RCA VICTOR

TELEVISION RECEIVER

MODEL 17T45

(TOWNSMAN)

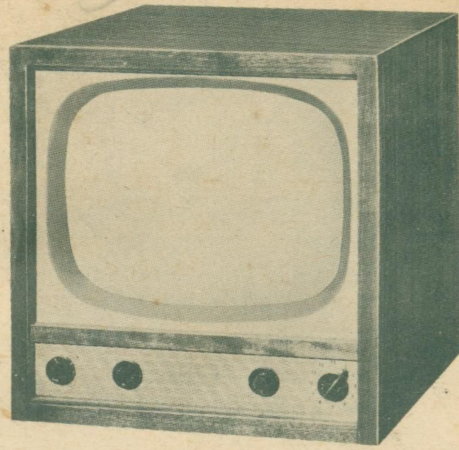
SERVICE DATA

—1952 NO2—

HEAD OFFICE SERVICE DEPARTMENT

RCA VICTOR COMPANY, LTD.

MONTREAL, QUE.



MODEL 17T45 ('TOWNSMAN')

GENERAL DESCRIPTION

The Model 17T45 (Townsman) is a twenty tube, AC-DC table model television receiver using a 17BP4A kinescope and a 4" P.M. speaker, housed in the cabinet behind the control panel.

ELECTRICAL & MECHANICAL SPECIFICATIONS

TUBE COMPLEMENT

	Symbol	Tube	Function
1)	V-1	6CB6	R.F. Amplifier (on tuner)
2)	V-2	12AT7	Mixer and Oscillator (on tuner)
3)	V-101	6AU6	Sound I.F. Amplifier
4)	V-102	6AU6	Limiter
5)	V-103	6AL5	Ratio Detector
6)	V-104	6AV6	Audio Amplifier
7)	V-105	25L6GT	Audio Output
8)	V-106	6AU6	1st Video I.F.
9)	V-107	6CB6	2nd Video I.F.
10)	V-108	6AU6	3rd Video I.F.
11)	V-109A	½ 12AU7	Video Detector
12)	V-109B	½ 12AU7	Sync. Separator
13)	V-110	12BY7	Video Amplifier
14)	V-111	6AU6	A.G.C. Amplifier
15)	V-112A	½ 12AX7	Sync. Amplifier
16)	V-112B	½ 12AX7	Vertical Oscillator
17)	V-113	25L6GT	Vertical Output
18)	V-114	12SN7GT	"Syncroguide" Horizontal Oscillator and A.F.C.
19)	V-115	25BQ6GT	Horizontal Output
20)	V-116	12AX4GT	Damper
21)	V-117	1X2A	High Voltage Rectifier
22)	V-118	17BP4A	Kinescope

FINE TUNING RANGE

Channel 2 approximately	± 2.5 MC
Channel 13 approximately	± 2.0 MC

INTERMEDIATE FREQUENCY

1st Sound I.F.	21.25 MC
2nd Sound I.F (intercarrier I.F.)	4.5 MC
Picture I.F.	25.75 MC

RECEIVER ANTENNA INPUT IMPEDANCE	300 ohm balanced

POWER SUPPLY RATING
105-125 volts, 25/60 cycles, 150 watts

AUDIO POWER OUTPUT RATING

Undistorted	2 watts
Maximum	3 watts

OVERALL VIDEO RESPONSE (approx.)	3.5 MC
FOCUS	Permanent Manget
SWEEP DEFLECTION	Magnetic
SCANNING	Interlaced 525 lines
HORIZONTAL SWEEP FREQUENCY	15750 cps.
VERTICAL SWEEP FREQUENCY	60 cps.
FRAME FREQUENCY	30 cps.

R.F. FREQUENCY RANGES:

Channel No.	Channel Freq.(MC)	Picture Carrier Freq.(MC)	Sound Carrier Freq.(MC)
2	54-60	55.25	59.75
3	60-66	61.25	65.75
4	66-72	67.25	71.75
5	76-82	77.25	81.75
6	82-88	83.25	87.75
7	174-180	175.25	179.25
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75

HIGH VOLTAGE WARNING:

OPERATION OF THIS RECEIVER OUTSIDE THE CABINET OR WITH THE COVERS REMOVED, INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED.

KINESCOPE HANDLING PRECAUTIONS:

DO NOT REMOVE THE RECEIVER CHASSIS, 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 KINESCOPES. KEEP THE KINESCOPE AWAY FROM THE BODY WHILE HANDLING.

The kinescope bulb encloses a high vacuum and, due to its large surface area, is subjected to considerable air pressure. For this reason, kinescopes must be handled with more care than ordinary receiving tubes.

The large end of the kinescope bulb - particularly that part at the rim of the viewing surface - must not be struck, scratched or subjected to more than moderate pressure at any time. During service if the tube sticks or fails to slip smoothly into its socket, or deflecting yoke, investigate and remove the cause of the trouble. Do not force the tube. All RCA Victor replacement kinescopes are shipped in special cartons and should be left in the carton until ready for installation in the receiver.

SET UP INSTRUCTIONS

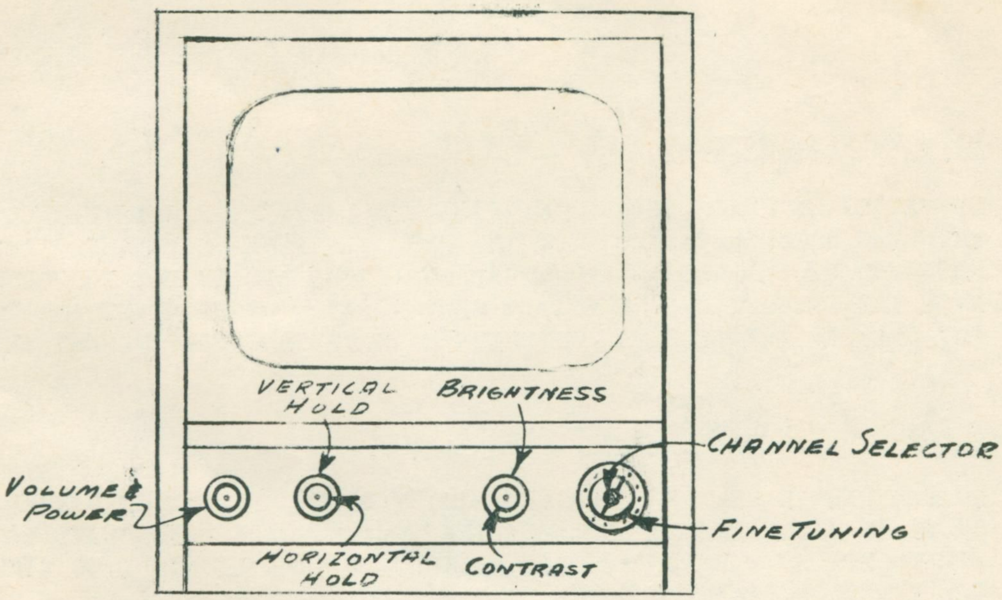


FIG. 1 RECEIVER OPERATING CONTROLS

1) Unpack the receiver and place in a suitable operating location.

2) Remove the back cover and check that all tubes are well located in their sockets, especially the R.F. Tuner tubes.

3) Check that all tube shields are well anchored in their respective base clips, especially those on the R.F. Tuner.

4) Connect a "cheater" line cord to the interlock plug connector.

5) Connect an external antenna ("Rabbit Ear" antenna) to the antenna input leads.

6) Plug line cord into A-C wall receptacle (NOTE: this receiver will not operate on a D-C power supply source.

7) Turn the power on by turning the Volume Control knob in a clockwise direction and advance this control halfway, allowing the receiver to warm up for a period of 10 minutes. Sound will be heard from the speaker in approximately 15 seconds.

8) Advance the Vertical and Horizontal hold control knobs to halfway.

9) Advance the Brightness and Contrast knobs halfway. A raster will appear on the kinescope tube in about thirty to forty-five seconds from the time the set is turned on.

10) Set channel selector switch to desired station and adjust fine tuning control for best sound and picture.

The following is a list of set up procedure which may be required to perform in the field for customer satisfaction and optimum performance of the television receiver.

BRIGHTNESS:

If the picture does not appear bright enough at average control setting, it is suggested that the ion trap be adjusted.

The ion trap is a metallic strap bent in the form of a hexagon and is located on the kinescope tube neck near the kinescope socket.

Set the brightness control to a point where the picture is just visible and adjust the ion trap by sliding it back and forth along the neck of the tube at the same time rotating it to a position where maximum brightness is obtained.

This completes the ion trap adjustment.

PICTURE TILT:

If the picture appears tilted the deflection yoke is to be adjusted.

The deflection yoke consists of a set of coils located on the neck of the kinescope tube at the extreme front.

Loosen the wing nut, located on the top bracket supporing the yoke and move deflection yoke to the left or right applying a slight forward pressure as the case may require.* Line the raster parallel to the molding frame of the cabinet above the control knobs. Tighten wing screw and check the picture. *(NOTE:Yoke must be pushed forward to rest on the shoulder of the tube)

This completes the yoke adjustment.

PICTURE CENTERING:

With operating controls set for average reception, check the location of the picture.

The picture on the face of the kinescope may be moved in either a vertical or horizontal plane by adjustment of the lever located on the focus magnet.

Loosen the Phillip's*screw located on the top of the focus magnet. Shifting this lever from left to right will affect the picture centering in a vertical plane, and pushing or pulling the lever in a vertical plane will affect the picture centering in a horizontal plane. Adjust till the picture is well centered and tighten the screw. * (NOTE: Wing nut used on later productions)

FOCUS MAGNET ADJUSTMENT

The focus magnet adjustment is located on the focus magnet which in turn is located on the neck of the tube. A small plastic knob located on the top of the focus magnet adjusts the focusing by either clockwise or counter-clockwise rotation. Rotate the knob, at the same time applying a slight pressure on the bottom of the metallic ring in the direction in which the ring is being moved. This is done to facilitate the adjustment.

Adjust the focus magnet for clearest picture or raster. The back cover may now be replaced, 'cheater' live cord disconnected, the tuner connected to the antenna terminal board and the external antenna also connected to the terminal board.

HORIZONTAL OSCILLATOR:

In carrying out the forgoing adjustments it was assumed that the horizontal oscillator required no adjustment due to the slight possibilities of disturbance during shipment. However if adjustments are required, please refer to the alignment instructions.

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. Normally the picture will not remain in sync. Turn the control clockwise slowly. The picture should show the blanking bar on the left side as the control is approaching the maximum clockwise position. If the receiver does not pass the above check refer to the Horizontal Oscillator Alignment.

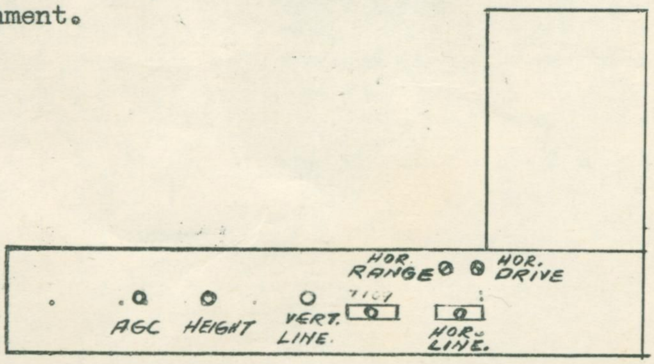


FIG. I CHASSIS REAR APRON ADJUSTMENTS

HORIZONTAL LINEARITY:

This screw driver adjustment is located on the rear apron of the chassis and is used to adjust for picture linearity in the horizontal plance.

VERTICAL LINEARITY:

This is a control adjustment located on the rear apron of the chassis and is used to adjust for picture linearity in the vertical plane. When the picture linearity control is adjusted, it is usually necessary to re-adjust the height control.

HEIGHT CONTROL:

This is a control adjustment located on the rear apron of the chassis and is used for adjusting picture height. When this control is adjusted, it is sometimes necessary to re-check the vertical linearity.

A. G. C.

A.G.C. is a control type of adjustment and is used for setting the correct gain level over which the receiver is to operate. The control is adjusted clockwise to a point where the picture begins to tear and then the control is slowly turned counter-clockwise until the picture ceases to tear.

This completes the A.G.C. adjustment.

