MAINTENANCE MANUAL

FOR

THE *Capehart*

610P

651P and 661P

TELEVISION RECEIVERS

Price 50¢

Issued by the Service Department

CAPEHART-FARNSWORTH CORPORATION

FORT WAYNE, INDIANA

INTRODUCTION

This maintenance manual is based upon factual data and does not encompass a technical circuit analysis detailing operational theory.

As a source of theoretical discussion relative to both transmission and reception in television, the serviceman may wish to procure a copy of "Television—The New Horizon". This material presents discussion of telecasting, antennas, the generalized receiver, test equipment, The Capehart receiver and a section on color television.

Television—The New Horizon is obtainable from the Service Department at Fort Wayne, Indiana. Price $2.00 Net.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

MODEL 651-P & 661-P TELEVISION RECEIVERS

FREQUENCIES

Intermediate Frequency, Television.....26.25 MC
Intermediate Frequency, Sound.....21.75 MC
Adjacent Channel Trap.....27.75 MC
Co-Channel Sound Trap.....21.75 MC

TV Channel No.	Frequency MC	Sound Carrier	Video Carrier	Local Osc.
2	54-60	59.75	55.25	81.50
3	60-66	65.75	61.25	87.50
4	66-72	71.75	67.25	93.50
5	76-82	81.75	77.25	103.50
6	82-88	87.75	83.25	109.50
7	174-180	179.75	174.25	201.50
8	180-186	185.75	181.25	207.50
9	186-192	191.75	187.25	213.50
10	192-198	197.75	193.25	219.50
11	198-204	203.75	199.25	225.50
12	204-210	209.75	205.25	231.50
13	210-216	215.75	211.25	237.50

TUBE COMPLEMENT

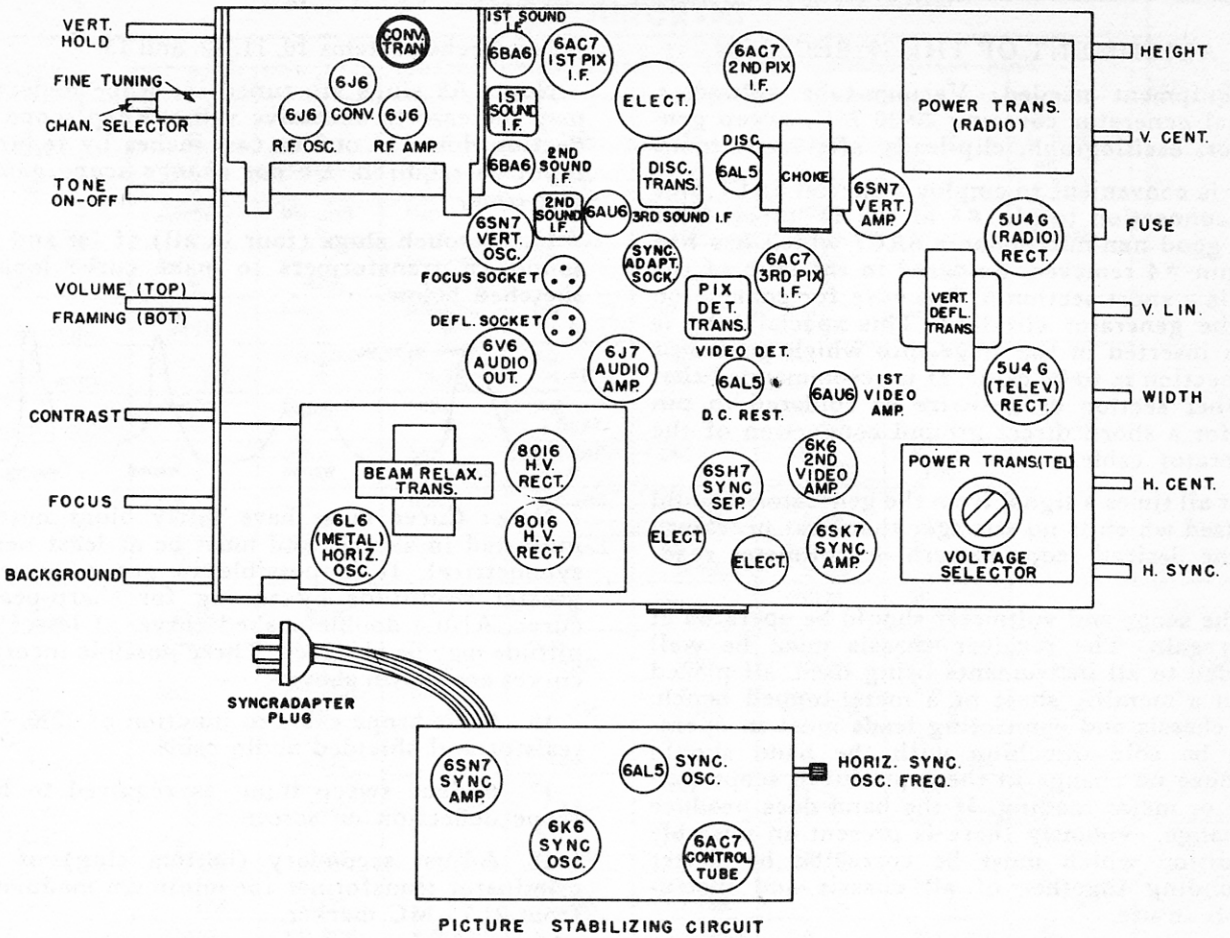
FUNCTION	TUBE	TUBE	FUNCTION
RF Amplifier	6J6	6J7	Audio Ampl.
Mixer	6J6	6V6	Audio Ampl.
Oscillator	6J6	6SK7	Sync Ampl.
1st Video IF Ampl.	6AC7	6SH7	Sync Stripper
2nd Video IF Ampl.	6AC7	6SN7 (½)	Sync Clipper
3rd Video IF Ampl.	6AC7	6SN7	Vert. Osc.
Video Detector	6AL5 (½)	6SN7	Vert. Ampl.
1st Video Ampl.	6AU6	6AC7	Reactance
2nd Video Ampl.	6K6	6K6	AFC Osc.
D. C. Restorer, Sync Sep.	6AL5 (½)	6AL5	Sync Disc.
1st Sound IF Ampl.	6BA6	6SN7 (½)	Sync Clipper
2nd Sound IF Ampl.	6BA6	6L6	Hor. Osc.
3rd Sound IF Ampl.	6AU6	5U4G (2)	L. V. Power
Discriminator	6AL5	8016 (2)	H. V. Power
		10FP4	Picture Tube

Total Number 29

MISCELLANEOUS

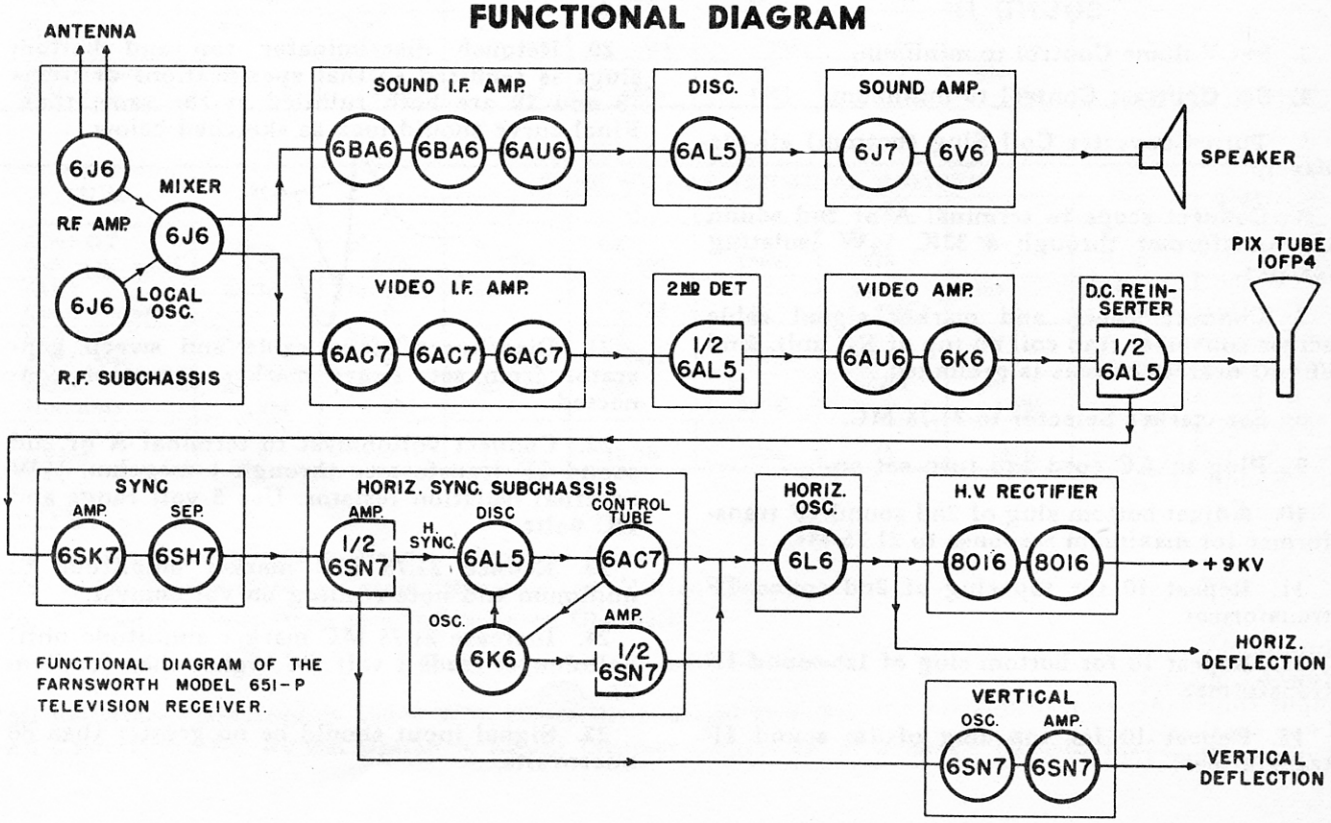
Supply Source .....105-120V., 60 c.p.s.
Power Consumption .....300 watts
Input Impedance to transmission line ....300 ohms
Type speaker (651P).....Eliptical 6" x 9", PM
Type speaker (661P).....12" PM
Speaker impedance (661P).....4 ohms
Speaker impedance (651P).....3.2 ohms
Size of cabinet (651P) .....16¾ x 17 x 22½ inches
Shipping weight of receiver (651P).....102 lbs.
Size of cabinet (661P).....42 x 19½ x 22 inches

CHASSIS LAYOUT



PICTURE STABILIZING CIRCUIT

FUNCTIONAL DIAGRAM



FUNCTIONAL DIAGRAM OF THE FARNSWORTH MODEL 651-P TELEVISION RECEIVER.

