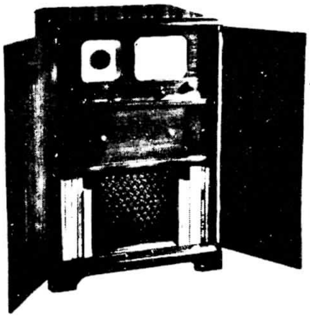
MODEL 802

GENERAL ELECTRIC CO.



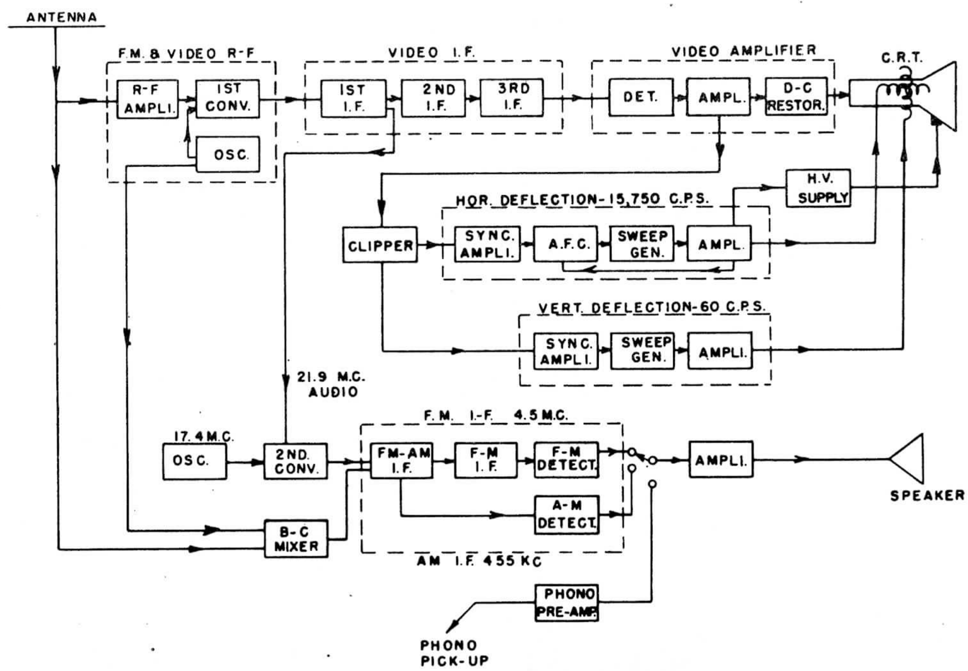


Fig. 1. Block Diagram, Model 802

GENERAL INFORMATION

The General Electric Model 802 television receiver is a console type, 26-tube instrument providing reception of all 13 commercial television channels, radio reception in the Broadcast and FM bands, and phonograph reproduction using the new G-E Variable Reluctance Pickup. The television picture is reproduced on a 10-inch electromagnetically deflected picture tube. The phonograph makes use of an automatic record changer that will handle up to ten 12-inch records or twelve 10-inch records. All electrical components are mounted on a single chassis, permitting optimum ease in adjustment and service.

Features of the television receiver include a constant input impedance r-f amplifier, ion trap, safe high voltage power supply, automatic frequency control for horizontal synchronization, ten-inch picture tube, and high fidelity FM audio system.

On late production receivers, a Type 10FP4 picture tube is used. This makes use of metallic film on the screen which does not require the use of an ion trap.

DESCRIPTION—TELEVISION AND RADIO CIRCUITS

The receiver circuits are divided into the following sections:

1. R-F amplifier, converter and oscillator.
2. Video and audio i-f amplifier.
3. Video detector and amplifier.
4. Sync pulse clipper-amplifier.
5. Horizontal multivibrator and AFC sync.
6. Horizontal sweep output.
7. Vertical multivibrator and sweep output.
8. High voltage power supply (H.V. supply).
9. Low voltage power supply (L.V. supply).

A brief description of the operation of each section is described in the following paragraphs. This will be supplemented by a comprehensive television training course in the publication, RSM-4-TV.

A block diagram of the complete receiver is shown in Figure 1 to assist in signal tracing and to better visualize the operation of the receiver as a whole.

1. R-F AMPLIFIER, CONVERTER AND OSCILLATOR (SEE FIGURES 2 AND 3).—The television and FM r-f amplifier makes use of a Type 6AU6 tube connected as a triode grounded-grid amplifier. The antenna is connected into the cathode circuit so as to provide a substantially constant input impedance of 300 ohms to the antenna at all frequencies. With a 300-ohm antenna and

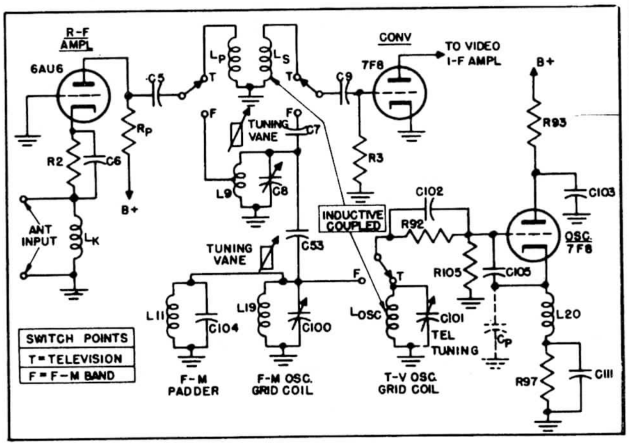


Fig. 2. Television and F-M R-F Amplifier, Converter and Oscillator

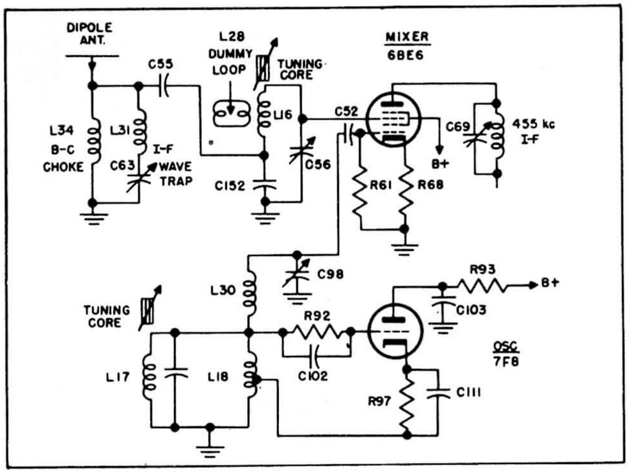


Fig. 3. Broadcast Converter and Oscillator

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transmission line system, this coupling arrangement permits optimum transfer of signal from antenna to r-f amplifier for all 13 channels and also prevents reflections from being set up on the transmission line. R2 is the normal bias resistor. A choke, L_k, is placed in series with this cathode resistor to prevent the input impedance from being lowered by the shunting effect of the total stray capacity to ground of the cathode of the tube. The choke value is changed for different channels.

For television operation, the r-f amplifier is coupled to the converter tube by a wide band transformer consisting of windings L_p and L_s. The windings are overcoupled and self-tuned by the distributed and tube capacities to provide optimum gain and band width. On channels No. 1 and No. 2, the transformer is triple tuned to prevent the image frequencies of the 88 to 108 mc FM band from interfering with these two channels. For FM reception in the 88–108 mc band, the r-f amplifier is coupled to the converter through the Guillotine Tuner Unit, L9. This unit operates as an auto-transformer, the inductance, and therefore frequency, of which is varied by the tuning vane which travels in and out of L9. L9 is tuned to resonance by the stray and tube capacities, as well as by a trimmer, C8.

The triode converter is one section of a Type 7F8 dual triode, V2. Bias for this tube section is provided by the oscillator voltage appearing in the grid of the converter tube, causing grid rectification charging the grid resistor-condenser combination, R3 and C9.

The oscillator makes use of the remaining half of the Type 7F8 tube, V2B, and for television operation, the oscillator voltage is coupled inductively to the converter grid by locating the oscillator grid coil, L_{osc}, adjacent to the converter grid coil, L_s. For FM operation, the oscillator voltage is coupled through capacitor C53 into the grid circuit tuning circuit, L9. The oscillator is a modified Colpits oscillator, oscillation being produced by the cathode-to-grid, C_g, and cathode-to-plate, C_k, interelectrode capacities of the oscillator tube. C105 shunts C_g to provide uniform operation. The choke, L20, provides a d-c ground to the cathode of the oscillator tube but maintains the cathode off-ground at the r-f frequencies. The oscillator operates on the high frequency side of the r-f signal on all bands.

For broadcast reception, no r-f amplifier stage is used, the r-f signal being applied directly to a Type 6BE6 mixer, V26. Here the broadcast signal is converted to 455 kc in the plate circuit. The oscillator section of V2 operates as the local oscillator for broadcast, operating on the high frequency side of the incoming signal. The oscillator is connected in a Hartley circuit by taking off the cathode tap on L18 which forms part of the grid tank circuit. The oscillator voltage is capacity coupled to mixer grid through C52. Tuning through the broadcast band is accomplished by moving powdered iron cores in the mixer and oscillator grid tank coils which are ganged to the tuning control and dial scale.

The r-f unit, including the r-f amplifier, converter and oscillator tubes and their associated components, is constructed as a complete unit sub-assembly which can be demounted from the main chassis.

2. VIDEO AND AUDIO I-F AMPLIFIERS (SEE FIGURE 4)—The video i-f amplifier consists of a three-stage band-pass amplifier using three Type 6AC7 tubes. The transformers, T15, T16, T17, and 18, are overcoupled and then loaded with resistance to give adequate (approx 4 mc) band-pass frequency characteristic. A series tuned trap consisting of L32, C127 and C126 tuned to 27.9 mc is connected in the 1st i-f amplifier grid circuit to provide rejection of the adjacent channel sound. A tertiary trap winding

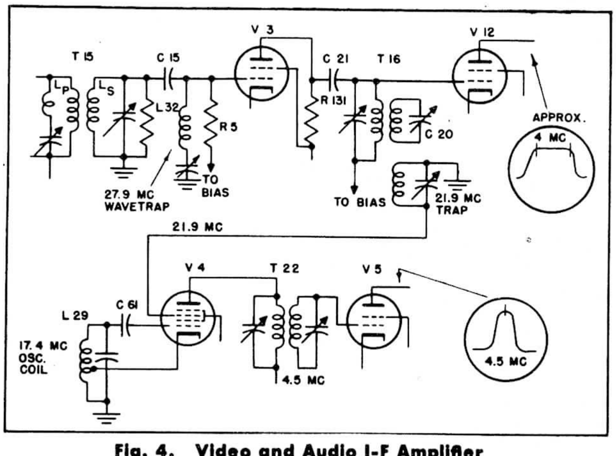

Fig. 4. Video and Audio I-F Amplifier

on transformers T16 and T17, tuned to 21.9 mc, is used to provide rejection of the same channel audio. A series tuned 21.9 mc trap is used at the diode stage (T18).

The audio i-f frequency is developed by taking the 21.9 mc sound i-f signal from across the trap at T16 and applying it to the 2nd converter tube, V4. At this tube, the 17.4 mc local oscillator combines with the 21.9 mc to form a difference frequency of 4.5 mc. At this frequency it is amplified by V5, applied to the limiter tube V6 and then detected. Since the audio channel of the television is frequency-modulated, the transformer T24 functions with sections of V7A as the discriminator. This double conversion used to receive the 88 to 108 mc FM band, provides high gain and selectivity necessary for tuning of the FM stations.

A low negative voltage derived from the output damping tube (V23) grid circuit is applied to the contrast control R108A and then to the grids of the i-f amplifier tubes V3 and V12. This is used to change bias on these tubes and therefore the video i-f gain.

3. VIDEO DETECTOR AND AMPLIFIER (SEE FIGURE 5)—The video i-f amplifier output is applied to a diode rectifier, V15A, and the diode load, R18, is connected so as to develop a negative-going signal at this point. The signal is amplified by the pentode amplifier, V14, and then applied to the cathode of the picture tube, V24, through the coupling capacitor C3. The remaining diode section of V15 is used to provide d-c reinsertion to the picture at the picture tube.

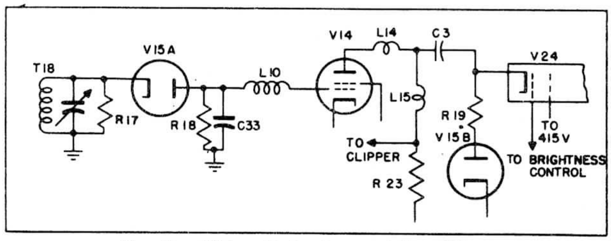

Fig. 5. Video Detector and Amplifier

The chokes L10 and L14 are series-peaking chokes, while L15 is a shunt-peaking choke. These are used to obtain good high-frequency response. L10 in combination with C33 also prevents harmonics of the i-f frequency from being passed through the video amplifier. R23 is the V14 tube plate load resistor.

