure 76.

Sym.	Tube	Function	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Remarks
V601	12AT7	Converter and Oscillator	198	-6 FM -20 AM	0	0	0	209 FM 245 AM	0 FM 3.2 AM	3	6.3 AC	
V602	6BA6	1st IF Amp.	-1	0	0	6.3 AC	240	90	0			
V603	6BA6	FM 2nd IF or AM 2nd Det.	-1	0	0	6.3 AC	215 FM 0 AM	92 FM 0 AM	0			
V604	6AL5	Ratio Det.	.2	-.2	6.3 AC	0	0	0	0			

Figure 75. Bottom View of Chassis.

Note: V403 is 6AU6 in early sets, 12AU7 in later sets. See figures 81 and 83.



CONDENSERS

Sym.	Mmf.	Part No.	Function
C311	.05 mfd., 400 v. ....	.64B 5-22	Video coupling
C312	10, Cer., ±5%.....	.65B 6-69	RF bypass
C313	.05 mfd., 200 v. ....	.64B 5-32	Audio bypass
C314	120, Mica, ±3%.....	.65B 1-10	Sound take-off
C401	.002 mfd., 600 v. ....	.64B 5-14	Integrating
C402	.005 mfd., 600 v. ....	.64B 5-12	Integrating
C403	4,700, Mica .....	.65B 21-472	Integrating
C404	4,700, Mica .....	.65B 21-472	Integrating
C405	.05 mfd., 600 v. ....	.64A 2-4	Vert. peaking
C406	.1 mfd., 400 v. ....	.64B 5-20	Coupling
C407A	20 mfd., 450 v.}	Elect.	Decoupling
C407B	10 mfd., 450 v.}	.67C 15-3	Decoupling
C407C	50 mfd., 500 v.}		Cathode bypass
C408	.2 mfd., 200 v. ....	.64B 5-29	Video coupling
C409	.01 mfd., 400 v. ....	.64B 5-25	Sync coupling
C410	.1 mfd., 200 v. ....	.64B 5-30	Screen bypass
C411	1,000, Mica, ±5%.....	.65B 20-102	Coupling
C412	1,000, Mica, ±5%.....	.65B 20-102	Coupling
C413	.01 mfd., 400 v. ....	.64B 5-25	Coupling
C414	.01 mfd., 400 v. ....	.64B 5-25	Filter
C415	3,900, Mica, ±5%.....	.65B 20-392	Hor. osc. tank
C416	.05 mfd., 200 v. ....	.64B 5-32	Disc. filter
C417	.005 mfd., 600 v. ....	.64B 5-12	Filter
C418	330, Mica .....	.65B 21-331	Coupling
C419	{390, Mica, in 20A1. .65B 21-391 330, Mica, in 20B1. .65B 21-331 270, Mica, in 21A1. .65B 21-271		Hor. wave shaping
C420	270, Mica .....	.65B 21-271	Coupling
C421	20-280, Trimmer ....	.66A 30-1	Hor. drive cont.
C422	20 mfd., 450 v, Elect. See C309A		
C423	{15, 1,500 v. in 20A1. .65A 23-1 10, 1,500 v. in 20B1. .65A 23-2 7.5, 1,500 v. in 21A1. .65A 23-3		Feedback
C424	{.1 mfd. 200v, in 20B1 and early 20A1. .... .64B 5-30 .2 mfd, 200 v, in later 20A1. .... .64B 5-29 Before replacing, see Production Change "G". .25 mfd., 200 v. in 21A1 .....	.64B 6-28	Cathode bypass Cathode bypass
C425	.05 mfd., 600 v. ....	.64B 5-7	Decoupling
C426	{.035 mfd., 600 v. in 20A1, 20B1 .....	.64A 2-5	Hor. lin. filter
	{.05 mfd., 600 v., in 21A1 .....	.64A 2-4	
C427	500, 10 KV .....	.65A 11-1	2nd anode filter
C428	Part of T404A (Before replacing, see Production Change "C".)		
C429	.5 mfd., 200 v. ....	.64B 6-27	Decoupling
C430	1,000, Mica .....	.65B 20-102	DC blocking
C431	.1 mfd., 600 v. ....	.64A 2-6	Hor. lin. filter
C432	50, Mica .....	.65B 7-11	Hor. Hold bypass
C433	500, 10,000 v. Cer....	.65A 11-1	Filter (Used only when 12" tube has no outer coating.)
C436	.5 mfd., 200 v. ....	.64B 6-27	Bypass
C437	.05 mfd., 400 v. ....	.64B 5-22	Coupling
C438	120, Mica .....	.65B 1-10	Coupling
C440	500, 10,000 v. ....	.65B 18-1	Filter
C441	500, 10,000 v. ....	.65B 18-2	Coupling
C501	.01 mfd., 400 v. ....	.64B 5-25	Audio coupling
C502	.1 mfd., 400 v. ....	.64B 5-20	Decoupling
C503	.01 mfd., 400 v. ....	.64B 5-25	Audio coupling

Continued from preceding column

Sym.	Mmf.	Part No.	Function
C504	.01 mfd., 600 v. ....	.64B 5-10	Filter
C505A	20 mfd., 350 v.}	Elect.	LV filter
C505B	30 mfd., 250 v.}	.67C 15-6	LV filter
C505C	20 mfd., 250 v.}		Audio bypass
C506A	40 mfd., 450 v.}	Elect.	HV filter
C506B	40 mfd., 450 v.}	.67C 15-1	HV filter
C511	.01 mfd., 400 v. ....	.64B 5-25	
C512	.1 mfd., 400 v. ....	.64B 5-20	
C513	.01 mfd., 400 v. ....	.64B 5-25	
C514	.01 mfd., 400 v. ....	.64B 5-25	
C515	.01 mfd., 400 v. ....	.64B 5-25	
C516	.1 mfd., 400 v. ....	.64B 5-20	
C517	.002 mfd., 600 v. ....	.64B 5-14	
C518A	40 mfd., 450 v.}	Elect.	
C518B	40 mfd., 450 v.}	.67C 15-1	
C519A	30 mfd., 250 v.}	Elect.	
C519B	20 mfd., 350 v.}	.67C 15-8	
C601	2-20, Trimmer	Part of L601	
C602	.001 mfd. min, Cer. ....	.65B 6-41	
C603a	486 (max.) AM RF}		
C603b	15 (max.) FM RF.}	Gang	
C603c	114 (max.) AM Osc.}	.68B 24	
C603d	15 (max.) FM Osc.}		
C604	.01 mfd. min, Cer....	.65A 10-3	
C605	40, Ceramic .....	.65B 6-67	
C606	.68 mfd., Ceramic ..	.65A 16-1	
C607	.001 mfd., Ceramic ..	.65B 6-41	
C609	50, Silver Mica....	.65B 1-60	
C610	100, Silver Mica....	Part of T601	
C611	1000, Silver Mica...Part of T604		
C612	300, Silver Mica....Part of T604		
C613	.01 mfd. min, Cer....	.65A 10-3	
C614	.005 mfd. min, Cer. ....	.65A 10-1	
C615	.01 mfd. min, Cer....	.65A 10-3	
C616	250, Ceramic .....	.65B 6-5	
C617	100, Silver Mica....	Part of T602	
C618	200, Silver Mica....	Part of T605	
C619	200, Silver Mica....	Part of T605	
C620	.005 mfd. min, Cer....	.65A 10-1	
C621	.01 mfd. min, Cer....	.65A 10-3	
C622	90, Silver Mica....	Part of T603	
C623	100, Ceramic}		
C624	100, Ceramic}	.63A 7-1	
In early production C623 and C624 were individual condensers (part number 65B6-68). If a section of the dual condenser (late production) becomes defective, replace with exact duplicate or two condensers of the same value with a tolerance within 10% of each other.			
C625	.001 mfd. min, Cer....	.65B 6-41	
C626	4 mfd, 150 v, Elec....	.67A 4-2	
C627	.002 mfd, Ceramic....	.65B 9-39	
C628	100, Ceramic .....	.65B 6-68	
C629	.001 mfd. min, Cer....	.65B 6-41	
C630	.005 mfd. min, Cer....	.65A 10-1	
C631	.005 mfd. min, Cer....	.65A 10-1	
C632	.01 mfd. min, Cer....	.65A 10-3	
C633	.01 mfd. min, Cer....	.65A 10-3	
C634	5, Ceramic .....	.65B 6-61	
C636	.005, Ceramic .....	.65A 10-1	
C637	.005, Ceramic .....	.65A 10-1	

COILS

Sym.	Description	Part No.	Function
L101	Antenna Coil for Channel #2...98A 58-2 for Channel #3...98A 58-3 for Channel #4...98A 58-4 for Channel #5...98A 58-5 for Channel #6...98A 58-6 for Channel #7...98A 58-7 for Channel #8...98A 58-8 for Channel #9...98A 58-9 for Channel #10...98A 58-10 for Channel #11...98A 58-11 for Channel #12...98A 58-12 for Channel #13...98A 58-13		
L102	Mixer—Oscillator Coil for Channel #2...98A 59-2 for Channel #3...98A 59-3 for Channel #4...98A 59-4 for Channel #5...98A 59-5 for Channel #6...98A 59-6 for Channel #7...98A 59-7 for Channel #8...98A 59-8 for Channel #9...98A 59-9 for Channel #10...98A 59-10 for Channel #11...98A 59-11 for Channel #12...98A 59-12 for Channel #13...98A 59-13		
<p>Before inserting replacement coil L101 or L102 in turret, check to see that teeth at inner end of coils fit together when fitted in detent plate at center of turret. If necessary, file teeth slightly.</p>			
L103	Choke, Filament RF.98A 45-13		
L104	Choke, Fil. Osc. ....98A 45-14		
L105	Coil, Choke .....98A 45-72 Early sets used part #98A 45-68 choke coil. Before replacing, see Production Change "F".		
L106	Coil, 1st IF.....98A 45-69		
L202	Filament Choke ....73A 2-1 R215, C213 and L202 were added in later production; see Production Change "E".	Fil. choke	
L301	Coil, 4.2 microhy....73A 6-1	RF choke	
L302	Coil, 90 microhy. (wound on R314).73A 5-4	Video peaking 4.5 MC trap	
L303	Coil, 7.3 microhy....73A 4-1		
L304	Coil, 250 microhy. (wound on R322).73A 5-1	Series peaking	
L305	Coil, 150 microhy. (wound on R321).73A 5-2	Shunt peaking	
L306	Coil .....69B 35-1	Focus coil	
L307	RF Choke .....73A 2-1	RF choke	
L308	Coil, 1st Sound IF..72A 88-1	Sound trap	
L310	Coil, 250 microhy. (wound on R322).73A 5-5		
L311	Coil, 250 microhy. (wound on R321).73A 5-5		
L401	Coil, 25 to 40 millihenrys .....94A 17 (includes C415 and R431)	Hor. lock cont.	
L402	Coil, 5.5 to 20 millihenrys .....94A 3	Hor. lin. cont.	
L501	Choke, 2.8 henry....74A 17	LV filter choke	
L502	Choke, 2 henry....74A 12	HV filter choke	
L511	Filter Choke, LV (2.8 henry) .....74A 17		
L512	Filter Choke, HV (2 henry) .....74A 12		

Continued from preceding column

Sym.	Description	Part No.	Function
L601	Antenna, Loop (AM) (includes C601)...69C 100		
L602	Antenna, FM (54" twin lead folded dipole and lead- in) .....AB195		
L603	Antenna Coil (FM).69A 85		
L604	Coil, Osc. (AM)...69A 86		
L605	Coil, Osc. (FM)...69A 87		
L606	Coil, AM Peaking..73A 5-3		
L607	Choke, Filament RF.73A 2-4		
L610	Choke, RF Dual....69A 102		

TRANSFORMERS

T201	2nd Sound IF Trans.72B 86-2 Early sets used part #72B86-1, 2nd sound IF transformer. Before replacing, see Production Change "F".		
T202	Ratio Det. Trans....72B 87-1		
T301	1st Video Trans. & Sound Link .....72A 84 (Before replacing, see Production Change "A").		
T302	2nd Video Trans. ...72A 83-2 (Before replacing, see Production Change "A").		
T303	3rd Video Trans. ...72A 83-1		
T401	Vert. Osc. Trans. ...79A 18-1		
T402	Vert. Output Trans. in 20A1, 20B1 ...79B 24 in 21A1 .....79B 20 Part 79B20 used in early 20A1 and 20B1; 79B20 and 79B24 are interchangeable.		
T403	Horiz. Output Trans. in 20A1....79C 19-2 Horiz. Output Trans. in 20B1...79C 23		
T404A	{Horiz.-Vert. } T404B {Deflection Yoke} 94B 2-2 (Before replacing, see Production Change "C").		
T405	Trans., Width Control in 20A1, 20B1....94A 16 in 21A1 .....94A 19		
T406	Hor. Output Trans. in 21A1 .....79C 17-2		
T501	Trans., Output (for 4 tube power sup- ply) .....79A 9		
T502	Trans., Power .....80B 17		
T511	Trans., Output (for 6 tube power sup- ply) .....79A 16		
T512	Trans., Power .....80B 17		
T601	Trans, 1st IF (FM).72B 93		
T602	Trans, 2nd IF (FM) .....72B 76		
T603	Trans, Ratio Det....72B 39		
T604	Trans, 1st IF (AM) .....72B 92		
T605	Trans, 2nd IF (AM) .....72B 94		

PICTURE TUBES

Sym.	Description	Part No.
V307	10" Picture Tube (20A1)	10BP4
	12" Picture Tube (20B1)	12BP4
	12" Picture Tube (20B1)	12LP4
	12" Picture Tube (20B1)	12TP4
	16" Picture Tube (21A1)	16AP4

Important

Alternate 12" picture tubes used in 20B1 chassis. Replace with identical tube (see "WIRED FOR—" stamp on rear of chassis): or when substituting see page 33.

SOCKETS AND PLUGS

Sym.	Description	Part No.
M201	Plug, Audio Input	88A 2-1
M301	Socket, Wafer (14 contact rectangular)	88A 20-2
M302	Plug, AC Input (Interlock)	88A 22-2
M303	Line Cord, with plug and interlock socket	89A 22-1
M305	Plug, Cabinet Back Interlock	88A 15-10
M306	Socket Insert, Cabinet Back Interlock (2 contact)	87A 17-3
	Shell and Bracket (for 87A 17-3 socket)	88A 26
M307	Plug, Focus Coil (4 pin)	88B 22-1
	Cover & Insulator for plug 88B 22-1	88B 22-3
M308	Socket, Focus Coil (4 contact)	87A 6-3
M309	Socket and Leads, Radio-Phono Compartment Light	89A 6-1
M310	Plug (2 pin round)	88A 8-1
M311	Socket and Leads	82A 12-1
M401	Socket, Deflection Yoke (6 contact)	87B 30-2
M402	Plug, Deflection Yoke (6 pin)	88A 9-1
	Cover & Insulator for plug 88A 9-1	88A 17
M403	Connector (Female), 2nd Anode (includes wire lead)	88A 25-1
M404	Connector (Male), 2nd Anode (includes lead and contact spring)	A2078
M501	Plug, Cable (14 pin rectangular)	88A 20-1
	Cover, Cable Plug (for M501)	88A 20-12
	Cable (8 wire) includes plug M501	AB191
M503	Socket, Audio Output	88A 1
M510	Socket, Audio Input	88A 1
M511	Cable, Connecting (includes M512 socket, M513 plug and eight-50" connecting wires)	AB193
M512	Socket, Cable (for AB193 connecting cable)	88A 20-10
M513	Plug, Cable (for AB193 connecting cable)	88A 20-11
	Cover, Cable (for M512 socket and M513 plug)	88A 20-6
M514	Socket, Cable (9 contact)	88A 20-8
M515	Plug, Cable (14 pin rectangular)	88A 20-1
	Cover, Cable Plug (for M515)	88A 20-12
	Cable (9 wire), includes plug M515	
	Without braided ground strap (used on sets with 4K1 radio tuner)	AB202
	With 28" braided ground strap (used on sets with 4J1 radio tuner)	AB192
	Socket and Leads, Pilot Light	82A 11-5
M518	Socket and Leads, Phono Motor	89A 6-10
M601	Socket, Phono Input	88A 1
M605	Plug and Shielded Cable (Audio output)	89A 29-6
M606	Socket and Shielded Cable (TV audio input)	89A 29-26
M607	Plug, 9 pin (on radio tuner chassis)	88A 20-9
M609	Plug, Phono-Motor (Male)	88A 8-1

Continued from preceding column

Description	Part No.
Socket, Tube	
for 10" or 12" Picture Tube	87A 31-1
for 16" Picture Tube	87A 31-2
for Miniature Tube (7 pin)	87A 3-7
for Miniature Tube (9 pin)	87A 25-2
for Octal Tube	
Standard	87A 5-1
Ring Mounting (plain)	87A 20
Ring Mounting (mica filled)	87A 20-1

MISCELLANEOUS PARTS FOR TELEVISION CHASSIS

Picture tube mounting parts listed below are for 10" and 12" picture tubes. See separate heading on page 43 for 16" picture tube mounting parts.

