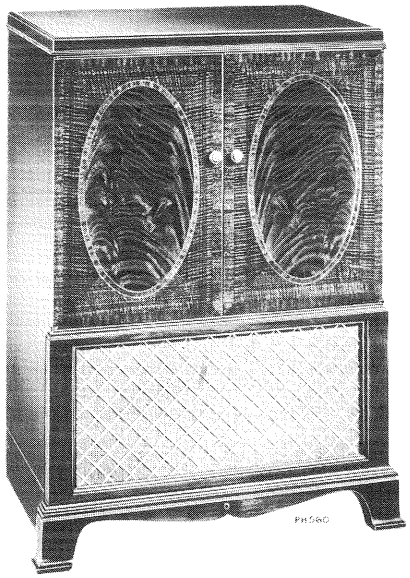
RCA VICTOR



Model 6T72 Walnut, Mahogany or Oak

TELEVISION RECEIVER MODEL 6T72

Chassis No. KCS40B

—Mfr. No. 274—

SERVICE DATA

—1950 No. T10—

RADIO CORPORATION OF AMERICA
RCA VICTOR DIVISION
CAMDEN, N. J., U. S. A.

GENERAL DESCRIPTION

Model 6T72 is a console type television receiver in a choice of three cabinet finishes. The chassis employs twenty-one tubes plus two rectifiers and a 16GP4 kinescope.

Features of the television unit are: full twelve channel coverage; FM sound system; improved picture brilliance; picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; two stages of video amplification; noise saturation circuits; improved sync separator and clipper; four mc. band width for picture channel and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE.....146 square inches on a 16GP4 Kinescope

TELEVISION R-F FREQUENCY RANGE
All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
Fine Tuning Range..±250 kc. on chan. 2, ± 650 kc. on chan. 13

RECEIVER ANTENNA INPUT IMPEDANCE
Choice: 300 ohms balanced or 72 ohms unbalanced.

PICTURE INTERMEDIATE FREQUENCIES

Picture Carrier Frequency	25.50 Mc.
Adjacent Channel Sound Trap	27.00 Mc.
Accompanying Sound Traps	21.00 Mc.
Adjacent Channel Picture Carrier Trap	19.50 Mc.

SOUND INTERMEDIATE FREQUENCIES

Sound Carrier Frequency	21.00 Mc.
Sound Discriminator Band Width between peaks	350 kc

VIDEO RESPONSE ..... To 4 Mc.

FOCUS ..... Magnetic

SWEEP DEFLECTION ..... Magnetic

SCANNING ..... Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY ..... 15,750 cps

VERTICAL SWEEP FREQUENCY ..... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) ..... 30 cps

POWER SUPPLY RATING
KCS40B..... 115 volts, 60 cycles, 250 watts

AUDIO POWER OUTPUT RATING..... 3.5 watts max.

LOUDSPEAKERS
KCS40B..... 92569-10W 12" PM Dynamic, 3.2 ohms

RCA TUBE COMPLEMENT

	Tube Used	Function
(1)	RCA 6AG5	R-F Amplifier
(2)	RCA 6AG5	Converter
(3)	RCA 6J6	R-F Oscillator
(4)	RCA 6AU6	1st Sound I-F Amplifier
(5)	RCA 6AU6	2nd Sound I-F Amplifier
(6)	RCA 6AL5	Sound Discriminator
(7)	RCA 6AV6	1st Audio Amplifier
(8)	RCA 6K6GT	Audio Output
(9)	RCA 6BA6	1st Picture I-F Amplifier
(10)	RCA 6AG5	2nd Picture I-F Amplifier
(11)	RCA 6BA6	3rd Picture I-F Amplifier
(12)	RCA 6AG5	4th Picture I-F Amplifier
(13)	RCA 6AL5	Picture 2nd Detector & Sync Limiter
(14)	RCA 12AU7	1st and 2nd Video Amplifier
(15)	RCA 6SN7GT	AGC Amplifier & Vertical Sweep Oscillator
(16)	RCA 6SN7GT	AGC Rectifier & 1st Sync Separator
(17)	RCA 6SN7GT	Sync Amplifier & 2nd Sync Separator
(18)	RCA 6K6GT	Vertical Sweep Output
(19)	RCA 6SN7GT	Horizontal Sweep Oscillator & Control
(20)	RCA 6BG6G	Horizontal Sweep Output
(21)	RCA 6W4GT	Damper
(22)	RCA 1B3-GT/8016	High Voltage Rectifier
(23)	RCA 5U4G	Power Supply Rectifier
(24)	RCA 16GP4	Kinescope

WEIGHT

Chassis with Tubes in Cabinet..... 116 lbs.

DIMENSIONS (inches)	Width	Height	Depth
Cabinet (outside)	28	37⅛	23⅜
Chassis (overall)	19¼	11	18½

OPERATING INSTRUCTIONS

The following adjustments are necessary when turning the receiver on for the first time:

1. See that the TV-PH switch on the rear apron is in the "TV" position.

2. Turn the receiver "ON" and advance the SOUND VOLUME control to approximately mid-position.

3. Set the STATION SELECTOR to the desired channel.

4. Adjust the FINE TUNING control for best sound fidelity and the SOUND VOLUME control for suitable volume.

5. Turn the BRIGHTNESS control fully counter-clockwise, then clockwise until a light pattern appears on the screen.

6. Adjust the VERTICAL hold control until the pattern stops vertical movement.

7. Adjust the HORIZONTAL hold control until a picture is obtained and centered.

8. Turn the BRIGHTNESS control counter-clockwise until the retrace lines just disappear.

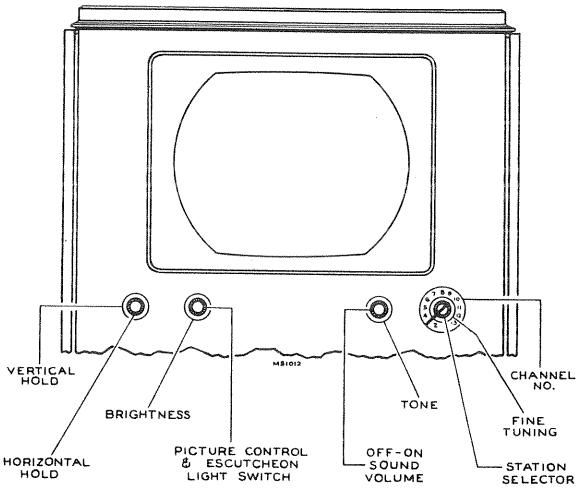


Figure 1—Receiver Operating Controls

9. Adjust the PICTURE control for suitable picture contrast.

10. After the receiver has been on for some time, it may be necessary to readjust the FINE TUNING control slightly for improved sound fidelity.

11. In switching from one station to another, it may be necessary to repeat steps 4, 8 and 9.

12. When the set is turned on again after an idle period, it should not be necessary to repeat the adjustments if the positions of the controls have not been changed. If any adjustment is necessary, step number 4 is generally sufficient.

13. If the positions of the controls have been changed, it may be necessary to repeat steps 2 through 9.

14. To use the instrument with a record player, plug the record-player output cable into the PHONO jack on the rear apron, and set the TV-PH switch on "PH." Set the TV-PH switch back to TV on completion of the record program.