Since the cathode of the picture tube is normally at a positive voltage, by the fact that it is returned to a B + source, a variable positive voltage is also applied to the grid of V24 for control of the brightness or beam current. As long as this grid voltage is less positive than the cathode voltage, the tube beam current will be within its rating. This positive voltage on the grid is controlled by Brilliance control potentiometer, R108B.

4. CLIPPER AND SYNC AMPLIFIER—The triode section, V16A, of a Type 6SN7GT tube is used to separate the sync pulses from the composite video signal taken off at the load resistor, R23. The clipper tube, V16A, is operated at a very low plate voltage and its bias is derived by grid rectification of the positive polarity video signal applied to the grid. Thus, conduction in V16A will occur only during the sync pulse intervals which are the most positive component of the video signal.

Tube V16B is a horizontal synchronizing amplifier which operates into the AFC input transformer, T19. This transformer by virtue of its low inductance acts as an integrator; that is, in the secondary, the original sync signals become positive and negative pips. Only the pip that is representative of the leading edge of the synchronizing pulse is used.

The vertical synchronizing amplifier tube, V18B, receives the sync pulse at its grid circuit through an integrating circuit consisting of R30 and C136. This integrating circuit accepts the wide vertical pulses and further amplifies them while the horizontal pulses do not have sufficient energy to charge the integrating circuits and are, therefore, attenuated. The tube V18B is operated as a cathode follower and further integration of the sync signal is provided in its cathode circuit.

5. HORIZONTAL MULTIVIBRATOR AND AFC SYNC (SEE FIGURE 6)—The horizontal sawtooth oscillator makes use of a Type 6SN7GT tube, V21, in a conventional cathode-coupled multivibrator circuit. Instead of its frequency being controlled directly by the horizontal sync pulses, it is controlled by a d-c voltage on its controlling grid, the d-c voltage being a resultant of the phase error between the incoming sync signal and a sawtooth voltage derived from the output of the horizontal sweep amplifier. This voltage is called an automatic frequency control (AFC) voltage.

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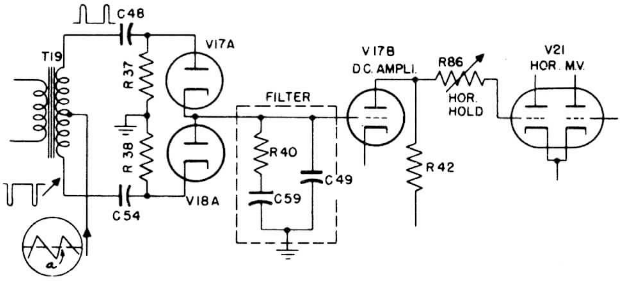

Fig. 6. Hor. Multivibrator and Sync

The AFC voltage is developed by the diode-connected triodes V17A and V18A by mixing the horizontal sync pulses at the secondary of transformer T19 with a sawtooth voltage waveform derived at the output of the sweep amplifier tube, V22, when the sync pulse occurs at the time "a" shown in the sawtooth waveform drawing in Figure 6, no voltage will be developed at the output of the filter. However, if the multivibrator runs faster or slower so that the pulse falls at a point other than at "a," a positive or negative voltage will appear at the filter, which will be amplified by the d-c amplifier V17B and then applied to the grid of the multivibrator. This change in d-c voltage on the grid of the multivibrator will cause it to speed up or slow down so as to cause the sawtooth wave to combine with the incoming sync pulses until the correction voltage becomes zero. With the filter consisting of R40, C59, and C49, the change is relatively slow in controlling the speed, permitting the equivalent of individual frame synchronization instead of each component line. This gives a picture characterized by greater detail than is possible where random noise triggers the directly synchronized sweep generator. The Horizontal Hold control, R86, in conjunction with the cathode tuned circuit C99 and L33, control the free-running speed of the multivibrator. They are adjusted near to the correct frequency during the time when no sync pulses are available.

6. HORIZONTAL SWEEP OUTPUT (SEE FIGURE 7)—The horizontal sawtooth voltage generated by the multivibrator, V21, is shaped and then amplified by a Type 6BG6G tube, V22. The output of this tube is coupled to the horizontal deflection coils through an impedance-matching transformer, T25. An oscillatory voltage, as shown in the dotted line in the waveshape at the upper left of Figure 7, which results from the rapid retrace in the transformer T25, is removed by the damping tube, V23. This tube is a dual triode, Type 6AS7G, and by its use the transient may be dampened, linearity controlled, and the positive overshoot voltage retained for use in the high voltage supply. The linearity of the horizontal trace is controlled by varying the voltage waveshape applied to the grid of V23 by potentiometer, R115. The horizontal size is controlled by the adjustable iron core inductance, L23, which is in series with the output to the yoke.

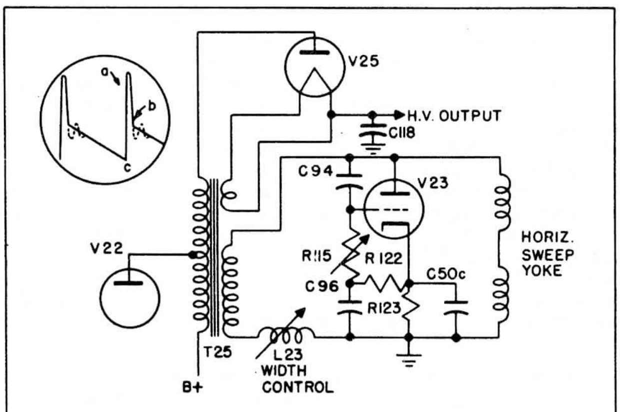

Fig. 7. Horizontal Sweep Output

7. VERTICAL MULTIVIBRATOR AND SWEEP OUTPUT (SEE FIGURE 8)—The vertical sawtooth voltage is generated by a Type 6SN7GT tube, V19, connected as a multivibrator. This voltage is coupled directly to a Type 6V6G vertical sweep output tube, V20, and then to the vertical sweep coils through the impedance-matching transformer, T20. Vertical speed is controlled by changing the time constant of the multivibrator grid circuit by the potentiometer, R46. Sweep size is changed by the potentiometer, R49, which changes B+ voltage applied to the charging network of tube V19 simultaneously with the screen voltage on tube, V20. Vertical linearity is controlled by a correction voltage developed in the cathode of V20 being fed back through C92 to the grid of the output tube. The amount of correction voltage is varied by the variable cathode resistor, R58.

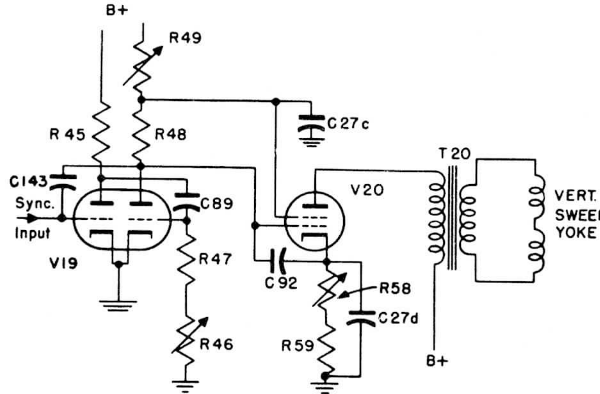

Fig. 8. Verticdl M.V. and Sweep Output

8. HIGH VOLTAGE SUPPLY (SEE FIGURE 7)—The high voltage is derived by making use of the inductive "kick" voltage produced during retrace in the horizontal output transformer. This "kick" voltage is shown in the waveshape shown as "c to b" in Figure 7. This voltage is generated in the primary winding and is further increased by an additional winding added to the transformer which connects to the rectifier tube plate of V25. The rectifier tube, V25, is a Type 8016 which derives its filament voltage from the horizontal sweep transformer T25 by a single turn around the transformer. Because of the high frequency (15,750 cps) which is rectified, a 500 mmf. capacitor is more than sufficient for filtering purposes.

9. LOW VOLTAGE POWER SUPPLY—Two rectifiers are used to supply the required plate current for the television and radio receiver. A Type 5U4G tube, V11, supplies the bulk of the current and makes use of a choke, L21, and capacitor, C106 and C45A filter. Type 5Y3GT, V10, is used to supply higher voltage to the horizontal output, horizontal multivibrator, and the picture tube 1st anode. This is followed by a choke-capacitor filter. All filament supply leads except for tubes V26, V4, V3, V5, V9, V2, V1, V8, V6 and V7 and the rectifier filaments pass through the band switch so that tubes may be switched ON or OFF when switching from phono to radio to television.

CIRCUIT ALIGNMENT

GENERAL—A complete alignment of the Model 802 television receiver consists of the following individual alignment procedures. These are listed below in the correct sequence of alignment. However, any one alignment may be performed without the necessity of realignment of any one of the other sectional alignments, provided the signal source for television traps and video i-f amplifier is accurately calibrated.

1. Broadcast i-f amplifier.
2. Broadcast r-f amplifier.
3. FM and television sound i-f amplifier.
4. Video i-f traps.
5. Video i-f amplifier.
6. FM r-f amplifier.
7. Television oscillator adjustments.
8. Television r-f amplifier.

The following paragraphs are important suggestions to be followed when attempting alignment and should be read thoroughly before alignment is attempted.

TEST EQUIPMENT REQUIREMENTS—To provide the over-all alignment as outlined above, the following test equipment is required.

1. Cathode Ray Oscilloscope—This scope should preferably have a 5-inch screen and should have good high frequency response, which will be useful in making the waveform measurements on page 20 and 21. Note—High frequency response is not essential for alignment.

2. Signal Generator—This signal generator must have good frequency stability and be accurately calibrated. It should give

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good output at the following frequencies with tone modulation where desired.
(a) 455 kc for broadcast i-f.
(b) 550–1620 kc for broadcast.
(c) 4.5 mc for FM and Tel. audio i-f marker.
(d) 21.9 mc for sound i-f marker and trap alignment.
(e) 27.9 mc for trap alignment.
(f) 23.0 mc for video i-f marker.
(g) 25.65 mc for video i-f marker.
(h) 26.4 mc for video i-f marker.
(i) 44–130 mc and 174–238 for FM r-f alignment and for oscillator adjustment and markers for the r-f channel bandwidth measurements.

3. *R-F Sweep Generator*—This should give at least 0.1 volt output with adjustable attenuation of the output. The output should be flat over wide frequency variations. The frequency coverage should be:
(a) 4.5 mc, with 1.0 mc sweep width.
(b) 21.9 mc with 1.0 mc sweep width.
(c) 20 to 30 mc, with 15 mc sweep width.
(d) 40 to 90 mc, with 25 mc sweep width.
(e) 170 to 220 mc, with 25 mc sweep width.

4. *Output Meter*—An output meter with a voltage range of 0-2.5 volts a-c.

5. *Wavetraps*—Accurately calibrated wavetraps may be used to supply markers in place of the signal generator for video i-f and r-f alignment purposes.

ALIGNMENT SUGGESTIONS—All trimmer locations are shown in the drawings of Figures 14 or 17. Remove the chassis from the cabinet and turn it on its side with the power transformer down. This is the only safe position in which the chassis will rest and leave all adjustments accessible. The following suggestions apply to each individual alignment procedure.

1. *Broadcast I-F Alignment*—(a) Although the oscilloscope is recommended in the table for indicating the output voltage during alignment, an output meter may be connected across the speaker voice coil as an alternate output indicating device. When this is used, the volume control should be set for maximum volume and then attenuate the signal generator output so as not to cause audio overload.

(b) Use a 500 mmf. mica capacitor between the high side of the signal generator and the signal input point, as indicated in the Alignment Table.

2. *Broadcast R-F Alignment*—Apply signal generator input to one of dipole input terminals (No. 1 or No. 2) through a 500 mmf. mica capacitor or IRE standard dummy antenna. An output meter across the speaker may be used in place of the oscilloscope for indicating output. The moving iron cores of the r-f and oscillator coils are adjusted by the hex head adjusting screw located on the elevator cross-arm to which the cores are mounted.

3. *FM and Television Sound I-F Alignment*—Amplification of the incoming sound signal is accomplished at 21.9 mc and then through double conversion is reduced to 4.5 mc and then further amplified. The tuned circuit consisting of L29 and C62 is not adjusted to 17.4 mc directly but is tuned to provide the proper output of 4.5 mc when a 21.9 mc signal is applied to the mixer grid of V4.

Since the sound i-f for FM and television makes use of slightly over-coupled transformers, a sweep generator is necessary. For alignment, connect the generator through a 500 uuf. capacitor to the input points as indicated in the table. Connect the oscilloscope across the limiter grid resistor, R69, through a 100,000-ohm resistor for steps 1 through 4. For the discriminator alignment, the oscilloscope is connected across the volume control and the series resistor to the scope is *reduced to 10,000 ohms.*

For steps 1 and 2, insert a 4.5 mc marker signal from an unmodulated signal generator into the same point of input as the sweep generator. This input, however, must be very loosely coupled so that it doesn't affect the response curve. See Figure 9A for curve for step 1.

Keep the input of the sweep generator low enough so that the sound i-f amplifier does not overload. To check for overload; the response curve should increase proportionally as the sweep output is increased. If it flattens off and won't increase in size, the amplifier is overloaded.