ALIGNMENT OF THE IF SECTION

Equipment needed: Vacuum-tube voltmeter, signal generator covering 20-30 MC, sweep generator, oscillograph, clip-leads, alignment tools.

It is convenient to employ a special 6AC7 tube for connection to pin #4 of the IF tubes. This is a good non-microphonic 6AC7 which has had its pin #4 removed. Soldered to the stub of the pin is a short section of bus-wire for connection of the generator clip-lead. This special tube is then inserted in the stage into which generator connection is to be made. It is recommended that another section of bus-wire be soldered to pin #1 for a short, direct ground connection of the generator cable.

At all times a signal from the generators should be used which is no stronger than that necessary to the desired scope pattern or voltmeter reading.

The scope and voltmeter should be operated at high gain. The receiver chassis must be well bonded to all instruments being used, all placed upon a metallic sheet or a metal-topped bench. All chassis and connecting leads must in operation be cold—touching with the hand should produce no change in the reproduced scope pattern or meter reading. If the hand does produce a change, evidently there is present an unstable condition which must be corrected by better grounding together of all chassis and instruments in use.

1. Remove Television 5U4G rectifier tube.

SOUND IF

3. Set Volume Control to minimum.

4. Set Contrast Control to minimum.

5. Turn Converter Coil Slug (bottom) all the way in.

6. Connect scope to terminal A of 2nd sound IF transformer through a 33K, ½W isolating resistor.

7. Connect sweep and marker signal cable across converter trap coil on top of RF unit. End of coil nearest chassis is grounded.

8. Set marker Selector to 21.75 MC.

9. Plug in AC cord and turn set on.

10. Adjust bottom slug of 2nd sound IF transformer for maximum response to 21.75 MC.

11. Repeat 10 for top slug of 2nd sound IF transformer.

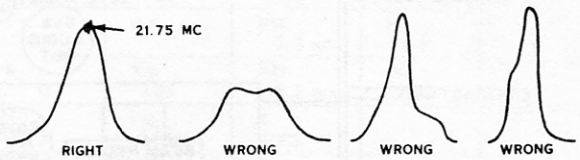
12. Repeat 10 for bottom slug of 1st sound IF transformer.

13. Repeat 10 for top slug of 1st sound IF transformer.

14. Recheck items 10, 11, 12, and 13.

Note: As slugs are tuned in, scope deflection may increase to excessive value. Keep scope deflection down to one or two inches by reducing input as required. *Do not change scope gain at any time.*

15. Retouch slugs (four in all) of 1st and 2nd sound IF transformers to make curve look as sketched below.



Note: Curve must have fairly blunt nose as indicated in sketch, and must be at least nearly symmetrical. It is possible to get a curve of greater amplitude by tuning for sharp-peaked curve. Also a double-peaked curve, of lower amplitude may be obtained. Three possible incorrect curves are shown above.

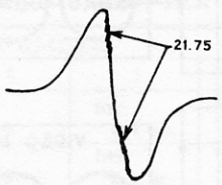
16. Move scope cable to junction of 22K, ½W resistor and shielded audio cable.

17. Reduce sweep input as required to keep scope deflection on screen.

18. Adjust secondary (bottom slug) of discriminator transformer for minimum modulation from 21.75 MC marker.

19. Adjust primary (top slug) of discriminator so that two peaks of S-curve are equal in amplitude.

20. Retouch discriminator top and bottom slugs as required so that specifications of items 18 and 19 are both fulfilled at the same time. Final curve should look as sketched below.



21. Disconnect scope cable and sweep generator from set. Leave marker generator connected.

22. Connect voltohmyst to terminal A of 2nd sound IF transformer through 1 megohm, ½W external isolation resistor. Use 5 volt range and DC volts.

23. Reduce 21.75 MC marker amplitude to minimum and note reading on voltohmyst.

24. Increase 21.75 MC marker amplitude until voltohmyst reads 1 volt DC higher than for item 23.

25. Signal input should be no greater than 80 microvolts.

PICTURE IF

1. Connect scope across video detector load resistor, 3.9K.

2. Remove 6AC7 third picture IF amplifier tube and replace with special 6AC7.

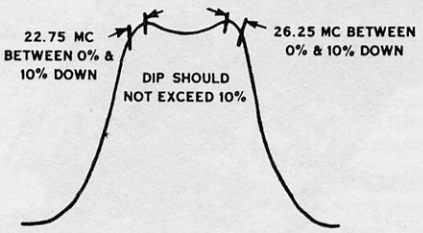
3. Connect sweep and marker signal cable to special 6AC7 input terminals. Set sweep and marker signals to minimum.

4. Adjust contrast control for 3V bias on IF bias line.

5. Adjust sweep output level for one or two inches deflection on scope.

6. Tune 3rd picture IF transformer trap (top) out of pass band on low frequency side.

7. Adjust 3rd picture IF transformer slugs for curve sketched below.



8. Inject 21.75 marker and tune 3rd picture IF transformer trap for minimum response to 21.75 MC.

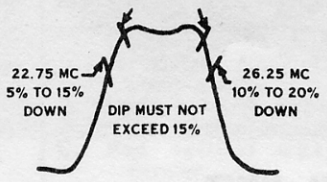
9. If necessary readjust 3rd picture IF transformer slugs to restore markers to position specified in item 7.

10. Remove 6AC7 2nd picture IF amplifier. Remove special 6AC7 from 3rd picture IF amplifier socket and insert in 2nd picture IF amplifier socket. Replace original tube in 3rd picture IF amplifier socket.

11. Apply sweep and marker input to special 6AC7, adjusting sweep input for suitable scope deflection.

12. Tune 2nd picture IF transformer trap out of pass band on low frequency side.

13. Adjust circuit capacitances associated with 2nd picture IF transformer for curve sketched below. Adjustment is made by lead-dress.



14. Inject 21.75 marker and tune 2nd picture IF transformer trap for minimum response to 21.75 MC.

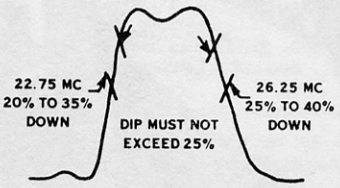
15. If necessary, readjust 2nd picture IF transformer capacitances to restore markers as specified in item 13.

16. Remove 6AC7 from 1st picture IF amplifier socket. Remove special 6AC7 from 2nd picture IF amplifier socket and place it in 1st picture IF amplifier socket. Replace original 6AC7 in 2nd picture IF amplifier socket.

17. Connect sweep and marker signal to special 6AC7 input, and adjust sweep level for suitable scope deflection.

18. Tune 1st picture IF transformer trap out of pass band on high frequency side.

19. Adjust circuit capacitances associated with 1st picture IF transformer for curve sketched below.



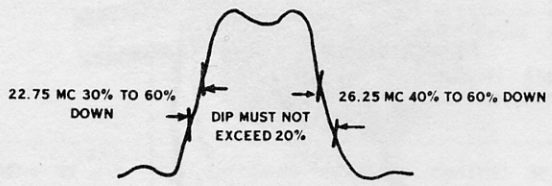
20. Inject 27.75 MC marker and tune 1st picture IF transformer trap for minimum response to 27.75 MC.

21. Recheck 21.75 MC and 26.25 MC markers and if necessary readjust 1st picture IF transformer capacitances to make markers conform to specifications of item 19.

22. Remove special 6AC7 from 1st picture IF amplifier socket and replace original tube in this socket.

23. Inject sweep and marker signal into converter grid. Short converter coil, sound IF trap midpoint to ground with short clip lead.

24. Turn converter coil slug (bottom) out until response curve top tilts, and than levels off at higher amplitude. Curve should appear as below. Slight readjustments of 3rd picture IF transformer slugs and converter coil slug may be necessary.



