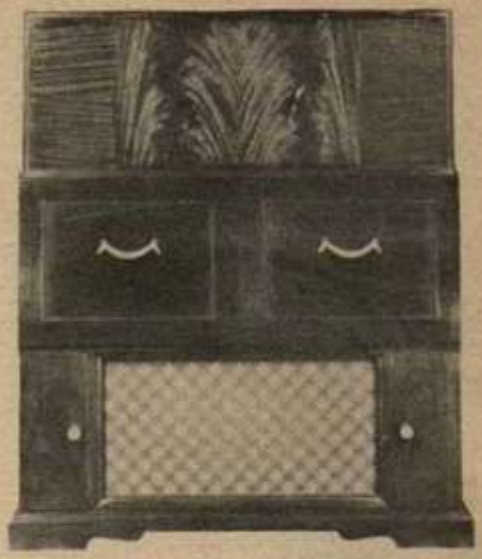
# CROSLEY

# TELEVISION RECEIVER INFORMATION

April, 1948 | MODEL 348 CP | No. 353



## GENERAL DESCRIPTION

Model 348CP is a television-radio-phonograph combination housed in an attractive mahogany console cabinet. Features of the receiver include: "Swing-A-View" picture, superlative picture brilliance, A-F-C of horizontal scan, high-stability "Picture Pilots", radio reception on the broadcast, shortwave, and F-M bands, and a fully automatic record changer.

## TABLE OF CONTENTS

## ELECTRICAL & MECHANICAL SPECIFICATIONS

Picture Size . . . . . 6-3/16" x 8-1/4"

## FREQUENCY COVERAGE AVAILABLE

Radio: Broadcast Band . . . . . 640 to 1600 KC
Shortwave Band . . . . 9.45 to 11.9 MC
Frequency Modulated Band ...Channel 200 to 300 . . . 88 to 108 MC

Television:

| Channel Number | Channel Freq. in MC | Video Carrier Freq. in MC | Sound Carrier Freq. in MC | Receiver Osc. Freq. in MC |
|---|---|---|---|---|
| 1 | 44-50 | 45.25 | 49.75 | 82.55 |
| 2 | 54-60 | 55.25 | 59.75 | 92.55 |
| 3 | 60-66 | 61.25 | 65.75 | 98.55 |
| 4 | 66-72 | 67.25 | 71.75 | 104.55 |
| 5 | 76-82 | 77.25 | 81.75 | 114.55 |
| 6 | 82-88 | 83.25 | 87.75 | 120.55 |
| 7 | 174-180 | 175.25 | 179.75 | 212.55 |
| 8 | 180-186 | 181.25 | 185.75 | 218.55 |
| 9 | 186-192 | 187.25 | 191.75 | 224.55 |
| 10 | 192-198 | 193.25 | 197.75 | 230.55 |
| 11 | 198-204 | 199.25 | 203.75 | 236.55 |
| 12 | 204-210 | 205.25 | 209.75 | 242.55 |
| 13 | 210-216 | 211.25 | 215.75 | 248.55 |

POWER SUPPLY RATING: at 117 volts, 60 cycle

Radio position . . . . . .70 watts
Phonograph position . . . . . .82 watts
Television position . . . . . .360 watts

AUDIO POWER OUTPUT RATING:

Undistorted . . . . . 4 watts
Maximum . . . . . 8 watts

LOUDSPEAKER:

Type . . . . . 10" Permanent Magnet
Voice coil impedance 3.2 ohms at 400 cycles

PICTURE TUBE:

Type . . . . . .10 FP 4
Brightness . . . . . .50 foot Lamberts

ANTENNA IMPUT IMPEDANCE:

F-M and Television . . . 75 ohm, balanced

WEIGHT:

Receiver, less cathode-ray tube . . . . . 221.5 lbs.
Shipping weight . . . . . .283 lbs.

DIMENSIONS:

| | Height | Width | Depth |
|---|---|---|---|
| Cabinet (outside) | 44½" | x 37½" | x 18½" |

DIMENSIONS: (Cont.)

| | Height | Width | Depth |
|---|---|---|---|
| Shipping carton (outside) | 47" | x 42" | x 23½" |

The principal components of the receiver include: -

TR-1 Main television chassis, located at bottom of cabinet.

TR-2 Picture chassis, located in "Swing-a-view" picture box.

TR-3 Radio chassis, located in radio tilt-out bin at right side of cabinet front.

Record Changer-located in pull-out drawer at left front of cabinet.

TUBE COMPLEMENT:

Main Chassis (TR-1)

| | | |
|---|---|---|
| (1) | 7F8 | Converter |
| (2) | 6AC7 | 1st. IF. Amplifier |
| (3) | 6AC7 | 2nd Video IF. Amplifier |
| (4) | 6AC7 | 3rd Video IF. Amplifier |
| (5) | 6AC7 | 4th Video IF. Amplifier |
| (6) | 6SN7GT | Video Cathode Follower & Phase Inverter |
| (7) | 6SG7 | 2nd Sound IF. Amplifier |
| (8) | 6SG7 | 3rd Sound IF. Amplifier |
| (9) | 6SG7 | 4th Sound IF. Amplifier |
| (10) | 6H6 | Sound Detector |

TUBE COMPLEMENT : (Cont.)

| | | |
|---|---|---|
| (11) | 6SN7GT | Pulse Inverter & Bias Rectifier |
| (12) | 6SN7GT | Vertical Deflection Oscillator |
| (13) | 6SN7GT | Vertical Deflection Output |
| (14) | 6H6 | AFC Detector |
| (15) | 6SN7GT | Horizontal Deflection Oscillator |
| (16) | 6BG6G | Horizontal Deflection Output |
| (17) | 6AS7G | Horizontal Deflection Damper |
| (18) | 6V6GT | High Voltage Oscillator |
| (19) | 1B3GT | High Voltage Rectifier |
| (20) | 5U4G | Power Supply Rectifiers (2 tubes) |

Picture Chassis (TR-2)

| | | |
|---|---|---|
| (21) | 6AC7 | Video Amplifier |
| (22) | 6SN7GT | DC Restorer & Cathode Follower |
| (23) | 6SN7GT | 1st Sync Separator & Sync Amplifier |
| (24) | 6V6GT | 2nd Sync Separator |
| (25) | 10FP4 | Picture Tube |

Radio Chassis (TR-3)

| | | |
|---|---|---|
| (26) | 6AC7 | 1st AM Mixer & FM Mixer |
| (27) | 7F8 | 1st & 2nd AM Osc. & FM Osc. |
| (28) | 6SG7 | 2nd AM Mixer & FM IF. Ampl. |
| (29) | 6SG7 | IF. Ampl. AM. & 2nd IF. Ampl. FM. |
| (30) | 6H6 | FM. Detector |
| (31) | 6SQ7 | AM. Det.-AVC-1st AF. Ampl. |
| (32) | 6V6GT | Output |
| (33) | 5Y3GT | Power Supply Rectifier |

RADIO-INTERMEDIATE AND OSCILLATOR FREQUENCIES:

Broadcast Band: 1st & 2nd I.F . . . 5825 and 167.5 KC

1st Oscillator . . . . . 6365 to 7425 KC
2nd Oscillator . . . . . 5992.5 KC
Shortwave Band 1st & 2nd I.F. . . . . 5825 and 167.5 KC
1st Oscillator . . . . . .14.275 to 17.725 MC
2nd Oscillator . . . . . .(fixed) 5992.5 KC

F-M Band
Intermediate Frequency. . . . . .10.7 MC
Oscillator . . . . . 98.7 to 118.7 MC

FREQUENCIES OF THE VIDEO IF. AMPLIFIER:

Video Carrier . . . . . 37.3 MC
Adjacent Channel and Sound Trap 38.8 MC
Accompanying Sound Trap . . . . . 32.8 MC
Adjacent Channel Picture Trap . . 31.8 MC

FREQUENCY OF THE SOUND IF. AMPLIFIER:

Sound Carrier . . . . . 32.8 MC
Sound bandwidth (between peaks) . . 300 KC
VIDEO RESPONSE: . . . . . to 3.5 MC
FOCUS: . . . . . Magnetic
DEFLECTION: . . . . . Magnetic
HORIZONTAL SCANNING FREQUENCY: . . . . . 15,750 cycles
VERTICAL SCANNING FREQUENCY: . . . . . 60 cycles
FRAME FREQUENCY: . . . . . 30 cycles
SCANNING: . . . . . Interlaced, 525 lines

OPERATING CONTROLS AND THEIR FUNCTIONS:

Function Switch . . . . Off-Radio-Phono-Video
Volume. . . . . Varies Audio Level
Radio Selector . . . . Selects Broadcast-Shortwave-FM.
Tone Control . . . Varies Tone & FM.

Horizontal, Vertical . . . . . Synchronizes Picture

Focus.. Sharpens & clarifies detail of Picture
Channel Selector. . . . . .Selects any of eight Television Channels.
Contrast . . . . . .Varies Video Gain
Brilliance . . . . . Adjusts Picture background

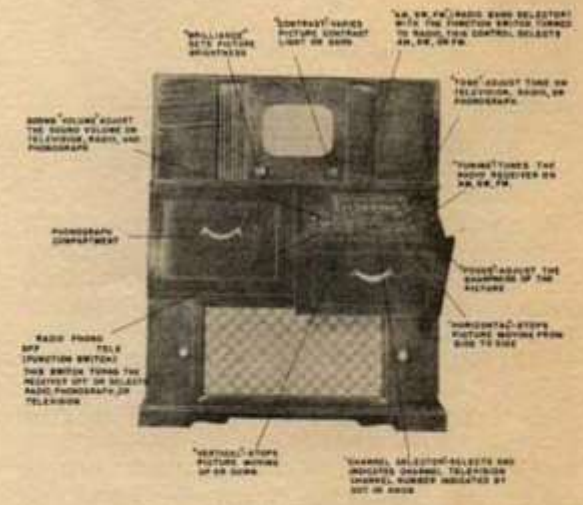


Fig. 2 - Operating Controls

## NON OPERATING TELEVISION CONTROLS

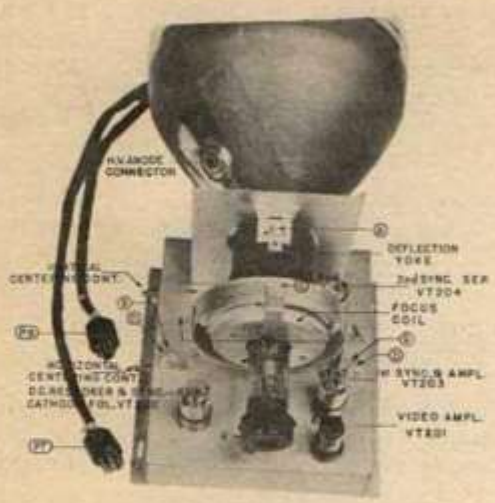



Fig. 3 - Picture Chassis

Horizontal Centering. . Side of Picture Chassis

Vertical Centering . . . Side of Picture Chassis

Focus Coil. . .Top of Picture Chassis (Wingscrews B-C-D)

Deflection Coil. . .Top of Picture Chassis (Wingscrew A)

### HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER WITH THE INTERLOCK BYPASSED, PICTURE BOX COVER REMOVED, OR CHASSIS REMOVED FROM CABINET INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. WHEN HANDLING THE HIGH VOLTAGE LEAD TO THE PICTURE TUBE THE RECEIVER POWER PLUG SHOULD BE DISCONNECTED FROM THE POWER RECEPTACLE.

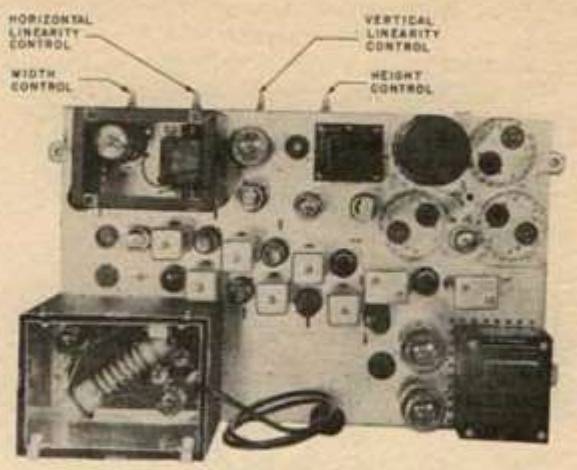



Fig. 4 - Top View of Main Chassis

Width . . . . . Rear of Main Chassis

Height . . . . . Rear of Main Chassis

Horizontal Linearity . . Rear of Main Chassis

Vertical Linearity . . . Rear of Main Chassis

### PICTURE TUBE - HANDLING PRECAUTIONS:

Do not open the picture tube shipping carton, install, remove or handle the picture tube in any manner unless safety goggles and heavy gloves are worn.

The glass bulb encloses a high vacuum, and, due to its large surface area, is subjected to considerable air pressure. For these reasons picture tubes must be handled with more care than ordinary receiving tubes.

The large end of the glass bulb must not be struck, scratched, or subjected to more than moderate pressure at any time. The neck of the tube must slide smoothly through the deflection yoke and focus coil. If it does not the coil may not be lined up properly, or the openings obstructed in some way. Remove the tube and investigate the trouble. Do not force tube.

All picture tubes are shipped in special cartons and should be left in cartons until ready for installation. Keep the picture tube carton for future use.

## LOCATION OF THE RECEIVER

The receiver should be located to permit viewing from the proper distance. For best results in detail the picture should be observed from a distance of three to five feet.

CAUTION: When placing the receiver, care should be taken not to block the ventilating holes in the bottom or back of the cabinet, as this may cause the receiver to overheat.

## INTERFERENCE

Under some conditions, interference may be present in the picture, this is not the fault of the receiver. See Users Instruction Book for pictures on interference.

## UNPACKING, ASSEMBLING AND ADJUSTING

### UNPACKING

The 348CP receiver is shipped complete in one crate except for the picture tube and "Picture Pilots."

### TO UNPACK RECEIVER

1. Remove four shipping bolts under bottom of container.
2. Remove the wood screws on outside bottom cleats of container.
3. Remove container by carefully lifting straight up until it clears cabinet.
4. Remove cardboard "hat" and kimpak from top of cabinet.
   NOTE: THIS CABINET IS SHIPPED IN FIRST CLASS CONDITION WITH CONSIDERABLE ATTENTION GIVEN TO THE FINISH. HANDLE WITH CARE.
5. Remove wood screws to open back.
6. Loosen main chassis mounting bolts and remove masonite strips under chassis.
7. Remove wood shipping block from rear of radio bin.
8. Take out the 1/4-inch screw that holds bin slide rigidly during shipment and replace screw in the hole about 4 inches back. This screw limits the travel of the shelf.
9. Remove the two wood screws holding shipping straps to rear cabinet rail under the automatic record changer. Remove the two machine screws holding straps to metal drawer slides and discard shipping straps. Be sure to REPLACE SCREWS IN DRAWER SLIDES.
10. Remove cardboard support used to hold down turntable and pickup arm during shipment, exercising care in its removal so as not to damage the Floating Jewel Needle.
11. Place pickup arm on rest.
12. Pull straight up on Record Support Knob until the record support clears spindle. Swing record support in either direction until pin in shaft drops into locating groove.
13. Remove turntable by lifting carefully up over spindle.
14. With a screwdriver turn down the two mounting screws (turn clockwise) and remove the cardboard under record changer base plate. The record changer should now float freely on its mounting springs.
15. Carefully replace turntable. If it does not seat properly, push back idler drive wheel to clear side of turntable, and lower turntable into place. In its normal position the idler drive wheel rests against the inside of the turntable side by spring tension.

### ASSEMBLING

1. Remove side panel of picture box and take out the hold-down screw inside of picture box. This screw holds picture box to shelf during shipment. Carefully remove the cardboard shipping strips between Picture Box and cabinet by pulling the strips back. Remove the two hex head shipping screws (S) on the base of the Focus Coil Supports (See figure 3). Remove the two No. 8 hex nuts in the upper inside, front corners of the box and the two screws in the lower front outside surface. This allows removal of the front safety glass panel of the picture box.
2. Remove all packing material from inside the picture box. Make sure that all tubes are firmly seated in the sockets.
3. Loosen the thumbscrew (A) and slide the deflection yoke towards the rear of the picture box and tighten. (See Fig. 3).
4. In order to insure that the picture tube can be inserted with a minimum of strain placed on the glass neck, the opening in the focus coil must be lined up with the opening in the deflection yoke.
5. To check the alignment of the focus coil with the yoke, look through the front of the picture box. The yoke and focus coil must be in line. If the opening is blocked by the focus coil, loosen the thumbscrews (B), (C) and (D) Fig. 3). Raise, lower or rotate the focus coil until a clear opening is obtained. Tighten the thumbscrews in this position.

6. Loosen the screws and raise the two lower picture tube centering brackets (on front of picture box) to approximately mid-position and tighten the screws. Do not open the picture tube shipping carton, install, remove or handle the picture tube in any manner unless safety goggles and heavy gloves are worn.
7. To unpack the picture tube, cut the paper tape along the edges and tear open the carton flaps. Remove the cardboard covering from the face of the tube.
8. Grasp the sides of the tube and remove from the carton.

   NOTE: It is good practice to have the receiver prepared, so that when the picture tube is removed from the carton, it can be placed immediately in the receiver. If it is necessary to set the tube down, it should always be placed face down, on a clean piece of paper or cloth to prevent scratching of the face. It should also be placed in a position where it will not be accidentally upset or jarred. Never handle the tube by the fragile neck.
9. Insert the neck of the picture tube (with the anode connector 90° to the right, see Fig. 3) through the deflection and focus coils until the tube face is approximately flush with the front of picture box. If the tube sticks or fails to slip into place smoothly, investigate and remove the cause of the trouble. Do not force the tube.

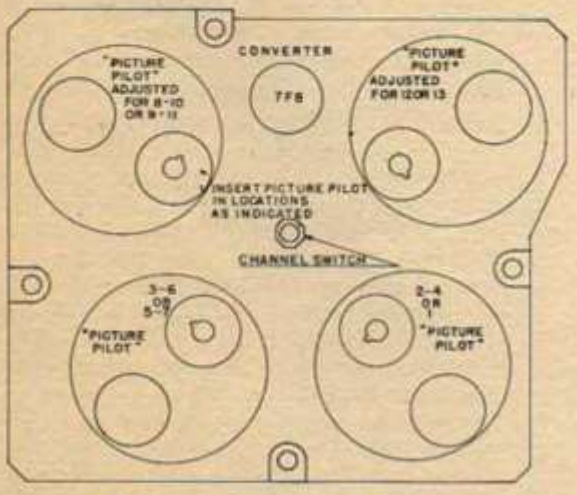



Fig. 5 - Socket Location for Picture Pilot

10. Adjust the four centering brackets until the face of the picture tube is in the center of the opening.
11. Tighten the four centering bracket screws securely.
12. Clean the picture tube screen surface and front panel safety glass with a good window cleaner. Replacing Front Panel.
13. Hold front panel in place and check to see if the picture tube is centered in front panel. If not, remove panel and adjust picture tube centering brackets accordingly.
14. Replace No. 8 nuts in upper inside corners and press bottom of panel into place. Insert and tighten the two lower panel screws.

    CAUTION: Do not put any pressure on the picture tube while installing the front panel. If the panel does not fit smoothly into place, investigate and remove the cause of the trouble.
15. Slide the picture tube forward against rubber gasket as far as possible. Loosen the thumbscrew (A), slide the deflection yoke as far forward as possible and tighten.
16. Insert the clip of the high voltage lead into the picture tube second anode connector.

    CAUTION: Only a small amount of pressure should be applied to the connector when inserting the clip. If appreciable pressure is applied, the seal may be broken permitting air to leak in the tube thus ruining the picture tube.
17. Attach the picture tube socket to the tube base.
18. Close the back of the receiver, connecting the interlock, but do not replace screws at this time.

## ADJUSTING THE TELEVISION RECEIVER

1. Plug the receiver power cord into a 115 volt, 60 cycle power supply outlet. Turn the function switch to "Video", the brilliance control fully clockwise and contrast control counter-clockwise.

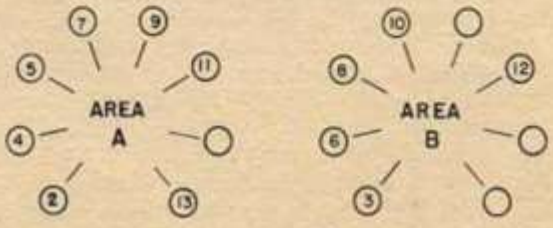



Fig. 5A - Selector Switch Positions

2. Turn the brilliance control on the front of the picture box counter-clockwise slightly until the illumination of the screen of the picture tube begins to decrease.
3. Adjust the focus control on the radio panel until the horizontal lines on the screen of the picture tube are clear and distinct.
4. Turn the vertical and horizontal centering controls to the center of their range. If the illumination on the screen is dark in one of the corners, it is due to misadjustment of the focus coil.
5. To adjust, loosen the three wingscrews (B), (C) and (D) and raise, lower or rotate the focus coil until the shadow is removed. When the focus coil is correctly adjusted, the entire screen should be illuminated. If the illumination does not cover the screen, the edges of the illuminated area should be straight and the illuminated area should be approximately centered on the screen.
6. When the above condition is obtained, tighten the wingscrews with the focus coil in this position.
7. The lines on the screen of the receiver should be horizontal or squared with the picture mask. If the lines are not horizontal loosen the wingscrews at (A), rotate the yoke around the neck of the tube until the lines are horizontal and tighten the wingscrews. Always push the yoke forward as far as it will go. It will now be necessary to obtain the picture in order to make further adjustments.
   Although it is possible to make these adjustments on a program picture, it is recommended that whenever possible these adjustments be made on a test pattern.
8. Connect the leads from the antenna to the receiver antenna plug and plug into the receiver antenna socket. For multiple antenna installation see "Description of Picture Pilot, page 10.
9. Insert the Picture Pilots for the desired channels into the correct sockets on the main chassis as shown in sketch, Fig. 5.
10. Place the channel number markers in the plastic caps and place on the buttons around the channel selector switch.
    These numbers must coincide with the channel actually selected by the switch. (See Fig. 5 & 5A ). These figures show the required position of the Picture Pilots and the selector switch position.
11. Tune in a television station as follows: (For detailed instructions see the Users Instruction Booklet.)
    A. Set the CHANNEL SELECTOR to the desired channel.
       Note: If the indicating dot on the CHANNEL SELECTOR KNOB does not correspond to the channel the receiver is tuned to, remove knob; replace knob so that the dot indicates the correct channel.
    B. Turn the SOUND VOLUME to approximately mid-position.
    C. Turn the CONTRAST control fully counter-clockwise.
    D. Turn the BRILLIANCE control clockwise until a glow appears on the screen then counter-clockwise until the glow just disappears.
    E. Turn the CONTRAST control clockwise until a glow or pattern appears on the screen.
    F. Adjust the VERTICAL hold control until the pattern stops vertical movement.
    G. Adjust the HORIZONTAL hold control until picture is obtained and centered.
    H. Adjust the CONTRAST control for suitable picture contrast.
    I. Adjust sound volume for desired level.
12. If the picture on the screen is off center vertically adjust the vertical centering control on the side of the picture box chassis.
13. If the picture is off center horizontally adjust the horizontal centering control on the side of the picture box chassis. At this point a good picture should be obtained on the screen.
14. If the small vertical detail in the pattern is indistinct, adjust the focus control until maximum clarity is obtained.
15. If the picture is too tall or too short, too wide or too narrow, or if the circles are not round, it will be necessary to adjust the height, width or linearity controls on the rear of the main chassis.
16. When adjustments are completed, make certain all wingscrews are tight and replace masonite panel to side of picture box.
17. Replace screws in cabinet back.