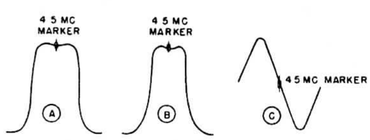

Fig. 9. T-V Audio I-F Curves

The response curve narrows up somewhat as more transformers are aligned and should appear as in Figure 9B for steps 2, 3, and 4.

For discriminator alignment, the secondary trimmer C140 of T24 is aligned by using a tone-modulated 4.5 mc signal and listening to the tone at the loudspeaker or observing it on an oscilloscope. The trimmer is adjusted for minimum output. If a sweep is used for the secondary trimmer alignment, the cross-over should be symmetrical about a 4.5 mc marker and should be a straight line between the alternate negative and positive peaks, as shown in Figure 9C. With the same sweep input as in step 1, adjust the primary trimmer, C80 of T24, for maximum peak-to-peak amplitude and symmetry of peaks above and below the baseline, as shown in Figure 9C.

4. *Video I-F Trap Alignment*—The video i-f traps are used to attenuate the sound i-f of the same and adjacent channels from being detected and reproduced on the picture tube. Misalignment of these traps results in interference patterns which have the appearance of horizontal bars or as a very fine pattern which spoils the contrast.

Set the Contrast control at maximum. Turn the Service Selector control to channel 13. Connect the oscilloscope through a 10,000-ohm resistor to the top of the video load resistor, R23.

Connect the output of an accurately-calibrated signal generator (with tone modulation) to the grid of the converter tube V2A, through a 500 mmf mica capacitor. The alignment frequencies are:

(C127)—27.9 mc
T17 (C29)—21.9 mc
T18 (C34)—21.9 mc

The trap trimmers C20 and C22 were aligned during "FM and Television Sound I-F Alignment" and should not be readjusted.

The trimmers should be aligned for minimum output, care being taken to get the lowest possible indication at the output. The input signal should be attenuated below saturation of the i-f amplifier tubes at start, then raised as signal is attenuated during alignment.

5. *Video I-F Alignment*—The video i-f amplifier uses transformers which are coupled and loaded to give the proper bandpass characteristics. Before attempting alignment of the video i-f, the sound i-f traps should be aligned as in (4), then do not touch the trap trimmers when making the video i-f alignment.

One-stage-at-a-time alignment should be performed so as to duplicate the curves, as shown in Figure 10. The markers are used to establish the correct bandwidth and frequency limits.

The trap formed by L24 and C131 in the cathode of V12 is tuned to reduce the overshoot which appears at a frequency of approximately 21.4 mc and which is caused by the 21.9 mc traps. Adjust the spacing of turns comprising L24 by either pushing the turns together or separating them so as to give a minimum amplitude to the overshoot.

Connect the sweep generator to the tube grid preceding the transformer to be aligned. Adjust the sweep width for a minimum of 15 mc about the center frequency of the video i-f frequency. The marker frequencies are supplied by a signal generator and sufficient marker signal may be supplied in most cases except at last stage by merely connecting the high side of the signal generator to the television chassis. At last stage couple marker generator through a small capacitor in parallel with sweep.

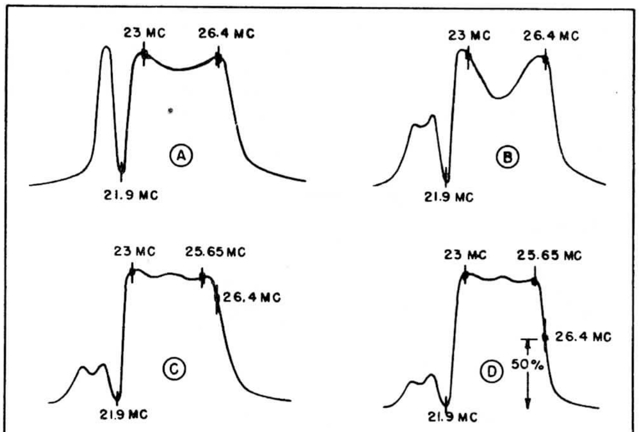

Fig. 10. Video I-F Alignment Curves

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The primary of the transformer preceding the grid where the signal is applied will act as a tuned trap, putting a hole in the alignment curve as viewed on the scope unless it is short-circuited or detuned. Place a temporary short across the primary as indicated in steps 1, 4 and 5. *Be sure to remove the short after the stage is aligned.*

Keep the input to the sweep generator low so as not to overload the video i-f amplifier.

The response curves shown in Figure 10 are obtained on an oscilloscope at the junctions of R23 and L15. Use a 10,000-ohm resistor in series with the input lead to the scope for isolation. Set contrast control to position as indicated under "Remarks" for each step.

The Service Selector switch should be in the "Phono" position for all i-f alignment. Use a temporary jumper across Section S1D wafer of the switch so as to keep the television tubes lit while in this position. If a television position is used for i-f alignment, the i-f curve may be affected by the interaction from the r-f coil in the converter tube grid.

6. *FM R-F Amplifier*—Apply the signal generator input with tone modulation to the antenna dipole terminals. Connect an oscilloscope or output meter across the limiter grid resistor, R69.

The scale is checked at the low and high frequency ends of the band for calibration and alignment. The oscillator range is either expanded or contracted by adjusting the padder coil inductance L11. To spread out the scale, it is necessary to decrease inductance of L11. This is done by moving the shorted turn on L11 towards the color dot. When contracting the scale; that is, when the reference frequencies are off scale, the reverse procedure should be followed. Always recheck and readjust, if necessary, trimmer C100 for 88 mc calibration after adjusting L11.

When installing new tuner vanes in L9 and L19, the vanes should be adjusted to seat at the bottom of travel when the dial pointer is at extreme clockwise position.

7. *Television Oscillator Adjustment*—The oscillator coils must be adjusted so that the Television Tuning Condenser, C101, will tune the sound carrier of the television signal at the middle of its range. Set the condenser, C101, to mid-position. Then adjust oscillator coil for channels No. 1 through No. 7 by spreading turns to raise frequency or compressing turns to lower frequency. For channels No. 8 through No. 13, the oscillator coil consists of a single turn. Adjust these coils by spreading the gap to lower frequency or closing the gap to raise frequency in the leads of the coil which run to the terminals.

Apply the signal generator with tone modulation to the antenna input terminals and set the generator to the sound carrier frequency for the channel under alignment. The signal generator must be very accurately calibrated. This can be done by beating its output against a known channel carrier or use a station operating on the channel and tune in the sound.

For output indication, advance the volume control about to mid-position so that the tone modulation or audio modulation on the channel station may be heard through the loudspeaker.

The oscillator coil is located on the coil form or assembly nearest to the front of the switch assembly and is wound of heavier wire than the other coils. This is shown in Figure 11.

8. *R-F Coil Alignment*—The r-f coil assembly is designed for stable, band-pass operation and under normal conditions will seldom require adjustment. In cases where it is definitely known that alignment is necessary (such as when the present coil is damaged and has been changed), do not attempt the adjustment unless suitable equipment is available. When tubes V1 or V2 are changed, alignment of r-f and oscillator may be necessary.

The minimum requirements for correct r-f alignment is to provide the correct band width, and for the response curve to be centered within the limit frequencies shown for each of the individual bands, as shown in Figure 12. It is also necessary that the curve be adjusted for maximum amplitude consistent with

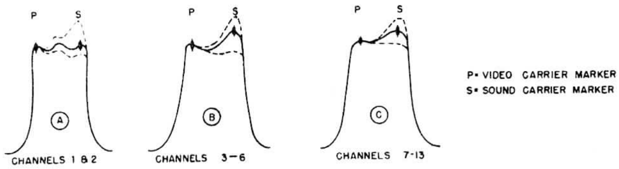

Fig. 12. R-F Alignment Curves

correct band width. To provide these minimum requirements, the r-f coils are overcoupled in a very similar manner to the video i-f transformers. However, instead of adjusting capacity to tune the coils, the inductance is varied by moving a few turns. Coupling is also adjustable by moving the entire coil either away from or toward the adjacent coil on the form.

The physical assembly of the coils in the band switch locates the r-f amplifier plate coil at the rear of the switch and the oscillator coil towards the front end. Two types of coils are used—the Channel No. 1 and No. 2 coils have an additional link circuit between the grid and plate coils to provide better image rejection of the FM band (88 to 108 mc) signals on these two channels. These links are tuned by means of two copper rings which are moved along the coil forms for adjustment.

The input sweep signal is applied to the antenna terminal board at the r-f unit. The 300-ohm cable between the antenna terminal board and r-f amplifier input must be disconnected at the r-f unit when making r-f alignment. The marker signal generator may be coupled loosely to the antenna input terminals.

The output r-f response curve is taken off at the junction of R4 and a terminal of the 1st video i-f transformer. The Contrast control should be set for minimum for all r-f alignment.

For Channels No. 1 and No. 2, the r-f coils should be aligned to give approximately the curve shown in Figure 12-A. The "P" marker represents the video carrier marker while the "S" marker is the high frequency or sound marker. As shown in dash lines, the amplitude limits of the curves, with the "P" marker as reference no portion of the curve should be any more than 25 per cent higher or 12 per cent lower than this reference point. The markers should be located on the inside of the humps of the curves. Adjustment of the bandwidth is made by moving the plate coil closer to the grid coil or vice versa. In most cases, the sliding of the copper rings will give both the required bandwidth and the frequency adjustment. Spread or squeeze turns in plate and grid coils if the frequency cannot be obtained by sliding the rings. Spreading turns results in a raising of the frequency; while squeezing turns lowers the frequency.

For the remainder of the channels, the adjustment of the plate coil in relation to the grid coil changes the bandwidth, while the spreading or squeezing of the plate and grid coil results in the raising or lowering of frequency. Only when the plate and grid coils are tuned to the same frequency will the amplitude be greatest with the correct bandwidth. The outside peaks of the r-f response curve should be aligned to the carrier markers.

The upper channel coils (No. 12 and No. 13) have the plate winding reversed from the winding direction of the plate coil of the other transformers. In this case, the bandwidth will be increased by separating the plate and grid coils.

