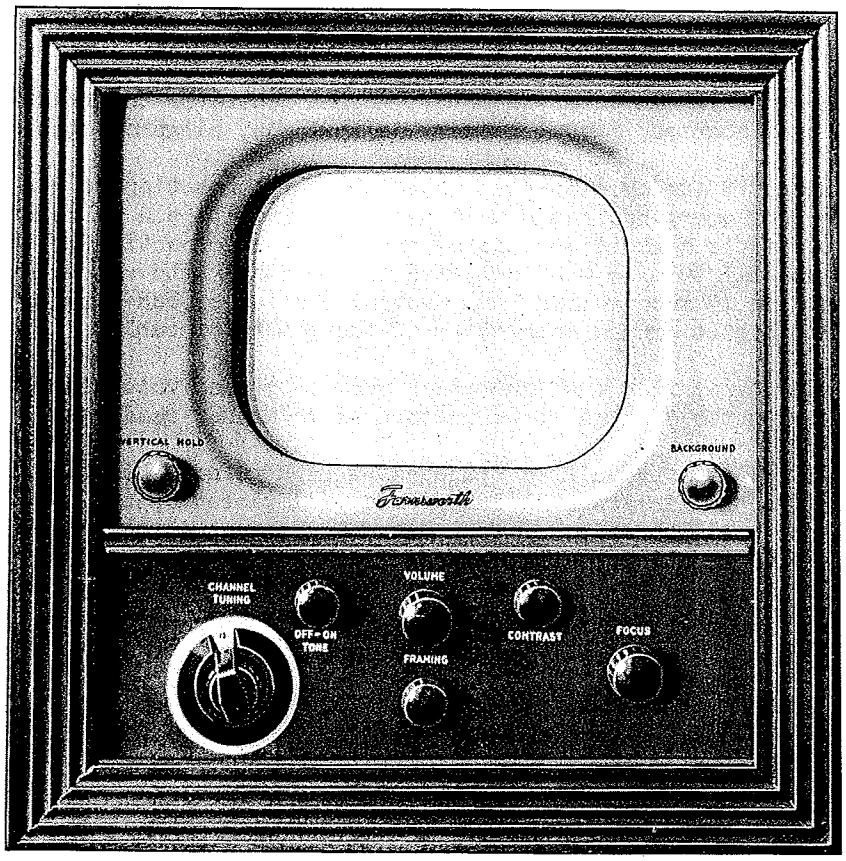
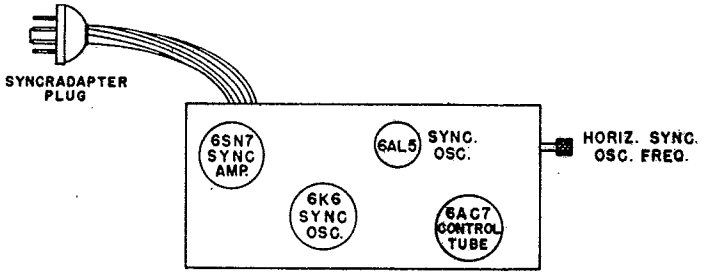
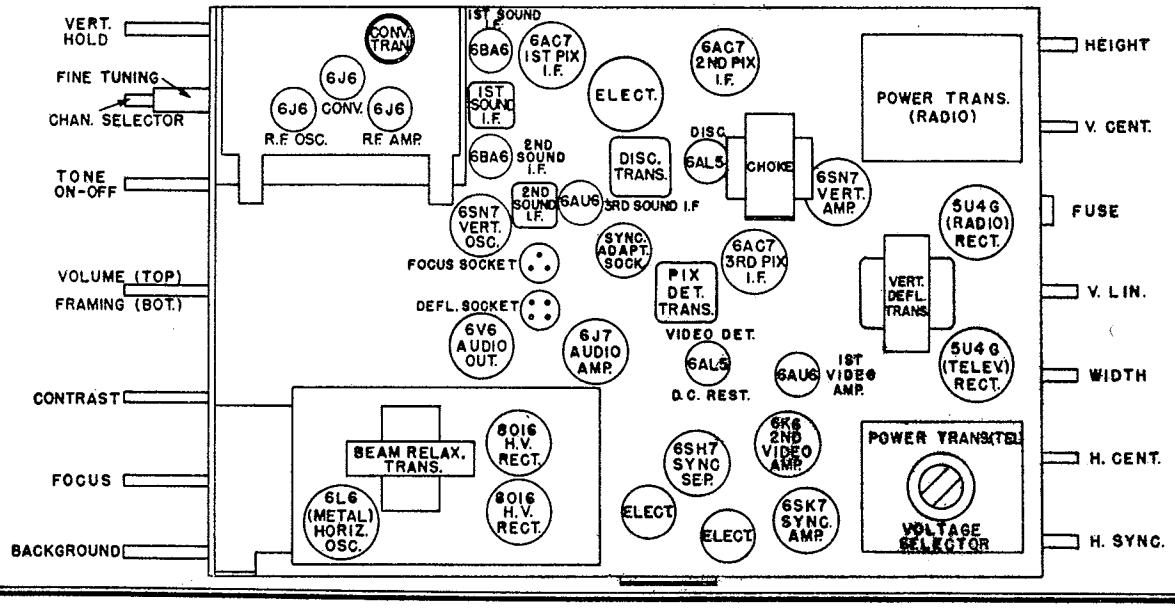
FARNSWORTH TELEV. & RADIO CORP.