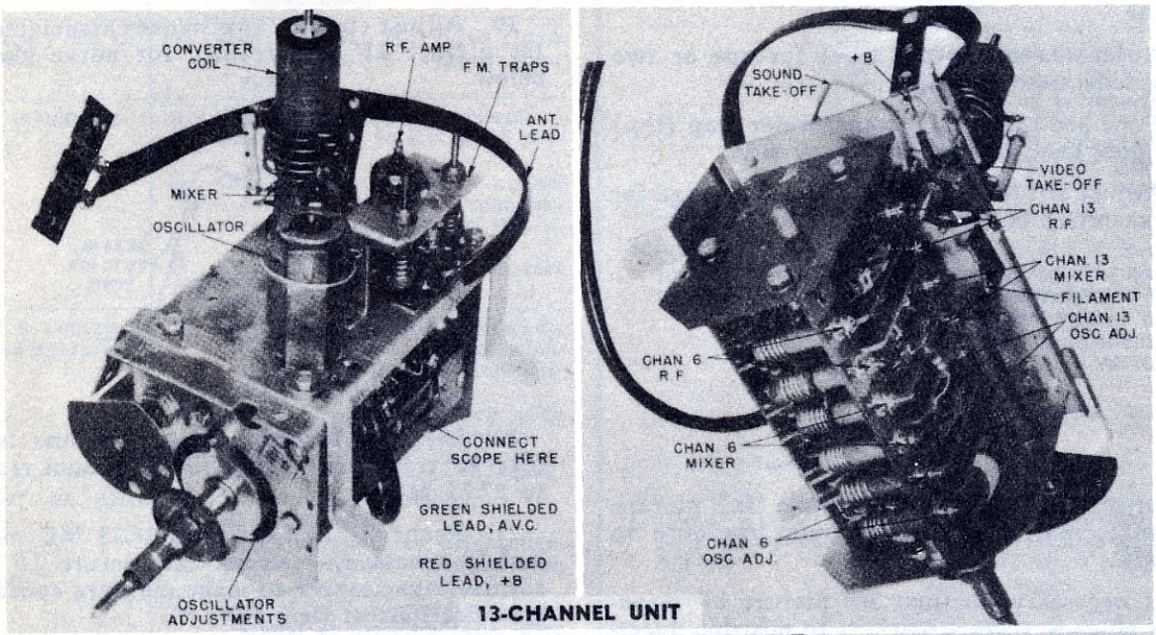
25. Inject 21.75 MC marker and tune converter trap coil slug (top) for minimum response to 21.75 MC.

26. Recheck overall response and retouch if necessary.

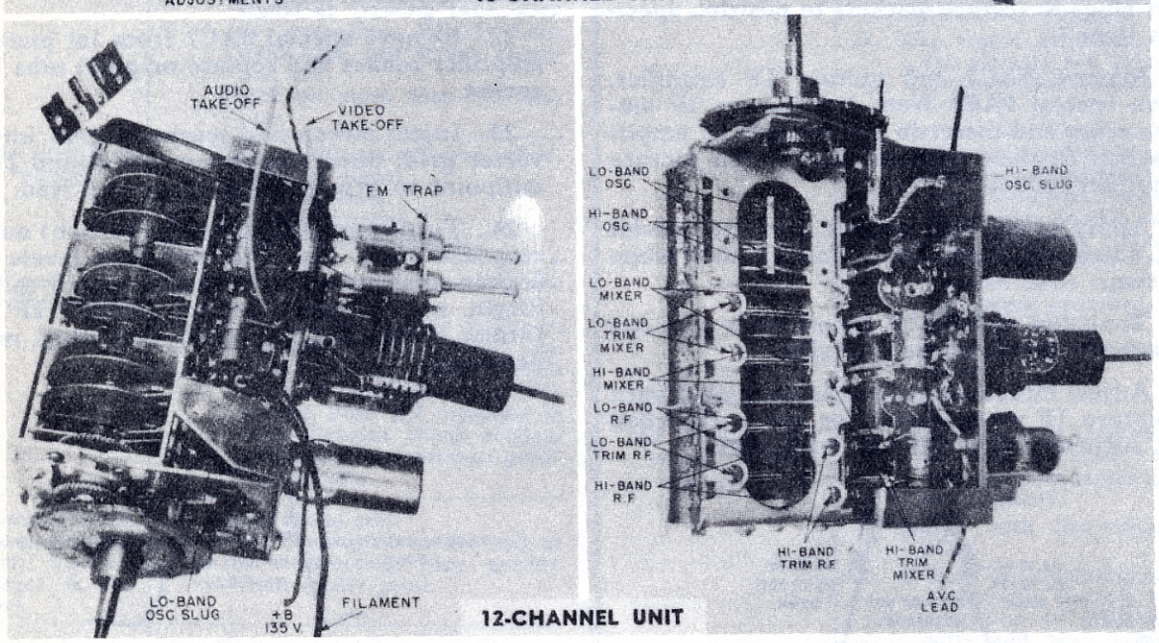
27. Recheck alignments of all traps.

There have been incorporated in production two types of RF sub-assembly (1) that switching coils in selection of channels, and (2) that using continous variable condenser tuning. The former is readily identified by 13 channel reception and the appearance of the channel number through a window in the channel selector switch.

The latter, (2) provides 12 channel reception (channel #1 is deleted since this channel is no longer assigned to telecasting service by order of the FCC) and channel identification is by a brass pin extending from the selector switch.



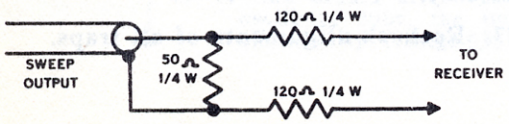
13-CHANNEL UNIT



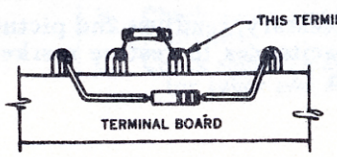
12-CHANNEL UNIT

ALIGNING THE 13-CHANNEL UNIT

1. Connect sweep generator to antenna terminals. If the sweep has 50 ohm unbalanced output, connect through the pad shown:



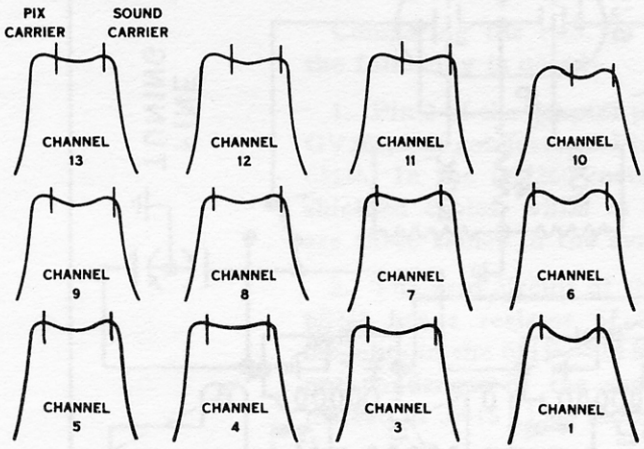
2. Connect oscillograph across the 1 megohm resistor at the end of the converter line:



3. Bypass the first picture IF grid to ground through a .001 mfd. condenser, keeping the leads of this bypass as short as possible. Too-long leads will result in incorrect response curve.

4. Set the contrast control for approximately 1½ volts bias on the RF stage grids.

5. Set the channel switch to channel 7. Adjust sweep and markers to channel 7. Adjust L25, L26, L51 and L52 for approx. flat-topped response. In making this adjustment, the stud extension of all cores should be kept approximately equal.



RF RESPONSE

Note: All markers must be above the 70% amplitude level.

6. Check response of channels 8-13. If not approximately as shown, adjust L25, 26, 51 and 52 and compromise some channel slightly. Normally, no such difficulty will be experienced.

7. Set receiver, sweep and markers to channel 6. Adjust L11, 12, 37, 38.

8. Check channels 5 through 2. If not correct, L11, 12, 37, 38 should be readjusted. All channels must be within the 70% specification.

OSCILLATOR ALIGNMENT

1. It must first be assured that the sound discriminator is properly aligned. Signals for oscillator adjustment must be supplied either by a crystal-controlled source, or a signal generator which has been crystal-calibrated.

2. Connect generator to antenna terminals, connect, a Voltohmyst to the sound discriminator output (across volume control). Set channel switch to 13, signal generator to sound-carrier frequency. The frequencies for the several channels are:

Channel	Freq. of Sound Carrier, MC	Channel	Freq. of Sound Carrier, MC
2	59.75	8	185.75
3	65.75	9	191.75
4	71.75	10	197.75
5	81.75	11	203.75
6	87.75	12	209.75
7	179.75	13	215.75

Set fine tuning control to middle of its range.

3. Adjust L77, 78 for zero voltage from the discriminator. Core studs should be maintained equal.

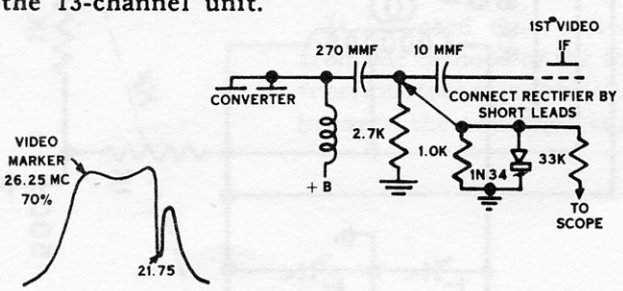
4. Adjust L76 for channel 12, and all other channels in succession.

ALIGNING THE 12-CHANNEL UNIT

Alignment of the 12 channel RF assembly is as follows:

1. Accurate setting of the converter coil trap to 21.75 MC as outlined in connection with picture IF alignment is essential, since oscillator adjustment is based upon this premise.

2. As shown in sketch below, connect a 1000 ohm resistor and 1N34 crystal, through 33K isolation resistor, to oscilloscope. Connect sweep generator to antenna as previously outlined for the 13-channel unit.