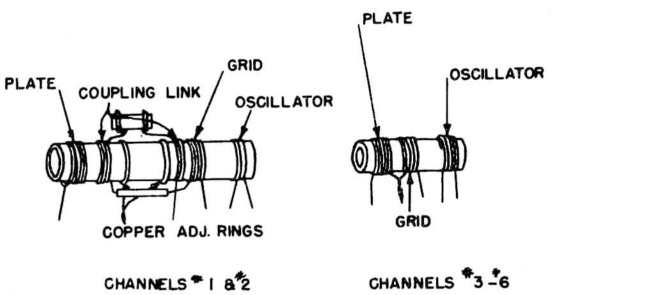

Fig. 11. R-F Coil Assembly

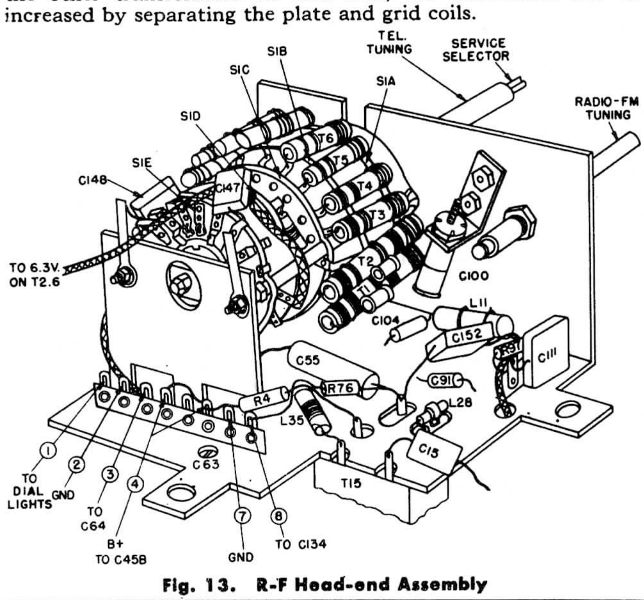

Fig. 13. R-F Head-end Assembly

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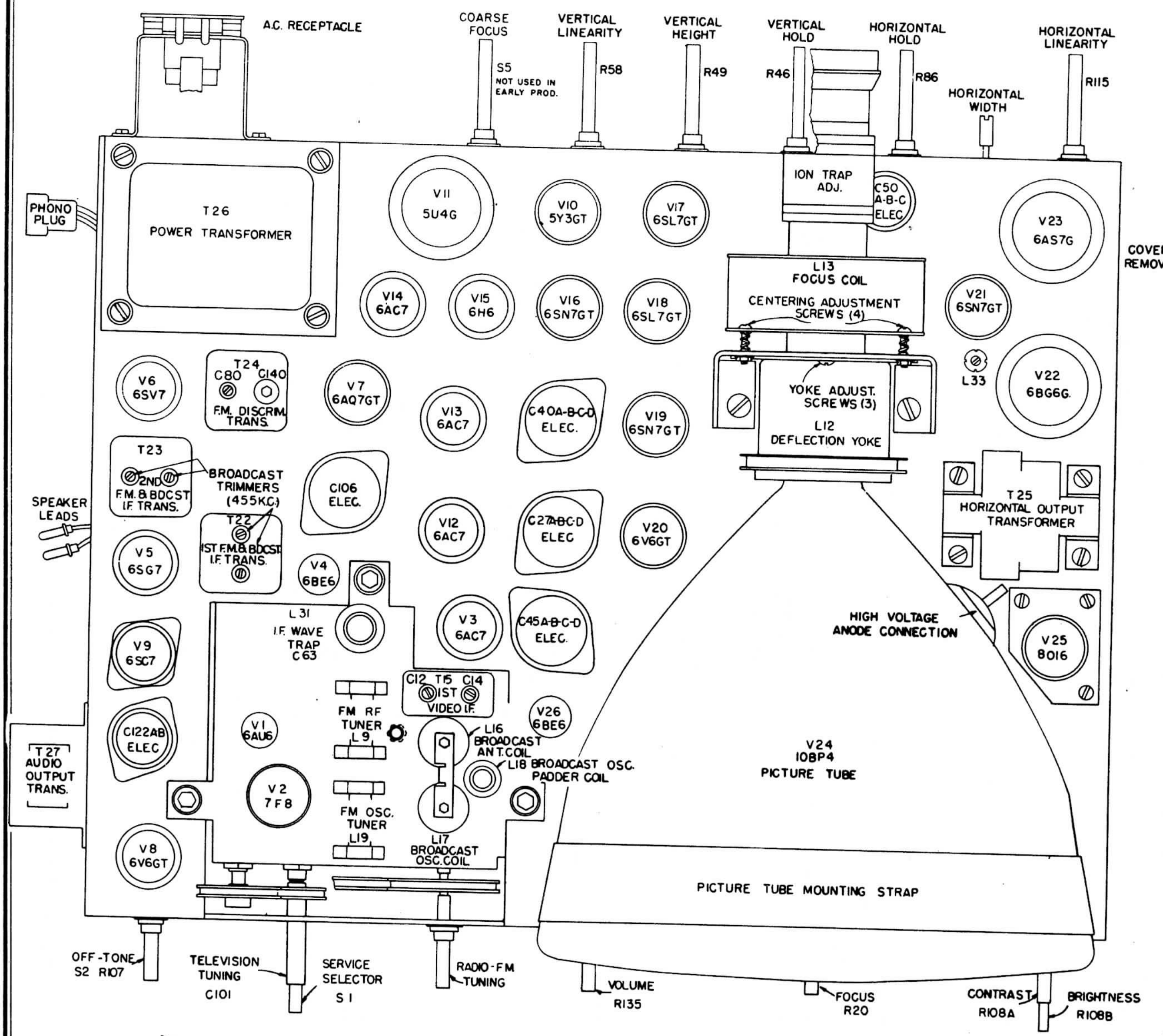

Fig. 14. Component Location, Top View of Chassis

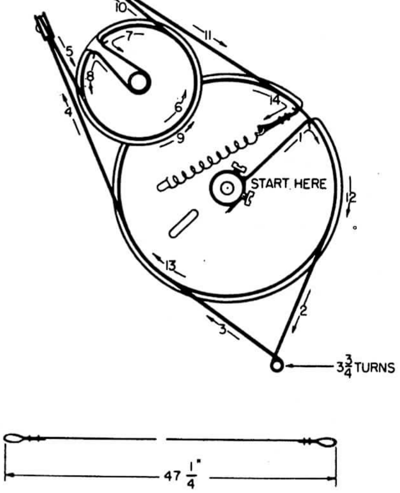

Fig. 15. Radio Tuning Drive Stringing

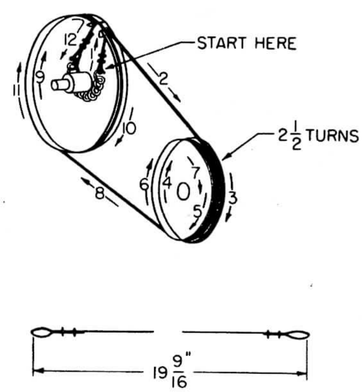

Fig. 16. T-V Tuning Drive Stringing

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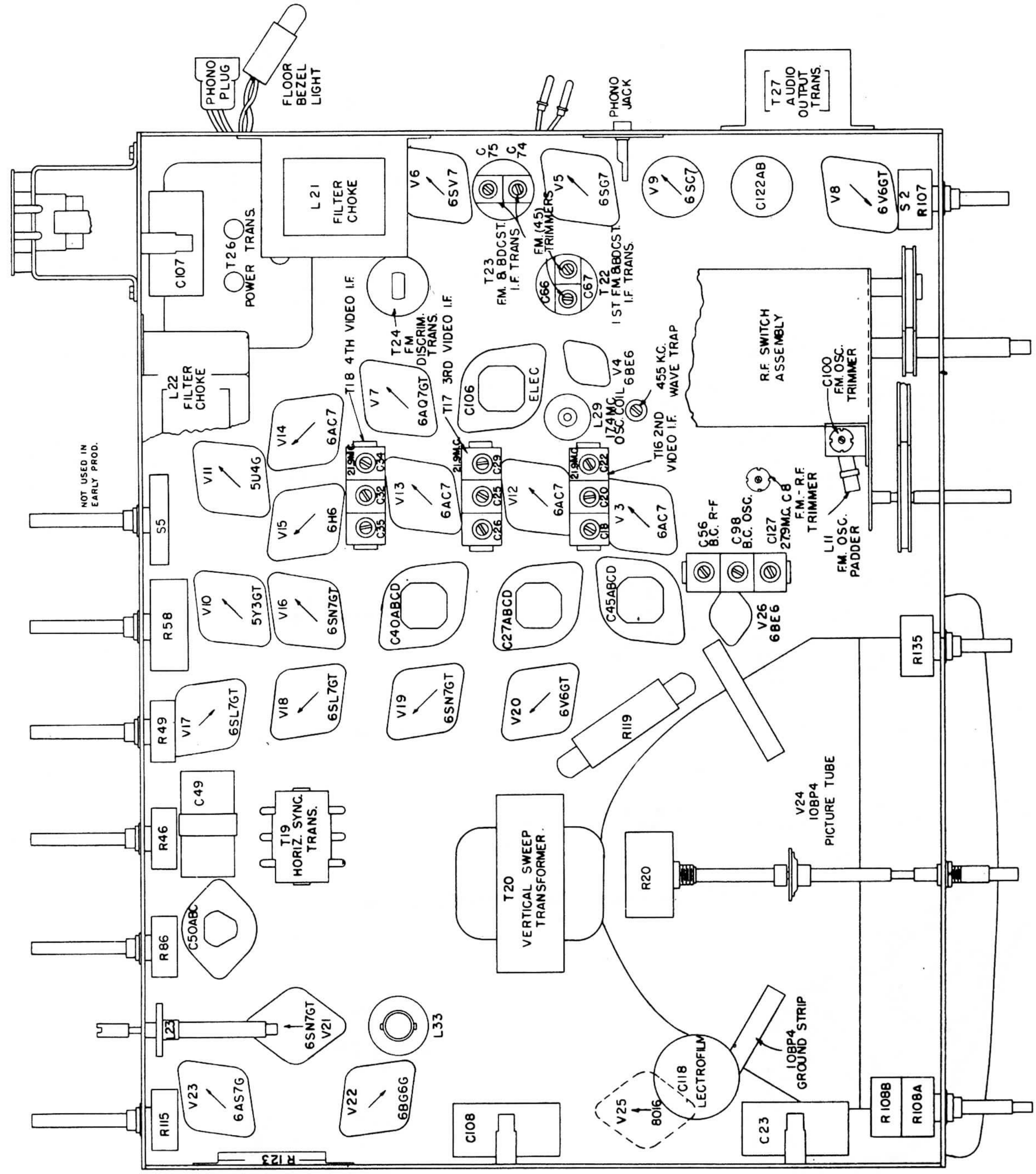

Fig. 17. Component Location, Bottom View of Chassis

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ALIGNMENT TABLE

Before attempting the following tabular alignment procedure, read the preceding section "ALIGNMENT SUGGESTIONS"

STEP NO.	GENERATOR FREQUENCY SIGNAL	GENERATOR FREQUENCY SWEEP	SIGNAL INPUT POINT	CONNECT OSCILLO-SCOPE TO CHASSIS &	STATION SELECTOR SWITCH	DIAL SET-TING	ADJUST	REMARKS
(1) BROADCAST I-F AND WAVETRAP ALIGNMENT								
1	455 kc with tone modulation	Not used	Grid (4) of V5 through 500 mmf.	Junction of C84 & R135	Radio	550 kc	C77 & C78 for max. output	
2	455 kc with tone modulation	Not used	Grid (7) of V26 through 500 mmf.	Junction of C84 & R135	Radio	550 kc	C68 & C69 for max. output	
3	455 kc with tone modulation	Not used	Antenna terminals No. 1 or No. 2 & Gnd.	Junction of C84 & R135	Radio	550 kc	C63 for minimum output	
(2) BROADCAST R-F ALIGNMENT								
1	1620 kc with tone modulation	Not used	Antenna terminal No. 1 or No. 2	Junction of C84 & R135	Radio	Pointer at ex-treme clockwise position	C98 (Osc.) & C56 (R-F) for maximum	
2	1500 kc with tone modulation	Not used	Antenna terminal No. 1 or No. 2	Junction of C84 & R135	Radio	Pointer at 1500 kc	L17 core for maximum*	*After alignment, check calibration at 600 kc. Adjust L17 for best compromise calibration at 600 kc and 1500 kc
3	1620 kc with tone modulation	Not used	Antenna terminal No. 1 or No. 2	Junction of C84 & R135	Radio	Pointer at ex-treme clockwise position	C98 (osc.) for maximum	
4	1000 kc with tone modulation	Not used	Antenna terminal No. 1 or No. 2	Junction of C84 & R135	Radio	*See Remarks	L16 core for maximum	*Rock tuning pointer through approx. 1000 kc point while aligning.
5	Repeat Step 1 and Step 4.							
(3) FM AND TELEVISION SOUND I-F ALIGNMENT								
1	4.5 mc without modulation for marker	4.5 mc with approx. 1 mc sweep	Grid (4) of V5 through 500 mmf.	Junction R69 & C70 through 100K resistor	FM	—	C74 and C75 for max. amplitude and symmetry at 4.5 mc. See Fig. 9-A.	Remove V7 before making adjustments. Keep input signal low to prevent overload. Couple marker signal loosely.
2	4.5 mc without modulation for marker	4.5 mc with approx. 1 mc sweep	Grid (7) of V4 through 500 mmf.	Junction R69 & C70 through 100K resistor	FM	—	C66 & C67 of T22 for max. amplitude and symmetry* at 4.5 mc. See Fig. 9-B.	*It is usually necessary to readjust C74 to obtain symmetry.
3	21.9 mc without modulation for marker	21.9 mc with approx. 1 mc sweep	Grid (7) of V4 through 500 mmf.	Junction R69 & C70 through 100K resistor	FM	—	L29 for centering of marker and symmetry of curve. See Fig. 9-B.	Same as 1.
4	21.9 mc without modulation for marker	21.9 mc with approx. 1 mc sweep	Grid (4) of V3 through 500 mmf.	Junction R69 & C70 through 100K resistor	FM	—	C20 & C22 of T16 for max. amplitude and symmetry of curve about marker. See Fig. 9-B.	Same as 1.