CIRCUIT DESCRIPTION

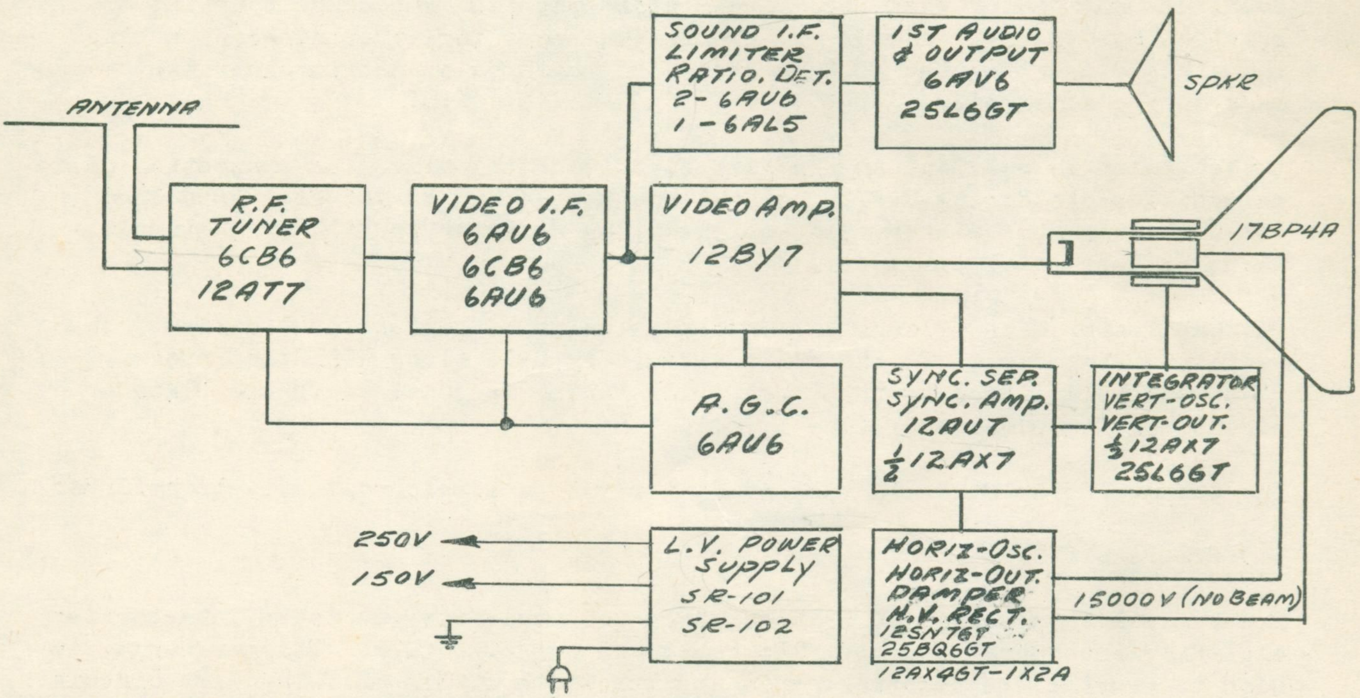


FIG. 3 RECEIVER BLOCK DIAGRAM

R.F. TUNER:

The Model 17T45 "Townsman" television receiver uses a TV-20 type tuner bearing our stock number S-9396. The TV-20 tuner is a switch type tuner designed to cover the twelve presently allocated channels. The input circuit is designed to match a 300 ohm balanced antenna system. The R-C network in the antenna input circuit is used to isolate the antenna from the transformerless chassis. The antenna circuit is very critical and should be properly matched with the antenna or serious loss of gain may result.

R.F. TUNER (Cont'd)

The antenna input circuit T-2 is inductively coupled to channel 13 antenna coil providing ample gain and bandwidth for channels 7 - 13. Antenna transformer T-3 is overcoupled to channel 6 antenna coil to provide adequate gain and sufficient bandwidth for channels 2 to 6. R-1 serves to broaden the response of channels 2 to 4 antenna coils. C-1 tunes the antenna circuit. R-2 is a grid load resistor damping the tuned circuit and also supplying tube .A.G.C. C-16 is an R.F. decoupling capacitor. The 6CB6 is a conventional R.F. amplifier which has a high 'Q' plate tuning in the output, permitting use of C-2 as frequency adjustment referred to in the tuner alignment, and is capacitively overcoupled to a tuned grid circuit of the mixer which is of lower 'Q', where C-3 mainly affects the tilt of the response curve. The coupling consists of C-9, C-21, C-6 and C-7 of which C-9 is effective only on channels 2 - 6 and serves for decoupling and decreasing the bandwidth. C-6, C-21 and C-7 form a low impedance coupling. Variable coupling between the R.F. plate and mixer grid is provided by two wires which are soldered to the trimmer (C-2, C-3) electrodes which form a small variable capacitor. The coupling provided by these two wires aids the low impedance coupling provided by C-6, C-21 and C7 so that maximum coupling is obtained by moving the wires closer together. Care should be taken so as not to short the two ends during alignment.

A test point is provided in the grid circuit of the mixer for connection of an oscilloscope during R.F. tuner alignment. R4 and R5 act as a grid load for the mixer and R-5 serves as an isolating resistor for the grid circuit when the test point is in use.

The oscillator uses a Colpitts circuit which is of conventional design. The oscillator is coupled to the mixer circuit by C-11 along with the interelectrode capacitance of the tube. Fine tuning is provided in the plate circuit of the oscillator tube by C-14.

The output of the mixer is coupled directly to a single coil I.F. transformer.

VIDEO I.F. SYSTEM:

The video I.F. consists of a three stage quadruple stagger tuned intercarrier amplifier incorporating two 6AU6 tubes and one 6CB6 tube. Stagger tuning is used to provide the necessary gain and bandwidth of 3.5 MC. The I.F. circuit has two low 'Q' transformers and two high 'Q' tranformers. Low 'Q' transformers being T-1 and T-106 and high 'Q' transformers are T-104 and T-105.

VIDEO I.F. SYSTEM: (Cont'd)

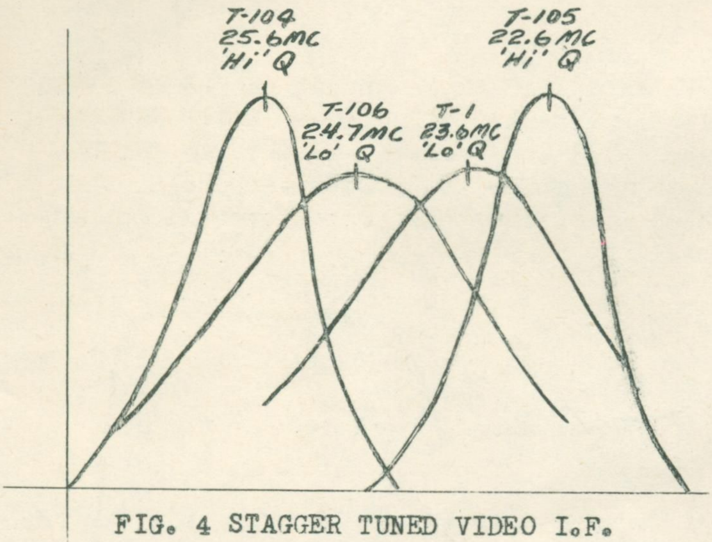


FIG. 4 STAGGER TUNED VIDEO I.F.

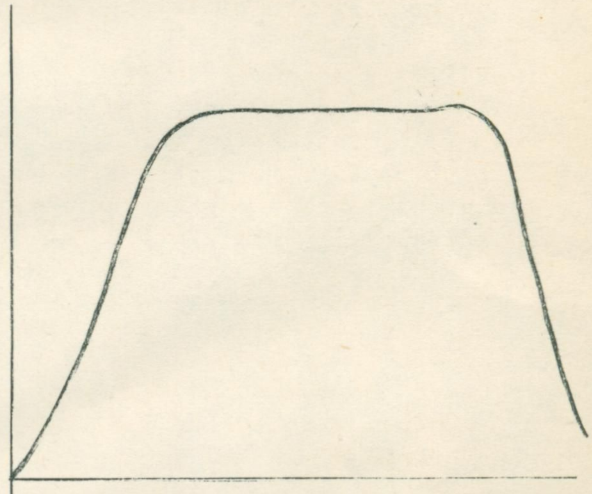


FIG. 5 OVERALL VIDEO I.F. RESPONSE

Bifilar windings are used in T-104, T-105 and T-106 which consist of inter-winding the primary and secondary of each transformer producing the effect of a single coil in the circuit.

The output of the converter is applied to the first picture I.F. transformer T-1 whose damping is provided by the plate resistance of the mixer tube V-2, R-11, R-120 and the input grid resistance of V-106. It should be noted that at high frequencies the input resistance is not infinite (relatively speaking) as is usually assumed at low frequencies and must therefore be considered where high frequency circuits are concerned.

C-123 is a coupling capacitor and isolates the grid of V-106 from D.C. potential. R-120 is connected to the A.G.C. line supplying the tube with A.G.C. R-121 is the cathode bias resistor. The value of this resistor is critical due to the fact that it is unbypassed and also due to the Miller effect of the tube.

Miller effect causes primarily the input capacitance of the tube to vary with the gain of the stage. The input capacity of a tube increases as the gain of stage is increased. This effect if uncompensated would cause serious detuning of the I.F. tuned circuit with changes in the A.G.C. voltage thereby changing the stage gain. For this reason the cathode resistors R-121 and R-126 are not bypassed and are of the proper value to maintain reasonably uniform bandpass.

The output of V-106 is fed to T-104 2nd picture I.F. Transformer which is damped by R-122 and the grid resistance of V-107. The associated capacitors C-189, C-126 and C-127 are bypass and decoupling capacitors.

VIDEO I.F. SYSTEM: (Cont'd)

V-107 is a conventional picture I.F. amplifier whose output is fed to T-105 3rd picture I.F. transformer. This transformer is damped by R-129 and the grid resistance of V-108. C-130 and C-131 are by-pass capacitors. T-105 picture I.F. transformer has a trap which tunes to 21.25 MC. reducing the intensity of the sound carrier and also provides the proper overall response curve of the picture I.F. amplifier.

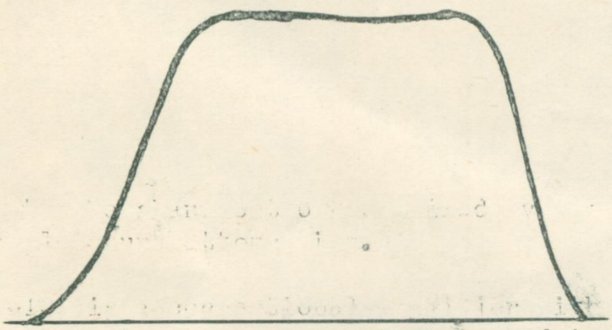


FIG. 6 RESPONSE WITHOUT TRAP

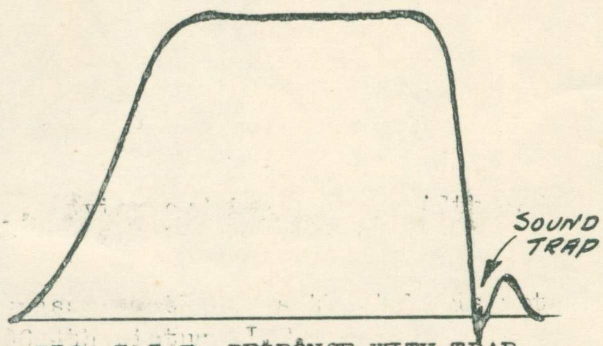


FIG. 7 I.F. RESPONSE WITH TRAP

Note the sharp cut off obtained by the trap, giving sufficient bandwidth and ample sound attenuation.

V-108 is a conventional amplifier with a by-passed cathode as the tube is not gain controlled. The output is fed to T-106 4th picture I.F. transformer which is damped by the loading of V-109A video detector which in turn is dependent on the value of R-135.

C-136 is a by-pass condenser.

VIDEO AMPLIFIER:

The video amplifier consists of a single stage high transconductance pentode 12BY7 V-110. The grid load of the video amplifier consists of a series combination of R-135 and L-103. L-103 raises the impedance of the load circuit at higher video frequencies to compensate for the loss in high frequency due to the shunt capacity of the tube. L-102 is an R.F. Filtering coil for high frequencies. L-101 and C-101 form a parallel resonant circuit which when tuned to 4.5 MC. acts as a high impedance to the 4.5 MC. inter-carrier beat frequency. This attenuates most of the sound at the grid of V-110. The composite video signal is then passed on to the grid of the video amplifier.

The cathode resistor R-136 is by-passed by C-194 which acts to remove degeneration at high frequency. R-136 however does producesome degeneration at low frequencies reducing the gain therefore increasing high frequency response. This compensation also serves to increase the speed of response of the circuit to short impulses producing good picture fidelity.

VIDEO AMPLIFIER (Cont'd)

The plate circuit of the video amplifier is connected to a combination series and shunt peaking coils L-104 and L-105

L-104 acts as a series peaking coil and improves the high frequency response of the video amplifier. A damping resistor R-204 is connected across L-104 to prevent ringing. The series peaking coil serves the purpose of isolating the plate capacity of the video amplifier from the kinescope input capacity by acting as a low pass filter, in other words it divides the shunt capacity.

L-105 is a shunt peaking coil which is damped by R-205 and serves to raise the plate load impedance of the video amplifier at the higher video frequencies to compensate for high frequency losses caused by the shunt capacity of the circuit.

The output of the video amplifier is DC coupled to the Picture control R-198 and AC coupled from the control to the cathode of the kinescope. The AC coupling is provided to protect the kinescope due to the cathode heater potential rating.

R-198 Picture control, controls the amplitude of the video signal applied to the cathode of the kinescope. This control circuit provides superior performance as compared to other forms of contrast control since the signal input to the sync separator and AGC amplifier is not affected by the setting of the picture control.

Shunt capacity from the associated video amplifier and circuit tends to reduce the high frequency response to the kinescope as the slider is moved lower on the picture or contrast control. To compensate for this loss C-195 is connected from the top of the contrast control to the first tap, and acts as a low impedance to the high frequency.

The cathode of the kinescope is also connected through R-144 to the Brightness control which controls the intensity of the electron beam in the kinescope by varying the DC cathode potential.

The video signal is coupled to the cathode of the kinescope through C-191. The beam current of the kinescope flowing through R-144 charges C-191 the time constant of this combination being sufficient to hold the background level constant.

SOUND I.F. SYSTEM:

The sound I.F. system consists of a single stage amplifier using a 6AU6 tube: a 6AU6 limiter and 6AL5 Ratio Detector.

The sound I.F. carrier (4.5 MC) is taken off at the junction of R-135 and L-103 by the beat produced at the sound detector of the picture and sound carriers (25.75 MC - 21.25 MC = 4.5 MC). The sound I.F. amplifier is conventional and needs no mention in this text. The limiter is also a conventional circuit which serves the purpose of reducing noise pulses and A.M. from being passed on to the Ratio Detector.

The Ratio Detector is also conventional; a test point is provided at the junction of R-112 and R-113 for connection of a voltohmyst during ratio detector alignment.

Audio output is obtained at the junction of R-110 and C-115 which in combination form a de-emphasis circuit reducing the high frequency response and thereby keeping the output reasonably flat due to the pre-emphasis of the transmitter.

The audio amplifier and output circuits are conventional and need no further elaboration.

A. G. C.

The A.G.C. circuit uses a 6AU6 pentode tube. This circuit is a keyed A.G.C. whereby the plate voltage is provided by positive pulses approximately 7 microseconds wide supplied by the horizontal output transformer through C-138. These pulses which occur during the horizontal retrace interval drive the plate positive with respect to its cathode since the latter is returned to the video amplifier plate load resistor R-137 and R-199 through an isolating resistor R-142 so that the composite video signal appearing across R-140 and R-141 is applied between grid and cathode. Plate current only flows when the flyback and sync pulses coincide, the magnitude of the current being determined by the level of the sync pulses applied to the grid of the A.G.C. tube. Plate current flows through load and filter resistors R-134, R-127 and R-125 developing a negative D.C. voltage which is the controlling A.G.C. voltage.

The A.G.C. amplifier grid to cathode voltage depends on the voltage drop across R-140 and R-141 due to video amplifier plate current flow. Since only a few volts negative bias is required to cut off the A.G.C. amplifier plate current, no A.G.C. voltage will be developed until the incoming signal strength is such that the video plate current approaches cut-off on sync pulse tips and the A.G.C. amplifier grid - cathode voltage then rises above cut-off (A.G.C. amplifier plate current begins to flow). As the incoming signal strength increases, the video signal at the plate of the video amplifier increases and plate current cut-off is more closely approached on sync pulse tips. This results in an increase in the A.G.C. bias voltage which, by reducing the gain of the R.F. and I.F. amplifiers V-1, V-106 and V-107 counteracts the increased incoming signal strength. Equilibrium is reached when the video signal is of such amplitude as to develop sufficient A.G.C. bias voltage to prevent a further increase in video signal amplitude. This keyed A.G.C. circuit maintains

A. G. C. (Cont'd)

the output of the video amplifier almost constant over a wide range of incoming signal strength (above the threshold level below which A.G.C. bias voltage is not developed).

This keyed A.G.C. system has one fundamental advantage and that is its relative immunity to noise pulses. The only noise pulses which can affect the A.G.C. bias voltage, are those which occur during the horizontal retrace pulse interval. Noise immune A.G.C. prevents the video amplifier output voltage from being affected by noise pulses because of the A.G.C. bias changing the gain of the R.F. and I.F. stages. Picture contrast on the kinescope remains unchanged and more important, sync pulse tips are maintained near cut-off bias on the video amplifier so that the noise pulses are clipped just slightly above the sync pulses. This noise clipping results in noise stable synchronization since the sync separation derives its input signal from the video amplifier plate circuit.

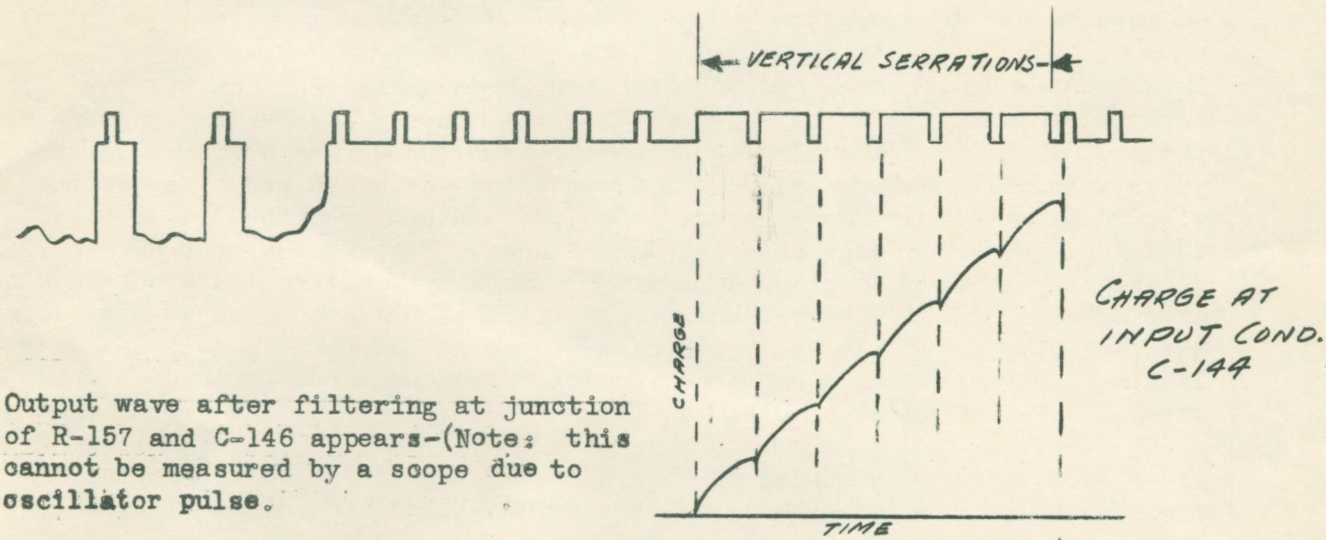
The A.G.C. voltage is connected to a diode section of V-104 to prevent any possibility of damaging the A.G.C. controlled tubes should any of them become gassy and start drawing grid current.

SYNC SEPARATOR & SYNC AMPLIFIER:

The sync separator consists of ½ tube section of a 12AU7. The sync separator is connected to the output of the video amplifier through an isolating resistor R-146. The grid of V-109B is driven positive by the incoming sync pulses and causes grid current to flow charging capacitors C-141 and C-142. Sufficient negative D.C. voltage is developed by the grid current of V-109B to prevent the sync pulses from going more than slightly positive. The sync pulse is thus compressed at the grid of the sync separator. The plate of the sync separator is supplied with low B voltage due to the resistors R-149 and R-150 so that the tube requires very little voltage to cut off plate current. Blanking pulses and video information extend below the cut-off bias and do not appear at the output of the sync separator when strong noise pulses (extending above the sync pulses) are present in the composite video signal applied to the sync separator, grid current will flow and the negative grid voltage developed will increase so that the sync pulse could be momentarily depressed beyond cut-off and no sync information could appear in the output. To minimize the possibility of this occuring the fast time constant network C-142 and R-148 is used in the grid circuit of the sync separator. Approximately 18% of the grid voltage appears across R-148 and this voltage changes quite rapidly because of the short time constant to counteract the effect of the noise pulses. In other words the circuit can follow rapid changes. C-141 and R-147 comprise a long time constant which prevents undue distortion of the long duration of the vertical sync pulses.

INTEGRATOR - VERTICAL OSCILLATOR - VERTICAL OUTPUT

The integrator circuit is an R-C network consisting of R-155, R-156, R-157, C-144, C-145 and C-146 resistors and capacitors which convert the vertical sync serrations into a sawtooth wave form.



Output wave after filtering at junction of R-157 and C-146 appears-(Note: this cannot be measured by a scope due to oscillator pulse.

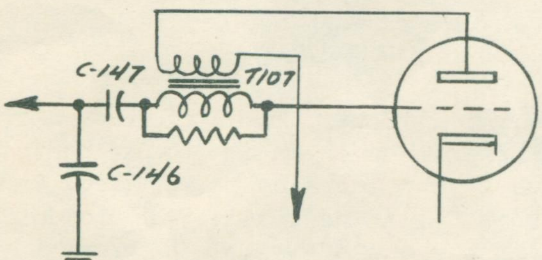


FIG. 9 VERTICAL OSCILLATOR

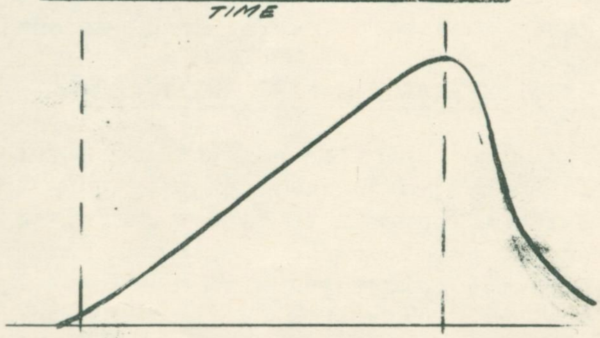


FIG. 8 OUTPUT WAVE AFTER PASSING THROUGH INTEGRATOR

The positive sync pulse is applied to the grid of V-112B causing the tube to draw grid current. This makes the plate current increase in such a way that the plate winding of the vertical oscillator transformer causes the grid to become more and more positive until the tube saturates. When saturation is reached, the field partially collapses in the transformer and the grid is driven negative very rapidly.

During the time that the grid is positive, C-147 and C-146 are charged up, and as soon as the grid is driven negative, the capacitors discharge through R-158 and R-159, repeating the cycle 60 times per second (depending on your vertical hold control setting).

The combination of R-158 and R-159 act as a grid leak for the vertical oscillator and also form a time constant in combination with C-146 and C-147 controlling the rate at which the grid is made positive. In other words, it contols the frequency of the vertical oscillator.

INTEGRATOR - VERTICAL OSCILLATOR - VERTICAL OUTPUT (Cont'd)

The plate winding of the T-107 is connected to a 2.5 megohm control R-162 through a plate load resistor R-161. This changes the time constant in the plate circuit and therefore affects the shape of the sawtooth in the plate circuit of the vertical oscillator output. This control is known as the Height Control.

The output of the vertical oscillator is coupled to the grid of the vertical output tube V-113 through a .1 capacitor C-151. C-144 and R-165 are shunted across the plate load to maintain more uniform impedance across the plate due to the characteristic of the vertical output transformer. It also provides feed back from the plate to the grid of the vertical output by virtue of C-144, R-163, C-150 and C-152, for obtaining the proper wave form in the grid of the Vertical output tube V-113.

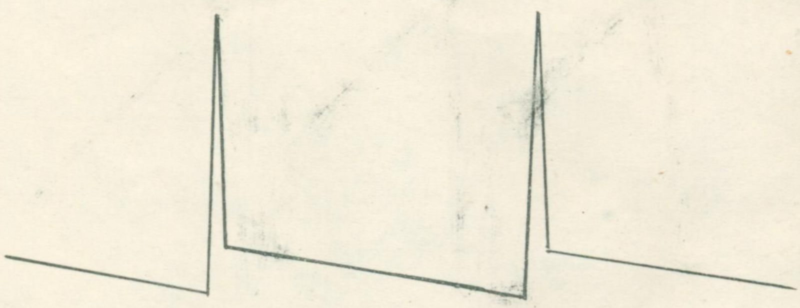


FIG. 10 WAVEFORM AT PLATE OF V113

The output of the vertical output transformer which consists of a sawtooth waveform

FIG. 11 SAWTOOTH WAVEFORM

is applied to the vertical deflection yokes.

C-153 is a bypass capacitor for horizontal flyback pulse.

C-200, R-206, C-198 and R-207 are used for retrace suppression of vertical pulses. C-200 and R-206 have a very fast time constant as compared with

INTEGRATOR - VERTICAL OSCILLATOR - VERTICAL OUTPUT (Cont'd)

the vertical oscillator frequency. The sawtooth is removed and a negative pulse appears across R-207.

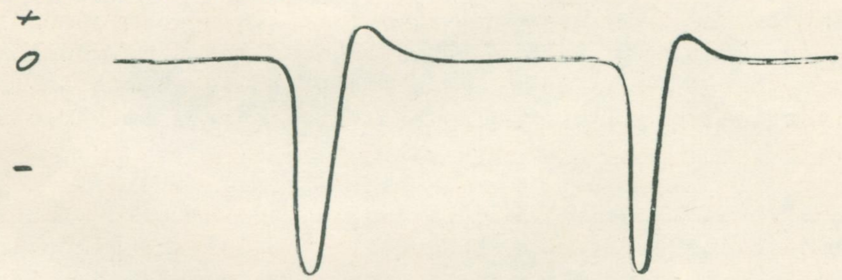


FIG. 12 PULSE ACROSS R207

Capacitor C-198 removes the positive peak as shown above.

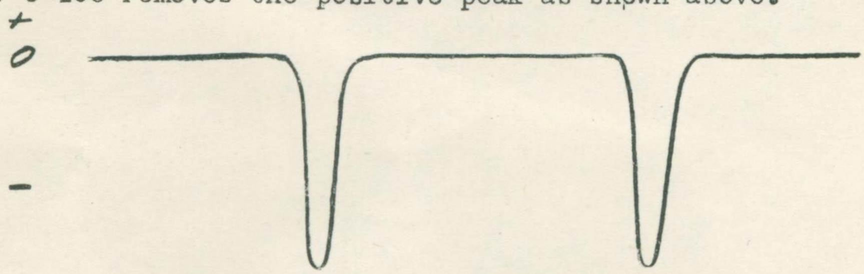


FIG. 13 PULSE WITH POSITIVE PEAK REMOVED

R-168 is provided as a linearity control. The grid voltage plate-current curve of the tube is not a straight line over its entire range; therefore the effect of adjustments of R-168 is to produce variations in shape of sawtooth by shifting the operating point of the tube to different points along the curve. Since the slope of the curve varies the effective gain of the tube, adjustments of linearity affect picture height and such adjustments must be accompanied by readjustment of the height control R-162.

1) HORIZONTAL OSCILLATOR 2) OUTPUT 3) DAMPER & 4) H.V. RECTIFIER

1) The horizontal AFC circuit is of the "syncroguide" type with minor modifications. The horizontal oscillator, discharge, and AFC circuits utilize the double triode tube V-114. The triode (pin 4.5 and 6) is the blocking oscillator with grid coupling capacitor C-162 and grid leak resistor R-183, R-180, etc. T-109 is the horizontal oscillator transformer in

1) HORIZONTAL OSCILLATOR 2) OUTPUT 3) DAMPER & 4) H.V. RECTIFIER

1) Cont'd

which winding C-D and capacitor C-163 form a stabilizing tuned circuit. The feedback for blocking action is supplied by autotransformer winding A-C-F. The coarse frequency adjustment of this oscillator consists of the moveable core in coil A-C-F. The generated sawtooth is coupled to the grid of the output tube V-115 by the capacity divider C-165 - C-157B. C-157B marked horizontal drive provides a means of varying the sawtooth amplitude, which in turn varies the horizontal linearity of the picture as well as width and high voltage.

Synchronization is accomplished by means of the triode (pin 1, 2 and 3) as follows: A complex wave consisting of the sync pulse and partially integrated sawtooth is fed on the grid through coupling capacitors C-155 and C-156. The trimmer C-157A varies the amplitude of this coupled wave since the sync is fed through the capacity divider C-155, C-156 and C-157A, and the integrated sawtooth is formed from the sawtooth at point D of T-109 through R-173 and C-157A. As C-157A is reduced in capacity the amplitude of this wave increases and vice versa. The tube is cathode biased from the drop across R-179 to such a value that plate current flows only during the positive peak portions of the complex wave. C-159 connects between a tap on the grid return (R-177 and R-178) and the cathode to minimize degeneration at pull-in frequencies. This provides a better pull in action. The cathode voltage is essentially a DC voltage obtained from the pulses of current by filter action of C-160 and C-161 and since a portion of this voltage is applied to the oscillator grid through R-183 its magnitude affects the frequency of the oscillator in such a way as to automatically hold it in synchronism with the received sync signal.

The peak of the complex wave on the grid of the control tube is essentially the sync pulse "riding" atop the integrated sawtooth which is derived from the oscillator. As shown in the figure below, actually only a portion of the sync pulse atop the barabola, the remaining portion sliding down the sharp incline following the peak of the sawtooth.

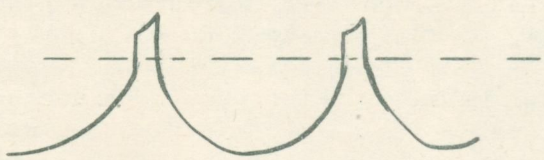


FIG. 15 SYNC TOO EARLY

FIG. 16 SYNC TOO LATE

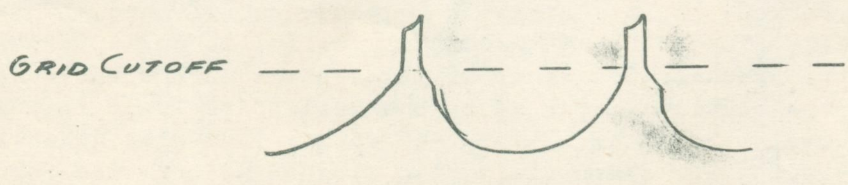


FIG. 17 SYNC PHASING NORMAL

1) HORIZONTAL OSCILLATOR 2) OUTPUT 3) DAMPER & 4) H.V. RECTIFIER

1) Cont'd)
Area above cut off is the portion of waveform effective in producting oscillator control. Therefore, the plate current pulse has a width equal to the width of the portion of the sync atop the sawtooth. As the phase between the oscillator and sync tends to change, the width of the portion of sync atop the sawtooth changes, and with it the width of current pulses in the tube and the average cathode voltage, which then acts on the oscillator in such a direction as to restore the correct phase.

2 & 3) The operation of these two circuits is so interconnected that they must be discussed simultaneously. The function of the output tube V-115 is to supply sufficient current of the proper wave form to the horizontal deflection coils to provide horizontal scanning for the kinescope. The function of the damper tube V-116 is to stop oscillation of certain deflection components during trace and help provide a linear trace. Other functions of these circuits include the utilization of energy stored in the horizontal deflection coil to furnish retrace and with the aid of the series transformer primary to supply kinescope high voltage. The damper circuit also recovers some of the energy from the yoke kickback and uses it to help supply the plate power requirements of the output tube.

In operation, the visible portion of the horizontal trace is approximately 53 microseconds in duration. Although the inductance of the horizontal deflection coil is in the order of only thirteen millihenries, the reactance of the coil predominates over the coils resistance of the horizontal scanning frequency. This is a different case than that encountered in the vertical deflection system and so a different method of operation must be employed.

Horizontal blanking is approximately ten microseconds in duration. During this time, the kinescope beam must be returned to the left side of the tube, and the trace must be started and made linear. To accomplish all this within the horizontal blanking time, only seven and one-half microseconds can be allowed for the return trace. In order to obtain such rapid retrace, the horizontal deflection coil, high voltage transformer and associated circuits are designed to resonate at a frequency such that one-half cycle of oscillation at this frequency will occur in the seven and one-half microseconds retrace time limit. This represents a frequency of approximately 66 KC.

During the latter part of the horizontal retrace, the output tube conducts very heavily and builds up a strong magnetic field in the deflection coil and high voltage transformer. When the steep negative slope of the sawtooth from the horizontal oscillator discharge (V-114) is applied to the output tube grid, the 25BQ6GT plate current is suddenly cut off and the magnetic field in the deflection coil and transformer begins to collapse at a rate determined by the resonant frequency of the system. Since the output tube is cut off and the voltage generated by the collapsing field is positive for the first half cycle preventing V-116 conduction, there is essentially no load on the circuit. The damper tube then closes and prevents further

CIRCUIT DESCRIPTION (Cont'd)

1) HORIZONTAL OSCILLATOR 2) OUTPUT 3) DAMPER & 4) H.V. RECTIFIER

2 & 3 (Cont'd)

oscillation in the deflection coil. One half cycle of oscillation is permitted because at the end of such time the current in the deflection coil has reached a maximum in the opposite direction to which it was flowing at the end of the trace period. This reversal of current flow is the requirement for retrace and it is accomplished in the alloted seven and one half microseconds.

During the half cycle, retrace was accomplished with very little loss of energy. The field in the coil was merely reversed in polarity. So, at this point a strong field exists in the deflection coil.

The current in the deflection coil lags the voltage by approximately ninety degrees (considering ninety degrees as one quarter cycle resonant frequency; ie. 66 KC) and when the current has reached its maximum positive value, the voltage across the coil, being ninety degrees ahead, has begun to swing negative. When the voltage on the damper tube cathode becomes negative with respect to its plate, the tube begins to conduct heavily. This places such a load across the deflection coil that it cannot continue oscillation. Instead, the field begins to decay at a rate permitted by the load which the damper tube circuit places on the coil. The circuit constants are such that this decay is linear and at a rate suitable for the visible trace.

If no additional energy was fed into the coil, the field would fall to zero and the kinescope beam would come to rest in the center of the tube. In such a circuit, the current approaches its final value exponentially. The output tube must, therefore begin to supply power to the deflection coil before the energy in the coil is completely dissipated. Although the currents supplied by the output tube and by the decaying field are curved at the crossover point, together they produce a yoke current that is linear. By the time the beam has reached the right side of the kinescope, the output tube is conducting heavily and has built up a strong field in the deflection coils and transformer. At this point, the output tube is again suddenly cut off and the process is repeated.

The kinescope 1st anode voltage is indirectly supplied through the 12AX4GT damper tube, which is conducting over the major portion of the trace. Capacitors C-171 and C-172 are charged during this period and this charge is sufficient to supply the kinescope 1st anode when the 12AX4GT is not conducting.

These capacitors are charged by the receiver DC supply and by the current produced by the collapse of the field in the horizontal deflection coil. The charge placed on the capacitors by the decay of deflection energy is additive to that from the DC supply and thus the capacitors are charged to a voltage greater than the power supply. This permits operation of the kinescope at a higher voltage than is obtainable from the normal supply and produces an increase in the system efficiency by salvaging energy that would otherwise have been wasted.

1) HORIZONTAL OSCILLATOR 2) OUTPUT 3) DAMPER & 4) RECTIFIER

2 & 3 Cont'd

In addition, this B+ boost is used to supply part of the plate voltage for the horizontal syncroguide tube V-114 and part of the vertical oscillator tube V112B.

4) The high voltage is supplied from the energy stored in the deflection inductance during each horizontal scan. Where the 25BQ6GT plate current is cut off by the incoming signal, a positive pulse appears on the T-110 primary due to the collapsing field in the horizontal yoke. This pulse of voltage is stepped up, rectified by 1X2A tube filtered and applied to the second anode of the kinescope. Since the frequency of the supply voltage is high (15,750 cps) relatively little filter capacity is necessary. Since the filter capacity is small, the stored energy is small, and the high voltage supply is made less dangerous. The filter capacitors are C-197 and the capacitor formed by the inner and outer coatings on the kinescope.

LOW VOLTAGE POWER SUPPLY

The low voltage power supply used in this receiver is a conventional half wave voltage doubler circuit which needs no further explanation.

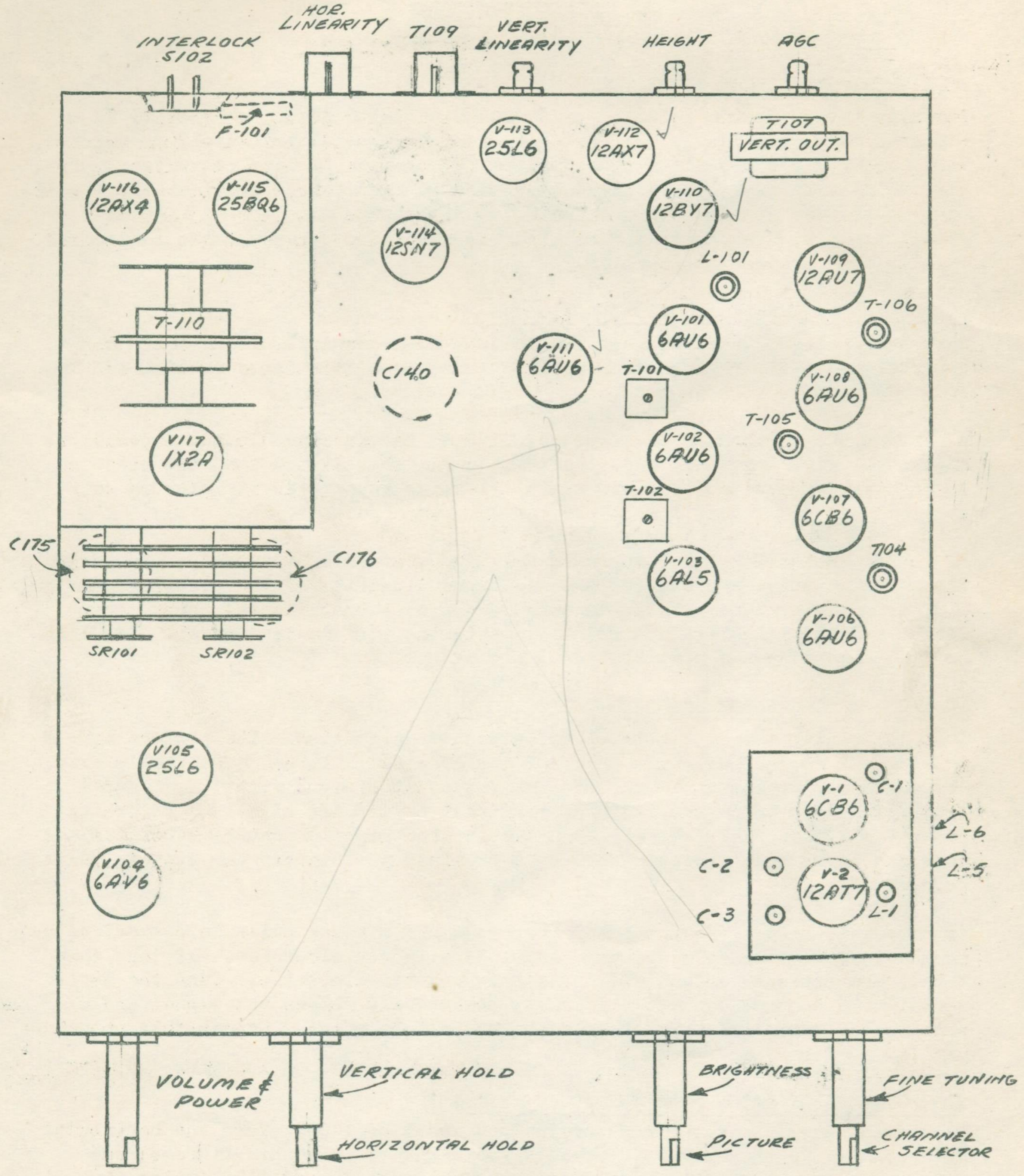


FIG. 18 CHASSIS LAYOUT

ALIGNMENT PROCEDURE

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 wave form 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:

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 R175 to the extreme clockwise position. Adjust the T109 Frequency Adjustment (atop 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.

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 C157B, and the linearity control L111 until the picture is correct. If C157B or L111 were adjusted, repeat step A above.

HORIZONTAL LOCKING RANGE ADJUSTMENT:

Turn the horizontal hold control fully counter-clockwise. The picture may remain in sync. If so, turn the T109 top core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Momentarily remove the signal by switching off channel then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 9 pars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C157A slightly clockwise. If less than 7 bars are present, adjust C157A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 7 to 9 bars are present.

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, adjust the Oscillator Waveform Adjustment Core of T109 (under the chassis) until the horizontal blanking bar appears in the raster.

HORIZONTAL OSCILLATOR WAVEFORM ADJUSTMENT: (Cont'd)

A. - Connect the low capacity probe of an oscilloscope to terminal C of T109. Turn the horizontal hold control one quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 34. Adjust the Oscillator Waveform Adjustment Core of T109 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

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 over-stabilized, 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 HORIZONTAL OSCILLATOR ADJUSTMENTS:

Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 2 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C157A slightly clockwise. If less than 2 bars are present, adjust C157A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 bars are present.

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.

17T45 (TOWNSMAN)

ALIGNMENT INSTRUCTIONS

Prior to any alignment an isolation transformer (117V/117V) should be used.

TRAP ALIGNMENT

1) Set up a 3.0 volt bias using standard cells. Connect the positive to the common ground and the negative to the junction of R127 and C135 (AGC).

2) Set signal generator to 21.25 MC AM 400 cycles 30% modulation and connect to test point on tuner, 'hi' end to test point and 'lo' end to common ground.

3) Connect 'hi' end of scope to contrast control (sliding arm) and low end to metallic shield strip. At this point a sine wave with superimposed noise will appear on scope.

4) Adjust the sound trap T105 bottom for minimum amplitude.

ALTERNATE METHOD:

If a signal generator is capable of delivering an output of one volt adjust the trap as follows:

a) Connect the signal generator to the test point on the tuner (as above)

b) Connect 'hi' end of voltohmyst to junction of L101 and L102 (Grid circuit of 12BY7, V110 video amplifier) and 'lo' end to junction of copper shield and common ground shield above V110.

c) Adjust T105 bottom (21.25 MC trap) for minimum output on meter.

VIDEO I.F. ALIGNMENT

1) Set up a 4.5 volt bias using standard cells. Connect the positive to the common ground and the negative to the junction of R127 and C135 line.

2) Connect signal generator to test point on tuner as described in trap alignment.

3) Set signal generator to 24.7 MC 400 cycles 30% modulation.

VIDEO I.F. ALIGNMENT (Cont'd)

4) Connect 'hi' end of scope to contrast control (sliding arm) and low end to junction of copper strip and shield above V110.

5) Connect 'hi' end of voltohmyst to junction of L101 and L102 (Grid of 12BY7, V110 video amplifier) and 'lo' end to junction as mentioned above. It is suggested that the voltohmyst be set on the 10 volt range and zero centered for the remaining alignment.

6) Adjust T106 top 4th video I.F. for a maximum output on meter, not to exceed - 2 volts if it does, reduce generator output.

NOTE: This alignment can be accomplished by use of the scope.

a) Connect scope hi end to contrast control (slide arm) and low end to junction of copper strip and common ground shield.

b) Adjust T106 top for maximum amplitude on scope.

7) Set signal generator to 22.6 MC.

8) Adjust T105 top 3rd video I.F. for maximum output on meter or amplitude on scope.

9) Set signal generator to 25.6 MC.

10) Adjust T104 top 2nd video I.F. for maximum output on meter and maximum amplitude on scope.

11) Set signal generator to 23.6 MC.

12) Adjust T-1 top 1st I.F. transformer on tuner for maximum output on meter and maximum amplitude on scope.

4.5 MC SOUND TRAP ALIGNMENT

1) Set signal generator to 4.5 MC AM 400 cycles 30% modulation.

2) Connect signal generator 'hi' end to junction of R135 and L103 and 'Lo' end to junction of copper strip and common ground shield above V110.

3) Connect diode jig (see sketch below) 'hi' end to contrast control (sliding arm) and low end to junction of copper strip and common ground shield above V110.

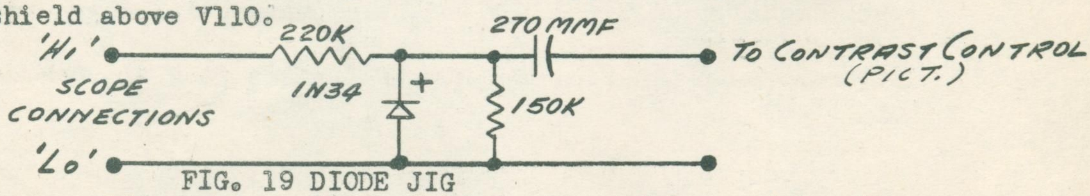


FIG. 19 DIODE JIG

4) Connect scope 'hi' end to output of diode jig and low end to above mentioned common ground junction.

4.5 SOUND TRAP ALIGNMENT (Cont'd)

5) Set contrast control in maximum clockwise position.

6) Adjust L101 top or bottom for minimum output on scope.

SOUND I.F. ALIGNMENT

1) Connect voltohmyst 'lo' end to test point of Ratio Detector junction of R112 and R113 'hi' end to common ground shield.

2) Adjust signal generator output to give meter reading of -4 to -5 volts.

3) Adjust T101 top and bottom Sound I.F. for maximum output.

4) Adjust T102 top Ratio Detector for maximum output.
In steps 3 and 4 if -5 volts is exceeded, the output of the generator should be lowered and kept within the -5 volt limit.

RATIO DETECTOR ALIGNMENT

1) Connect meter 'hi' end to junction of C115 and R110 'lo' end is kept on test point of Ratio Detector.

2) Connect scope to voice coil.

3) Adjust T102 bottom for minimum output on scope keeping generator output at same level as used in Step 4 of Sound I.F. Alignment. Adjust T-102 and observe meter swing above and below the zero setting; the correct zero setting is at the center of swing from left to right. NOTE- in some cases, the zero balance will not coincide with minimum amplitude on the scope, and therefore a limit ± 1 volt is acceptable.

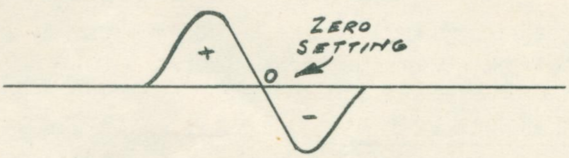


FIG. 20 RATIO DETECTOR CURVE

SWEEP SOUND ALIGNMENT

1) Connect sweep generator 'hi' end to junction of R135 and L103 and 'lo' end to junction of copper strip and common ground shield above V110.

2) Connect scope to lug "A" of T101 through an isolating resistor of approximately 100 K and low end to above mentioned ground.

3) Calibrate scope to read maximum of 2 volts peak to peak developed at lug "A".

4) Loosely couple a 4.5 MC unmodulated signal to the sweep cable to refer to as a marker. (Connecting both leads to chassis is sufficient).

SWEEP SOUND ALIGNMENT (Cont'd)

5) Adjust T101 top and bottom for maximum amplitude and most symetrical curve about the 4.5 MC marker.

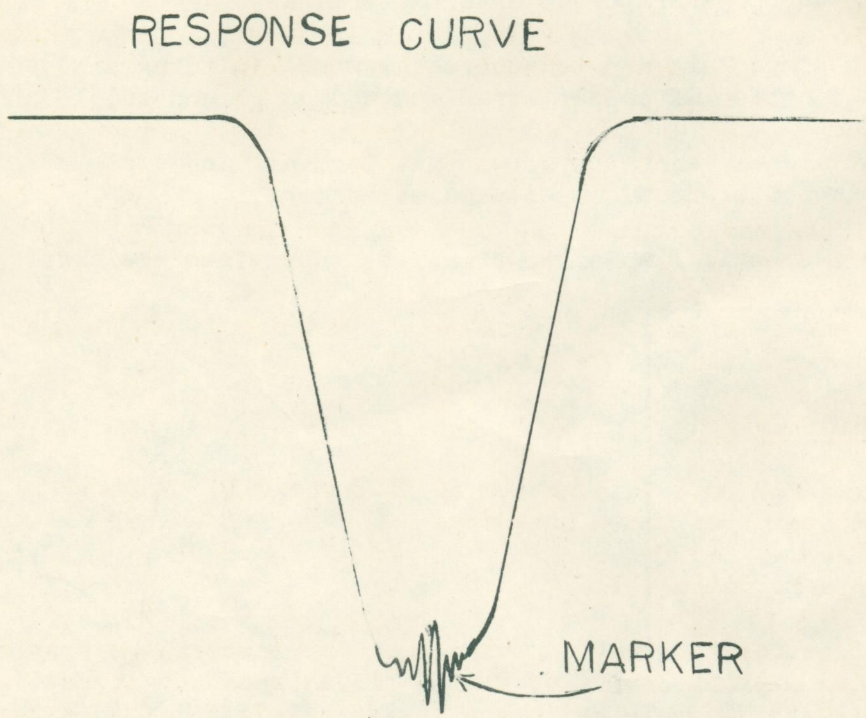


FIG. 21 T101 RESPONSE CURVE

TUNER ALIGNMENT

1) Set tuner to channel 13.

2) Adjust fine tuning for mechanical center (see limits for Fine Tuning)

3) Connect sweep generator to antenna terminal.

4) Connect scope 'hi' end to contrast control (sliding arm) and 'lo' end to the junction of copper strap and common ground shield above V110.

5) Connect signal generator to antenna terminal and apply a sound carrier frequency of 21.25 MC to be used as marker.

6) Adjust C-4 until the marker signal is tuned into the trap.

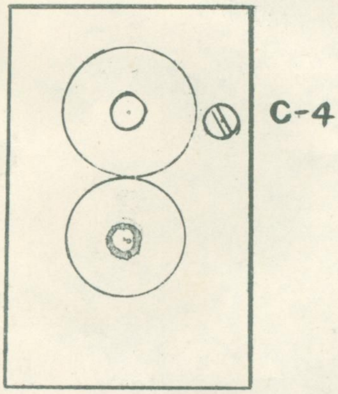


FIG. 22 FRONT OF TUNER

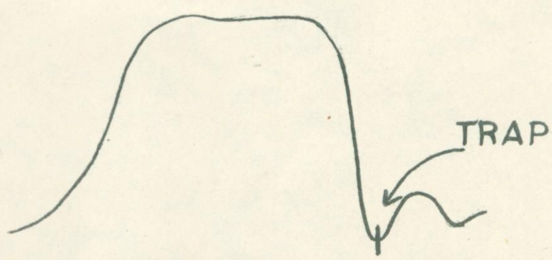


FIG. 23 TRAP LOCATION ON VID. I.F. RESPONSE

7) Check fine tuning setting on channels 13-8.

8) Set tuner to channel 7.

9) Check fine tuning, if tuning is off and knob shaft is turned clockwise from mechanical center of fine tuning shaft; remove tuner cover, spread turns of L-1, replace cover less screws and repeat steps 1 to 7. Check that all fine tuning settings for channels 7 to 13 are within the limits.

LIMITS FOR FINE TUNING

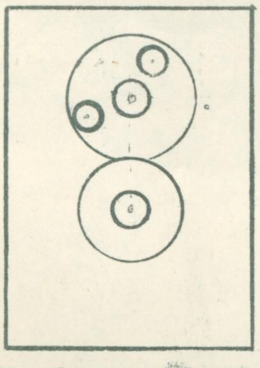


FIG. 24 LIMIT FOR CLOCKWISE ROTATION OF FINE TUNING KNOB

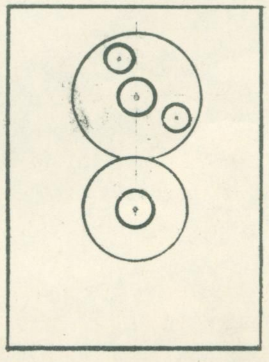


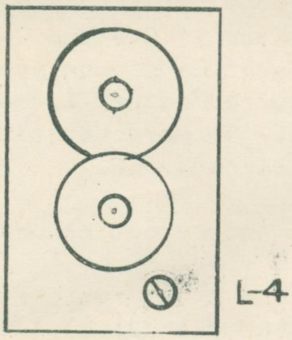
FIG. 25 LIMIT FOR COUNTER-CLOCKWISE ROTATION OF FINE TUNING KNOB

If oscillator tunes within the above setting of the fine tuning control, it is acceptable. On some tuners a compromise setting of fine tuning must be made to accomodate all channels with the limits shown above.

10) Set tuner to channel 6.

11) Adjust L-4 to set fine tuning to mechanical center as outlined above.

FIG. 26
FRONT VIEW
OF TUNER



12) Set tuner to channel 5.

13) Adjust channel 5 oscillator coil to set fine tuning to mechanical center as outlined in steps 9 and Coil Adjustment D & C.

NOTE: On channel 2 to 6, fine tuning can be mechanically centered by adjustment of oscillator coils.

COIL ADJUSTMENT:

Spread coil if fine tuning knob shaft has to be turned clockwise for mechanical center and close up coil if fine tuning knob shaft has to to turned counter-clockwise.

14) Follow the same procedure on channels 2 to 4 oscillator fine tuning adjustments.

15) Set tuner to channel 13.

16) Calibrate oscilloscope for 180 u.v. peak to peak.

17) Connect sweep generator to antenna terminals.

18) Connect scope to test point on tuner through a 4700 ohm isolating resistor.

19) Connect hi end of signal generator (or generators) as markers (Sound and picture carriers) to antenna terminals through isolating resistors of approximately 1000 ohms, 'lo' end to tuner case.

20) Connect a -3 volt bias, 'hi' end to common ground and 'lo' end to junction of R127 and C135.

21) Adjust C-1, C-2 and C-3.

NOTE: C-1 reduces hump between markers.
C-2 adjusts the frequency range.
C-3 mainly affects the tilt.

22) Check channel 13 to 7 and observe the trend of the wave shapes, switching associated equipment on each channel as required.

23) If channel 7 is off - check if C-2 and C-3 require more or less capacity. Clockwise increases capacity and counter-clockwise decreases capacity. If less capacity is required adjust L-2 or L-3 by closing up the windings (Increasing inductance). If more capacity is required spread apart the winding (Decrease inductance).

24) Set tuner to channel 13 and repeat channel 13 alignment.

25) Set tuner to channel 7 and check response, adjust if necessary as mentioned above and repeat channel 13 alignment if any adjustments are made on channel 7.

26) Set tuner to channel 6 and tuning fine tuning for correct marker setting (should be at mechanical center).

27) Adjust L-5 and L-6 for proper response curve and proper marker location on curve.

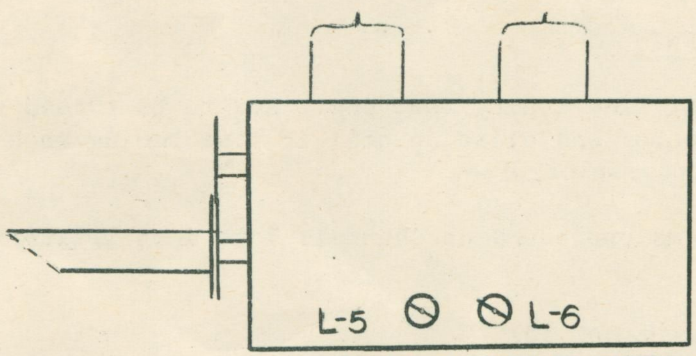


FIG. 27 SIDE VIEW OF TUNER

28) Set tuner to channel 5 through 2 and check the response curves. The response may be adjusted by spreading or closing up the antenna coils.

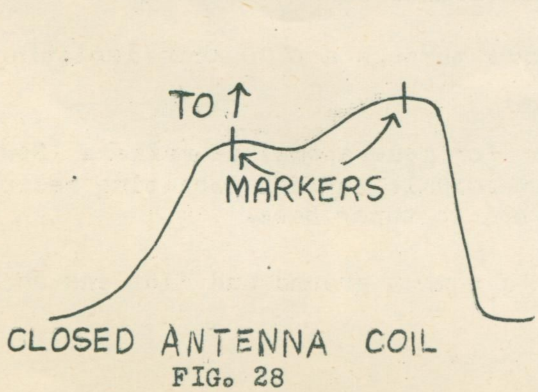


FIG. 28

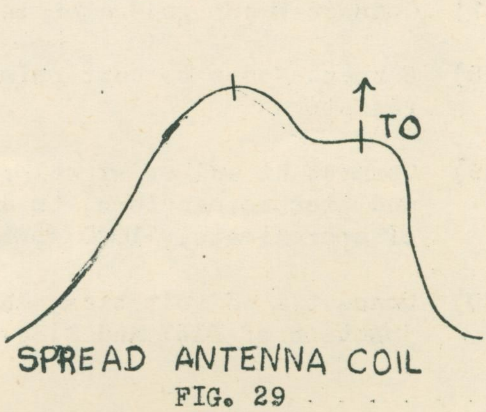


FIG. 29

In some cases the R.F. and mixer coils will have to be adjusted to obtain proper response.

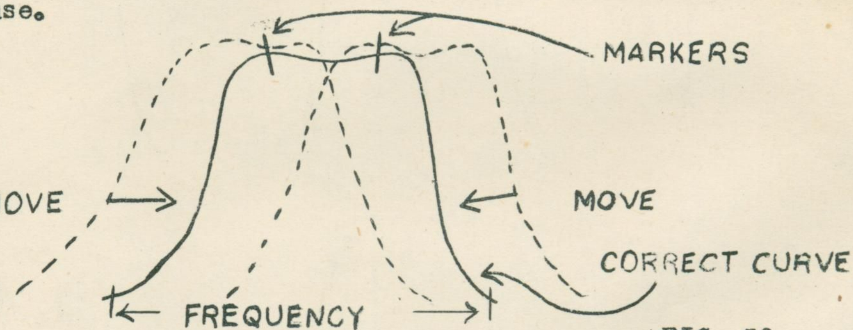
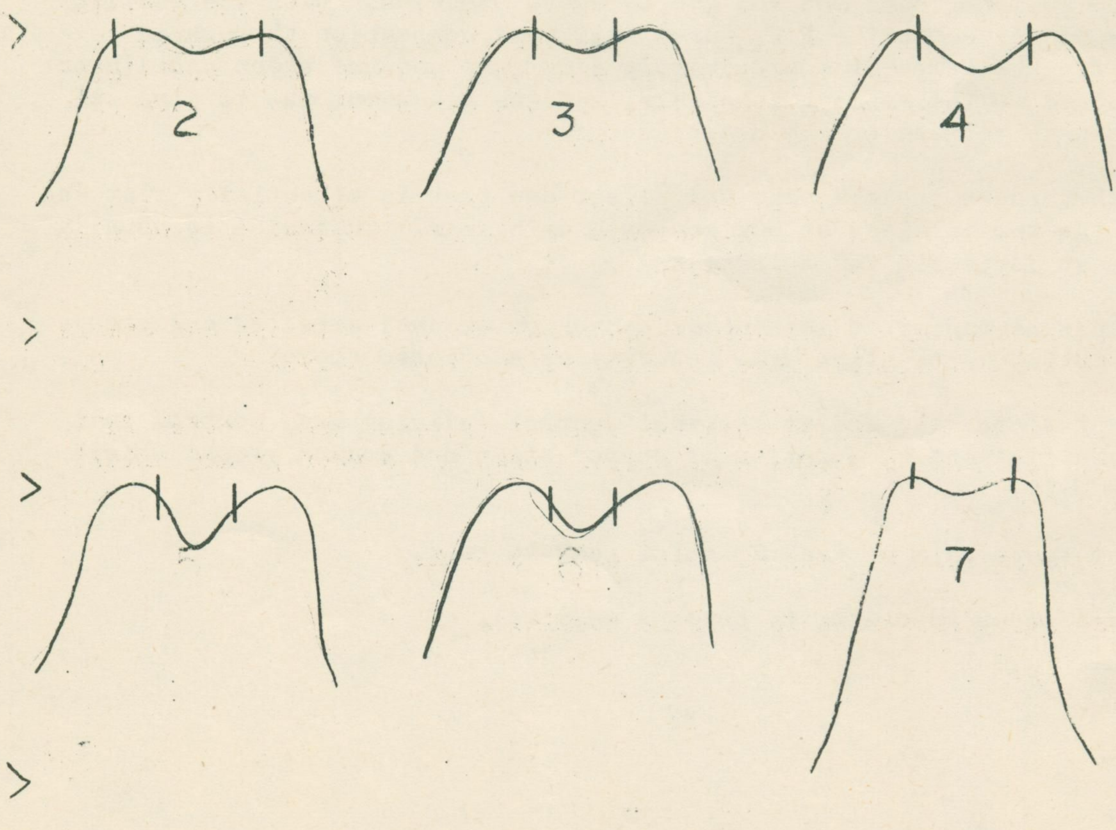


FIG. 30

NOTE:
R.F. coils mainly affect the frequency.
Mixer coils affect the tilt.
When tuner alignment is completed, it is advisable to drop a little wax on L-4, L-5 & L-6 inductances to fix the setting between the coil and core.
Care should be exercised so as not to detune the coil.
Mount screws on tuner cover and tighten.

R.F. TUNER RESPONSE CURVES

FIG. 31



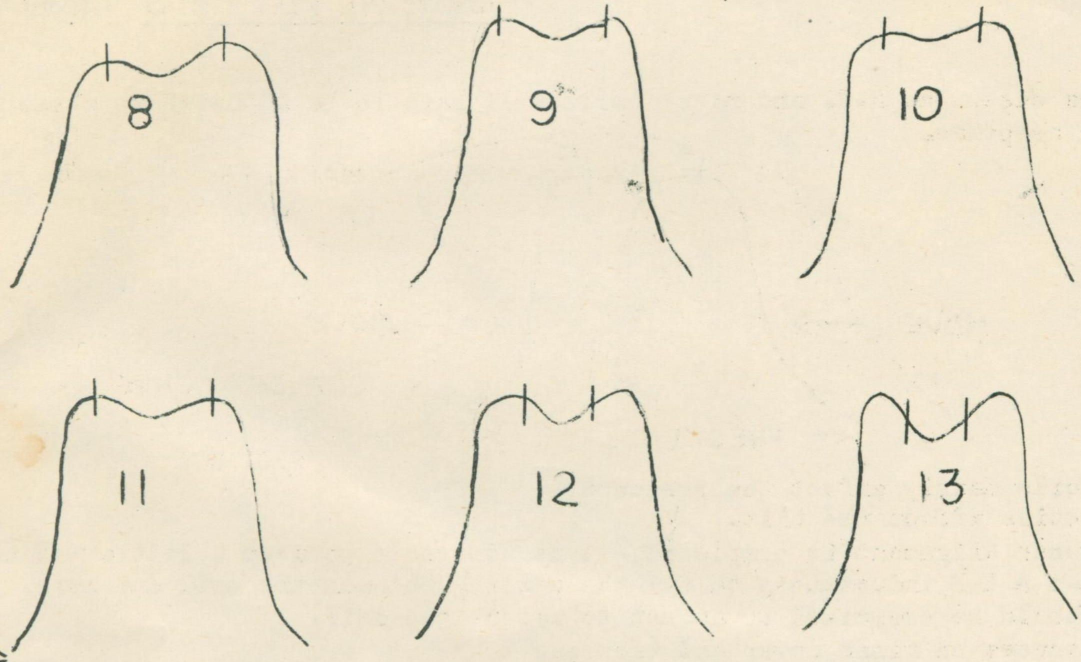


FIG. 31

OVERALL SWEEP ALIGNMENT

TUNER CHECK

1) Set up a 3 volt bias and connect to the junction of R127 and C135, 'hi' end to common ground and low end to above junction. With the oscilloscope connected to the R.F. tuner unit test connection through an isolating resistor of approximately 4700 ohms and the sweep oscillator connected to the antenna terminals, set the sweep out put to give .18 volts peak to peak on the oscilloscope.

   Switch through the channels and select one that is essentially flat and with the two carriers at 90% response or higher. Channel 4 is usually the most desirable for this test.

2) Set up fine tuning at mechanical center on channel selected and change bias to 4.5 volts using same polarity as mentioned above.

3) Connect scope 'hi' end to contrast control (sliding arm, control full on) and 'lo' end to junction of copper strap and common ground shield above V110.

4) Adjust scope gain to read 20 volts peak to peak.

5) Connect sweep generator to antenna terminal.

6) Connect marker or signal generator to antenna terminal board through an isolating resistor of approximately 1000 ohms. See that marker generator does not affect the response curve by controlling the output.

7) Adjust marker (or signal generator) to sound carrier frequency on each channel and check if the fine tuning control will tune the sound carrier into the sound trap within the fine tuning limits.

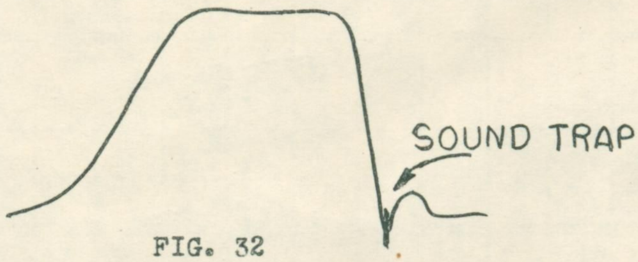


FIG. 32

8) Observe the overall response curve, it should appear as shown below.

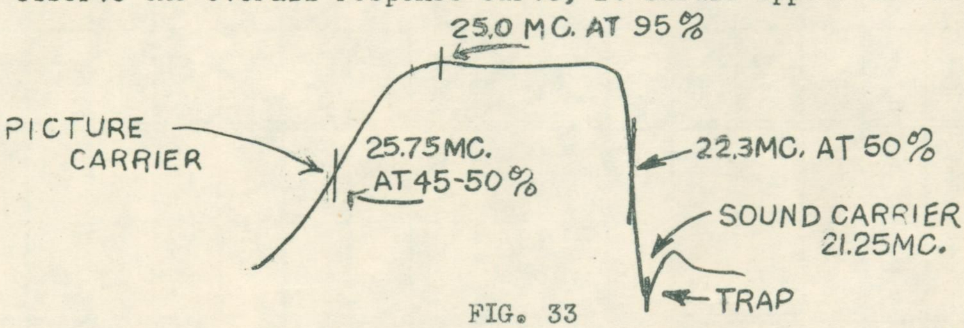


FIG. 33

The overall response curve may be touched up by making the following adjustments, T-1, T-104, T-105 and T-106.

NOTE:

T-1 and T-106 will affect general shape of curve.
T-104 will place picture carrier at 50%.
T-105 will place 22.3 MC marker at 50% on sound side of curve.

Condition A - 3500 µ v. Signal Input

B - Ant. Terminals Shorted

VOLTAGE CHART

SYM	TUBE	PIN # 1 A	PIN # 1 B	PIN # 2 A	PIN # 2 B	PIN # 3 A	PIN # 3 B	PIN # 4 A	PIN # 4 B	PIN # 5 A	PIN # 5 B	PIN # 6 A	PIN # 6 B	PIN # 7 A	PIN # 7 B	PIN # 8 A	PIN # 8 B
V101	6AU6	0	0	-	-	6.4	6.4	6.4	6.4	130V	117V	130	117	1.0V	.9V		
V102	6AU6	-4V		-	-	6.6V	6.6V	6.6V	6.6V	140V	127V	140	127	.12V	.11V		
V103	6AL5					6	6	6	6								
V104	6AV6	.7V	-.7V	0V	0V	6.2	6.2	6.2	6.2					103V	103V		
V105	25L6GT			23.5	23.5	240		133		0				23.5	23.5	10.3	
V106	6AU6									250	242	134	117	.21	.72		
V107	6CB6	-5.5	-.2	.3	.73	5.9	5.9	5.9	5.9	250	242	134	117				
V108	6AV6	0	0			6.2	6.2	6.2	6.2	130	117	130	117	1.0	.86		
V109	12AU7	27.5	24	-22	-5.5	0	0	6.5	6.5	6.5	6.5	-1.1	-5.5	-1.1	-.55	0	0
V110	12BY7	1.0V	1.0V	-1.1	-.5			6	6	6	6			188	178	140	125
V111	6AU6	92	89			6.0	6.0	6.0	6.0	-5.2	-.5V	140	120	110	108		
V112	12AX7	283	280	-23	-22.5	0	0	6.5	6.5	6.5	6.5	93	85	-.3	-.2	0	0
V113	25L6GT					240	240	140	120	0	0					18.5	16.7
V114	12SN7GT	192	190	-55	-55	0	0	11.8	11.8	11.8	11.8	160	160	-7	-7	10.5	10.1
V115	25BQ6GT	-	-	21	21			158		-8.6				21	21	16.5	
V116	12AX4GT													12.3	12.3	12.3	12.3
V118	17BP4A																

PLEASE ATTACH TO Page 34

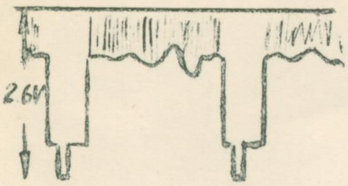
VOLTAGE CHART

Condition A - 3500 u v. Signal Input
B - Ant. Terminals Shorted

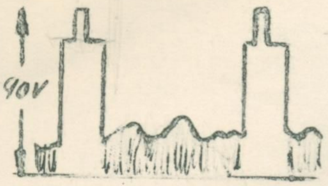
SYM	TUBE	PIN #1		PIN #2		PIN #3		PIN #4		PIN #5		PIN #6		PIN #7		PIN #8		PIN #9	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
V101	6AU6	0	0	-	-	*6.4 AC	*6.4 AC	*6.4 AC	*6.4 AC	130	117	130	117	1.0	.9				
V102	6AU6	-4				*6.6 AC	*6.6 AC	*6.6 AC	*6.6 AC	140	127	140	127	.12	.11				
V103	6AL5					* 6 AC	* 6 AC	* 6 AC	* 6 AC										
V104	6AV6	.7	-.7	0	0	*6.2 AC	*6.2 AC	*6.2 AC	*6.2 AC					103	103				
V105	25L6GT			23.5 * AC	23.5 * AC	240		133		0				23.5 * AC	23.5 * AC	10.3			
V106	6AU6					*6.2 AC	*6.2 AC	*6.2 AC	*6.2 AC	250	242	134	117	.21	.72				
V107	6CB6	-5.5	-.2	.3	.73	*5.9 AC	*5.9 AC	*5.9 AC	*5.9 AC	250	242	134	117						
V108	6AU6	0	0			*6.2 AC	*6.2 AC	*6.2 AC	*6.2 AC	130	117	130	117	1.0	.86				
V109	12AU7	-1.1	-.4	-1.1	-.4	0	0	*6.5 AC	*6.5 AC	*6.5 AC	*6.5 AC	33	33	-35	-.7	0	0	*6.5 AC	
V110	12BY7	-1.0	-1.0	-1.1	-.5			* 6 AC	* 6 AC	* 6 AC	* 6 AC			120	111	140	125		
V111	6AU6	92	89	110	110	*6.0 AC	*6.0 AC	*6.0 AC	*6.0 AC	-5.2	-.5	200	200	110	108				
V112	12AX7	83	80	-.1		0	0	*6.5 AC	*6.5 AC	*6.5 AC	*6.5 AC	93 ✓	85 ✓	-3	-3	0	0	*6.5 AC	
V113	25L6GT			*25 AC	*25 AC	240	240	140	120	0	0			*25 AC	*25 AC	18.5	16.7 ✓		
V114	12SN7GT	-2.5	-2.5	192 ✓	192 ✓	0	0	-60	-60	190	190			10.5 * AC	10.5 * AC	10.5 * AC	10.1 * AC		
V115	25BQ6GT	-	-	* 21 AC	* 21 AC			158		-14				* 21 AC	* 21 AC	16.5			
V116	12AX4GT					520	520							12.3 * AC	12.3 * AC	12.3 *AC	12.3 * AC		
V118	17BP4A	Pin #12 - 6.3 AC				Pin #11 - 100 ✓				Pin #10 - 520 + boosted									

* Measured across filaments

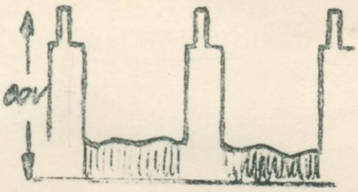
V112 ✓ affected by setting of R162
V113 ✓ affected by setting of R168
V114 ✓ affected by setting
V118 ✓ affected by setting



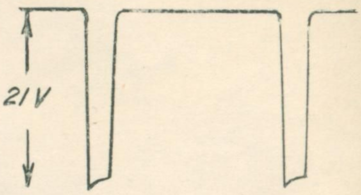
PIN 2 of V110



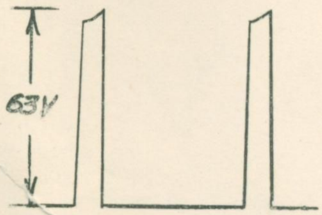
PIN 7 of V110



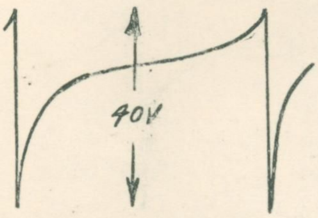
JUNCTION C141 & R147



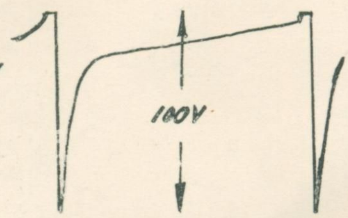
PIN 6 OF V109B



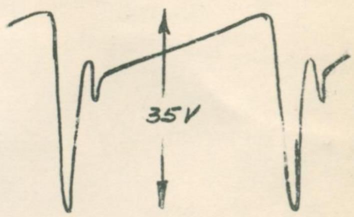
PIN 1 of V112A



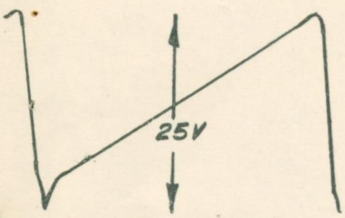
JUNCTION C147 & R160



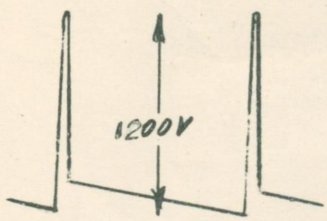
PIN 7 of V112B



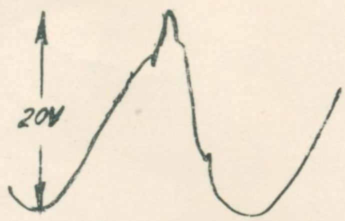
PIN 6 of V112B



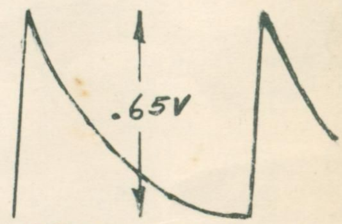
JUNCTION C152 & R161



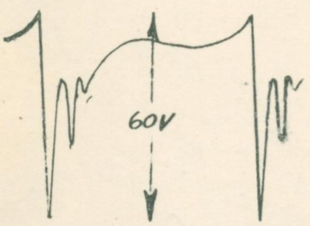
PIN 3 of V113



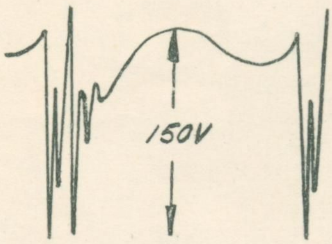
PIN 1 of V114



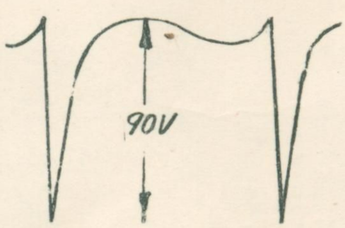
PIN 3 of V114



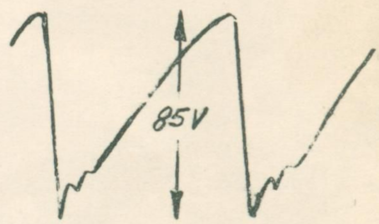
JUNCTION R179 & R180



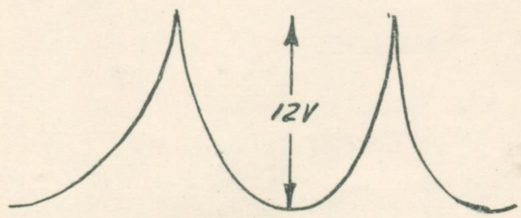
PIN 5 of V114



TER 'C' of T109



JUNCTION C165 & R184



PIN 8 of V115

FIG. 34 RESPONSE CURVES

REPLACEMENT PARTS FOR MODEL 17T45

SYMBOL #	STOCK #	DESCRIPTION
C-101		Capacitor in L101
C-102		" .001 mf., 600V
C-103	S-6326	" .01 mf., 500V
C-104	S-9371	" 4700 mmf., 500V
C-105	S-6326	" .01 mf., 500V
C-106	71924	" 56 mf., 500V
C-107	S-9371	" 4700 mmf., 500V
C-108	S-6326	" .01 mf., 500V
C-109		" in T102
C-110		" in T102
C-111		" 1000 mmf., 500V
C-112	S-9371	" 4700 mmf., 500V
C-113	S-9367	" electrolytic 5 mf., 50V
C-114	S-9371	" 4700 mmf., 500V
C-115		" .0022 mf., 600V
C-116		" .0047 mf., 600V
C-117		" .0047 mf., 600V
C-118	S-6326	" .01 mf., 500V
C-119		" .022 mf., 400V
C-120		" .01 mf., 400V
C-121		" .01 mf., 600V
C-122A	S-9403	" electrolytic, 20 mfd., 350V
C-122B		" " 100 mfd., 250V
C-123	S-4438	" 150 mmf., 500V
C-124	S-9371	" 4700 mmf., 500V
C-125	S-9371	" 4700 mmf., 500V
C-126	S-9371	" 4700 mmf., 500V
C-127	S-9371	" 4700 mmf., 500V
C-128	S-9370	" 1500 mmf., 500V
C-129	S-9370	" 1500 mmf., 500V
C-130	S-9371	" 4700 mmf., 500V
C-131	S-9370	" 1500 mmf., 500V
C-132	S-9371	" 4700 mmf., 500V
C-133	S-9370	" 1500 mmf., 500V
C-134	S-9371	" 4700 mmf., 500V
C-135		" .47 mf., 200V
C-136	31709	" 10 mmf., 500V
C-137	S-9371	" 4700 mmf., 500V
C-138		" .001 mf., 1000V
C-139	23101	" 22 mmf., 500V
C-140A	S-9402	" electrolytic, 10 mfd., 150V
C-140B	"	" " 150 mfd., 50V
C-140C	"	" " 40 mfd., 350V
C-141		" .0047 mf., 600V
C-142	71920	" 220 mmf., 500V

REPLACEMENT PARTS FOR MODEL 17T45

SYMBOL #	STOCK #	DESCRIPTION
C-143		Capacitor P. .047 mf., 500V
C-144		" 2000 mmf
C-145		5000 mmf int. net.
C-146		" 5000 mmf
C-147	73561	" .01 mf., 400V, P.
C-148		" 390 mmf., 500V, M.
C-149	S-9311	" .022 mf., 600V., P.
C-150	73551	" .1 mf., 400V, P.
C-151	73557	" .1 mf., 600V, P.
C-152	73592	" .047 mf., 600V, P.
C-153	73551	" .1 mf., 400V, P.
C-154	73557	" .1 mf., 600V, P.
C-155	73090	" 82 mmf., 1000V, M.
C-156	73090	" 82 mmf., 1000V, M.
C-157A	S-9393	" - Trimmer 2(10-160 mmf, 500V)
C-157B	S-9393	" - Trimmer 2(10-160 mmf, 500V)
C-158	73553	" .047 mf., 400V, P.
C-159	73551	" .1 mf., 400V, P.
C-160	73562	" .022 mf., 400V, P.
C-161	73787	" .47 mf., 200V, P.
C-162	75248	" 220 mmf., 1000V, M.
C-163	73594	" .01 mf., 600V.
C-164	S-9307	" .001 mf., 600V. P.
C-165	74250	" 560 mmf., 1000V. M.
C-166	S-9371	" 4700 mmf., 500V.
C-167		" .1 mf., 400V.
C-168		" .22 mf., 200V.
C-169		" .47 mf., 200V.
C-170		" in yoke 91
C-171		" .022 mf., 600V.
C-172		" .022 mf., 600V.
C-173	28417	" 5 mf., 450V.
C-174	S-9400	" Electrolytic 300 mfd., 200V.
C-175	S-9401	" Electrolytic 200 mfd., 350V.
C-176		" Electrolytic 200 mfd., 350V.
C-177	S-9371	" 4700 mmf., 500V.
C-178	S-9371	" 4700 mmf., 500V.
C-179	S-9371	" 4700 mmf., 500V.
C-180	S-9371	" 4700 mmf., 500V.
C-181	S-9371	" 4700 mmf., 500V.
C-182	S-9371	" 4700 mmf., 500V.
C-183	S-9371	" 4700 mmf., 500V.
C-184	S-9371	" 4700 mmf., 500V.
C-185		" in T105
C-186		" in T101
C-187		" in T101
C-188		

REPLACEMENT PARTS FOR MODEL 17T45

SYMBOL #	STOCK #	DESCRIPTION
C-189	S-9371	Capacitor 4700 mmf., 500V.
C-190	S-6326	" .01 mf., 500V.
C-191	73794	" .22 mf., 400V.
R-195	S-9481	Capristor 3.3 meg. 330 mmf. 500V.
C-192	S-9481	Capristor 3.3 meg. 330 ohms 500V.
C-193	S-9481	Capristor 3.3 meg. 330 mmf. 500V.
R-196	S-9481	Capristor 3.3 meg. 330 ohms 500V.
C-194		Capacitor .0056 mf., 400V.
C-195		" 39 mmf., 500V.
C-196	S-9304	" 100 mmf., 1000V.
C-197	S-9474	" Hi-volt (500 mmf, 20,000V)
C-198	73920	" .0047 mf., 600V.
C-199		" .1 mf., 400V.
C-200		" .01 mf., 400V.
C-201	S-9370	" 1500 mmf., 500V.
C-202A	75089	" .0015x2 mf., 500V.
C-202B	75089	" .0015x2 mf., 500V.
F-101		Fuse
J-102	S-4465	Jack-Phono jack
L-101	S-9413	4.5 M.C. Trap (on base)
L-102	S-9106	Coil - Peaking Coil 36 u.h.
L-103	S-9483	Coil - Peaking Coil 750 u.h.
L-104	S-9405	Coil - Peaking Coil 12K, 500 u.h.
L-105	S-9405	Coil - Peaking Coil 12K, 500 u.h.
L-106		Vert. Yoke
L-107		Vert. Yoke
L-108	S-9406	Reactor Choke
L-109		Horizontal Yoke
L-110		Horizontal Yoke
L-111	71449	Coil - Horizontal linearity

REPLACEMENT PARTS FOR MODEL 17T45

SYMBOL #	STOCK #	DESCRIPTION
R-101		Resistor, 680 ohms, 10%, 1W
R-102		" 82 ohms, 10%, $\frac{1}{2}$W
R-103		" 1000 ohms, 20%, $\frac{1}{2}$W
R-104		" 47K ohms, 10%, $\frac{1}{2}$W
R-105		" 68 ohms, 10%, $\frac{1}{2}$W
R-106		" 47K ohms, 10%, $\frac{1}{2}$W
R-107		" 47K ohms, 10%, $\frac{1}{2}$W
R-108		" 1000 ohms, 20%, $\frac{1}{2}$W
R-109		" 47 ohms, 10%, $\frac{1}{2}$W
R-110		" 33K ohms, 10%, $\frac{1}{2}$W
R-111		" 330 ohms, 10%, $\frac{1}{2}$W
R-112		" 6800 ohms, 5%, $\frac{1}{2}$W
R-113		" 6800 ohms, 5%, $\frac{1}{2}$W
R-114	S-9394	" Control Volume
R-115	30992	" 10 meg. 20%, $\frac{1}{2}$W
R-116	S-5647	" 220K ohms, 10%, $\frac{1}{2}$W
R-117		" 270 ohms, 10%, 1W
R-118	30648	" 470K ohms, 10%, $\frac{1}{2}$W
R-119	S-5647	" 220K ohms, 10%, $\frac{1}{2}$W
R-120		" 4700 ohms, 10%, $\frac{1}{2}$W
R-121		" 47 ohms, 10%, $\frac{1}{2}$W
R-122		" 12 K ohms, 10%, $\frac{1}{2}$W
R-123		" 1000 ohms, 20%, $\frac{1}{2}$W
R-124		" 1000 ohms, 20%, $\frac{1}{2}$W
R-125	S-5647	" 220 K ohms, 10%, $\frac{1}{2}$W
R-126		" 68 ohms, 10%, $\frac{1}{2}$W
R-127		" 100 K ohms, 10%, $\frac{1}{2}$W
R-128		" 100 K ohms, 20%, $\frac{1}{2}$W
R-129		" 33 K ohms, 10%, $\frac{1}{2}$W
R-130		" 1000 K ohms, 20%, $\frac{1}{2}$W
R-131	S-6646	" 120 ohms, 10%, $\frac{1}{2}$W
R-132	S-9478	" 2500 ohms, 15W
R-133		" 1000 ohms, 20%, $\frac{1}{2}$W
R-134		" 47 K ohms, 10%, $\frac{1}{2}$W
R-135		" 4700 ohms, 10%, $\frac{1}{2}$W
R-136		" 47 ohms, 10%, $\frac{1}{2}$W
R-137		" 12 K ohms, 10%, 2W
R-138		" 33 K ohms, 10%, $\frac{1}{2}$W
R-139		" 100 K ohms, 10%, $\frac{1}{2}$W
R-140	S-9417	" Control - A.G.C.
R-141		" 100 K ohms, 10%, $\frac{1}{2}$W
R-142	S-6174	" 47 K ohms, 10%, 1W
R-143		" 27 K ohms, 10%, $\frac{1}{2}$W
R-144		" 150 K ohms, 10%, $\frac{1}{2}$W
R-145	S-9423	" Control Brightness
R-146	S-6144	" 18 K ohms, 10%, $\frac{1}{2}$W
R-147		" 2.2 M. 10%, $\frac{1}{2}$W
R-148	30648	" 470 K ohms, 10%, $\frac{1}{2}$W
R-149		" 100 K ohms, 10%, $\frac{1}{2}$W

REPLACEMENT PARTS FOR MODEL 17T45

SYMBOL #	STOCK #	DESCRIPTION
R-150		Resistor, 33K ohms, 10%, ½W
R-151		" 330K ohms, 10%, ½W
R-152		" 22K ohms, 10%, ½W
R-153	36714	" 15K ohms, 10%, ½W
R-154		" 6800 ohms, 10%, ½W
R-155		" Int. Network, 22K ohms
R-156		" Int. Network, 8200 ohms
R-157		" Int. Network, 8200 ohms
R-158		" 470K ohms, 10%, ½W
R-159	PT of S-9411	" Vertical Hold Control
R-160		" 1.0 Meg. 10%, ½W
R-161		" 2.2 Meg. 10%, ½W
R-162	S-9317	" Height Control 2.5 Meg.
R-163		" 33K ohms, 10%, ½W
R-164		" 33K ohms 10%, ½W
R-165		" 100K ohms, 10%, 1W
R-166		" 2.2 Meg. 10%, ½W
R-167	S-6214	" 470 ohms 10%, ½W
R-168	S-9316	" Linearity Control
R-169		" 470 ohms 10%, 1W
R-170		" in Focus
R-171		" in Vertical Yoke 560
R-172		" in Vertical Yoke 560
R-173		" 150K ohms, 10%, ½W
R-174		" 68K ohms, 10%, 1W
R-175	PT of S-9411	" Hor. Hold 74K ohms
R-176		" 22K ohms, 10%, 1W
R-177		" 330K ohms, 5%, ½W
R-178		" 820K ohms, 10%, ½W
R-179		" 82K ohms, 10%, 1W
R-180		" 330K ohms, 5%, 1W
R-181		" 3900 ohms, 10%, ½W
R-182		" 8200 ohms, 5%, ½W
R-183		" 220K ohms, 5%, 1W
R-184		" 47 ohms, 20%, ½W
R-185	30648	" 470K ohms, 10%, ½W
R-186		" 180 ohms, 10%, 2W
R-187		" 82K ohms, 10% 1W
R-188	30648	" 470K ohms, 10%, ½W
R-189		" 10K ohms, 10%, 2W
R-190		" in Horizontal Yoke
R-191		" 56K ohms, 10%, ½W
R-192	S-9479	" 5 ohms, 10%, 10W
R-193		" 43 ohms, 8W
R-194		

REPLACEMENT PARTS FOR MODEL 17T45

SYMBOL #	STOCK #	DESCRIPTION
R-195	S-9481	Capacitor, 3.3 Meg. 330 mmf, 500V
R-196	S-9481	Capacitor, 3.3 Meg. 330 mmf, 500V
R-197		Resistor, 1000 ohms, 20%, ½W
R-198	S-9422	" Picture Control
R-199		" 27K ohms, 20%, 1W
R-200		" 12K ohms, 10%, 2W
R-201		" 2200 ohms, 10%, ½W
R-202		" 470K ohms, 20% 1W
R-203		" 1 Meg. 10%, ½W
R-204		" in L104
R-205		" in L105
R-206		" 6800 ohms, 10%, ½W
R-207		" 56K ohms, 10%, ½W
R-208		" 47K ohms, 10%, ½W
R-209		" 43 ohms, 5%, 2W
R-210	S-9482	" 30 ohms, 5%, 2W
SR101	S-9404	Rectifier - Selenium
SR102	S-9404	Rectifier - Selenium
T-101	S-9416	Transformer - Sound I.F.
T-102	S-9418	" - Ratio Det.
T-103	S-9407	" - Output (audio)
T-104	S-9498	" - 2nd I.F. Trans.
T-105	S-9399	" - 3rd I.F. Trans.
T-106	S-9398	" - 4th I.F. Trans.
T-107	S-9467	" - Blocking Osc. Trans.
T-108	S-9469	" - Vert. Out. Trans.
T-109	S-9415	" - Hor. Osc. Trans.
T-110	S-9395	" - H.V. Trans.
	S-9396	Unit - R.F. tuner
	S-9392	Beam Bender
	S-9505	Connector for H.V. Rect. tube
	S-9414	Connector for Anode
	S-9499	Deflection yoke
	S-9470	Focus Magnet

SPEAKER ASSEMBLY

S-5575	Cone & Voice Coil Assembly
S-9419	Speaker 4' P.M.

REPLACEMENT PARTS FOR MODEL 17T45

MISCELLANEOUS ASSEMBLIES

STOCK #	DESCRIPTION
S-9421	Back Cover Assembly
71457	Cord - Power cord
S-9410	Cushion - For kinescope mounting on yoke support
S-9486	Decals - (Wal-Mah)
S-9487	Decals - Blonde
S-9472	Fuse Holder
S-9502	Glass - Safety Glass
S-9471	Insulator - Stand-off
75461	Knob Assembly - Blonde (Fine Tuning)
S-9451	Knob Assembly - Blonde (Channel Selector)
75463	Knob Assembly - Blonde (Vertical Hold & Brightness)
75464	Knob Assembly - Blonde (Horizontal Hold & Contrast)
75503	Knob Assembly - Blonde (Volume & On-Off)
74959	Knob Assembly - Wal-Mah (Fine Tuning)
74962	Knob Assembly - Wal-Mah (Vertical Hold & Brightness)
74969	Knob Assembly - Wal-Mah (Volume & On-Off)
74963	Knob Assembly - Wal-Mah (Horizontal Hold & Contrast)
S-9450	Knob Assembly - Wal-Mah (Channel Selector)
S-9501	Mask - Kinescope
S-9475	Pad - For mounting focus magnet on kinescope neck.
S-9408	Pad - Support R.H. for kinescope
S-9409	Pad - Support L.H. for kinescope
S-9503	Panel - Metal Knob
S-9504	Plate - Channel Selector
74594	Plug - Male (P101)
S-9506	Shaft - for brightness control
S-9507	Shield for 12AU7
73584	Shield for 6AU6 & 6AL5
S-9397	Socket - Kine. Socket & Leads

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