INSTALLATION INSTRUCTIONS

Connect the antenna transmission line to the receiver antenna terminals. Plug the receiver power cord into a 115 volt a-c power source. Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

WARNING. — The high voltage supply in this receiver delivers 12,000 volts! A.C. interlocks are provided at the back of the set so that when the back is removed — so is the power.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 2, and with the part number on magnet towards the rear of the chassis. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust the focus control (R191 on the chassis rear apron) until the line structure of the raster is clearly visible. Readjust the ion trap magnet

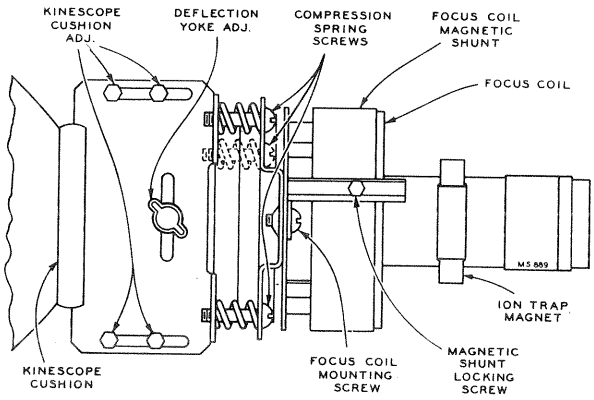


Figure 2—Yoke and Focus Coil Adjustments

for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

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

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern picture in order to make further adjustments. See steps 3 through 9 of the receiver operating instructions.

If the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC threshold control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R138 on the rear apron (see Figure 3) clockwise until the set operates normally and the picture can be synced.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Usually the picture will remain in sync. Turn the control clockwise slowly. If the picture did fall out of sync upon removal of the signal, the number of diagonal black bars will be gradually reduced and when only 2 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. The picture should remain in sync for approximately 180 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should be out of sync and should show 1 vertical or diagonal black bar in the raster.

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

ALIGNMENT OF HORIZONTAL OSCILLATOR. — If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 180 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments:

Horizontal Frequency Adjustment.—Turn the T109 sine wave core (on the outside of the apron) all the way out of the coil.

Set the locking range trimmer C153A one-half turn out from maximum capacity.

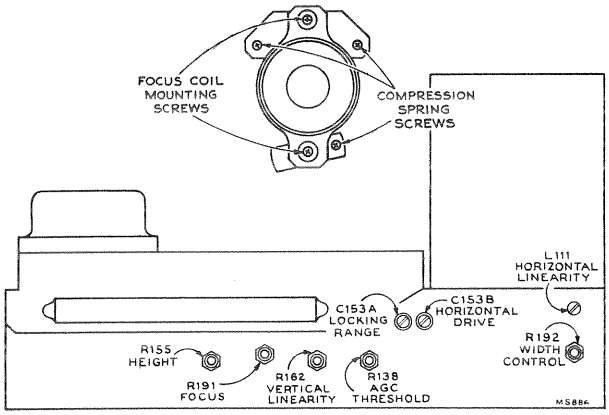


Figure 3—Rear Chassis Adjustments

Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and turn the frequency wave core of T109 under the chassis until the picture syncs and the sync bar just begins to move into the picture.

Note.—Occasionally, a tube may be found which does not respond to this alignment procedure since it may not be possible to sync the picture by means of the frequency core when the sine wave core is all the way out of the coil. Yet, the tube may work perfectly well when the circuit is properly aligned. In such a case, it may be necessary to turn the sine wave core in slightly, and readjust the frequency core to obtain sync.

Turn the sine wave core of T109 in until the blanking bar begins to move off to the left of the picture. Alternately turn the sine wave core in and the frequency out, keeping the picture in sync and the blanking bar showing in the picture.

Continue alternate adjustments until the picture falls from sync into a parasitic oscillation as indicated by a non-synchronized pattern which flickers in width and centering with possibly a light ragged vertical bar through the center of the screen.

Turn the sine wave core out ½ turn. Adjust the frequency core in until the picture is in sync and horizontal blanking appears as a vertical bar in the picture.

Check of Pull-in Range.—Turn the horizontal hold control fully counter-clockwise. Connect a 270K ohm resistor across C156. Momentarily switch off channel and back; the picture will then be out of sync. Turn the hold control clockwise slowly and observe the minimum number of bars obtained just before the picture pulls into sync.

The picture should snap in from two complete blanking bars. If two bars are not obtained, turn the locking range trimmer C153A in to obtain less bars or out to obtain more bars.

If C153A was adjusted, remove the 270K resistor, turn the horizontal hold control fully clockwise and adjust the T109 frequency core until horizontal blanking appears as a vertical bar in the synced picture. Then repeat the entire check of pull-in range to this point.

Repeat the adjustments under "Check of Pull-in Range" until the conditions specified are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If the oscillator does not hold sync properly at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on page 11.

FOCUS COIL ADJUSTMENTS.—The focus coil should be adjusted so that there is approximately one-quarter inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus coil. This spacing gives best average focus over the face of the tube. The axis of the hole through the focus coil should be parallel with the axis of the kinescope neck.

The focus coil is provided with a magnetic shunt in the form of a metal sleeve as shown in Figure 2. If the receiver focuses with the focus control near the end of its range, loosen the shunt locking screw and slide the shunt backward or forward until focus occurs in the center range of the focus control.

CENTERING ADJUSTMENT. — No electrical centering controls are provided. Centering is obtained by loosening the two focus coil mounting screws and sliding the coil up or down or from side to side. If the focus coil was appreciably changed in position or if a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by sliding the coil. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In extreme cases it may be necessary to adjust one or more of the three focus coil compression spring screws to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive counter-clockwise as far as possible without losing tension on trimmer.

Set the width control to minimum picture width.

Turn the horizontal linearity coil out until appreciable loss in width occurs, then in until nearly maximum width and the best linearity is obtained. Do not run the core in beyond the point of maximum linearity change, as the current drawn by the 6BG6G then becomes excessive.

Adjust the width control for the proper picture width.

Readjust linearity, but again not beyond the point of maximum linearity change. If necessary adjust the drive control for best linearity.

If at very high line voltage, the picture width is excessive even with the width control set at minimum, turn the linearity coil out to obtain the proper width. On high line voltage, excessive width generally will be accompanied by good linearity, without retouching the drive.

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

FOCUS.—Adjust the focus control (R191 on chassis rear apron) for maximum definition in the test pattern, vertical "wedge" and best focus in the white areas of the pattern.

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

Check to see that the cushion and yoke thumbscrews and the focus coil mounting screws are tight.

AGC THRESHOLD CONTROL.—The AGC threshold control R138 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC threshold control, tune in a strong signal, sync the picture and turn the picture control to the maximum clockwise position. Turn the brightness control counter-clockwise until the vertical retrace lines are just invisible. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R138. If the picture requires an appreciable portion of a second to reappear, R138 should be readjusted.

Set the picture control at the maximum clockwise position. Turn R138 fully clockwise. The top one-half inch of the picture may be bent slightly. This should be disregarded. Turn R138 counter-clockwise until there is a very, very slight bend or change of bend in the top one-half inch of the picture. Then turn R138 clockwise just sufficiently to remove this bend or change of bend.

If the signal is very weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R138 counter-clockwise until the snow in the picture becomes more pronounced, then clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far counter-clockwise on a weak signal, then the receiver may overload when a strong signal is received.

CHECK OF R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 10. The adjustments for channels 2 through 5 and 7 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis and channel 6 adjustment is in the kinescope well. See Figures 8 and 9 for their location.