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ALIGNMENT TABLE (Cont'd)

STEP NO.	GENERATOR FREQUENCY		SIGNAL INPUT POINT	CONNECT OSCILLO-SCOPE TO CHASSIS &	STATION SELECTOR SWITCH	DIAL SET-TING	ADJUST	REMARKS
	SIGNAL	SWEEP						
	(3) FM AND TELEVISION SOUND I-F ALIGNMENT (Cont'd)							
5	4.5 mc with tone modulation	Not used	Grid (4) of V5 through 500 mmf.	Junction R135 & C84 through 10K resistor	FM	—	C140 of T24 for null point of modulation on scope.	Replace V7. Keep input signal low enough to prevent overload.
6	Not used	4.5 mc with approx. 1 mc sweep	Grid (4) of V5 through 500 mmf.	Junction R135 & C84 through 10K resistor	FM	—	C80 of T24 for max. peak-to-peak amplitude and symmetry of peaks above and below base-line. See Fig. 9-C.	—
7	Repeat Steps 5 and 6.							
	(4) VIDEO I-F TRAP ALIGNMENT							
1	21.9 mc with tone modulation	Not used	Grid (4) of V3 through 500 mmf.	Junction L15 & R23 through 10K resistor	Channel No. 13	—	C34 of T18 for minimum response.	Contrast control at maximum. Input low enough to prevent overload.
2	21.9 mc with tone modulation	Not used	Grid (4) of V3 through 500 mmf.	Junction L15 & R23 through 10K resistor	Channel No. 13	—	C29 of T17 for minimum response.	
3	27.9 mc with tone modulation	Not used	Grid (8) of V2 through 500 mmf.	Junction L15 & R23 through 10K resistor	Channel No. 13	—	C127 for minimum response.	
	(5) VIDEO I-F AMPLIFIER ALIGNMENT							
1	23.0 mc & 26.4 mc marker	20–30 mc sweep	Grid (4) of V13 through 500 mmf.	Junction L15 & R23 through 10K resistor	Phono-Jump filament wafer of selector switch so tube filament will be lit.	—	C32 & C35 of T18 for max. amplitude, band width and correct position of markers. See Fig. 10-A.	Short C25 on T17 primary with jumper.
2	23.0 mc & 26.4 mc marker	20–30 mc sweep	Grid (4) of V12 through 500 mmf.	Junction L15 & R23 through 10K resistor	Same as 1.	—	C25 & C26 of T17 for max. amplitude, band width and correct position of markers. See Fig. 10-B.	Remove short across C25. Contrast control set at mid-position.
3	23.0 mc & 26.4 mc marker	20–30 mc sweep	Grid (4) of V12 through 500 mmf.	Junction L15 & R23 through 10K resistor	Same as 1.	—	L24 for min. overshoot. See Fig. 10-B.	L24 is adjusted by spreading or squeezing turns for min. amplitude of overshoot.
4	23.0 mc & 26.4 mc marker	20–30 mc sweep	Grid (4) of V3 through 500 mmf.	Junction L15 & R23 through 10K resistor	Same as 1.	—	C18 of T16 for flat-top of response curve and position markers as shown in Fig. 10-C.	Short primary of T15 with jumper. Contrast control set at about mid-position.
5	23.0 mc & 26.4 mc marker	20–30 mc sweep	Grid (4) of V3 through 500 mmf.	Junction L15 & R23 through 10K resistor	Same as 1.	—	Readjust L24 for minimum amplitude of overshoot.	Same as Step 3.
6	23.0 mc & 26.4 mc marker	20–30 mc sweep	Grid (8) of V2 through 500 mmf.	Junction L15 & R23 through 10K resistor	Same as 1.	—	C12 & C14 of T15 for max. amplitude, band width and correct position of markers. See Fig. 10-D.	Remove short across T15 primary. Contrast control set at mid-position.

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ALIGNMENT TABLE (Cont'd)

(6) FM R-F AMPLIFIER ALIGNMENT

STEP NO.	GENERATOR FREQUENCY: SIGNAL	GENERATOR FREQUENCY: SWEEP	SIGNAL INPUT POINT	CONNECT OSCILLO-SCOPE TO CHASSIS &	STATION SELECTOR SWITCH	DIAL SET-TING	ADJUST	REMARKS
1	88 mc	—	Antenna terminals	Junction R69 & C70 through 100K resistor	FM	88 mc	Adjust C100 for max.	
2	98 mc	—	Antenna terminals	Junction R69 & C70 through 100K resistor	FM	Tune carrier.* See Remarks.	Adjust shorted turn on L11*	*Observe calibration; if pointer falls below 98 mc, move shorted turn on L11 towards color dot; if high, reverse procedure.
3	Repeat 1.							
4	Repeat Step 2.							
5	108 mc	—	Antenna terminals	Junction R69 & C70 through 100K resistor	FM	Check that you can tune through carrier*	No adjustment.	*If not, compress scale by moving shorted turn on L11 away from color dot. If this adjustment is made, repeat Step 1.
6	98 mc	—	—	—	FM	Tune carrier	Adjust C8 for maximum	

(7) TELEVISION OSCILLATOR ADJUSTMENTS

STEP NO.	GENERATOR FREQUENCY: SIGNAL	GENERATOR FREQUENCY: SWEEP	SIGNAL INPUT POINT	CONNECT OSCILLO-SCOPE TO CHASSIS &	STATION SELECTOR SWITCH	DIAL SET-TING	ADJUST	REMARKS
1	49.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 1	—	Turns of osc. coil T1.	Volume control at mid-position. Make sure C101 is at mid-position of travel. Use sound output as indicator.
2	59.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 2	—	Turns of osc. coil T2.	
3	65.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 3	—	Turns of osc. coil T3.	
4	71.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 4	—	Turns of osc. coil T4.	
5	81.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 5	—	Turns of osc. coil T5.	
6	87.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 6	—	Turns of osc. coil T6.	
7	179.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 7	—	Turns of osc. coil T7.	
8	185.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 8	—	Lead gap of osc. coil, T8.	
9	191.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 9	—	Lead gap of osc. coil, T9.	
10	197.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 10	—	Lead gap of osc. coil, T10.	

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ALIGNMENT TABLE (Cont'd)

STEP NO.	GENERATOR FREQUENCY SIGNAL	GENERATOR FREQUENCY SWEEP	SIGNAL INPUT POINT	CONNECT OSCILLO-SCOPE TO CHASSIS &	STATION SELECTOR SWITCH	DIAL SET-TING	ADJUST	REMARKS
(7) TELEVISION OSCILLATOR ADJUSTMENTS (Cont'd)								
11	203.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 11	—	Lead gap of osc. coil, T11.	
12	209.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 12	—	Lead gap of osc. coil, T12.	
13	215.75 mc with tone modulation	—	Antenna terminals	—	Channel No. 13	—	Lead gap of osc. coil, T13.	
(8) TELEVISION R-F COIL ALIGNMENT								
1	Markers 45.25 mc & 49.75 mc	Channel No. 1 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 1	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-A for resultant alignment curve.
2	Markers 55.25 mc & 59.75 mc	Channel No. 2 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 2	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-A for resultant alignment curve.
3	Markers 61.25 mc & 65.75 mc	Channel No. 3 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 3	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-B for resultant alignment curve.
4	Markers 67.25 mc & 71.75 mc	Channel No. 4 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 4	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-B for resultant alignment curve.
5	Markers 77.25 mc & 81.75 mc	Channel No. 5 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 5	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-B for resultant alignment curve.
6	Markers 83.25 mc & 87.75 mc	Channel No. 6 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 6	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-B for resultant alignment curve.
7	Markers 175.25 mc & 179.75 mc	Channel No. 7 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 7	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-C for resultant alignment curve.
8	Markers 181.25 mc & 185.75 mc	Channel No. 8 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 8	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-C for resultant alignment curve.
9	Markers 187.25 mc & 191.75 mc	Channel No. 9 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 9	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-C for resultant alignment curve.
10	Markers 193.25 mc & 197.75 mc	Channel No. 10 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 10	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-C for resultant alignment curve.
11	Markers 199.25 mc & 203.75 mc	Channel No. 11 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 11	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-C for resultant alignment curve.

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ALIGNMENT TABLE (Cont'd)

STEP NO.	GENERATOR FREQUENCY SIGNAL	SWEEP	SIGNAL INPUT POINT	CONNECT OSCILLO-SCOPE TO CHASSIS &	STATION SELECTOR SWITCH	DIAL SET-TING	ADJUST	REMARKS
(8) TELEVISION R-F COIL ALIGNMENT (Cont'd)								
12	Markers 205.25 mc & 209.75 mc	Channel No. 12 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 12	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-C for resultant alignment curve.
13	Markers 211.25 mc & 215.75 mc	Channel No. 13 with 25 mc sweep	Antenna terminals at r-f amplifier	Junction of R4 and T15	Channel No. 13	—	For max. amplitude and recommended response with correct marker placement.	See Fig. 12-C for resultant alignment curve.

MISCELLANEOUS INSTALLATION AND SERVICE ADJUSTMENTS

REPLACEMENT OF PICTURE TUBE

To remove the picture tube from the television chassis, remove the picture tube socket and then untape and slide off the ion trap adjustment assembly. The ion trap can be removed readily, if the gap in the assembly is pulled apart slightly with the fingers while attempting to slide it. Loosen the two set screws partially that clamp the left side of the picture tube mounting strap, then slide the strap backward from the top-front rim of the picture tube until the rim of the tube is free from the strap. Carefully pull the tube out through the focus and deflection coils.

To replace a picture tube the reverse procedure should be followed, being careful never to force the picture tube if it sticks or fails to slip into place readily. Investigate and remove the source of the trouble. The picture tube should be oriented so that the anode cap is adjacent to the H.V. rectifier, V25, and the high voltage lead.

Wipe the screen surface of the tube to remove finger marks and dust. *PRECAUTION—Do not handle, remove, or install a picture tube unless shatterproof goggles and heavy gloves are worn.*

ION TRAP ADJUSTMENT

The ion trap may be approximately located as shown in Figure 18; however, its final adjustment must be made with the television receiver operating.

The approximate adjustment requires that the gaps in the two magnets be lined up with the break in the rubber holder.

NOTE—Some ion traps have been magnetized so that it is necessary to rotate the small magnet at 180 degrees to this normal position. Then slide the assembly onto the picture tube neck so that the ion trap assembly slit is at the bottom or top (dependent upon picture tube) and lines up approximately with pin No. 12 or No. 6. Slide the assembly forward on the picture tube until it is about the position shown in the illustration. NOTE—The wider of the two magnets should be located at the rear or the base end of the picture tube. The final following steps should be taken with the television receiver operating:

1. With Brilliance control advanced, turn ion trap assembly so that gap in rubber holder is faced up or down and lines up with either pin No. 6 or pin No. 12. Whichever way gives some illumination is the correct approximate orientation of assembly. If the tube, V19, is removed, it will be found much easier to adjust for maximum illumination since the resultant thin line will illuminate even though the magnets are considerably out of adjustment.

2. Move assembly back and forth and rotating it while viewing screen, adjust for maximum brightness.

3. If illuminated area gets very bright, reduce brightness with control and repeat Step 2. If tube V19 was removed as suggested in Step 1, replace it before proceeding with Step 4.

4. If any shadowing of the tube neck is present after completing Step 3, rotate the small (front) magnet to correct shadow and repeat Step 2 and 3. NOTE—Badly out-of-line focus coils or when the focus coil is too far away from the deflection coil assembly can also cause neck shadowing. The focus coil should be symmetrical and straight before starting the ion trap adjustment.

CENTERING (FOCUS COIL) ADJUSTMENT

The four focus coil adjustment screws should all be tightened sufficiently so that the springs are always under tension. Too loose pressure on the springs will result in the picture centering being unstable and possible neck shadowing. These adjustments are not readily available with the back cover in place unless a long screwdriver is used. Since each screw adjustment reacts in both the horizontal and vertical directions, a maladjustment in the centering may have to be corrected by the adjustment of one to four screws.

DEFLECTION YOKE ADJUSTMENT

Three set screws permit the deflection yoke to be loosened, permitting limited turning in either direction. If the picture does not line up horizontally or square with the picture tube mask, rotate the yoke until this condition is remedied, then tighten the set screws.

HORIZONTAL (HOLD) OSCILLATOR SPEED ADJUSTMENT

The horizontal hold control is a preset adjustment on the rear of the chassis which is used to adjust the speed. In addition, L33 changes the speed but is only used for supplemental adjustment when initially adjusting the circuit operation. For complete alignment both controls must be adjusted. Check operation first as follows:

Check on Alignment—With a normal television signal being received, free from excessive noise, turn the horizontal hold control to the position where the picture locks in horizontally and passes the following tests:

1. With a picture being received, switch the Service Selector to a channel having no program and then back to the desired channel. The picture should immediately lock into position.

2. With a picture being received, turn the television receiver power "off" for two or three seconds and then turn it back "on" again. The picture should come into synchronization within ten seconds after the picture tube has been illuminated.

3. Turn the Station Selector to the "radio" or "phono" position and allow the television receiver to transfer for two or three minutes to Broadcast reception, and then return to the television channel transmitting a picture. The picture should synchronize immediately upon showing raster.

4. Turn power off for three or four minutes and then turn "ON." The picture should lock-in horizontally within ten seconds after the raster becomes illuminated.

Minor Adjustments—The Horizontal Speed control should normally take care of any changes necessary to permit the circuit adjustment to pass the tests under "Check on Alignment." If attempted adjustment of the hold control will not permit all these checks to be met, then make the adjustment as outlined under "Complete Realignment."