3. Align the oscillator coil slugs (one for high, one for low-channel groups) so that:

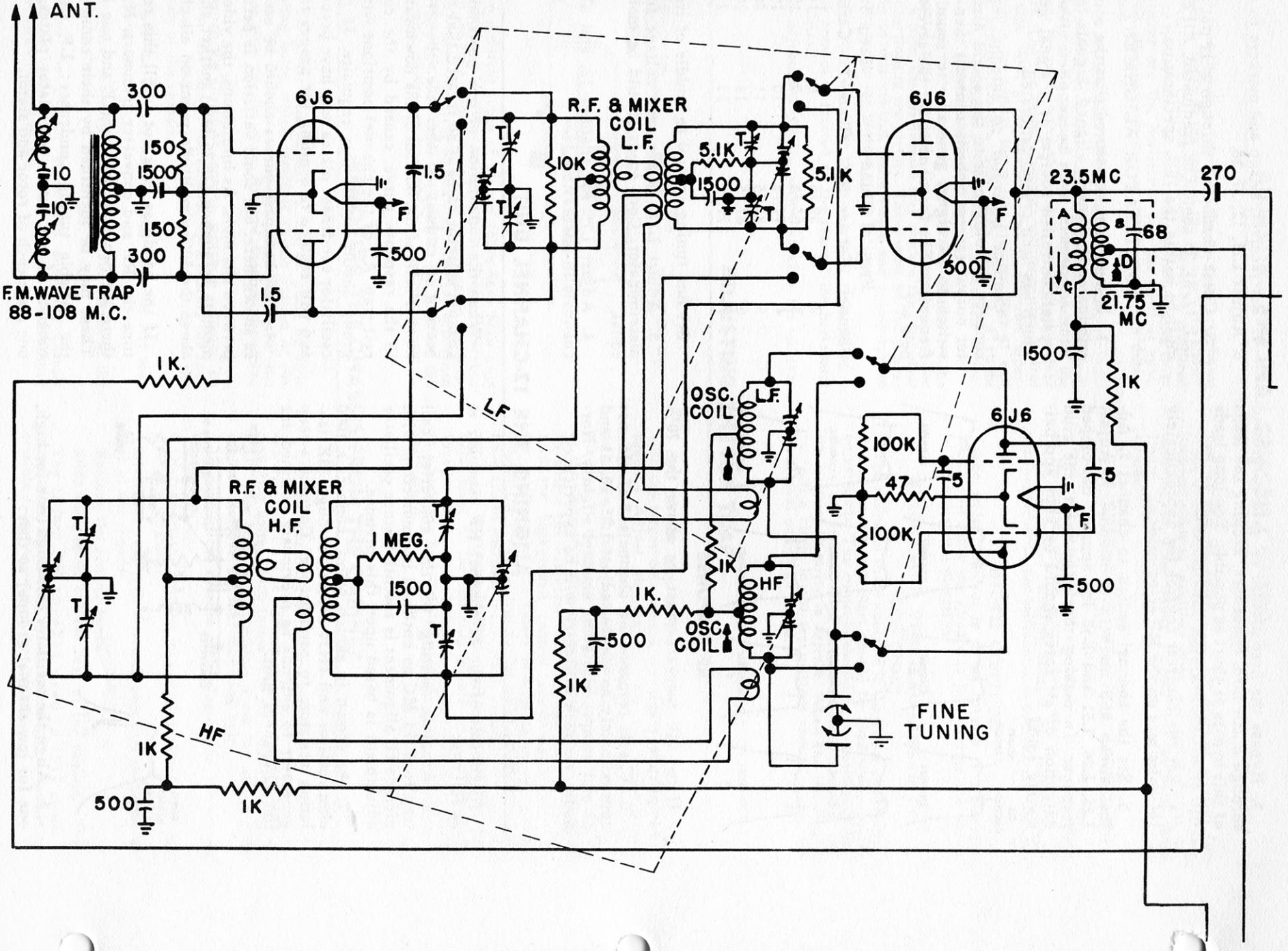
When the indentation of one position of the channel selector races is so rotated that the ball-bearing is midway in the race, the 21.75 MC marker falls at the bottom of the downward "pip" in the response curve, caused by the converter coil trap. All of the channel positions within the group should fulfill this requisite. If not, the oscillator condenser plates may have become bent and will require re-bending for proper tracking.

4. RF bandpass curves should be essentially as shown here, but some variation is permissible between channels. As limitations, the video intermediate frequency (26.25 MC) marker should be above the 70% amplitude point on all channels.

If the bandpass does not fulfill this requisite, tune the RF and converter trimmers. Note that there are two sets, one for HF and one for low. These may be identified by their connection to the variable tuning condenser; LF condenser consists of one rotor, two stator plates, HF is one plate each of rotor and stator.

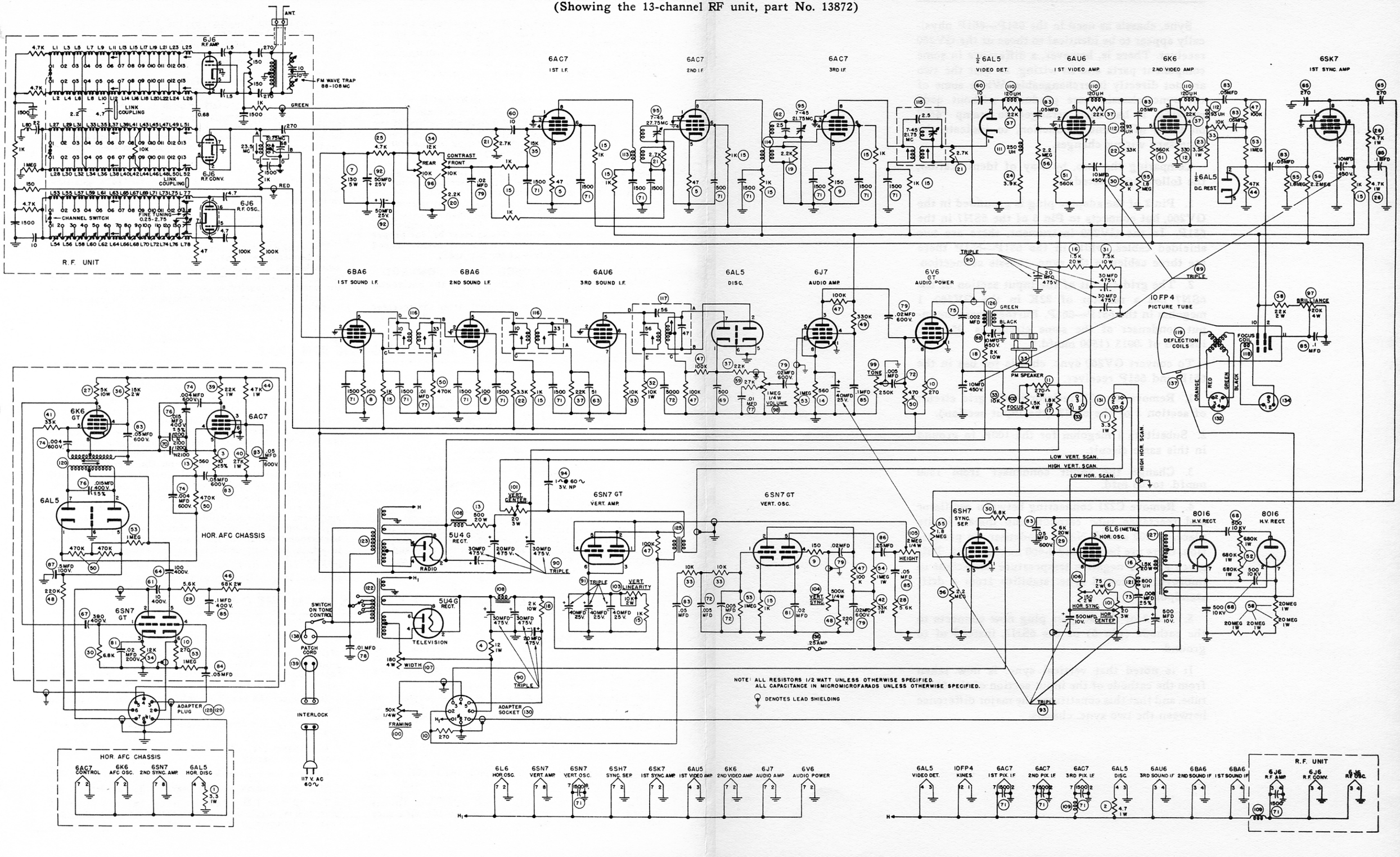
12 CHANNEL RF UNIT

Part No. 13900



610P, 651P AND 661P SCHEMATIC

(Showing the 13-channel RF unit, part No. 13872)



ADJUSTING THE REAR CHASSIS CONTROLS

The rear-chassis controls of the receiver are shown on page 3. Those at the rear of the receiver are known as serviceman's controls and should never be tampered with by the layman. The two controls commanding close adjustment are the horizontal and the vertical sync. controls. Mal-adjustment may result in picture deterioration.

HORIZONTAL SYNC. CONTROL

There are two major lock-in points of this control. One will cause a vertical black bar in the center of the picture; the other being the correct point, gives a clear picture. The two limits of proper setting of this control are: One limit gives unstable synchronization. Operation may be normal for a few minutes, then it will break synchronization. The other limit is a slight condition of fuzziness in the picture, particularly noticeable in the transmitted test pattern.

Between these limits is the correct setting of the horizontal sync. control. By close inspection of the picture tube, the serviceman may discern the individual scanning lines in the picture. These must be, for proper setting of this control, quite stable and evenly-spaced from the top to the bottom of the picture.

HORIZONTAL AFC OSCILLATOR CONTROL

This control is located on the rear of the horizontal sync. chassis.

This adjustment is to be such that, after the receiver has warmed up, rotation of the framing control (on front of receiver) from extreme clockwise to extreme counterclockwise position does not cause horizontal scanning to break sync.; rather, that between these limits, the picture remains stable, moving from side to side.