MODELS 651-P, 661-P





PICTURE STABILIZING CIRCUIT



MODELS 651-P, 661-P

FARNSWORTH TELEV. & RADIO CORP.

ALIGNMENT INSTRUCTIONS

ALIGNMENT OF THE IF SECTION

Equipment needed: Vacuum-tube voltmeter, signal generator covering 20-30 mc, sweep generator, oscillograph, 6-volt battery, 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.

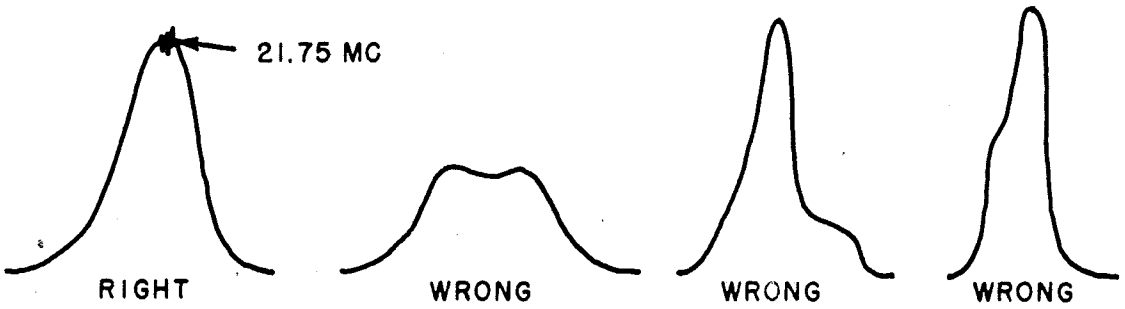
1. Remove Television 5U4G rectifier tube.
2. Connect filter as shown.

SOUND IF

3. Set Volume Control to Minium.
4. Set Contrast Control to Minimum.
5. Turn Converter Coil Slug (bottom) All Way In.
6. Connect Scope to Terminal A of 2nd Sound IF Transformer.
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 2nd sound IF transformer.
13. Repeat 10 for top slug of 2nd 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.

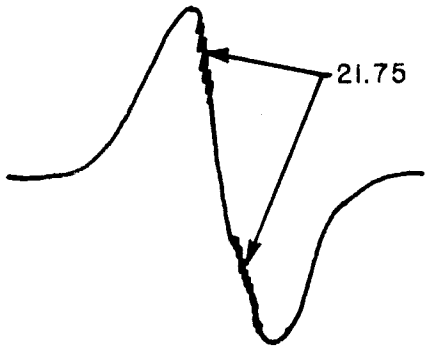
16. Move scope cable to junction of 22K 1/2W resistor and shielded Audio Cable.

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 1/2W 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.