**DO NOT MAKE ADJUSTMENTS ON ANY CONTROL UNLESS THAT ADJUSTMENT IS SPECIFICALLY DIRECTED IN THESE INSTRUCTIONS. ADJUSTMENT OR OTHER CONTROLS REQUIRES THE USE OF SPECIAL TEST EQUIPMENT.**

## CORNER OF PICTURE SHADOWED

To correct, adjust the focus coil on top of the chassis (Fig. 3) until the corners of the picture are clear. If may then be necessary to readjust the centering controls in the back of the receiver. It may also be necessary to readjust the focus control to provide the clearest picture.

PICTURE BLURRED AND INDISTINCT
To clear the picture, adjust the focus control in the back of the receiver.

PICTURE AT AN ANGLE
To correct, rotate the deflection yoke. (Fig. 3)

PICTURE OFF-CENTER HORIZONTALLY
To correct, adjust the horizontal centering control.

PICTURE OFF-CENTER VERTICALLY
To correct, adjust the vertical centering control.

PICTURE CROWDED (or Stretched) AT TOP
To correct, adjust the vertical linearity control. It may also be necessary to readjust the height control.

PICTURE TOO TALL OR TOO SHORT
To correct, adjust the height control. It may also be necessary to readjust the vertical linearity control.

PICTURE TOO WIDE OR TOO NARROW
To correct, adjust the width control.

PICTURE STRETCHED AT ONE END
To correct, adjust the horizontal linearity control. It may also be necessary to readjust the width control.

WEAK OR DISTORTED SOUND
In rare cases an adjustment of the local oscillator frequency in the Picture Pilot is required. (See Oscillator Adjustment).

THERE SHOULD BE NO ADJUSTMENTS REQUIRED FOR RADIO OR PHONOGRAPH OPERATION. THESE CAN BE CHECKED IN THE USUAL MANNER. (SEE USERS INSTRUCTIONS.

OSCILLATOR ADJUSTMENT
The local oscillators in the 348CP Picture Pilots should be adjusted for correct frequency on all channels available in the area at the time of installation. It is necessary to make this adjustment at a time when the temperature of the Picture Pilot is approximately midway between room temperature and final operating temperature, to accomplish this, Adjustments are made as follows:

(1) With channel selector switch in blank position, operate receiver with Picture Pilot plugged in place for 20 to 40 minutes.
(2) At the end of the warm up period unscrew the cap on top of the Picture Pilot. See Fig. 6 and Fig. 8.
(3) Turn Channel selector switch to the desired station and, if necessary adjust the oscillator trimmer screw until the television sound signal is heard.
(4) Reduce the signal strength to the receiver by adding a resistive attenuator, until hiss is heard together with the desired signal. Then adjust osc. trim. screw for minimum hiss without tuning out the desired signal.
(5) Screw the cap on tightly.
(6) Repeat the above for all available channels.

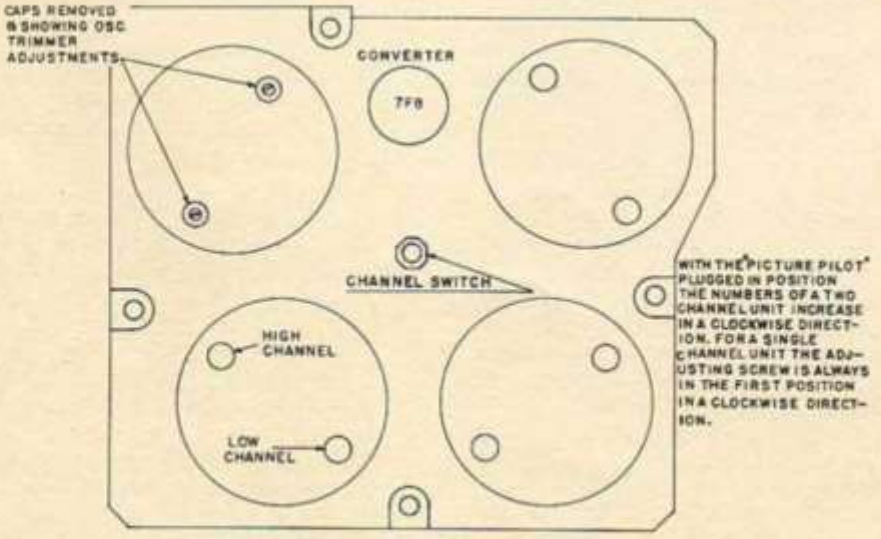



Fig. 6 - Showing Location of Oscillator Trimmers "Picture Pilot"

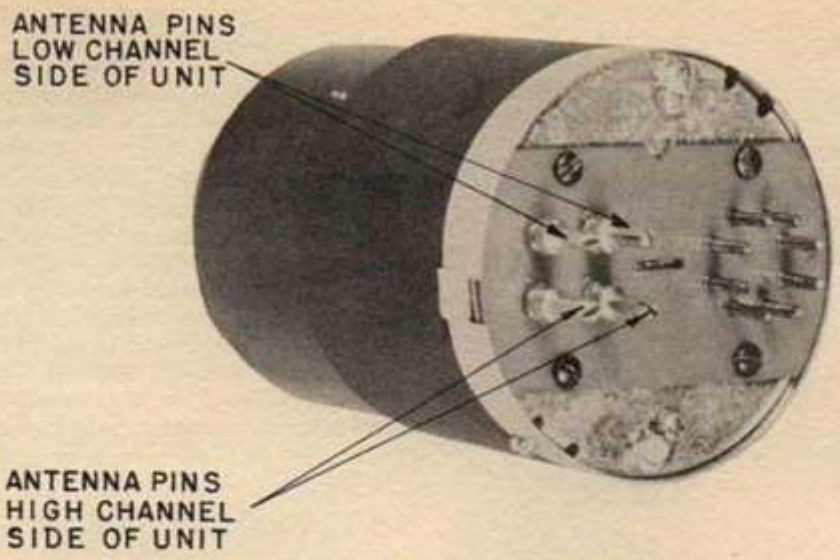



Fig. 7 Bottom View of "Picture Pilot" Showing Ant. Pin Locations.

## DESCRIPTION OF PICTURE PILOT AND HOW IT FITS INTO THE TELEVISION ALLOCATION PLAN

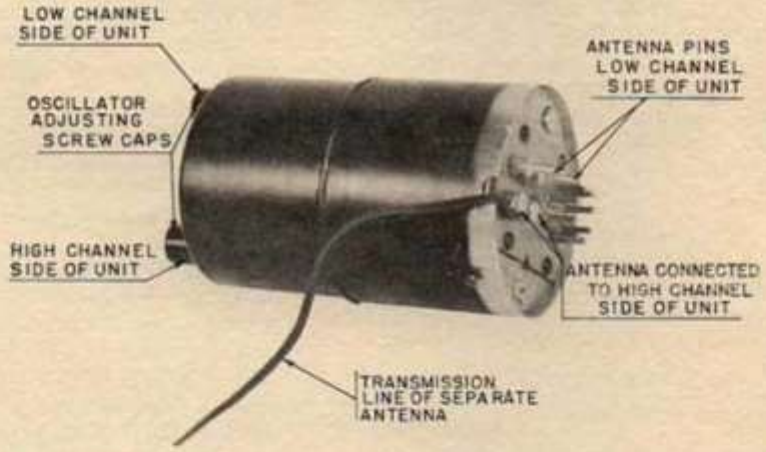



Fig. 8 "Picture Pilot" Showing Separate Antenna Connections

The Picture Pilot is a unit 3-inches in diameter and 4-1/2 inches high, which incorporates the channel selecting portion of the television receiver.

First of all the Picture Pilot has two tuned circuits which serve to select the desired television signal and couple it from the antenna to the first detector which is located on the main chassis. These circuits are shielded and balanced and are preset in factory alignment. The adjustments are enclosed and not accessible to the customer. Included in the Picture Pilot is the local oscillator tube which heterodynes the desired television signal to a fixed intermediate frequency incorporated in the output of the 1st detector and located on the main chassis. This local oscillator must be stable in frequency and not subject to shift or otherwise the television picture will deteriorate due to mistuning and undesired interference and also the sould will become distorted. This stability is accomplished in the Picture Pilot by rugged design, high capacity circuits, built in oscillator tube, elimination of switch contacts in the oscillator circuit, and the use of a complete hermetic seal (soldered can) surrounding the oscillator tube. The hermetic seal eliminates the effect of changes in humidity.

There are eight types of Picture Pilots which have been chosen to serve the requirements

of the various areas based on F. C. C. allocation of television channels.

Television channels are divided into two groups: the first six being below the F. M. band and the last seven above.

Channel frequencies are as follows:

GROUP 1--(Low Group)

| Channel No. | Frequency--megacycles | Use |
|---|---|---|
| Channel 1 | 44--50 | Community--low power |
| (Amateur) | (50--54) | |
| Channel 2 | 54--60 | Metropolitan--Area 1 |
| Channel 3 | 60--66 | Metropolitan--Area 2 |
| Channel 4 | 66--72 | Metropolitan--Area 1 |
| (Air Beacons) | (72--76) | |
| Channel 5 | 76--82 | Metropolitan--Area 1 |
| Channel 6 | 82--88 | Metropolitan--Area 2 |
| (FM) | (88--108) | |
| (Air-Govt.) | (108--164) | |

GROUP 2--(High Group)

| | | |
|---|---|---|
| Channel 7 | 174--180 | Metropolitan--Area 1 |
| Channel 8 | 180--186 | Metropolitan--Area 2 |
| Channel 9 | 186--192 | Metropolitan--Area 1 |
| Channel 10 | 192--198 | Metropolitan--Area 2 |
| Channel 11 | 198--204 | Metropolitan--Area 1 |
| Channel 12 | 204--210 | Metropolitan--Area 2 |
| Channel 13 | 210--216 | Metropolitan--Area 1 |

There are two basic assignment plans determined by the fact that adjacent channels cannot be assigned to television stations in the same city.

Thus Area A may have a maximum of seven metropolitan stations, namely: Channels 2, 4, 5, 7, 9, 11, 13. Area B may have a maximum of five metropolitan stations namely: 3, 6, 8, 10, 12. Community Channel 1 is for small communities and will not be assigned in metropolitan areas.

A majority of the Picture Pilots are dual units covering two channels but three are single units representing those channels on which little use can be expected in conjunction with another channel. Units are listed below:

CROSLEY "PICTURE PILOTS"

Channels Covered

| | | | |
|---|---|---|---|
| 2-4 | 5-7 | 13 | 1 |
| 3-6 | 9-11 | 8-10 | 12 |

The Picture Pilot plugs into a socket on the rear of the main television chassis. Four sockets are provided. Therefore from 1 to 8 television channels can be covered depending on the number and type of Picture Pilots plugged in. Selection by the customer of the channel desired is accomplished by a front panel switch which has 8 positions and provision for the indication of the channel numbers covered.

If it becomes necessary to install multiple antennas, due to the location of the broadcast stations, provisions are made in the "Picture Pilot" to connect separate antennas for each channel without the use of external switches. It is possible to use a separate antenna for each channel if desired.

When one antenna is used for more than one station, it should be connected to the antenna plug on the rear of the cabinet in the usual manner.

There are two antenna pins for each channel (4 pin plug) located on the underside of the "Picture Pilot." Unscrew the two antenna pins for the channel to which the extra antenna is to be connected. Fasten the leads of the 75 ohm transmission line to the two screws with two No. 4 nuts. See Figure 8. Do not replace the two pins. This disconnects the picture pilot from the antenna switch, and allows it to be connected to the supplemental antenna at all times.

## ADJUSTMENT OF "SWING-A-VIEW" AND TAMBOURS

The Picture Box is properly adjusted when, in the closed position, it has approximately 1/16 inch clearance all around from the edges of the opening in the front panel of the cabinet, and can be moved within the limits of rotation provided for without rubbing on the cabinet in any position. If the Picture Box is out of adjustment proceed as follows: (See Fig. 9)

1. With two pieces of wire or string tie slide arm assemblies (M1) in their fully retracted position. This can be done by passing the wire or string thru the holes provided in the upper shelf for the loop antenna.
2. Loosen Top Bearing. This can be done by backing off screws (A). Do not remove screws but leave loose enough so that bearing sleeve (M18) is free to move.
3. TO ADJUST BOTTOM BEARING (Metal Shelf). Loosen the metal shelf mounting screws (D), and with the picture box in the closed position, move the shelf until the bottom edge of the picture box is flush with the front panel of the cabinet and centered within the cabinet opening. Tighten the metal shelf screws (D) to secure shelf in this position.

3(a) TO ADJUST BOTTOM BEARING (Wood Shelf). Loosen four screws (B) holding bottom bearing plate (M12), to cabinet, With the picture box in the closed position move the bearing plate until the bottom edge of the picture box is flush with the front panel of the cabinet and centered within the cabinet opening. Tighten the four screws to secure the bearing plate in this position.

4. Adjust Thrust Bearing Screws. The picture box is adjusted vertically by four

screws, (M6) (accessible from bottom of upper shelf). These screws should be adjusted so that the top and bottom clearances are approximately equal and so that the picture box does not rub on the cabinet in any position.

5. Tighten Top Bearing. After all the previous adjustments have been made, the top bearing should be fixed in position by tightening screws (A). The picture box should be flush with and parallel to the front of the cabinet and have approximately 1/16 inch clearance all around in the cabinet opening before and after this bearing is tightened.

position. This is usually due to excessive friction between tambours and the grooves in which they slide.

a. Check for foreign matter in grooves. Add dry flake graphite lubricant to grooves if necessary (never use oil or grease).
b. Check to see that slide arm (M1) is floating freely between the two slide brackets (M17). If the arm is bent so that it contacts either bracket, excessive pressure may be applied to the tambour slide causing it to bind.
c. Check bearing of the slide arm assem-

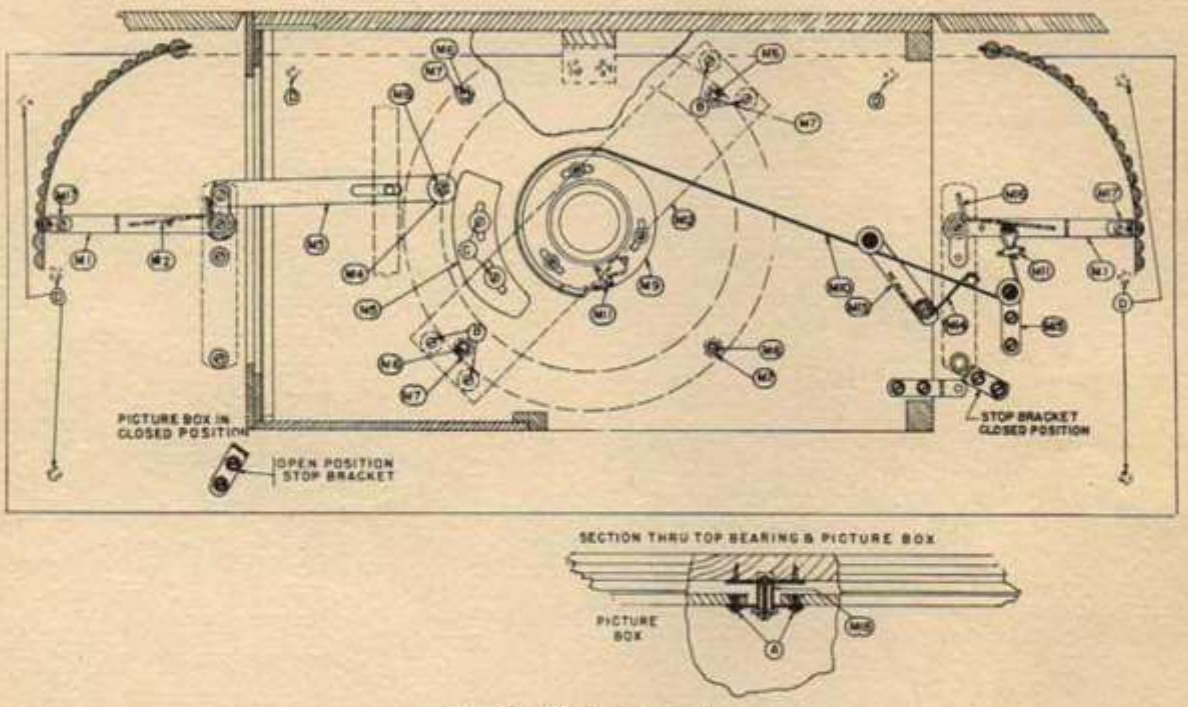



Fig. 9 - Slide Mechanism

6. Adjust Stops. The stop brackets should now be adjusted by loosening their mounting screws and moving them so that the picture box has the correct movement. The open position stop is correctly adjusted when the picture box stops with its left hand vertical edge just flush with the front panel on the left side of the cabinet. The closed position stop is correctly adjusted when the exposed panel of the picture box, in its closed position, is parallel to the front of the cabinet.

## SLIDE MECHANISM ADJUSTMENTS

1. Slide motion jumpy or slides fail to maintain contact with picture box in viewing

blies and the cam lever assembly-all should be free. Lubricate with light oil if necessary.

d. Check cable, (M10) this may catch on some other part of mechanism. Be sure that it lies in the grooves of both the idler (M15) and slack take-up pulleys (M13).

2. Right hand tambour does not clear corner of picture box when closing. This is due to cam, (M5) being out of adjustment.
With the front right hand corner of the picture box just flush with the right front panel of cabinet, loosen the two screws (C) holding cam to bottom of Picture Box and slide cam counter-clockwise until contact is made with cam roller (M4) and

tambour slide just begins to move. Hold in this position and tighten screws securely. Check opening and closing action and readjust if necessary.

3. Left hand tambour does not clear corner of picture box when closing. This fault is due to excess slack in the cable (M10). Make sure the cable lies in the grooves of both the idler and slack take up pulleys then with the right hand corner of the picture box flush with the right front panel of cabinet, remove excess slack by sliding thru cable clamp (M11). Tighten clamp screws securely. If it is ever necessary to replace this cable use only the standard service part. (W-138103). This cable is made of high tensile strength stainless steel. Soft steel or phosphor bronze cables are not satisfactory for this application.

The model 348CP receiver is designed for 75 ohm input. Best results are obtained by using the Crosley Tennaflex with 75 ohm transmission line.

OPERATING INSTRUCTIONS - FOR TELEVISION, RADIO, AND PHONOGRAPH - (See 348CP Users Instructions)

## DETAILED DESCRIPTION OF CIRCUITS & MECHANISM
## TELEVISION RECEIVER

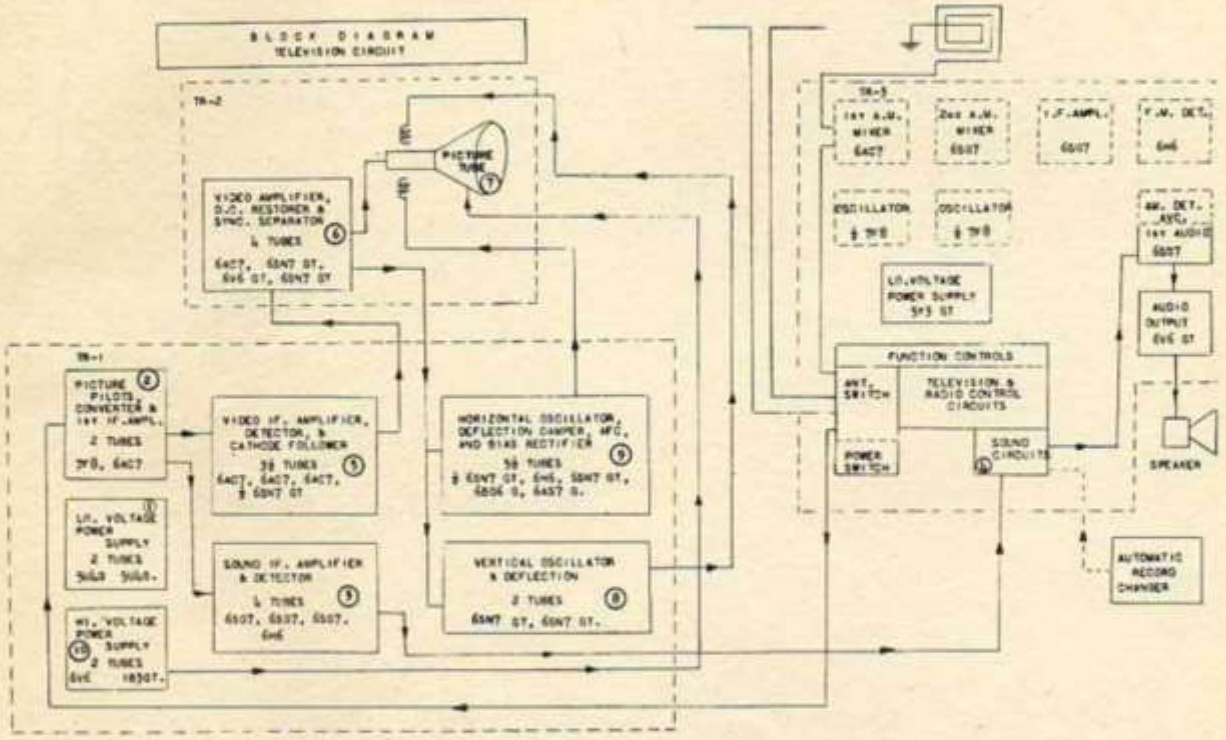



Fig. 10

For ease of understanding the basic operation of the receiver, see Figure 10. The circuit description follows the neumerical order of the blocks. Symbols refer to the schematic diagram. It is assumed that the reader is familiar with the general principle underlying the operation of a radio and television receiver.