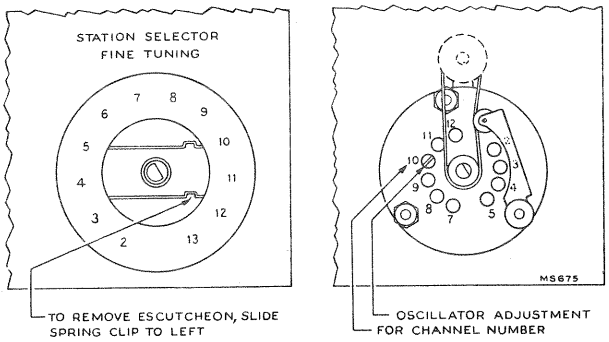


Figure 4—R-F Oscillator Adjustments

Replace the cabinet back and make sure that the screws are tight in order to prevent rattling at high volume.

WEAK SIGNAL AREA OPERATION.—Since the vast majority of receivers are sold in strong signal areas, the chassis are aligned to produce the cleanest pictures in those areas. However, if the receiver is to be operated in a weak signal area, better performance can be obtained by "peaking" the r-f unit.

To peak the r-f unit in these receivers, disconnect the 390-ohm resistor R14 which is on top of the r-f unit chassis. Adjust L66 to obtain the best possible picture on the weakest low channel station received.

If the peaked receiver is subsequently taken to a strong signal area, the resistor R14 should be connected in place and L66 adjusted for "flat" response on the low channels.

CHASSIS REMOVAL.—To remove the chassis from the cabinet for repair or installation of a new kinescope, remove the control knobs, the cabinet back, unplug the speaker cable, the kinescope socket, the antenna cable, the pilot light cable, the yoke and focus coil cable. Remove the yoke frame grounding strap and the interlock switch. Take out the six chassis bolts under the cabinet. Withdraw the chassis from the back of the cabinet.

KINESCOPE HANDLING PRECAUTION.—Do not install, remove, or handle the kinescope in any manner, unless shatterproof goggles and heavy gloves are worn. People not so equipped should be kept away while handling the kinescope. Keep the kinescope away from the body while handling.

To remove the kinescope from the cabinet, take out the four screws and one wing screw which hold the yoke frame to the cabinet. Remove the kinescope, the yoke frame with yoke and focus coil as an assembly.

INSTALLATION OF KINESCOPE.—Handle this tube by the metal rim at the edge of the screen. Do not cover the glass bell of the tube with fingermarks as it will produce leakage paths which may interfere with reception. If this portion of the tube has inadvertently been handled, wipe it clean with a soft cloth moistened with "dry" carbon tetrachloride.

Wipe the kinescope screen surface and front panel safety glass clean of all dust and fingermarks with a soft cloth moistened with "Windex" or similar cleaning agent.

Turn the tube so that the key on the base of the tube will be down and insert the neck of the kinescope through the deflection and focus coils. If the tube sticks, or fails to slip into place smoothly, investigate and remove the cause of the trouble. Do not force the tube.

Replace the kinescope and yoke frame assembly in the cabinet. Insert the four screws and wing screw and tighten.

Slip the kinescope as far forward as possible. Slide the kinescope cushion firmly up against the flare of the tube and tighten the adjustment wing screws. Slide the deflection yoke as far forward as possible. If this is not done, difficulty will be encountered in adjusting the ion trap magnet and focus coil because of shadows on the corner of the raster.

Slide the chassis into the cabinet, then insert and tighten the six chassis bolts.

Slip the ion trap magnet over the neck of the kinescope.

Connect the kinescope socket to the tube base and slip the high voltage lead clip between the rim of the kinescope and the mask.

Reconnect all other cables. Do not forget to replace the yoke frame grounding strap. Perform the entire set-up procedure beginning with Ion Trap Magnet Adjustment.

ANTENNAS.—The finest television receiver built may be said to be only as good as the antenna design and installation. It is therefore important to select the proper antenna to suit local conditions, to install it properly and orient it correctly.

CABINET ANTENNA.—A cabinet antenna is provided which may be employed in strong signal areas in which no reflections are experienced. The antenna leads are brought out near the receiver antenna terminal board.

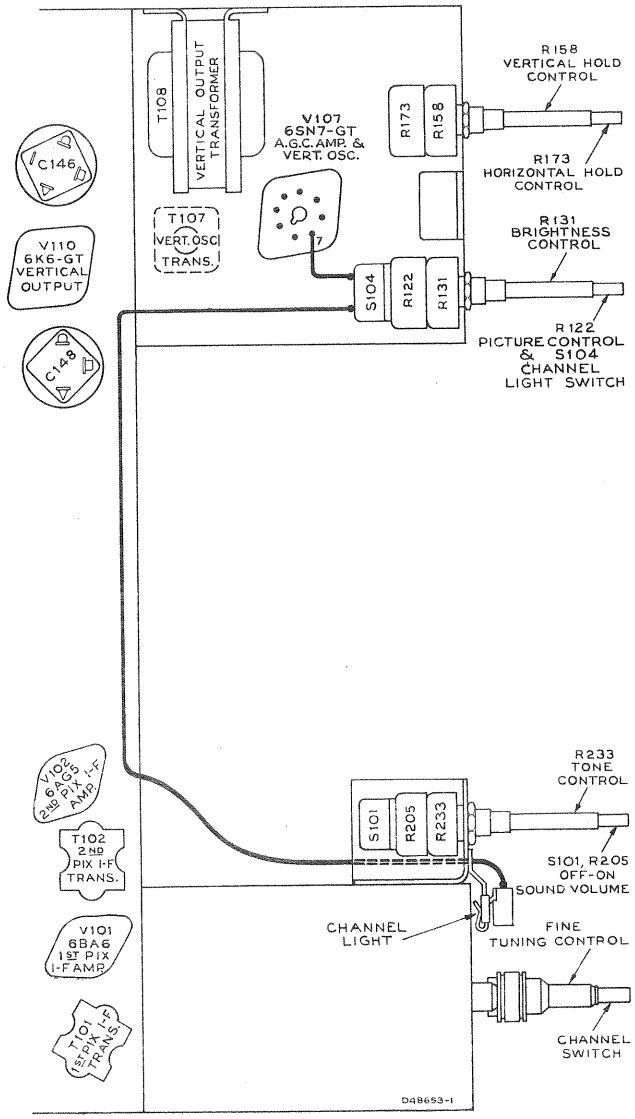


Figure 5—Partial Bottom View of Chassis Showing Channel Light and Channel Light Switch (Chassis is otherwise identical to KCS40A used in Models TC165, TC166, TC167 and TC168)

THE CHASSIS USED IN MODEL 6T72 IS VERY SIMILAR TO THE CHASSIS USED IN MODELS T164, TC165, ETC. THE DIFFERENCE BEING IN THE ADDITION OF A CHANNEL INDICATOR LIGHT SWITCH (S104) IN MODEL 6T72.

THE ALIGNMENT PROCEDURE IS IDENTICAL TO THAT GIVEN FOR MODELS T164, TC165, ETC., ON PAGES 267 TO 273 EXCEPT FOR A SLIGHT DIFFERENCE IN THE ALIGNMENT FREQUENCIES.

(EARLY PRODUCTION OF MODEL 6T72 WAS ALIGNED AT THE SAME FREQUENCIES AS MODEL T164. THE CHANGE WAS MADE TO REDUCE I-F HARMONIC INTERFERENCE.)

REFER TO MODELS T164, TC165, ETC., ON PAGES 261 TO 288 FOR ADDITIONAL SERVICE INFORMATION.

ALIGNMENT PROCEDURE

Service Precautions. — If possible, the chassis should be serviced without the kinescope. However, if it is necessary to view the raster during servicing, it would be a great convenience to have a set of yoke, focus coil, kinescope socket, high voltage and speaker extension cables.

CAUTION: Do not short the kinescope second-anode lead. Its short circuit current represents a considerable overload on the high voltage rectifier V113.