Sym.	Description	Part No.
M313	Fuse, Line (3 amp.)	84A 1-14
M405	Fuse, Horiz. Output (.25 amp., 250 v.)	84A 4-2
	Fuse Holder	
	for single fuse	84A 5-1
	for double fuse	84A 5-3
M502	Speaker	
	for 24A11, 24A12, 24C15, 24C16, 24A17, 24A125, 24A126, 24A127 (6" PM)	78B 46
	for 4H15A, or B, 4H16A or B, 4H17A or B, 30F15, 30F16, 30F17 (10" PM)	78B 47
	for 4H145, 4H146, 4H147 25A15, 25A16, 25A17 (10" PM)	78B 41
	for 4H165, 4H166, 4H167, 4H126, 4H137 (12" PM)	78B 44-2
	for 4H155, 4H156, 4H157 (12" PM)	78B 44-1
SW301	On-Off Switch (AC power switch)	Part of R212
	Bracket, Chassis Mounting	15A 246
	Bracket, Chassis Support	15A 532
	Bracket, Picture Tube Support	
	with tube support bent down, used in 10" and early 12" sets	
	Right side (facing tube)	15C 259-2
	Left side (facing tube)	15C 259-1
	with tube support bent up, used in late 12" sets	
	Right side (facing tube)	15A 541-2
	Left side (facing tube)	15A 541-1
	Bracket, Focus Coil Mtg.	
	(for 3 point focus coil mtg.)	15A 484
	Bracket, Fuse Holder Mtg.	15A 539
	Bracket, Tube and Focus Coil Mtg.	
	for 10" Picture Tube (20A1)	15C 240-1
	for 12" Picture Tube (20B1)	15C 403-1
	Bumper Plate, Picture Tube	
	with 21/32" offset	15A 500
	with 25/32" offset	15A 489
	with 31/32" offset	15A 493
	Bumper, Rubber (for picture tube bumper plate)	12A 5-6
	Bumper, Rubber (for picture tube support bracket)	12A 16
	Cable, Shielded Audio (4 feet)	89A 24-4
	Channel, Rubber 8 5/8" long (for picture tube bracket, used in early production)	12A 9-5
	Clamp, Cable	11A 2-1
	Clamp, Radio-Phono Compt. Line Cord	11A 9-1
	Clamp, Picture Tube Mtg. Strap	15A 245
	Clip, 1B3GT or 6BG6G Plate Cap.	19A 54
	Collar, Rubber (Inside focus coil)	12A 14
	Connector, Male (for 2nd anode of picture tubes 10BP4, 12LP4, 12TP4)	88A 16-4
	Cover, IF Strip	15C 465
	Grommet, Rubber (1 1/4" dia. for picture tube mtg.)	12B 34
	Insulator, Ceramic Stand-off (1 1/2" x 1/2", 6-32 thread)	29A 8-1

Continued from preceding column

Description	Part No.
Insulator, Fibre (for deflection yoke)	32A 75
Insulator, Fibre (2nd anode lead support)	32A 74
Ion Trap	
for 10BP4, 12BP4, 12LP4 & 12TP4	94B 6
for 16AP4 Picture Tube	94A 15-1
Plate, 1B3GT Mounting	
for 20A1, 20B1	A2019
for 21A1	A2024
Plate, Channel Selector Shaft Bearing (Fibre) with 3/8" hole, for chassis using 94C18-1 Telev. Tuner	32A 111-1
Plug, Special Adapter (used to play combination models without radio tuner)	89A 31
Ring, Corona	19A 5-2
Screw, 9KV Bleeder (6-32x5/8") (20A1 only)	1A 99-1-71
Screw, Deflection Yoke Adjustment (8-32x3/8", wing)	1A 101-1-71
Screw, Focus Coil Adjustment (10-32x1 1/2")	100-1500-F2-21
Screw, Interlock Bracket Mounting	1A 6-23-71
Shield, Tube (Miniature)	87A 7-7
Wire, Braided Copper (order length needed)	95A 12-7
Shockmount, Shear Type	AA190
Socket and Line Cord, Special Adapter (used to play 4J1 or 4K1 radio tuner without television)	89A 30
Spring, Focus Coil Mounting	19A 22
Spring, Grounding (Picture tube to chassis)	19A 23
Spring, Tube Retainer (for 5U4G tube)	87A 22-2
Support, HV Lead (Fibre)	32A 115
Terminal Board, Antenna	10A 6-2
Tuner, Television (complete)	94C 18-1
Washer, Cup (5/8"ODx3/16"ID)	4A 7-6-71
Webbing, 10" Picture Tube Mtg. Strap (30" length)	50A 3-1
Webbing, 12" Picture Tube Mtg. Strap (36" length)	50A 3-3

PARTS FOR MOUNTING 16" PICTURE TUBE

Sym.	Description	Part No.
L306	Coil, Focus	69B 94-1
T404	Coil, Deflection Yoke	94B 2-2
M306	Socket Insert, Cabinet Back Interlock (2 contact)	87A 17-3
M307	Plug, Focus Coil (4 pin)	88B 22-1
M402	Plug, Deflection Yoke (6 pin)	88A 9-1
M404	Connector (Male), 2nd Anode (includes wire lead and tube contact spring)	A2078
	Band, Tube Front Insulating (Plastic)	33A 47
	Band, Tube Retaining (Metal)	28A 40-1
	Base Assembly, Deflection Yoke (includes insulator)	A2071
	Bracket, Deflection Yoke Adjusting	15A 433
	Bracket, Tube Mounting (Front)	
	Left hand—(from front)	15B 468-2
	Right hand—(from front)	15B 468-1
	Cover, Protective Cardboard (for picture tube)	43E 76
	Cover & Insulator (for 88A9-1 plug)	88A 17
	Cover & Insulator (for 88B22-1 plug)	88A 22-3
	Deflection Yoke Mtg. (Upper section)	15C 428
	Ground Wire Assembly	A1971
	Insulator, Deflection Yoke (Fibre)	32A 104
	Insulator, 2nd Anode Lead Support	32A 115
	Insulator, Tube Band (Plastic sheet 3"x5 1/2")	32A 103-1
	Ion Trap	94A 15-1
	Mounting Board, Picture Tube	35E 102
	Nut (8-32 Hex, for tube band)	2A 1-15-71
	Nut (10-32 tee-nut for tube mtg. board)	2A 17-2

Continued from preceding column

Description	Part No.
Nut, Tinnerman (for yoke bracket)	2B 10-8-59
Plate, Focus Coil Mounting (U shaped)	15B 432
Rubber Channel (11-13/16" for tube rear support)	12A 9-7
Rubber Collar inside focus coil	12A 14
Screen, 13 3/4"x13 1/2", Perforated Metal	16C 13
Screw, Bracket Mtg. (8-32x3/8" RH MS)	380-375-C2-71
Screw, Focus Coil Mtg. (10-32x1 1/2" RH MS)	100-1500-F2-71
Screw, Wing (for deflection yoke)	1A 101-1-71
Sheet, Insulating (under tube mask)	32D 122
Shell and Bracket (for 87A17-3 socket)	88A 26
Spring, Focus Coil Mounting	19A 22
Spring, HV Contact at front of tube	18A 37
Tape, Aluminum Foil (order length needed)	52A 1-17
Tube, 16" Picture	16AP4
Tube Support, Bakelite (in front of deflection yoke)	32B 99
Washer, Cup (5/8"ODx3/16"ID)	4A 7-6-71

MISCELLANEOUS PARTS FOR TV TUNER 94C18-1

Sym.	Description	Part No.
M100	Tuner, Television (complete)	94C 18-1
M101	Roller, Detent (3/8" diameter)	98A 45-50
M102	Spring, Detent (1 1/8" long)	98A 45-45
M103	Contact Plate and Bracket Assembly	98A 45-30
M104	Shaft Shell & Rotor Assy. (Sharp Tuning) (with 4 1/2" long brass shaft Shell)	98A 45-71
M105	Spring, Sharp Tuning Rotor Contact (Flat bronze 7/8"x1/2")	98A 45-60
M106	Spring, Front and Rear Turret Shaft (Wire 2 3/4" long)	98A 45-44
M107	Bracket, Sharp Tuning Rotor Retaining	98A 45-61
M108	Spring, Detent Plate Grounding	98A 45-74
M109	Shield, Tube (Slotted; for 6J6)	98A 45-73
M110	Shield, Tube (Plain; for 6AG5)	98A 45-36
M111	Turret and Shaft Assembly (less coils) (5/8" shaft and 1/8" detent depression)	98A 45-70
M112	Spring, Slug Retaining (Osc. coil)	98A 45-52
M113	Washer, Fibre Spacer (1/4" IDx1/2" OD)	98A 45-63
M114	Nut, Locking Spring (for trimmers)	98A 45-31
M115	Screw, Trimmer (4-36x5/8")	98A 45-33
	Screw, Bracket Mounting (6-32x1/4")	98A 45-62

MISCELLANEOUS PARTS FOR 4J1 and 4K1 FM-AM RADIO TUNER CHASSIS

M601	Socket, Phono Input	88A 1
M605	Plug and Shielded Cable (Audio output)	89A 29-6
M606	Socket and Shielded Cable (TV audio input)	89A 29-26
M607	Plug 9-Pin Power	88A 20-9
SW601	Switch, AM-FM Band	76B 18
SW602	Swith, Telev.-Radio-Phono	
	on 4J1 radio tuner	76B 19
	on 4K1 radio tuner	76B 21
	Antenna Lead (300 ohm transmission line)	95A 16-11
	Bracket, Dual Control	15A 385
	Bracket, Tuning Sleeve	15A 394
	Cover Assembly, Chassis	A1880
	Dial Back and Bracket Assembly	A1881
	Dial Cord (40" approx.)	50A 1-3
	Dial Scale	22B 19-1
	Escutcheon, Radio	23D 39-3
	Grommet, Rubber (Gang mounting)	12A 1-4

Continued from preceding column

Description	Part No.
Pilot Light, Mazda No. 47.....	81A 1-8
Pilot Light, Socket and 12" Lead.....	82A 8-6
Pointer, Dial	25A 33
Pulley, Dial	17A 1-3
Spacer Sleeve (for gang mounting).....	29A 2-10-71
Spring, Dial Cord	19B 1-3
Spring, Tube Retaining (for 12AT7).....	19A 56-1
Tube Socket (7-pin miniature).....	87A 3-7
Tube Socket (9-pin miniature).....	87A 25-2
Tuner Sleeve	27A 61
Shield, Antenna (Aluminum: 11"x3½").....	15A 524

PHONOGRAPH PARTS

Check the changer model label and see Record Changer Service Manual for complete Record Changer parts list.

Sym.	Description	Part No.
M602	Cable, Shielded (includes plug).....	413A 11-1
M603	Cartridge, Dual (includes needles).....	409A 11
M604	Motor (3 speed).....	407B 17
M609	Plug, Motor (Male).....	88A 8-1

Continued from preceding column

Description	Part No.
Belt, Rubber Drive	406A 20
Centerpost, Record	
for 10" and 12" records.....	G400B 311
for 7" 33 RPM records.....	G400B 310
for 7" 45 RPM records.....	G400B 329
Idler Wheel Assembly (includes tire).....	G400A 279
Needle, Phonograph (Long play)	98A 15-6
Needle, Phonograph (Standard 78 RPM).....	98A 15-7
Needle Retaining Nut.....	98A 54-2
Shoulder Eye Bolt (for adjusting phono tilt-out spring)	1A 87-1
Spindle Mounting Assembly (for holding extra centerpost and spindle).....	A2002
Tilt-Out Hinge Assembly	
for Left side (facing front).....	AC183-1
for Right side (facing front).....	AC183-2
Tilt-Out Spring (2½" long).....	19A 15-1
Tilt-Out Tie Bar Spring (8½" long, used in late production sets).....	19A 59
Tilt-Out Tie Bar (13½" long, used in early production sets)	15B 126-1
Tilt-Out Tie Rod (13½" long).....	28A 22-1
Touch-Up Paint (Coppertone Hammer).....	98A 54-3

CABINET PARTS

Cabinets parts are listed in numerical order according to model numbers.

**CABINET PARTS for 4H15A, B, C, or CN;
4H16A, B, C, or CN; 4H17A, B, C, or CN**

Description	Part No.
Back, Album compartment	43C 85-1
Back, Cabinet (Radio-Phono compartment)	43B 64-1
Back, Cabinet (Telev. compt. 15½"11").....	16D 6
Bracket, Plug Lock	15A 365
‡Cabinet	
for sets with rectangular picture window	
Walnut (4H15A or B).....	35E 89-1
Mahogany (4H16A or B).....	35E 89-2
Blond (4H17A or B).....	35E 89-3
for sets with rounded-end picture window	
Walnut (4H15A, B, C, or CN).....	35E 89-4
Mahogany (4H16A, B, C, or CN).....	35E 89-5
Blond (4H17A, B, C, or CN).....	35E 89-6
Carton and Fillers.....	44B 124
Clamp, Cable	11A 2-6
Cushion Plate, Fibre (Channel Escutcheon mtg.).....	32A 78
‡Door, Television and Radio-Phono	
pair for Walnut (4H15A, B, C, or CN).....	98A 48-16
pair for Mahogany (4H16A, B, C, or CN).....	98A 48-17
pair for Blond (4H17A, B, C, or CN).....	98A 48-18
‡Door, Record Compartment Complete	
for Walnut (4H15A, B, C, or CN).....	98A 48-19
for Mahogany (4H16A, B, C, or CN).....	98A 48-20
for Blond (4H17A, B, C, or CN).....	98A 48-21
Door Bumper, Sponge Rubber (¾"x3½"x2").....	12A 5-6
Door Catch and Strike Plate, Bullet.....	98A 48-26
Escutcheon, Radio	23D 39-3
Escutcheon, Channel (less spring, speed nuts and fibre cushion plate).....	23B 44-1

Continued from preceding column

Description	Part No.
Escutcheon, Television	
for sets with rounded end picture window	
Window and Frame, Picture Tube (less lower monogram panel).....	23D 48-1
Lower Monogram Panel (less upper window section)	23D 48-2
for sets with rectangular picture window	
Picture Tube Frame and Lower Monogram Panel (less picture tube window).....	23D 30-5
Window only, Picture Tube (less frame).....	23D 30-6
Eye Bolt (for Tilt-Out Spring).....	1A 87-1
Gasket, Sponge Rubber (for back of picture tube escutcheon)	12A 32-5
Grille Cloth (2 pieces)	
for Walnut (4H15A, B, C, or CN) and Mahogany (4H16A, B, C, or CN).....	98A 48-22
for Blond (4H17A, B, C, or CN).....	98A 48-23
Hinge Assembly, Tilt-Out	
Left side (facing front).....	AC183-1
Right side (facing front).....	AC183-2
Hinge, Knife Door	
pair for Walnut (4H15A, B, C, or CN); Mahogany (4H16A, B, C, or CN).....	98A 48-24
pair for Blond (4H17A, B, C, or CN).....	98A 48-25
Jewel, Pilot Light.....	82A 10-8
Knob, Door (Telev. and Radio Phono compt.).....	33A 41-1
Knob, Door (Record Compartment).....	33A 41-2
Knob, Radio Tuning	
'Telev-Phono-Radio' (Maroon and gold, single knob)	33C 40-11
'Tuning' (Maroon outer knob).....	33C 40-15
'AM-FM' (Gold inner knob).....	33C 40-12
'Tone' (Maroon outer knob).....	33C 40-13
'Off-Volume' (Gold inner knob).....	33C 40-14

‡Supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

Continued from preceding column

Description	Part No.
Knob, Television	
'Channel' (Gold inner knob).....	33C 28-17
'Horizontal,' 'Contrast,' and 'Off-Volume' (Gold inner knob).....	33C 28-18
'Sharp Tuning' (Maroon outer knob).....	38C 28-21
'Vertical,' 'Brightness' and 'Focus' (Maroon outer knob).....	33C 28-22
Nut, Hex (#4-40 for Tilt-Out Tie Bar).....	2A 1-6-71
Ring, Knob Compression.....	18A 5-3
Screen, Perforated (8"x11").....	16A 2-1-70
Screw, Telev. Chassis Mtg. (# 1/4-20x1 1/4").....	1A 67-44-71
Screw, Escutcheon Mtg. (# 3x5/8" OH WS).....	1A 15-6-58
Screw, TV Window Mtg. (# 4x1/2" FH WS).....	1A 10-8-59
Screw, Tilt-Out Tie Rod Mtg. (# 6-32x1/4" Bd H.M.S.).....	365-250-C2-58
Screw, Tilt-Out Spring Mtg. (# 8-32x1/4" Bd H.M.S.).....	85-250-C2-21
Screw, Tilt-Out Tie Bar Mtg. (# 4-40x1 1/8" R.H. M.S.).....	40-437-C2-71
Speaker, 10" PM.....	78B 47
Spindle Mounting Assembly (for holding extra centerpost and spindle).....	A2002
Speed Nut (Radio escutcheon mounting).....	2B 10-24-59
Speed Nut (Picture Tube escutcheon mtg.).....	2B 10-5-68
Speed Nut (#8-22 Speaker mounting).....	2B 10-8-59
Spring, Channel Escutcheon Retaining.....	18A 27
Spring, Tilt-Out Coil.....	19A 15-1
Tie Bar, Tilt-Out.....	15B 126-1
Tie Rod, Tilt-Out.....	28A 22-1
Washer, Felt (Radio Knobs).....	5A 4-11
Washer, Felt (Television for 'Horizontal-Vertical,' 'Contrast- Brightness,' 'Off-Volume-Focus' knobs.....	5A 4-6
for 'Channel-Sharp Tuning' knobs.....	5A 4-5

**CABINET PARTS for 4H126A, B, C, or CN
and 4H137A, B, C, or CN**

Back, Cabinet	
for Radio-Phono Compartment.....	43C 66
for Television Compartment (4H126).....	A1914
for Television Compartment (4H137).....	A2000
Bracket, Plug Lock.....	15A 365
Bracket, Escutcheon Mounting.....	15A 69-1
‡Cabinet	
Mahogany (4H126A, B, C or CN).....	35E 95-2
Blond (4H137A, B, C or CN).....	35E 96-3
Crate, Fibre Board.....	44B 130
Crate Fillers, Cardboard.....	43C 72
Clamp, Cable.....	11A 2-6
Cover, Loop Antenna.....	43C 77
‡Door, Cabinet (Radio-Phono and Television Tube Compartment)	
Matched pair for Mahogany (4H126A, B, C, or CN).....	98A 48-41
Matched pair for Blond (4H137A, B, C, or CN).....	98A 56-4
‡Door, Cabinet (Record Compartment)	
Complete Door for Mahogany (4H126A, B, C, or CN).....	98A 48-43
Complete Door for Blond (4H137A, B, C, or CN).....	98A 56-3
‡Door, Cabinet (Television Tuning Compt.)	
for Mahogany (4H126A, B, C, or CN).....	98A 48-51
for Blond (4H137A, B, C, or CN).....	98A 56-2
Door Catch and Strike Plate, Bullet.....	98A 48-45
Escutcheon, Channel.....	23B 43-1
Escutcheon, Picture Tube.....	23D 42
Escutcheon, Radio.....	23D 39-1
Eye Bolt (for Tilt-Out Spring).....	1A 87-1
Gasket, Sponge Rubber (for back of picture tube escutcheon).....	12A 5-18

Continued from preceding column

Description	Part No.
Grille Cloth	
2 pieces for Mahogany (4H126).....	98A 48-44
2 pieces for Blond (4H137).....	98A 56-5
Hinge, Knife	
for TV Tuning, Radio-Phono and Record Compt.	
Mahogany (4H126A, B, C, or CN).....	98A 48-48
Blond (4H137A, B, C, or CN).....	98A 56-7
for TV Tube Compartment	
Mahogany (4H126A, B, C, or CN).....	98A 48-47
Blond (4H137A, B, C, or CN).....	98A 56-2
Hinge Assembly, Tilt-Out	
Left Side (facing front).....	AC183-1
Right Side (facing front).....	AC183-2
Jewel, Pilot Light.....	82A 10-8
Knob, Door (for Mahogany 4H126).....	98A 48-46
Knobs, Radio Tuning	
'Telev-Phono-Radio' (Maroon and gold single knob).....	33C 40-6
'Tuning' (Maroon and gold outer knob).....	33C 40-7
'AM-FM' (Gold inner knob).....	33C 40-8
'Tone' (Maroon outer knob).....	33C 40-9
'Off-Volume' (Gold inner knob).....	33C 40-10
Knobs, Television Tuning	
for Mahogany (4H126A, B, C, or CN)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical,' 'Brightness' and 'Focus' (Gold outer knob).....	33C 28-16
'Channel' (Maroon inner knob).....	33C 28-19
'Horizontal,' 'Contrast' and 'Off-Volume' (Maroon inner knob).....	33C 28-20
for Blond (4H137A, B, C, or CN)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical,' 'Brightness' and 'Focus' (Gold outer knob).....	33C 28-16
'Channel' (Gold inner knob).....	33C 28-17
'Horizontal,' 'Contrast' and 'Off-Volume' (Gold inner knob).....	33C 28-18
Nut, Hex (#4-40 for Tilt-Out Tie Bar).....	2A 1-6-71
Ring, Compression (for Channel knob).....	18A 5-3
Rubber Channel; 3 3/4" long (for Telev. back).....	12A 9-6
Rubber Pad (used under escutcheon mount- ing brackets).....	12A 5-15
Rubber Strip, Sponge; 1/8"x3/8"x42 1/4" (for picture tube escutcheon).....	12A 5-13
Rubber Strip, Sponge; 1/8"x3/8"x2" (for television chassis support blocks).....	12A 5-14
Screen, Perforated Metal	
"L"-shaped.....	16C 13
2"x17 1/2".....	16A 9-1-70
Screw, Tilt-Out Tie Bar mtg. (# 4-40x1 1/8" M.S.).....	40-437-C2-71
Screw, Tilt-Out Spring mtg. (# 8-32x1/4" M.S.).....	85-250-C2-71
Screw, Tie Rod mtg. (# 6-32x1/4" Bd. H.M.S.).....	365-250-C2-58
Screw, Picture Tube Board mtg. (1/4"-20x1 1/4" R.H. M.S.).....	1A 3-12-71
Screw, Telev. Chass mtg. (1/4"-20x1 1/4").....	1A 67-44-71
Screw, Escutcheon mtg. (# 3x5/8" O.H. W.S.).....	1A 15-7-58
Sheet, Insulating (under tube mask).....	32D 122
Shelf, Picture Tube Mounting.....	98A 48-50
Speaker (12" PM).....	78B 44-2
Speed Nut (Radio Escutcheon mounting).....	2B 10-24-59
Speed Nut (Picture Tube Escutcheon mtg.).....	2B 10-5-68
Speed Nut (#8-22 Speaker mounting).....	2B 10-8-59
Spindle Mounting (holding extra centerpost or spindle).....	A2002
Spring, Knob Tension (for telev. inner knobs).....	98A 44-1
Spring, Knob Tension (for 'Sharp Tuning').....	98A 44-2
Spring, Mounting (for channel escutcheon).....	19A 48
Tilt-Out Spring (2 1/8" long).....	19A 15-1
Tilt-Out Tie Bar Spring (8 1/2" long, used in late production sets).....	19A 59