The circuit description begins with the function switch in "Video" position. With the switch in this position the AC power is applied to TR-1 as well as TR-3.

### LOW VOLTAGE SUPPLY:

This supply delivers 360 m.a. at 300 volts, plate power for all circuits TR-1 and TR-2 and the television control circuits of TR-3. In addition it supplies filament current to all the tubes of TR-1 and TR-2.

### PICTURE PILOTS:

The Picture Pilot contains circuits necessary

for the preselection of two television channels, i.e. the antenna to converter grid matching transformers and the heterodyne oscillator tube and circuits. The oscillator tube and oscillator circuits are in a hermetically sealed container. When this unit is plugged into the socket provided on TR-1 chassis, whichever two channels are contained (2-4, 3-6, 5-7, etc.), will be found in increasing numerical order in a clockwise direction from top of chassis.

Connections from the Picture Pilot thru the channel selector switch and thru the converter for a typical channel are shown in simplified form on the schematic drawing (See Fig. 11). The input transformer is a balanced, electrostatic shielded, band pass filter (input impedance 75 ohms) and having a gain on the lower channels of 6 to 8 and on the higher channels of 1.5 to 3.

## CONVERTER VT-1

The input circuit of the converter is standardized by the factory adjustment of trimmer capacitors C1 and C2 (see schematic for TR-1) which permits the installation of "Picture Pilots" without further alignment of the input circuit. This tube operates as a push-pull triode converter, with a gain of approximately 1 and is partially neutralized by capacitors C3 and C4. The difference frequencies between the sound and video carriers and the local oscillator are selected and amplified in the plate circuit in conjunction with the first IF Transformer T-1.

1st IF. TRANSFORMER T-1 (Refer to Schematic TR-1.)

This transformer couples the sound and picture

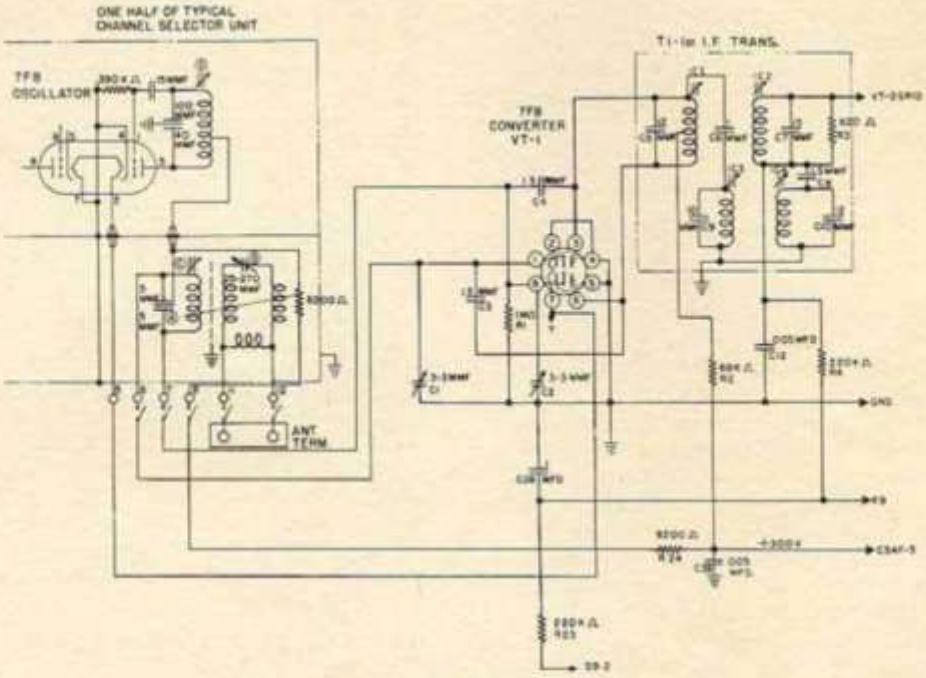



Fig. 11

The dipole antenna is connected thru a 75 ohm transmission line thru the selector switch to the primary of this transformer. The transformer secondary couples the signal thru the selector switch to the grids of the balanced converter. In addition, the local oscillator voltage from an unbalanced Colpitts oscillator is coupled to the transformer secondary, thru capacitor (A). Alignment of the input transformer is accomplished by adjusting capacitor (B) and iron core (C). Adjustment of the oscillator is made by adjusting iron core (D).

IF. signals (32.8 MC and 37.3 MC respectively) to the grid of the next amplifier by means of a primary circuit tuned by C5 and a secondary circuit tuned by C7. In addition the interference which might result from adjacent channel sound carrier is trapped in a circuit resonated at 38.8 MC by C9 and coupled to the primary by C6. A second trap for adjacent picture interference is resonated by C10 to 31.8 MC and coupled to the secondary by C8. The secondary couples both desired IF signals to the grid of the 1st IF amplifier tube VT-2.

## 1st IF AMPLIFIER VT-2

The tube operates as a pentode amplifier for both IF signals with manual controled bias applied to the control grid. The unbypassed cathode resistor, R7, minimizes the normal shift in alignment resulting from the change in bias, known as the "Miller Effect". The plate of this tube is loaded by the primary of the 2nd IF transformer T2.

## 2nd IF TRANSFORMER T-2

The primary of the transformer is resonated only by the output capacity of VT-2 and the distributed circuit capacity. The secondary is resonated only by the input capacity of VT-3 and the distributed circuit capacity. A trap resonated by C15 to 32.8 MC and coupled to the primary by C16 is used to connect the Sound IF signal to the 2nd Sound IF amplifier VT-7 and also to attenuate the sound signal with respect to the picture signal. A second trap resonated at 38.8 MC by C18 and coupled to the secondary by C17 further attenuates the adjacent sound channel.

## SOUND IF. AMPLIFIER

The sound signal is further amplified in the sound IF amplifier composed of tubes VT-7, VT-8 and VT-9 and transformers T-6, T-7 and T-8. The band width of this amplifier is approximately 300KC. Since the sound carrier is frequency modulated, the detector circuit composed of transformer T-8 and tube VT-10 comprises a conventional discriminator circuit. The operation of the circuit results from the phase relationships existing in a transformer having a tuned primary and secondary. In effect, the primary circuit is in series, for R-F., with each half of the secondary to ground. When the received signal is at the resonant frequency of the secondary, the R-F voltage across the secondary is 90 degrees out of phase with that across the primary. Since each diode is across one half of the secondary winding and the primary winding is in series, the resultant R-F voltages applied to each are equal, and the DC voltages developed across each diode load resistor are equal and of opposite polarity. Hence the net voltage between the top of the load resistors and ground is zero. If, however, the signal varies from the resonant frequency, the 90 degrees phase relationship no longer exists between the primary and secondary. The resultant voltages applied to the two diodes are no longer equal, and a d.c. voltage proportional to the difference between the R-F. voltages applied to the two diodes will exist across the series load resistors. As the signal varies back and forth across the resonant frequency of the discriminator, an a.c. voltage of the same frequency as the original modulation, and proportional to the deviation, is developed and passed on to the audio amplifier.

The approximate gain of VT-7 & VT-8 is 625. The gain of VT-9 together with the detector (conversion gain from R-F to Audio) is 1 for 7.5 KC deviation. The output of the sound discriminator is connected thru the function switch to the audio circuits of TR-3.

## VIDEO IF. AMPLIFIER

Returning to the transformer T-2 the video IF signal is coupled to the video IF amplifier composed of tubes VT-3, VT-4, & VT-5 and transformer T-3, T-4, & T-5. VT-3 also has manual gain control in the form of bias applied to the control grid and the cathode resistor R-10 is unbypassed in the same manner as VT-2 to minimize the Miller effect.

## 3rd VIDEO IF. TRANSFORMER T-3

Transformer T-3, provides a load for the plate circuit of VT-3, being resonated by the output capacity of VT-3 and the input capacity of VT-4 to approximately 33.5 MC. A trap circuit resonated by C22 to 32.8 MC and inductively coupled to the plate coil provides further attenuation for the sound IF signal.

## 4th VIDEO IF. TRANSFORMER T-4

Transformer T4, provides a load for the plate circuit of VT-4, being resonated by the output capacity of VT-4 and the input capacity of VT-5 to approximately 38 MC. A trap circuit resonated by C30 to 32.8 MC is coupled to the cathode of VT-5 providing additional attenuation for the sound IF signal.

## 5th VIDEO IF. TRANSFORMER T-5

This transformer is conventional in design, serving to couple the video IF signal to the detector which is a crystal rectifier CR-1. The video signal thus demodulated appears across the rectifier load resistor R22. The overall bandwidth of the video IF amplifier is approximately 3.6 MC.

## CATHODE FOLLOWER VT-6A

This stage transforms the video signal to a low impedance so that it can be conducted to the TR-2 chassis with a shielded lead where the signal is coupled to the grid of the video amplifier VT-201.

## VIDEO AMPLIFIER VT-201

This stage amplifies the video signal over a bandwidth of about 3.6 MC to a level sufficient for the grid of the picture tube, VT-205. In addition the signal is coupled to the cathode of the D.C. restorer VT-202B.

## D.C. RESTORER VT-202B

This triode is connected as a diode and rectifies the video signal in such a manner as to provide a D.C. voltage across C205 which maintains the correct bias on the picture tube to restore the black level to the picture; i.e. when the background is changed at the transmitting studio, the background automatically changes on the picture tube.

## PICTURE TUBE VT-205

This is a 10" cathode ray tube employing an aluminum back screen which provides a great improvement in picture brilliance. Magnetic deflection and magnetic focus circuits are used.

Some picture tubes have an external metallic coating which is grounded by a clip on the deflection yoke support bracket. This coating provides a 500 mmf filter capacitor across the second anode metallic coating within the tube.

## 1st SYNC SEPARATOR V-203B

The signal connected to the grid of the video amplifier is also coupled to the grid of the 1st separator VT-203B. This triode operates with grid leak bias - the low plate voltage results in a low cutoff bias and a very non-linear plate current - grid bias characteristic. Therefore, at inputs as low as one volt the sync pulse portion of the signal is amplified more than the picture and blanking level, thus part of the picture information is eliminated, improving the performance of the 2nd sync separator.

## SYNC AMPLIFIER VT-203A

This stage amplifies the output of the 1st sync separator in a fairly linear manner with a gain of approximately 10. This signal is coupled to the grid of the 2nd sync separator VT-204.

## 2nd SYNC SEPARATOR VT-204

This stage also operates with grid leak bias, the voltage determined by the peak amplitude of the input signal. When the magnitude of the sync pulse portion of the signal on positive side of AC axis is equal to the cutoff bias of the tube, only sync pulses will appear in the plate circuit, this eliminates the balance of the picture information. This is illustrated in Fig. 12. A screen grid tube is used for this stage to minimize signal feed thru across the grid to plate capacity. This gain is so arranged that this complete separation occurs with just sufficient voltage to produce a very dim picture. With increased input voltage the separating action remains the same. This separated sync is coupled to the grid of the Sync Cathode Follower VT-202 A.

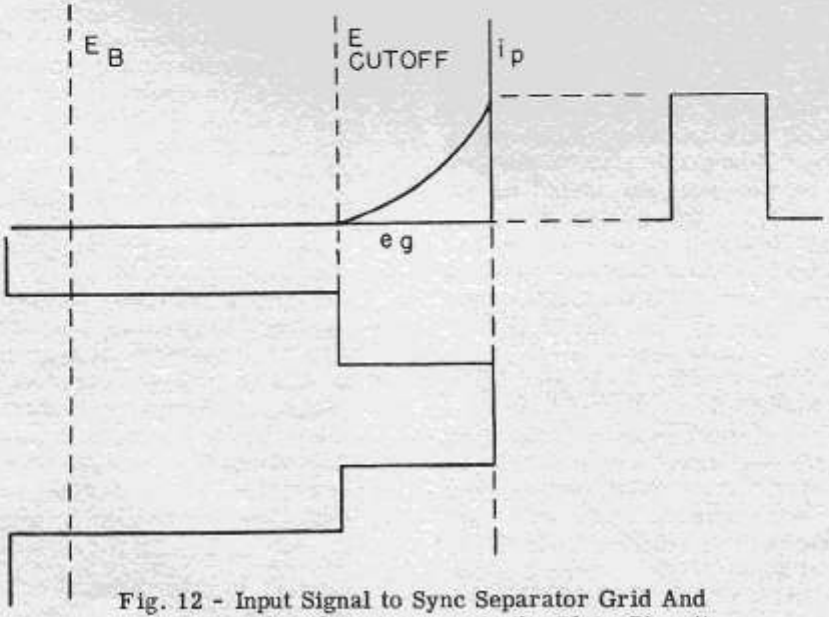



Fig. 12 - Input Signal to Sync Separator Grid And Pulse as it Appears in the Plate Circuit

## SYNC CATHODE FOLLOWER VT-202 A

This tube transforms the sync pulse signal to low impedance which permits conduction of the sync signal thru a shielded lead back to the TR-1 chassis.

## INTEGRATING NETWORK

In order to separate the vertical pulses from the horizontal, the sync signal is integrated in the network composed of R-41, R-42, R-43, C-60, C-61 and C-62.

## VERTICAL DEFLECTION

### VERTICAL OSCILLATOR VT-12

This stage is a mulitvibrator, synchronized by the super sync, so that it will oscillate at the field frequency of 60 cycles and in phase with the transmitted field. Its function is to form a saw-tooth voltage wave to drive the vertical deflection tube. It is to be assumed that the VT-12 A triode is fully conducting and VT-12 B is non-conduction at the starting position. When the sync signal drives the grid of VT-12 A negative, the grid of VT-12 B is driven in a positive direction by the amplified sync pulse, and if the Vertical Sync Control R 340 has been properly adjusted, this occurs at the correct time to cause VT-12 B to become conductive. A regenerative action thru the common cathode resistor R-46 to VT-12A and back to the grid of VT-12 B immediately occurs, and the grid cathode conductance of VT-12 B discharges the coupling capacitor C-64. This period of conduction also discharges capacitor C-66 to a point where the regenerative action can no longer be maintained. When this occurs, grid current in VT-12 B ceases, and the capacitors C-64 and C-66 are left with charges that must leak off thru resistors R-47 and R-48 respectively. This gives rise to the saw-tooth voltage on the plate of VT-12 B, see figure 13.

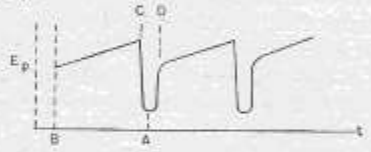



Fig. 13 - Voltage Ep on Plate of VT-12 B at time "t"

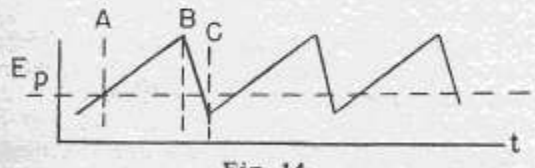



Fig. 14

The magnitude of this voltage is controlled by the Height Control, R-49. Resistor, R-50 provides the peaking indicated by "A". The need for this is explained under "Vertical Deflection VT-13".

### VERTICAL DEFLECTION VT-13

This tube together with matching transformer T-9 provides a saw-tooth current in the vertical deflection coils of the yoke. The voltage applied to the grid of this tube at time "B", Figure 13, causes a steady increase of plate and deflection coil current until time "C". The tube is then at cut-off until time "D", while the energy stored in the deflection coil dissipates in the resistors R-226 and R-227. The cycle can then begin again. The peaking at time "A" is necessary so that the tube is fully cut-off; if this were not the case, the circuit would be so highly damped that the deflection current could not decrease to zero in sufficient time.

The action of the electron beam in response to this deflection coil current is as follows:

> From time "B" to "C" the beam traverses the face of the picture tube from top to bottom at a fairly uniform rate of speed (about one inch in 2600 microseconds). From "C" to "D" the beam returns to the top of the picture about 50 times faster.

The vertical linearity control R-52 adjusts the bias of the deflection tube so that the position of the applied saw-tooth voltage is shifted along its operating characteristic. The vertical size and linearity controls have a considerable amount of interaction. Centering controls R-224 R-225 are so arranged in the deflection circuits and the plate supply circuit that direct current can be caused to flow thru the deflection coils in either direction, by the adjustment of these controls, resulting in a static centering of the picture.

## HORIZONTAL DEFLECTION

Horizontal oscillator VT-19 is a multivibrator arranged to oscillate at line frequency (15,750 CPS) in phase with the transmitted line. This oscillator is not triggered by the sync as in the case of the vertical oscillator; its speed is regulated by an automatic frequency control described below. A manual speed control, R-338, is provided to compensate for aging tubes and other components.

The operation of this multivibrator is quite similar to that of the vertical oscillator, and the wave form of Figure 14 is derived on the

plate of VT-19 B. This voltage drives the horizontal deflection tube VT-20.

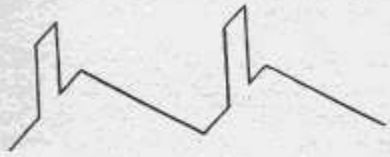


Fig. 15

(a) Voltage applied to diode (pins 3-4)

## HORIZONTAL DEFLECTION TUBE VT-20

This tube is a beam power tetrode specially designed for the application. Its function, together with the matching transformer, T-12, is to cause a saw-tooth current to flow in the horizontal deflection coils. The voltage of Figure 14 is of such magnitude that plate current does not flow in the tube until time "A". By time "B", peak plate current has been obtained as determined by the width control, R-78, and maximum required deflection coil current. The tube is then cut-off. The self-induced voltage across the deflection coil reverses the current flow relatively quickly. The current would reverse again if it were not for the action of the horizontal damper tube VT-21.

## HORIZONTAL DAMPER TUBE VT-21

This high perveance dual-triode was designed especially for this application. When the voltage across the deflection coil between time "B" & "C" rises in a direction to reverse the coil current a second time, this tube becomes conductive at time "C"; the circuit thus highly damped gives rise to a decay of the current toward zero. The signal coupled by the grid-plate capacity to the grids varies the conductance in such a manner as to make this current decay fairly linear with time. This effect is adjusted by horizontal linearity control R-80. As this current approaches zero, the tube, VT-20, begins to conduct again, as in Figure 14. In this manner the tubes VT-20 and VT-21 form a push-pull driver for the horizontal deflection coils. When the damper tube conducts, the capacitor C-94 is charged. This capacitor is then discharged thru the plate circuit of tube VT-20. The direct voltage across this capacitor is about 40 volts which is added to the plate supply voltage and represents a recovery of energy of about 3.5 watts.

## AUTOMATIC FREQUENCY CONTROL OF HORIZONTAL DEFLECTION (AFC)

The separated sync pulse is coupled to the grid of the phase inverter, VT-6B, which provides positive and negative sync pulses on plate and cathode repsectively. These are coupled to the detector, VT-18; the two diodes are connected in series with resistors R-67 and R-68 as series load so that current flows during the time of the horizontal sync pulse. The purpose of this detector is to compare the phase of the sync pulse and the phase of the horizontal deflection, and provide a d.c. control voltage to the horizontal oscillator in a direction to correct any phase difference. To this end, the pulse resulting from current reversal in the horizontal deflection coil is coupled to the grid of pulse limiter tube VT11A. From the plate circuit of this stage the pulse is integrated to a saw-tooth by resistor R-64 and capacitor C-82, and coupled to the junction of the two diodes of detector VT-18. The two diodes act as peak rectifiers on the voltages applied to them as shown in Fig. 15 and 15A.

Fig. 15A

(b) Voltage applied to diode (pins 5-8)

It is apparent that a phase displacement between pulse and saw-tooth will increase the peak-to-peak voltage applied to one diode and decrease that applied to the other diode. When these voltages are equal, the direct voltage at the junction of resistors R-67 and R-68 is zero. A change of bias on the grid of VT-19A shifts the oscillator frequency because it changes the electrode voltages which determine the length of time of various portions of the cycle previously described. If the oscillator speed should change because of a change in line voltage, temperature, or humidity, the AFC direct voltage changes in a direction to correct the initial shift of frequency.

## HIGH VOLTAGE POWER SUPPLY

This power supply is built as a doubly-shielded sub-assembly, principal components being tubes, VT-14, & VT-15, and transformer, T-10. Operation is as follows: Tube VT-15 is connected with the coils of T-10 as an oscillator; the primary or plate winding is adjusted by trimmer capacitor, C-72, below and close to the self-resonant frequency of the rectifier or

secondary winding. Frequency of oscillation is approximately 250 KC. The secondary-to-primary turns ratio acts as a step-up transformer of about 35 to 1. Thus a peak voltage of about 10 K.V. appears across the secondary winding. This voltage is rectified by tube, VT-15, and the direct voltage is filtered by capacitors C-75 and C-76 and resistors R-57 and R-58, and by the capacity of the Hi. Voltage cable Filament voltage for the rectifier is supplied by a two-turn coil on the transformer.