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For test patterns see back of Manual

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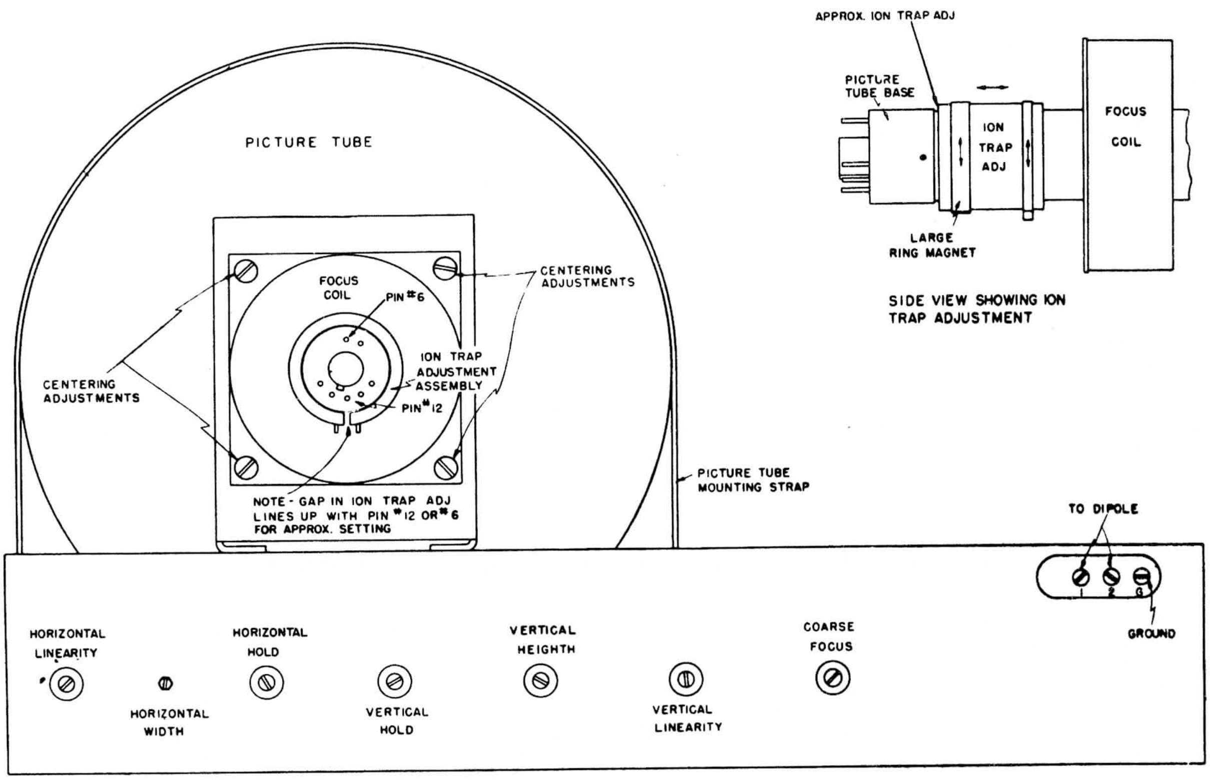

Fig. 18. Location of Preset Adjustment Controls

Complete Realignment—Tune in a television signal for optimum sound and adjust for normal contrast.

1. Remove clipper tube, V16A.
2. Short L33 out of circuit by placing a clip lead across its terminals.
3. Adjust the Horizontal Hold control until the picture is approximately held in frame horizontally. NOTE—With clipper tube V16A removed, the multivibrator is free-running and must be manually controlled vertically and horizontally.
4. Remove short circuit across L33.
5. Adjust iron core in L33 until the picture is approximately held in frame horizontally.
6. Replace clipper tube, V16A; then readjust Horizontal Hold control if necessary until all tests underlined under "Check on Alignment" are fulfilled.

VERTICAL (HOLD) OSCILLATOR SPEED ADJUSTMENT

This control, R46, is used to lock the picture in synchronism with the transmitted picture in the vertical direction. When the control is maladjusted the picture will slide vertically out-of-frame or lock out-of-frame, giving overlapping vertical images or even double images in the vertical direction. After the picture is locked in vertically on a normal picture, reduce the contrast control until the picture is barely visible, then readjust the control until the picture holds in frame.

HORIZONTAL LINEARITY AND WIDTH CONTROL

These controls react on each other so that when one control is adjusted the other may have to be. The adjustment of the linearity control should only be made on a test pattern signal. First, obtain the correct width by adjusting the width control, L23, until the picture extends approximately 1/8 inch outside the edge of the mask on both sides. Next, adjust the Horizontal Linearity control, R115, until the test pattern is symmetrical in the left and right direction. A slight readjustment of the Width control may now be necessary, as well as touching up of the centering adjusting screws.

VERTICAL LINEARITY AND HEIGHT CONTROL

The Height control, R49, is adjusted until the picture extends approximately 1/8 inch outside the edge of the mask on both top and bottom. Next, adjust the Vertical Linearity control, R58, until the test pattern is symmetrical from top and bottom. Readjustment of the Height and Vertical Hold controls as well as the centering adjustments may be necessary.

COARSE FOCUS

This control only appears on late production receivers. It is a three-position switch and it is adjusted to the position which permits the Focus control on the front panel to go through focus at about its mid-position.

PRODUCTION CHANGES

The following production changes have taken place up to the time that this service data was compiled. In all cases, the time of the change can only be approximately indicated by the serial number of the chassis.

1. *Video Coupling Capacitor, C3*—The original value of this capacitor was 0.5 mfd. This was reduced to a 0.1 mfd. capacitor to improve immunity to aircraft and elevated railway flutter. Change made at approximately Serial No. 8500.
2. *Coarse Focus Switch*—This switch was incorporated at Serial No. 9000 approximately. This permitted the Focus control on the front panel to always operate at or near its mid-position.
3. *21.9 MC Wave Trap*—The 21.9 mc wavetrap in the diode video i-f transformer, T18, was changed from an absorption type to a series tuned trap. This was done to improve the sound carrier rejection. This change was made at approximately Serial No. 9000.

TROUBLE SHOOTING

The following is a listing of possible troubles and their cures. This is not intended as a comprehensive coverage of all possible failures but serves to point out some of the more difficult troubles that may be experienced. From time to time this information will be expanded as information becomes available.

1. NO RASTER ON PICTURE TUBE

(a) Ion trap adjustment incorrectly made. Assembly on backward or improperly oriented. See ion trap adjustment under "Miscellaneous Preset and Service Adjustments."

(b) Check for waveform at output of T25. If present, the trouble is probably in the Type 8016 rectifier tube or filter circuit. Check for open in high voltage winding of T25. If the V25 tube filament glows yellow, high-voltage is being generated and the trouble will possibly exist in the picture tube, V24.

(c) If there is no waveform at output of T25, check operation of V22, and multivibrator V21 by oscilloscope waveform measurement.

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1. NO RASTER ON PICTURE TUBE (Cont'd)

(d) Check that high voltage anode cap is contacting the anode terminal of V24.
(e) Open Brightness control R108B, R60, or R111.
(f) No. B+ voltage at cathode of V24.
(g) If only 2000 or 3000 volts are generated, check deflection yoke, L12, and Width control, L23, for continuity.

2. RASTER NORMAL, NO PICTURE OR SOUND

(a) Oscillator V2 defective, or oscillator coil resonates out of band.
(b) Defective antenna or lead-in.
(c) Converter, r-f amplifier, or first video i-f amplifier stage defective.

3. PICTURE NORMAL, NO SOUND

(a) 4.5 mc audio i-f amplifier, V4, oscillator circuit, discriminator, or audio amplifier defective.
(b) Oscillator V2 off frequency.
(c) Defective speaker.

4. RASTER NORMAL, SOUND NORMAL, NO PICTURE

(a) Video i-f amplifier (after 1st i-f) inoperative.
(b) Resistor R134 in contrast control defective or open.
(c) Screen by-pass C40C open or shorted.

5. NORMAL PICTURE AND SOUND, NO HORIZONTAL OR VERTICAL SYNC.

(a) Check for signal input waveform at grid (1) of V16A.
(b) Defective V16A or plate circuit components.
(c) Operation of receiver with Contrast control advanced too far.

6. PICTURE NORMAL, NO VERTICAL SYNC.

(a) Check grid of V18B for normal waveform.
(b) Check speed of vertical multivibrator. Should be capable of free running speed less than 60 cps.
(c) Check V18A circuit components.

7. PICTURE NORMAL, NO HORIZONTAL SYNC.

(a) Check AFC transformer, T19.
(b) Check alignment of L33.
(c) Check socket voltages and waveforms of V17B and V21.
(d) Check resistors R39 and R136 for correct value.

8. NO VERTICAL OR NO HORIZONTAL DEFLECTION

(a) Check waveform and socket voltages of output and multivibrator tubes of respective sweep circuits.
(b) Check output transformer and yoke for continuity.

9. RIPPLE ON EDGE OF PICTURE

(a) Reflections on antenna lead-in.
(b) Defective capacitor, C59.

10. RASTER EDGE NOT STRAIGHT—KEYSTONING

(a) Defective yoke.
(b) Defective sweep transformer.
(c) Improperly adjusted ion trap adjustment assembly.

11. PICTURE JUMPY

(a) Operation at too high contrast control setting.
(b) If left of picture jitters, change 6BG6G sweep tube.
(c) Noisy sweep or sync circuit tubes.

12. POOR PICTURE DETAIL

(a) Mismatch in antenna or lead-in.
(b) Misalignment of i-f or r-f circuits.
(c) Defective chokes L10, L14, or L15 in video amplifier.
(d) Make sure that focus control operates on both sides of proper focus point.
(e) Overload of video amplifier, check contrast control operation.

13. PICTURE CANNOT BE CENTERED

(a) Move focus coil back by loosening all four adjustment screws.

14. HOWL ON FM BAND

(a) Move lead weight on oscillator tuner vane so that it mounts tightly against textolite crossarm.
(b) Use two polyethylene spacers in oscillator guillotine windows.
(c) Add Vistac "C" to oscillator vane.

SPECIFICATIONS

OVER-ALL DIMENSIONS:

Height .... 40 3/8 inches
Width .... 27 3/8 inches
Depth .... 23 inches

ELECTRICAL RATING:

Frequency .... 60 cycles
Voltage .... 105–125 volts
Wattage (Radio) .... 100 watts
Wattage (Television) .... 225 watts

R-F FREQUENCY RANGE:

Service Selector Switch	Freq. Range	Picture Carrier	Sound Carrier
Radio	540–1600 kc	.....	.....
FM	88–108 mc	.....	.....
No. 1	44–50 mc	45.25	49.75
No. 2	54–60 mc	55.25	59.75
No. 3	60–66 mc	61.25	65.75
No. 4	66–72 mc	67.25	71.75
No. 5	76–82 mc	77.25	81.75
No. 6	82–88 mc	83.25	87.75
No. 7	174–180 mc	175.25	179.75
No. 8	180–186 mc	181.25	185.75
No. 9	186–192 mc	187.25	191.75
No. 10	192–198 mc	193.25	197.75
No. 11	198–204 mc	199.25	203.75
No. 12	204–210 mc	205.25	209.75
No. 13	210–216 mc	211.25	215.75

INTERMEDIATE FREQUENCIES:

Television Video (Carrier Freq. Equivalent) .... 26.4 mc
Television and FM Audio (1st Conversion) .... 21.9 mc
Television and FM Audio (2nd Conversion) .... 4.5 mc
Broadcast Radio .... 455 kc

AUDIO POWER OUTPUT:

Undistorted .... 3 watts
Maximum .... 4.5 watts

RECORD PLAYER:

Type .... Automatic (Type P2)
Pickup .... G-E Variable Reluctance
Pickup Impedance .... 230 ohms

LOUDSPEAKER:

Type .... Alnico "PM" Dynamic
Size .... 12 inches
Voice Coil Impedance (400 cycles) .... 3.2 ohms

PICTURE SIZE:

Height .... 6 inches
Width .... 8 inches

ANTENNA REQUIREMENTS:

Type .... Folded Dipole
Impedance .... 300 ohms

PILOT LAMPS:

Dial (2) .... 6–8 v., G.E. No. 44 Frosted
Bezel .... 13 v., G.E. No. 1816

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MODEL 802

GENERAL ELECTRIC CO.

SOCKET VOLTAGE CHART

NOTE—All d-c measurements taken by a 20,000 ohm/volt meter. Service selector switch at Channel No. 1 unless noted. Contrast control at maximum. Brilliance at minimum.