‡ Supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

Continued from preceding column

Description	Part No.
Tilt-Out Tie Bar (13 $\frac{7}{8}$ " long, used in early production sets)	15B 126-1
Tilt-Out Tie Rod (13 $\frac{7}{8}$ " long)	28A 22-1
Touch-Up Paint (Coppertone Hammer)	98A 54-3
Washer, Felt (Radio Knobs)	5A 4-11
Washer, Felt (Television) for 'Horizontal—Vertical,' 'Contrast—Brightness,' 'Off-Volume—Focus' knobs	5A 4-6
for 'Channel—Sharp Tuning' knob	5A 4-5
Washer, Fibre (used between inner and outer television knobs)	5A 1-30

Parts For Phono Compartment Light

M309 Socket and Leads, Radio-Phono Compartment Light	89A 6-1
M310 Plug (2 Pin round)	88A 8-1
M311 Socket and Leads	82A 12-1
SW302 Switch, Light	77A 29
Bracket, Switch	15B 502
Bulb, Light (7 watt Mazda #7C7)	81A 2-4
Light Assembly, Complete (less bulb)	AB196
Shield, Light	82A 13
Switch, Light	77A 29

CABINET PARTS for 4H145A, B, C, or CN; 4H146A, B, C, or CN; 4H147A, B, C, or CN; 4H155A, B, C, or CN; 4H156A, B, C, or CN; and 4H157A, B, C, or CN

Back, Record Compartment	43C 85-1
Back, Radio-Phono Compartment	43B 64-1
Back, Telev. Compartment (Perforated metal)	16D 5-1
Bracket, Plug Lock	15A 365
‡Cabinet (with rounded-end picture window)	
Walnut (4H145A, B, C, or CN)	35E 98-4
Mahogany (4H146A, B, C, or CN)	35E 98-5
Blond (4H147A, B, C, or CN)	35E 98-6
Walnut (4H155A, B, C, or CN)	35E 92-10
Mahogany (4H156A, B, C, or CN)	35E 92-11
Blond (4H157A, B, C, or CN)	35E 92-12
‡Cabinet Leg	
Walnut (4H155A, B, C, or CN)	98A 48-6
Mahogany (4H156A, B, C, or CN)	98A 48-7
Blond (4H157 A, B, C, or CN)	98A 48-8
Clamp, Cable	11A 2-6
Crate Filler, Cardboard	43C 78
Crate, Shipping	44B 138
‡Door, Television and Radio-Phono	
pair for Walnut (4H155A, B, C, or CN)	98A 48-1
pair for Mahogany (4H156A, B, C, or CN)	98A 48-2
pair for Blond (4H157A, B, C, or CN)	98A 48-3
pair for Walnut (4H145A, B, C, or CN)	
size 14"x14 $\frac{3}{8}$ "	98A 48-1
size 15 $\frac{1}{2}$ "x14 $\frac{3}{8}$ "	98A 48-62
pair for Mahogany (4H146A, B, C, or CN)	
size 14"x14 $\frac{3}{8}$ "	98A 48-2
size 15 $\frac{1}{2}$ "x14 $\frac{3}{8}$ "	98A 48-63
pair for Blond (4H147A, B, C, or CN)	
size 14"x14 $\frac{3}{8}$ "	98A 48-3
size 15 $\frac{1}{2}$ "x14 $\frac{3}{8}$ "	98A 48-64
Door Catch and Strike Plate, Bullet	98A 48-11
Escutcheon, Radio	23D 39-3
Escutcheon, Television Channel	23B 43
§Escutcheon, Picture Tube Window and Frame	23D 49
Eye Bolt (for tilt-out spring)	1A 87-1
Gasket, Sponge Rubber (includes chipboard backing for back of picture tube escutcheon)	98A 61-2

‡ Supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Sponge rubber gasket (includes chipboard backing) needed when replacing picture tube window escutcheon.

Continued from preceding column

Description	Part No.
Grille, Cabinet Metal	36C 11-1
Grille Cloth	
for Walnut (4H155A, B, C, or CN and Mahogany (4H156A, B, C, or CN)	98A 48-4
for Blond (4H157A, B, C, or CN)	98A 48-5
Hinge Assembly, Tilt-Out	
Right side (facing front)	AC183-2
Left side (facing front)	AC183-1
Hinge, Knife Door	
pair for Walnut (4H155A, B, C, or CN) and Mahogany (4H156A, B, C, or CN)	98A 48-9
pair for Blond (4H157A, B, C, or CN)	98A 48-10
pair for Walnut (4H145A, B, C or CN) and Mahogany (4H146A, B, C or CN)	98A 48-65
pair for Blond (4H147A, B, C or CN)	98A 48-66
Jewel, Pilot Light	82A 10-8
Knob, Door (Television and Radio-Phono)	
for Walnut (4H155A, B, C, or CN) and Mahogany (4H156A, B, C, or CN)	98A 48-12
for Blond (4H157A, B, C, or CN)	98A 48-13
Knob, Radio Tuning	
'Telev-Phono-Radio' (Maroon and gold, single knob)	33C 40-6
'Tuning' (Maroon outer knob)	33C 40-7
'AM-FM' (Gold inner knob)	33C 40-8
'Tone' (Maroon outer knob)	33C 40-9
'Off-Volume' (Gold inner knob)	33C 40-10
Knob, Television Tuning	
for Walnut (4H155A, B, C, or CN) and Mahogany (4H156A, B, C, or CN)	
'Sharp Tuning' (Gold outer knob)	33C 28-15
'Focus, Brightness and Vertical' (Gold outer knob)	33C 28-16
'Channel Selector' (Maroon inner knob)	33C 28-19
'Contrast, Off-Volume and Horizontal' (Gold inner knob)	33C 28-20
for Blond (4H157A, B, C, or CN)	
'Sharp Tuning' (Gold outer knob)	33C 28-15
'Focus, Brightness and Vertical' (Gold outer knob)	33C 28-16
'Channel Selector' (Maroon inner knob)	33C 28-17
'Contrast, Off-Volume and Horizontal' (Maroon inner knob)	33C 28-18
Nut, Hex (#4 for tilt-out tie bar)	2A 1-6-71
Ring, Knob Compression	18A 5-3
Screen, Perforated Metal (8"x11")	16A 2-1-70
Screw, Telev. Chassis Mtg. (1/4-20x1 1/4")	1A 67-44-71
Screw, Escutcheon Mounting (6x1/2" R.H. W.S. Ph.)	1A 7-24-59
Screw, Tilt-Out Tie Rod Mtg. (6-32x1/4" Bd. H.M.S.)	365-250-C2-58
Screw, Tilt-Out Spring Mtg. (8-32 1/4" Bd. H.M.S.)	85-250-C2-71
Screw, Tilt-Out Tie Bar Mtg. (4-40x7/16" R.H. M.S.)	40-437-C2-71
Speaker, 12" PM	78B 44-1
Speed Nut (Radio escutcheon mounting)	2B 10-24-59
Speed Nut (8-22 speaker mounting)	2B 10-8-59
Spindle Mounting Assembly (for holding extra centerpost and spindle)	A2002
Spring, Channel Escutcheon Retaining	19A 48
Tilt-Out Spring (2 1/8" long)	19A 15-1
Tilt-Out Tie Bar Spring (8 1/2" long, used in late production sets)	19A 59
Tilt-Out Tie Bar (13 7/8" long, used in early production sets)	15B 126-1
Tilt-Out Tie Rod (13 7/8" long)	28A 22-1
Touch-up Paint (Coppertone Hammer)	98A 54-3

Continued from preceding column

Description	Part No.
Washer, Felt (Radio knobs)	5A 4-11
Washer, Felt (Television)	
for 'Horizontal—Vertical, Contrast—	
Brightness, Off-Volume—Focus' knobs.....	5A 4-6
for 'Channel—Sharp Tuning' knobs.....	5A 4-5
Washer, Fibre (used between inner and outer	
television knobs)	5A 1-30
Washer, Insulating (for mtg. plastic escutcheon)	5A 1-21

**CABINET PARTS for 4H165A, B, C, or CN;
4H166A, B, C, or CN; 4H167A, B, C, or CN**

Back, Album Compartment.....	43C 85-2
Back, Cabinet (Radio-Phono Compartment).....	43B 64-1
Back, Cabinet (Television compartment).....	16D 5-1
Bracket, Plug Lock.....	15A 365
‡Cabinet (with rounded-end picture window)	
Walnut (4H165A, B, C, or CN).....	35E 91-5
Mahogany (4H166A, B, C, or CN).....	35E 91-6
Blond (4H167A, B, C, or CN).....	35E-91-7
Clamp, Cable	11A 2-6
Crate, Shipping	44B 125
Crate Fillers, Cardboard.....	43C 67
‡Doors, Matched	
pair for Walnut (4H165A, B, C, or CN).....	98A 48-54
pair for Mahogany (4H166A, B, C, or CN).....	98A 48-55
pair for Blond (4H167A, B, C, or CN).....	98A 48-56
Door Catch and Strike Plate, Bullet.....	98A 48-34
Door Handle	98A 48-37
Escutcheon, Radio	23D 39-3
§Escutcheon, Picture Window	23D 49
Escutcheon, Television Channel	23B 43
Gasket, Sprong Rubber (Includes chipboard	
backing for back of picture tube escutcheon) ..	98A 61-2
Grille Cloth	
for Walnut (4H165A, B, C, or CN) and	
Mahogany (4H166A, B, C, or CN).....	98A 48-57
for Blond (4H167A, B, C, or CN).....	98A 48-58
Hinge, Knife Door (Pair).....	98A 48-33
Jewel, Pilot Light.....	82A 10-8
Knobs, Radio Tuning	
'Telev-Phono-Radio' (Gold with maroon rim) ..	33C 40-6
'Tuning' (Maroon outer knob).....	33C 40-7
'AM-FM' (Gold inner knob).....	33C 40-8
'Tone' (Maroon outer knob).....	33C 40-9
'Off-Volume' (Gold inner knob).....	33C 40-10
Knobs, Television Tuning	
for Walnut (4H165) and Mahogany (4H166)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical,' 'Brightness' and 'Focus'	
(Gold outer knob).....	33C 28-16
'Channel' (Maroon inner knob).....	33C 28-19
'Horizontal,' 'Contrast' and 'Off-Volume'	
(Maroon inner knob).....	33C 28-20
for Blond (4H167)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical,' 'Brightness' and 'Focus'	
(Gold outer knob).....	33C 28-16
'Channel' (Gold inner knob).....	33C 28-17
'Horizontal,' 'Contrast' and 'Off-Volume'	
(Gold inner knob).....	33C 28-18
Pilot Light #47.....	81A 1-8
Ring, Compression (for channel knob).....	18A 5-3
Screen, Perforated Metal (8"x11")	16A 2-1-70
Screw, Escutcheon Mtg. (#6x $\frac{1}{2}$ " R.H. W.S.) ..	1A 7-24-59
Screw, Slide Mtg. (#8-32x1 $\frac{1}{8}$ " Bd Hd M.S.) ..	85-1625-C2-71
Screw, Telev. Chassis Mtg. ($\frac{1}{4}$ x20x1 $\frac{1}{4}$ ")	1A 67-43-71
Shelf, Slide Drawer	
for Walnut (4H165).....	98A 48-59
for Mahogany (4H166)	98A 48-60
for Blond (4H167)	98A 48-61

Continued from preceding column

Description	Part No.
Slide Assembly, Drawer	
for left side	37C 17-23
for right side	33C 17-24
Speaker (12" PM).....	78B 44-2
Speed Nut (Radio Escutcheon mounting).....	2B 10-24-59
Speed Nut (#8-22 Speaker mounting).....	2B 10-8-59
Spindle Mounting (for holding extra centerpost	
and spindle)	A2002
Spring, Knob Tension (for telev. inner knobs) ..	98A 44-1
Spring, Knob Tension (for telev. Sharp Tuning	
knob)	98A 44-2
Washer, Felt (Radio Knob)	5A 4-11
Washer, Felt (Television)	
for 'Horizontal—Vertical,' 'Contrast—	
Brightness,' 'Off-Volume—Focus' knobs.....	5A 4-6
for 'Channel—Sharp Tuning' knob.....	5A 4-5
Washer, Fibre (used between inner and outer	
television knobs)	5A 1-30

CABINET PARTS for 24A11 and 24A12

(The above models may have suffix letter "N".)

Back, Cabinet (Perforated metal).....	16D 8
Bracket, Plug Lock.....	15A 365
Cabinet, Plastic	
Ebony (24A11)	34E 24-1
Mahogany (24A12)	34E 24-2
Carton and Fillers, Shipping.....	44B 143
Clamp, Cable	11A 2-6
§Escutcheon, Picture Tube	23D 50
Escutcheon, Channel (less spring, speed nuts	
and fibre cushion plate).....	23B 43-2
Gasket, Sponge Rubber (includes chipboard	
backing for back of picture tube escutcheon) ..	98A 61-1
Grille Cloth	
for 24A11 (Black; 15"x15")	36B 3-14
for 24A12 (Brown; 15"x15")	36B 3-15
Grommet, Speaker Mounting.....	12A 2-6
Knobs, Television Tuning	
for Ebony (24A11)	
'Channel' (Ebony inner knob).....	33C 28-29
'Horizontal, Contract and Off-Volume'	
(Ebony inner knob).....	33C 28-30
'Sharp Tuning' (Brass outer knob).....	33C 28-35
'Vertical, Brightness and Focus'	
(Brass outer knob).....	33C 28-36
for Mahogany (24A12)	
'Channel' (Maroon inner knob).....	33C 28-19
'Horizontal, Contrast and Off-Volume'	
(Maroon inner knob).....	33C 28-20
'Sharp Tuning' (Brass outer knob).....	33C 28-35
'Vertical, Brightness and Focus'	
(Brass outer knob).....	33C 28-36
Lockwasher, Escutcheon Mtg. (#6 E.T.).....	3B 1-3-71
Ring, Channel Knob Compression.....	18A 5-3
Screen, Perforated Metal (Chassis bottom).....	16D 10
Screw, Chassis Mtg. ($\frac{1}{4}$ -20x1" Hex Hd.).....	1A 67-43-71
Screw, Escutcheon Mtg. (6-32x $\frac{1}{8}$ " Bd. Hd. M.S.) ..	65-312-C2-71
Shockmount, Chassis	AA190
Spacer, Speaker Grommet (Metal).....	29A 2-5-71
Speaker, 6" PM.....	78B 46
Speed Nut, Baffle Board Mtg.	2B 10-26-59
Spring, Tuning Knob	
for 'Channel, Horizontal, Contrast,	
On-Off Volume' (inner knobs).....	98A 44-1
for 'Sharp Tuning' (outer knob).....	98A 44-2
Spring, Channel Escutcheon Retaining.....	19A 48
Strip, Shelf Support (Metal $\frac{1}{8}$ "x1 $\frac{3}{4}$ ").....	15B 457
Washer, Escutcheon Mtg. (.156x $\frac{1}{16}$ "x $\frac{1}{8}$ ").....	4B 1-187-71

‡ Supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Sponge rubber gasket (includes chipboard backing) needed when replacing picture tube window escutcheon.

Continued from preceding column

Description	Part No.
Washer, Felt	
for 'Horizontal—Vertical, Contrast—	
Brightness, Off-Volume—Focus' knobs.....	5A 4-6
for 'Channel—Sharp Tuning' knobs.....	5A 4-5
Washer, Fibre (used between Telev.	
tuning knobs)	5A 1-30
Washer, Rubber (for mounting power supply) ..	5A 3-7

CABINET PARTS for 24C15, 24C16, 24C17, 24A125, 24A126, 24A127

(All the above model numbers may have suffix letter "N").

Back, Cabinet	
for 24C15, 24C16, 24C17.....	16D 7
for 24A125, 24A126, 24A127.....	16D 12
Bottom, Metal Cabinet.....	16A 2-1-70
Bracket, Plug Lock.....	15A 365
‡Cabinet, Wood	
Walnut (24C15)	35E 93-4
Mahogany (24C16)	35E 93-5
Blond (24C17)	35E 93-6
Walnut (24A125)	35E 104-1
Mahogany (24A126)	35E 104-2
Blond (24A127)	35E 104-3
Carton and Fillers	
for 24C15, 24C16, 24C17.....	44B 126
for 24A125, 24A126, 24A127.....	44B 153
Clamp, Cable	11A 2-6
Decal, Cabinet Lettering.....	98A 15-1
Escutcheon, Channel	
for 24C15, 24C16, 24C17.....	23B 43
for 24A125, 24A126, 24A127.....	23B 43-2
§Escutcheon, Picture Window	
for 24C15, 24C16, 24C17.....	23D 49
for 24A125, 24A126, 24A127.....	23D 50
Gasket, Sponge Rubber (includes chipboard	
backing for back of picture tube escutcheon)	
for 24C15, 24C16, 24C17.....	98A 61-2
for 24A125, 24A126, 24A127.....	98A 61-1
Grille Cloth	
for 24C15, 24C16	98A 38-7
for 24C17	98A 38-8
for 24A125, 24A126	36B 3-15
for 24A127	36B 3-19
Grommets, Speaker Mounting	12A 2-6
Knobs, Tuning	
for 24C15, 24C16	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical,' 'Brightness,' 'Focus' (Gold	
outer knob)	33C 28-16
'Channel' (Maroon inner knob).....	33C 28-19
'Horizontal,' 'Contrast,' 'On-Off-Volume'	
(Maroon inner knob).....	33C 28-20
for 24C17	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical,' 'Brightness,' 'Focus' (Gold	
outer knob)	33C 28-16
'Channel' (Gold inner knob).....	33C 28-17
'Horizontal,' 'Contrast,' 'On-Off-Volume'	
(Gold inner knob)	33C 28-18
for 24A125, 24A126, 24A127	
'Sharp Tuning' (Brass rim outer knob).....	33C 28-35
'Vertical,' 'Brightness,' 'Focus'	
(Brass rim outer knob).....	33C 28-36
'Channel' (Maroon inner knob).....	33C 28-19
'Horizontal,' 'Contrast,' 'On-Off-Volume'	
(Maroon inner knob).....	33C 28-20
Medallion, Speaker Grille	
for 24A125, 24A126, 24A127.....	37A 23-1
for Walnut (24C15)	98A 49-4
for Mahogany (24C16)	98A 49-5
for Blond (24C17)	98A 49-6

‡ Supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Sponge rubber gasket (includes chipboard backing) needed when replacing picture tube window escutcheon.