## BIAS RECTIFIER, VT-11 B

On the plate of V-11A a pulse of about 70 volts peak magnitude and horizontal line frequency is formed. It is convenient, therefore, to rectify this pulse with tube, VT-11B, to obtain a bias voltage which requires a relatively small amount of capacity to filter because of the high recurrence rate. This voltage is used in conjunction with the contrast control, R-232, to bias the 1st and 2nd IF amplifier tubes for gain control.

## PICTURE BOX AND SLIDE MECHANISM

The Picture Box is mounted with bearings at the center of both its top and bottom panels and is free to rotate thru an angle of 120°. Tambour slides are provided to close the unused portions of the opening in the cabinet front panel when the picture box is in the viewing position.

With reference to Fig. 9. When the Picture Box is in the viewing position, the right and left slide arm assemblies, M-1, urge the tambour slides into contact with the sides of the Picture Box through the action of torsion springs, M-2 and M-16. The springs alone control the action of the slides during motion in the viewing position.

When the front right-hand corner of the picture box becomes flush with the cabinet front panel (counter-clockwise limit of viewing position), the mechanism provided in the cabinet begins to take control of the action of the slides.

At this point cam, M-5, fastened to the bottom of the picture box has just come into contact with the roller M-4 on the end of cam lever assembly, M-3. Further counter-clockwise rotation of the picture box moves the cam lever assembly, M-3, toward the right due to the rise on the surface of the cam, M-5. Since the cam lever assembly is coupled to the right hand slide arm assembly, M-1, this motion is translated into a counter-clockwise rotary motion of the right hand tambour slide. Thus, owing to the action of the cam, the right hand slide is removed from contact with the picture box and held away during the remainder of the counter-clockwise rotation.

At approximately the same time that the cam and cam lever arm come into contact, the rotation of the drive pulley, M-9, which is fastened to the bottom of the picture box, has wound on the pulley all of the slack in cable, M-10. At this point further rotation applies tension to the cable which is translated into clockwise rotation of the left hand slide arm assembly, M-1. This motion results in rapid retraction of the left hand tambour slide so that it is completely removed from the area of the cabinet opening before the rear left hand corner of the picture box reaches a position where interference would result.

## DESCRIPTION OF RADIO CIRCUIT

The radio, with the Range Switch, SW-3 in the Broadcast or Shortwave position, uses a double superheterodyne circuit, with Intermediate frequencies of 167.5 and 5825 KC. The Function Switch SW-2 is a four position switch, advancing two lugs on each detent position. In the "RADIO" position, and with the Range Switch SW-3 in the Broadcast position, the signal is picked up by the loop antenna L-301 and passes thru the antenna loading coil L-302, the Range Switch SW-3 and the capacitor C-311 to the grid of VT-301.

With the Range Switch SW-3 in the Shortwave position, the signal is fed from the dipole antenna (utilized as a single ended antenna), thru the primary center tap of T-301 to the primary of the shortwave antenna coil L-303. The shortwave antenna coil is tuned broadly for band pass of the shortwave frequencies from 9.45 to 11.9 megacycles. The signal is fed from the secondary of L-303 thru the Range Switch SW-3 and capacitor C-311 to the grid of VT-301.

## FIRST AM. OSCILLATOR VT-308

The first triode section, pins 1, 3 and 4 of this 7F8 tube is a variable oscillator, the frequency being controlled by the tuning capacitor C-308B and the oscillator coil L-306. This oscillator frequency is fed into the 1st AM Mixer tube VT-301 where it is mixed with the AM signal. The difference frequency between the incoming signal and the oscillator frequency (5825 KC higher) is amplified in the plate circuit in conjunction with the first I.F. Transformer T-302 resulting in the 1st Intermediate frequency of 5825 KC.

## FIRST I.F. TRANSFORMER T-302 & T-303

The secondary of T-302 is link coupled to the primary of T-303 by L-304. The inductance of L-304 determines the coupling between T-302 and T-303. The first Intermediate frequency of 5825 KC is fed from the secondary of T-303 to the grid of the 2nd AM Mixer VT-302.

## SECOND AM. OSCILLATOR VT-308

The second triode section of this 7F8 tube, pins 5, 6 and 8, is a crystal controlled oscillator operating at 5992.5 KC. This frequency is mixed with the 5825 KC signal in the grid of the second AM. Mixer VT-302 resulting in a second Intermediate frequency of 167.5 KC. This 167.5 KC. signal is amplified in the plate circuit of VT-302 in conjunction with the primary of T-304.

## 1st AM. I.F. TRANSFORMER T-304

The 1st AM. I.F. Transformer is a quadruple-tuned transformer with primary & secondary windings for 167.5 KC and 10.7 MC.; these windings are connected in series. The 10.7 MC winding offers a low impedance to the circuit when operating at 167.5 KC. in the AM. band. This circuit is over coupled to produce a flat top or doubled peak response curve. The secondary of T-304 is coupled to the A.M. I-F Amplifier Tube VT-303, where the signal is then amplified and coupled from the plate of VT-303 to the primary of T-305 and the primary T-306 2nd. AM. I-F Transformer connected in series. The primary of T-305 again offers a low impedance to the 167.5 KC. I.F. signal.

## 2nd AM. I-F TRANSFORMER T-306

The 2nd A.M. I-F. Transformer is over-coupled to produce a flat top, double peaked response. The secondary is connected to the diode section of VT-306, A.M. detector where it is rectified and fed to the audio system in the usual manner.

## F.M. BAND

With the Range Switch, SW-3 in the F.M. position the circuit is changed to a conventional superheterodyne with an intermediate frequency of 10.7 MC., and operates in the following manner.

The FM. signal picked up by the dipole antenna is fed to the primary of the FM Antenna Transformer T-301, where mutal coupling of the secondary transfers it to the grid of the FM. Mixer VT-301 thru the Range Switch SW-3 and the coupling capacitor C-311.

## FM. ANTENNA TRANSFORMER T-301

This transformer is used in a band pass circuit tuned to pass the FM band from 88 to 108 megacycles. The center tap of the primary is connected to the primary of the shortwave coil L-303 thru the padder capacitance C-303. This coil and capacity is tuned to 10.7 MC. and forms a trap for the 10.7 MC. I-F frequency. One leg of the secondary coil of T-301 is connected to C-310 that returns to ground. The capacitor C-310 is the F.M. Radiation Balance that minimizes the oscillator signal radiated by the dipole antenna.

## F.M. OSCILLATOR VT-308

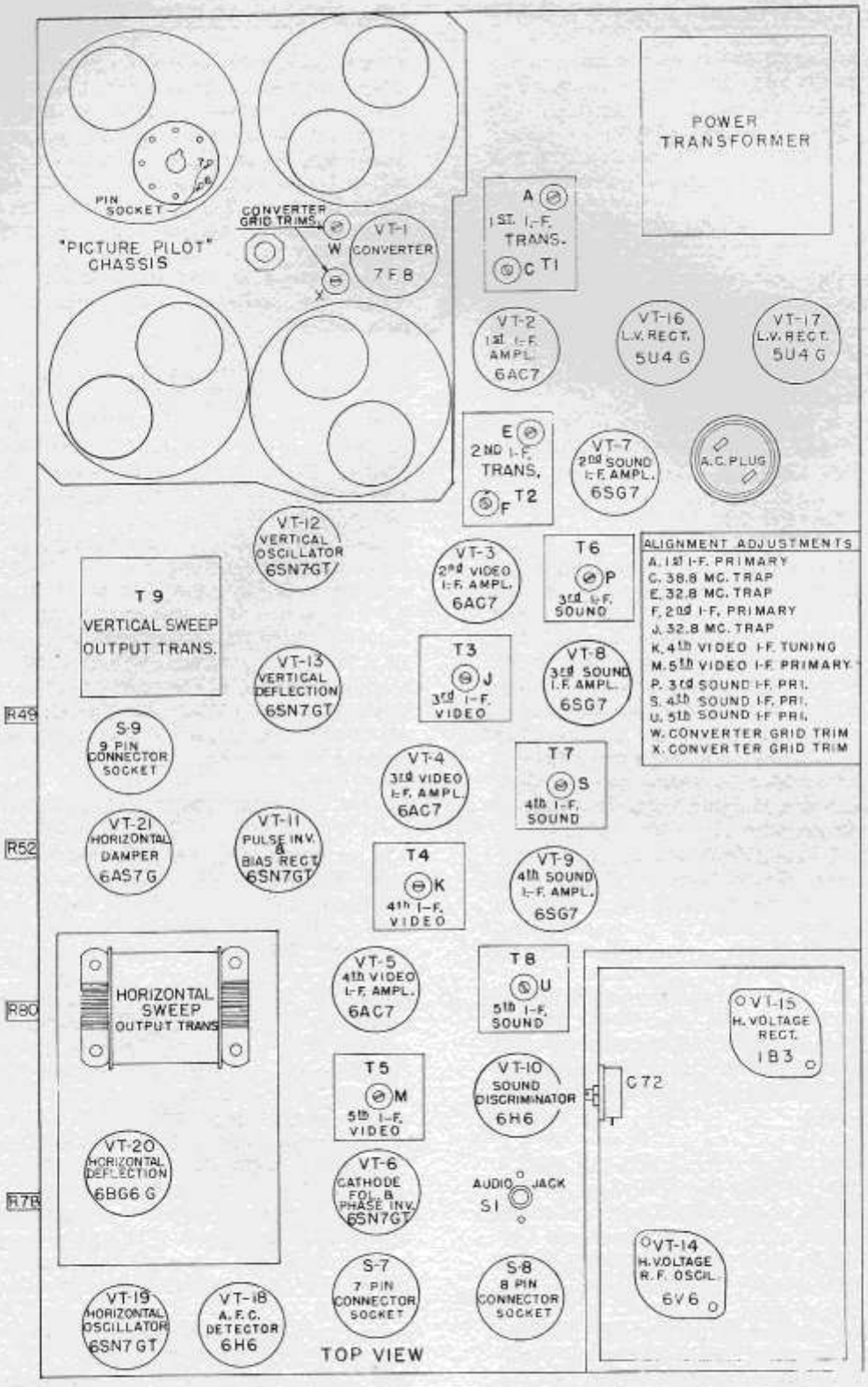
One section of this 7F8 triode is used as an oscillator in conjunction with the tuning capacitor C-308B, L-305 and IC-314 and capacitors C-355, C-336, C-359 and C-360, and oscillating at a difference frequency of 10.7 megacycles higher than the incoming FM. signal. This difference frequency from the local oscillator is fed into the grid of the Mixer Tube VT-301 where it is mixed with the incoming signal to form the intermediate frequency of 10.7 MC. This signal then passes from the plate of VT-301 to the primary of the 1st I.F. Transformer T-302. Note: The second section of VT-308, pins 5, 6 and 8 is not in operation in the F.M. position.

## 1st I.F. TRANSFORMER T-302 & T-303

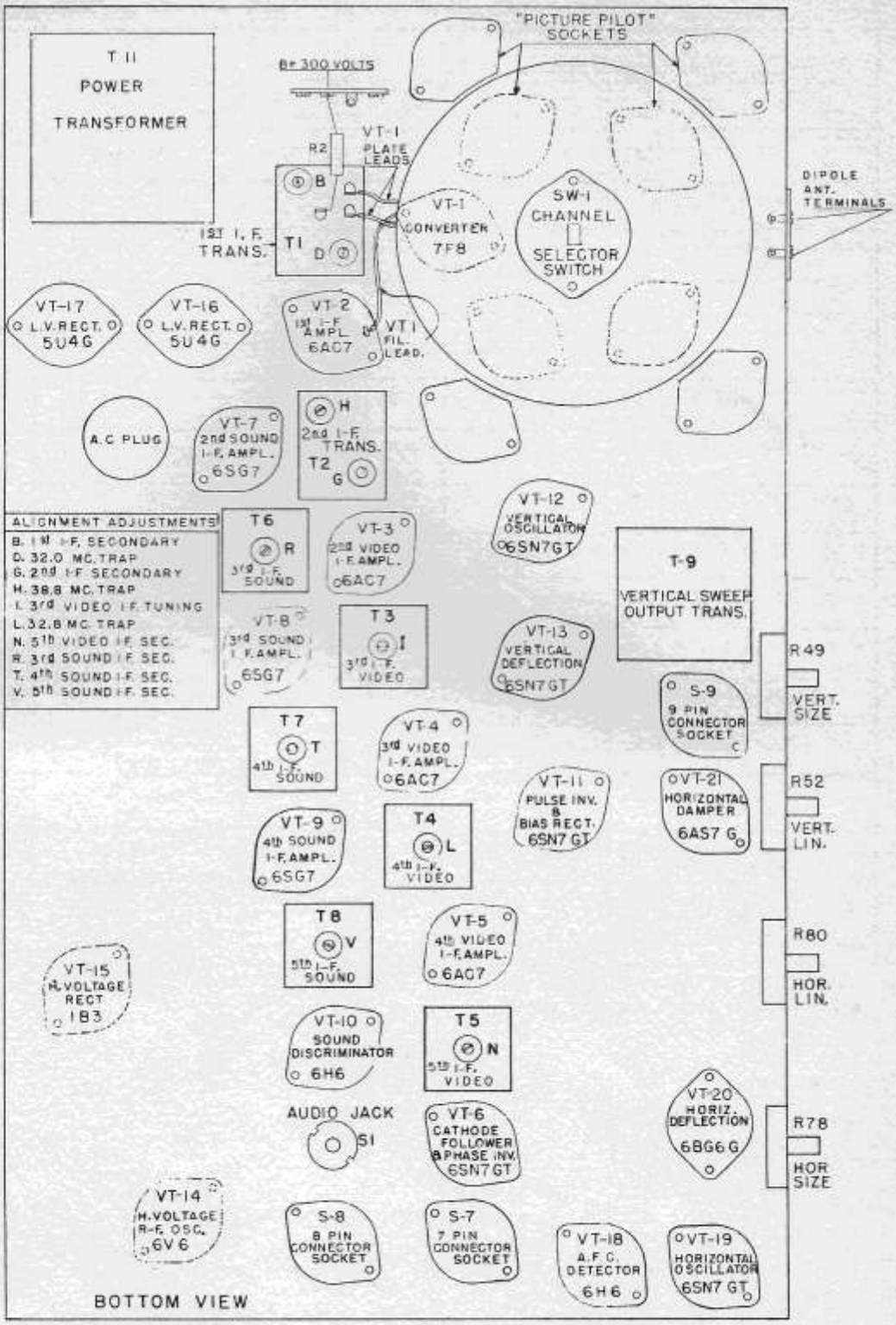
The primary of T-302 is tuned with the iron core IC-302 and the capacitor C-316 in parallel with C-315 to 5825 KC when the Range Switch SW-3 is in the Broadcast or Shortwave position. With the Range Switch in the F.M. position, the capacitors C-315 and C-316 are taken out of the circuit so that the primary resonates at 10.7 MC, the I.F. frequency used on the F.M. band. The secondary of T-303 is treated in the same manner, C-320 and C-321 being taken out of the circuit that it also resonates at 10.7 MC. The Link Coupling Coil L-304 together with C-317 and C-318 couples the secondary of T-302 to the primary of T-303. The signal is fed from the secondary of T-303 to the grid of the 1st I.F. Amplifier VT-302 where it is amplified in the plate circuit and passed on to the 10.7 I.F. section of T-304 the 2nd I.F. Transformer.

## 2nd I.F. TRANSFORMER

The capacitors C-328 in the primary and C-331 in the secondary circuit offer low impedance to the 10.7 MC signal. (Cont. page 24)




**ALIGNMENT ADJUSTMENT & TUBE LOCATION CHART**




**ALIGNMENT ADJUSTMENT & TUBE LOCATION CHART**

TELEVISION ALIGNMENT ADJUSTMENT

| Alignment Sequence | Sweep Generator Output Connection | Width | In Series With | Position Of Markers Frequency in M. C. Sound Carrier | Picture Carrier | Adj. Ch. Sound Carrier | Short Circuit | *Adjust Screws | Type Of Selectivity Curve See Voltage Waveform Chart |
|---|---|---|---|---|---|---|---|---|---|
| 1. | ---------- | ----- | -------- | ------- | ------- | ---------- | ---------- | V | ---------- |
| 2. (a) | ---------- | ----- | -------- | ------- | ------- | ---------- | ---------- | L-E-J | ---------- |
| 2. (b) | ---------- | ----- | -------- | ------- | ------- | ---------- | ---------- | D | ---------- |
| 2. (c) | ---------- | ----- | -------- | ------- | ------- | ---------- | ---------- | C-H | ---------- |
| 3. (a) | Pin 4 Of VT-6 | 8 MC. | 1000 MMF | 32.8 | ------- | ---------- | ---------- | L | Fig. 1 |
| 3. (b) | Pin 4 Of VT-6 | 8 MC. | 1000 MMF | ------- | 37.3 | ---------- | ---------- | N-M | Fig. 1 |
| 3. (c) | Pin 4 Of VT-4 | 8 MC. | 1000 MMF | ------- | 37.3 | ---------- | ---------- | K | Fig. 2 |
| 3. (d) | Pin 4 Of VT-5 | 8 MC. | 1000 MMF | ------- | 37.3 | ---------- | T-1 Plate Winding | I | Fig. 3 |
| 3. (e) | Pin 4 Of VT-5 | 8 MC. | 1000 MMF | 32.8 | ------- | ---------- | T-1 Plate Winding | J | Fig. 3 |
| 4. (a) | Pin 4 Of VT-8 | 1 MC. | 1000 MMF | 32.8 | ------- | ---------- | ---------- | U-V | Fig. 6 |
| 4. (b) | Pin 4 Of VT-8 | 1 MC. | 1000 MMF | 32.8 | ------- | ---------- | ---------- | S-T | Fig. 7 |
| 4. (c) | Pin 4 Of VT-7 | 1 MC. | 1000 MMF | 32.8 | ------- | ---------- | ---------- | P-R | Fig. 8 |
| 5. | Pin 4 Of VT-2 | 8 MC. | 1000 MMF | 32.8 | 37.3 | 38.8 | Converter Plate Winding | E-F-G-H | Fig. 4 |
| 6. | Pin 6 Of Octal Pic. P. Socket | 8 MC. | 1000 MMF | 32 | 37.3 | 38.8 | ---------- | A-B-C-D | Fig. 5 |
| 7. | Pin 6 Of Octal Pic. P. Socket | 1 MC. | 1000 MMF | 32.8 | ------- | ---------- | ---------- | D▲ | Fig. 9 |
| 8. | ---------- | ----- | -------- | ------- | ------- | ---------- | ---------- | W-X | See Step 8 Alignment Procedure |
| NOTE | | | | | | | SEE NOTE FOLLOWING ALIGNMENT PROCEDURE | | |

* Refer To Alignment Adjustment Location Chart

▲ If Necessary to Improve Symetry Of Pattern

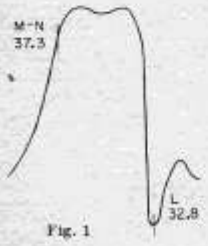


Fig. 1

Fig. 2

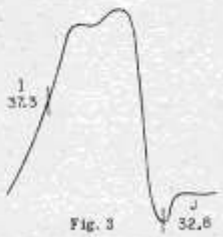


Fig. 3

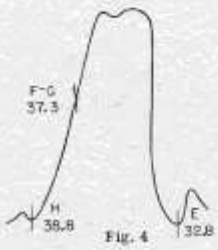


Fig. 4

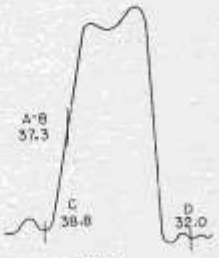


Fig. 5

CHART

| Oscilloscope Connection | Signal Generator Output | | | VTVM Connection | Remarks |
|---|---|---|---|---|---|
| | Freq. In M.C. | In Series With | To | | |
| ---------- | 32.8 | 1000 MMF | Pin 6 On Octal Pic. P. Socket | Junction Of C-57, C-97, R-35 | Adjust For Zero Reading |
| ---------- | 32.8 | 1000 MMF | Pin 6 On Octal Pic. P. Socket | Junction Of R-22, L-2 | Adjust For Min. Reading |
| ---------- | 32 | 1000 MMF | Pin 6 On Octal Pic. P. Socket | Junction Of R-22, L-2 | Adjust For Min. Reading |
| ---------- | 38.8 | 1000 MMF | Pin 6 On Octal Pic. P. Socket | Junction Of R-22, L-2 | Adjust For Min. Reading |
| Junction Of R-22 L-2 | 32.8 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of R-22, L-2 | 37.5 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of R-22, L-2 | 37.5 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of R-22, L-2 | 37.5 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of R-22, L-2 | 32.8 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of C-57, C-97, R-35 | 32.8 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of C-57, C-97, R-35 | 32.8 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of C-57, C-97, R-35 | 32.8 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of R-22, L-2 | 32.8<br>37.5<br>38.8 | Loosely Coupled To Sweep Generator | | ---------- | |
| Junction Of R-22, L-2 | 32<br>37.5<br>38.8 | Loosely Coupled To Sweep Generator | | ---------- | Connect 1 Meg ohm Resistor From Pin 6 To Chassis |
| Junction Of C-57, C-97, R-35 | | | | ---------- | 1 Meg ohm From Pin 6 To Chassis |
| | | | | | |

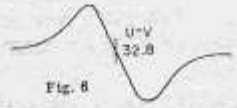


Fig. 6

Fig. 7

Fig. 8

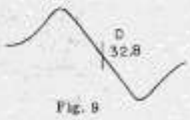
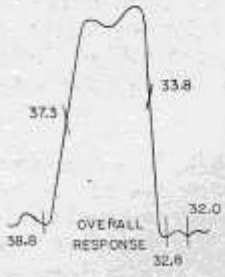


Fig. 9



## SOCKET VOLTAGE CHART

Measurements made with the receiver operating on 117 volts, 60 cycle AC and with no signal input. Voltage measurements made with an Electronic Volt meter between the tube socket lugs and chassis. Both Brilliance and Contrast Controls completely counterclockwise. W.J. = Wiring Junction. * = AC. Voltage.