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

R-F Sweep Generator meeting the following requirements:

(a) Frequency Ranges
20 to 30 mc., 1 mc. and 10 mc. sweep width
50 to 90 mc., 10 mc. sweep width
170 to 225 mc., 10 mc. sweep width

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

(c) Output constant on all ranges.

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

Cathode-Ray Oscilloscope. — For alignment purposes, the oscilloscope employed must have excellent low frequency and phase response, and should be capable of passing a 60-cycle square wave without appreciable distortion. While this requirement is not met by many commercial instruments, RCA Oscilloscopes, types WO-55A, WO-58A, WO-79A, and WO-60C fill the requirement and any of these may be employed.

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

Signal Generator to provide the following frequencies with crystal accuracy.

(a) Intermediate frequencies
19.50 mc. adjacent channel picture trap
21.00 mc. sound i-f and sound traps
22.05 and 24.75 mc. conv. and first pix i-f trans.
25.3 mc. second picture i-f transformer
24.35 mc. fourth picture i-f transformer
21.75 mc. third picture i-f transformer
22.5 mc. fifth picture i-f transformer
25.50 mc. picture carrier
27.00 mc. adjacent channel sound trap

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
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	185.75
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

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

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

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

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

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

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

SOUND DISCRIMINATOR ALIGNMENT. — Set the signal generator for approximately .1 volt output at 21.00 mc. and connect it to the second sound i-f grid.

Detune T113 secondary (bottom).

Set the "VoltOhmyst" on the 3-volt scale.

Connect the meter, in series with a 1-megohm resistor, to the junction of diode resistors R203 and R204.

continued on page 9

6T72

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 5 SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED.

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
				DISCRIMINATOR AND SOUND I-F ALIGNMENT					
1	2nd sound i-f grid (pin 1, V117)	21.00 .1 volt output	Not used		Not used	In series with 1 meg. to junction of R203 & R204		Detune T113 (bot.) Adjust T113 (top) for max. on meter	Fig. 8 Fig. 9 Fig. 10
2	"	"	"		"	Junct. of C183 & R203	Meter on 3 volt scale	T113 (bottom) for zero on meter	Fig. 9 Fig. 10
3	"	"	2nd sound i-f grid (pin 1, V117)	21.25 center 1 mc. wide .1 v. out	Junction of C183 & R203	Not used	Check for symmetrical response waveform (positive & negative). If not equal adjust T113 (top) until they are equal		Fig. 10 Fig. 12
4	1st sound i-f grid (pin 1, V116)	21.00 reduced output	1st sound i-f grid	21.25 reduced output	Terminal A, T112 in series with a 33,000 ohm resistor	"	Sweep output reduced to provide .3 volt p-to-p on scope	T112 (top & bot.) for max. gain and symmetry at 21.00 mc.	Fig. 8 Fig. 9 Fig. 10 Fig. 13
				PICTURE I-F AND TRAP ADJUSTMENT					
5	Not used		Not used		Not used	Junction of R135 & C190	Remove V107. Connect potentiometer between pins 5 & 6 of V107 socket	Adjust pot. for meter reading of −12 volts	Fig. 10
6	Converter grid (pin 1, V2)	21.00	"		"	Across R119	Meter on 3 volt scale. Receiver between 2 and 13	T103 (top) for min. on meter	Fig. 8
7	"	21.00	"		"	"	"	T105 (top) for min.	"
8	"	27.00	"		"	"	"	T102 (top) for min.	"
9	"	27.00	"		"	"	"	T104 (top) for min.	"
10	"	19.50	"		"	"	"	T106 (top) for min.	"
11	"	19.50	"		"	"	"	T101 (top) for min.	"
12	"	22.5	"		"	"	"	T106 (bottom) for max. on meter	Fig. 9
13	"	24.35	"		"	"	"	T104 (bottom) for max.	"
14	"	21.75	"		"	"	"	T103 (bottom) for max.	"
15	"	25.3	"		"	"	"	T102 (bottom) for max.	"
16	"	22.05 24.75	Converter grid (pin 1, V2)	Sweeping 20 to 30 mc.	Pin 1, V106	Junction of R135 & C190	Shunt 330 ohms across pri. T102, T103, T104, T106. Set bias −2 V. Set swp. gen. for 4 V. P-P on scope.	Adjust T1 (top) and T101 (bottom) for proper response	Fig. 8 Fig. 9 Fig. 14
17	"		"	"	"	"	Remove shunt resistors. Set bias to give 15 volts P to P on scope.	Adjust T1 (top), T101, T102, T103, T104, T106 (bot.) for proper resp.	Fig. 8 Fig. 9 Fig. 15
				ANTENNA, R-F AND CONVERTER LINE ALIGNMENT					
18	Antenna terminals	215.75	Not used		Not used	Junction of C183 & R203 for signal gen. method only	Fine tuning centered. Receiver on channel 13. Heterodyne meter coupled to oscillator if used.	C6 for zero on meter or beat on het. freq. meter	Fig. 8 Fig. 10
19						Junction of R135 & L117	Remove V101	Potentiometer for −3.5 volts on meter	Fig. 8 Fig. 10
20	Antenna terminal (loosely)	175.25 & 179.75	Antenna terminals (see text for precaution)	Sweeping channel 7	Test Connection R13	Not used	Receiver on channel 7	L6, C10, C11 & C14 for flat top response between markers. Markers above 90%.	Fig. 8 Fig. 9 Fig. 16 (7)
21	"	205.25 209.75	"	channel 12	"	"	Receiver on channel 12	L6 for max. response and min. slope of top of curve	Fig. 8 Fig. 16 (12)
22	"	175.25 179.75	"	channel 7	"	"	Receiver on channel 7	Check to see that response is as above	Fig. 16 (7)
23	"	181.25 185.75	"	channel 8	"	"	Receiver on channel 8	"	Fig. 16 (8)
24	"	187.25 191.75	"	channel 9	"	"	Receiver on channel 9	"	Fig. 16 (9)
25	"	193.25 197.75	"	channel 10	"	"	Receiver on channel 10	"	Fig. 16 (10)