Continued from preceding column

Description	Part No.
Medallion Plug for 24C15, 24C16, 24C17.....	20A 6-1
Ring, Channel Knob Compression.....	18A 5-3
Rubber Grommet (for shock mounting speaker,	
use with spacer sleeve 29A 2-5-71).....	12A 2-6
Screw, Escutcheon Mtg. (#6x½ Phillips W.S.) ..	1A 7-24-59
Shockmount, Chassis (Rubber block vulcanized	
to chassis mtg. bracket)	AA190
Spacer, Fibre Cabinet Level (Kit of six).....	98A 44-47
Spacer, Grommet (Metal).....	29A 2-5-71
Speaker, 6" PM.....	78B 46
Spring Clip, Channel Escutcheon.....	19A 48
Spring, Tuning Knob	
for 'Channel,' 'Horizontal,' 'Contrast,' 'On-	
Off-Volume' (inner knobs).....	98A 44-1
for 'Sharp Tuning' (outer knob).....	98A 44-2
Washer, Felt (Television)	
for 'Horizontal—Vertical,' 'Contrast—	
Brightness,' 'Off-Volume Focus' knobs.....	5A 4-6
for 'Channel—Sharp Tuning' knobs.....	5A 4-5
Washer, Fibre (used between inner and outer	
television knobs)	5A 1-30

CABINET PARTS for MODELS 25A15, 25A16 and 25A17

(The above models may contain the suffix "N").

Back, Television (Complete).....	A1914
Bracket, Escutcheon Mounting.....	15A 69-1
Bracket, Plug Lock.....	15A 365
‡Cabinet (Complete)	
Walnut (25A15)	35E 100-1
Mahogany (25A16)	35E 100-2
Blond (25A17)	35E 100-3
Carton and Fillers.....	44B 146
Caster, Skid (for cabinet leg).....	98A 60-7
Clamp, Cable	11A 2-6
Decal, Cabinet Lettering.....	98A 15-1
Door Catch and Strike Plate, Bullet.....	98A 60-12
Doors, Matched Pair	
for Walnut (25A15)	98A 60-4
for Mahogany (25A16)	98A 60-5
for Blond (25A17)	98A 60-6
Escutcheon, Channel (less spring, speed nuts	
and fibre cushion plate).....	23B 43-1
Escutcheon and Window, Picture Tube.....	23D 42
Gasket, Sponge Rubber (for back of picture	
tube escutcheon)	12A 5-13
Grille Cloth	
for Walnut (25A15) and Mahog. (25A16)....	98A 60-2
for Blond (25A17)	98A 60-3
Handle, Door	37A 21
Hinge, Knife Door	
pair for Walnut (25A15) & Mahog. (25A16) ..	98A 60-1
pair for Blond (25A17)	98A 60-10
Knobs, Television Tuning	
for Walnut (25A15) and Mahogany (25A16)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical, Brightness and Focus'	
(Gold outer knob).....	33C 28-16
'Channel Selector' (Maroon inner knob)....	33C 28-19
'Horizontal, Contrast and Off-Volume'	
(Maroon inner knob).....	33C 28-20
for Blond (25A17)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical, Brightness and Focus'	
(Gold outer knob).....	33C 28-16
'Channel Selector' (Gold inner knob).....	33C 28-17
'Horizontal, Contrast and Off-Volume'	
(Gold inner knob).....	33C 28-18

Continued from preceding column

Description	Part No.
Mounting Board	
for Picture Tube Assembly.....	35E 102
for TV Chassis	98A 60-11
Plug, Interlock (on cabinet back).....	88A 15-6
Ring, Compression (for channel knob).....	18A 5-3
Rubber Channel; 3¾" long (for telev. back)....	12A 9-6
Rubber Pad (used under esc. mtg. brackets)....	12A 5-15
Screw, Deflection Yoke Plug Mtg. (#6x¼" S.T.)	1A 51-2-71
Screw, Focus Coil Plug Mtg. (6-32x½" RH MS)	60-500-C2-71
Sheet, Insulating (under tube mask).....	32D 122
Speaker, 10" PM.....	78B 41
Speed Nut, Speaker Mtg. (#8-32).....	2B 10-8-59
Spring, Mounting (for channel escutcheon).....	19A 48
Washer, Felt (Television) for 'Horizontal—Vertical, Contrast— Brightness, Off-Volume—Focus' knobs.....	5A 4-6
for 'Channel—Sharp Tuning' knobs.....	5A 4-5
Washer, Fibre (used between inner and outer television knobs).....	5A 1-30
Washer, Telev. Back Mtg. (.265x½"x⅜").....	4B 1-127-71

CABINET PARTS for 30F15, 30F16, 30F17

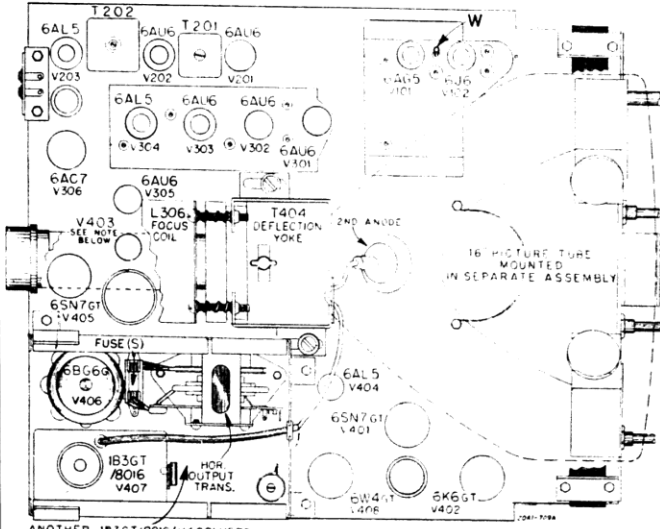
(All of the above model numbers may contain the suffix letters N, A, or AN)

Back, Album Compartment.....	43C 85-1
Back, Cabinet (Radio-Phono compartment).....	43B 64-1
Back, Cabinet (Telev. compt. Perforated metal).....	16D 5-1
Bracket, Plug Lock	15A 365
‡Cabinet, Wood for sets with wood television panel	
Walnut (30F15)	35E 103-1
Mahogany (30F16)	35E 103-2
Blond (30F17)	35E 103-3
for sets with all-plastic television panel	
Walnut (30F15)	35E 103-4
Mahogany (30F16)	35E 103-5
Blond (30F17)	35E 103-6
Carton and Fillers.....	44B 149
Clamp, Cable	11A 2-6
Cushion Plate, Fibre (Channel Escutcheon mtg.).....	32A 78
‡Door, Television and Radio-Phono pair for Walnut (30F15)	98A 48-16
pair for Mahogany (30F16)	98A 48-17
pair for Blond (30F17)	98A 48-18
‡Door, Record Compartment Complete for Walnut (30F15)	98A 48-19
for Mahogany (30F16)	98A 48-20
for Blond (30F17)	98A 48-21
Door Bumper, Sponge Rubber (⅜"x¼"x1").....	12A 5-6
Door Catch and Strike Plate, Bullet.....	98A 48-26
Escutcheon, Radio	23D 39-3
Escutcheon, Channel (less spring, speed nuts and fibre cushion plate) 2½"x2¼", for sets with wood television panel	23B 43
3½"x2¼", for sets with all-plastic television panel	23B 44-1
Escutcheon (Plastic), Television Panel and Picture Tube Frame.....	23D 54-2
Escutcheon, Picture Window for wood television panel.....	23D 49
for all-plastic television panel.....	23D 54-1
Eye Bolt (for Tilt-Out Spring).....	1A 87-1
Gasket, Sponge Rubber (for back of picture tube escutcheon)	12A 32-4

‡ Supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

Continued from preceding column

Description	Part No.
Grille Cloth (2 pieces) for Walnut (30F15) and Mahogany (30F16).....	98A 48-22
for Blond (30F17)	98A 48-23
Hinge Assembly, Tilt-Out Left side (facing front).....	AC183-1
Right side (facing front).....	AC183-2
Hinge, Knife Door pair for Walnut (30F15); Mahog. (30F16).....	98A 48-24
pair for Blond (30F17)	98A 48-25
Jewel, Pilot Light.....	82A 10-8
Knob, Door (Telev. and Radio Phono Compt.).....	33A 41-1
Knob, Door (Record Compartment).....	33A 41-2
Knob, Radio Tuning 'Telev-Phono-Radio' (Maroon and gold, single knob)	33C 40-6
'Tuning' (Maroon outer knob).....	33C 40-7
'AM-FM' (Gold inner knob).....	33C 40-8
'Tone' (Maroon outer knob).....	33C 40-9
'Off-Volume' (Gold inner knob).....	33C 40-10
Knob, Television Tuning for Walnut (30F15) and Mahogany (30F16)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical, Brightness and Focus' (Gold outer knob).....	33C 28-16
'Channel Selector' (Maroon inner knob).....	33C 28-19
'Horizontal, Contrast and Off-Volume' (Maroon inner knob).....	33C 28-20
for Blond (30F17)	
'Sharp Tuning' (Gold outer knob).....	33C 28-15
'Vertical, Brightness and Focus' (Gold outer knob).....	33C 28-16
'Channel Selector' (Gold inner knob).....	33C 28-17
'Horizontal, Contrast and Off-Volume' (Gold inner knob).....	33C 28-18
Nut, Hex (#4-40 for Tilt-Out Tie Bar).....	2A 1-6-71
Ring, Knob Compression.....	18A 5-3
Screen, Perforated (8"x11").....	16A 2-1-70
Screw, Telev. Chassis Mtg. (#¼-20x1¼").....	1A 67-44-71
Screw, Escutcheon Mtg. (#3x½" O.H. W.S.).....	1A 15-6-58
Screw, Tilt-Out Tie Rod Mtg. (#6-32x¼" Bd H.M.S.).....	365-250-C2-58
Screw Tilt-Out Spring Mtg. (#8-32x¼" Bd H.M.S.)	85-250-C2-21
Screw, Tilt-Out Tie Bar Mtg. (#4-40x⅞" R.H.M.S)	40-437-C2-71
Speaker, 10" PM.....	78B 47
Spindle Mounting Assembly (for holding extra centerpost and spindle).....	A2002
Speed Nut (Radio escutcheon mounting).....	2B 10-24-59
Speed Nut (Picture Tube escutcheon mtg.).....	2B 10-5-68
Speed Nut (#8-22 Speaker mounting).....	2B 10-8-59
Spring, Channel Escutcheon Retaining flat bronze; for channel escut. 23B 44-1	18A 27
wire; for channel escutcheon 23B 43.....	19A 48
Tilt-Out Spring (2½" long).....	19A 15-1
Tilt-Out Tie Bar Spring (8½" long, used in late production sets).....	19A 59
Tilt-Out Tie Bar (13⅞" long, used in early production sets)	15B 126-1
Tilt-Out Tie Rod (13⅞" long).....	28A 22-1
Touch-Up Paint (Coppertone Hammer).....	98A 54-3
Washer, Felt (Radio knobs)	5A 4-11
Washer, Felt (Television) for 'Horizontal—Vertical,' 'Contrast— Brightness, Off-Volume Focus' knobs.....	5A 4-6
for 'Channel-Sharp Tuning' knobs.....	5A 4-5



NOTE: V403 is 6AU6 in early sets, 12AU7 in later sets. See figures 81 and 83.
 Figure 78. Television Chassis, Top View Showing Tube Locations.

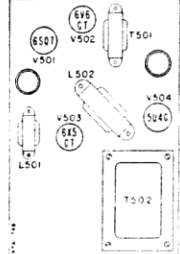


Figure 79. 4 Tube Power Supply.

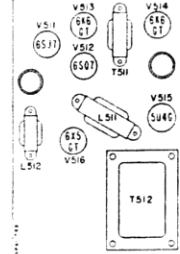


Figure 80. 6 Tube Power Supply.

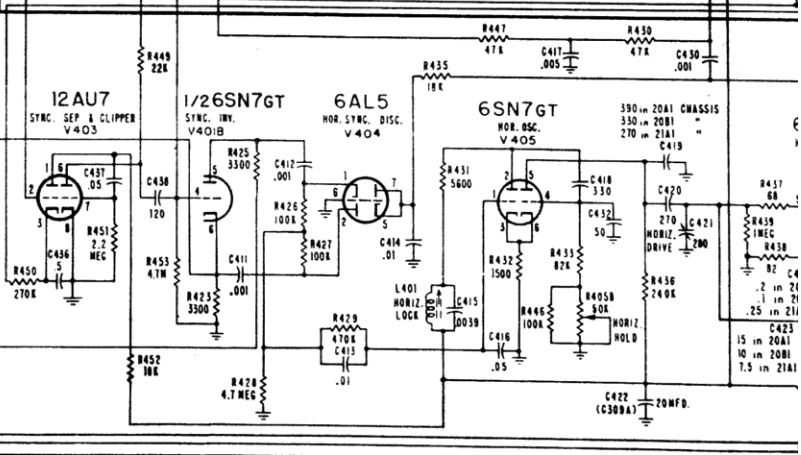
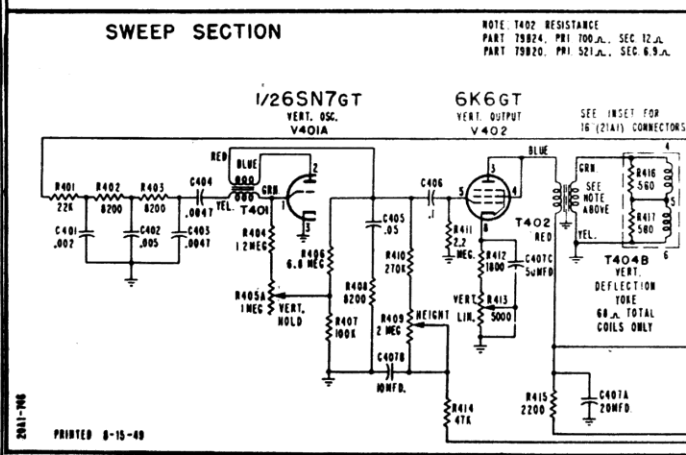
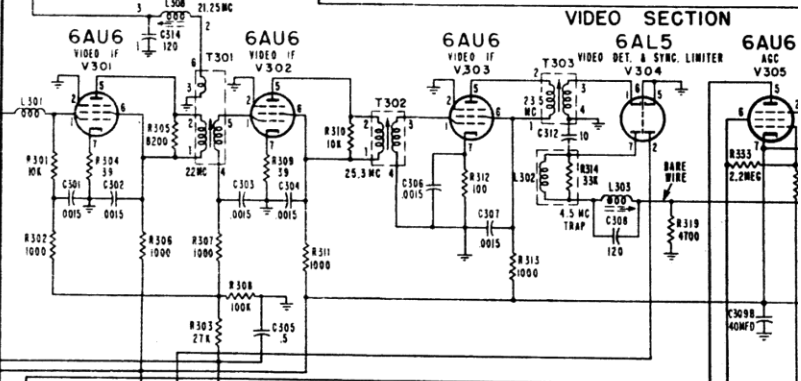
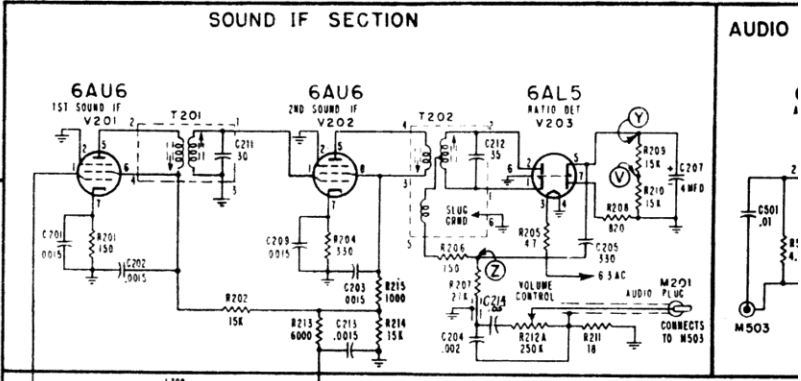
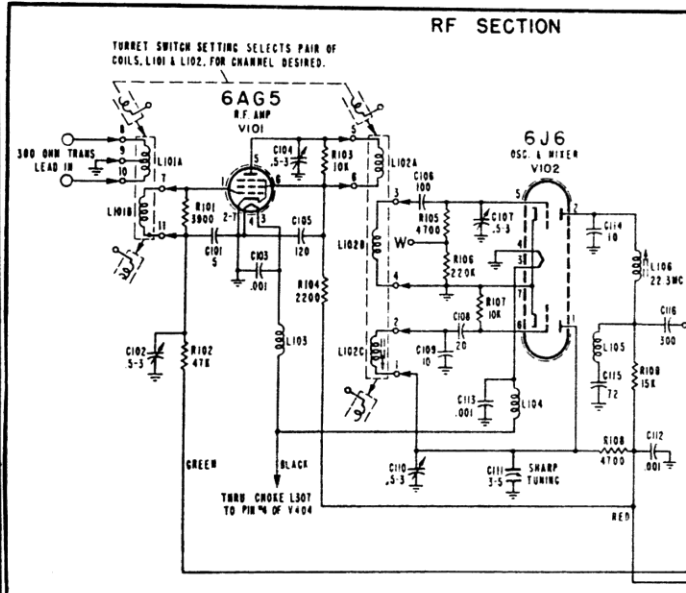
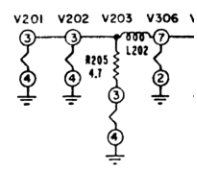
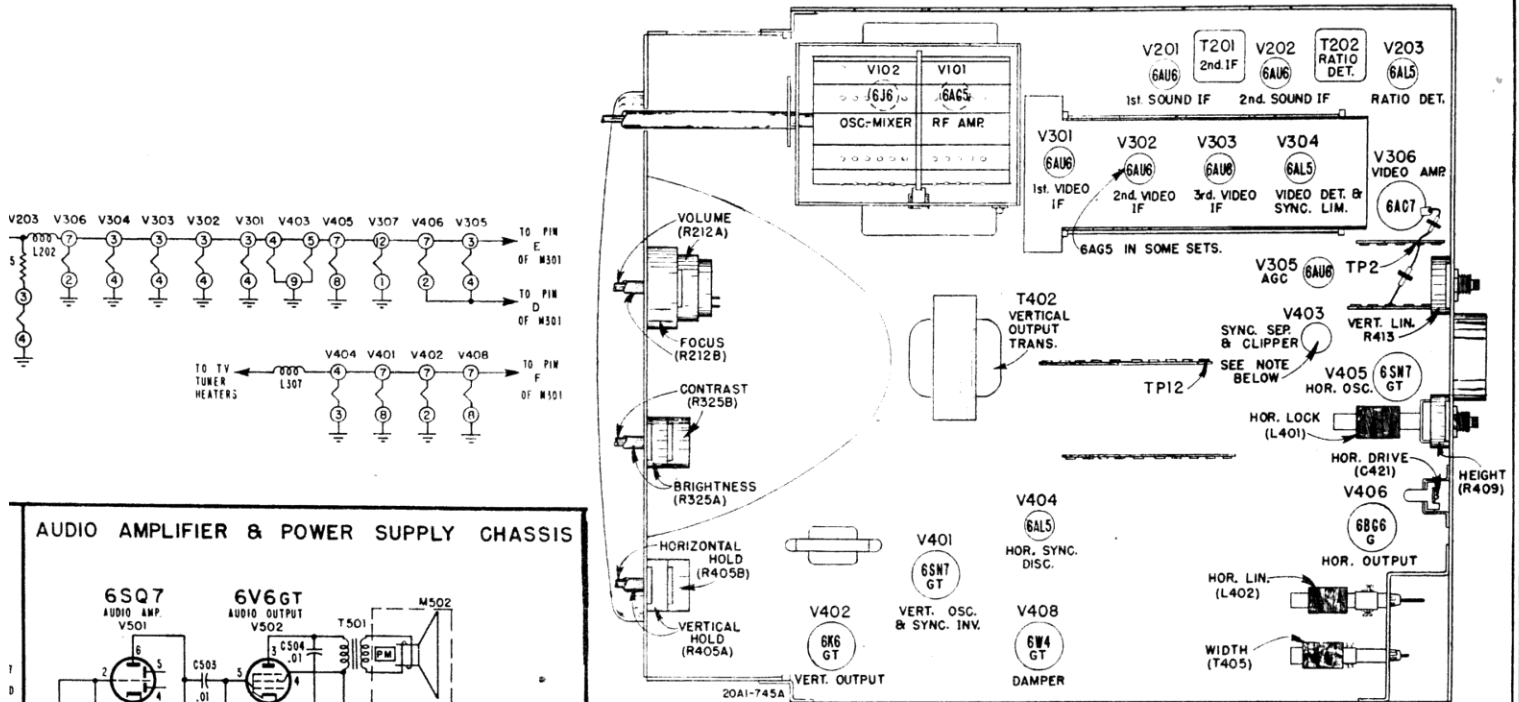
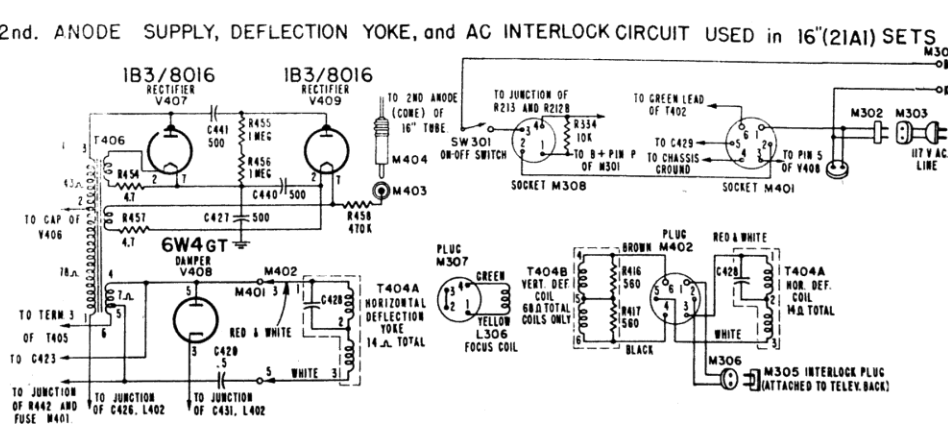
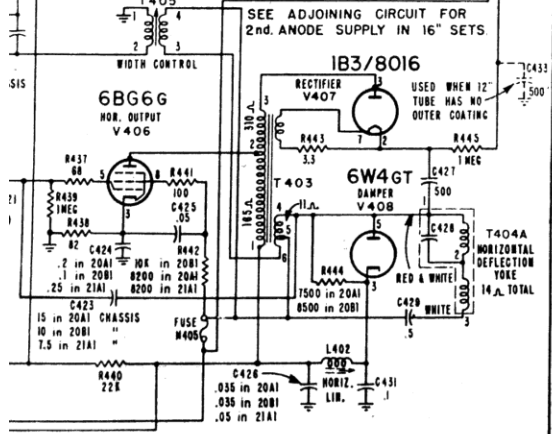
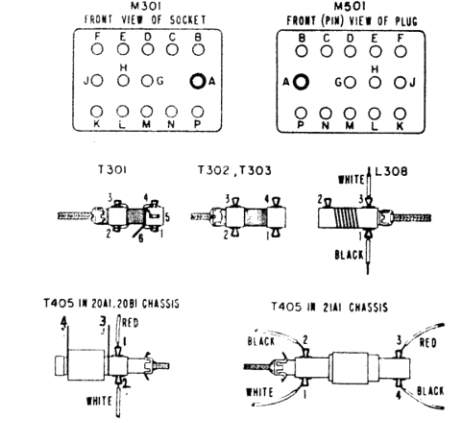
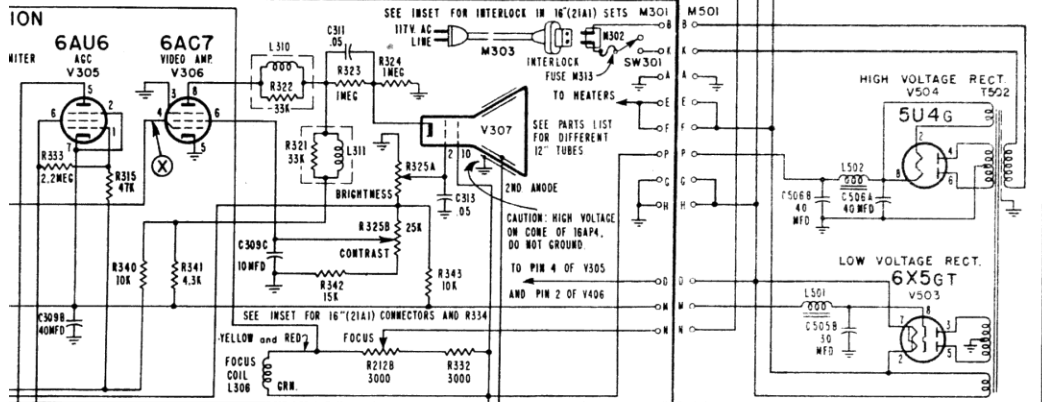
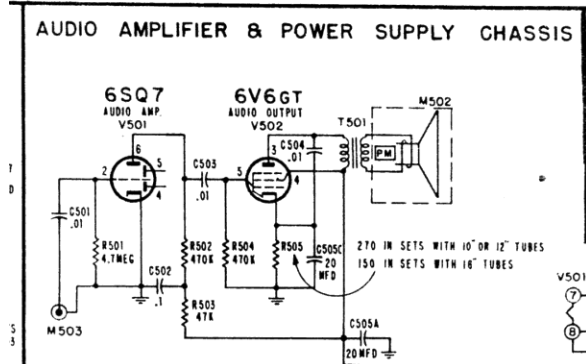