HORIZONTAL AND VERTICAL CENTERING CONTROLS

The centering controls are used to locate the image in the center of the picture tube screen. Adjustment of the horizontal centering control may require slight readjustment of the horizontal synchronizing control.

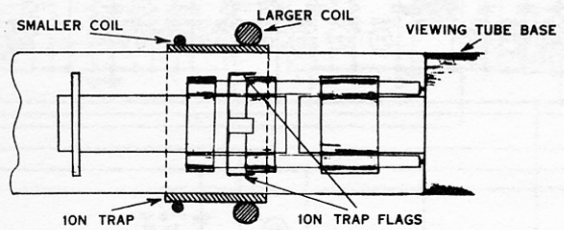
WIDTH CONTROL

The width conntrol is to be rotated to a position which will cause the picture to just overlap the screen in the horizontal direction.

HEIGHT AND VERTICAL LINEARITY CONTROLS

The action of these controls is somewhat interlocked. A transmitted test chart should be used when making adjustments. The controls should be so positioned that the screen is just filled in the vertical direction and the vertical linearity is correct. When the linearity is correct, a circle in the test pattern should not appear to be oval or out of round.

ADJUSTING THE ION TRAP



Two different types of picture tubes have been used in production; (1) those employing an aluminized screen within the tube structure and not requiring an ion trap, and (2) those requiring an ion trap. We are concerned in this section with those requiring an ion trap and the adjustment of the ion trap which is outlined herein:

Slip the ion trap on the neck of the viewing tube with the larger coil toward the base of the tube. (See sketch.) Adjust the trap so that the rear (larger) magnetic coil is over the viewing tube ion trap flags as shown in sketch. From the position shown adjust the trap by moving it forward or backward, turning it at the same time (slowly about the neck of the tube) to obtain the brightest raster on the screen. Next:— turn the background control counterclockwise until the brilliance of the raster is slightly above average. Adjust the focus control to the point where the raster lines are in sharpest focus. Next, readjust the ion trap again for maximum brilliance of the raster. The final adjustment of the ion trap should be made with the background control at the maximum clockwise position in which the best definition of the raster lines can be maintained.

REMOVING THE CHASSIS FROM THE CABINET

MODEL 651P: The chassis is held in place by four mounting bolts, which fasten it to the bottom of the cabinet. The bolts are accessible from the top of the cabinet with the lid open. Remove the four mounting bolts.

Remove the elliptical speaker, which is mounted on the inner left side of the cabinet, by removing the four wing nuts. Disconnect the speaker cable plug on the left side of the chassis.

Remove the antenna lead-in plug from the left side of the chassis.

Disconnect the A.C. interlock plug and socket at the rear of the chassis.

Remove the control knobs and slide the chassis toward the back of the cabinet to provide clearance for the front control shafts.

Lift the chassis up out of the cabinet.

MODEL 661P: The chassis is held in place by four mounting bolts, which fasten it to the chassis mounting shelf. The bolts are accessible from the rear of the cabinet. Remove the four mounting bolts.

Disconnect the speaker cable plug on the left side of the chassis.

Disconnect the antenna lead-in plug also on the left side of the cabinet.

Disconnect the A.C. interlock plug and socket at the rear of the chassis.

Remove the control knobs.

Slide the chassis out the rear of the cabinet.

The 12-inch PM speaker used in this model is mounted in the lower cabinet compartment and is accessible from the rear of the cabinet.

THE SYNC. CHASSIS

Sync. chassis as used in the 651P—661P physically appear to be identical to those of the GV260 receiver. There is, however, a difference in some component parts and in wiring, so that the two are not directly interchangeable. While some of the sync. chassis were produced without code marking, it has been arranged to stamp "650" on those of recent production, to indicate the necessary wiring changes.

Comparing the two, by way of identification, the following is noted:

1. Pin 2 of the adapter plug is grounded in the GV260, but connects to Pin 6 of the 6SN7 in the 651P. In the GV260 instrument, there are two shielded cables, while in the 651P—661P there are three cables in the sync. chassis connection.

2. The grid circuit of the input section of the 6SN7 has a resistor of 22K in the GV260, 1 megohm in the 651P—661P. Furthermore, the input condenser of the same circuit is .05 mfd. instead of .0015 (1500 mmfd.).

To convert GV260 sync. chassis for use in the 651P and 661P receiver.

1. Remove the 22K resistor in the grid circuit of section 2 of the 6SN7 (the input section).

2. Substitute 1 megohm for the 100K to ground in this same circuit.

3. Change the input condenser from 1500 mmfd. to .05 mfd.

4. Remove C221 connecting between oscillator and reactance tube cathode, and install in its place, a 1200 mmfd. N2100 condenser. In production, there are being used 3-400 mmfd. units. This gives greater negative temperature coefficient to improve horizontal sync. stability from a drift standpoint.

5. Pin 2 of the adapter plug now connects to the cathode (pin 6) of the 6SN7, instead of to ground.

It is noted that vertical sync. is now taken from the cathode of the input section of the 6SN7 tube, and that this constitutes the major difference between the two sync. chassis.

MALFUNCTION—ITS CAUSE

This section is presented as an aid to the serviceman in the analysis of defective receiver operation. Although it is fairly comprehensive, it of course cannot include every defect which might appear. It will, nevertheless, establish a pattern of trouble shooting which will be of assistance to the technician. In the following table of faults and check points, tube checking is seldom mentioned. Tubes should be checked in the suspected portion of the receiver prior to investigating the other components or circuits.

FAULT	PROBABLE CAUSE
Picture non linear horizontally	A. Check R, L & C in Beam Relaxor grid circuit. B. Shorted turns in horizontal deflection coils or transformer.
Picture non-linear vertically	A. Check linearity control. B. Shorted turns in vertical deflection coils or transformer. C. Defective component in vertical amplifier circuit. D. Peaking, or any other circuit in the vertical oscillator-amplifier which influences the wave form, may lead to non-linearity.
Improper aspect ratio	A. Adjust height, width and linearity controls. B. If unable to achieve proper aspect ratio, some circuit component in either horizonal or vertical oscillator—amplifier (depending upon whether horizontal or vertical is deficient). Check high voltage power supply components. Too-great high voltage decreases picture size.
Bright bar toward top of picture. Poor vertical linearity	A. Check adjustment of height, V. sync. and linearity controls. B. Vertical sweep circuit components. Probably a condition of fold-over, caused by improper vertical deflection wave form.
Single horizontal bar of light on the picture tube	A. Check vertical sweep circuits —oscillator, amplifier, deflection coil and connections. Centering control, transformer. Evidently, there is no vertical scan. Check also positioning of vertical hold control.
Single vertical bar of light on the picture tube	A. Horizontal oscillator is operating, since there is light (indicating high voltage present). Check horizontal deflection coil and connections, transformer, centering control.
"Stretch" at top of picture. This is a wide spacing of several lines	A. Defective (open) capacitor in vertical oscillator circuit, possible .05 mfd.—or open resistor, 5.6K. Check other components. B. Open cathode bypass condenser, vertical amplifier. C. Bad vertical output transformer.
Black vertical bar(s) at left side of picture	A. Spurious oscillation in horizontal oscillator. Change 6L6 tube.
Poor horizontal sync. lines in picture similar to auto ignition	A. High votage corona which upsets the sync. May be caused by (1) tube socket lugs (8016) bent together. (2) wire dressing near the high voltage bleeder.
Horizontal sync. drifts	A. Bad 6SN7 or 6K6, sync. chassis. B. Check A.F.C. circuit associated with horizontal sweep oscillator. C. Replace entire sync. chassis.
Vertical centering control does not function properly	Picture size changes when control is rotated or only the central portion of the picture moves with a "jumpy" motion. A. Bad centering condenser (connected across Vert. Cent. Pot).
White bar at bottom of picture	Overloading of vertical amplifier. Change tubes, check operating characteristics.
Both vertical and horizontal sweeps will not stay synchronized	A. Weak Signal. B. Misalignment of RF or IF sections. C. With scope, trace sync. signal from DC reinserter, through the sync. chain.
Horizontal sweep not synchronized, vertical sweep is synchronized	A. Transformer adjustments in sync. chassis, or horizontal sync. adjustment. B. Some component in sync. chassis leading to loss of signal therein, such as failure of oscillator. C. Cable or plug to sync. chassis. Check solder connection in plug.
Vertical sweep not synchronized, horizontal sweep is synchronized	A. Vertical sync. control. B. Input circuit of vertical osc. (integrating network). Check components. C. With vertical oscillator tube removed, check for presence of sync. pulse.
Picture jumps or bounces	A. Interference. B. This may be a function of poor sync. as outlined above. C. Microphonic or noisy tubes. D. Noisy resistor or capacitor in either the sync. circuits or the picture circuits. E. Cold solder connection (tap components and connections with a fibre rod).
Portions of picture "tear out"	A. Reduce contrast control setting. B. If this follows the sound impulses, audio is entering the picture tube grid circuit. Check sound traps in IF amplifier. C. Signal too strong. Rotate antenna or install an "H" pad in transmission line. D. Interference pulses strong enough to upset synchronization. E. Replace 6L6 tube.