ALIGNMENT PROCEDURE

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	ANTENNA, R-F AND CONVERTER LINE ALIGNMENT (Continued)								
26	"	199.25 203.75	"	channel 11	"	"	Receiver on channel 11	"	Fig. 16 (11)
27	"	205.25 209.75	"	channel 12	"	"	Receiver on channel 12	"	Fig. 16 (12)
28	"	211.25 215.75	"	channel 13	"	"	Receiver on channel 13	"	Fig. 16 (13)
29	If the response on any channel (steps 22 through 28) is below 80% at either marker, switch to that channel and adjust L6, C10, C11 & C14 to pull response up on that channel. Then recheck steps 22 through 28.								
30	Antenna terminals (loosely)	83.25 87.75	Ant. terminals (see text for precaution)	Sweeping chan. 6	Test Connection R13	Not used	Receiver on channel 6	L9, L13, L66 & C12 for response as above	Fig. 16 (6)
31	"	77.25 81.75	"	channel 5	"	"	Receiver on channel 5	Check to see that response is as above	Fig. 16 (5)
32	"	67.25 71.75	"	channel 4	"	"	Receiver on channel 4	"	Fig. 16 (4)
33	"	61.25 65.75	"	channel 3	"	"	Receiver on channel 3	"	Fig. 16 (3)
34	"	55.25 59.75	"	channel 2	"	"	Receiver on channel 2	"	Fig. 16 (2)
35	If the response on any channel (steps 31 through 34) is below 80% at either marker, switch to that channel and adjust L9, L13, L66 & C12 to pull response up on that channel. Then recheck steps 30 through 34. Disconnect the bias pot. and replace V101 and V107.								
	R-F OSCILLATOR ALIGNMENT								
STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
36	Antenna terminals	215.75	Loosely coupled to r-f osc.	236.75	Not used	Junction of C183 & R203 for sig. gen. method only	Fine tuning centered. Receiver on channel 13	C6 for zero on meter or beat on het. freq. meter	Fig. 8 Fig. 10
37	"	209.75	"	230.75	"	"	Rec. on chan. 12	L14 as above	Fig. 11
38	"	203.75	"	224.75	"	"	Rec. on chan. 11	L15 as above	"
39	"	197.75	"	218.75	"	"	Rec. on chan. 10	L16 as above	"
40	"	191.75	"	212.75	"	"	Rec. on chan. 9	L17 as above	"
41	"	185.75	"	206.75	"	"	Rec. on chan. 8	L18 as above	"
42	"	179.75	"	200.75	"	"	Rec. on chan. 7	L19 as above	"
43	"	87.75	"	108.75	"	"	Rec. on chan. 6	L31 as above	Fig. 9
44	"	81.75	"	102.75	"	"	Rec. on chan. 5	L21 as above	Fig. 11
45	"	71.75	"	92.75	"	"	Rec. on chan. 4	L22 as above	"
46	"	65.75	"	86.75	"	"	Rec. on chan. 3	L23 as above	"
47	"	59.75	"	80.75	"	"	Rec. on chan. 2	L24 as above	"
48	Repeat steps 36 through 47 as a check.								
	AGC THRESHOLD ADJUSTMENT								
49	Not used		Not used		Pin 1, V106	Not used	Tune in station, turn pix control clockwise. Adjust R138 for max. gain without clipping sync on scope		Fig. 10 Fig. 17
	HORIZONTAL OSCILLATOR ADJUSTMENT								
50	Short circuit terminals C and D of T109. Tune in a station. Set locking range trimmer C153A ½ turn out from maximum.								
51	Turn hold control fully clockwise. Adjust T109 Frequency Adjustment until horizontal blanking bar appears in the picture.								
52	Turn hold control ¼ turn from clockwise to sync picture. Adjust width (R192), linearity (L111) and drive (C153B) controls until picture is correct. Repeat step 51, then proceed with step 53.								
53	Remove clip from terminals C and D of T109. Turn hold control fully clockwise. Adjust T109 Oscillator Waveform Adjustment until horizontal blanking bar appears in picture with core in outer of two possible positions.								
54	Connect low capacity probe of oscilloscope to terminal C of T109. Alternately adjust T109 Oscillator Waveform Adjustment and frequency adjustment until broad and sharp peaks of wave on oscilloscope are same height while keeping picture in sync. Remove oscilloscope.								
55	Connect a 270K resistor across C156. Turn hold control fully counter-clockwise. Momentarily remove signal. Turn hold control slowly clockwise. Note least number of bars before pull-in. Adjust Locking Range Control (C153A) for 2 bar pull-in.								
56	Turn hold control fully clockwise. Adjust T109 Freq. Adjustment until horizontal blanking appears as single vertical or diagonal bar in pix.								
	4.5 MC VIDEO TRAP ADJUSTMENT								
57	Tune in a strong station. Short T103 trap. If a 4.5 mc. beat appears in picture adjust 4.5 mc. trap (L110) until beat is eliminated.								
	SENSITIVITY CHECK								
58	Connect antenna to receiver through attenuator pad to provide weak signal. Compare the picture and sound obtained to that obtained on other receivers under the same conditions.								

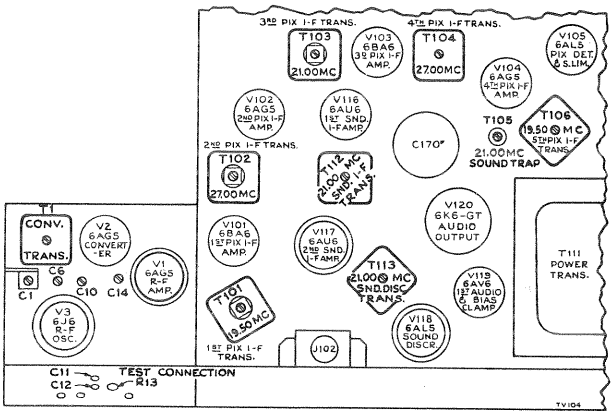


Figure 8—Top Chassis Adjustments

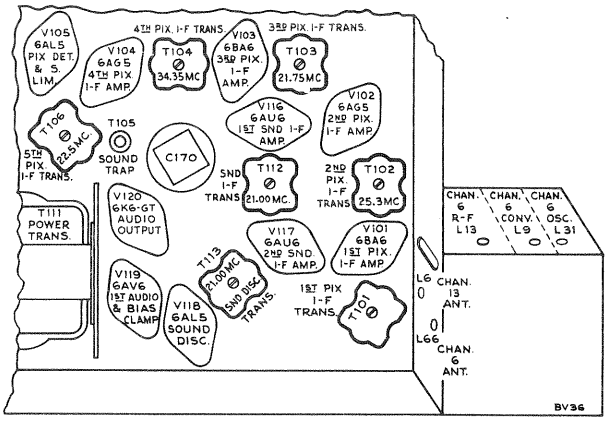


Figure 9—Bottom Chassis Adjustments

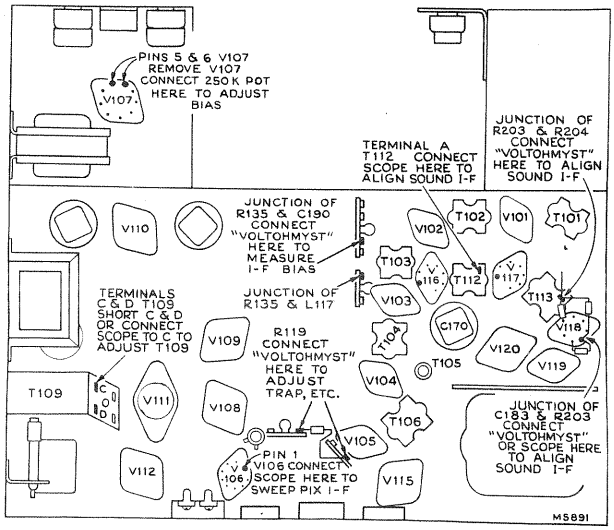
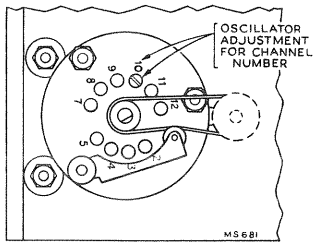


Figure 10—Test Connection Points



OSCILLATOR ADJUSTMENT FOR CHANNEL 13 IS ON TOP OF R-F UNIT AND CHANNEL 6 IS ON SIDE.