Figure 81. Schematic for 20A1, 20B1, 21A1 Television Chassis with 12AU7 Sync S Chassis having 12AU7 Sync Separator and Clipper are rubber-st

CHASSIS 20A1, 20B1, 21A1, with 12AU7 Sync Separator and Clipper



NOTE: V403 is 6A6 in early sets, 12AU7 in later sets. See figures 81 and 83. Figure 77. Television Chassis, Bottom View Showing Tube Locations.



7 Sync Separator and Clipper. (For sets with 6AU6 Sync Separator, refer to Figure 83 or 84.) rubber-stamped with run number "16" or higher at rear of television chassis.

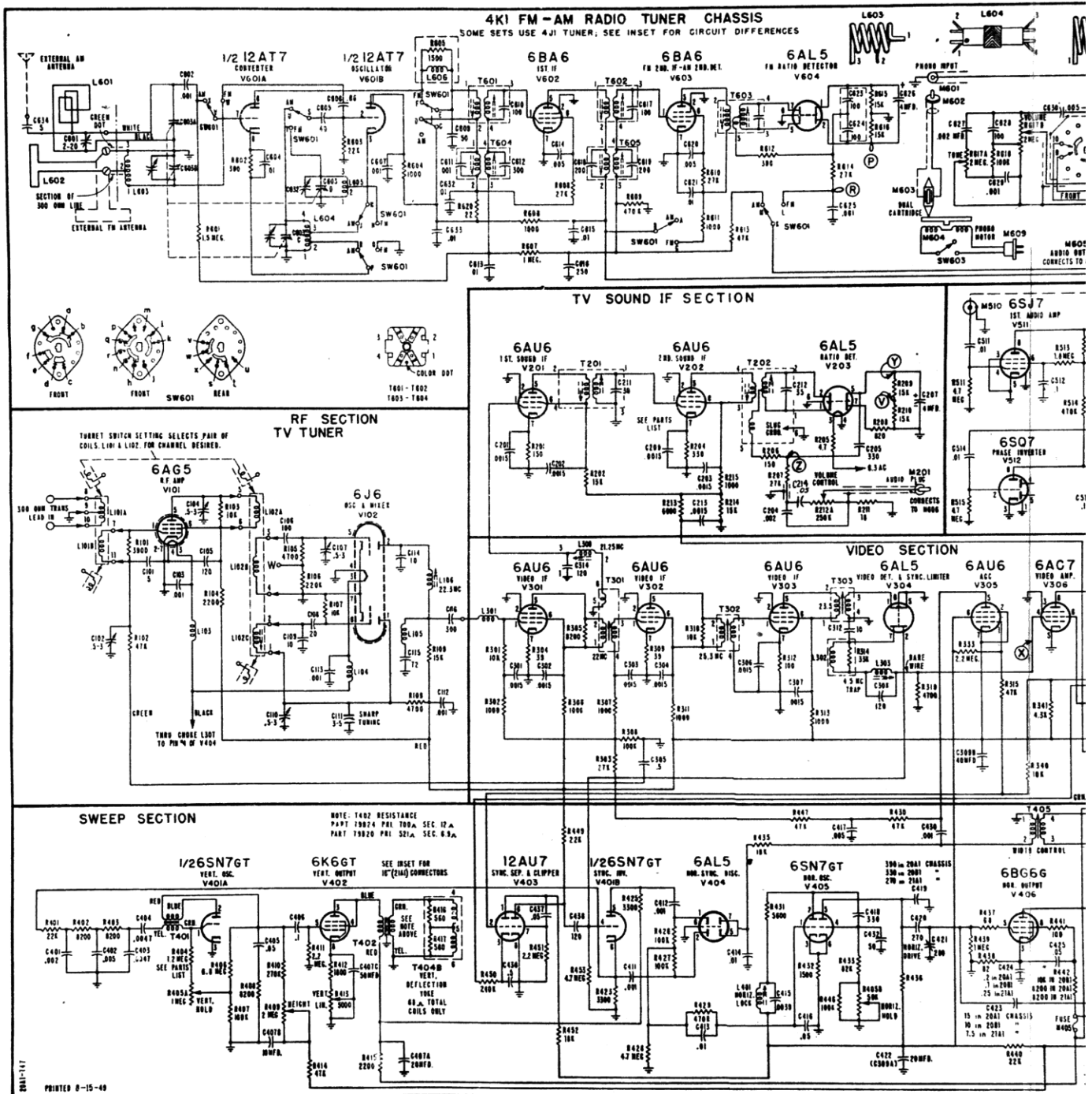
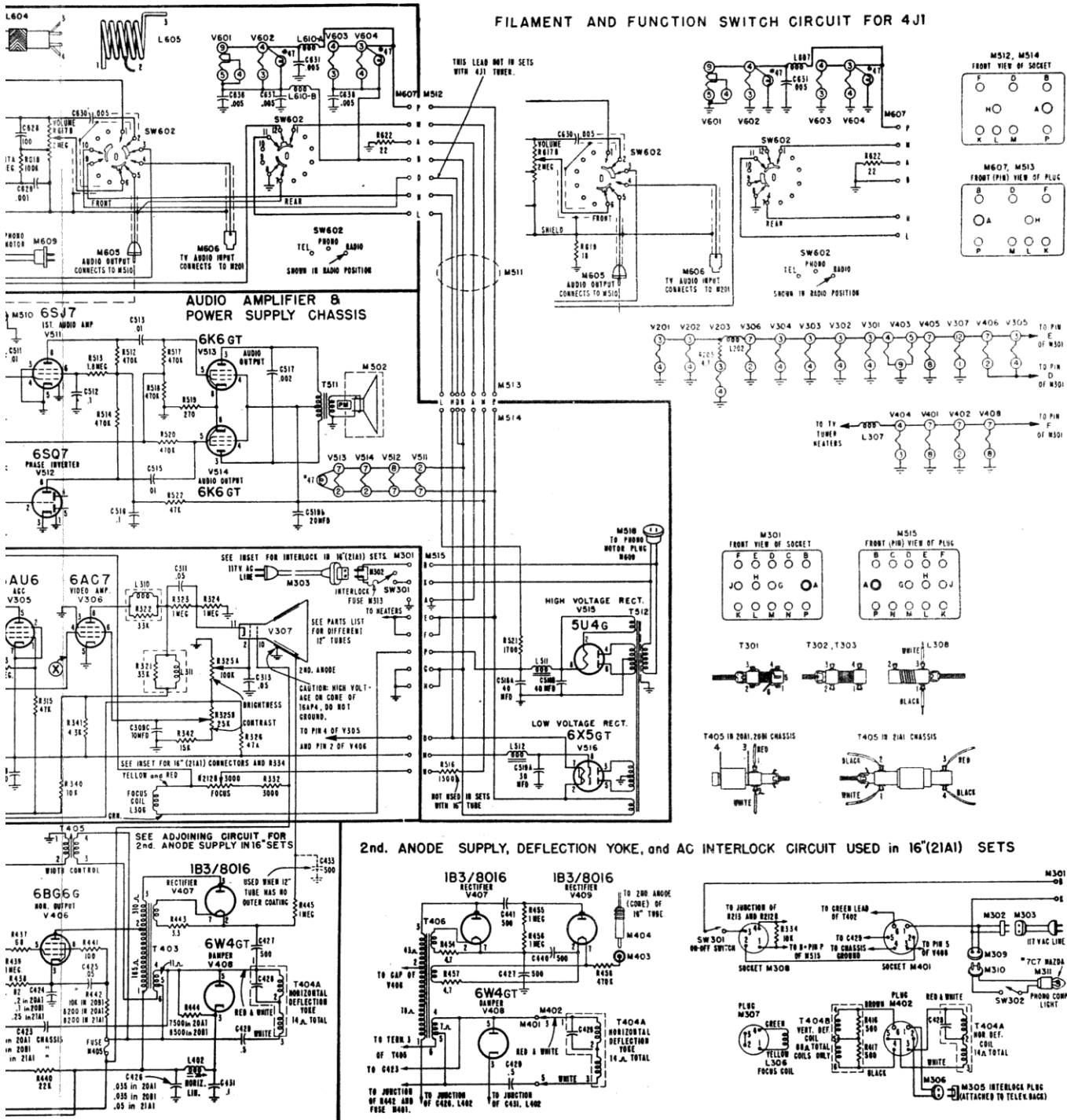


Figure 82. Schematic for 4K1 and 4J1 Radio Tuner, and 12AU7 Sync Separator and 6G66 Chassis having 12AU7 Sync Separator and Clipper are rubber. For sets with 6AU6 Sync Separator, 1

RECORD CHANGER: Admiral Model RC-221, Vol.20, Pages RCD.CH.20-9 to RCD.CH.20-20.



Tuner, and 20A1, 20B1, 21A1 Television Chassis with
Separator and Clipper.

Upper are rubber-stamped with run number "16" or higher.
Sync Separator, refer to Figure 83.

PARTS LIST

Electrical parts have symbols according to "section" location on schematics. For example: C204 is in the Audio section, V303 in the Video section, T402 in the Sweep section, etc.
Order parts by part number

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

RESISTORS

Sym.	Ohms	Part No.	Function
R101	3,900, 1/2 W.	98A 45-16	
R102	47,000, 1/2 W.	98A 45-17	
R103	10,000, 1/2 W.	98A 45-18	
R104	2,200, 1/2 W.	98A 45-19	
R105	4,700, 1/2 W.	98A 45-20	
R106	220,000, 1/2 W.	98A 45-21	
R107	10,000, 1/2 W.	98A 45-18	
R108	4,700, 1/2 W.	98A 45-20	
R109	15,000, 1/2 W.	98A 45-67	
R201	150, 1/2 W.	60B 8-151	Cathode bias
R202	15,000, 1/2 W.	60B 8-153	Isolating (R201 was 1,000; R202 was 47,000)
R203	27,000, 1/2 W.	60B 8-273	Damping Not used when T201 is part #72B86-1; see Production Change "F".
R204	330, 1/2 W.	60B 8-331	Cathode bias
R205	4.7 1/2 W.	60B 28-11	Fl. drooping
R206	150, 1/2 W.	60B 8-151	Ratio det. bal.
R207	27,000, 1/2 W.	60B 8-273	De-emphasis net.
R208	820, 1/2 W.	60B 8-821	Ratio det. bal. (R208 was 560 in early production.)
R209	15,000, 1/2 W.	60B 8-153	Ratio det. load
R210	15,000, 1/2 W.	60B 8-153	Ratio det. load
R211	18, 1/2 W.	60B 8-180	Audio regeneration suppressor

R212A	250,000 Pot. & Switch SW301	75B 12-3	Off-Volume cont.
R212B	3,000 Pot.		Focus control
R213	6,000, 5 W.	61A 3-11	B+ drooping
R214	15,000, 2 W.	60B 20-153	B+ bleeder
R215	1,000, 1/2 W.	60B 8-102	B+ decoupling
R215, C213 and L202 were added in later production; see Production Change "E".			
R301	10,000, 1/2 W.	60B 8-103	Grid leak
R302	1,000, 1/2 W.	60B 8-102	AGC isolating
R303	27,000, 1/2 W.	60B 8-273	AGC drooping R303 was 47 K in early sets. See Production Change "F".
R304	39, 1/2 W.	60B 8-390	Cathode bias
R305	8,200, 1/2 W.	60B 8-822	Primary loading R305 was 10,000 in very early sets; 12,000 in later sets. See Production Change "A".
R306	1,000, 1/2 W.	60B 8-102	Isolating
R307	1,000, 1/2 W.	60B 8-102	AGC isolating
R308	100,000, 1/2 W.	60B 8-104	AGC filter
R309	39, 1/2 W.	60B 8-390	Cathode bias

R310	10,000, 1/2 W.	60B 8-103	Primary loading R310 was 12,000 in early sets. See Production Change "A".
R311	1,000, 1/2 W.	60B 8-102	Isolating
R312	100, 1/2 W.	60B 8-101	Cathode bias
R313	1,000, 1/2 W.	60B 8-102	Isolating
R314	33,000, 1/2 W.	(part of L302) ... 73A 5-4	Damping
R315	47,000, 1/2 W.	60B 8-473	Isolating
R316	1,800, 1/2 W.	60B 8-182	Plate load
R317	3,300, 1 W.	60B 14-332	Plate load
R318	4,700, 1/2 W.	60B 8-472	Sync coupling
R319	4,700, 1/2 W.	60B 8-472	Video det. load
R320	68, 1/2 W.	60B 8-680	Cathode bias
Order exact replacement part			
R321	1 Meg, 1/2 W.	(part of L305) ... 73A 5-2	Damping
R322	33,000, 1/2 W.	(part of L311) ... 73A 5-1	Damping
R323	1 Meg, 1/2 W.	(part of L304 or L310) ... 73A 5-1	Damping
R324	1 Meg, 1/2 W.	60B 8-105	DC coupling
R325A	100,000	Dual Pot. ... 75B 11-4	Brightness control
R325B	25,000		Contrast control
R326	47,000, 1/2 W.	60B 8-473	Bleeder
R328	27,000, 1/2 W.	60B 8-273	Bleeder
R401			
R402			
R403			
R404			
R405A			
R405B			
R406			
R407			
R408			
R409			
R410			
R411			
R412			