FAULT	PROBABLE CAUSE
Picture poorly shaded or dark	A. Adjust contrast and background controls. B. If picture is still "washed out" or "flat," this indicates insufficient picture signal at the viewing tube caused by (a) weak received signal (b) misalignment (c) defect in video amplifier tube or circuit. Check viewing tube by replacement.
Stationary bar in picture	A. Hum entering the video chain. Check power supply filter system.
Poor resolution	A. Check "fine tuning" control. B. Misalignment in RF or IF section(s). C. Check video amplifier circuit for loss of high frequency response, particularly the inductive components. D. Condition of ghosts, wherein separation is small.
Picture contains noise splotches	A. Interference from outside sources. Check antenna orientation and transmission line. Relocate the antenna. B. Noisy components. Tap with insulated screw driver. C. Corona from HV supply.
"Snow" on picture	A. Weak signal strength. B. Misalignment. C. Check antenna for orientation. D. Check antenna — transmission line for open or short. E. Any circuit fault leading to low signal at viewing tube, such as excessive RF-IF bias, weak tube, low screen potential, etc. Check on more than one station.
Double image(s) or "ghosts"	This condition indicates reflections of signal. A. Rotate antenna. B. Relocate antenna. C. Check for misalignment.
White retrace lines in picture	A. Reduce background and/or increase contrast. B. Vertical sync. slightly improper. C. A condition of foldover or too-great retrace time. Check vertical oscillator-amplifier circuit. Poor HF response in these circuits, check vertical deflection transformer, peaking circuits.
No focus, picture size changes when focus control is rotated	A. Open focus coil. B. Poor connection at the coil or in connecting plug socket. Poor solder-joint.
No Picture. Viewing tube is lighted (raster is present). Sound is present	A. Defective tube or circuit component in the video circuits following first IF amplifier. Check IF amplifier, demodulator, video amplifier circuits. B. If sync. is present (retrace lines stationary, these circuits are functioning and fault lies between reinserter and CRT). C. If this occurs after changing oscillator tube, the tube is off-capacity. Change 6J6 tube.

FAULT	PROBABLE CAUSE
No picture, viewing tube dark. Sound is functioning	A. Advance contrast and brilliancy controls. B. Check high voltage. If none, C. Faulty 6L6, 8016 or 5U4G tubes. D. Low voltage power supply which furnishes plate potential to beam relaxor. E. Beam relaxor circuit. If oscillating check high voltage circuits. If there is high voltage, F. Replace viewing tube. G. Check bias and first anode potentials on picture tube. NOTE: 8016 tubes may check good, yet have gas content. Check tubes by replacement.
No picture, focus and width controls run hot	A. Arc-over in 6L6 socket, causing carbonization. Replace socket, using a ceramic unit. B. Breakdown of filter condenser or other component or wiring, causing a short of +B to ground. C. The wire dressing around the 6L6 socket.
No picture or sound. Viewing tube is lighted	A. Antenna or transmission line disconnected or shorted. B. Check RF section including local oscillator components, and voltages. C. Check first IF section components and voltages. D. Use signal generator to trace the circuits for defects, particularly the RF-first IF sections. E. Oscillation. This is usually a case of grounding in shields and RF subassembly. IF circuit oscillation caused by under-chassis shields not properly grounded. These must be well grounded (*every* nut screwed down tight) *only* at the points provided. Touching the shield to another groundpoint may cause oscillation.
No picture, no sound, viewing tube not lighted	A. Check entry of 110V supply into the receiver (observe whether pilot lamps and tubes are lighted). B. Check both low-voltage supplies. C. If both are operating, follow a systematic tracing system—operation of deflection circuits and high voltage circuits first to establish light upon the screen. After that, follow a procedure as outlined in the above sections.
Picture present, no sound	A. Rotate "fine tuning" control. B. Check audio amplifier—speaker circuits. C. Check sound IF and discriminator tubes and components.

MODELS 651-P & 661-P TELEVISION RECEIVERS
TUBE SOCKET TERMINAL RESISTANCES TO GROUND

TUBE	TUBE SOCKET TERMINAL NUMBER								
	1	2	3	4	5	6	7	8	TOP CAP
6AC7 1st. vid. i.f.	shield 0	htr.gnd. 0	sup. 0	c.g. 25K	k. 47	s.g. 6K	htr. 0	pl. 6.4K	
6AC7 2nd. vid. i.f.	shield 0	htr.gnd. 0	sup. 0	c.g. 7.7K	k. 47	s.g. 6K	htr. 0	pl. 7.4K	
6AC7 3rd. vid. i.f.	shield 0	htr.gnd. 0	sup. 0	c.g. .4	k. 150	s.g. 6.1K	htr. .1	pl. 7.3K	
6AL5 d.c. rest. vid. det.	k. 0	pl. 47K	htr.gnd. 0	htr. 0	k. 1.05M	shield 0	pl. 4K		
6AU6 1st. vid. amp.	c.g. 440K	sup. 0	htr.gnd. 0	htr. 0	pl. 17K	s.g. 4.9K	k. 0		
6K6 GT 2nd. vid. amp.	n.c. inf.	htr.gnd. 0	pl. 8.2K	s.g. 4.9K	c.g. 425K	n.c. inf.	htr. 0	k. 330	
6SK7 1st. sync. amp.	shield 0	htr.gnd. 0	sup. 0	c.g. 1.05M	k. 0	s.g. 6K	htr. 0	pl. 16.8K	
6BA6 1st. sound i.f.	c.g. 0	sup. 0	htr. 0	htr.gnd. 0	pl. 6K	s.g. 5.9K	k. 100		
6BA6 2nd. sound i.f.	c.g. 470K	sup. 0	htr. 0	htr.gnd. 0	pl. 6K	s.g. 8.3K	k. 100		
6AU6 3rd. sound i.f.	c.g. 22K	sup. 0	htr. 0	htr.gnd. 0	pl. 6.4K	s.g. 6.4K	k. 0		
6AL5 Sound discr.	k. 180K	pl. 93K	htr.gnd. 0	htr. 2.4	k. 0	shield 0	pl. 93K		
6J7 Audio amp.	shield 0	htr.gnd. 0	pl. 110K	s.g. 380K	sup. 560	n.c. 6.2K	htr. 0	k. 560	g.cap 1M
6V6 GT Audio pwr.	shield 0	htr.gnd. 0	pl. 13.5K	s.g. 13.5K	c.g. 470K	n.c. inf.	htr. 0	k. 260	
5U4G Rect. (radio)	n.c. inf.	htr. 6.8K	n.c. inf.	pl. 160	n.c. 200M	pl. 160	n.c. inf.	htr. 6.8K	
5U4G Rect. (tv.)	n.c. inf.	htr. 74K	n.c. inf.	pl. 56	n.c. 200M	pl. 56	n.c. inf.	htr. 74K	
6SN7 GT Vert. amp.	c.g. 1.3M	pl. 74K	k. 2.7K	c.g. 1.3M	pl. 74K	k. 2.7K	htr. 0	htr.gnd. 0	
6SN7 GT Vert. osc.	c.g. 1M	pl. 210K	k. 1K	c.g. 560K	pl. 1.1M	k. 1K	htr. 0	htr.gnd. 0	
6SH7 Sync. sep.	shield 0	htr.gnd. 0	k.& sup. 0	c.g. 1.1M	k.& sup. 0	s.g. 5K	htr. 0	pl. 12.5K	
6L6 (metal) Hor. osc.	shield inf.	htr.gnd. 0	pl. 74K	s.g. 80K	c.g. 10	n.c. inf.	htr. 0	k. 200	
8016 (outer) H.V. rect.	n.c. inf.	htr. inf.	n.c. inf.	n.c. inf.	n.c. inf.	n.c. inf.	htr. inf.	n.c. inf.	pl. cap 74K
8016 (inner) H.V. rect.	n.c. inf.	htr. 40M	n.c. inf.	to # 7 40M	to # 7 40M	to # 7 40M	htr. 40M	n.c. inf.	pl. cap inf.

SYNC. ADAPTER

TUBE	TUBE SOCKET TERMINAL NUMBER								
	1	2	3	4	5	6	7	8	TOP CAP
6SN7 GT 2nd. sync. amp.	c.g. 6.8K	pl. 80K	k. 12K	c.g. 1M	pl. 150K	k. 270	ht.. 0	htr.gnd. 0	
6AC7 Control tube	shield 0	htr.gnd. 0	sup. 0	c.g. 1.7M	k. 10	s.g. 27K	htr. 0	pl. 96K	
6K6 GT A.F.C. osc.	n.c. inf.	htr.gnd. 0	pl. 79K	s.g. 89K	c.g. 65K	n.c. 12	htr. 0	k. 10.5	
6AL5 Hor. discr.	k. 1.2M	pl. 1.8M	htr.gnd. 0	htr. 0	k. 220K	shield 0	pl. 1.8M		
Sync. Adapt. Socket	0	270	12.5K	18.5K	74K	12	80K	0	

NOTES

"K" is The Symbol Used to Denote "Thousand Ohms."
"M" is The Symbol Used to Denote "Megohms" or "Million Ohms."
"inf." Denotes Infinite Resistance Indication on Ohmmeter.

All Resistance Measurements Taken With Power Disconnected From Set.
All Controls Set For Normal Operation, Except Contrast Control Set at Minimum (Counter-clockwise.)