SYMBOL	TUBE TYPE	PLATE		SCREEN		CATHODE		GRID		PLATE M.A.	SCREEN M.A.	NOTES
		PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	PIN	VOLTS			
V1	6AU6	5	130	6	130	7	1.4	1	0	7	—	
V2A	7F8	6	95	—	—	5	0	8	—	2.7	—	
V2B		3	140	—	—	4	0.8	1	—	6	—	
V3	6AC7	8	137	6	157	5	2.1	4	0	10.3	2.6	
V4	6BE6	5	202	6	33	2	0	7	0	1.0	1.6	
V5	6SG7	8	183	6	120	5	1.3	4	0	7.0	2.6	
V6	6SV7	6	215	4	31	3	0	2	−.58	.5	.2	
V7A	6AQ7GT	1 & 3	—	—	—	2	—	—	—	—	—	
V7B		5	88	—	—	6	0	4	−.47	1.2	—	
V8	6V6GT	3	233	4	212	8	11	5	0	34	2.3	
V9	6SG7	2	88	—	—	6	0	3	−.37	.9	—	
		5	132	—	—	6	0	4	−.37	1.2	—	
V10	5Y3GT	4 & 6	285AC	—	—	2	440	—	—	93 *	—	* Cathode current
V11	5U4G	4 & 6	228AC	—	—	2	270	—	—	175*	—	* Cathode current
V12	6AC7	8	155	6	158	5	2	4	0	10.4	1.6	
V13	6AC7	8	115	6	170	5	2.2	4	0	10.5	2.7	
V14	6AC7	8	201	6	113	5	0	4	−.7	13	2.9	
V15A	6H6	5	—	—	—	8	0	—	—	—	—	
V15B		3	150	—	—	4	155	—	—	—	—	
V16A	6SN7GT	2	14.3	—	—	3	0	1	−7	.2	—	
V16B		5	117	—	—	6	9.7	4	8.5	9.6	—	
V17A	6SL7GT	2	−6.4	—	—	3	.15	1	−6.4	0	—	
V17B		5	40.7	—	—	6	.68	4	.15	.5	—	
V18A	6SL7GT	2	.18	—	—	3	7	1	.18	0	—	
V18B		5	108	—	—	6	9.2	4	3	.9	—	
V19	6SN7GT	2	14	—	—	3	0	1	−.45	.8	—	
		5	7	—	—	6	0	4	−1.05	0	—	
V20	6V6GT	3	200	4	215	8	24	5	7	21	1.9	
V21A	6SN7GT	5	245	—	—	6	5	4	−31.5	2	—	
V21B		2	230	—	—	3	5	1	0	2.8	—	
V22	6BG6G	CAP	425	8	350	3	17	5	5.6	73	11.6	
V23	6AS7G	2	−.83	—	—	3	32	1	−6.5	—	—	
		5	−.83	—	—	6	32	4	−6.5	—	—	
V24	10BP4	CAP	8200*	10	425	11	157	2	80	—	—	* Use multiplier with 20,000 ohm/volt meter
V25	8016	CAP	—	—	—	2	8200*	—	—	—	—	* Use multiplier with 20,000 ohm/volt meter
V26	6BE6	5	205	6	55	2	.7	7	—	2.5	7.6	

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GENERAL ELECTRIC CO. MODEL 802

WAVEFORM MEASUREMENTS

The waveforms shown in Figures 35 through 55 represent measurements on an average receiver wherein the controls have been adjusted for a normal picture with correct Contrast, Height, Width and Linearity. Most measurements must be made when a signal is being received.

An oscilloscope where the vertical deflection amplifier has been pre-calibrated is used to take measurements at the point indicated in the waveform boxes. The oscilloscope sweep frequency is indicated in the waveform title.

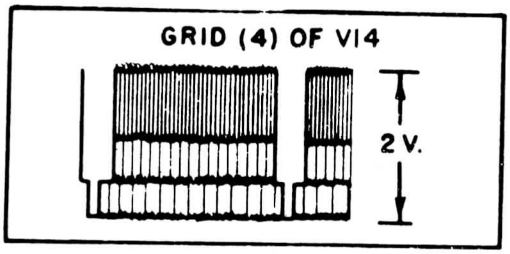

Fig. 35. Video Output of Detector (Osc. Synced at Half of Vert. Speed)

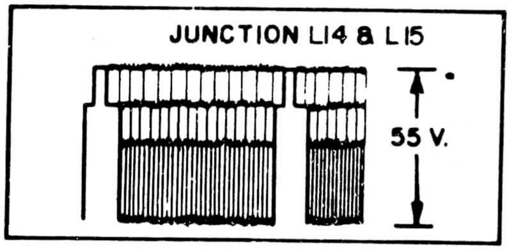

Fig. 36. Video Output of V14 (Osc. Synced at Half of Vert. Sweep Speed)

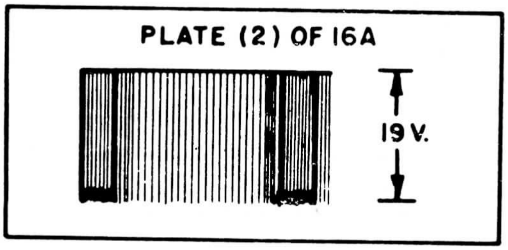

Fig. 37. Clipper Output (Osc. Synced at Half of Vert. Sweep Speed)

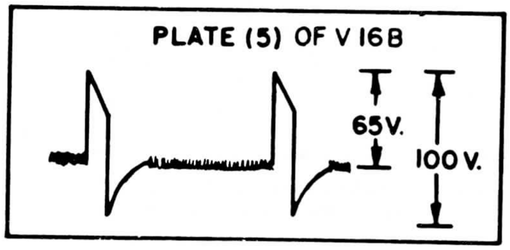

Fig. 38. Sync Amplifier Output (Osc. Synced at Half of Hor. Sweep Speed)

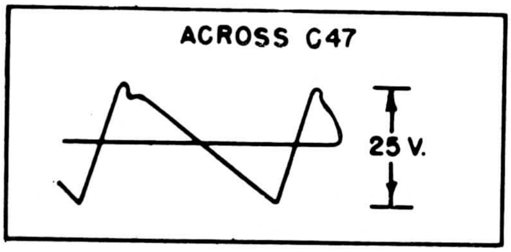

Fig. 39. A.F.C. Sawtooth (Osc. Synced at Half of Hor. Sweep Speed)

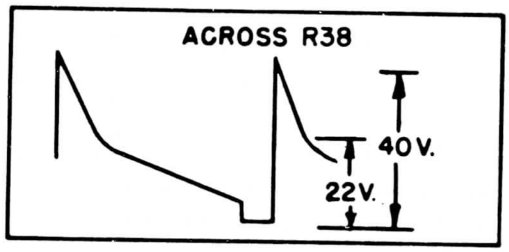

Fig. 40. Discriminator Voltage (Osc. Synced at Half of Hor. Sweep Speed)

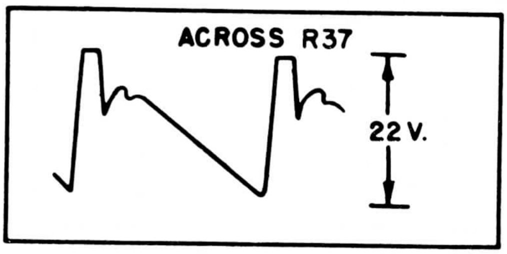

Fig. 41. Discriminator Voltage (Synced at Half of Hor. Sweep Speed)

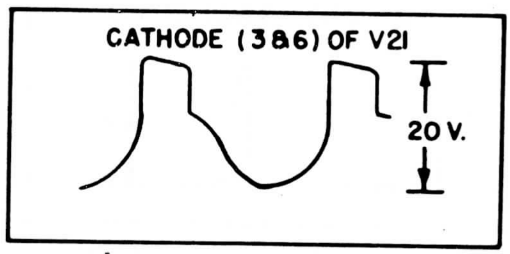

Fig. 42. Hor. M-V Cathode (Osc. Synced at Half of Hor. Sweep Speed)

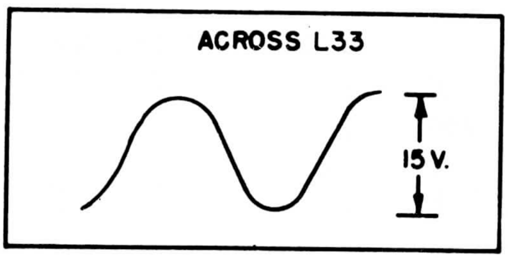

Fig. 43. Cathode Tuned Circuit (Synced at Half of Hor. Sweep Speed)

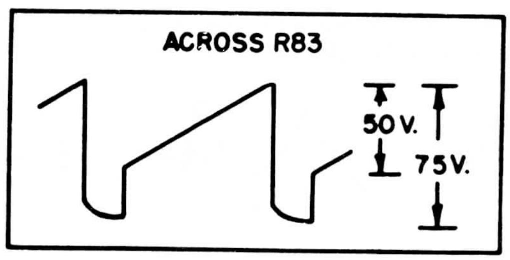

Fig. 44. Hor. M-V Output (Osc. Synced at Half of Hor. Sweep Speed)

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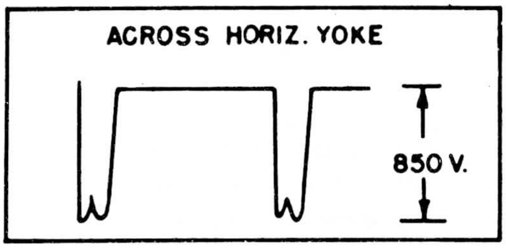

Fig. 45. Hor. Yoke Input (Osc. Synced at Half of Hor. Sweep Speed)

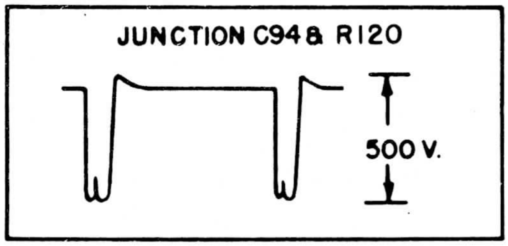

Fig. 46. V14 Control Voltage (Osc. Synced at Half of Hor. Sweep Speed)

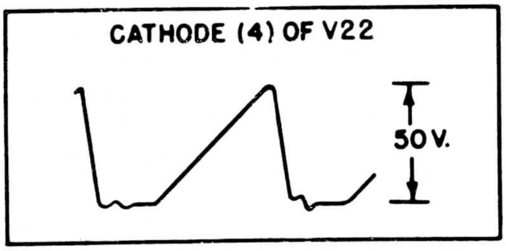

Fig. 47. 6BG6G Cathode (Osc. Synced at Half of Hor. Sweep Speed)

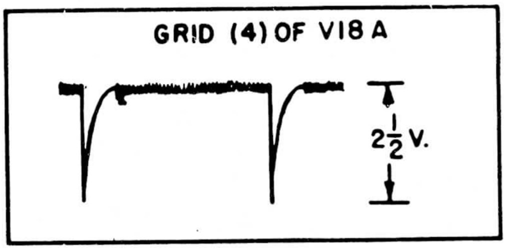

Fig. 48. Vert. Sync at V18A (Osc. Synced at Half of Vert. Sweep Speed)

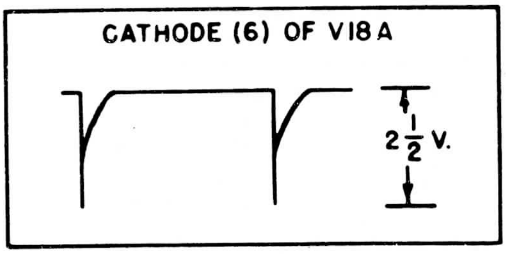

Fig. 49. Vertical Sync at Cathode V18A (Osc. Synced at Half of Vert. Sweep Speed)

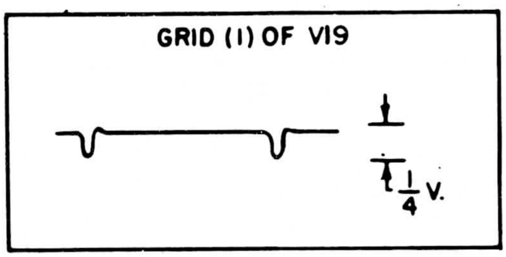

Fig. 50. Vert. Sync at Grid of M-V (Osc. Synced at Half of Vert. Sweep Speed)

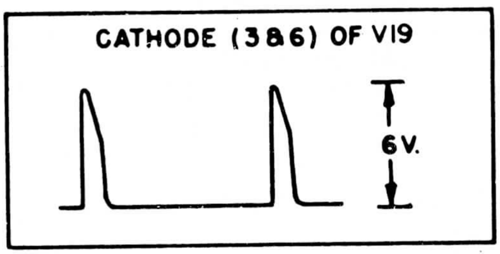

Fig. 51. Vert. M-V Cathode (Osc. Synced at Half of Vert. Sweep Speed)

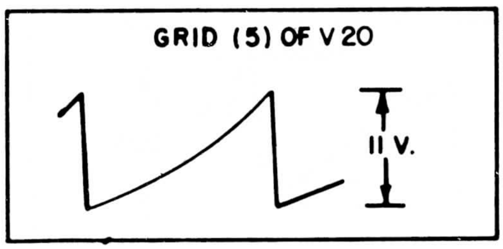

Fig. 52. Vert. M-V Output (Osc. Synced at Half of Vert. Sweep Speed)

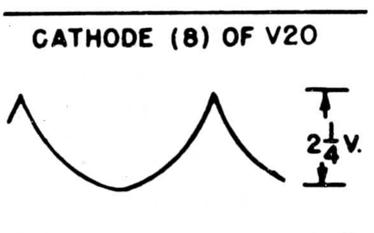

Fig. 53. Vert. Output Cathode (Osc. Synced at Half of Vert. Sweep Speed)

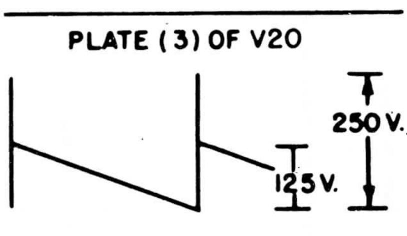

Fig. 54. Vert. Output of V20 (Osc. Synced at Half of Vert. Sweep Speed)

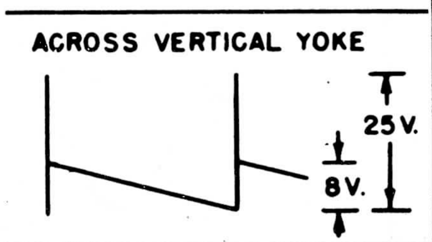

Fig. 55. Vert. Yoke Input (Osc. Synced at Half of Vert. Sweep Speed)