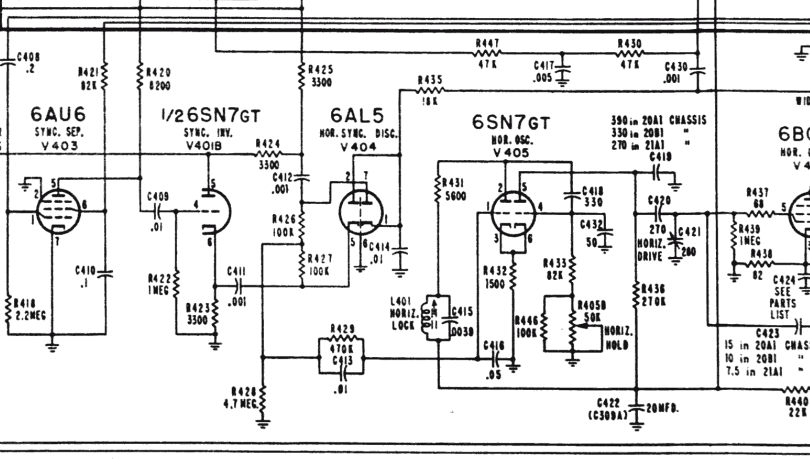
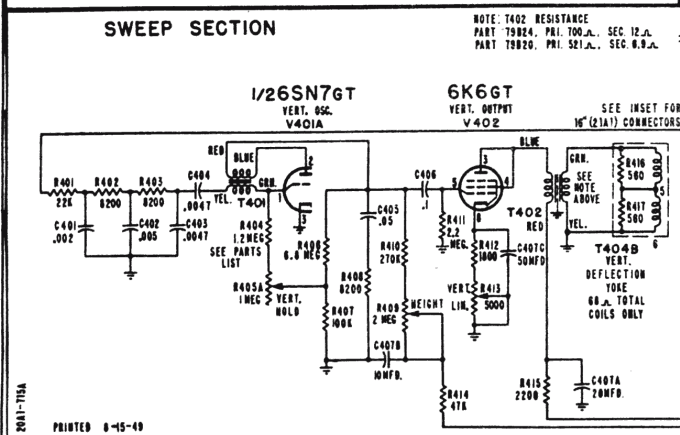
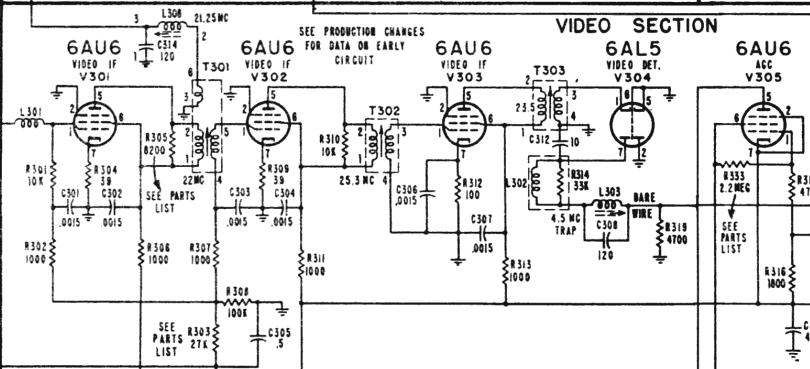
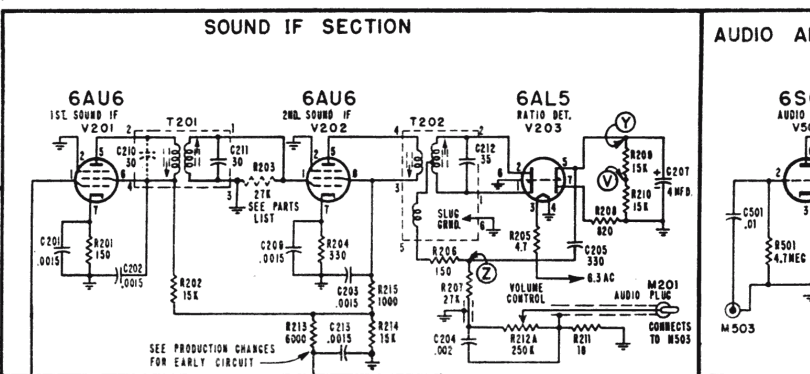
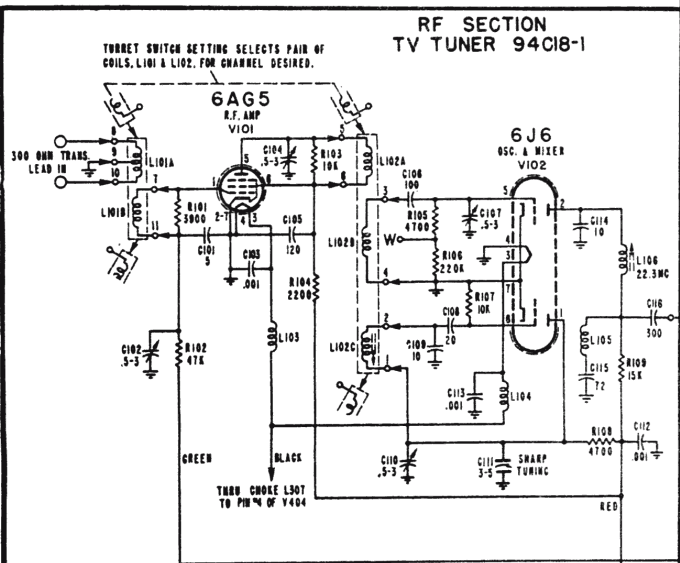


Figure 83. Schematic for 20A1, 20B1, 21A1 Television Chassis with 6AU6 Chassis having 6AU6 Sync Separator are rubber-stamped with

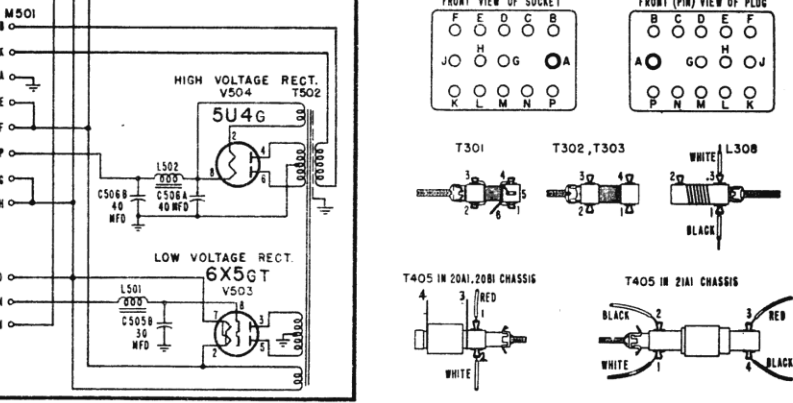
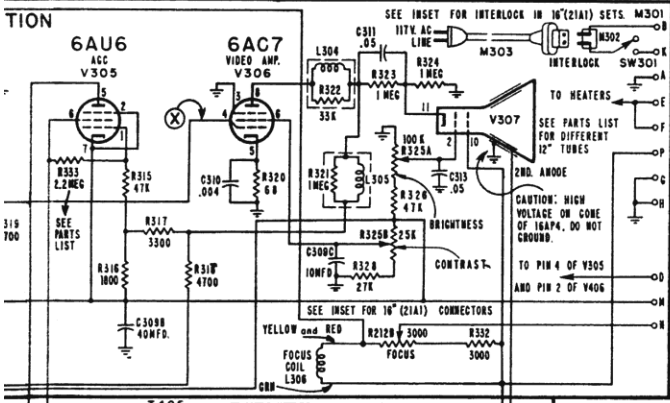
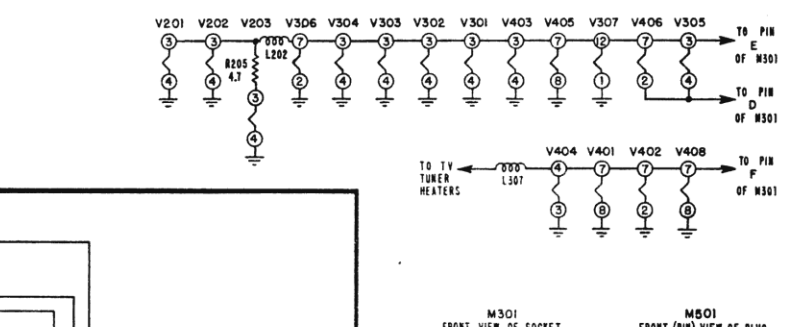
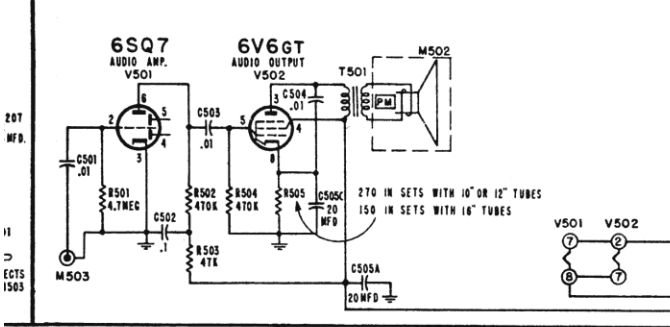
CHASSIS 20A1, 20B1, 21A1, with 6AU6 Sync Separator

R332	{ 3000, 5 W. in 20A1, 20B1 .....61A 1-15 3000, 7.5 W. in 21A1.61A 1-16 R332 was 5 W. in early 21A1 (16") sets. See Production Change "K".	Focus circuit Focus circuit
R333	2.2 Meg, 1/2 W. ....60B 8-225 See Production Change "D".	
R334	10,000, 2 W. ....60B 20-103 See Production Change "H".	Focus circuit
R340	10,000, 1/2 W. ....60B 8-103	Isolating
R341	4,300, 1 W. ....60B 13-432	B+ dropping
R342	15,000, 1/2 W. ....60B 8-153	Bleeder
R343	10,000, 1/2 W. ....60B 8-103	B+ dropping
R401	22,000, 1/2 W. ....60B 8-223	Vert. integrating
R402	8,200, 1/2 W. ....60B 8-822	Vert. integrating
R403	8,200, 1/2 W. ....60B 8-822	Vert. integrating
R404	1.2 Meg, 1/2 W. ....60B 8-125	Vert. osc. freq. control
R404 is generally 1.2 Meg. However, when R405A will not operate reasonably close to the center of its range. R404 may be 1 Meg. (Part #60B 8-105) or 1.5 Meg. (Part #60B 8-155).		
R405A	1 Meg. } Dual Pot. .75B 11-5	{Vert. Hold control
R405B	50,000 }	{Hor. Hold control
R406	6.8 Meg, 1/2 W. ....60B 8-685	Vert. osc. freq. control
R407	100,000, 1/2 W. ....60B 8-104	Vert. osc. freq. control
R408	8,200, 1/2 W. ....60B 8-822	Sweep peaking
R409	2 Meg. (Pot.) ....75A 13-3	Height control
R410	270,000, 1/2 W. ....60B 8-274	Vertical size
R411	2.2 Meg, 1/2 W. ....60B 8-225	Grid leak
R412	1,800, 1 W. ....60B 14-182	Cathode bias

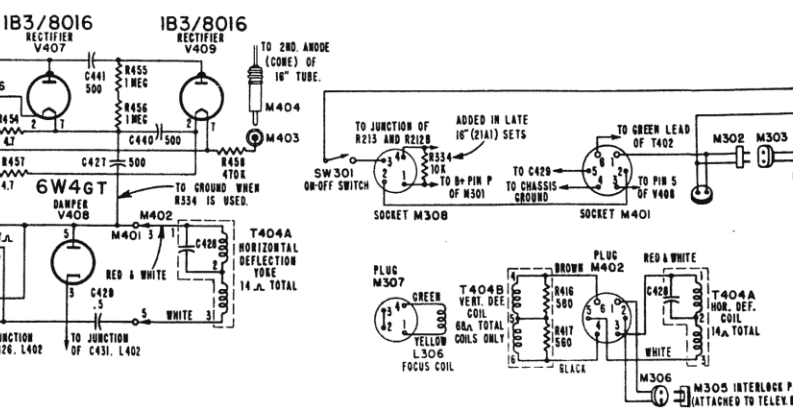
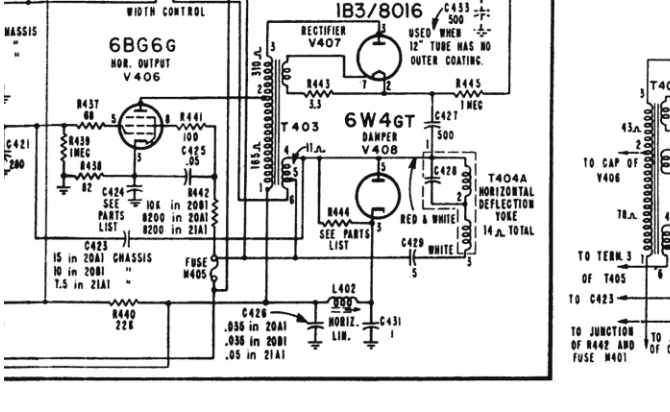
R413	5,000, 1/2 W. ....75A 13-1	Vert. lin. control
R414	47,000, 1/2 W. ....60B 8-473	Isolating
R415	2,200, 1 W. ....60B 14-222	Isolating
R416	560, 1/2 W. ....60B 8-561	T404B damping
R417	560, 1/2 W. ....60B 8-561	T404B damping
R418	2.2 Meg, 1/2 W. ....60B 8-225	Grid leak
R420	8,200, 1/2 W. ....60B 8-822	Plate load
R421	82,000, 1/2 W. ....60B 8-823	Screen dropping
R422	1 Meg, 1/2 W. ....60B 8-105	Grid leak
R423	3,300, 1/2 W. ....60B 8-332	Cathode bias
R424	3,300, 1/2 W. ....60B 8-332	Coupling
R425	3,300, 1/2 W. ....60B 8-332	Plate dropping
R426	100,000, 1/2 W., ±5% .60B 7-104	Sync disc. load
R427	100,000, 1/2 W., ±5% .60B 7-104	Sync disc. load
R428	4.7 Meg, 1/2 W., ±5% .60B 7-475	Sync DC return
R429	470,000, 1/2 W. ....60B 8-474	Coupling
R430	47,000, 1/2 W. ....60B 8-473	AGC load
R431	5,600, 1/2 W. ....60B 8-562	Plate load
R432	1,500, 1/2 W. ....60B 8-152	Cathode bias
R433	82,000, 1/2 W. ....60B 8-823	Grid leak
R435	18,000, 1/2 W. ....60B 8-183	Coupling
R436	240,000, 1/2 W., ±5% .60B 7-244	Plate load
(R436 was 270,000 in early sets.)		
R437	68, 1/2 W. ....60B 8-680	Parasitic sup.
R438	82, 2 W., ±5% .60B 20-820	Cathode bias
R439	1 Meg, 1/2 W. ....60B 8-105	Grid leak
R440	22,000, 2 W., ±5% .60B 20-223	Isolating
R441	100, 1/2 W. ....60B 8-101	Parasitic sup.

R442	{ 8,200, 2 W., ±5% in 20A1, 21A1....60B 20-822	Screen dropping
	{ 10,000, 2 W., ±5% in 20B1 .....60B 20-103	Screen dropping
R443	3.3, 1/2 W. ....60B 28-10	Filament drop
R444	{ 7,500, 25 W. in 20A1 .....61A 12-2	Hor. damping
	{ 8,500, 25 W. in 20B1 .....61A 12-1	Hor. damping
R444 was 6,300 ohms, 50 W. in early 20A1 sets. Before replacing, see Production Change "C".		
R445	1 Meg, 1 W.	10 KV filter
	in 20A1, 20B1 ....60B 28-33	Hor. Hold shunt
R446	100,000, 1/2 W. ....60B 8-104	Hor. Hold shunt
R447	47,000, 1/2 W. ....60B 8-473	AGC load
R449	22,000, 1/2 W. ....60B 8-223	Plate load
R450	270,000, 1/2 W. ....60B 8-274	B+ dropping
R451	2.2 meg, 1/2 W. ....60B 8-225	Grid leak
R452	18,000, 1/2 W. ....60B 8-183	Plate load
R453	4.7 meg, 1/2 W. ....60B 8-475	Grid bias
R454	4.7, 1/2 W. ....60B 28-11	Fil. dropping
R455	1 Meg., 2 W. ....60B 28-42	Coupling
R456	1 Meg., 2 W. ....60B 28-42	Coupling
R457	4.7, 1/2 W. ....60B 28-11	Fil. dropping
R458	470,000, 1 W. ....60B 14-474	Filter
(Some sets used 400,000; 1 W.)		
R501	4.7 Meg., 1/2 W. ....60B 8-475	Grid leak
R502	470,000, 1/2 W. ....60B 8-474	Plate load
R503	47,000, 1/2 W. ....60B 8-473	Plate isolating
R504	470,000, 1/2 W. ....60B 8-474	Grid leak

AUDIO AMPLIFIER & POWER SUPPLY CHASSIS



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



with 6AU6 Sync Separator. (For sets with 12AU7 Sync Separator, refer to Figure 81.)
r-stamped with run number "15" or lower at rear of television chassis.

RESISTORS

Sym.	Ohms	Part No.	Function
R505	270, 2 W., 5% in 20A1, 20B1	60B 20-271	Cathode bias
	150, 2 W., 5% in 21A1	60B 20-151	Cathode bias
R511	4.7 Meg., 1/2 W.	60B 8-475	
R512	470,000, 1/2 W.	60B 8-474	
R513	1.8 Meg., 1/2 W.	60B 8-185	
R514	470,000, 1/2 W.	60B 8-474	
R515	4.7 Meg., 1/2 W.	60B 8-475	
R516	1,500, 5 W.	61A 3-10	(R516 not used with 16" (21A1) sets.)
R517	470,000, 1/2 W.	60B 8-474	
R518	470,000, 1/2 W.	60B 8-474	
R519	270, 2 W.	60B 20-271	

R520	470,000, 1/2 W.	60B 8-474
R521	1,700, 20 W.	61A 3-9
R522	47,000, 1/2 W.	60B 8-473
R601	1.5 Meg., 1/2 W.	60B 8-155
R602	390, 1/2 W.	60B 8-391
R603	22,000, 1/2 W.	60B 8-223
R604	1,000, 1/2 W.	60B 8-102
R605	1,500, 1/2 W.	Part of L606
R606	1,000, 1/2 W.	60B 8-102
R607	1 Meg., 1/2 W.	60B 8-105
R608	27,000, 1 W.	60B 14-273
R609	470,000, 1/2 W.	60B 8-474
R610	27,000, 1 W.	60B 14-273
R611	1,000, 1/2 W.	60B 8-102
R612	390, 1/2 W.	60B 8-391
R613	47,000, 1/2 W.	60B 8-473
R614	27,000, 1/2 W.	60B 8-273
R615	15,000, 1/2 W.	60B 8-153
R616	15,000, 1/2 W.	60B 8-153

R617A	2 Meg., Tone	75B 11-7
R617B	2 Meg., Vol.	75B 11-7
R618	100,000, 1/2 W.	60B 8-104
R619	18, 1/2 W.	60B 8-180
R620	22, 1/2 W.	60B 8-220
(R620 was 1000 in early sets.)		
R622	22, 1/2 W.	60B 8-220

CONDENSERS

Sym.	Mmf.	Part No.	Function
C101	5 ± 5 mmfd. Cer.	98A 45-22	Zero Temp. Coeff.
C102	5 to 3, Cer. Trim.	98A 45-82	
C103	.001 mfd. min., Cer., Hi K.	98A 45-24	
C104	5 to 3, Cer. Trim.	98A 45-23	
C105	120, 5%, -750	Temp. Coeff., Cer.	98A 45-25