♦ = Positive DC. voltage on 6.3 V. AC heater.
N.C. = No connection.
Voltage of Radio Chassis TR-3 measured with Radio Band Switch in Standard Broadcast Position except where marked with delta (△), this voltage measured with the Band Switch in the F-M position.

| Tube No. | Tube Type | Function | Socket Lug Number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VT-1 | 7F8 | Converter | | 0 | 82 | 0 | 0 | 82 | *6.3 | | |
| VT-2 | 6AC7 | 1st I.F.Ampl. | 0 | *6.3 | | -19 | | 320 | *6.3 | 330 | |
| VT-3 | 6AC7 | 2nd Video IF | 0 | *6.3 | 0 | -19 | | 320 | 0 | 330 | |
| VT-4 | 6AC7 | 3rd Video IF | 0 | *6.3 | 0 | | 0 | 83 | 0 | 295 | |
| VT-5 | 6AC7 | 4th Video IF | 0 | *6.3 | 0 | | 1.4 | 125 | 0 | 300 | |
| VT-6 | 6SN7 | Cath.Foller / Phase Invert. | | 300 | 11 | | 290 | 11 | *6.3 | 0 | |
| VT-7 | 6SG7 | 2nd Sound IF | 0 | 0 | 0 | | 0 | 122 | *6.3 | 300 | |
| VT-8 | 6SG7 | 3rd Sound IF | 0 | 0 | 0 | | 0 | 110 | *6.3 | 295 | |
| VT-9 | 6SG7 | 4th Sound IF | 0 | 0 | 0 | | 0 | 120 | *6.3 | 290 | |
| VT-10 | 6SG7 | Sound Discrim. Bias Rect. | 0 | 0 | | | | | *6.3 | | |
| VT-11 | 6SN7 | Pulse Invert. | -3.9 | 113 | 0 | -85 | -85 | 0 | 0 | *6.3 | |
| VT-12 | 6SN7 | Vert. Osc. | | 191 | 7.5 | -1.3 | 32 | 7.5 | 0 | *6.3 | |
| VT-13 | 6SN7 | Vert. Deflect. | | 235 | 9 | | 235 | 9 | 0 | *6.3 | |
| VT-14 | 6V6 | R.F. Osc. | 0 | 0 | 310 | 120 | -42 | | *6.3 | 0 | |
| VT-15 | 1B3GT | Hi.V.Rect. | | †9200 | | | | | †9200 | | †Approx.9200V. depending on HV.Osc. adj. |
| VT-16 | 5U4G | Lo.V.Rect. | | 360 | | *340 | | *340 | | 360 | |
| VT-17 | 5U4G | Lo.V.Rect. | | 360 | | *340 | | *340 | | 360 | |
| VT-18 | 6H6 | AFC.-Det. | 0 | 0 | | 1.3 | -0.9 | W.J. | *6.3 | | |
| VT-19 | 6SN7 | Horiz. Osc. | | 120 | 3.8 | -11.5 | 68 | 4.9 | 0 | *6.3 | |
| VT-20 | 6BG6 | Horiz.Deflect.NC | | 0 | 9.5 | W.J. | -12 | W.J. | *6.3 | 290 | 330 V. on cap. |
| VT-21 | 6AS7 | Horiz.Damper | 281 | 300 | 330 | 281 | 300 | 330 | ♦330 | ♦330 | |
| | | | | PICTURE CHASSIS TR-2 | | | | | | | |
| VT-201 | 6AC7 | Video Ampl. | 0 | 0 | 0 | | 1.6 | 130 | *6.3 | 270 | |
| VT-202 | 6SN7 | DC.Restorer sync.cath.fol. | | 300 | 11 | 0 | 6.8 | 1.4 | *6.3 | 0 | |
| VT-203 | 6SN7 | 1st Sync.Sep. | 18.5 | 165 | 20 | | 18.5 | 0 | *6.3 | 0 | |
| VT-204 | 6V6 | 1st Sync.Amp. 2nd Sync.Sep. | 0 | 0 | 17.5 | 9 | | W.J. | *6.3 | 0 | |
| VT-205 | 10FP4 | Picture Tube | | | | | | | | Approx. 9200 V. on cap measured with Electronic Voltmeter & hi.volt. multiplier probe. | |
| | | | | RADIO CHASSIS TR-3 | | | | | | | |
| VT-301 | 6AC7 | 1st AM Mixer / FM Mixer | 0 | 0 | 0 | | 0 | 110 | *6.3 | 255 | |
| VT-302 | 6SG7 | 2nd AM Mixer / 1st FM.IF.Amp. | 0 | 0 | 0 | | 0 | 140 / 115△ | *6.3 | 255 | |
| VT-303 | 6SG7 | AM.IF.Ampl. / 2nd FM.IF.Amp. | 0 | 0 | 0 | | 0 | 155 / 135△ | *6.3 | 255 | |
| VT-304 | 6HS | FM.Discrim. | 0 | 0 | | | | | *6.3 | 0 | |
| VT-305 | 6V6 | Output | 0 | 0 | 285 | 270 | | | *6.3 | 12 | |
| VT-306 | 6SQ7 | AM.Det.-AVC. / 1st AF.Ampl. | 0 | | 0 | | 0 | 85 | *6.3 | 0 | |
| VT-307 | 5Y3GT | Rectifier | | ♦340 | | *300 | | *300 | | ♦340 | |
| VT-308 | 7F8 | 1st & 2nd AM Osc.F.M. Osc. | see remarks | 0 | 58 / 185△ | 0 | 0 | 13.5 | *6.3 | -3.3 | Min.Freq.Am Band -8.2<br>Min.Freq.SW Band -2.5<br>Min.Freq.FM Band -3.1 |

(Description of Radio Circuit cont.)
The 10.7 MC. section of this transformer is resonated by the iron cores IC-306 and IC-307 and the capacitors C-329 & C-330. The secondary of T-304 is coupled to the grid of the 2nd F.M. I-F Amplifier tube 6SG7 where the signal is amplified in the plate circuit and passes on to the primary of the discriminator transformer T-305.

## DISCRIMINATOR CIRCUIT

The discriminator circuit composed of T-305, VT-304 and their accompanying components, is conventional in design and operates in the following manner: -

The operation of the circuit results from the phase relationships existing in a transformer having a tuned primary & secondary. In effect, the primary circuit is in series, for R-F., with each half of the secondary to ground. When the received signal is at the resonant frequency of the secondary, the R-F voltage across the secondary is 90 degrees out of phase with that across the primary. Since each diode is across one-half of the secondary winding and the primary winding in series, the resultant R-F voltage applied to each are equal, and the direct voltages developed across each diode load resistor are equal and of opposite polarity. Hence the net voltage between the top of the load resistors and ground is zero. If, however, the signal varies from the resonant frequency, the 90 degrees phase relationship no longer exists between the primary and secondary. The resultant voltages applied to the two diodes are no longer equal, and a d.c. voltage proportional to the difference between the R-F voltage applied to the two diodes will exist across the series load resistors. As the signal varies back and forth across the resonant frequency of the discriminator, an a.c. voltage of the same frequency as the original modulation, and proportional to the deviation, is developed and passed on to the 1st Audio Amplifier VT-306.

## 1st AUDIO AMPLIFIER VT-306 & AUDIO OUTPUT VT-305

The audio frequency volume level is controlled by R-322 in the input circuit of VT-306, and the tone is controlled by R-346 in the plate circuit of this tube. VT-306 is a resistance coupled amplifier, and couples into the grid of the output tube VT-305 by the coupling capacitor C-358. The audio frequencies are amplified by these two tubes and are passed on to the speaker thru the output transformer T-307.

**PHONOGRAPH:** Automatic Record Changer

For detailed description of the Automatic Record Changer, refer to Service Bulletin No. 332 for Model 400-12.

## SERVICE NOTES

A. Service Precautions:

Make every effort to preserve the finish of the cabinet. Observe precautions listed under assembling. It it is necessary to remove the picture chassis from the cabinet, the picture tube must be removed first. If the tube is installed in the picture chassis on the work bench, provision must be made to support the viewing end of the tube so that no weight is applied to the neck.

Make every effort to analyze the fault in the receiver before taking any major steps such as removing chassis or realigning circuits. Refer to "Service Suggestions" page 23.

As a general approach, it is recommended that if the trouble cannot be analyzed by reference to "Service Suggestions", the voltages on the tube pins be checked against the "Voltage Chart". If this shows no fault then the wave forms of AC voltage should be checked with an oscilloscope.

B. Test Equipment:

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

RF. Sweep generator or generators covering the following ranges.

10.7 M.C. (1 M.C. Sweep width)
32.8 to 37.3 MC.(10 M.C. Sweep Width)

40 to 90 M.C. (10 M.C. Sweep width)
170 to 225 M.C. (20 M.C. Sweep width)

The output should be adjustable, preferably with 1 volt maximum. Cathode ray oscilloscope, preferably one with wide band, vertical deflection, input calibrating source, and a low capacity probe.

Accurately calibrated signal generator to provide the following frequencies.

Intermediate Frequencies
31.8 MC Adjacent channel picture trap

32.8 MC Accompanying Sound Trap
37.3 MC Video Carrier
38.8 MC Adjacent channel sound trap
10.7 MC Radio Chassis - F.M. IF
5.825 KC Radio Chassis - AM 1st IF
167.5 KC Radio Chassis - AM 2nd IF

Radio Frequencies

Broadcast 540 - 1600 KC
Shortwave 9 - 12 MC
F.M. 88 - 108 MC

Television Frequencies

| Channel No. | Picture Carrier Freq. MC | Sound Carrier Freq. MC |
|---|---|---|
| 1 | 45.25 | 49.75 |
| 2 | 55.25 | 59.75 |
| 3 | 61.25 | 65.75 |
| 4 | 67.25 | 71.75 |
| 5 | 77.25 | 81.75 |
| 6 | 83.25 | 87.75 |
| 7 | 175.25 | 179.75 |
| 8 | 181.25 | 188.75 |
| 9 | 187.25 | 191.75 |
| 10 | 193.25 | 197.75 |
| 11 | 199.25 | 203.75 |
| 12 | 205.25 | 209.75 |
| 13 | 211.25 | 215.75 |

Output of these ranges should be adjustable and preferably one volt maximum.

Electronic volt meter with a high voltage attenuator probe for use in measurements of voltage up to 10 kv.

## C. ALIGNMENT PROCEDURE

Television:

Picture Pilots; The only alignment operation in the picture pilot available to the serviceman is the oscillator. The iron-core screw which is used to adjust the oscillator frequency is located inside the top projection, which has a removeable cap. NOTE: This oscillator circuit is designed and manufactured with a high degree of stability and will rarely require readjustment. If adjustment is necessary, refer to page 8, Oscillator Adjustment.

## D. CONVERTER GRID ADJUSTMENTS

If the converter tube has been changed, it may be necessary to readjust trimmers C1 and C2. These should be maintained approximately equal in capacity value. For this adjustment, refer to step 8 page 27 of the alignment procedure.

## E. HIGH VOLTAGE OSCILLATOR ADJUSTMENT

With the contrast control set in the counter-clockwise position, set brilliance control clockwise until the raster is just visible. Adjust C-72 for maximum anode voltage. Minimum raster size and maximum brightness indicates maximum anode voltage. Turn C-72 adjusting screw 1/8 to 1/4 counter-clockwise from maximum voltage setting.

Sound Discriminator:

1. Connect VTVM to junction of C-57, C-97, R-35. Connect signal generator in series with a 1000 mmf. capacitor to pin 6 (counter-clockwise from top of chassis) of the octal Picture Pilot socket. Any of the octal Picture Pilot sockets that are not in use may be used, provided, the Channel Switch is rotated to the corresponding channel position of the socket. Set signal generator to 32.8 megacycles, accurately calibrated. Set receiver contrast control to approximately three quarters of maximum gain. Adjust signal generator output to approximately 100,000 u.v. Set the VTVM on the low voltage scale and adjust T-8 sound discriminator secondary (V). It is possible to produce a positive or negative voltage on the meter dependent upon this adjustment. T-8(V) should be adjusted so that the meter reads zero output.

2. Trap Adjustment:

In making the trap adjustments set the output of the signal generator and contrast control of the receiver so that a distinct null is indicated on the meter. Increase receiver gain or signal generator output when necessary to obtain a sharp null. Transfer VTVM to junction of R-22, L-2.

a. Without changing the frequency of the signal generator (32.8 mc), adjust the following for minimum reading on the VTVM: T-4 (L) bottom of chassis
T-2 (E) top of chassis
T-3 (J) top of chassis
b. Change frequency setting of signal generator to 32 megacycles and adjust T-1 (D), bottom, for minimum VTVM reading.
c. Set signal generator frequency to 38.8 mc. and adjust T-1 (C), top and T-2 (H), bottom for minimum VTVM read-

ing. Disconnect the VTVM and signal generator from the receiver.

IF Alignment:

This is a major undertaking and should only be resorted to after all other measures have been taken. This procedure is outlined below and on the alignment chart, for both sound and picture channels. This alignment can only be performed by the visual method, i.e., with an r-f sweep generator and an oscilloscope. In addition, an accurately calibrated signal generator is required to provide markers to locate the pass bands properly.

3. Picture I.F. Transformer Adjustments:

Connect CRO to the junction of the Peaking coil L-2 and resistor R-22. Connect sweep generator output in series with a 1000 mmf capacitor to pin 4 of VT-5. Set sweep generator for a sweep width of 8 megacycles, (31 to 39 mc). Loosely couple the marker generator output to the output of the sweep generator. Set contrast control on receiver as low as possible and the sweep generator output as high as possible to obtain a clear image on the scope. (Hi. signal to noise ratio). See wave forms (figs. 1 thru 9) pages 22 and 23.

a. Set marker generator to 32.8 mc and inspect location of marker on the scope. The marker should be located in dip of the wave form pattern, see wave form figure 1. If this is not the case, make a slight adjustment of T-4 (L), bottom, to locate marker.
b. Change marker generator frequency to 37.3 mc. and adjust the 5th Video I.F. Trans. T-5 secondary (N), bottom, and primary (M), top, until marker appears on the high frequency slope of the pattern, and a wave form that conforms with figure 1.
c. Without changing frequency of generators, transfer them to pin 4 of VT-4. Reduce the output of the generators if necessary. Adjust the 4th Video I.F. Transformer T-4 (K), top, until marker appears on high frequency side of wave form pattern, see fig. 2.
d. Remove marker and sweep generators from pin 4 of VT4 and connect to pin 4 of VT-3. Frequency setting of marker should remain in the same (37.3 mc). Short circuit 1st I.F. Transformer T-1 plate winding (across C-5). Lower output of generators if necessary and adjust 3rd. Video I.F. Transformer T-3 (I), bottom, until marker appears on the high frequency side of the slope, see figure 3.
e. Change frequency of marker generator to 32.8 mc. and observe pattern on scope. The marker should appear in the valley of the pattern. If this is not the case, adjust T-3 (J) to locate marker. Remove short circuit from T-1 plate winding.

Sound I.F. Transformer Adjustments:

4. Connect CRO to junction of C-57, C-97, R-35. Connect sweep generator in series with 1000 mmf. capacitor to pin 4 of VT-9. Loosely couple marker generator to output of sweep generator. Set sweep width for 1 megacycle (32.3 to 33.3 mc) and adjust output for suitable pattern on scope. Set marker generator to 32.8 mc. with sufficient output to produce marker on response curve.

(a). Examine pattern on scope, and adjust 5th sound I.F. Transformer T-8 (U), top and T-8 (V), bottom until marker appears in the center of the straight portion of the pattern, see figure 6. Peak to peak band width should be between 300 and 400 KC.
(b). Transfer marker and sweep generators to pin 4 of VT-8 and adjust the 4th sound I.F. Transformer T-7 (S), top, and T-7 (T), bottom for pattern as shown in figure 7. Reduce generator output if necessary.
(c). Remove signal and sweep generators from pin 4 of VT-8 and connect to pin 4 of VT-7. Reduce generator outputs if necessary and adjust 3rd sound I.F. Transformer T-6 (P), top, and T-6 (R), bottom, until wave form pattern as shown in figure 8 is obtained. Remove the generators from pin 4 of VT-7 and the scope from the audio detector, filter network.

2nd I.F. Trans. & Final 32.8 and 38.8 mc. Trap Adjustments:

5. Connect CRO to junction of the Peaking coil L-2 and resistor R-22. Connect sweep generator output in series with a 1000 mmf. capacitor to grid of 1st I.F. Amplifier, pin 4 on VT-2. Set sweep width to 8 megacycles (31 to 39 mc). Loosely couple marker generator to sweep generator output. Short circuit converter plate winding, (see bottom view of alignment adjust-

ment chart page 21 VT-1 plate leads). Inspect wave form pattern on scope, this should compare with Fig. 4 wave form pattern after making the following adjustments. Set marker generator frequency to 32.8 mc. and adjust (E), top of T-2, if necessary. Set marker generator frequency to 37.3 mc. and adjust (F), top and (G) bottom of T-2. Set marker generator frequency to 38.8 mc. and adjust (H), bottom of T-2 if necessary. After adjustments remove the short circuit from the converter plate winding.

6. Transfer the sweep and marker generator to pin 6 of the octal Picture Pilot socket. Connect a 1 megohm resistor from this pin to ground. Sweep with 8 mc. and adjust output of generator for good image on scope. Make the following adjustments until image on scope matches wave form pattern fig. 5. Set signal generator to 37.3 mc. and adjust (A), top and (B) bottom of T-1. Set signal generator to 38.8 mc. and adjust (C) top of T-1, if necessary. Set signal generator to 32. mc. and adjust (D) bottom of T-1, if necessary.

7. Remove scope from L-2 and R-22 and connect to the junction of C-57, C-97, R-35. With the generators connected as above, set sweep for one megacycles sweep width (32.3 to 33.3 mc.) and marker generator frequency to 32.8 mc. Inspect pattern on scope, this should match wave form pattern figure 9. To improve symmetry it may be necessary to make a slight adjustment of (D) bottom of T-1.

8. CONVERTER GRID TRIMMER ADJUSTMENTS.
Adjust trimmers (W) and (X) each for 16.5 uuf ± 0.1 uuf capacity to ground from converter (VT-1) grid pins 1 and 8. A capacity bridge should be used for this adjustment. Capacity balance between the two trimmers is necessary for the proper operation of the Picture Pilots. Connect capacity bridge from pin 6 on the octal Picture Pilot socket to chassis, and adjust (X) to 16.5 uuf. Transfer capacity bridge to pin 7 and adjust (W) to 16.5 uuf. Any of the octal Picture Pilot sockets may be used, provided, the Channel Selector Switch is rotated to the corresponding channel position of the socket.

NOTE: To improve horizontal resolution it may be necessary to adjust the 5th Video I.F. Transformer secondary screw (N), (bottom of chassis) from one to six turns counterclockwise after all adjustments have been made. The number of turns required will be determined by the quality of the signal from the transmitter. After making this adjustment the receiver should be checked on all available stations; too many turns would result in an excessive amount of trailing white on dark objects.

9. PICTURE ADJUSTMENTS

These are covered under "ASSEMBLING" & "ADJUSTING" pages 5, 6, 7 and 8

10. OSCILLATOR ADJUSTMENT

See page 8.

RADIO ALIGNMENT
See page 30.

SERVICE SUGGESTIONS TELEVISION:

Following is a list of failures and some possible causes.

NO RASTER ON PICTURE TUBE.

1. No high voltage - this may be due to shorted H.V. cable, defective capacitors C-75 or C-76, inoperative tubes V-14 or V-15, defective H.V. Trans. T-10.
2. Defective picture tube.
3. R-228 or R-230 open.
4. No plate voltage - filter capacitor shorted, filter resistor R-61, focus coil, R-224, R-225, or R-338 open.

NO VERTICAL DEFLECTION

1. VT-12 or VT-13 inoperative.
2. T-9 or cable from T-9 shorted.
3. Vertical deflection coils shorted or open.

NO HORIZONTAL DEFLECTION

1. VT-19, VT-20, VT-21 inoperative.
2. T-12 or cable from T-12 open or shorted.
3. Horizontal deflection coils shorted or open.

SMALL RASTER

High Anode Voltage or low line voltage.

POOR VERTICAL LINEARITY - ADJUSTMENT WILL NOT CORRECT.

1. Change VT-13.
2. Defective T-9.
3. Check VT-12.
4. Check C-66, C-69 and R-48.
5. Check plate supply voltage.

POOR HORIZONTAL LINEARITY - ADJUSTMENTS WILL NOT CORRECT.

1. Change VT-20 to VT-21.
2. T-12 defective.
3. Check C-90 or R-73 or R-77.

VERTICAL SHADING BARS ON LEFT SIDE OF RASTER.

1. C-181 defective.
2. Defective yoke.

TRAPEZOIDAL OR NON-SYMMETRICAL RASTER.

1. Improper adjustment or focus coil.
2. Defective yoke.

RASTER AND SIGNAL ON PICTURE TUBE BUT NO SOUND.

1. Sound IF, descriminator or audio amplifier inoperative.
2. Picture pilot oscillator off frequency.

SIGNAL AT PICTURE TUBE BUT NO SYNC.

1. Contrast control advanced too far.
2. Tubes VT-202, VT-203, or VT-204 inoperative.
3. Cable to P-7 lead to pin 5 open or shorted.

SIGNAL AT PICTURE TUBE BUT NO VERTICAL SYNC.

1. Check VT-12 and associated circuit components, including integrating network C-60, C-61, C-62, R-41, R-42, R-43 and speed control R-339, and R-340.