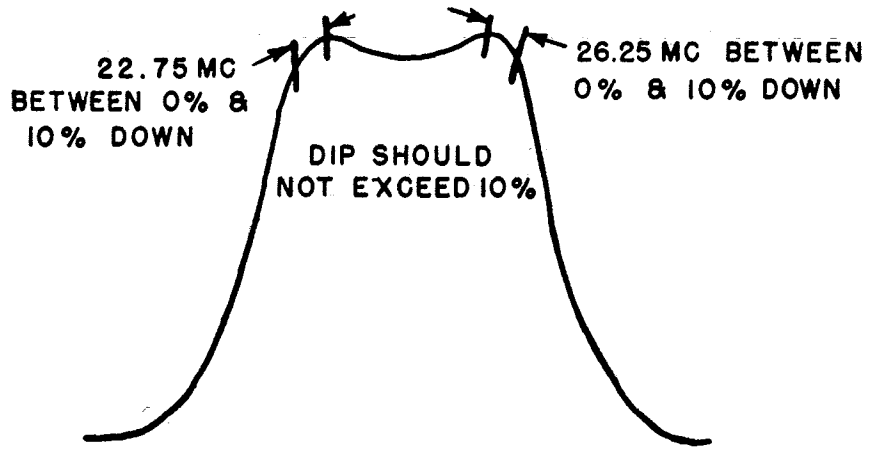
25. Signal input should be no greater than 80 microvolts.

MODELS 651-P, 661-P

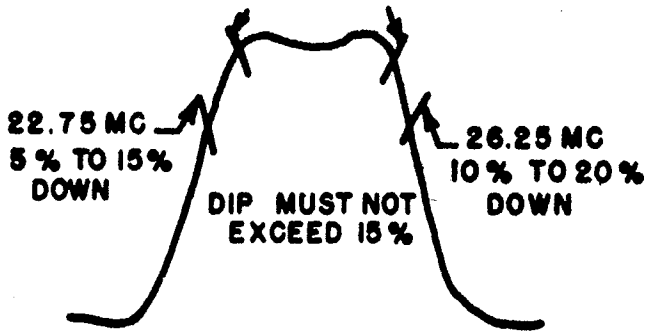
FARNSWORTH TELEV. & RADIO CORP.

PICTURE IF

1. Connect scope across video detector load.
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 T4 trap out of pass band on low frequency side.
7. Adjust T4 slugs for curve sketched below.



8. Inject 21.75 marker and tune T4 trap for minimum response to 21.75 MC.
9. If necessary readjust T4 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 T3 trap out of pass band on low frequency side.
13. Adjust circuit capacitances associated with T3 for curve sketched below. Adjustment is made by lead-dress.



14. Inject 21.75 marker and tune T3 trap for minimum response to 21.75 MC.

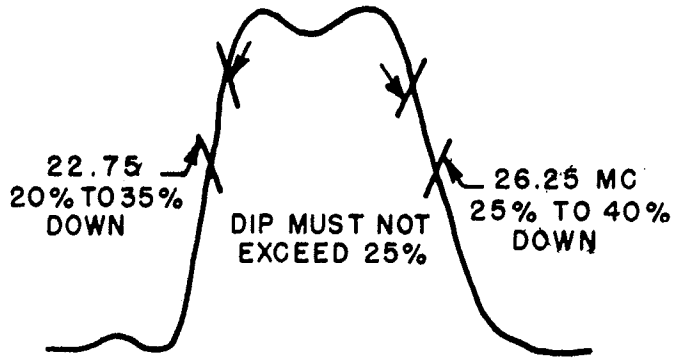
15. If necessary, readjust T3 capacitances to restore markers as specified in item 13.

16. Remove 6AC7 from 1st picture IF amplifier socket. Remove special 6AC7 from 2nd picture IF amplifier socket and replace 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 T2 trap out of passband on high frequency side.

19. Adjust circuit capacitances associated with T2 for curve sketched below.



20. Inject 27.75 MC marker and tune T2 trap for minimum response to 27.75 MC.

21. Recheck 22.75 MC and 26.25 MC markers and if necessary readjust T2 capacitances to make markers conform to specifications of item 25.

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 grid IF trap midpoint to ground with short clip lead. (See figure below.)