MODELS 651-P & 661-P TELEVISION RECEIVERS
APPROXIMATE SOCKET TERMINAL VOLTAGES

TUBE	TUBE SOCKET TERMINAL NUMBER								
	1	2	3	4	5	6	7	8	TOP CAP
6AC7 1st. vid. i.f.	shield 0	htr.gnd. 0	sup. 0	c.g. −4.7	k. 0	s.g. 128	htr. 6.5 ac.	pl. 270	
6AC7 2nd. vid. i.f.	shield 0	htr.gnd. 0	sup. 0	c.g. −4.8	k. 0	s.g. 128	htr. 6.5 ac.	pl. 270	
6AC7 3rd. vid. i.f.	shield 0	htr.gnd. 0	sup. 0	c.g. 0	k. 1.6	s.g. 122	htr. 6.3 ac.	pl. 255	
6AL5 d.c. rest. vid. det.	k. 0	pl. 0	htr.gnd. 0	htr. 6.3 ac.	k. .55	shield 0	pl. −.1		
6AU6 1st. vid. amp.	c.g. −1.65	sup. 0	htr.gnd. 0	htr. 6.3 ac.	pl. 190	s.g. 125	k. 0		
6K6 GT 2nd. vid. amp.	n.c.	htr.gnd. 0	pl. 107	s.g. 130	c.g. −7.2	n.c.	htr. 6.3 ac.	k. 4.5	
6SK7 1st. sync. amp.	shield 0	htr.gnd. 0	sup. 0	c.g. −4.4	k. 0	s.g. 125	htr. 6.3 ac.	pl. 160	
6BA6 1st. sound i.f.	c.g. 0	sup. 0	htr. 6.4 ac.	htr.gnd. 0	pl. 112	s.g. 113	k. 1.65		
6BA6 2nd. sound i.f.	c.g. .02	sup. 0	htr. 6.4 ac.	htr.gnd. 0	pl. 115	s.g. 113	k. 1.8		
6AU6 3rd. sound i.f.	c.g. −.25*	sup. 0	htr. 6.4 ac.	htr.gnd. 0	pl. 45	s.g. 45	k. 0		
6AL5 Sound discr.	k. −.5*	pl. #	htr.gnd. 0	htr. 5.1 ac.	k. 0	shield 0	pl. #		
6J7 Audio amp.	shield 0	htr.gnd. 0	pl. 78	s.g. 75	sup. 1.38	n.c. 270	htr. 6.3 ac.	k. 1.38	g. cap 0
6V6 GT Audio pwr.	shield 0	htr.gnd. 0	pl. 150	s.g. 167	c.g. 0	n.c.	htr. 6.3 ac.	k. 7.6	
5U4G Rect. (radio)	n.c.	htr. 355	n.c.	pl. 360 ac.	n.c. 0	pl. 360 ac.	n.c. 47 ac.	htr. 355	
5U4G Rect. (tv.)	n.c.	htr. 400	n.c.	pl. 370 ac.	n.c. 0	pl. 370 ac.	n.c. 47 ac.	htr. 400	
6SN7 GT Vert. amp.	c.g. .1	pl. 325	k. 5.8	c.g. .1	pl. 325	k. 5.8	htr. 6.3 ac.	htr.gnd. 0	
6SN7 GT Vert. osc.	c.g. 0	pl. 64	k. 2	c.g. −18.5	pl. 83	k. 2	htr. 6.3 ac.	htr.gnd. 0	
6SH7 Sync. sep.	shield 0	htr.gnd. 0	k.& sup. 0	c.g. −4.7	k.& sup. 0	s.g. 128	htr. 6.3 ac.	pl. 128	
6L6 (metal) Hor. osc.	shield %	htr.gnd. 0	pl. $	s.g. 130	c.g. .1	n.c.	htr. 6.3 ac.	k. 26	
8016 (outer) H.V. rect.	n.c. HIGH	htr. VOLTAGE	n.c. DO NOT	n.c. MEASURE	n.c. ———	n.c. ———	htr. ———	n.c. ———	pl. cap ———
8016 (inner) H.V. rect.	n.c. HIGH	htr. VOLTAGE	n.c. DO NOT	to # 7 MEASURE	to # 7 ———	to # 7 ———	htr. ———	n.c. ———	pl. cap ———

APPROXIMATE SOCKET TERMINAL VOLTAGES FOR SYNC. ADAPTER

TUBE	TUBE SOCKET TERMINAL NUMBER								
	1	2	3	4	5	6	7	8	TOP CAP
6SN7 GT 2nd. sync. amp.	c.g. −1.9	pl. 128	k. 42	c.g. 0	pl. 64	k. .9	htr. 6.1 ac.	htr.gnd. 0	
6AC7 Control tube	shield 0	htr.gnd. 0	sup. 0	c.g. −1.75	k. .05	s.g. 125	htr. 6.1 ac.	pl. 255	
6K6 GT A.F.C. osc.	n.c.	htr.gnd. 0	pl. 225	s.g. 230	c.g. −28	n.c. −2.25	htr. 6.1 ac.	k. .3	
6AL5 Hor. discr.	k. −2	pl. −4.5	htr.gnd. 0	htr. 6.1 ac.	k. −2	shield 0	pl. −4.5		
Sync. Adapter Socket	6.3 ac.	.9	128	−12.5	340	−2.2	130	0	

NOTES

* Circuit may oscillate when measured, giving erroneous reading of approximately minus fifteen volts d.c.
\# Circuit will oscillate when measured.
% Do not measure. Has high voltage a.c. component.
$ Do not measure. Has high voltage a.c. component of approximately 3,000 volts. Measure B plus of 340 d.c. at fuse.

All Voltages Measured from Terminal to Ground.
Line Voltage, 117 volts, 60 cycles a.c.
T.V. Power Transformer Tap Switch Set on Position #3.
All Controls Set For Normal Operation, With Contrast Control Set at Minimum.
No Signal Received.
All D.C. Measured With Vacuum-Tube-Voltmeter.
All A.C. Measured With Meter of 1,000 Ohms-per-volt Sensitivity.