SIGNAL AT PICTURE TUBE BUT NO HORIZONTAL SYNC.

1. Check VT-6B, VT-18, VT-19, and associated circuits.
2. Check VT-11A and associated circuit.
3. Check R-335, R-336, R-71, C-88, C-98.

SOUND AND RASTER ON PICTURE TUBE BUT NO PICTURE.

1. Video IF, detector, or video amplifier inoperative. Check VT-2, VT-3, VT-4, VT-5, VT-6A, VT-201 and associated circuits.
2. Bad contact at picture tube grid.

PICTURE STABLE BUT POOR RESOLUTION.

1. Check peaking coils L-2 or L-201.
2. Improper focus - make certain focus control operates on both sides of proper focus.
3. Video detector CR-1, VT-6A, or VT-201 defective.
4. RF or video IF Circuits misaligned.

PICTURE SMEAR.

1. Too much contrast - reduce contrast control.
2. Check peaking coils.
3. Check voltages on VT-6A and VT-201.
4. Trouble can originate at transmitter - check on another station.

NON-UNIFORM FOCUS OR INABILITY TO REACH FOCUS WITH CONTROL.

1. Check high voltage.
2. Check mechanical position of focus coil as to centering around CR tube. Adjustment of coil forward or backward may improve action or focus control.
3. In some cases it may be necessary to change R-233 to a new value which permits more or less current to flow through the focus coil.

BLACK BARS IN PICTURE WITH HIGH VOLUME OF SOUND.

1. Change VT-2 or VT-201.

WAVE IN VERTICAL EDGE OF PICTURE WITH HIGH VOLUME OF SOUND.

1. Change VT-19.

ONE OR TWO CYCLE WAVE IN VERTICAL EDGE OF PICTURE.

1. Change VT-18.

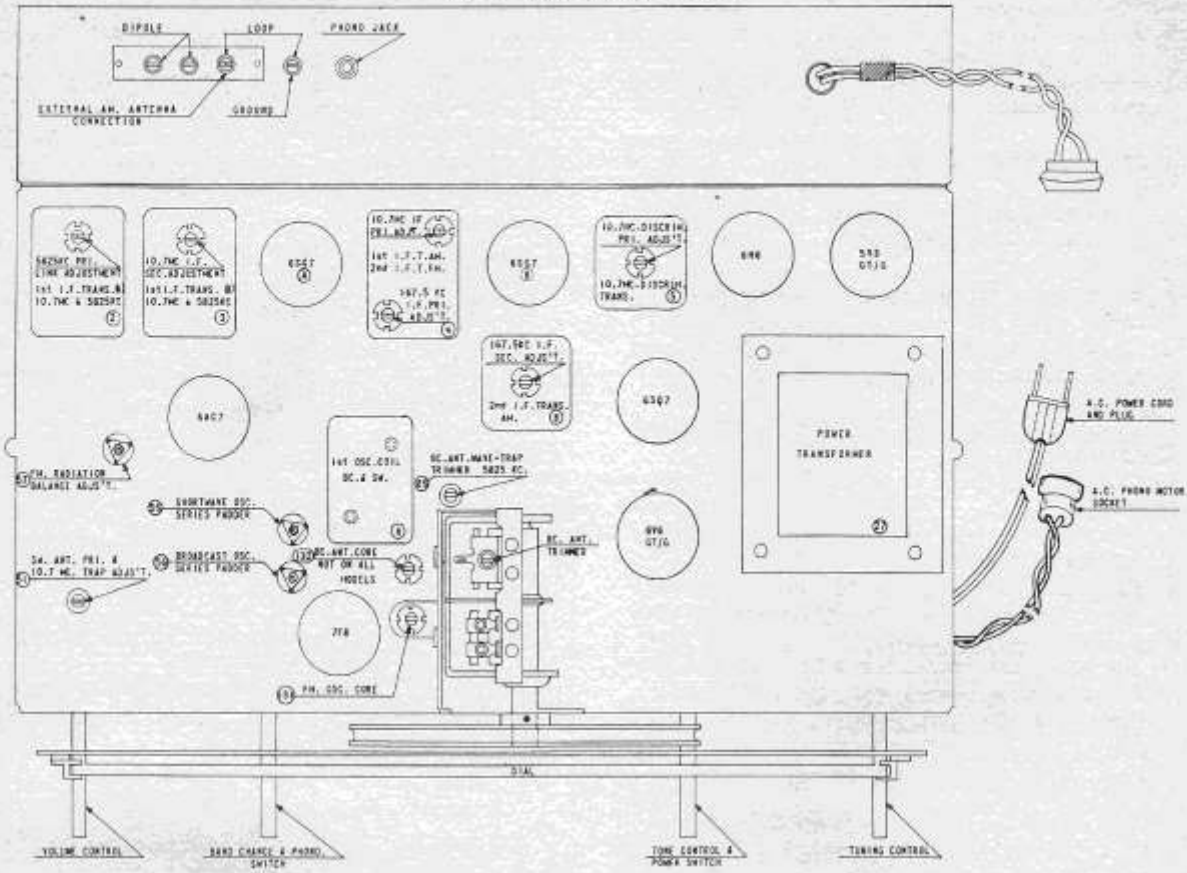



Fig. 17 - Top View, Alignment Adjustments

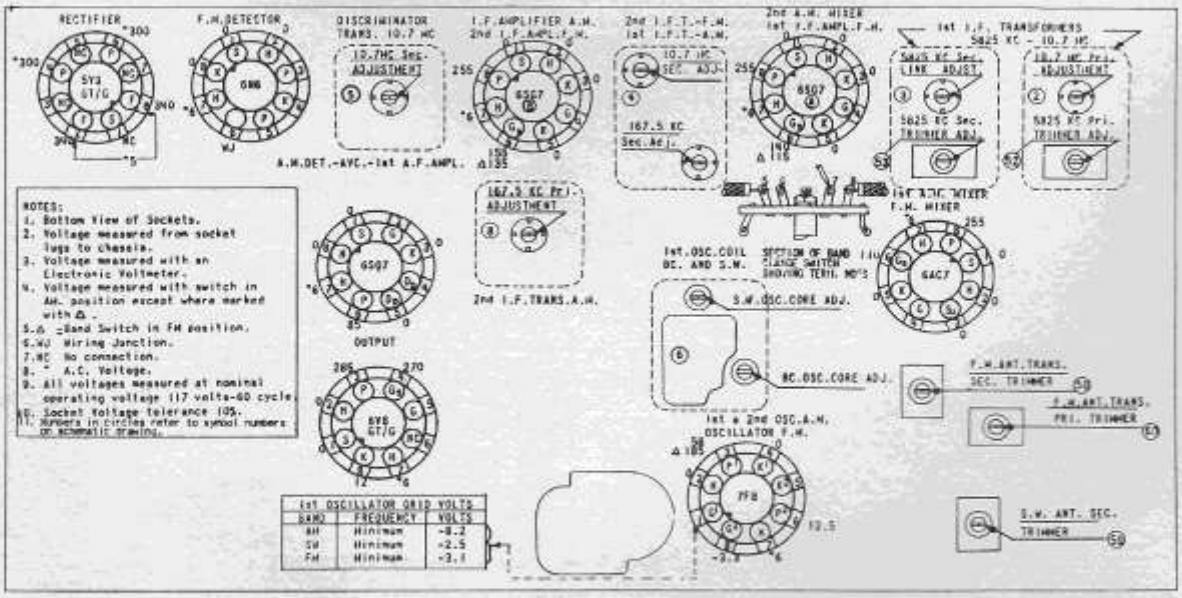



Fig. 18 - Socket Voltage Chart and Bottom Alignment Adjustments

## ALIGNMENT EQUIPMENT

The following equipment is used as indicated in the alignment charts and alignment notes:

### SIGNAL GENERATORS:

1. Amplitude Modulated Signal Generator with 400 cycle modulated signal to cover 167.5 kc. to 108 mc.
2. Frequency Modulated Signal Generator to cover 87 to 108 mc., with sweep to cover 10 to 30 kc. on narrow band and 450 kc. on wide band (Scope alignment only).

### CATHODE RAY OSCILLOGRAPH (Scope alignment only).

Meters:

1. Suitable Output Meter.
2. Field Strength Meter (Fig. 19). This meter may consist of a D.C. 100 microampere (full scale) meter, shunted by a 1000 mmf. mica by-pass condenser; a crystal rectifier connected in series with the meter and a five foot, 75 ohm twisted, pair of leads. The open ends of the leads are connected to the dipole antenna terminals. Connect condenser directly across meter terminals, and crystal directly to one terminal of meter. Keep connecting leads as short as possible.

### DUMMY ANTENNAS:

1. 78 ohm Dummy Antenna (Fig. 20).
2. Dummy Loop Antenna (Fig. 21) is used to place "Signal Web" antenna, when chassis is removed from cabinet.

### CONDENSERS:

1. 0.1 mfd. Condenser.
2. 30 mmf. Condenser.

### SHUNTS:

1. 5000 ohm carbon Resistor in series with a 0.1 mfd. Condenser.
2. Hairpin Shorting Shunt composed of two inches of No. 14 bare tinned copper wire.

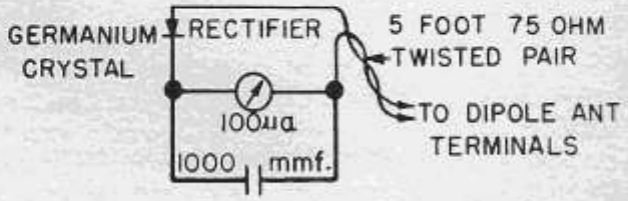



Fig. 19

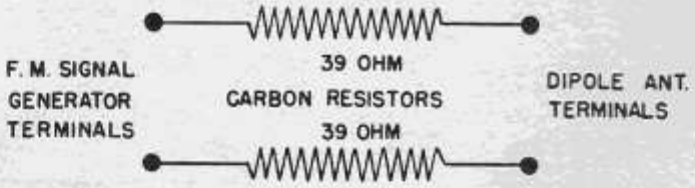



Fig. 20

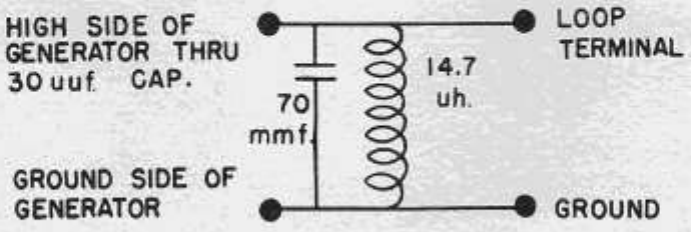



Fig. 21

## ALIGNMENT PROCEDURE (Output Meter and Scope Method)

1. This receiver has been aligned at the factory for best performance, and no attempt should be made to realign it unless the proper test equipment is available.
2. Turn the tuning condenser to full mesh, against stop, and set the dial pointer to the reference point which is to the left of 87.9 M.C. on the dial.
3. Set tone control knob to the treble position, (extreme left).
4. When output meter is used, connect across voice coil: (3.2 ohms).
5. Feed an R.F. signal modulated 30% at 400 cycles to the receiver as indicated on the alignment chart (below). Connect signal generator ground terminal to the chassis of the receiver, except where noted.
6. When F.M. signal generator is used, a 30% modulated signal is equal to 22.5 kilocycles deviation.
7. Turn volume control knob to maximum clockwise position and adjust signal generator output to produce a noticeable output meter reading, (approx. 500 mw.) Keep signal generator output as low as possible to prevent excessive AVC action in the receiver.
8. The low impedance "Signal Web" antenna should remain connected, or, if the chassis is removed from cabinet, a dummy antenna should be connected in its place (See Fig. 21).

**ALIGNMENT CHART (Output Meter Method)**

**To Locate Adjustments, Refer to Page 29**

| Alignment Sequence | A. M. Signal Generator Output | | | Position of | | Adjust | Osc. Frequency | Remarks (Alignment notes begin on page 32) |
|---|---|---|---|---|---|---|---|---|
| | Frequency | In Series with | To | Range Switch | Dial Pointer or Var.Cond. | | | |
| 1 | 167.5 kc. | 0.1 mfd. | 2nd I. F. Grid 6SG7 (B) | SW | Open | 2nd I. F. Trans. (8) | | See Note 1 |
| 2 | 167.5 kc. | 0.1 mfd. | 1st I. F. Grid 6SG7 (A) | SW | Open | 1st I. F. Trans. (4) | | See Note 2 |
| 3 | 10.7 mc. | 30 mmf. | 2nd I. F. Grid 6SG7 (B) | FM | Open | Discriminator Trans. (5) | | See Note 3 |
| 4 | 10.7 mc. | 30 mmf. | 1st I. F. Grid 6SG7 (A) | FM | Open | 2nd I. F. 10.7 mc. Trans. (4) | | See Note 4 |
| 5 | 10.7 mc. | 30 mmf. | See Note 5 | FM | Open | 1st I. F. 10.7 mc. Trans. (2) & (3) | | See Note 5 |
| 6 | 5825 kc. | 30 mmf. | *Link Coupling on 10.7 mc. I. F. No. 2 | SW | Open | 5825 kc. I. F. Trans. (3) | 167.5 kc. Above | See Note 6—*The short lead between Transformers No. 2 & 3 |
| 7 | 5825 kc. | 30 mmf. | 6AC7 Grid | SW | Open | 5825 kc. I. F. Trans. (2) | 167.5 kc. Above | See Note 7 |
| 8 | 100 mc. | *78 ohm Dummy | F. M. Dipole Terminals | FM | Channel 260.5 | F. M. Osc. Core F. M. Ant. Trims. Sec. & Prim. | 10.7 mc. Above | See Note 8—*See "Dummy Antennas (1)," page 30 |
| 9 | 97.9 mc. | *78 ohm Dummy | F. M. Dipole Terminals | FM | Channel 250 | F. M. Osc. Core | 10.7 mc. Above | See Note 9—*See "Dummy Antennas (1)," page 30 |
| 10 | Disconnect Generator *Connect Field Strength Meter | | | FM | Channel 215 | Radiation Bal. Trimmer | | *See Note 10—*See "Field Strength Meter" page 30 |
| 11 | *9.6 mc. | 30 mmf. | One F. M. Ant. Term. | SW | 9.6 mc. | S. W. Oscillator Series Padder | 5825 kc. Above | *Disconnect Field Strength Meter Connect Signal Generator. See Note 11 |
| 12 | 11.8 mc. | 30 mmf. | One F. M. Ant. Term. | SW | 11.8 mc. | S. W. Osc. Core | 5825 kc. Above | See Note 12 |
| 13 | 10.7 mc. | 30 mmf. | One F. M. Ant. Term. | SW | 10.7 mc. | S. W. Ant. Prim. & Sec. Padder | | See Note 13 |
| 14 | 10.7 mc. | 30 mmf. | One F. M. Ant. Term. | FM | 10.7 mc. | S. W. Primary (10.7 mc. Trap) | | See Note 14 |
| 15 | 535 kc. | 30 mmf. | *HI. Side of Dummy Loop Ant. | AM | Closed | B. C. Oscillator Series Padder | 5825 kc. Above | *See Note 15—See "Dummy Antennas (2)," page 30 |
| 16 | 1620 kc. | 30 mmf. | HI. Side of Dummy Loop Ant. | AM | Open | B. C. Osc. Core | 5825 kc. Above | See Note 16 |
| 17 | 1400 kc. | 30 mmf. | HI. Side of Dummy Loop Ant. | AM | 1400 kc. | B. C. Antenna Trimmer | | See Note 17 |
| 18 | 600 kc. | 30 mmf. | HI. Side of Dummy Loop Ant. | AM | 600 kc. | B. C. Antenna Core | | See Note 18 |
| 19 | 5825 kc. | 30 mmf. | HI. Side of Dummy Loop Ant. | AM | 1400 kc. | B. C. Wave Trap Trim. | | See Note 19 |
| 20 | 600 kc. | See Note 20 | | | | | | |

*Refer to remarks (with corresponding asterisk) in last column.

## ALIGNMENT NOTES (Output Meter Method)

Use the following notes in conjunction with ALIGNMENT CHART (page 31), TOP AND BACK VIEW (page 29), SOCKET VOLTAGE CHART (page 29), and SCHEMATIC DIAGRAM.

(a) Place Shunt from link, between transformers (5) and (8), to ground (See "Shunts (1)", page 30). Adjust secondary (top) for maximum output.

(b) Connect the Shunt from diode plate (pin No. 4) of 6SQ7 tube socket to the shielded lead junction on transformer (8). Adjust primary (bottom) for maximum output. Remove Shunt.

2.(a) Place Shunt from plate of the 6SG7 tube socket (A) to the transformer side of 2200 ohm resistor (106), See "Shunts (1)", page 30. Adjust secondary (bottom) for maximum output.

(b) Connect the Shunt from grid of the 6SG7 tube socket (B) to Transformer side of 68,000 ohm resistor (109). Adjust primary (top) for maximum output. Remove Shunt.

3.(a) Adjust secondary (bottom) core for null point.

(b) Tune Signal Generator for maximum Output Meter reading, approximately 75 to 100 kc. off the null point obtained in 3 (a), and note reading.

(c) Tune Signal Generator to the opposite side of the null point for maximum reading on the Output Meter. Note this reading. If the two readings are not equal, adjust primary (top) core until equal readings are obtained.

4.(a) Set Signal Generator to peak on high side of 10.7 mc. and adjust primary (top) and secondary (bottom) for maximum output. Note meter reading.

(b) Set Signal Generator to peak on low side of 10.7 mc. and note reading. If necessary, readjust primary (top) and secondary (bottom), slightly, until Output Meter readings and frequency spacing are equal on both sides of the 10.7 mc. null point.

5.(a) Connect Signal Generator output in series with a 30 mmf. condenser to either lug of the F.M. antenna transformer primary Trimmer (60). Connect Signal Generator ground to the receiver chassis at a point close to the trimmer. Keep lead lengths to a minimum and do not drape shielded cable, from Signal Generator output, near under side of chassis.

(b) Set Signal Generator to peak on high side of 10.7 mc. and adjust 10.7 mc. primary (bottom) of transformer (2). Adjust 10.7 mc. secondary (top) of transformer (3). These two adjustments should be adjusted for maximum output. Note reading on Output Meter.

(c) Set Signal Generator to peak on low side of 10.7 mc. and note Output Meter reading. If meter readings obtained on the peaks on both sides of 10.7 mc. are not equal, readjust the 10.7 mc. primary of transformer (2), and the 10.7 mc. secondary of transformer (3). The peaks should appear approximately 80 kc. on each side of 10.7 mc.

6.(a) Set Signal Generator frequency control for maximum output. Adjust 5825 kc. secondary Trimmer and secondary link adjustment, on bottom of transformer (3), for maximum output.

7.(a) Adjust 5825 kc. primary trimmer (bottom) and 5825 kc. primary link adjustment (top) of transformer (2) for maximum output.

8.(a) Adjust F.M. oscillator core (131), on top of chassis, to midway position.

(b) Preset F.M. radiation balance adjustment (57), on top of chassis, to approximately two turns from the closed position.

(c) Short circuit F.M. antenna primary trimmer (60), located on bottom of chassis, with Hairpin Shorting Shunt (See "Shunts (2)", page 30).

(d) Adjust F.M. antenna secondary trimmer (58), on bottom of chassis, for maximum output.

(e) Transfer Shorting Shunt to F.M. antenna secondary Trimmer (58) and adjust F.M. antenna primary Trimmer (60) for maximum output.

(f) Remove Shorting Shunt.

9.(a) Adjust F.M. oscillator core (131), slowly, until 97.9 mc. signal is tuned in. Receiver should tune thru 87.9 and 107.9 mc. signal (channel 200 and 300).

10.(a) Connect Field Strength Meter to dipole antenna terminals, on back of chassis.

(b) Adjust F.M. radiation balance trimmer (57), on top of chassis, to null point. If

it is necessary to move this trimmer more than a quarter turn, repeat steps 8 and 10.

Alternate Method:--Connect a D.C. Vacuum Tube Volt meter to No. 1 lug of 7F8 tube socket and adjust F.M. radiation balance trimmer for maximum grid volt reading.

11.(a) Set Signal Generator to 9.6 mc. modulated 30% at 400 cycles.

(b) Turn volume control to maximum.

(c) Adjust short-wave series padder (55), on top of chassis, for maximum output.

12.(a) Adjust short-wave oscillator core, on bottom of chassis, for maximum output. Repeat steps 11 and 12 until dial tracks at 9.6 and 11.8 mc.

13.(a) Shunt short-wave antenna primary padder (51), (lug connected to coil) to chassis with a Shorting Clip.

(b) Increase Signal Generator output if necessary.

(c) Adjust short-wave antenna secondary trimmer (59), for maximum output, while rocking variable condenser.

(d) Transfer the Shorting Clip to across the short-wave antenna secondary trimmer (59).

(e) Adjust short-wave antenna primary padder (51), for maximum output, while rocking variable condenser.

(f) Remove Shorting Clip.

14.(a) Connect Field Strength Meter from Signal Generator side of 30 mmf. condenser to chassis.

(b) Increase or decrease Signal Generator output until Field Strength Meter reads between 10 and 15 microamperes.

(c) Adjust short-wave antenna primary padder (51), for lowest reading on Field Strength Meter. Make this adjustment slowly, otherwise the dip may be passed unnoticed when a highly damped meter is used.

(d) Disconnect Field Strength Meter.

Alternate Method:--After the receiver is installed in cabinet, turn band switch to F.M. position and tune in an F.M. station. If a 10.7 kc. signal (indicated by a whistle or code) is heard in the speaker, adjust the short-wave antenna primary (51) until the interferring signal disappears or is minimized. Make this adjustment slowly.

15.(a) Connect Dummy Loop Antenna to Signal Web Antenna terminal and to ground terminal (See "Dummy Antennas (2)," page 30).

(b) Preset broadcast antenna wave trap (85), on top of chassis, to approximately two turns from the closed position.