Figure 11—R-F Oscillator Adjustments

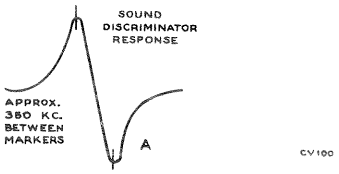


Figure 12 Discriminator Response

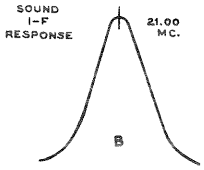


Figure 13 Sound I-F Response

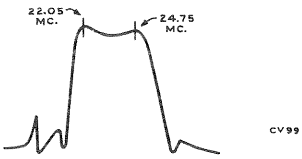


Figure 14 T1 and T101 Response

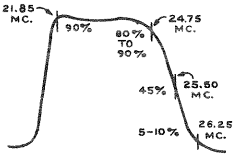


Figure 15 Overall I-F R-F Response

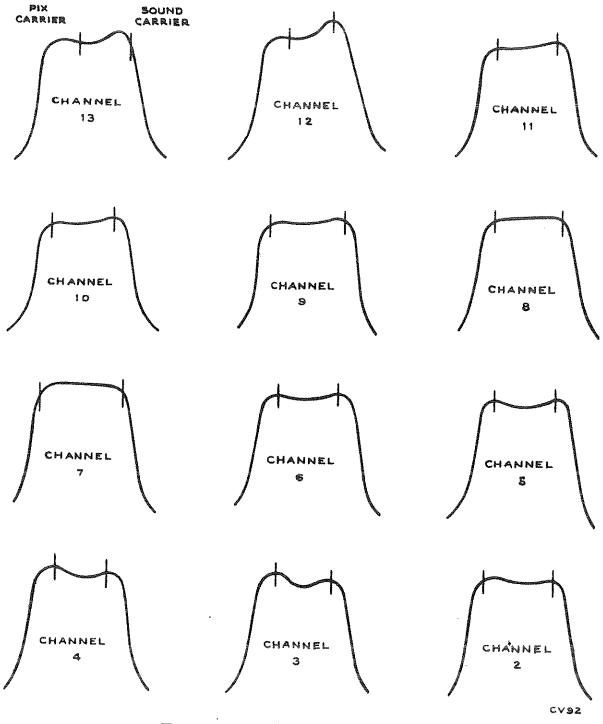


Figure 16—R-F Response

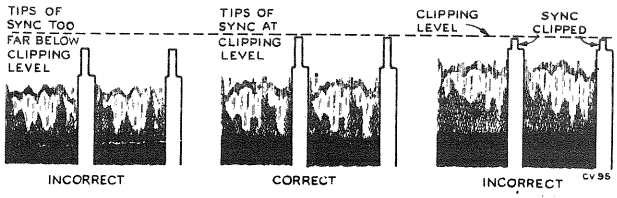


Figure 17—AGC Threshold Adjustment Waveforms

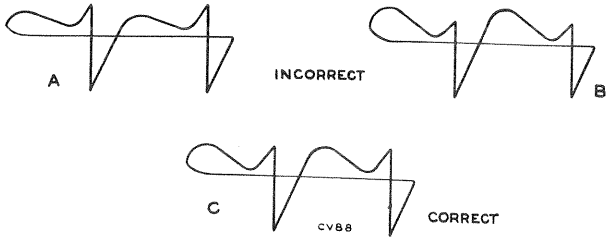


Figure 18—Horizontal Oscillator Waveforms

tion is encountered, it is sometimes possible to stop oscillation by adjusting the transformers approximately to frequency by setting the adjustment cores of T101, T102, T103, T104, T105 and T106 to be approximately equal to those of another receiver known to be in proper alignment. If this does not have the desired effect, it may now be possible to stop oscillation by increasing the grid bias. If so, it should then be possible to align the transformers by the usual method. Once aligned in this manner, the i-f amplifier should be stable with reduced bias.

If the oscillation cannot be stopped in the above manner, shunt the grids of the first three pix i-f amplifiers to ground with 1,000 mmf. capacitors. Connect the signal generator to the fourth pix i-f grid and align T106 to frequency. Progressively remove the shunt from each grid and align the plate coil of that stage to frequency.

If this does not stop the oscillation, the difficulty is not due to i-f misalignment as the i-f section is stable when properly aligned. Check all i-f by-pass condensers, transformer shunting resistors, tubes, socket voltages, etc.

ANTENNA, R-F AND CONVERTER LINE ADJUSTMENT. — In order to align the r-f tuner, it will first be necessary to set the channel-13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.

The channel-13 oscillator may be aligned by adjusting it to beat with a crystal-calibrated heterodyne frequency meter, or by feeding a signal into the receiver at the r-f sound carrier frequency and adjusting the oscillator for zero output from the sound discriminator. In this latter case the sound discriminator must first have been aligned to exact frequency. Either method of adjustment will produce the same results. The method used will depend upon the type of test equipment available. Regardless of which method of oscillator alignment is used, the frequency standard must be crystal controlled or calibrated.

If the receiver oscillator is to be adjusted by the heterodyne frequency meter method, couple the meter probe loosely to the receiver oscillator.

If the receiver oscillator is adjusted by feeding in the r-f sound carrier signal, connect the signal generator to the receiver antenna terminals. Connect the "VoltOhmyst" to the sound discriminator output (junction of C183 and R203).

Set the receiver switch to 13.

Adjust the frequency standard to the correct frequency 236.75 mc. for heterodyne frequency meter or 215.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range.

Adjust C6 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator.

Now that the channel-13 oscillator is set to frequency, we may proceed with the r-f alignment.

Connect the "VoltOhmyst" to the junction of R135 and L117. Adjust the 250K pot. for −3.5 volts on the meter.

Remove the first pix i-f amplifier tube V101.

Connect the oscilloscope to the test connection at R13 in the r-f tuning unit.

Connect the r-f sweep oscillator to the receiver antenna terminals. The method of connection depends upon the output impedance of the sweep. The P102 connections for 300-ohm balanced or 72-ohm single-ended input are shown in the circuit diagrams If the sweep oscillator has a 50-ohm single-ended output, 300-ohm balanced output can be obtained by connecting as shown in Figure 7.

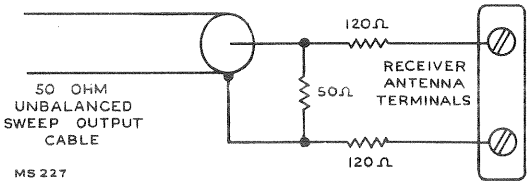


Figure 7—Unbalanced Sweep Cable Termination

Connect the signal generator loosely to the receiver antenna terminals.

Since channel 7 has the narrowest response of any of the high frequency channels, it should be adjusted first.

Set the receiver channel switch to channel 7.

Set the sweep oscillator to cover channel 7.

Insert markers of channel 7 picture carrier and sound carrier, 175.25 mc. and 179.75 mc.

Adjust C10 and C14 until the curve falls symmetrically between the sound and picture carrier markers. Adjust C11 to give the proper band width. Roughly peak L6 in conjunction with slight adjustments of C10 and C14 for a flat-topped response curve with the sound and picture carriers at 90% to 95% response points on this curve. See Figure 16, channel 7.

Switch to channel 12 and adjust L6 for maximum response and minimum top slope of the curve.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep oscillator and marker oscillator to each of these channels and observing the response obtained. See Figure 16 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response. If the markers do not fall within this requirement on one or more high frequency channels, since there are no individual channel adjustments, it will be necessary to readjust L6, C10, C11 and C14, and possibly compromise some channel slightly in order to get the markers up on other channels. Normally, however, no difficulty of this type should be experienced since the higher frequency channels are comparatively broad and the markers easily fall within the required range.

Channel 6 is next aligned in the same manner.

Set the receiver to channel 6.

Set the sweep oscillator to cover channel 6.

Set the marker oscillator to channel 6 picture and sound carrier frequencies.

Adjust L9, L13, L66, and C12 for an approximately flat-topped response curve located symmetrically between the markers. L9, L13 and L66 are the center frequency adjustments. C12 is the band-width adjustment

Check channels 5 down through channel 2 by switching the receiver, sweep oscillator and marker oscillator to each channel and observing the response obtained. In all cases, the markers should be above the 80% response point. If this is not the case, L9, L13, L66 and C12 should be retouched. On final adjustment, all channels must be within the 80% specification.