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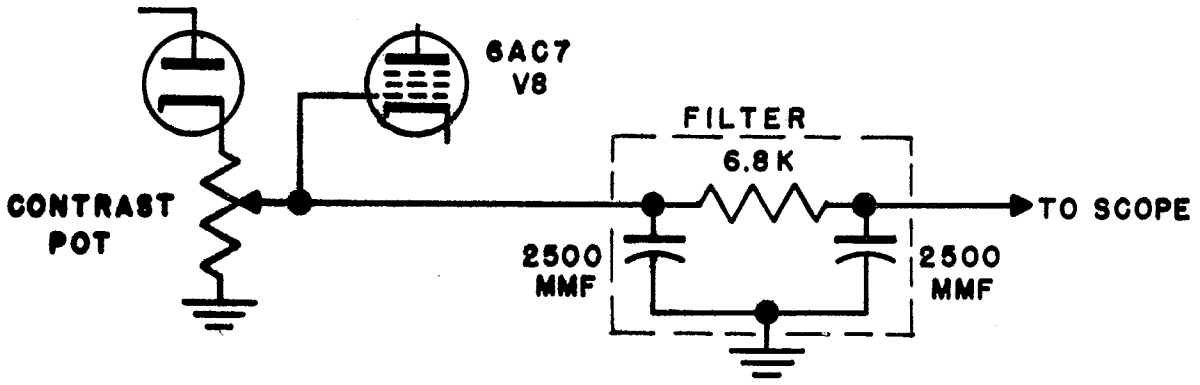
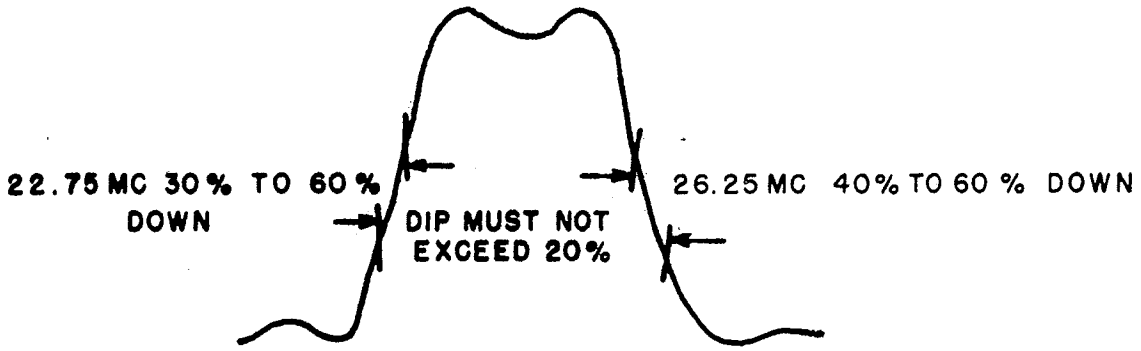


24. Turn converter coil slug out until response curve top tilts, and then levels off at higher amplitude. Curve should appear as below.



Slight readjustments of T4 slugs and converter coil slug may be necessary.

25. Inject 21.75 Mc marker and tune converter trap coil for minimum response to 21.75 MC.

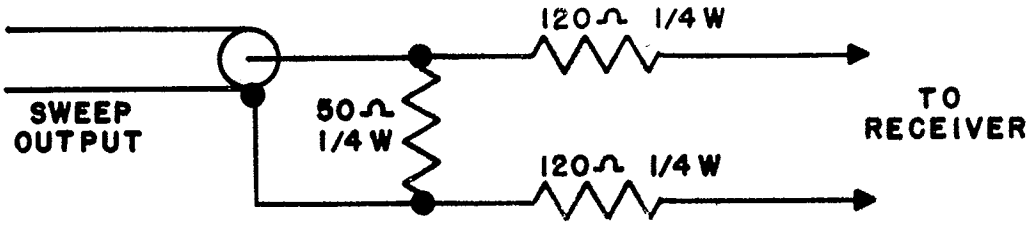
26. Recheck overall response and retouch if necessary.

27. Recheck alignments of all traps.

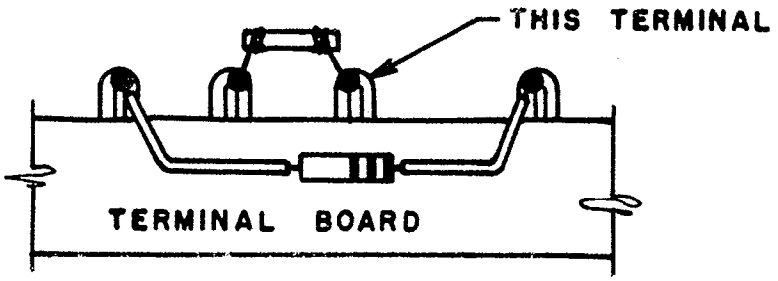
28. Remove all test leads and turn set off.