(c) Adjust broadcast oscillator series padder (56), on top of chassis, for maximum output.

16.(a) Adjust broadcast oscillator core, on

CROSS REFERENCE TABLE - Showing Equivalent Alignment Chart Reference numbers to Symbol Numbers on TR-3 Schematic.

| | | | |
|---|---|---|---|
| 1 - | T-301 | 58 - | C-302 |
| 2 - | T-302 | 59 - | C-305 |
| 3 - | T-303 | 60 - | C-301 |
| 4 - | T-304 | 85 - | C-307 |
| 5 - | T-305 | 106 - | R-309 |
| 6 - | L-306 | 109 - | R-310 |
| 8 - | T-306 | 131 - | 1C-314 |
| 51 - | C-303 | 132 - | 1C-301 |
| 55 - | C-363 | 6SG7(a) | VT-302 |
| 56 - | C-362 | 6SG7(b) | VT-303 |
| 57 - | C-310 | | |

bottom of chassis, for maximum output.

(b) Repeat steps 15 to 16 until frequency shift stops.

17.(a) Adjust broadcast antenna trimmer, on top of variable condenser, for maximum output.

18.(a) Adjust broadcast antenna core (132), on top of chassis, for maximum output while rocking variable condenser.

19.(a) Set dial pointer to approximately 1400 kc. and retune Signal Generator to maximum output. (approx. 5825 KC)

(b) Adjust Signal Generator output to approximately midscale reading on the Output Meter.

(c) Adjust broadcast antenna wave trap trimmer (85), for lowest reading on Output Meter.

(e) All Air Trimmers should be locked in position by appling a drop of household cement on the screw threads.

20.(a) After the receiver is placed in cabinet and all connections are made for normal operation, readjust the broadcast antenna core for maximum output at 600 kc.

## ALIGNMENT NOTES (Scope Method)

1.(a) Sweep align (Use approximately 20 to 30 kc. to sweep).

(b) Sweep align (Use approximately 450 kc. to sweep).

2.(a) For 167.5 kc.; connect Scope to terminal No. 8 on the rear plate section of band change switch.

(b) For 10.7 mc.; connect Scope, thru a 100,000 ohm resistor, to lug No. 6 of 6H6 tube socket.

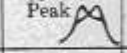
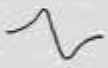
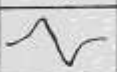
3. Sweep Generator output 100,000 to 200,000 microvolts.

4. Scope Adjustment remains. Reduce Sweep input.

5. Connect Output Meter across voice coil. Feed an R.F. signal, calibrated at 10.7 mc. and modulated 30% at 400 cycles, to the receiver as indicated.

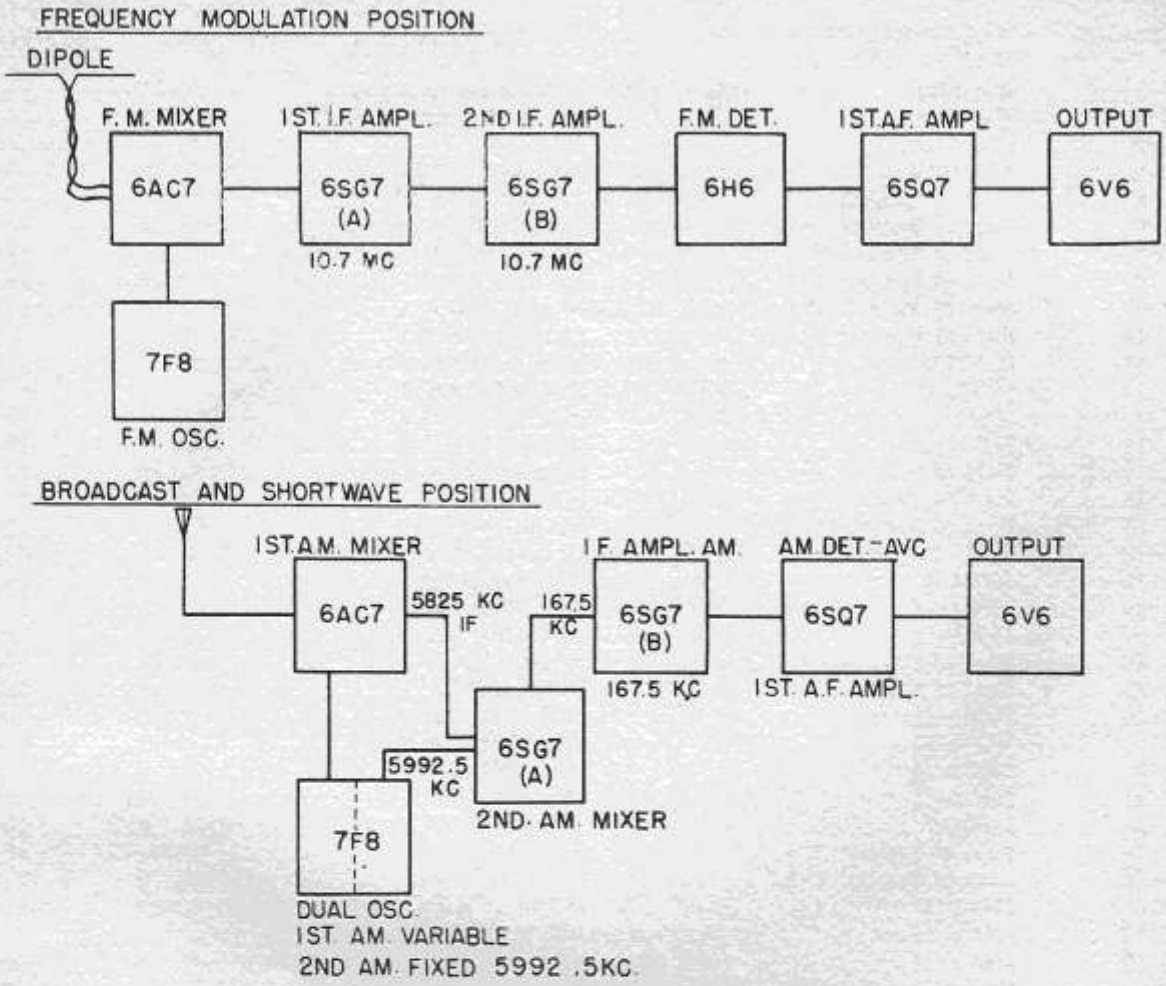
## ALIGNMENT CHART (Scope Method)

**Before using this chart, see ALIGNMENT PROCEDURE on page 31 To locate adjustments, refer to page 29**

| Alignment Sequence | Type Generator | Signal Generator Output | | | Position of | | Adjust | Type of Selectivity Curve | Osc. Frequency | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | In Series with | To | Range Switch | Dial Pointer or Var. Cond. | | | | |
| 1 | F. M. | 167.5 kc. | 0.1 mfd. | 2nd I. F. Grid 6SG7 (B) | SW | Open | 2nd I. F. Trans. (8), Top & Bottom | Flat or Double Peak | | See Notes 1(a) & 2(a) |
| 2 | F. M. | 167.5 kc. | 0.1 mfd. | 1st I. F. Grid 6SG7 (A) | SW | Open | 1st I. F. Trans. (4), Bottom & Top | 10% Double Peak  | | See Notes 1(a) & 2(a) |
| 3 | * A. M. | 10.7 mc. | 30 mmf. | 1st I. F. Grid 6SG7 (A) | FM | Open | Discriminator Trans. (5), Bottom | Adjust for null point | | *Disconnect F. M. Signal Generator and Scope See Note 5. |
| 4 | * F. M. | 10.7 mc. | 30 mmf. | 1st I. F. Grid 6SG7 (A) | FM | Open | Discriminator Trans. (5), Top |  | | *Disconnect A. M. Signal Generator and Output Meter See Notes 1(b), 2(b), & 3 |
| 5 | F. M. | 10.7 mc. | 30 mmf. | 1st I. F. Grid 6SG7 (A) | FM | Open | 2nd I. F., 10.7 mc., Trans. (4), Top & Bottom |  | | See Notes 1(b), 2(b), & 4 Readjust, slightly, discriminator primary (Top). |
| 6 | F. M. | 10.7 mc. | 30 mmf. | Grid of 6AC7 | FM | Open | 1st I. F., 10.7 mc., Trans. (2) & (3) |  | | See Notes 1(b), 2(b), & 4 Adjust Trans. (2) bottom. Adjust Trans. (3) Top |
| 7 | A. M. | Use Alignment Chart on page 31 Begin with sequence No. 6 and continue thru to sequence No. 19, inclusive. | | | | | | | | |

*Refer to Remarks (with corresponding asterisk) in last column.

## BLOCK DIAGRAM OF CIRCUITS:




## CHANNEL NUMBERS TO MEGACYCLES

Cross index between channel calibrations on the dial and frequency in megacycles follow:

| Channel No. | Frequency in Megacycles | Channel No. | Frequency in Megacycles |
|---|---|---|---|
| 200 | 87.9 | 265 | 100.9 |
| 205 | 88.9 | 270 | 101.9 |
| 210 | 89.9 | 275 | 102.9 |
| 215 | 90.9 | 280 | 103.9 |
| 220 | 91.9 | 285 | 104.9 |
| 225 | 92.9 | 290 | 105.9 |
| 230 | 93.9 | 295 | 106.9 |
| 235 | 94.9 | 300 | 107.9 |
| 240 | 95.9 | | |
| 245 | 96.9 | | |
| 250 | 97.9 | | |
| 255 | 98.9 | | |
| 260 | 99.9 | | |

To find the frequency in megacycles for CHANNEL NUMBERS between those given above, add .2 megacycle for every whole number added to the CHANNEL NUMBER; for example Channel 204 would be 88.7 megacycles and 251 would be 98.1 megacycles.

## PARTS LIST FOR 348 CP

| SYMBOL | PART NUMBER | DESCRIPTION | PART OF SYMBOL |
|---|---|---|---|
| C-1 | W-139268 | CAPACITOR .3 - 3 mmf trimmer | |
| C-2 | W-138268 | " .3 - 3 mmf trimmer | |
| C-3 | AW-136911 | " 1.3 mmf | |
| C-4 | AW-136911 | " 1.3 mmf | |
| C-5 | Part of Symbol T-1 | " 12 mmf 500 V. | |
| C-6 | Part of Symbol T-1 | " 1 mmf 500 V. | |
| C-7 | Part of Symbol T-1 | " 15 mmf 500 V. | |
| C-8 | Part of Symbol T-1 | " 1.5 mmf 500 V. | |
| C-9 | Part of Symbol T-1 | " 10 mmf 500 V. | |
| C-10 | Part of Symbol T-1 | " 12 mmf 500 V. | |
| C-11 | C-137727-38 | " 5000 mmf 500 V. | |
| C-12 | 39001-11 | " .005 MFD 600 V. | |
| C-13 | 39001-11 | " .005 MFD 600 V. | |
| C-14 | 39001-11 | " .005 MFD 600 V. | |
| C-15 | Part of Symbol T-2 | " 56 mmf 500 V. | |
| C-16 | Part of Symbol T-2 | " 1 mmf 500 V. | |
| C-17 | Part of Symbol T-2 | " 1 mmf 500 V. | |
| C-18 | Part of Symbol T-2 | " 10 mmf 500 V. | |
| C-19 | 39004-8 | " 150 mmf mica | |
| C-20 | 39001-11 | " .005 MFD 600 V. | |
| C-21 | 39001-11 | " .005 MFD 600 V. | |
| C-22 | Part of Symbol T-3 | " 15 mmf 500 V. | |
| C-23 | Part of Symbol T-3 | " 180 mmf 500 V. | |
| C-24 | 39001-11 | " .005 MFD 600 V. | |
| C-25 | 39001-11 | " .005 MFD 600 V. | |
| C-26 | 39001-11 | " .005 MFD 600 V. | |
| C-27 | 39001-11 | " .005 MFD 600 V. | |
| C-28 | 39001-7 | " .001 MFD 600 V. | |
| C-29 | Part of Symbol T-4 | " 4.7 mmf 500 V. | |
| C-30 | Part of Symbol T-4 | " 47. mmf 500 V. | |
| C-31 | 39004-8 | " 150 mmf Mica | |
| C-32 | 39001-11 | " .005 MFD 600 V. | |
| C-33 | 39001-11 | " .005 MFD 600 V. | |
| C-34 | Part of Symbol T-5 | " 5000 mmf 500 V. | |
| C-35 | Part of Symbol T-5 | " 4.7 mmf 500 V. | |
| C-36 | Part of Symbol T-5 | " 10 mmf 500 V. | |
| C-37 | Part of Symbol T-5 | " 10 mmf 500 V. | |
| C-39 | C-137727-48 | " 5000 mmf 500 V. | |
| C-41 | 39001-11 | " .005 MFD 600 V. | |
| C-42 | 39001-11 | " .005 MFD 600 V. | |
| C-43 | Part of Symbol T-6 | " 36 mmf 500 V. | |
| C-44 | Part of Symbol T-6 | " 33 mmf 500 V. | |
| C-45 | 39001-7 | " .001 MFD 600 V. | |
| C-46 | 39001-11 | " .005 MFD 600 V. | |
| C-47 | 39001-11 | " .005 MFD 600 V. | |
| C-48 | Part of Symbol T-7 | " 36 mmf 500 V. | |
| C-49 | Part of Symbol T-7 | " 33 mmf 500 V. | |
| C-50 | 39001-7 | " .001 MFD 600 V. | |
| C-51 | 39001-11 | " .005 MFD 600 V. | |
| C-52 | 39001-11 | " .005 MFD 600 V. | |
| C-53 | Part of Symbol T-8 | " 27 mmf 500 V. | |
| C-54 | Part of Symbol T-8 | " 10 mmf 500 V. | |
| C-55 | Part of Symbol T-8 | " 43 mmf 500 V. | |
| C-56 | 39004-8 | " 150 mmf Mica | |
| C-57 | 39001-7 | " .001 MFD 600 V. | |
| C-58 | 39001-13 | " .01 MFD 600 V. | |
| C-60 | 39001-14 | " .015 MFD 600 V. | |

## PARTS LIST (Cont.)

| SYMBOL | PART NUMBER | DESCRIPTION | PART OF SYMBOL |
|---|---|---|---|
| C-61 | 39001-17 | CAPACITOR .05 MFD 600 V. | |
| C-62 | 39001-17 | " .05 MFD 600 V. | |
| C-63 | B-138013 | " 4 MFD Elect. | |
| C-64 | 39001-81 | " .025 MFD 600 V. | |
| C-65 | 39001-11 | " .005 MFD 600 V. | |
| C-66 | 39001-17 | " .05 MFD 600 V. | |
| C-67 | 39001-19 | " .1 MFD 600 V. | |
| C-68 | 39001-13 | " .01 MFD 600 V. | |
| C-69 | B138011 | " 100 MFD Elect. | |
| C-70 | B139203 | " 16 MFD Elect. | |
| C-72 | W-139257 | " 110-300 mmf | |
| C-74 | 39001-19 | " .1 MFD 600 V. | |
| C-75 | W-137477 | " 500 mmf 10 KV | |
| C-76 | W-137477 | " 500 mmf 10 KV | |
| C-77 | B-138007 | " 80 MFD Elect. | |
| C-78 | B-138007 | " 80 MFD Elect. | |
| C-79 | B-138007 | " 80 MFD Elect. | |
| C-80 | B-138009 | " 40 MFD Elect. | |
| C-81 | 39001-7 | " .001 MFD 600 V. | |
| C-82 | 39001-11 | " .005 MFD 600 V. | |
| C-83 | 39001-7 | " .001 MFD 600 V. | |
| C-84 | 39001-11 | " .005 MFD 600 V. | |
| C-85 | B-138007 | " 80 MFD Elect. | |
| C-86 | 39001-19 | " .1 MFD 600 V. | |
| C-87 | 39001-81 | " .025 MFD 200 V. | |
| C-88 | C-137727-16 | " 82 MFD 500 V. | |
| C-89 | B-139203 | " 16 MFD Elect. | |
| C-90 | B-137498-16 | " 150 mmf Mica | |
| C-91 | 39001-13 | " .01 MFD 600 V. | |
| C-92 | B-138013 | " 4 MFD Elect. | |
| C-93 | 39001-19 | " .1 MFD 600 V. | |
| C-94 | B-138013 | " 4 MFD Elect. | |
| C-95 | 39004-8 | " 150 mmf Mica | |
| C-97 | 39001-7 | " .001 MFD 600 V. | |
| C-98 | 39001-17 | " .05 MFD 600 V. | |
| C-99 | C-137727-48 | " 5000 mmf 500 V. | |
| C-100 | C-137727-48 | " 5000 mmf 500 V. | |
| C-101 | C-137727-16 | " 82 mmf 500 V. | |
| C-102 | 39001-13 | " .01 MFD 600 V. | |
| C-103 | 39001-13 | " .01 MFD 600 V. | |
| CR-1 | W-137449 | (1-N-34) Crystal Rectifier | |
| | 39012-62 | Iron Core IC-2-4-5-6-9-14 | |
| | 39012-72 | " " IC-11-12-15-16-17-18-19-20 | |
| | 39012-73 | " " IC-1-3-7-8-10-13 | |
| L-1 | AW-138290 | Video I.F. Choke 13 uh | T-5 |
| L-2 | AW-139277 | Detector Peaking Coil 93 uh | |
| L-3 | AW-138014 | RF Choke | |
| L-4 | AW-138621 | Filter Choke 3MH | |
| R-1 | 39373-92 | Resistor IM ohm $\frac{1}{2}$W | |
| R-2 | 39374-223 | " 68 K ohm 2W | |
| R-3 | 39374-24 | " 820 ohm $\frac{1}{2}$W | T-1 |
| R-4 | 39373-80 | " 220 K ohm $\frac{1}{2}$W | |
| R-5 | 39373-33 | " IK ohm $\frac{1}{2}$W | |

## PARTS LIST (Cont.)

| SYMBOL | PART NUMBER | DESCRIPTION | PART OF SYMBOL |
|---|---|---|---|
| R-6 | 39374-48 | Resistor 82 K ohm ½W | |
| R-7 | 39374-45 | " 47 ohm ½W | |
| R-8 | 39374-27 | " 1500 ohm ½W | T-2 |
| R-9 | 39373-80 | " 220 K ohm ½W | |
| R-10 | 39374-9 | " 47 ohm ½W | |
| R-11 | 39374-48 | " 82K ohm ½W | |
| R-12 | 39373-33 | " 1K ohm ½W | |
| R-13 | 39374-32 | " 3900 ohm ½W | T-3 |
| R-14 | 39374-48 | " 82K ohm ½W | |
| R-15 | 39373-33 | " 1K ohm ½W | |
| R-16 | 39373-87 | " 470K ohm ½W | |
| R-17 | 39374-14 | " 120 ohm ½W | |
| R-18 | 39374-48 | " 82K ohm ½W | |
| R-19 | 39373-87 | " 470K ohm ½W | |
| R-20 | 39373-33 | " 1K ohm ½W | T-5 |
| R-21 | 39373-33 | " 1K ohm ½W | |
| R-22 | 39374-32 | " 3900 ohm ½W | |
| R-23 | 39373-80 | " 220K ohm ½W | |
| R-24 | 39374-36 | " 8200 ohm ½W | |
| R-25 | 39373-92 | " 1M ohm ½W | |
| R-26 | 39374-45 | " 475 ohm ½W | |
| R-27 | 39373-87 | " 470 ohm ½W | |
| R-28 | 39373-92 | " 1M ohm ½W | |
| R-29 | 39374-45 | " 47K ohm ½W | |
| R-30 | 39373-92 | " 1M ohm ½W | |
| R-31 | 39374-45 | " 47 K ohm ½W | |
| R-32 | 39373-87 | " 470 ohm ½W | |
| R-33 | 39374-49 | " 100K ohm ½W | |
| R-34 | 39374-49 | " 100K ohm ½W | |
| R-35 | 39374-49 | " 100K ohm ½W | |
| R-36 | 39374-51 | " 150K ohm ½W | |
| R-37 | 39374-51 | " 150K ohm ½W | |
| R-38 | 39374-40 | " 18K ohm ½W | |
| R-39 | 39374-215 | " 15K ohm 2W | |
| R-40 | 39374-51 | " 150K ohm ½W | |
| R-41 | 39374-32 | " 3900 ohm ½W | |
| R-42 | 39374-29 | " 2200 ohm ½W | |
| R-43 | 39374-29 | " 2200 ohm ½W | |
| R-44 | 39374-127 | " 15K ohm 1W | |
| R-45 | 39374-127 | " 15K ohm 1W | |
| R-46 | 39374-28 | " 1800 ohm ½W | |
| R-47 | 39374-61 | " 1M ohm ½W | |
| R-48 | 39374-75 | " 3.9M ohm ½W | |
| R-49 | B-138026 | Control 2M ohm (Vert.size) | |
| R-50 | 39374-34 | Resistor 5600 ohm ½W | |
| R-51 | 39374-69 | " 2.2M ohm ½W | |
| R-52 | B-138023 | Control 3K ohm Vert. Lin. | |
| R-53 | 39374-22 | Resistor 560 ohm ½W | |
| R-54 | 39374-211 | " 6800 ohm 2W | |
| R-56 | 39374-219 | " 33K ohm 2W | |
| R-57 | 39374-56 | " 390K ohm ½W | |
| R-58 | 39374-53 | " 220K ohm ½W | |
| R-59 | W-138624 | " 1100 ohm 5W | |
| R-60 | W-138624 | " 10K ohm 10W | |
| R-61 | W-138143 | " 70 ohm 10W | |
| R-62 | 39374-49 | " 100 K ohm ½W | |