Disconnect the 250K pot., and replace V107 and V101.

Following an r-f alignment, the oscillator alignment must be checked.

R-F OSCILLATOR LINE ADJUSTMENT. — The r-f oscillator line may be aligned by adjusting it to beat with a crystal calibrated heterodyne frequency meter, or by feeding a signal into the receiver at the r-f sound carrier frequency and adjusting the oscillator for zero output from the sound discriminator. In this latter case the sound discriminator must first have been aligned to exact frequency. Either method of adjustment will produce the same results. The method used will depend upon the type of test equipment available.

Regardless of which method of oscillator alignment is used, the frequency standard must be crystal controlled or calibrated. If the receiver oscillator is to be adjusted by the heterodyne frequency meter method, the calibration frequency listed under R-F Osc. Freq. must be available.

Channel Number	Receiver R-F Osc. Freq. Mc.	R-F Sound Carrier Freq. Mc.	Channel Oscillator Adjustment
2	80.750	59.75	L24
3	86.750	65.75	L23
4	92.750	71.75	L22
5	102.750	81.75	L21
6	108.750	87.75	L31
7	200.750	179.75	L19
8	206.750	185.75	L18
9	212.750	191.75	L17
10	218.750	197.75	L16
11	224.750	203.75	L15
12	230.750	209.75	L14
13	236.750	215.75	C6

Continued from Page 5

ALIGNMENT PROCEDURE (Continued)

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

Connect the "VoltOhmyst" to the junction of C183 and R203. Adjust T113 secondary (bottom). It will be found that it is possible to produce a positive or negative voltage on the meter dependent upon this adjustment. Obviously to pass from a positive to a negative voltage, the voltage must go through zero. T113 (bottom) should be adjusted so that the meter indicates zero output as the voltage swings from positive to negative. This point will be called discriminator zero output.

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

Adjust the sweep band width to approximately 1 mc. with the center frequency at approximately 21.00 mc. and with an output of approximately .1 volt.

Connect the oscilloscope to the junction of C183 and R203. The pattern obtained should be similar to that shown in Figure 12. If it is not, adjust T113 (top) until the waveform is symmetrical.

The peak-to-peak band width of the discriminator should be approximately 350 kc. and the trace should be linear from 21.150 mc. to 21.300 mc.

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

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

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

Adjust T112 (top and bottom) for maximum gain and symmetry about the 21.00 mc. marker. The pattern obtained should be similar to that shown in Figure 13.

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

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

PICTURE I-F TRAP ADJUSTMENT. — Connect the "VoltOhmyst" to the junction of R135 and C190.

Remove the 6SN7GT AGC Amplifier tube V107. Connect a 250,000-ohm potentiometer between pins 5 and 6 of the V107 socket. Adjust the potentiometer until the "VoltOhmyst" reads approximately −12 volts.

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

Connect the "VoltOhmyst" across the picture detector load resistor R119. Under this condition, both leads of the meter are at approximately −120 volts. In making this connection, care should be taken not to touch the case of the meter or to permit the meter case to become grounded.

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

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

(1) 21.00 mc.—T103 (top)
(2) 21.00 mc.—T105 (top)
(3) 27.00 mc.—T102 (top)
(4) 27.00 mc.—T104 (top)
(5) 19.50 mc.—T106 (top)
(6) 19.50 mc.—T101 (top)

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

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

22.5 mc.—T106 (bottom)
24.35 mc.—T104 (bottom)
21.75 mc.—T103 (bottom)
25.3 mc.—T102 (bottom)

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

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

Connect the "VoltOhmyst" to the junction of R135 and C190. Adjust the 250,000-ohm variable resistor for −2.0 volts on the meter.

Connect the oscilloscope to the plate of the first video amplifier, pin 1 of V106.

Connect a sweep generator to the converter grid through a 1,500 mmf capacitor. Set the generator to sweep from 20.0 mc. to 30.0 mc. and adjust the output to provide a 4-volt peak-to-peak signal on the scope.

Connect the signal generator loosely to the converter grid and tune it to provide markers at 22.05 mc. and 24.75 mc.

Adjust T1 (top) and T101 (bottom) to obtain the response shown in Figure 14. The T1 core must penetrate to the terminal-board end of the coil in order to obtain the correct response.

Remove the 330-ohm resistors from across T102, T103, T104 and T106.

Adjust the 250,000-ohm potentiometer for a 15-volt peak-to-peak signal at the plate of the first video amplifier. The bias as measured by the "VoltOhmyst" should be −12 volts or less.

Observe and analyze the response curve obtained. The response will not be ideal and the i-f adjustments must be retouched in order to obtain the desired curve. See Figure 15.

On final adjustment the picture carrier marker must be at approximately 45% response. The curve must be approximately flat topped, with the 21.85 mc. marker at approximately 90% response and the 24.75 mc. marker below 90% response. A 26.25 mc. marker must fall between 5 and 10% response.

The most important consideration in making the i-f adjustments is to get the picture carrier at the 45% response point. If the picture carrier operates too low on the response curve, loss of low frequency video response, of picture brilliance, of blanking, and of sync may occur. If the picture carrier operates too high on the response curve, the picture becomes smeared. In making these adjustments, care should be taken to see that no two transformers are tuned to the same frequency as i-f oscillation may result.

Remove the converter tube and take off the clip to pin number 1. Replace the tube in the socket.

Picture I-F Oscillation. — If the receiver will operate without oscillating with the test equipment disconnected but breaks into oscillation or becomes unstable with the equipment connected, it may become necessary to establish a ground plane. Cover the test bench with a sheet of copper and set the chassis on the sheet. Set all the test equipment except the "VoltOhmyst" on the sheet and bond or bypass them to it. A Junior "VoltOhmyst" should not be bonded to the sheet since the negative test probe is not always connected to ground during alignment. If the receiver is badly misaligned and two or more of the i-f transformers are tuned to the same frequency, the receiver may fall into i-f oscillation. I-F oscillation shows up as a voltage across the picture detector load resistor that is unaffected by r-f signal input. If such a condi-

If the receiver oscillator is adjusted by feeding in the r-f sound carrier frequency, the frequencies listed under Sound Carrier Freq. must be available.

If the heterodyne frequency meter method is used, couple the meter probe loosely to the receiver oscillator.

If the r-f sound carrier method is used, connect the "Volt-Ohmyst" to the sound discriminator output (junction of C183 and R203) and connect the signal generator to the receiver antenna terminals. The order of alignment remains the same regardless of which method is used.

If the r-f unit is removed from the receiver for service and is aligned separately, the shield over the bottom of the r-f unit must be in place when making adjustments.

Since the lower frequencies are obtained by adding steps of inductance, it is necessary to align channel 13 first and continue in reverse numerical order.

Set the receiver channel switch to 13.

Adjust the frequency standard to the correct frequency 236.75 mc. for heterodyne frequency meter or 215.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range while making the adjustment.

Adjust C6 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator. Oscillator adjustments L1 and L2 shown on the schematic are factory control adjustments and should not be touched in the field.

Switch the receiver to channel 12.

Set the frequency standard to the proper frequency as listed in the alignment table.

Adjust L14 for indications as above.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator trimmer for the specified indication. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control in the middle third of its range.

After the oscillator has been set on all channels, start back at channel 13 and recheck to make sure that all adjustments are correct.

AGC THRESHOLD ADJUSTMENT. — The AGC threshold adjustment can be made by the method outlined in the Installation Instructions. However, a more accurate adjustment can be obtained by the use of an oscilloscope.