SERVICE REPLACEMENT PARTS LIST

MODELS 651-P & 661-P—TELEVISION RECEIVERS

Ref. No.	Part No.	Description	Unit Price
1	77492	Resistor 3.3 ohm, 1W 10% Ins. Car.....	.15
2	77505	Resistor 4.7 ohm, 1W 10% W.W.....	.15
3	77455	Resistor 10 ohm, ½W 5% Ins. Car.....	.15
4	77457	Resistor 12 ohm, 1W 10% Ins. Car.....	.15
5	77376	Resistor 47 ohm, ½W 10% Ins. Car...	.15
6	77425	Resistor 75 ohm, 2W 5% Ins. Car.....	.30
7*	77502-2	Resistor 130 ohm, 5W 10% W.W.....	.15
8	77176	Resistor 100 ohm, ½W 20% Ins. Car.	.15
9	77380	Resistor 150 ohm ½W 10% Ins. Car...	.15
10	77368	Resistor 270 ohm, ½W 10% Ins. Car.	.15
11	77495	Resistor 270 ohm, 2W 20% Ins. Car...	.20
12*	77191	Resistor 330 ohm, ½W 10% Ins. Car.	.15
13	77402	Resistor 500 ohm, 20W 10% W.W.....	.95
14	77414	Resistor 560 ohm, ½W 10% Ins. Car...	.15
15	77193	Resistor 1K ½W 10% Ins. Car.....	.15
16*	77404	Resistor 1.5K 20W 10% W.W.....	.90
17	77496	Resistor 1.8K 1W 20% Ins. Car.....	.15
18	77484-2	Resistor 2K 7W 10% W.W.....	.55
19	77419	Resistor 2.2K ½W 5% Ins. Car.....	.15
20	77184	Resistor 2.2K ½W 20% Ins. Car.....	.15
21	77420	Resistor 2.7K ½W 5% Ins. Car.....	.15
22	77195	Resistor 3.3K ½W 10% Ins. Car.....	.15
23	77476	Resistor 3.3K 1W 10% Ins. Car.....	.15
24	77475	Resistor 3.9K ½W 5% Ins. Car.....	.15
25	77196	Resistor 4.7K ½W 10% Ins. Car.....	.15
26	77429	Resistor 4.7K 1W 10% Ins. Car.....	.15
27	77391	Resistor 5K 10W 10% W.W.....	.15
28	77365	Resistor 5.6K ½W 10% Ins. Car.....	.15
29	77403	Resistor 6K 20W 10% W.W.....	.95
30	77148	Resistor 6.8K ½W 10% Ins. Car.....	.15
31*	77503	Resistor 7.5K 10W 10% W.W.....	.15
32	77022	Resistor 10K 1W 10% Ins. Car.....	.15
33	77371	Resistor 10K ½W 10% Ins. Car.....	.15
34	77445	Resistor 12K ½W 10% Ins. Car.....	.15
35	77251	Resistor 15K ½W 10% Ins. Car.....	.15
36	77325	Resistor 15K 2W 10% Ins. Car.....	.15
37	77198	Resistor 22K ½W 10% Ins. Car.....	.15
38	77390	Resistor 22K 2W 10% Ins. Car.....	.20
39	77389	Resistor 22K 1W 10% Ins. Car.....	.15
40	77456	Resistor 27K 1W 10% Ins. Car.....	.15
41	77199	Resistor 33K ½W 10% Ins. Car.....	.15
42	77387	Resistor 33K 1W 10% Ins. Car.....	.15
43	77379	Resistor 47K ½W 10% Ins. Car.....	.15
44	77454	Resistor 47K 1W 10% Ins. Car.....	.15
45	77375	Resistor 68K ½W 10% Ins. Car.....	.15
46	77458	Resistor 68K 2W 10% Ins. Car.....	.15
47	77201	Resistor 100K ½W 10% Ins. Car.....	.15
48	77386	Resistor 220K ½W 10% Ins. Car.....	.15
49	77442	Resistor 330K ½W 10% Ins. Car.....	.15
50	77374	Resistor 470K ½W 10% Ins. Car.....	.15
51	77326	Resistor 560K ½W 10% Ins. Car.....	.15
52	77364	Resistor 680K 1W 10% Ins. Car.....	.15
53	77367	Resistor 1Meg ½W 10% Ins. Car.....	.15
54	77388	Resistor 1 Meg 1W 10% Ins. Car.....	.15
55*	77352	Resistor 1.8 Meg ½W 10% Ins. Car...	.15
56	77206	Resistor 2.2 Meg ½W 10% Ins. Car...	.15
57	77400	Resistor 10 Meg 1W 10% Ins. Car.....	.15
58	77363	Resistor 20 Meg 1W 5% Ins. Car.....	.15
59	77410	Resistor 27K ½W 10% Ins. Car.....	.15
60	25425	Cap. 10 mmf 500V 20% Ins. Ceramic	.20
61*	25383	Cap. 10 mmf 350V 10% Ins. Ceramicon	.20
62	25179	Cap. 25 mmf 500V 10% Ins. Ceramic..	.20
63*	25477	Cap. 51 mmf 500V 20% Ins. Ceramic	.20
64	25379	Cap. 100 mmf 500V 10% Ins. Ceramicon	.20
65*	25475	Cap. 270 mmf 500V 20% Ins. Ceramic	.20
66	25505-16	Cap. 350 mmf 1000V 20% Molded Tubular	.20
67	25446	Cap. 390 mmf 500V 10% Mica.....	.25
68	25370	Cap. 500 mmf Ceramicon.....	.20
69	25474	Cap. 500 mmf 500V 20% Ins. Ceramic	.25
70	25454-2	Cap. 1200 mmf 10% Ceramicon.....	.50
71*	25273	Cap. 1500 mmf 350V 20% Ceramic (High K)	.30
72*	25473	Cap. 5000 mmf 500V 20% Ins. Ceramic	.40
73	25367	Cap. .008 mfd 400V 5% Tubular.....	.22
74	25445	Cap. .004 mfd 600V Oil Impreg. Tubular	.30
75	25410	Cap. .002 mfd 600V Molded Oil Paper	.35
76	25448	Cap. .015 mfd 400V Oil Impreg. Tubular	.45
77	25482-10	Cap. .01 mfd 200V 20% Mineral Oil-flat	.25
78	25209	Cap. .01 mfd 600V 20%-10% Tubular Metal Case	.85
79	25363	Cap. .02 mfd 600V Molded Oil Paper	.35
80	25421	Cap. .02 mfd 400V High Temp. Tubular	.20
81	25505-15	Cap. .02 mfd 200V 20% Mineral Oil Tubular	.20
82	25463	Cap. .05 mfd 600V Molded Oil Paper	.30
83	25453	Cap. .05 mfd 600V 20% Molded Oil Paper	.30
84	25482-1	Cap. .05 mfd 600V 20% Oil Paper Tubular	.25
85	25103	Cap. .1 mfd 400V Paper Tubular....	.30
86	25352	Cap. .25 mfd 400V Paper Tubular....	.30
87	25118	Cap. .5 mfd 100V Paper Tubular.....	.55
88	25464	Cap. 10 mfd 450V Tubular Electrolytic	1.35
89	25357	Cap. 10, 10, 10 mfd 400V F. P. Electrolytic	2.20
90*	25358	Cap. 20, 30, 30 mfd 475V F. B. Electrolytic	3.55
91*	25356	Cap. 40, 40, 40 mfd 25V W.P. Electrolytic	1.55
92*	25269	Cap. 50 mfd 25V Elect.....	.85
93*	25359	Cap. 500, 500 mfd 10V, 40 mfd, 25V W.P. Elect.	2.70
94*	25355	Cap. W. P. Electro. 1 ohm Z @ 60 cy. (3V N. P.).....	3.10
95*	25385	Cap. 7 to 45 mmf Ceramic trimmer....	1.50
96*	78172	Contrast Pot 10K Dual.....	1.90
97*	78136	Background, 20K, 4W.....	2.35
98*	78174	Volume, 1 Meg, ¼W	.80
99*	78170	Tone, 250K, ¼W-On-Off Switch.....	1.10
100*	78152	Framing, 250K, ¼W.....	.75
101*	78132	Vertical and Hor. Centering, 20 Ohm, 3W	2.05
102*	78135	Focus, 1500 Ohm, 4W.....	2.05
103*	78129	Vert. Linearity 10K, 2W.....	1.45
104*	78171	Vert. Sync. 500K ¼W.....	.75
105*	78130	Height 2 Meg ¼W.....	.85
106*	78126	Horiz. Sync. 150 Ohm, 2W.....	1.40
107*	78128	Width 180 Ohm, 4W.....	2.15
108*	94233	Filter Choke.....	3.80

Ref. No.	Part No.	Description	Unit Price
109	38865	Heater Choke	.25
110 *	38975	Peaking Coil 120 UH	.55
111 *	38974	Peaking Coil 250 UH	.55
112 *	38976	Peaking Coil 93 UH	.55
113 *	38797	2nd Video IF	1.45
114 *	38742	3rd Video IF	1.50
115 *	38740	4th Video IF	4.75
116 *	38970	2nd & 3rd Sound IF	2.90
117 *	38971	Sound Discriminator	3.65
118 *	38735	Focus Coil	14.15
119 *	38734	Deflection Yoke & Housing	10.75
120 *	38916	Horiz. Sync Discr. Trans.	4.55
121 *	38475	Linearizing Coil	.50
122 *	94261	Power Trans., Tapped	19.59
123	94231	Power Trans. Untapped (early prod.)	15.45
124 *	94280	Power Trans. Untapped (late prod.)	15.45
125 *	94223	Vert. Defl. Trans.	7.60
126 *	94222	Audio Transformer	2.30
127	13655	Beam Relaxor Trans. Assy	30.75
128	80437	Sync Adapt. Plug	.60
129	80488	Sync. Adapt. Plug Cover	.45
130	80487	Sync Adapt. Socket	.15
131	80389	Deflection Coil Socket	.25
132	80387	Deflection Coil Plug	.28
133	80390	Focus Coil Socket	.25
134	80388	Focus Coil Plug	.20
135 *	81194	Speaker—Leads & Plug-6" x 9" Eliptical (inc. Excise Tax)	9.25
136 *	48016	¼ Amp Fuse	.10
137 *	22172-1	Anode Button Connector	1.00
138	80520	Alden Socket	.15
139 *	80041	Alden Plug	.15
140	80391	Octal Socket	.30
141 *	80501	7 Pin Miniature Wafer Socket	.15
142 *	80319	7 Pin Miniature Socket	1.65
143 *	80404	Cathode Ray tube Socket	2.80
144 *	80381	Jack strip	.10
145	80250	Antenna lead spacer	.10
146	80473	High Voltage rectifier plate cap	.15
147 *	54325	Fuse holder	.25
148 *	13640	Beam relaxor unit	41.35
149 *	14102	Beam relaxor (wide scanning)	41.35
150 *	C-257	Sync. Adapter Chassis	53.65
151 *	13900	12 Channel R. F. Unit	83.95
152 *	13872	13 Channel R. F. Unit (short shaft ass'y)	113.20
153	92377	Speaker gasket (Model 651)	.17
154 *	22208-1	Line Cord (interlock)	1.35
155 *	80489	Interlock receptable	.10
156	80477	Recessed Male connector	.15
157 *	11492	Antenna terminal lead & plug ass'y	.40
158 *	31474	Cabinet glass escutcheon (Model 651)	6.95
159 *	59523	Knob (green)	.10
160 *	59477	Knob (large Rohden)	.10
161 *	59481	Knob (small Rohden)	.10
162 *	59491-3	Knob (13 channel coax.)	.45
163 *	59527	Knob (12 channel coax.)	.30
164 *	59490-3	Knob (13 channel tuning)	.30
165 *	59525	Knob (12 channel tuning)	.15
166	51140	Spring (12 channel coax.)	.15
167	58927	Spring (knob)	.15
168	58928	Spring (knob)	.15
169 *	31457	13 channel Escutcheon (flat type)	.65
170 *	59524-1	12 channel Escutcheon	2.87
171 *	64477	Escutcheon spring	.10
172	60615	Knob washer (small)	.10
173	60546	Knob washer (large)	.10
174 *	11498	12" PM speaker (leads & plug) Model 661-P10 (inc. Excise Tax)	15.98
175 *	31476	Glass Escutcheon (Model 661-P10)	10.77
176 *	13917	Ion Trap	2.50

Parts marked with an asterik are suggested for Distributors Stock.
All Prices are subject to change without notice.

FACTORY REPAIRS AND RETURNED GOODS POLICY

It should seldom, if ever, be necessary that a receiver chassis be returned for factory service repairs, since there are few parts which can become inoperative in the modern receiver which a competent radio serviceman cannot repair by first locating, then making substitution for, the defective part.

A great deal of time is lost as a result of merchandise being returned to us without authorization. Instruments arrive without any explanation of why they were returned . . . or what disposition is to be made. These indiscriminate returns seriously handicap our efforts toward PROMPT AND EFFICIENT SERVICE. Therefore:

1. No merchandise of any type is to be returned to the Capehart-Farnsworth Corporation without written authorization and issuance of R.G.A. (RETURNED GOODS AUTHORIZATION).
2. To facilitate the return of such merchandise, special forms are provided. These forms are issued only by the Capehart-Farnsworth Field Service Representative in your area.
3. Upon the request of the Capehart-Farnsworth Distributor, and if proper, he will issue Returned Goods Authorization papers to accompany the return of material to the factory.
4. All merchandise returned to the factory must be properly packed to avoid damage in transit. We reserve the right to refuse adjustments on parts returned or to charge back for parts or equipment which are damaged in transit, and which upon inspection are found to have been caused by improper packing.
5. The Return Goods form supplied must accompany the merchandise.
6. The Returned Goods number must be plainly marked on the outside of the shipping container.
7. All merchandise must be shipped prepaid.