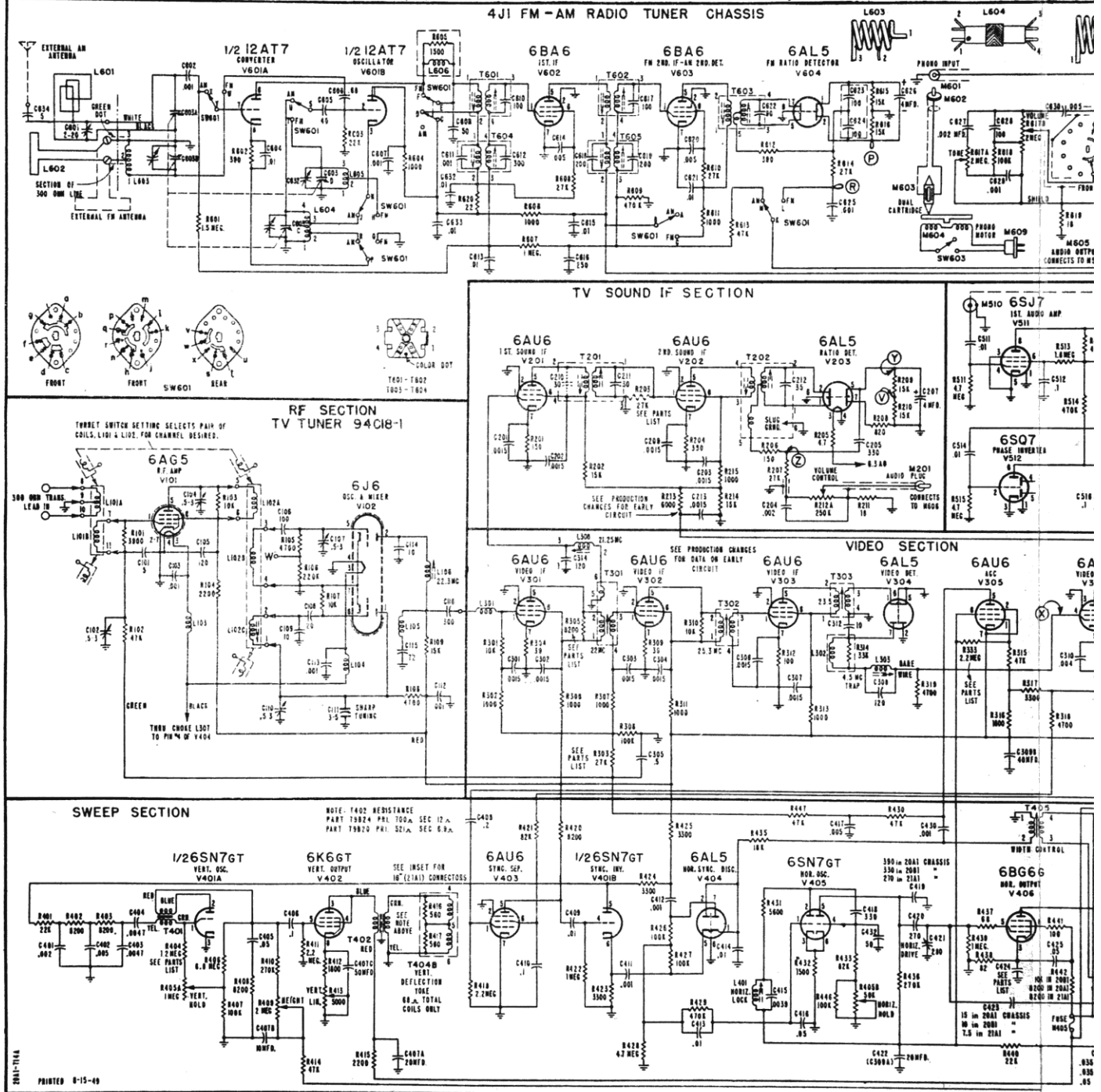


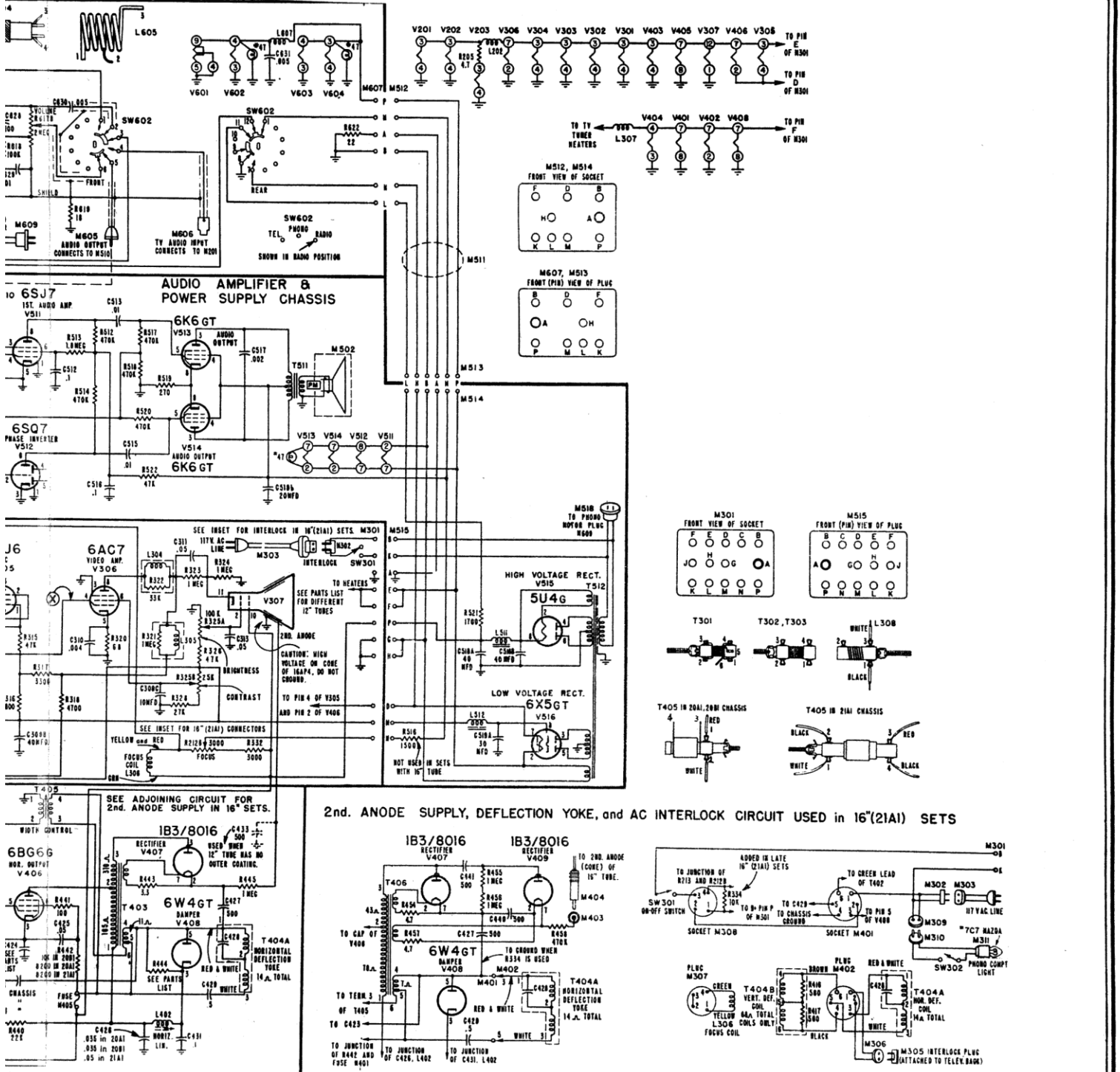
Figure 84. Schematic for 4J1 Radio Tuner Chassis and 20A1, 20B1, Chassis having 6AU6 Sync Separator and Clipper are rubber-stamped with (For sets with 12AU7 Sync Separator, or 4K1 Radio

CHASSIS 20A1, 20B1, 21A1,
with 6AU6 Sync Separator;
Radio Ch. 4J1

- C106 100, 5%, — 750
Temp. Coeff., Cer. .98A 45-26
- C107 .5 to 3, Cer. Trim. .98A 45-23
- C108 20, Zero Temp. Coeff.
Cer.98A 45-27
- C109 10, 5%, —750
Temp. Coeff., Cer. .65B 6-33
- C110 .5 to 3, Cer. Trim. .98A 45-23
- C111 3 to 5, Sharp Tuning
Part of M104
- C112 .001 mfd. min.,
Cer., Hi K.98A 45-24
- C113 .001 mfd. min.,
Cer., Hi K.98A 45-24
- C114 10, 5%, Zero Temp.
Coeff., Cer.98A 45-64
- C115 72, 3%, Sil. Mica . . .98A 45-65
- C116 300, Cer., Hi K. . . .98A 45-66

- C201 1,500, Ceramic65A 10-4 Audio bypass
- C202 1,500, Ceramic65A 10-4 Screen bypass
- C203 1,500, Ceramic65A 10-4 Screen bypass
- C204 .002 mfd., 600 v. . . .64B 5-14 Output filter
- C205 330, Mica65B 21-331 Output filter
- C207 4 mfd., 50 v, Elec. . . .67B 16-1 DC filter
- C209 1,500, Ceramic65A 10-4 Audio bypass
- C210 30Part of (early) T201
- C211 30Part of T201
- C212 35Part of T202
- C213 1,500, Ceramic65A 10-4 B+ decoupling
R215, C213 and L202 were added in later production.
See Production Change "E".

- C301 1,500, Ceramic65A 10-4 Decoupling
- C302 1,500, Ceramic65A 10-4 Decoupling
- C303 1,500, Ceramic65A 10-4 Decoupling
- C304 1,500, Ceramic65A 10-4 Decoupling
- C305 .5 mfd., 200 v.64B 6-27 AGC filter
- C306 1,500, Ceramic65A 10-4 Cathode bypass
- C307 1,500, Ceramic65A 10-4 Screen bypass
- C308 120, Mica, ±3%65B 1-10 4.5 MC trap
- C309A 20 mfd., 450 v. } Elect.
C309B 40 mfd., 250 v. }67C 15-7 Decoupling
C309C 10 mfd., 250 v. } LV filter
- C310 .004 mfd., 600 v. . . .64B 5-33 Cathode bypass



20A1, 20B1, 21A1 Television Chassis with 6AU6 Sync Separator.
Stamped with run number "15" or lower at rear of television chassis.
or 4K1 Radio Tuner, refer to figure 81 or 82.)

This supplement contains necessary service data for late production 20A1, 20B1, 21A1, 4J1, and 4K1 chassis. It also includes corrections and additions

The most important production change is the use of a new TV Tuner (part number 94C18-2). Page 64 explains how to identify the type of tuner used. When servicing, or ordering parts for a 94C18-2 Tuner (late production), BE SURE to use this Service Manual Supplement. When servicing, or ordering for a 94C18-1 Tuner (early production)

ION TRAP ADJUSTMENT FOR 16" (21A1) SETS

Care must be exercised in adjustment of the ion trap for 16" sets since there are two locations on the neck of the tube where a raster can be produced.

Locate the ion trap magnet approximately over the metal flags of the electron gun structure located near the tube base. Starting from this point, very carefully move

the ion trap forward or backward and at the same time rotate it slightly in either direction; adjust for the brightest raster possible with the lowest setting of the brightness control on which good line focus can be maintained. The second ion trap location, which is further forward on the tube neck, should not be used.

IMPORTANT

To identify a 4J1 or 4K1 Radio tuner, note that there are two leads for each pilot light in the 4K1 since the pilot lights and heaters are not returned to ground in the 4K1 chassis. In the 4J1 tuner, the pilot lights have one lead and are grounded by the pilot light mounting brackets; one side of the heater circuit is grounded to the 4J1 chassis. The Tuner type is also indicated on the serial number decal.

Note that the power supplies are stamped with their number; usually on the top of the chassis near the power transformer. The power supplies can also be identified by the following differences:

R505 is 270 ohms in the 4PA1 Power Supply.

R505 is 150 ohms in the 4PA2 Power Supply.

R516 is used in the 6PA1 and 6PA3 Supplies.

R516 is NOT used in the 6PA2 and 6PA4 Supplies.

Models 4H18C, 4H19C, 4H145C, 4H146C, 4H156C, 4H166C and 4H167C should be added to the list of models given on the first page of the service manual. (Note that any of these model numbers may have a suffix letter "N".) All these models use a 4K1 radio tuner and a 6PA3 power supply.

In the schematics for combination models, on pages 54 and 56, the band switch section (SW601) connected between the oscillator (V601B) and the 1st IF Transformer (T601) is shown in the FM position. This should have been shown in the AM position since all other sections of this switch are shown in the AM position.

Note that in the cabinet parts list, the descriptions given for channel escutcheons are not always correct. Channel escutcheons are supplied less mounting spring and any other parts if used. The following information should be noted: Channel escutcheons part #23B43, 23B43-1 and 23B43-2 require a hairpin wire mounting spring (part #19A48). Channel escutcheon part #23B44-1 requires a bronze mounting spring (part #18A27), two speed nuts (part #2B10-5-68) and a fibre cushion plate (part #32A78).

On page 49, the part number for cabinet doors on models 30F15, 30F16, 30F17 are incorrect. See parts list

20A1, 20B1, 21A1 Chassis 110 Volt Line Fuse

Late production "20A series" chassis have a 4 ampere line fuse in place of the 3 ampere fuse used in earlier production. The 4 ampere fuse provides adequate protection and is less likely to burn out with high momentary current surges.

When replacing burnt out 3 ampere fuses in early production models, the 4 ampere fuse, part number 84A1-18 should be used.

WRITING TO DISTRIBUTOR OR FACTORY

When reporting about any Admiral product, be sure to include the following information:

1. Model number and anything stamped on model label.
2. Fill out and send the Inspection Tag, if a tag is attached to chassis.
3. If Inspection Tag is *not* sent in, give all letters and

numbers stamped on back of chassis.

4. Detailed explanation to speed investigation.
5. If reporting parts failure, give symbol number, part number and any brand name on part.
6. For record changers, give model and anything stamped on model label on bottom of changer pan.

FM RF ALIGNMENT PROCEDURE

The FM RF alignment procedure for 4J1 and 4K1 Radio Tuners has been changed as indicated below to prevent possible spurious oscillation at the high frequency end of the FM band.

It is important to use the FM RF Alignment Procedure Chart given below and disregard the chart on page 21 of the "Television Service Manual for 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis" (Form No. S267).

FM RF ALIGNMENT PROCEDURE					
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 as described in "FM Alignment Equipment" on page 19 of the Service Manual.

IMPORTANT

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.

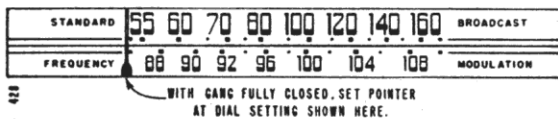


Figure 85. Pointer Setting.

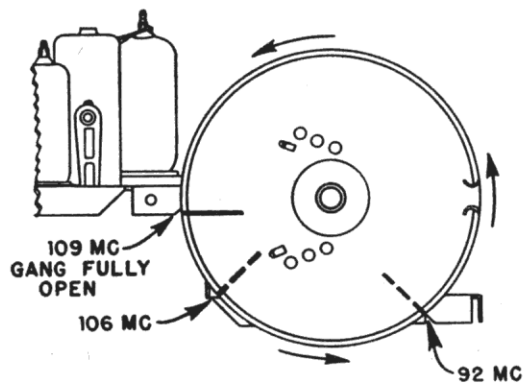


Figure 86. Locating Alignment Settings.

ADDITIONAL PRODUCTION CHANGES AND TROUBLE SHOOTING

(For earlier Production Changes and complete Trouble Shooting data, see pages 25 through 32 of Television Service Manual for 20A1, 20B1, 21A1, 4J1 and 4K1 Chassis, Form No. S267.)

S. 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.

T. 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, 1/2 watt resistor to a 240,000 ohm, 1/2 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.

A check can easily be made with an ohmmeter. When replacing R436, use part number 60B7-244.

U. 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.

V. 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. Then resolder the lead to the antenna terminals.

W. 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.

X. UNGROUNDED STATOR PLATE FOR SHARP TUNING CONDENSER C111 CHANGED TO MINIMIZE FREQUENCY DRIFT

A ceramic ungrounded stator plate was added to late production 94C18-1 Tuners. This new type stator plate is also used in the 94C18-2 Tuner and is shown in figure 86 as M118. Use of this stator minimizes frequency drift.

To install this new type stator plate on a tuner, see instructions on page 64.

Y. 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.

Z. 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.

CHANGE IN AMPERAGE OF LINE FUSE M313

A 3-ampere fuse F313 was added in late production sets (see production change "M" on page 26 of the manual). The amperage of line fuse M313 has since been increased from 3 amperes, 250 volts (part number 84A1-14) to 4 amperes, 250 volts (part #84A1-18) to avoid burning out of fuse due to possible momentary increase in current drain.

SERVICE HINTS

These service hints have been compiled as an addition to the "Trouble Shooting" information and chart on pages 27 to 32 in the "Television Service Manual for the 20A1, 20B1, 21A1, 4J1, 4K1 Chassis" (Form No. S267). In general, the regular trouble shooting procedures apply, but these hints should assist you in making a quick diagnosis of some service troubles. Note, however, that these service hints are not intended to cover all possibilities that may cause a particular trouble, but should be used together with the material in the service manual.

HINTS ON AUTOMATIC GAIN CONTROL (AGC) CIRCUIT

Note: Although reference numbers used in the following discussion apply to the schematic (Figure 81) showing the 12AU7 sync separator and clipper, these service hints apply to all 20A1, 20B1, 21A1 chassis.

The AGC system employed in the 20A1, 20B1, 21A1 chassis can be serviced more readily if its function is properly understood.

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. Before handling picture tube, see "Picture Tube Replacement" on page 33 of the Service Manual.

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; see "Cleaning Plastic Picture Tube Window" on page 32 of the Service Manual.

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.

Arcing or corona from the front of the picture tube (cone or screen) to the polyethylene insulating sheet. This may be due to presence of moisture or dust on the screen of the picture tube and on the polyethylene insulating sheet. It may also be due to locating the insulating sheet mounting staple too close to the edges of the picture window.

Clean picture tube screen. Remove the polyethylene sheet and clean it with carbon tetrachloride. If insulating sheet is deteriorated, torn, or has deep scratches or holes in it, replace it.

Arcing or corona inside the connector on the 2nd anode connector lead. Push the connector together for good contact. If the connector does not fit together securely, trim excess material off with a file or sharp knife.

If the arcing or corona is located in the 2nd anode supply in the chassis (does not stop when 2nd anode lead is disconnected) the remedy may be found in the following:

Arcing or corona between or across components mounted on the 1B3(8016) rectifier tube mounting strip. Make proper clearances, tighten mounting screws, check soldered connections. Clearance between the corona ring (below the 1B3/8016 tube socket) and the chassis should be approximately $\frac{3}{4}$ of an inch. Check for leakage across 500 mmfd. condensers (C440, C441 or C427). Clean surface of condensers, tube sockets, phenolic mounting strip, etc. with carbon tetrachloride. If arc-over or corona persists, replace the part.

Arcing or corona between terminals, leads or windings of horizontal output transformer. If arcing occurs across terminals, check for protruding edges of solder or strands of wire.

If arcing occurs between wire leads, separate leads. If insulation on leads is not burned badly, the surface of wire and terminal may be cleaned with carbon tetrachloride and the part may still be usable.

GENERAL SERVICE HINTS

Focus Control Requires Full Rotation, Or Some Tubes Have No Heater Voltage, Due To Use Of Wrong Power Supply. It is important to use the correct power supply with the various television and radio tuner chassis. To determine the correct power supply, refer to the "Model Identification Chart" given on page 58.

If the power supplies for 10-inch, 12-inch television sets are used in 16-inch television sets, or vice-versa, incorrect focus will result. The picture may focus at an extreme setting of the focus control.

If a 6PA1 or 6PA2 power supply (used in combination models having 4J1 tuners) is used in sets which require a 6PA3 or 6PA4 (used in combination models having 4K1 tuner), the heaters of the 6X5 rectifier (V516), the video amplifier (V306), and the horizontal output tube (V406) will not be connected to the heater string, and therefore will not operate.

The AM-FM radio tuners can be identified either by the serial number decal on the tuner chassis or by noting that the pilot lights in the 4K1 have two leads, while the 4J1 pilot lights have only one lead.

Split-frame Picture. See Production Change "T" in this supplement.

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.

No Raster, Sound OK. See production change "W"

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, re-

connect 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.

Weak Sound in Normal or Fringe Area. While watching picture, carefully turn slug A9 (see Figure 27, page 15 of the manual) approximately two turns inward for an increase in audio gain without loss of picture contrast. If further audio gain is necessary see Production Change F, on page 25 of Television Service Manual for 20A1, 20B1, 21A1, 4J1 and 4K1 chassis.