RF and Converter Alignment

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



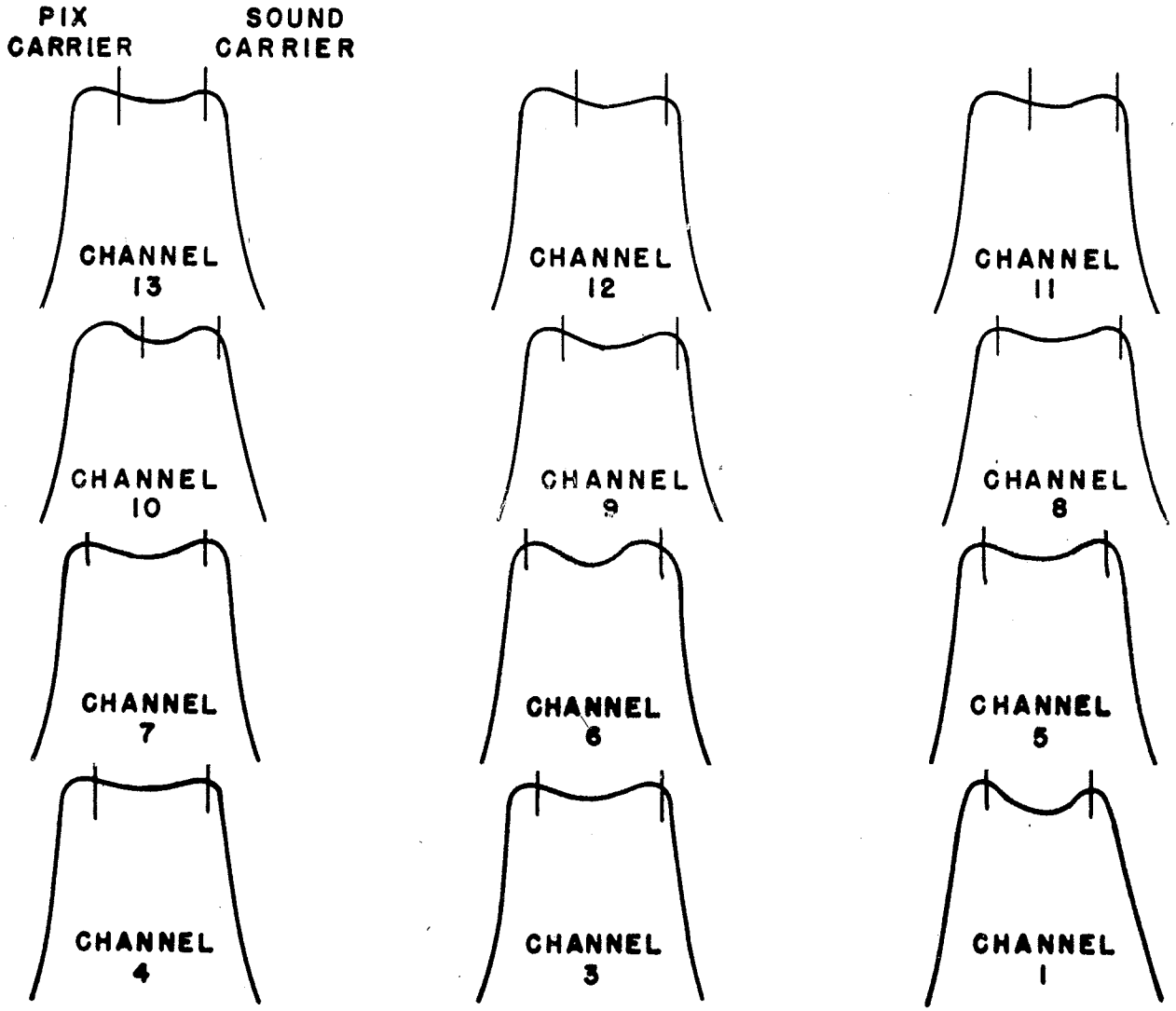
2. Connect oscillograph across 1 megohm resistor at the end of the converter line:



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 approximately flat-topped response. In making this adjustment, the stud extension of all cores should be kept approximately equal.



NOTE: ALL MARKERS MUST BE ABOVE THE 70% AMPLITUDE LEVEL.

R-F RESPONSE

MODELS 651-P, 661-P FARNSWORTH TELEV. & RADIO CORP.