| SYMBOL | PART NUMBER | DESCRIPTION | | PART OF SYMBOL |
|---|---|---|---|---|
| R-63 | 39374-28 | Resistor | 1800 ohm ½W | |
| R-64 | 39374-45 | " | 47K ohm ½W | |
| R-65 | 39374-27 | " | 1500 ohm ½W | |
| R-66 | 39374-49 | " | 100K ohm ½W | |
| R-67 | 39374-49 | " | 100K ohm ½W | |
| R-68 | 39374-49 | " | 100K ohm ½W | |
| R-69 | 39374-48 | " | 82K ohm ½W | |
| R-70 | 39374-133 | " | 47K ohm 1W | |
| R-71 | 39374-57 | " | 470K ohm ½W | |
| R-72 | 39374-25 | " | 1000 ohm ½W | |
| R-73 | 39374-61 | " | 1M ohm ½W | |
| R-74 | 39374-37 | " | 10K ohm ½W | |
| R-75 | 39374-13 | " | 100 ohm ½W | |
| R-76 | 39374-13 | " | 100 ohm 1W | |
| R-77 | 39374-61 | " | 1M ohm ½W | |
| R-78 | B-138022 | Control | 50K ohm Hor. Size | |
| R-79 | 39374-45 | Resistor | 47K ohm ½W | |
| R-80 | B-138027 | Control | 250K ohm Hor. Lin. | |
| R-81 | 39373-14 | Resistor | 100 ohm ½W | |
| R-82 | 39374-40 | " | 18K ohm ½W | |
| R-83 | 39374-61 | " | 1M ohm ½W | |
| R-84 | 39374-49 | " | 100K ohm ½W | |
| R-85 | 39374-37 | " | 10K ohm ½W | |
| R-86 | 39374-37 | " | 10K ohm ½W | |
| R-87 | 39374-49 | " | 100K ohm ½W | |
| S-1 | W-136998 | Tele. Sound Socket | | |
| S-7 | W-138668-1 | Socket (7 prong) | | |
| S-8 | W-138668-2 | Socket (8 prong) | | |
| S-9 | W-138668-3 | Socket (9 prong) | | |
| SW-1 | C-138066 | Channel Selector Switch | | |
| CS-5 | C-138065 | Wafer (Channel Sel. Switch) | | |
| T-1 | AC-137725 | 1st I.F. Trans. | | |
| T-2 | AC-137762 | 2nd I.F. Trans. | | |
| T-3 | AC-137670 | 3rd Video I.F. Trans. | | |
| T-4 | AC-138121 | 4th Video I.F. Trans. | | |
| T-5 | AC-137671 | 5th Video I.F. Trans. | | |
| T-6 | AC-137562 | 3rd Sound I.F. Trans. | | |
| T-7 | AC-137562 | 4th Sound I.F. Trans. | | |
| T-8 | AC-137638 | 5th Sound I.F. Trans. | | |
| T-9 | B-137491 | Vert. Trans. | | |
| T-10 | AB-138094 | H.V. Trans. | | |
| T-11 | B-137496 | Power Trans. | | |
| T-12 | B-137938 | Hor. Trans. | | |
| | 138839 | H. V. Power Supply (Complete Assy.) | | |
| | 138669 | Power Plug | | |
| | 138487 | H. V. Cable Assem. | | |
| | 138279 | Adapter - Flexible Shaft | | |
| | 138090-2 | Stand-Off Insulator (H.V. Supply) | | |
| | 138799 | Speed Nut (H.V. Supply) | | |
| | 138488 | Connector (H.V. Anode) Socket | | |
| | 138838 | Convertor Plate Assem. | | |
| C-201 | B-138011 | Capacitor 100 MFD Electrolytic | | |
| C-202 | B-138013 | 4 MFD Electrolytic | | |

## PARTS LIST (Cont.)

| SYMBOL | PART NUMBER | DESCRIPTION | PART OF SYMBOL |
|---|---|---|---|
| C-203 | B-138010 | Capacitor 500 MFD Electrolytic | |
| C-204 | 39001-17 | " .05 MFD 600 V. | |
| C-205 | 39001-17 | " .05 MFD 600 V. | |
| C-206 | B-138007 | " 80 MFD Electrolytic | |
| C-207 | B-137968 | " 100 MFD Electrolytic | |
| C-208 | B-137968 | " 100 MFD Electrolytic | |
| C-209 | 39001-19 | " .1 MFD 600 V. | |
| C-210 | B-138011 | " 100 MFD Electrolytic | |
| C-211 | 39001-13 | " .01 MFD 600 V. | |
| C-212 | 39001-19 | " .1 MFD 400 V. | |
| C-213 | 39001-17 | " .05 MFD 400 V. | |
| C-214 | B-137498-15 | " 56 mmf | L-202 |
| C-215 | B-138013 | " 4 MFD Electrolytic | |
| L-201 | AW137448 | 2nd Peaking Coil 270 uh | |
| L-202 | 139684 | Delection Yoke Assem. | |
| L-203 | AB-137534 | Focusing Coil | |
| P-7 | AB-138231 | Plug & Cable (7 Pin) | |
| P-9 | AB-138232 | Plug & Cable (9 Pin) | |
| | W-138225 | Plug Only (7 Pin) | |
| | W-138226 | Plug Only (9 Pin) | |
| R-201 | 39374-27 | Resistor 1500 ohm $\frac{1}{2}$W | |
| R-202 | 39374-27 | " 1500 ohm $\frac{1}{2}$W | |
| R-203 | 39374-14 | " 120 ohm $\frac{1}{2}$W | |
| R-204 | 39374-47 | " 68K ohm $\frac{1}{2}$W | |
| R-205 | 39374-31 | " 3300 ohm $\frac{1}{2}$W | |
| R-206 | 39374-37 | " 10K ohm $\frac{1}{2}$W | |
| R-207 | 39374-49 | " 100K ohm $\frac{1}{2}$W | |
| R-208 | 39373-92 | " 1M ohm $\frac{1}{2}$W | |
| R-209 | 39374-33 | " 4.7K ohm $\frac{1}{2}$W | |
| R-210 | 39373-80 | " 220K ohm $\frac{1}{2}$W | |
| R-211 | 39374-37 | " 10K ohm $\frac{1}{2}$W | |
| R-212 | 39373-92 | " 1M ohm $\frac{1}{2}$W | |
| R-213 | 39374-37 | " 10K ohm $\frac{1}{2}$W | |
| R-214 | 39374-138 | " 120K ohm 1W | |
| R-215 | 39374-213 | " 10K ohm 2W | |
| R-216 | 39374-37 | " 10K ohm $\frac{1}{2}$W | |
| R-217 | 39374-27 | " 1500 ohm $\frac{1}{2}$W | |
| R-218 | 39373-92 | " 1M ohm $\frac{1}{2}$W | |
| R-219 | 39374-140 | " 180K ohm 1W | |
| R-220 | 39374-73 | " 3.3M ohm $\frac{1}{2}$W | |
| R-221 | 39374-41 | " 22K ohm $\frac{1}{2}$W | |
| R-222 | 39373-92 | " 1M ohm $\frac{1}{2}$W | |
| R-223 | 39374-27 | " 1500 ohm $\frac{1}{2}$W | |
| R-224 | B-137463 | Control 20 ohm (Hor. Cent) | |
| R-225 | B-137463 | " 20 ohm (Ver. Cen.) | |
| R-226 | 39373-33 | Resistor 1K ohm $\frac{1}{2}$W | L-202 |
| R-227 | 39373-33 | " 1K ohm $\frac{1}{2}$W | L-202 |
| R-228 | B-138028 | Control 50K ohm $\frac{1}{2}$W (Brilliance) | |
| R-229 | 39374-48 | Resistor 82K ohm $\frac{1}{2}$W | |
| R-230 | 39374-31 | " 3.3K ohm $\frac{1}{2}$W | |
| R-232 | B-138028 | Control 50K ohm (Contrast) | |
| R-233 | 39374-24 | Resistor 820 ohm $\frac{1}{2}$W | L-203 |
| | 138203 | Socket - Picture Tube | |

| SYMBOL | PART NUMBER | | DESCRIPTION | PART OF SYMBOL |
|---|---|---|---|---|
| B-301 | W-48858 | Bulb Dial | | |
| B-302 | W-48858 | Bulb Dial | | |
| B-303 | W-48858 | Bulb Dial | | PL-303 |
| C-301 | B-136327-32 | Capacitor | 8-95 mmf Trimmer | T-301 |
| C-302 | B-136327-31 | " | 1-6 mmf Trimmer | T-301 |
| C-303 | C-137219-1 | " | 30 - 200 mmf Trimmer | |
| C-304 | B-137498-12 | " | 30 mmf 500 V. Mica | |
| C-305 | B-136327-31 | " | 1-6 mmf Trimmer | |
| C-306 | B-137727-4 | " | 82 mmf 500 V. | |
| C-307 | C-137219-3 | " | 1-6 mmf Trimmer | |
| C-308A | C-135946 | " | 400 mmf 2 section | |
| C-308B | C-135946 | " | 114 mmf Tuning | |
| C-309 | | " | | |
| C-310 | W-136964 | " | 3-30 mmf Trimmer | |
| C-311 | B-137727-12 | " | 120 mmf 300 V. | |
| C-312 | B-137727-11 | " | 27 mmf 500 V. | |
| C-313 | 39001-11 | " | .005 MFD 600 V. | |
| C-314 | 39001-11 | " | .005 MFD 600 V. | |
| C-322 | 39001-11 | " | .005 MFD 600 V. | |
| C-323 | | " | | |
| C-324 | 39001-11 | " | .005 MFD 600 V. | |
| C-325 | 39001-11 | " | .005 MFD 600 V. | |
| C-326 | 39001-13 | " | .01 MFD 600 V. | |
| C-327 | 39001-11 | " | .005 MFD 600 V. | |
| C-332 | C-137727-8 | " | 1000 mmf Ceramic | |
| C-333 | 39001-11 | " | .005 MFD 600 V. | |
| C-334 | 39001-81 | " | .025 MFD 600 V. | |
| C-342 | B-137498-11 | " | 50 mmf Mica. | |
| C-343 | 39001-7 | " | .001 MFD 600 V. | |
| C-344A | B-137028 | " | 20 MFD 25 V. | |
| C-344B | B-137028 | " | 20 MFD 400 V. | |
| C-344C | B-137028 | " | 30 MFD 350 V. | |
| C-344D | B-137028 | " | 20 MFD 300 V. | |
| C-345 | 39001-17 | " | .05 MFD 600 V. | |
| C-348 | 39001-76 | " | .003 MFD 600 V. | |
| C-349 | 39001-82 | " | .033 MFD 600 V. | |
| C-350 | B-137498-10 | " | 100 mmf Mica | |
| C-351 | 39001-82 | " | .033 MFD 400 V. | |
| C-352 | 39001-17 | " | .05 MFD 600 V. | |
| C-353 | AW-142826 | " | 1.0 mmf | |
| C-354 | W-137398-6 | " | 4.7 mmf | |
| C-355 | B-137727-20 | " | 91 mmf 300 V. | |
| C-356 | B-137727-19 | " | 39 mmf 300 V. | |
| C-357 | | " | | |
| C-358 | 39001-13 | " | .01 MFD 600 V. | |
| C-359 | W-138531 | " | 53 mmf 500 V. | |
| C-360 | B-137727-27 | " | 15 mmf 500 V. | |
| C-361 | B-137727-17 | " | 10 mmf 300 V. | |
| C-362 | W-136964 | " | 3-30 mmf Trimmer | |
| C-363 | W-136964 | " | 3-30 mmf Trimmer | |
| C-364 | B-137727-17 | " | 10 mmf 300 V. | |
| C-365 | 39001-7 | " | .001 MFD 600 V. | |
| C-366 | 39001-11 | " | .005 MFD 600 V. | |
| C-367 | C-137727-8 | " | 1000 mmf Ceramic | |
| C-368 | | | | |

| SYMBOL | PART NUMBER | DESCRIPTION | PART OF SYMBOL |
|---|---|---|---|
| C-369 | 39001-11 | Capacitor .005 MFD 600 V. | |
| C-370 | 39001-11 | " .005 MFD 600 V. | |
| C-371 | 39001-11 | " .005 MFD 600 V. | |
| CRY-301 | B-138774 | 5992.5 K.C. Crystal | |
| | 39012-57 | Iron Core - I-C-302-303-304-305-306-307-310 311-315-316 | |
| | 39012-58 | Iron Core -I-C- 308-309-312-313 | |
| | 39012-59 | Iron Core - I-C-301-314 | |
| IL-301 | W-139900 | Interlock | |
| L-301 | W-137143 | Loop | |
| L-302 | AW-136511 | B.C. Ant Coil | |
| L-303 | AB-136444 | S.W. Ant Coil | |
| L-304 | | Coil Assem. | T-303 |
| L-305 | W-136179 | Coil F.M. Oscillator | |
| L-306 | AC-136509 | Coil 1st OSC BC & SW | |
| P-8 | AB-138480 | Plug & Cable Assy. (8 Pin) | |
| PL-301 | W-139853 | Shielded Cable & Plug (Tele. Sound) | |
| PL-302 | C-132300-6 | Power Cable & Plug | |
| PL-303 | AD-138713 | Plug & Pilot Light (Cabinet Pilot Light) | |
| R-301 | 39373-92 | Resistor 1M ohm $\frac{1}{2}$W | T-301 |
| R-302 | 39373-33 | " 1K ohm $\frac{1}{2}$W | T-301 |
| R-303 | | | |
| R-304 | 39373-92 | " 1M ohm $\frac{1}{2}$W | |
| R-305 | 39374-50 | " 120K ohm $\frac{1}{2}$W | |
| R-306 | 39373-92 | " 1M ohm $\frac{1}{2}$W | |
| R-307 | 39373-90 | " 680K ohm $\frac{1}{2}$W | |
| R-308 | 39373-67 | " 47K ohm $\frac{1}{2}$W | |
| R-309 | 39373-40 | " 2200 ohm $\frac{1}{2}$W | |
| R-310 | 39373-71 | " 68K ohm $\frac{1}{2}$W | |
| R-311 | 39374-42 | " 27K ohm $\frac{1}{2}$W | |
| R-312 | 39373-40 | " 2200 ohm $\frac{1}{2}$W | |
| R-313 | 39373-71 | " 68K ohm $\frac{1}{2}$W | T-306 |
| R-314 | 39373-74 | " 100K ohm $\frac{1}{2}$W | |
| R-315 | 39373-74 | " 100K ohm $\frac{1}{2}$W | |
| R-316 | 39373-74 | " 100K ohm $\frac{1}{2}$W | |
| R-317 | 39374-106 | " 270 ohm 1W | |
| R-318 | 39374-57 | " 470K ohm $\frac{1}{2}$W | |
| R-319 | 39374-57 | " 470K ohm $\frac{1}{2}$W | |
| R-321 | 39374-45 | " 47K ohm $\frac{1}{2}$W | |
| R-322 | B-135783 | Control 3M ohm Volume | |
| R-323 | 39373-107 | Resistor 10M ohm $\frac{1}{2}$W | |
| R-324 | 39373-80 | " 220K ohm $\frac{1}{2}$W | |
| R-325 | 39373-90 | " 680K ohm $\frac{1}{2}$W | |
| R-326 | 39374-50 | " 120K ohm $\frac{1}{2}$W | |
| R-327 | 39373-40 | " 220 ohm $\frac{1}{2}$W | |
| R-328 | 39374-129 | " 22K ohm 1W | |
| R-329 | 39373-94 | " 1.5M ohm $\frac{1}{2}$W | |
| R-330 | 39374-46 | " 56K ohm $\frac{1}{2}$W | |
| R-331 | 39374-41 | " 22K ohm $\frac{1}{2}$W | |
| R-332 | 39374-92 | " 1M ohm $\frac{1}{2}$W | |

## PARTS LIST (Cont.)

| SYMBOL | PART NUMBER | DESCRIPTION | | PART OF SYMBOL |
|---|---|---|---|---|
| R-333 | W-137021 | Resistor | 400 ohm 4W | |
| R-334 | W-137021 | " | 700 ohm 4W | |
| R-335 | 39374-53 | " | 220K ohm ½W | |
| R-336 | B-138551 | Control | 5K ohm Horizon Hold | |
| R-337 | 39374-29 | Resistor | 2.2K ohm ½W | |
| R-338 | B-138025 | Control | 20 ohm Focus | |
| R-339 | 39374-53 | Resistor | 220 K ohm ½W | |
| R-340 | B-138024 | Control | 10K ohm (Vert. Hold) | |
| R-341 | 39374-37 | Resistor | 10K ohm ½W | |
| R-342 | 39373-92 | " | 1M ohm ½W | |
| R-343 | 39373-92 | " | 1M ohm ½W | |
| R-344 | 39373-60 | " | 22K ohm ½W | |
| R-345 | 39373-84 | " | 330K ohm ½W | |
| R-346 | B-142735 | Control | 3M ohm (Tone) | |
| R-347 | 39374-69 | Resistor | 2.2M ohm ½W | |
| RC-301 | AW-139792 | Record Changer | | |
| S-301 | W-136998 | Phono Jack | | |
| S-302 | B-139727-3 | Cable & Socket (Phono Motor) | | |
| S-303 | AB-138935 | Speaker Cable & Socket | | |
| S-304 | AB-138714 | Socket & Cable (Cabinet Pilot Light) | | |
| SP-301 | C-138777 | Speaker Assem. | | |
| SWZ | B-137956 | Switch Function | | |
| SW3 | C-135946 | Range Switch | | |
| T-301 | AC-136171 | F.M. Ant Trans. | | |
| T-302 | AC-136264 | 1st I.F. Trans. (A) | | |
| T-303 | AC-136081 | 1st I.F. Trans. (B) | | |
| T-304 | AC-136276 | 1st A.M. I.F., 2nd F.M. I.F. | | |
| T-305 | AC-136260 | Discriminator Trans. | | |
| T-306 | AC-136261 | 2nd A.M. I.F. Trans. | | |
| T-307 | B-138131-2 | Transformer - Output Part of S301 | | |
| T-308 | B-135336 | Transformer - Power | | |
| TL-301 | 142882-1 | 75 ohm Transmission Line (in 75 ft. Rolls) | | |
| TL-302 | 142882-1 | 75 ohm Transmission Line (in 75 ft. Rolls) | | |
| | 138851 | Control Panel Assy. | | |
| | 139006 | Record Changer Drawer Slides | | |
| | 144073 | Record Changer Drawer Frame Assy. | | |
| | 144074 | Record Changer Drawer Panel & Radio Bin Panel | | |
| | 144075 | Record Compartment Doors (Left & Right) | | |
| | 144082 | Radio Bin Frame Assy. | | |
| | 144076 | Radio Bin Hinged Slide Assy. | | |
| | 144077 | Tambour (Right) | | |
| | 144078 | Tambour (Left) | | |
| | 144079 | Grille (Metal) | | |
| | 143509 | Grille (Cloth) | | |
| | 144080 | Knob, Record Compartment Door | | |
| | 143829 | Handle, Drawer & Radio Bin | | |
| | AW-137266 | Hinge, Record Compartment Door | | |
| | 144081 | Hinge, Radio Bin | | |
| | 139319-SB | Catch & Strike Assembly | | |
| | 139950 | Decal (Crosley) | | |
| | 138953 | Decal (Tone) | | |

| SYMBOL | PART NUMBER | DESCRIPTION | PART OF SYMBOL |
|---|---|---|---|
| | 138954 | Decal (Volume) | |
| | 138955 | Decal (Tuning) | |
| | 138956 | Decal (AM - SW - FM) | |
| | 138299 | Decal (Focus) | |
| | 138300 | Decal (Horizontal) | |
| | 138301 | Decal (Vertical) | |
| | 138302 | Decal (Brilliance) | |
| | 138303 | Decal (Contrast) | |
| | 138304 | Decal (Switch) | |
| | 138305 | Decal (Channel Selector) | |
| | 138567 | Indicator (Power) | |
| | 138541 | Safety Glass | |
| | 138542 | Gasket | |
| | 138507 | Clips (Safety Glass) | |
| | 138600 | Tube Socket (4 prong) | |
| | 210860-9 | Tube Socket (6AS7) | |
| | 39437-1 | Tube Socket (Octal - small) | |
| | 39388 | Tube Socket (Octal - Large) | |
| | AD-139924 | Cabinet Back Assem. | |
| | B-138283 | Flexible Shaft | |
| | W-137349 | Knob (6 Req.) | |
| | W-137350 | Knob (3 Req.) | |
| | W-135391 | Knob (2 Req.) | |
| | W-139523 | Channel Number Sheet | |
| | W-139525-1 | Channel Number Cover | |
| | B-138622 | Bin Spring (Top) | |
| | W-138811 | Bin Spring (Bottom) | |
| | AD-138993 | Picture Pilot (Channel 2-4) | |
| | AD-139728 | Picture Pilot (Channel 3-6) | |
| | AD-139916 | Picture Pilot (Channel 5-7) | |
| | AW-143071 | Picture Pilot (Channel 8-10 or 9-11) | |
| | AW-143217 | Picture Pilot (Channel 12 or 13) | |
| | AR-137909 | Cabinet Assembly | |
| | | SLIDE MECHANISM PARTS | |
| M-1 | AW-139271 | Assem. - Arm & Hub | |
| M-2 | W-137814 | Slide - Spring (R.H.) | |
| M-3 | W-137812 | Cam Lever | |
| M-4 | W-137821 | Cam Roller | |
| M-5 | B-137830 | Cam | |
| M-6 | W-138104 | Adjusting Screw | |
| M-7 | W-134956 | #8-32 Tee Nut | |
| M-8 | W-137819 | Cam Roller Sleeve | |
| M-9 | B-138111 | Drive Pulley | |
| M-10 | W-138103 | Cable | |
| M-11 | W-138107 | Cable Clamp | |
| M-13 | AW-139273 | Assem. - Take Up Pulley & Bracket | |
| M-14 | W-137815 | Cable Take Up Spring | |
| M-15 | AW-139272 | Assem. - Idler Pulley & Bracket | |
| M-16 | W-137813 | Slide - Spring (L.H.) | |
| M-17 | W-137825 | Slide Bracket | |
| M-18 | W-138106 | Sleeve - Top Bearing | |

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