Whistle on AM Band of 4J1, 4K1 Tuner. See production change "U".

Noisy Volume Control. See Production Change "Y" in this supplement.

Horizontal Output Transformer Protection Fuse M405 Blows When Set Is Apparently OK. If the .25 ampere fuse M405 (located inside the high voltage housing) blows repeatedly, even though the television set appears to be operating properly, try replacing damper tube V408 (6W4GT).

3 Ampere Line Fuse M313 Blowing. See Production Change on page 61 in this supplement.

Cabinet Grille Rattle. See "Sound Has Excessive Bass Response" on this page.

Operating The 4J1, 4K1 Radio Tuner Without Television Chassis Connected to Power Supply. If the special adapter socket, illustrated on page 19 in the manual is used to operate the radio tuner without the television set, be sure that the band switch is in the "Radio" position. This adapter will not suffice to check the phonograph, since plate voltage is not supplied to the audio amplifier and output tubes when the band switch is in the "Phono" position.

BUILT-IN "ROTO-SCOPE" ANTENNA

Some late production models were equipped with the new Admiral Built-In "Roto-Scope" Antenna which may eliminate the need for either an indoor or outdoor antenna if the installation is in a "normal signal strength" area.

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.

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.

Weak Signal Areas: Some signal areas are so weak, or some particular locations are so unfavorable, that it is not possible to get satisfactory pictures with a built-in antenna. **Important:** Before connecting an indoor or outdoor antenna, be sure to disconnect the Built-In Roto-Scope antenna from the antenna terminals. Do not reconnect the Roto-Scope leads. When disconnected the matching stub (see figure 87) may be taped to the side of the cabinet.

If an indoor or outdoor antenna is to be used, select the proper Admiral antenna for the location and type of installation. Admiral antennas and transmission line are made of the highest quality material and workmanship. They are designed for ease of installation, good appearance, sturdiness, long use and top performance.

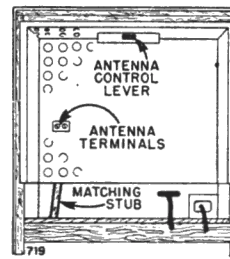


Figure 87

94C18-1 and 94C18-2 TELEVISION TUNERS

IMPORTANT: *It is very important to correctly identify a tuner to be serviced so that the proper service instructions and parts lists are used.*

TELEVISION TUNER IDENTIFICATION

Early production sets used the 94C18-1 Tuner. Late production sets use the 94C18-2 Tuner. These tuners are similar in physical appearance and electrical operation but are only interchangeable as a complete unit. Many of the parts are neither electrically or mechanically interchangeable. Some of the parts appear to be identical physically but are not interchangeable. For example: The detent rollers in these tuners both have a $\frac{3}{8}$ " diameter but the diameters of the bearings are different. The bearing diameter for the 94C18-1 Tuner is $\frac{1}{16}$ "; the bearing diameter for the 94C18-2 Tuner is $\frac{3}{32}$ ". Consequently it is important that the tuner being serviced is identified properly and the correct parts list used.

The most noticeable identifying feature of the 94C18-2 Tuner is the individual channel coils. The coils on the 94C18-2 Tuner are stamped 2F, 3F, 4F, etc. and the coil contacts are mounted on a "raised" portion on the surface of the coil. See Figure 89.

The coils on the 94C18-1 Tuner are stamped 2, 3, 4, etc. (without letter "F") and the coil contacts are mounted on the flat surface of the coil. (For 94C18-1 Tuner illustration see Figure 73 on page 37 of Television Service Manual, Form No. S267.)

Another distinguishing feature is the difference in detent plates. See the adjoining illustration for detent plate detail.

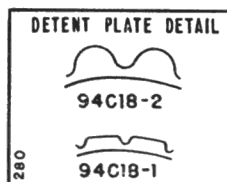


Figure 88.

94C18-2 TELEVISION TUNER SERVICE

Service procedure for the 94C18-2 Tuner is practically identical with service procedure for the 94C18-1 Tuner. Refer to pages 36 and 37 of the Television Service Manual (Form No. S267) for all service data for 94C18-1 tuners. The only difference in servicing the 94C18-2

Tuner is that the contact plate assembly M123 can not be repositioned and the detent spring M122 can not be reset. Therefore, the paragraphs under heading "Repositioning Contact Plate Assembly M103" and "Resetting Detent Spring M102" apply only to the 94C18-1 Tuner.

Replacement of the Ungrounded Stator Plate of Sharp Tuning Control. The new type (ceramic disc) ungrounded stator plate M118 will be supplied as a replacement for the metal stator plate with a phenolic wafer used in the 94C18-1 Tuner and early production 94C18-2 Tuners. The part number for the new type stator plate is 98A45-86. Note that this part is supplied with wiring lead and trimmer condenser C110 attached, because it is difficult to solder the wire lead to the silver plated surface on the ceramic stator plate disc.

To replace an early production stator plate (in 94C18-1 or very early 94C18-2 Tuner) remove turret assembly as described under "Removing Tuner Turret Assembly" on page 36 of the Television Service Manual (Form No. S267). Remove mounting rivets from stator plate by drilling out or clipping them out with diagonal wire cutters. Remove trimmer screw M115 and locking nut M114 from trimmer condenser C110. Unsolder wiring lead connecting trimmer to terminal on contact plate.

Assemble the replacement stator plate (M118) by placing the ceramic button over the $\frac{5}{8}$ " hole in the chassis with the wiring lead extending into the chassis. Place the mounting bracket over the ceramic button and mount securely using $\#4 \times \frac{3}{16}$ round head machine screws with $\#4-40 \times \frac{3}{16}$ hex nuts and $\#4$ shake proof lock washers. Mount trimmer condenser C110 in chassis and solder wire lead to its original terminal on the contact plate making this lead as short as possible. Dress wiring lead from ceramic stator plate to trimmer condenser C110 so it does not come in contact with the turret drum. After replacement of the stator plate, it will be necessary to make "Overall Oscillator Adjustment (A15)". See page 17 in Television Service Manual (Form No. S267).

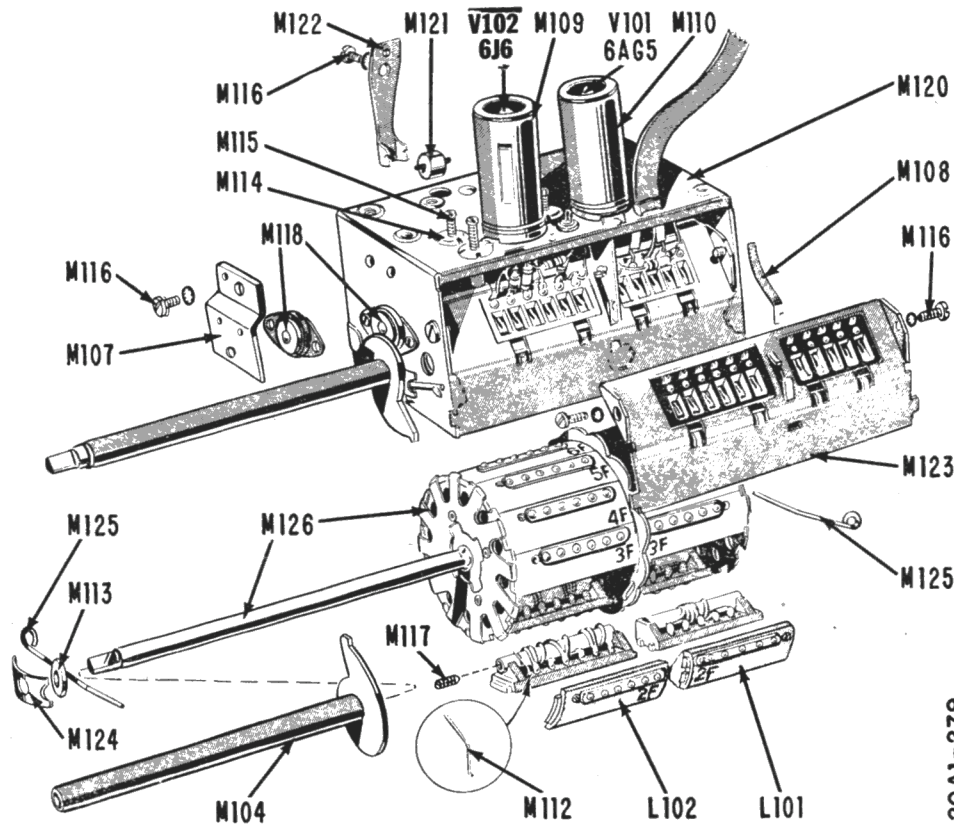


Figure 89. 94C18-2 Television Tuner, Exploded View

20A1-279

PARTS LIST FOR 94C18-2 TELEVISION TUNER

IMPORTANT

Use this parts list for 94C18-2 Tuner only. Some parts for early tuner (94C18-1) and late tuner (94C18-2) are not interchangeable. Be sure to use the parts list in the Television Service Manual (Form S267) for all 94C18-1 parts.

CONDENSERS

Sym.	Description	Part No.
C102	.5 to 3 mmfd, Ceramic Trimmer	98A 45-87

COILS FOR 94C18-2 TUNER

NOTE: Channel coils in this tuner are stamped 2F, 3F, 4F, etc.

L101	Antenna Coil	
	for Channel #2	98A 62-2
	for Channel #3	98A 62-3
	for Channel #4	98A 62-4
	for Channel #5	98A 62-5
	for Channel #6	98A 62-6
	for Channel #7	98A 62-7
	for Channel #8	98A 62-8
	for Channel #9	98A 62-9
	for Channel #10	98A 62-10
	for Channel #11	98A 62-11
	for Channel #12	98A 62-12
	for Channel #13	98A 62-13
L102	Mixer—Oscillator Coil	
	for Channel #2	98A 63-2
	for Channel #3	98A 63-3
	for Channel #4	98A 63-4
	for Channel #5	98A 63-5
	for Channel #6	98A 63-6
	for Channel #7	98A 63-7
	for Channel #8	98A 63-8
	for Channel #9	98A 63-9
	for Channel #10	98A 63-10
	for Channel #11	98A 63-11
	for Channel #12	98A 63-12
	for Channel #13	98A 63-13

Before inserting replacement coil L101 or L102, see that teeth at inner end of coils fit together when fitted in detent plate at center of turret. If necessary file teeth slightly.

MISCELLANEOUS PARTS FOR TV TUNER 94C18-2

To identify a 94C18-1 or 94C18-2 Tuner see illustrations. For illustration of 94C18-1 Tuner, see Figure 73 on page 37 of the Television Service Manual. For illustration of 94C18-2 Tuner, see Figure 89 in this Supplement.

Sym.	Description	Part No.
M104	Shaft Shell & Rotor Assy. (Sharp Tuning) (with 4½" long brass shaft Shell)	98A 45-71
M107	Bracket, Sharp Tuning Rotor Retaining	98A 45-61
M108	Spring, Detent Plate Grounding	98A 45-74
M109	Shield, Tube (Slotted; for 6J6)	98A 45-73
M110	Shield, Tube (Plain; for 6AG5)	98A 45-36
M112	Spring, Slug Retaining (Osc. coil)	98A 45-52
M113	Washer, Fibre Spacer (¼" ID x ½" OD)	98A 45-63
M114	Nut, Locking Spring (for trimmers)	98A 45-31
M115	Screw, Trimmer (4-36 x 5/8")	98A 45-33
M116	Screw, Bracket Mounting (6-32 x ¼")	98A 45-62
M117	Slug, Brass Tuning	98A 45-88
M118	Stator Plate (ungrounded); Silver with Ceramic Insulator, for Sharp Tuning C111. (includes mtg. bracket)	98A 45-86
M120	Tuner, Television (complete)	94C 18-2
M121	Roller, Detent (3/8" dia., 3/2" dia. bearing)	98A 45-82
M122	Spring, Detent (2 5/16" long)	98A 45-81
M123	Contact Plate and Bracket Assembly (uses wiping contacts)	98A 45-84
M124	Spring, Sharp Tuning Rotor Contact (Flat bronze 1 7/8" x 1/2")	98A 45-83
M125	Spring, Front and Rear Turret Shaft (Wire 2 3/4" long, 3/4" dia.)	98A 45-85
M126	Turret and Shaft Assembly (less coils) (5/8" shaft and 3/8" detent depression)	98A 45-80

HORIZONTAL OUTPUT CIRCUIT FOR 16" SETS (21A1 CHASSIS) WITH ROUNDED-END PICTURE WINDOW

Chassis with this change stamped run "19" or higher.

Greater sweep width is required for 16" sets using a rounded-end picture tube window. The schematic and parts list given below are for the horizontal output and

2nd anode supply circuits used in these sets.

For sets with rectangular picture window, see the Television Service Manual (Form No. S267).

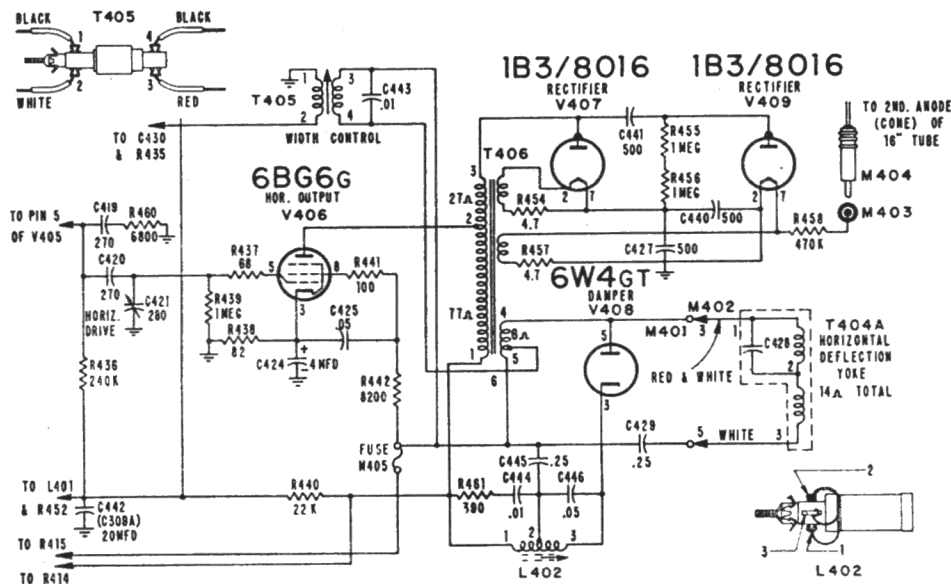


Figure 90. Horizontal Output Circuit For 16" Sets With Rounded End Picture Window.

PARTS FOR 16" SETS WITH ROUNDED-END PICTURE WINDOW

For 16" sets with rounded-end picture window, use this list FIRST, then use the list in the manual for any parts not given below.

RESISTORS

Sym.	Description	Part No.
R460	6800 ohms, 1/2 watt.....	60B 8-682
R461	390 ohms, 1/2 watt.....	60B 8-391

CONDENSERS

C424	4 mfd., 25 volts Electrolytic.....	67A 4-3
C444	.01 mfd., 200 volts.....	64A 2-7
C446	.05 mfd., 200 volts.....	64A 2-8
C445	.25 mfd., 600 volts.....	64B 6-3
C443	.01 mfd., 400 volts.....	64B 5-25

COILS AND TRANSFORMERS

L402	Coil, Horizontal Linearity for sets with rounded-end picture window (2.5 to 9 millihenrys).....	94A 26
	for sets with rectangular picture window (5.5 to 20 millihenrys).....	94A 3
T405	Transformer, Width Control for sets with rounded-end picture window	94A 19-1
	for sets with rectangular picture window	94A 19

Sym. Description

T406	Transformer, Horizontal Output for sets with rounded-end picture window	79C 17-3
	for sets with rectangular picture window	79C 17-2

CABINET PARTS FOR 25A15, 25A16, 25A17

(For all other parts see page 48 of "Television Service Manual for 20A1, 20B1, 21A1, 4J1, 4K1 Chassis")

Escutcheon, Television for sets with rectangular picture window.....	23D 42
for sets with rounded-end picture window.....	23D 55-1
Sheet, Insulating (for back of picture window) for use with 23D42 escutcheon.....	32D 122
for use with 23D55-1 escutcheon.....	32D 126
Gasket, Sponge Rubber for 23D42 escutcheon	12A 5-13
for 32D55-1 escutcheon	12A 32-6
(rubber channel 12A35-1 was used in early sets)	

SUPPLEMENTARY PARTS LIST

This parts list contains corrections and additions to the parts list in the Television Service Manual for 20A1, 20B1, 21A1, 4J1, and 4K1 Chassis (Form No. S267). Use this parts list **FIRST**, then use the list in the manual.

Sym.	Description	Part No.	Remarks
R436	240,000 ohms, 1/2 W, ±5%	60B 7-244	See Production Change T.
C102	.5 to 3 mmfd, Ceramic Trimmer	98A 45-87	Part number corrected.
C214	.05 mfd., 400 V	64B 5-22	See Production Change Y.
C311	.05 mfd., 600 V	64B 5-7	See Production Change W.
C437	.05 mfd., 600 V	64B 5-7	See Production Change S.
L104	Choke, Fil. Osc.	98A 45-14	Part number corrected.
L606	Coil, AM Peaking	73A 5-10	See Production Change U.
M302	Plug, AC Input (Interlock)	89A 22-2	Part number corrected.
M313	Fuse, Line (4 amp. 250 volts)	84A 1-18	See "Production Changes"
Clamp,	Webbing Strap Tension	19A 61	Part added.
	Slug, Brass Tuning (for L102)	98A 45-88	Omitted from parts list.
	Stator Plate (ungrounded); Silver with ceramic insulator, for Sharp Tuning C111. (includes mtg. bracket)	98A 45-86	See Production Change X.

CABINET PARTS FOR 30F15, 30F16, 30F17

When ordering parts for these models, use this parts list **FIRST**. Then see page 49 of the Television Service Manual (Form No. S267) for any parts not listed here.

Description	Part No.	Remarks
Door, Television and Radio-Phono		
pair for Walnut (30F15)	98A 48-67	Part number corrected.
pair for Mahogany (30F16)	98A 48-68	Part number corrected.
pair for Blond (30F17)	98A 48-69	Part number corrected.
Gasket, Sponge Rubber (includes chipboard backing for back of picture window escutcheon) for sets with 23D49 Picture Window Escutcheon	98A 61-2	Omitted from parts list.
Knob, Television Tuning		
for Walnut (30F15) and Mahogany (30F16)		These knobs for sets with all plastic television panel. For sets with wood television panel, see Television Service Manual (Form No. S267).
'Sharp Tuning' (Maroon outer knob)	33C 28-21	
'Vertical, Brightness and Focus' (Maroon outer knob)	33C 28-22	
'Channel Selector' (Gold inner knob)	33C 28-17	
'Horizontal, Contrast and Off-Volume' (Gold inner knob)	33C 28-18	

BUILT-IN ROTO-SCOPE ANTENNA

Antenna, Built-In Roto-Scope	
for 4H126A, B, C, or CN	A3023
for 4H145C or CN, 4H146C or CN	A3060
for 4H156A, B, C, or CN	A3046
for 4H18C or CN, 4H19C or CN, 4H166A, B, C, or CN	A3029
for 24A12, 24A125	A3029
for 24C15, 24C16	A3029
for 25A15, 25A16, 25A17	A3023
for 30F15, 30F16, 30F17	A3060

Built-In Roto-Scope Antenna used only in late production sets.

Universal Replacement Parts for All Roto-Scope Antennas

Antenna Lead (includes matching stub and spade lugs)	A3030
Control Lever Arm (includes switch blades)	A3024
Contact, Bronze Spring	18A 40