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 is:

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.

MODIFICATION OF THE SYNC CHASSIS USED IN THE GV260, FOR USE IN THE 651-P RECEIVER

To convert GV260 synv chassis for use in the 651-P 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.

FARNSWORTH TELEV. & RADIO CORP. MODELS 651-P, 661-P

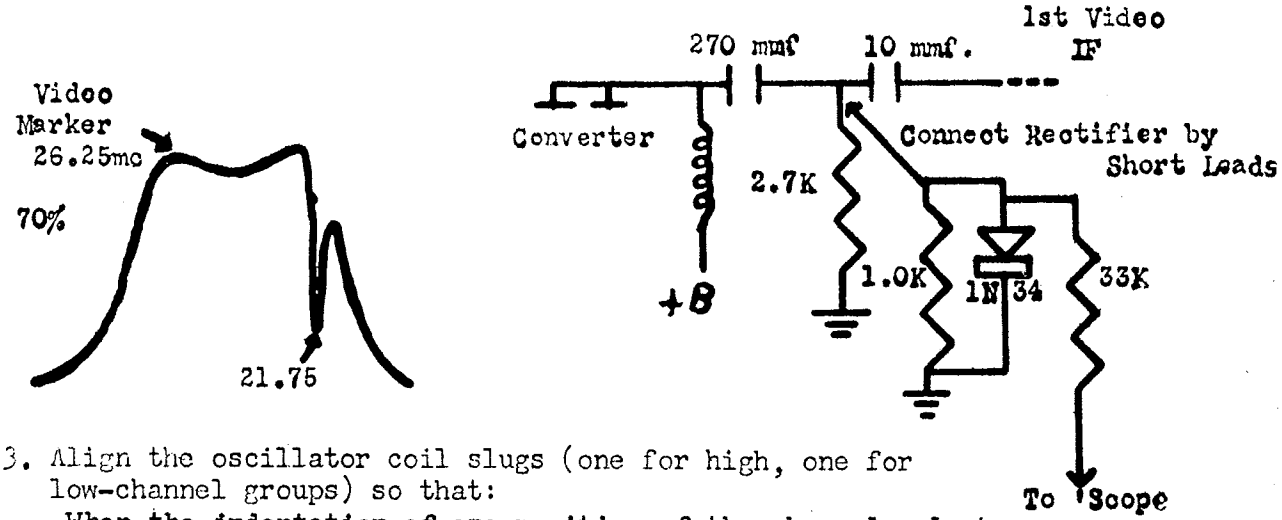
Additional Alignment Data
RF Sub-Assembly

There have been incorporated in production two types of RF sub-assembly (1) that switching coils in selection of channels, whose alignment is covered in the procedures given on previous pages and (2) that using continuous 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.

Alignment of this 12 channel RF assembly is as follows:

1. Accurately 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 in "RF and Converter Alignment"



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.

4. RF bandpass curves should be essentially as shown above, but some variation is permissable between channels. As limitations, the two intermediate frequencies (26.75 mc.) marker should be above the 70% amplitude point.

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 tuning condenser; L.F. condenser consists of one rotor, two stator plates, H.F. is one plate each of rotor and stator.

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. H I G H	htr. V O L T A G E	n.c. D O	n.c. N O T	n.c. M E A S U R E	n.c.	htr.	n.c.	pl. cap.
8016 (inner) H.V. rect.	n.c. H I G H	htr. V O L T A G E	n.c. D O	to #7 N O T	to #7 M E A S U R E	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 D.D. Vacuum-Tube-Voltmeter.
(R.C.A. Volt-Ohmyst or Equivalent.)

All A.C. Measured With Meter of 1,000 Ohms-per-volt Sensitivity.

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. 74 K	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.

TUBE SOCKET TERMINAL RESISTNACES TO GROUND

SYNC. ADAPTER

TUBE	TUBE SOCKET TERMINAL NUMBER								
	1	2	3	4	5	6	7	8	TOP CAP
6SN7 GT 2nd. sync. amp.	c.g. 6.8 K	pl. 80K	k. 12K	c.g. 1M	pl. 150K	k. 270	htr. 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.

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All Resistance Measurements Taken With Power Disconnected From Set.

All Controls Set For Normal Operation, Except Contrast Control Set at Minimum (Counter-clockwise.)