Tune in a station and advance the picture control to the maximum clockwise position. Connect the low capacity probe from the oscilloscope to the plate of the first video amplifier, pin 1 of V106. Adjust the oscilloscope to observe the horizontal sync pulse.

Turn the AGC threshold control R138 fully clockwise, then slowly counter-clockwise. As the control is turned counter-clockwise, the receiver gain will increase slowly, increasing the size of the pattern on the oscilloscope. R138 should be turned counter-clockwise until the receiver begins to overload as indicated by clipping of the sync. The control should be left in the maximum gain position in which no clipping of sync is observed. See Figure 17 for proper waveforms.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment requires the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Set the locking range trimmer one half turn out from maximum capacity. With a clip lead, short circuit the coil between terminals C and D of the horizontal oscillator transformer T109. Tune in a television station and sync the picture if possible.

A. — Turn the horizontal hold control R173 to the extreme clockwise position. Adjust the T109 Frequency Adjustment (under the chassis) so that the picture is just out of sync and the horizontal blanking appears in the picture as a vertical bar. The position of the bar is unimportant.

Note.—Occasionally a tube may be found which does not respond to step "A" above, since it may not be possible to sync the picture by means of the frequency core when the sine wave coil is shorted out. Yet, the tube may work perfectly well when the circuit is properly aligned. In such a case it may be necessary to remove the short then turn the sine wave core out then in until it is possible to obtain sync by adjustment of the frequency core.

B. — Turn the hold control approximately one-quarter of a turn from the extreme clockwise position and examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C153B, the width control R192 and the linearity control L111 until the picture is correct. If C153B was adjusted, repeat step "A" and note above.

Horizontal Oscillator Waveform Adjustment. — Remove the shorting clip from terminals C and D of T109. Turn the horizontal hold control to the extreme clockwise position. With a thin fibre screwdriver, if necessary, adjust the Oscillator Waveform Adjustment Core of T109 (on the outside of the chassis) until the horizontal blanking bar appears in the raster. The waveform adjustment core will sync the picture in two positions. The core should be in the position nearest the outside of the chassis.

A. — Connect the low capacity probe of an oscilloscope to terminal C of T109. Alternately adjust the waveform and frequency cores of T109 until the peak of the sine wave is equal in amplitude to the peak of the saw tooth, on the oscilloscope as shown in Figure 18, while maintaining the picture in synchronization. Then adjust the frequency core until horizontal blanking shows as a vertical bar in the picture.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Check of Oscillator Pull-in Range.—Set the horizontal hold control to the full counter-clockwise position.

Connect a 270K ohm resistor across C156.

Momentarily switch off channel and back. The picture will then be out of sync.

Turn the hold control clockwise slowly and observe the minimum number of bars obtained just before the picture pulls into sync. The picture should snap in from two complete blanking bars. If two bars are not obtained turn the locking range trimmer C153A in to obtain less bars or out to obtain more bars.

After adjustment of C153A, remove the 270K resistor, turn the horizontal hold control fully clockwise and readjust the frequency core of T109 until the picture is in sync and the horizontal blanking bar begins to move in the picture. Then repeat the entire "Check of Pull-in Range" procedure to this point. Repeat this procedure until two bar pull-in is obtained.

Turn the horizontal hold control to the maximum clockwise position. The picture should be just out of sync to the extent that the horizontal blanking bar appears as a single vertical or diagonal bar in the picture. Adjust the T109 Frequency Adjustment until this condition is fulfilled.

4.5 MC. VIDEO TRAP. — With a strong input from a station, detune the receiver from the correct fine tuning point. With a very short clip lead, short the trap winding of T103. Observe the picture for the appearance of a 4.5 mc. beat. If the beat appears in the picture, adjust L110 until the beat is eliminated.

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
	R-F UNIT ASSEMBLIES KRK 5B
	Same as listed on page 285
	TELEVISION CHASSIS ASSEMBLIES KCS 40B
	Same as listed for KCS 40A on page 285 except for the following:
75453	Bracket—Channel indicator lamp bracket
75452	Control—Picture control, brightness control and channel light switch (R122, R131, S104)
75454	Socket—Indicator lamp socket complete with lead (12¼")
	SPEAKER ASSEMBLIES 92569-10W RL 111-16 RMA 274
13867	Cap—Dust cap
74901	Cone—Cone and voice coil assembly (3.2 ohms)
5039	Connector—4 contact male connector for speaker (J101)
75035	Speaker—12" P.M. speaker complete with cone and voice coil less output transformer and plug
75036	Transformer—Output transformer (T114)
	SPEAKER ASSEMBLIES 92569-10B
75875	Cone—Cone and voice coil assembly (3.2 ohms)
	NOTE: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to model number of instrument, number stamped on speaker and full description of part required.
	MISCELLANEOUS
75020	Back—Cabinet back
71599	Bracket—Pilot lamp bracket
13103	Cap—Pilot lamp cap
71892	Catch—Bullet catch and strike
X3120	Cloth—Grille cloth for mahogany or walnut instruments
X3090	Cloth—Grille cloth for oak instruments
75608	Cushion—Dust seal cushion
71910	Decal—Trade mark decal
75440	Decal—Control panel function decal for mahogany or walnut instruments
75441	Decal—Control panel function decal for oak instruments
74809	Emblem—"RCA Victor" emblem
75455	Escutcheon—Channel marker escutcheon—dark—for walnut or mahogany instruments
75456	Escutcheon—Channel marker escutcheon — light — for oak instruments
74606	Glass—Safety glass
75439	Grille—Metal grille
37396	Grommet—Rubber grommet to mount speaker (4 required)
74308	Hinge—Cabinet door hinge (1 set)
74959	Knob—Fine tuning knob—maroon—for mahogany or walnut instruments (outer)
75461	Knob—Fine tuning knob—beige—for oak instruments (outer)
74960	Knob—Channel selector knob — maroon — for mahogany or walnut instruments (inner)
75462	Knob—Channel selector knob—beige—for oak instruments (inner)
74962	Knob—Tone control, brightness control or vertical hold control knob — maroon — for mahogany or walnut instruments (outer)
75463	Knob—Tone control, brightness control or vertical hold control knob — beige — for oak instruments (outer)
74963	Knob—Picture control, horizontal hold control or volume control and power switch knob—maroon—for mahogany or walnut instruments (inner)
75464	Knob—Picture control, horizontal hold control or volume control and power switch knob—beige—for oak instruments (inner)
11765	Lamp—Pilot or channel indicator lamp—Mazda 51
75460	Mask—Light mask—gold for channel marker escutcheon for oak instruments
75459	Mask—Light mask—burgundy for channel marker escutcheon for mahogany or walnut instruments
74162	Plate—Mounting plate for interlock switch
75438	Pull—Door pull
71456	Screw—No. 8-32 x 7/16" wing screw for deflection yoke and focus magnet mounting support
74307	Screw—No. 8-32 x 1¼" trimit head screw for door pull
73643	Spring—Spring clip for channel marker escutcheon
74966	Spring—Formed spring for kinescope masking panel (8 required)
30330	Spring—Retaining spring for knobs 74963 and 75464
72845	Spring—Retaining spring for knobs 74959 and 75461
14270	Spring—Retaining spring for knobs 74960, 74962, 75462 and 75463
72936	Stop—Cabinet door stop
74161	Stud—Locating stud for back (2 required)
75457	Washer—Felt washer—dark brown—between knob and channel marker escutcheon for mahogany or walnut instruments
75458	Washer—Felt washer—beige—between knob and channel marker escutcheon for oak instruments

To obtain resistors for which no stock number is given, order by stating type, value of resistance, tolerance and wattage.

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS