TV-44 Series; MODELS TV-46, TV-47

SWEEP CHASSIS

TUBE	FUNCTION	OPERATING CONDITION	PLATE PIN NO.	PLATE VOLTS	SCREEN PIN NO.	SCREEN VOLTS	CATHODE PIN NO.	CATHODE VOLTS	CONTROL PIN NO.	GRID VOLTS	REMARKS
1/2 6SN7	Sync. Amp.	Min.Contrast	2	30	X	X	3	0	1	.25 V	At normal pix setting
		Max. "	2	30	X	X	3	0	1	-2.0	
6J5	Vert.osc. Disch.	Min. "	3	68	X	X	8	-110	5	-100	
		Max. "	3	58	X	X	8	-110	5	-100	"
6K6	Vert. output	Min. "	3	165	X	X	8	-80	5	-105	
		Max. "	3	165	X	X	8	-80	5	-100	"
6AL5	Horiz. sync. disch.	Min. "	7-2	-13	X	X	1 5	-2.2	X	X	
		Max. "	7-2	-13	X	X	1 5	-2.2	X	X	"
6K6GT	Horiz. osc.	Min. "	3	185	4	200	8	0	5	-28	
		Max. "	3	185	4	200	8	0	5	-28	"
6AC7	Horiz. Osc. Control	Min. "	8	250	6	110	5	.02	4	-2.0	
		Max. "	8	230	6	110	5	.02.	4	-2.2	"
1/2 6SN7	Horiz. Disch.	Min. "	5	-1.0	X	X	6	-100	4	-150	
		Max. "	5	-1.0	X	X	6	-100	4	-150	"
6BG6G	Horiz. output	Min. "	cap.	440	8	200	3	-95	5	-130	
		Max. "	cap.	440	8	200	3	-95	5	-130	"
6W4GT	Damper	Min. "	5	280	X	X	3	380	X	X	
		Max. "	5	280	X	X	3	380	X	X	"

POWER SUPPLY CHASSIS

TUBE	FUNCTION	OPERATING CONDITION	PLATE PIN NO.	PLATE VOLTS	SCREEN PIN NO.	SCREEN VOLTS	CATHODE PIN NO.	CATHODE VOLTS	CONTROL PIN NO.	GRID VOLTS	REMARKS
6V6GT	Audio Power Amp.	Min. "	3	270	4	285	8	11	5	0	
5U4G	Rect-ifier	Min. "	6 4	400 A.C.	X	X	8	310	X	X	
5U4G	Rect-ifier	Min. "	6 4	400 A.C.	X	X	8	310	X	X	

PICTURE TUBE

TUBE	FUNCTION	OPERATING CONDITION	PLATE PIN NO.	PLATE VOLTS	SCREEN PIN NO.	SCREEN VOLTS	CATHODE PIN NO.	CATHODE VOLTS	CONTROL PIN NO.	GRID VOLTS	REMARKS
16AP4	Picture tube	Min.Bright	Shell	13 KV.	10	350	11	150	2	0.6*	*Min.Contrast
		Max.	Shell	13 KV.	10	350	11	45	2	0.8*	*Min.Contrast
		Aver. "	Shell	13 KV.	10	350	11	25	2	0.8*	*Min.Contrast

Line - 117 V. 60 cps.
Tuner set to Channel #3 (no signal)
Voltages reed on RCA Voltohmyst between terminal indicated and chassis

TV-44 SERIES
Tuner Chassis
VOLTAGE CHART

TUBE	FUNCTION	OPERATING CONDITION	PLATE PIN NO.	PLATE VOLTS	SCREEN PIN NO.	SCREEN VOLTS	CATHODE PIN NO.	CATHODE VOLTS	CONTROL GRID PIN NO.	CONTROL GRID VOLTS	REMARKS
12AT7	R.F.	Min.Contrast	1-6	142	X	X	3-8	0	2-7	-12V	
		Max. "	1-6	110	X	X	3-8	0	2-7	-0.35*	Noise*
12AT7	Mixer	Min. "	1-6	140	X	X	3-8	0	2-7	-1.3 V	
		Max. "	1-6	103	X	X	3-8	0	2-7	-1.0 V	— — —
12AT7	Osc.	Min. "	1-6	140	X	X	3-8	0	2-7	-2.5 V	
		Max. "	1-6	125	X	X	3-8	0	2-7	-1.8 V	— — —
6BA6	1st Sound I.F.	Min. "	5	125	6	125	7	1.9	1	0	
		Max. "	5	105	6	105	7	1.5	1	0	— — —
6BA6	2nd Sound I.F.	Min. "	5	130	6	125	7	1.6	1	0	
		Max. "	5	110	6	105	7	1.3	1	0	— — —
6AU6	3rd Sound I.F.	Min. "	5	50	6	50	7	0	1	-0.2*	*noise
		Max. "	5	42	6	42	7	0	1	-0.2*	*noise
6T8	Ratio Det.	Min. "	2	-1.35*	X	X	3	-0.75*	X	X	*noise
		Max. "	2	-2.0 *	X	X	3	-1.2 *	X	X	*noise
	Aud. Amp.	Min. "	9	72	X	X	7	0	8	-1.0	
		Max. "	9	70	X	X	7	0	8	-1.0	— — —
6AU6	A.G.C.	Min. "	5	-22	6	270	7	145	1	145	
		Max. "	5	-0.7	6	265	7	120	1	115	— — —
6AG5	1st Video I.F.	Min. "	5	140	6	140	7	0	1	-19	
		Max. "	5	115	6	115	7	0.15	1	-1.5	— — —
6AG5	2nd video I.F.	Min. "	5	140	6	140	7	0	1	-19	
		Max. "	5	115	6	115	7	0.15	1	-1.9	— — —
6AG5	3rd video I.F.	Min. "	5	140	6	140	7	0	1	-18	
		Max. "	5	115	6	115	7	0.15	1	-2.0	— — —
6AG5	4th video I.F.	Min. "	5	100	6	140	7	1.15	1	0	
		Max. "	5	88	6	120	7	1.0	1	0	— — —
6AL5	Video Det.	Min. "	7	-0.3	X	X	1	X	X	X	
		Max. "	7	-3.5*	X	X	1	X	X	X	* noise
6AU6	1st video Amp.	Min. "	5	145	6	0	7	0	1	-0.3	
		Max. "	5	125	6	130	7	0	1	-3.5	— — —
6V6	2nd video Amp.	Min. "	3	210	4	245	8	0	5	-13.5	
		Max. "	3	210	4	245	8	0	5	-13.5	— — —
1/2 6SN7	Sync.Clipper DC Rest	Min. "	5	7.7	X	X	6	0.8*	4	0	*noise
		Max. "	5	6.6	X	X	6	3.7*	4	0	*noise
1/2 6SN7	Sync.Cathode Foll.	Min. "	2	150	X	X	3	13	1	7.7	
		Max. "	2	130	X	X	3	11	1	6.6	— — —

ELECTRICAL SPECIFICATIONS

POWER SUPPLY RATING
105-120 volts, 60 cycles, 300 watts

AUDIO POWER OUTPUT RATING
3.5 watts

LOUDSPEAKER
Type-12" electro magnetic dynamic
Voice Coil Impedance - 3.2 ohms at 400 cycles
Field Coil resistance - 62 ohms

RECEIVER ANTENNA INPUT IMPEDANCE
300 ohms balanced

TUBE COMPLEMENT
See Figure 1.

TUNING RANGE
Channels 2 - 6 (54-88 mc.)
Channels 7 - 13 (174-216 mc.)

PICTURE I.F. FREQUENCIES
Picture Carrier Frequency - 26.4 Mc.
Adjacent Channel Sound Trap - 27.9 Mc.
Accompanying Sound Traps - 21.9 Mc.
Adjacent Channel Picture Carrier Trap - 20.4 Mc.

SOUND I.F. FREQUENCIES
Sound Carrier Frequency - 21.9 Mc.
Sound Ratio Detector Band Width (between peaks) - 350 Kc.

VIDEO RESPONSE
To 4 Mc.

FOCUS AND DEFLECTION
Electromagnetic

OPERATING CONTROLS (Front Panel)
See Figure 1A

NON-OPERATING CONTROLS (See "Installation Instructions")
See Figure 1B

RECEIVER OPERATING INSTRUCTIONS

Refer to the OPERATING INSTRUCTIONS booklet for Model TV-44 Series.

DISCUSSION OF RECEIVER CIRCUITS

Consult the block diagram Figure 2 to understand the basic layout of the circuits. There are four separate units in this receiver: the R.F., I.F., Video Unit, the Sweep Unit, the Audio and Low Voltage Power Supply Unit and the Cathode Ray Tube.

FRONT END

The front end is a separate sub-chassis of the receiver. Mounted on this chassis are the RF amplifier, converter and oscillator, bandswitch, all RF and oscillator coils and the converter transformer. Referring to the schematic diagram, it will be noticed that there are three double triodes in the front end. One section of each triode is used for high band tuning, and the other section of each triode is used for low band tuning. The switching comprises a changeover in the B+ and antenna coils. The two bands are otherwise completely independent.

With the chassis inverted and the tuning dials facing the operator, all components on the left side of the front end are associated with the low band and all components associated with the high band are located on the right side WITH THE EXCEPTION OF THE LOW AND HIGH BAND ANTENNA COILS WHICH ARE INVERTED IN THEIR LOCATION. The antenna terminates in a band-pass transformer for the low or high band respectively and is switched to the proper transformer when the bandswitch is set to the desired band. The trimmer T3 adjusts the high band antenna coil. The low band antenna coil is not adjustable. Tuning in the plate circuit of the RF amplifier and grid circuit of the converter is accomplished through a band-pass transformer which is continuously tuned by means of the 3 gang variable condensers located on the top of the chassis directly above their respective coils. The low band interstage transformer is aligned by iron slug SB. The high band interstage transformer is aligned by iron slug SD and trimmers T4 and T5. The RF oscillators are of the tickler feedback type, tuned over the bands by means of the rear sections of the variable condensers. The low band oscillator is adjusted by brass slug SA and trimmer T2 and the high band oscillator by brass slug SC and trimmer T6. The converter plate circuit is common to the low and high band.

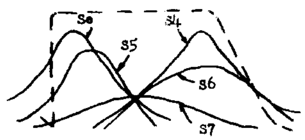
SOUND IF AMPLIFIER AND RATIO DETECTOR

The sound I.F. Carrier (21.9 mc.) is fed to the first sound I.F. amplifier. Three stages of amplification are used to provide adequate sensitivity. A conventional ratio detector is used to demodulate the signal. The ratio detector band width is approximately 350 kc. between peaks.

PICTURE I-F AMPLIFIER AND DETECTOR

To obtain the necessary wide band characteristic with adequate gain, four stages of i-f amplification are employed. The converter plate and each successive i-f transformer utilizes only one tuned circuit and each is tuned to a different frequency. The effective Q of each coil is fixed by the shunt plate load or grid resistor so that the response product of the total number of stages produces the desired overall response curve. Figure 3 shows the relative gains and selectivities of each coil and the shape of the curve of the quintiple combination.

Sharp cut off on overall response due to 21.9 mc sound traps.



The effects of the traps on the individual response curves are not shown.

FIG. 3 - Stagger Tuned I-F Response

In order to obtain this band pass characteristic, the picture i-f transformers are tuned as follows:

Converter transformer	22.45 mc.
First pix i-f transformer	25.95 mc.
Second pix i-f transformer	22.95 mc.
Third pix i-f coil	25.85 mc.
Fourth pix i-f coil	24.05 mc.

In such a stagger tuned system variations of individual i-f amplifier tube gain do not affect the shape of the overall i-f response curve if the Q and center frequency of the stages remain unchanged. This means that the i-f amplifier tubes are non-critical in replacement because variations in Gm do not affect response shape.

To align the i-f system, the transformers are peaked to the specified frequencies with a signal generator. The overall i-f response is then observed by use of a sweep generator and oscilloscope. Slight deviations from standard circuit Q are compensated for with slight shifts in transformer center frequency until the desired response curve is obtained. If this response cannot be obtained, the difficulty is likely to be in a location that affects either the frequency or Q of one or more of the i-f transformers.

The response curve does shift slightly as the picture control is varied due to the Miller effect. This effect is the change in the tube input capacitance as its gain is varied by grid bias changes. The change of input capacitance causes a slight detuning of the preceding i-f transformer and a small shift in response shape. This effect is slight, however, and when the receiver is aligned with the specified grid bias, no difficulty from this source should be encountered.

For familiarization with the frequencies which are important in the receiver's operation, Figure 4 shows the relative position of the picture and sound carriers for channels 2, 3 and 4. If a station on channel 3 is transmitting a picture with video frequencies up to 4 mc., the picture carrier will have side band frequencies up to 65.25 mc. The lower side bands are suppressed at the transmitter.

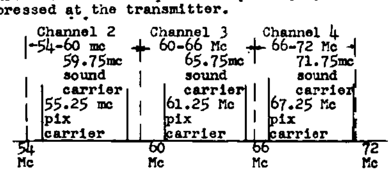


Fig. 4 - Television Channel Frequencies

With the receiver r-f oscillator operating at a higher frequency than the received channel, the i-f frequency relation of picture to sound carrier is reversed as shown in Figure 5.

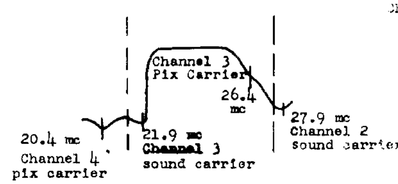


Fig. 5 - Overall Picture I.F. Response

TRAPS

Since it is necessary for the picture i-f to pass frequencies quite close to the sound carrier frequency, the sound carrier would produce interference in the picture. In order to prevent this interference, traps must be added to the picture i-f amplifier to attenuate the sound carrier. If the receiver should be operating on channel 3, it is possible that interference would be experienced from the channel 2 sound carrier and the channel 4 picture carrier. The adjacent channel traps are provided to attenuate these unwanted frequencies.

The first three traps are absorption circuits. The first trap is tuned to the accompanying sound i-f frequency, the second trap is tuned to the adjacent channel sound frequency, and the third trap tuned to the adjacent channel picture carrior frequency. The fourth trap is in the cathode circuit of the fourth picture i-f amplifier and is tuned to the accompanying sound carrier i-f frequency. The primary of the cathode trap assembly 279-43 in series with 80 mmf. forms a series resonant circuit at the frequency to which the fourth pix I.F. coil is tuned (24.05 mc.). This provides a low impedance in the cathode circuit at this frequency and permits the tube to operate with gain. However, at the resonant frequency of the secondary (21.9 mc.), a high impedance is reflected into the cathode circuit, and the gain of the tube for this frequency is reduced by degeneration. The rejection with this circuit is limited to the gain of the tube.

PICTURE SECOND DETECTOR

The detector is a conventional half wave rectifier connected to produce a video signal of the proper polarity.

VIDEO AMPLIFIER AND CONTRAST CONTROL

The function of this section of the receiver is to amplify the video output of the second detector. Two amplifier stages are employed. The gain from the first video grid to the grid of the cathode ray tube is 35 times and the frequency response extends to 4 mc.

To vary picture contrast, the gain of the first video amplifier is made adjustable by varying the screen grid voltage to the 6AU6 tube.

Due to the fact that an amplitude detector, such as the 6AL5 video detector in this receiver, is a non-linear device, a beat frequency appears in its output which is the resultant of the 21.9 mc. sound carrier frequency and the 26.4 mc. video carrier frequency. The resultant 4.5 mc. beat frequency is frequency modulated by the accompanying sound intelligence. If this signal is allowed to reach the grid of the cathode ray tube it produces a very undesirable cross-hatch effect in the picture. This is prevented by the insertion of a trap circuit in the plate of the second video amplifier which is carefully tuned to 4.5 mc.

KEYED AUTOMATIC GAIN CONTROL

The 6AU6 automatic gain control tube is direct coupled to the output of the 6AU6, first video amplifier which is, in turn, direct coupled to the output of the video detector. Both the cathode and control grid of this tube are returned to plus 135 volts, the screen grid is operated at plus 270 volts and the plate is returned to ground. A synchronized positive pulse voltage is inductively coupled from the width control by means of a pickup coil into the plate circuit of the automatic gain control tube. Due to these operating conditions, the tube can conduct only during these positive pulse intervals and cannot conduct between the keying pulses.

The video signal is fed to the control grid of this tube with the sync. pulses in the positive direction. Due to the fact that the keying pulses and the sync. pulses are in step, the tube will therefore conduct only during the sync. pulse interval and will not respond to noise pulses or other stray pulses that might occur between the normal sync. pulses. The plate current of this tube is therefore proportional to the amplitude of the sync. pulses, and results in a proportional negative D.C. voltage being developed across the R-C network in the plate circuit of this tube. The time constant of this network is such that slow changes in signal strength (up to approximately 200 cycles per second) will cause corresponding proportionate changes in the bias voltage being developed across it. The fact that this circuit will respond to changes in signal strength up to approximately 200 cycles per second is particularly useful in eliminating the effects of "airplane flutter" and other signal strength variations of a similar nature.

The total bias voltage thus developed is then used to control the gain of the first three I.F. amplifier stages and approximately half of the voltage developed is used as R.F. bias. The reduced R.F. bias allows greater R.F. gain and tends to overcome the effects of cross-modulation in the R.F. amplifier.

SYNC. CLIPPER - CATHODE FOLLOWER

The function of this system is to separate the synchronizing pulse from the composite video signal by clipping it and then, after amplification, applying it in proper polarity to the pulse and sawtooth generators.

The composite video signal is fed to the cathode of one half of a 6SN7 where the control grid is grounded. The operating voltages applied to the grid, plate and cathode are such that the positive portion of the applied signal is cut off. Thus, the video and blanking pulses are removed and only the negative sync. pulses appear in the plate circuit. Also, due to the extremely low plate voltage, noise pulses above the sync. level are compressed by the resulting limiting action of this stage and therefore the sync. to noise ratio is improved. The plate is then directly coupled to the grid of the second half of the 6SN7 which is connected as a cathode follower and which feeds the negative sync. pulses at low impedance into the connecting cable.

D.C. RESTORER

Since the video amplifier is an a-c amplifier, the d-c component of the video signal that represents the average illumination of the original scene will not be passed. Unless this d-c component is restored, difficulty will be experienced in maintaining proper scene illumination. For any given scene, this average illumination could be set properly by the brightness control, however, a change of scene would probably necessitate resetting this control. The d-c restorer accomplishes this setting automatically thus assuring proper picture illumination at all times.

D.C. restoration is accomplished in the grid-cathode circuit of the 1/2 6SN7 which acts as the sync. clipper. Due to rectification in this circuit a positive d-c voltage which is proportional to the average scene illumination appears in the cathode circuit and is applied to the grid of the cathode ray tube. Thus, the proper d-c component is maintained at all times.

SYNC. AMPLIFIER

The sync. amplfier tube is located on the sweep chassis. The sync. pulses from the cathode follower are negative in polarity and must be inverted before they can be injected into the sweep oscillators. The signal at the grid of this tube is sufficient to drive the tube beyond cut-off and the signal is again clipped. This final clipping removes all amplitude variations between sync. pulses due to noise, hum, etc., it is amplified and appears with correct polarity at the plate.

SWEEP UNIT

This unit, on a separate chassis, is located in the lower left corner of the cabinet.

VERTICAL OSCILLATOR DISCHARGE and OUTPUT

The function of these circuits is to provide a sawtooth of current of the proper frequency and phase to perform the vertical scanning for the Kinescope. To produce such a current in the vertical deflection coil, a somewhat differently shaped voltage wave is required.

Since the vertical trace is slow, requiring approximately 16,000 microseconds, and the vertical deflection coil inductance is small, approximately 50 millihenries, the majority of the voltage across the coil during trace is across its resistive component. In order to produce a linear change of current through a resistance, a linear change of voltage is necessary. Retrace, however, must be accomplished within the 666 microsecond vertical blanking time and therefore requires a much faster rate of change of current through the coil. During this time, the effect of its inductance becomes appreciable because of the required fast rate of change of current. It is therefore necessary to apply a large pulse of voltage across the coil in order to obtain rapid retrace. The composite waveform required to produce a sawtooth of current in the coil is a sawtooth of voltage with a sharp pulse as shown in Figure 6.

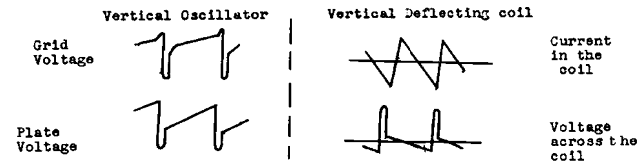


Fig. 6 - Vertical Sweep Waveforms

Vertical Oscillator and Discharge

A single 6J5 triode, with its associated components form a blocking oscillator and discharge circuit. The wave form of the voltage at the control grid of this tube with respect to time, is a small, positive surge followed by a large negative drop which returns to the positive condition at a relatively slow rate. During the negative part of the cycle, the grid is beyond cut-off and the .05 mf. discharge capacitor charges through the 220,000 ohm and 2.5 megohm resistors. When the grid reaches a voltage that permits plate to cathode conduction, the .05 mfd. capacitor discharges through the secondary of transformer 56-19 and the 6J5 tube. The discharge current builds up a magnetic field in the transformer that in turn induces a positive voltage at the grid of the 6J5. This positive voltage on the grid lowers the plate resistance of the tube and allows the condenser to discharge more rapidly. This process builds up very rapidly until the condenser is nearly discharged. The magnetic field in the transformer then collapses and drives the grid negative. As the charge on the 6,000 mmf. grid condenser leaks off, the grid slowly becomes less negative and approaches the point which will allow plate to cathode conduction. Just before the conduction point is reached, the 60 cycle vertical synchronizing pulse from the integrating network is applied to the 6J5 grid. This pulse is sufficient to drive the tube to conduction and the process is repeated. In this manner, the incoming sync. maintains control of vertical scanning.

On the plate of the 6J5, a sawtooth of voltage appears due to the slow charging and rapid discharging of the .05 mf. capacitor. A sharp negative pulse also occurs during the discharge period (See Figure 6). This pulse appears because of the action of the condenser and the 3,200 resistor, an action which is known as peaking. When the 6J5 is conducting, the plate voltage drops nearly to cathode potential. The .05 mf. capacitor discharges during this time. However, since the conduction time is short, it cannot be completely discharged due to the time constant of the 8200 ohms in series with it. When the 6J5 becomes non-conducting, the plate voltage does not have to rise slowly from cathode potential but instead rises immediately to an appreciable value due to the charge that remains on the condenser. Adjustment of the height control varies the amplitude of the sawtooth voltage on the plate by controlling the rate at which the capacitor can charge.

The voltage present on the 6J5 plate is of the shape required to produce a sawtooth of current in the vertical deflection coil. It is now necessary to amplify it in a tube capable of supplying a sufficient amount of power.

Vertical Output

A 6K6GT is connected as a triode for the output stage. The vertical output transformer matches the resistance of the vertical deflection coils to the plate impedance of the 6K6GT. A variable cathode resistor is provided as a vertical sweep linearity control. Since the grid control characteristic curve of the 6K6GT is not a straight line over its entire range the effect of adjustments of the vertical linearity control is to produce slight variations in shape of the sawtooth by shifting the operating point of the tube to different points along the curve.

Since the slope of the curve varies at these different points and thus varies the effective gain of the tube, it is apparent that adjustments must be accompanied by readjustments of the height control. Adjustments of the height control affect the shape of the sawtooth voltage so that adjustments of height must be accompanied by readjustments of linearity.

Horizontal Oscillator

The horizontal oscillator is an extremely stable Hartley oscillator operating at the scanning frequency 15,750 cps. The primary of transformer 279-42 (terminals A, B and C) is the oscillator coil. This coil is closely coupled to the secondary winding (terminals D, E and F) and thus feeds a sine wave voltage to the 6AL5 sync. discriminator.

HORIZONTAL SYNC DISCRIMINATOR

The sync. disriminator is a 6AL5 dual diode in a circuit which produces a d-c output voltage proportional to the phase displacement between two input voltages.

The sine wave oscillator voltages applied to the plates of the 6AL5 are equal in amplitude and opposite in phase. The synchronizing pulses from the second sync. amplifier are fed through a differentiating network to attenuate the vertical sync. and then applied to the center tap of 279-42. When the pulse and sine wave are properly phased as in Fig. 7(a), both diodes will produce equal voltage across their load resistances. However, these voltages are of opposing polarity and therefore the sum of the voltages across these two load resistors will be zero. If the phase of the pulse changes with respect to the sine wave as in Fig. 7(b), the top diode will produce more voltage across its load resistor than the bottom diode produces. Thus, the voltage across the two will be positive. In Fig. 7(c), the reverse condition exists. It is obvious that the output of the discriminator can swing from positive through zero to negative dependent upon the phase relation of the synchronizing signal and the oscillator. This d-c output is applied to the grid of the 6AC7 control tube.

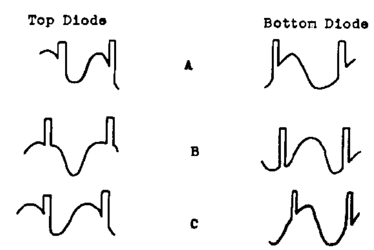


Fig. 7 - Sync. Discriminator Waveforms

HORIZONTAL OSCILLATOR CONTROL

The oscillator control is a 6AC7 connected as a reactance tube across the oscillator coil. A change in the d-c output of the discriminator produces a change in Gm of the 6AC7 which in turn changes the frequency of the oscillator. If the phase of the oscillator shifts with respect to the synchronizing pulse, the corresponding change in d-c from the discriminator brings the oscillator back into correct phase.

HORIZONTAL DISCHARGE, OUTPUT AND REACTION SCANNING

The purpose of these circuits is to produce a sawtooth of current in the deflection coils to provide horizontal scanning for the picture tube.

Horizontal Discharge

One-half of a 6SN7GT is employed for the discharge tube. The function of this stage is to produce a peaked sawtooth voltage for use in the horizontal sweep circuits.

The oscillation in the 6K6GT takes place between screen-grid and cathode. Since the peak to peak voltage on its grid is approximately 130 volts, a square wave is produced on its plate. This wave is differentiated, and the pulse so obtained is applied to the grid of the discharge tube.

The discharge tube is normally cut off due to bias produced by grid rectification of these incoming pulses. The pulse from the 6K6GT overcomes this bias and drives the tube into heavy momentary conduction. During this period the plate voltage falls nearly to cathode potential and the plate circuit condenser discharges rapidly. However, since the period of conduction is quite short, it is not completely discharged due to the time constant introduced by the plate loads. Then when the discharge tube again becomes non-conducting, the plate voltage rises quickly to a value determined by the charge remaining on the condenser. From this point the plate voltage rises slowly and approximately linearly.

Horizontal Output and Reaction Scanning

The operation of these two circuits is so interconnected that it will be necessary to discuss them simultaneously. The function of the output tube, 6BG6G, is to supply sufficient current of the proper wave form to the horizontal deflection coil in order to provide horizontal scanning for the cathode ray tube. The function of the reaction scanning tube 6W4GT, is to stop oscillation of certain components at certain times and thus help provide a linear trace. The reaction scanning 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 8 millihenries, at the horizontal scanning frequency, the reactance of the coil predominates over its resistance. 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 10 microseconds in duration. During this time, the cathode ray tube beam must be returned to the left side of the tube, the trace started and made linear. In order that all this be accomplished within the horizontal blanking time, only 7 microseconds can be allowed for the return trace. In order to obtain such rapid retrace, the horizontal deflection coil, output 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 7 microsecond retrace time limit.

During the latter part of the horizontal trace, the output tube conducts very heavily and builds up a strong magnetic field in the deflection coil and output transformer. When the negative pulse from the horizontal tube is applied to the output tube grid, its plate current is suddenly cut off and the magnetic field in the transformer and deflection coil begins to collapse at a rate determined by the resonant frequency of the system. Actually the system is shock excited into oscillation. Since the output tube is cut off and since the voltage generated by the collapsing field is negative on the reaction scanning tube plate so that it is non-conductive, there is essentially no load on the circuit and it oscillates vigorously for one half cycle. If the reaction scanning tube were not present, the circuit would continue to oscillate. This condition, however, is not permitted. One half cycle of oscillation is permitted because at the end of such a 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 the direction of flow of current was the requirement for retrace and it was accomplished in the allotted 7 microseconds.

Now that retrace has been completed, it is necessary to start the next trace. The energy which was placed in the deflection coil by the output tube in the later part of the last trace has not been dissipated. During the one-half cycle of oscillation, 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.

As mentioned previously, if the coil were not damped, it would continue to oscillate at its natural frequency. To prevent such an oscillation the reaction scanning tube is brought into action. This tube is a modified damper circuit which is effectively connected across the deflecting coil.

In the oscillating circuit, the current in the deflection coil lags the voltage by approximately 90 degrees and when the current has reached its maximum negative value, the voltage across the coil being 90 degrees ahead, has begun to swing positive. When the voltage on the reaction scanning tube plate becomes positive with respect to its cathode, it begins to conduct heavily. This places such a load across the deflection coil that it cannot oscillate. Instead the field begins to decay at a rate permitted by the load which the reaction scanning tube placed 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 were fed into the coil, the field would fall to zero and the cathode ray tube beam would come to rest in the center of the tube. In such an r-l circuit, as the current approaches its final value, it does not do so linearly. It is therefore necessary to have the output tube begin to supply power to the deflection coil before the energy in the coil is completely dissipated. Figure 8 shows the shape of the current supplied by the output tube. Although the currents supplied by the output tube and by the decaying field are curved at the cross-over point, together they produce a coil current that is linear.

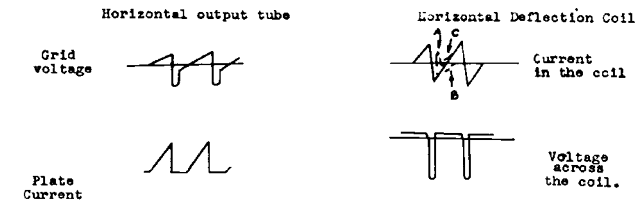


Fig. 8 - Horizontal Sweep Waveforms

By the time the beam has reached the right side of the raster, the output tube is conducting heavily and has built up a strong field in the transformer and coil. At this point, the output tube is again suddenly cut off and the process is repeated.

The 6BG6G plate voltage is supplied through the 6W4GT which is conducting over the major portion of the trace. The .1 mf. and .15 mf. capacitors connected to the horizontal linearity control are charged during this period and this charge is sufficient to supply the 6BG6G plate when the 6W4GT is not conducting.

The charge is placed on these capacitors by the receiver d-c supply and by the current from the collapse of the field in the horizontal deflecting coil. The a-c axis of the sweep voltage is 270 volts above ground since

the horizontal output transformer secondary is connected to the receiver 270 volt bus. The charge placed on these capacitors by the coil kick-back is therefore in addition to that from the d-c supply and thus the capacitors are charged to a voltage greater than the d-c supply. This permits operation of the 6BG6G at a higher voltage than is obtainable from the receiver power supply and produces an increase in the system efficiency by salvaging energy that would otherwise have been wasted.

During the trace period, the voltage across the .1 mf. capacitor connected to the linearity control varies due to the charging by the deflection coil kick-back and discharging through the output tube. This rise and fall of voltage constitutes an a-c "ripple" in the plate supply of the output tube. By shifting the phase of this ripple with respect to the tube plate current requirements, slight variations of plate characteristics are obtained. The linearity control and condensers constitute a phase shifting network. The inductance is variable and is provided to effect small improvements in linearity. Counter-clockwise rotation of the adjustment screw causes the second quarter of the picture to stretch and the first quarter to crowd.

The horizontal drive control determines the ratio of high peaking and sawtooth voltage on the grid of the output tube and thus affects the point on the trace at which the tube conducts. Clockwise rotation of control increases picture width, crowds the right side of the picture and stretches the left side.

The width control is provided to vary the output and hence the picture width by shunting a portion of the secondary winding of the output transformer.

Clockwise rotation of the adjustment increases the picture width and causes the right side of the picture to stretch slightly. In order to protect the horizontal output transformer in the event of 6BG6G tube failure, the plate supply lead to this tube has been fused with a type 3AG 1/4 Amp. slo-blo fuse. It is important that only type of fuse be used for replacement purposes.

H.V. POWER SUPPLY

The high voltage power supply is a "kick-back" type where the power is obtained from the energy stored in the deflection inductances during each horizontal scan. When the 6BG6G plate current is cut off by the incoming signal, a positive pulse appears on the primary of the horizontal output transformer due to the collapsing field in the deflection coil. This pulse of voltage is stepped up, rectified and filtered in a voltage doubler type of supply and applied to the second anode of the picture tube. 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.

LOW VOLTAGE POWER SUPPLY

The low voltage power supply is on a separate chassis which also contains the output stage of the audio amplifier. This power supply provides the filament and plate voltages for the RF, IF video unit and for the sweep chassis. The supply is conventional and employs two 5U4G rectifier tubes in parallel to supply 380 volts d-c at approximately 350 ma. The speaker field is used as a filter choke for this supply.

ALIGNMENT PROCEDURE

TEST EQUIPMENT

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

R-F Sweep Generator meeting the following requirements:

(a) Frequency Ranges

18 to 30 mc., 10 mc. sweep width
40 to 90 mc., 10 mc. sweep width
170 to 225 mc., 10 mc. sweep width

(b) Output adjustable with at least 1 volt maximum
(c) Output constant on all ranges and on all attenuator positions.

Cathode-Ray Oscilloscope, preferably one with a wide band vertical deflection, an input calibrating source, and a low capacity probe.

Signal Generator to provide the following frequencies:

(a) I-F Frequencies

4.5 Mc. F.M. trap
20.4 Mc. adjacent channel picture trap
21.9 Mc. sound i-f and sound traps
22.45 Mc. converter transformer
22.95 Mc. second picture i-f transformer
24.05 Mc. fourth picture i-f coil
25.85 Mc. third picture i-f coil
25.95 Mc. first picture i-f transformer
26.4 Mc. picture carrier
27.9 Mc. adjacent channel sound trap

(b) R-F frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

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

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

Electronic Voltmeter of Junior VoltOhmyst type.

ADJUSTMENTS REQUIRED (Refer to Figure 1 for location of alignement adjustments)

Front end - Normally only the RF oscillator coils will require the attention of the service technician. All other circuits are very broad and will therefore only rarely require readjustment. If a realignment should be needed only those thoroughly familiar with very high frequencies and sweep generators should attempt it. In this case, write for further information. The oscillator coil adjustments are critical and may be affected by a tube change. Low band, as well as high band oscillator, are aligned by a trimmer and padder like a normal AM receiver.

(A.) Low band
Switch band selector to the low band, engage variable condenser completely. Then, tune slug SA until the frequency of the oscillator equals 80.5 Mc. Disengage variable condenser completely and adjust trimmer T2 for an oscillator frequency of 110.5 Mc. Repeat this procedure several times to check accuracy.

(B.) High band
Throw the band selector switch to high band. Engage the variable condenser fully and adjust slug Sc until the oscillator frequency equals 200.5 Mc. Disengage condenser completely and adjust trimmer T6 to an oscillator frequency of 239.5 Mc. Repeat procedure several times.

The detailed alignment procedure which follows is intended primarily as a discussion of the method used, precautions to be taken and the reasons for these precautions. Then, for more convenient reference during alignment, a tabulation of the method is given. All the information necessary for alignment is given in the table. However, alignment by a table should not be attempted before reading the detailed instructions.

ORDER OF ALIGNMENT

When a complete receiver alignment is necessary, it can be most conveniently performer in the following order:-

Picture i-f traps
Picture i-f transformers
Sound ratio detector
Sound I-f transformers
R-F oscillator
R-F and converter
Retouch picture i-f transformers
4.5 mc. F.M. trap
Sensitivity check

PICTURE I-F TRAP ADJUSTMENT

Set the voltage on the i-f bias bus to approximately -3 volts by removing the 6AU6 A.G.C. tube and connecting a 3 volt battery with negative terminal to the point marked R in the schematic and with its positive terminal to ground.

Connect the VoltOhymst across the picture second detector load resitor at Point S.

Connect the output of the signal generator to the receiver antenna terminals

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

20.4 mc. - 273-131 (S1 - top)
21.9 mc. - 273-134 (Sf - bottom)
21.9 mc. - 279-43 (S2 - top)
27.9 mc. - 273-130 (S3 - top)

PICTURE I-F TRANSFORMER ADJUSTMENTS

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the VoltOhmyst.

22.45 mc.- Se (top)
25.95 mc. - S4 (bottom)
22.95 mc. -S5 (bottom)
25.85 mc. - S6 (top)
24.05 mc. - S7 (top)

If S5 (bottom) required adjustment, it will be necessary to reset S1 (top) for minimum response at 20.4 mc.

Picture I-F Oscillation

If the receiver is badly misaligned and two or more of the i-f transformers are tuned to the same frequency, the receiver may fall into i-f oscillation. I-F oscillation shows up as a voltage in excess of 3 volts at the picture detector load resistor. This voltage is unaffected by r-f signal input and sometimes is independent of picture control setting.

If such a condition is encountered, it is sometimes possible to stop oscillation by adjusting the transformers approximately to frequency by setting the adjustment stud extensions to be approximately equal to those of another receiver known to be in proper alignment. If this does not have the desired effect, it may now be possible to stop oscillation by increasing the grid bias with the bias battery. If so, it should then be possible to align the transformers by the usual method. Once aligned in this matter, the i-f should be stable with reduced bias.

If the oscillation cannot be stopped in the above manner, shunt the grids of the first three i-f amplifiers to ground with 1,000 mmf. capacitors.

Connect the signal generator to the fourth i-f grid and adjust S7 to frequency.

Remove the shunting capacitor from the third i-f grid, connect the signal generator to this grid and align S6.

Remove the shunting capacitor from the second i-f grid, connect the signal generator and align S5.

Remove the shunt from the first i-f grid, connect the signal generator to the receiver antenna terminals, and align S4 and Se (top) to frequency.

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

SOUND RATIO DETECTOR ALIGNMENT

Set the signal generator for approximately 1 volt output at 21.9 mc. and connect it to the third sound i-f grid.

Set the VoltOhmyst on the 10 volt scale.

Connect the meter in series with a one megohm resistor between Point F and ground (see schematic diagram).

Adjust the primary S6 (bottom) for maximum output on the meter.

Connect the VoltOhmyst to Points P and Q with balancing resistors as indicated in the schematic diagram.

Adjust S9 secondary (top). It will be found that it is possible to produce a positive or negative voltage on the meter dependent upon this adjustment. Obviously to pass from a positive to a negative voltage, the voltage must go through zero. S9 (top) should be adjusted so that the meter indicates zero output as the voltage swings from positive to negative. This point will be called ratio detector zero output.

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

Adjust the sweep band width to approximately 1 mc. with the center frequency 21.9 and with an output of approximately 1 volt.

Connect the oscilloscope to Point Q.

The pattern obtained should be similar to that shown in Figure 9A. If it is not, adjust the S8 (bottom) until the wave form is symmetrical.

The peak to peak bandwidth of the ratio detector should be approximately 350 kc. and it should be linear from 21.825 mc. to 21.975 mc.

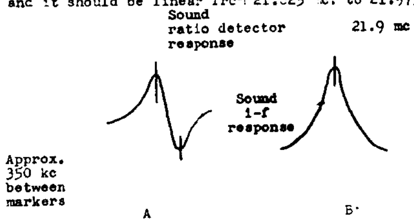


Fig. 9 - Sound Ratio Detector and I.F. Response

SOUND I-F ALIGNMENT

Connect the sweep oscillator to the second sound i-f amplifier grid. Connect the oscilloscope to the third sound i-f grid return in series with a 33,000 ohm isolating resistor.

Insert a 21.9 mc. marker signal from the signal generator into the second sound i-f grid.

Adjust S10 (top) and S11 (bottom) for maximum gain and symmetry about the 21.9 mc. marker. The pattern obtained should be similar to that shown in Figure 9B.

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

Connect the sweep and signal generator to antenna terminals.

Adjust S12 (top) and S13 (bottom), for maximum gain and symmetry at 21.9 mc.

Reduce the sweep output for the final adjustments so that approximately .3 volt peak-to-peak is present at the third sound i-f grid return. The band width at 70% response from the first sound i-f grid to the third i-f grid should be approximately 200 kc.

RETOUCHING OF PICTURE I-F ADJUSTMENTS

The picture i-f response curve varies somewhat with change of bias and for this reason it should be aligned with approximately the same signal input as it will receive in operation.

If the receiver is located at the edge of the service area, it should be aligned with a bias of about -1.5 volts. However, for normal conditions, (signals of 800 microvolts or greater), it is recommended that the picture i-f be aligned with a grid bias of -3 volts.

Connect the sweep generator to the receiver antenna terminals.

Connect the signal generator to the antenna terminals and feed in the 26.4 mc i-f picture carrier marker and a 22.95 mc. marker.

Connect the oscilloscope across the picture detector load resistor.

Set the i-f grid bias to -3 volts.

Set the sweep output to produce approximately .3 volt peak-to-peak across the picture detector load resistor.

Observe and analyze the response curve obtained. The response will not be ideal and the i-f adjustments must be retouched in order to obtain the desired curve. See Figure 10.

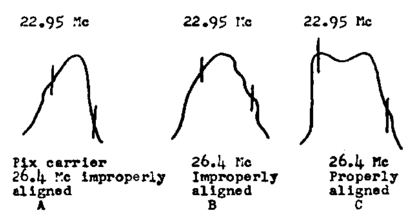


Figure 10 - Overall Response

If for example as in Figure 10A the response is peaked in the middle, and the picture carrier is low on the response curve slope, then the high Q transformer 273-130, (which is peaked at 25.95 mc. - near the picture carrier 26.4 mc.), should be retouched to bring the picture carrier response up to approximately 40%.

It will then probably be found that the response is generally high on the low frequency end of the curve as in Figure 10b. If this is the case, adjust S6, (25.85 mc. and fairly broad), to bring the high frequency end response up. The picture carrier is thus brought still further up the slope and an approximately flat topped response curve is obtained as in Figure 10C.

If S5 (bottom) required any adjustment, it will be necessary to reset S1 (top) for minimum response at 20.4 mc.

On final adjustment the picture carrier marker must be at approximately 60% response. The curve must be approximately flat topped and with the 22.95 mc. marker at approximately 100% response.

The most important consideration in making the i-f adjustments is to get the picture carrier at the 60% response point. If the picture carrier operates too low on the response curve, loss of low frequency video response, of picture brilliance, of blanking, and of sync may occur. If the picture carrier operates too high on the response curve, the picture definition is impaired by loss of high frequency video response.

The above example is used to show the line of reasoning involved in making the retouching adjustments. Since there are five transformers each aligned to a different frequency, it is obvious that many different conditions can exist, however, similar reasoning will apply to each case. With some experience in making these adjustments, it will be found that the desired response can be readily obtained. In making these adjustments, care should be taken that no two transformers are tuned to the same frequency as i-f oscillation may result.

ALIGNMENT OF 4.5 MC TRAP

Connect the receiver to an antenna and tune in a local television station. Connect wide band oscilloscope to grid of cathode ray tube and adjust sweep frequency so that one or two fields of the composite video signal appear on the screen. If trap is adjusted properly, the blanking pedestals and sync. pulses will appear sharply defined. On the other hand, if a 4.5 mc component is present, the pedestals and pulses will appear blurred and not sharply defined.

Adjust the 4.5 mc trap for a minimum of the above described blurring and therefore maximum sharpness of the trace of the composite video signal.

An alternate method, just as effective but slightly more difficult is done directly on the air without the use of an oscilloscope. Tune in a local television station with a full definition test pattern. The trap may now be adjusted for minimum 4.5 mc interference in this test pattern.

Care must be observed in using this method because improper adjustment of the trap will cause loss of picture definition. The point where minimum interference without loss of definition occurs is the proper setting of the 4.5 mc. trap.

SENSITIVITY CHECK

A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through an attenuator pad of the type shown in Figure 11. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is as the maximum clockwise position.

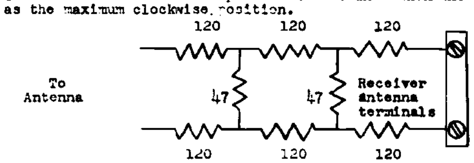


Fig. 11 - Attenuator Pad

Only the carbon type resistors should be used to construct the attenuator pad. Since many of the low value moulded resistors generally available are of wire wound construction, it is advisable to break and examine one of each type of resistor used in order to determine its construction.

RESPONSE CURVES

The response curves shown in Fig. 9 and 10 are referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

STEP NO.	CONNECT SIGNAL GEN. TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GEN. TO	SWEEP GEN. FREQ. MC.	CONNECT SCOPE TO	CONNECT "VOLT-OHMYST" TO	MISC. CONN. AND INST.	ADJUST	REFER TO
PICTURE I-F AND TRAP ADJUSTMENT									
1	Not used		Not used		Not used	Point R	Remove 6AU6-AGC tube	External bias supply for -3 volts on meter	Fig. 1 Fig. 12
2	Antenna terminal	20.4	"		"	Point S	Meter on 3 volt scale	S1 (top) for min. on meter	"
3	"	21.9	"		"	"	"	Sf (bottom) for min.	"
4	"	21.9	"		"	"	"	S2 (top) for min.	"
5	"	27.9	"		"	"	"	S3 (top) for min.	"
6	"	22.45	"		"	"	"	Se (top) for max.	"
7	"	25.95	"		"	"	"	S4 (bottom) for max.	"
8	"	22.95	"		"	"	"	S5 (bottom) for max.	"
9	"	25.85	"		"	"	"	S6 (top chassis) for max.	"
10	"	24.05	"		"	"	"	S7 (top chassis) for max.	"
11	If S5(bottom) required adjustment in step 8, repeat step 2.								

RATIO DETECTOR AND SOUND I-F ALIGNMENT

STEP NO.	CONNECT SIGNAL GEN. TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GEN. TO	SWEEP GEN. FREQ. MC.	CONNECT SCOPE TO	CONNECT "VOLT-OHMYST" TO	MISC. CONN. AND INST.	ADJUST	REFER TO
12	3rd sound i-f grid (pin 1)	21.9 1 volt output	not used		Not used	In series with 1 meg. to Point P		Adjust S8 (bottom) for max. on meter	Fig. 1 Fig. 12
13	"	"	"		"	As indicated on schematic diagram for detector alignment	Meter on 3 volt scale	S9 (top) for zero on meter	Fig. 1 Fig. 12
14	"	"	3rd sound i-f grid (pin 1)	21.9 center 1 mc. wide 1 v. out	Point Q	Not used	Check for symmetrical response waveform (positive & negative). If not equal adjust S8 (bottom) until they are equal.		Fig. 1 Fig. 12 Fig. 9A
15	2nd sound i-f grid (pin 1)	21.9 reduced output	2nd sound i-f grid	21.9 reduced output	Terminal A, in series with 33,000 ohms 2nd I-F transformer	"	Sweep output reduced to provide .3 V. p-to-p on scope	S10 (top) and S12 (bottom) for max. gain and symmetry at 21.9 mc.	Fig. 1 Fig. 9B Fig. 12
16	Ant.	21.9 reduced output	Ant.	21.9 reduced output	"	"	"	S12 (top) and S13 (bottom) for max. gain & symmetry at 21.9 mc.	Fig. 1 Fig. 9B Fig. 12

RETOUCHING PICTURE I-F TRANSFORMERS

STEP NO.	CONNECT SIGNAL GEN. TO	SIGNAL GEN. FREQ. MC.	CONNECT HET. FREQ. METER TO	HET. METER FREQ. MC.	CONNECT SCOPE TO	CONNECT "VOLT-OHMYST" TO	MISC. CONN. AND INST.	ADJUST	REFER TO
17			Not used		Not used	Point R	Receiver & Sweep on same channel	Adjust bias for -3 volts on meter	Fig. 1 Fig.12
18	Antenna terminals (loosely)	22.65 26.4	"		Junction Point 8	Not used	Retouch pix i-f adjustments. (Se, S4, S5, S6, & S7) as necessary to provide proper response		Fig. 1 Fig. 10 Fig. 12
19	If S5 (bottom) was adjusted in step 18, repeat step 2 and step 18								
R.F. OSCILLATOR ALIGNMENT									
20	Not used		Loosely coupled to oscillator	80.5 mc.	Not used	Not used	Band-switch to "low" -Gang closed	Tune Sa for zero beat	Fig. 1 Fig. 12
21	"		"	110.5 mc.	"	"	Band-switch to "low" -Gang open	Tune T2 for zero beat	"
22	Repeat steps 20 and 21 several times to check accuracy								
23	"		"	200.5 mc.	"	"	Band-switch to "High" -Gang closed	Tune Sc for zero beat	"
24	"		"	239.5 mc.	"	"	Band-switch to "High" -Gang open	Tune T6 for zero beat	"
25	Repeat steps 23 and 24 several times to check accuracy.								
4.5 Mc. TRAP ADJUSTMENT									
26	See text under "Alignment of 4.5 mc. trap								
SENSITIVITY CHECK									
27	Connect antenna to receiver through attenuator pad to provide weak signal. Compare picture & sound obtained to that obtained on other receivers under the same conditions.								

INSTALLATION INSTRUCTIONS

Preparation for Use

Each receiver is completely tested and aligned at the factory. When the TV-44 series receiver is unpacked and all packing material has been removed, the receiver is then ready for installation adjustments.

All servicing and installation procedures for these receivers may be performed from the front of the receiver comfortably and without additional equipment or assistance. To open front of cabinet for installation or service proceed as follows:-

1. Remove 2 wood screws in upper corners of speaker panel directly below horizontal cross-bar. (See sketch on back of receiver).
2. Remove speaker panel by pulling it outward and then upward out of the grooved channel at its bottom.
3. The speaker cable is long enough to permit laying the speaker and panel on the floor in front of and to one side of the cabinet without disconnecting it.

The above procedure is sufficient for all installation adjustments or service to all chassis except the tuner. To service the tuner chassis, it will be necessary to remove the top panel. To do so, proceed as follows:-

1. Remove the wood screws from the upper right hand panel.
2. Remove all knobs and felts.
3. Pull panel outward.
4. Tuner chassis may be slid out of cabinet on slide tracks by removing locking plate at top of chassis.

INSTALLATION ADJUSTMENTS

1. Connect proper antenna to terminals at rear of cabinet.
2. Remove speaker panel as described above.
3. Connect power cord to suitable outlet, turn set ON, and tune in station as outlined in "Operating Instructions".
4. Check electrical adjustments on sweep chassis as outlined in the following:

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 turning the picture control fully counter-clockwise and then returning it to the operating position. Normally the picture will pull into sync.

Turn the horizontal hold control to the extreme clockwise position. The picture should remain in sync. Momentarily remove the signal. Again the picture should normally pull into sync.

Rotate vertical hold control from one extreme to the other. The picture should remain steady in interlace and free of jitter at any setting of this control.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator".

ALIGNMENT OF HORIZONTAL OSCILLATOR

If in the above check the receiver failed to hold sync with the hold control at either extreme or failed to pull into sync after momentary removals of the signal, make the adjustments under "Slight Retouching Adjustments". If, after making these retouching adjustments, the receiver fails to pass the above checks or if the horizontal oscillator is completely out of adjustment, then make the adjustments under "Complete Realignment".

Slight Retouching Adjustments - Tune in a Television Station and adjust the tuning control for best sound quality. Adjust the picture control for slightly less than normal contrast. Turn the horizontal hold control to the extreme position in which the oscillator fails to hold or to pull in. Momentarily remove the signal. Turn the S15 frequency adjustment until the oscillator pulls into sync. Check hold and pull-in for the other extreme position of the hold control.

Complete Realignment - Tune in a Television Station and adjust the tuning control for best sound quality. Turn the S15 frequency adjustment (See Fig. 1), until the picture is synchronized. (If the picture is not synchronized vertically, adjust the vertical hold.) Adjust the picture control so that the picture is somewhat below average contrast level.

Turn the S14 phase adjustment screw until the blanking bar, which may appear in the picture, moves to the right and off the raster.

Turn horizontal hold control to extreme counter-clockwise position. Turn S15 frequency adjustment clockwise until the picture falls out of sync. Then turn it slowly counter-clockwise to the point where the picture falls in sync. again.

Set horizontal hold control at approximate center of rotation. Readjust S14 phase adjustment so that the blanked area at the right side of the picture is approximately 1/4" wide.

Rotate the vertical hold control from one extreme to the other. The picture should remain steady, in interlace and free of jitter at any setting of this control. If this does not occur, carefully move S14 phase adjustment very slightly either clockwise or counter-clockwise until it does.

Momentarily remove the signal. When the signal is restored, the picture should fall in sync. Repeat this operation at both ends of rotation of the horizontal hold control. In each case, when the signal is restored, the picture should fall in sync. If picture does not fall in sync. under all conditions, very carefully touch-up S15 frequency adjustment until above conditions are satisfied.

Recheck S14 phase adjustment as outlined above.

NOTE: If the picture does not pull in sync. after momentary removals of signal in both extreme positions of horizontal hold, the pull-in range may be inadequate, though not necessarily. A pull-in through 3/4 of the hold control range may still be satisfactory.

There is a difference between the pull-in range and a hold-in range of frequencies. Once in sync, the circuit will hold about 50% to 100% more variation in frequency than it can pull in. The range of the horizontal hold control is only approximately equal to the pull-in range, considerable variation may be found due to variations in the cut-off characteristic of the horizontal oscillator control tubes. Excessive pull-in is objectionable

because the higher sensitivity of the control circuits means also greater susceptibility to noise, and to the vertical sync and equalizing pulses which tend to cause a bend in the upper part of the raster.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS (See Figure 1)

Adjust the height control until the picture fills the screen vertically. Adjust vertical linearity until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust vertical centering to align the picture with the screen.

WIDTH AND HORIZONTAL LINEARITY ADJUSTMENTS (See Figure 1)

Turn the horizontal drive clockwise as far as possible without causing crowding of the right of the picture. Adjust the width control until the picture just fills the screen horizontally. Adjust the horizontal linearity control until the test pattern is symmetrical left to right. A slight readjustment of the horizontal drive control may be necessary when the linearity control is used. Adjust horizontal centering to align the picture with the screen.

RECEIVER LOCATION

The owner should be advised of the importance of placing the receiver in the proper location in the room.

The location should be chosen -

Away from bright windows and so that no bright light will fall directly on the screen. (Some illumination in the room is desirable, however.)

To give easy access for operation and comfortable viewing.

To permit convenient connection to the antenna.

Convenient to an electrical outlet.

To allow adequate ventilation.

VENTILATION CAUTION

The receiver is provided with adequate ventilation holes in the back of the cabinet. Care should be taken not to allow these holes to be covered or ventilation impeded in any way.

ANTENNAS

The finest television receiver built may be said to be only as good as the antenna design and installation. It is therefore important to use a correctly designed antenna, and use care in its installation.

In most cases, the antenna should not be installed permanently until the quality of the picture reception has been observed on a television receiver. A temporary transmission line can be run between receiver and the antenna, allowing sufficient slack to permit moving the antenna. Then, with a telephone system connecting an observer at the receiver and an assistant to the antenna, the antenna can be positioned to give the most satisfactory results on the received signal. A shift of direction or a few feet in antenna position may effect a tremendous difference in picture reception.

REFLECTIONS

If reflections are encountered, it may be possible to eliminate them by rotation of the antenna.

Occasionally reflections may occur that are not noticeable as reflections but that will cause a loss of definition in the picture.

Under certain extremely unusual conditions, it may be possible to rotate or position the antenna so it receives the cleanest picture over a reflected path. If such is the case, the antenna should be so positioned. However, such a position may give variable results as the nature of reflecting surfaces may vary with weather conditions. Wet surfaces have been known to have different reflecting characteristics than dry surfaces.

INTERFERENCE

Auto ignition, street cars, electrical machinery and diathermy apparatus may cause noise interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least 1/4 wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

SERVICE SUGGESTIONS

A. NO RASTER ON SCREEN

1. Defective cathode ray tube.
2. Defective high voltage power supply components (1B3 tubes defective)
3. No filament or B plus voltage
4. Failure in horizontal deflection circuits
5. Open fuse part #111-8
6. See troubles listed under No Horizontal Deflection

B. NO VERTICAL DEFLECTION

1. 6J5 or 6K6GT inoperative. Check voltage and waveforms on grids and plates.
2. Vertical output transformer (56-16) open.
3. Vertical deflection coils open (indicated by horizontal line on screen).
4. Failure in voltage supply circuits. Check voltage divider 31-113 and associated filter capacitors.
5. Check tubes and components in power supply chassis.

C. NO HORIZONTAL DEFLECTION

1. 6K6GT, 6SN7GT, 6BG6G or 6W4GT inoperative. Check voltage and waveforms on grids and plates.
2. Horizontal output transformer (56-21) open.
3. Horizontal deflection coils open.
4. Failure in voltage supply circuits. Check voltage divider 31-113 and associated filter capacitors.
5. Check tubes and components in power supply chassis.
6. 6BG6G plate fuse open.
7. Failure of 330K plate resistor in 6SN7GT.
8. Open horizontal linearity control (79-78).

D. SMALL RASTER

1. Low B+ voltages to sweep chassis or low line voltage.

E. VERY LARGE RASTER - OUT OF FOCUS

1. If size of raster varies greatly with rotation of brightness control, high voltage supply has poor regulation.
2. Check adjustments of size and focus controls.

F. POOR VERTICAL LINEARITY

1. If adjustments cannot correct, change 6K6GT.
2. Vertical output transformer (56-16) defective.
3. 6J5 defective. Check voltage and waveforms on grid and plate.
4. 6K6GT cathode by-pass condenser (24-68) open or shorted.
5. Low bias or plate voltages. Check supply circuits.

G. POOR HORIZONTAL LINEARITY

1. If adjustments do not correct, change 6BG6G or 6W4.
2. Horizontal output transformer (56-21) or horizontal linearity control (79-78) defective.
3. Horizontal linearity control by-pass condensers (.1 mf. and .15 mf.) defective.
4. 6SN7GT plate resistor (330,000 ohms) changed value.
5. Defective plate circuit components in 6SN7GT. Check 680 mmf. capacitor, and horizontal drive control (39-8).
6. Low bias or plate voltages. Check supply circuits.

H. PICTURE OUT OF PHASE HORIZONTALLY

1. Sync. discriminator transformer (279-42) defective or incorrectly tuned (S14).
2. Change 6AL5 or 6AC7.

I. NO HORIZONTAL HOLD

1. If adjustments do not correct, change 6AL5, 6AC7, or 6K6GT.
2. Sync. discriminator transformer (279-42) defective or incorrectly tuned (S15).
3. Low or zero bias or plate voltages. Check supply circuits.

J. RASTER AND SIGNAL ON SCREEN BUT NO SOUND

1. R.F. oscillator off frequency.
2. Sound I.F., ratio detector or audio amplifier inoperative. Check associated tubes and their socket voltages.
3. Defective speaker.

K. SIGNAL AT C.R.T. GRID BUT NO SYNC.

1. Sync. clipper or sync. amplifier tubes inoperative. Check voltage and waveforms at their grids and plates.
2. Sync.cable not connected to sweep chassis input socket.

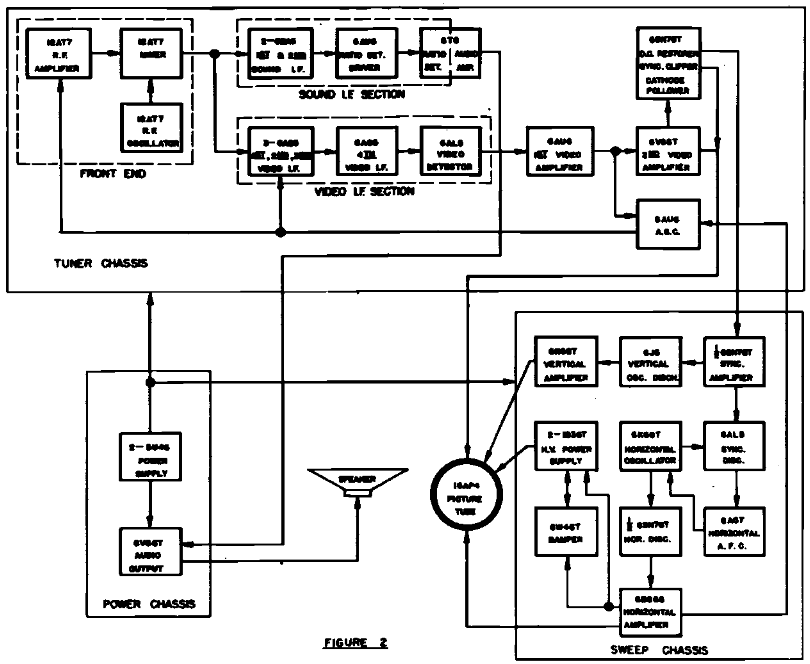


FIGURE 2

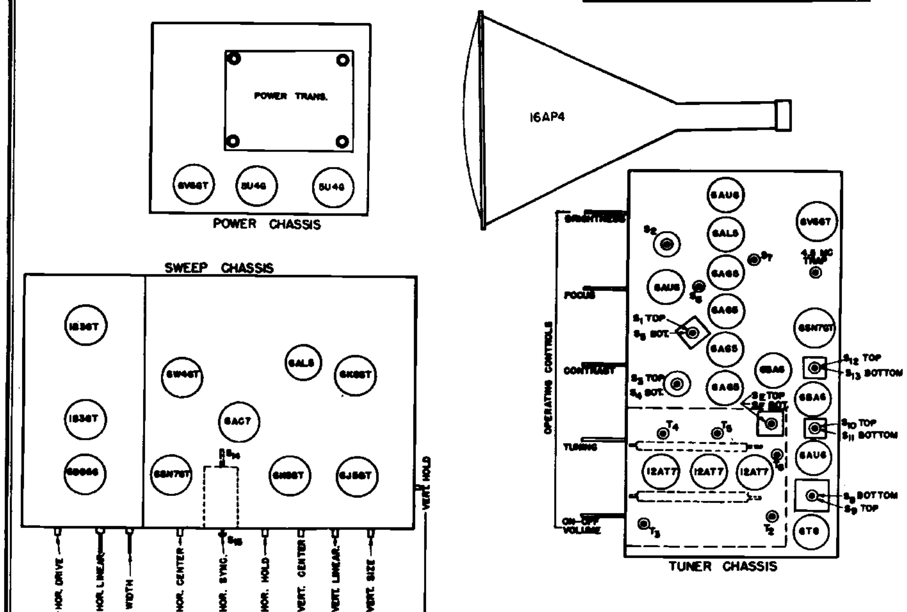


FIGURE 1

L. SIGNAL AT C.R.T. GRID BUT NO VERTICAL SYNC.

1. Check 6J5 and associated circuit.
2. Integrating network inoperative. Check all components.

M. SOUND AND RASTER BUT NO PICTURE OR SYNC.

1. Picture I.F., detector or video amplifier inoperative. Check video I.F., detector and amplifier tubes. Check socket voltages.
2. Check video peaking coils.

N. PICTURE STABLE BUT POOR RESOLUTION

1. Video detector or amplifier tubes defective. Check socket voltages.
2. Peaking coils defective. Check resistance.
3. Make sure that the focus control operates on both sides of proper focus.
4. R.F. and I.F. circuits misaligned.

O. PICTURE SMEAR

1. Video amplifier overloaded by excessive input. Check A.G.C. circuits and tube.
2. Insufficient bias on video amplifiers resulting in grid current on video signal. Check bias voltage for possible grid current.
3. Defective video coupling condensers, load resistors or peaking coils.

P. PICTURE JITTER

1. Contrast control set too high.
2. Vertical instability may be due to improper setting of vertical hold control, loose connections or noise.
3. Check horizontal oscillator alignment.
4. Horizontal instability may be due to unstable transmitted sync. Check on another channel.

Q. RASTER BUT NO SOUND, PICTURE OR SYNC.

1. Defective antenna or transmission line.
2. R.F. oscillator off frequency.
3. R.F. unit inoperative. Check 12AT7's and their socket voltages.

R. SET COMPLETELY DEAD

1. Check fuse in power supply unit.
2. Check for continuity through high voltage interlock circuit.
3. Open line cord.

TV-44 Series; MODELS TV-46, TV-47