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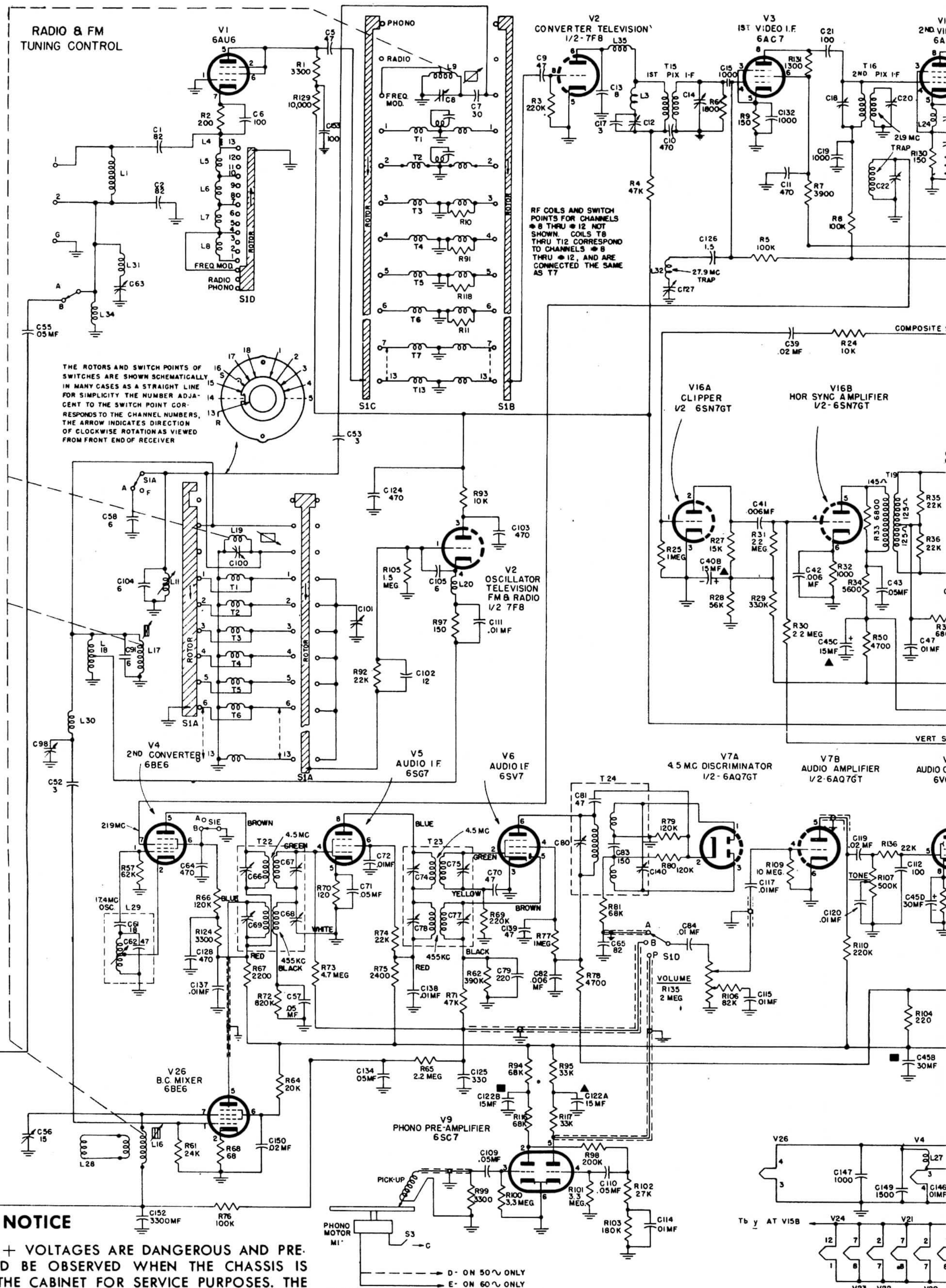

CAUTION NOTICE

THE REGULAR B+ VOLTAGES ARE DANGEROUS AND PRECAUTIONS SHOULD BE OBSERVED WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE PURPOSES. THE HIGH VOLTAGE SUPPLY (8000 V.) AT THE PICTURE TUBE ANODE WILL GIVE AN UNPLEASANT SHOCK BUT DOES NOT SUPPLY ENOUGH CURRENT TO GIVE A FATAL BURN OR SHOCK. HOWEVER, SECONDARY HUMAN REACTIONS TO OTHERWISE HARMLESS SHOCKS HAVE BEEN KNOWN TO CAUSE INJURY. SINCE THE HIGH VOLTAGE IS OBTAINED FROM THE B+ VOLTAGE CERTAIN PORTIONS OF THE HIGH VOLTAGE GENERATING CIRCUIT ARE DANGEROUS AND EXTREME PRECAUTIONS SHOULD BE OBSERVED.

Schematic Diagram, M

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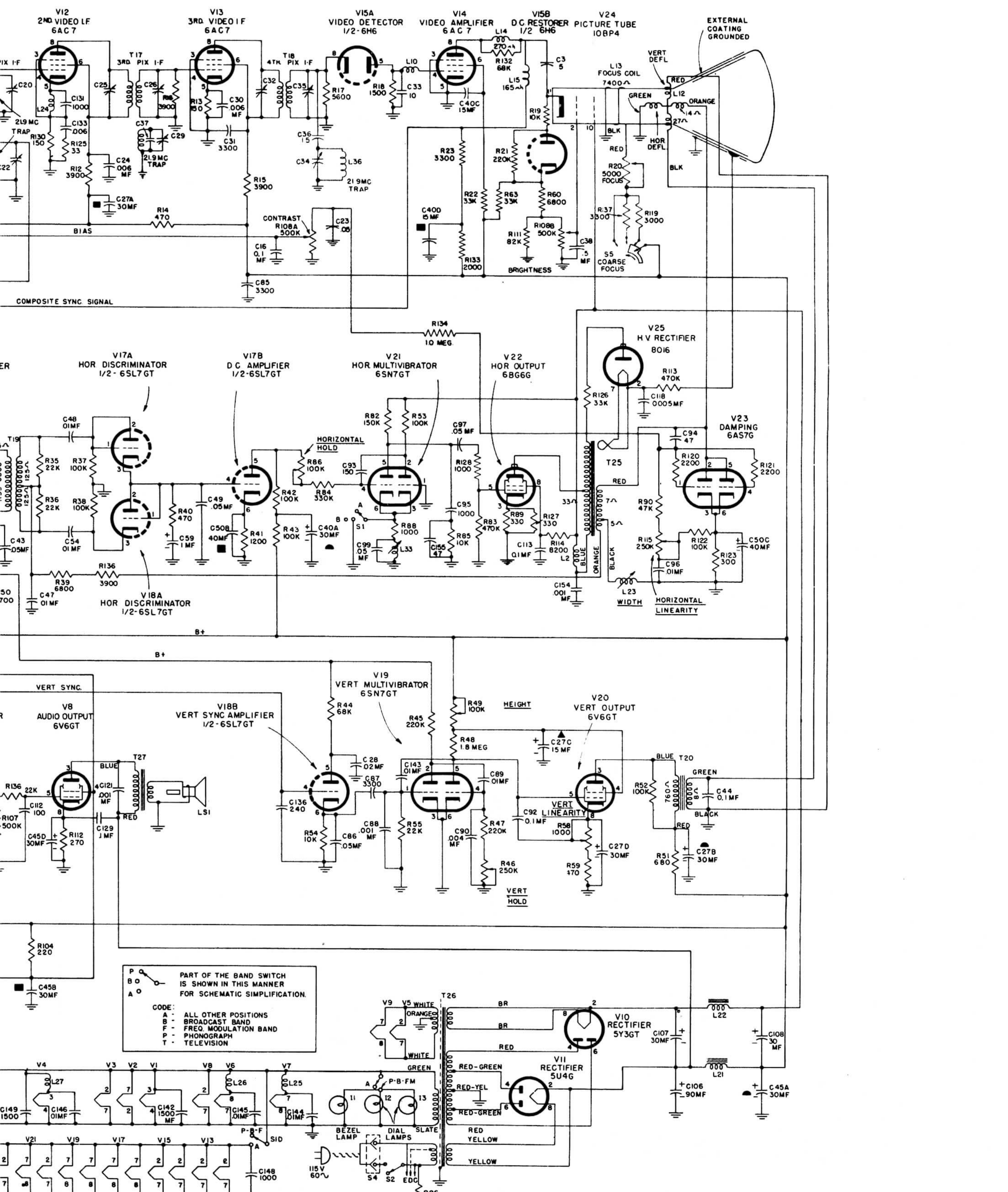

Diagram, Model 802

THE PICTURE TUBE IS HIGHLY EVACUATED AND IF BROKEN, GLASS FRAGMENTS WILL BE VIOLENTLY EXPELLED. IF IT IS NECESSARY TO CHANGE THE PICTURE TUBE, USE SAFETY GOGGLES AND GLOVES.

GENERAL ELECTRIC CO.

REPLACEMENT PARTS LIST

UNIVERSAL REPLACEMENT PARTS

Cat. No.	Symbol	Description	Suggested Unit List Price
UCC-001	C88	CAPACITOR—.001 mfd., 200 v., paper	
UCC-006	C30, 42, 133	CAPACITOR—.006 mfd., 200 v., paper	
UCC-008	C115, 117	CAPACITOR—.01 mfd., 200 v., paper	
UCC-011	C49, 55, 57, 71, 86, 134	CAPACITOR—.05 mfd., 200 v., paper	
UCC-013	C16	CAPACITOR—0.1 mfd., 200 v., paper	
UCC-017	C59	CAPACITOR—1.0 mfd., 200 v., paper	
UCC-021	C90	CAPACITOR—.004 mfd., 400 v., paper	
UCC-025	C48, 54, 114	CAPACITOR—.01 mfd., 400 v., paper	
UCC-026	C28	CAPACITOR—.02 mfd., 400 v., paper	
UCC-028	C109	CAPACITOR—.05 mfd., 400 v., paper	
UCC-030	C3, 92	CAPACITOR—0.1 mfd., 400 v., paper	
UCC-035	C121, 154	CAPACITOR—.001 mfd., 600 v., paper	
UCC-040	C38, 47, 72, 84, 89, 96, 120, 137, 143	CAPACITOR—.01 mfd., 600 v., paper	
UCC-041	C39, 119, 150	CAPACITOR—.02 mfd., 600 v., paper	
UCC-045	C23, 43, 97, 110	CAPACITOR—.05 mfd., 600 v., paper	
UCC-048	C44, 113, 129	CAPACITOR—0.1 mfd., 600 v., paper	
UCU-1036	C79	CAPACITOR—220 mmf., mica	
UCU-1540	C125	CAPACITOR—330 mmf., mica	
UCU-1544	C11, 64, 103, 124, 128	CAPACITOR—470 mmf., mica	
UCU-1052	C15, 19, 60, 95, 131, 132, 147, 148	CAPACITOR—1000 mmf., mica	
UCU-1064	C31, 85, 87, 152	CAPACITOR—3300 mmf., mica	
UCU-1076	C111, 144, 145, 146	CAPACITOR—10,000 mmf., mica	
UCU-1504	C33	CAPACITOR—10 mmf., mica	
UCU-1520	C70, 94, 139, 155	CAPACITOR—47 mmf., mica	
UCU-1526	C1, 2, 65	CAPACITOR—82 mmf., mica	
UCU-1528	C21, 112	CAPACITOR—100 mmf., mica	
UCU-2532	C93	CAPACITOR—150 mmf., mica	
UCU-2538	C136	CAPACITOR—240 mmf., mica	
UCW-1020	C5, 9	CAPACITOR—47 mmf., ceramic	
UCW-2006	C102	CAPACITOR—12 mmf., ceramic	
UDL-005		LAMP—Dial scale lamp. 6-8 v. (frosted)	
UDL-019		LAMP—Bezel lamp; 13 volts, 0.33 a.	
UJB-004		BOARD—Dipole antenna terminal board	
UOP-1247	LS1	SPEAKER—12-inch PM loudspeaker	
URD-013	R125	RESISTOR—33 ohms, ½ w., carbon	
URD-021	R68	RESISTOR—68 ohms, ½ w., carbon	
URD-029	R9, 13, 97, 130	RESISTOR—150 ohms, ½ w., carbon	
URD-049	R32, 94, 128	RESISTOR—1000 ohms, ½ w., carbon	
URD-052	R131	RESISTOR—1300 ohms, ½ w., carbon	
URD-055	R6	RESISTOR—1800 ohms, ½ w., carbon	
URD-057	R67, 120, 121	RESISTOR—2200 ohms, ½ w., carbon	
URD-061	R1, 99, 124	RESISTOR—3300 ohms, ½ w., carbon	
URD-065	R78	RESISTOR—4700 ohms, ½ w., carbon	
URD-069	R33, 60	RESISTOR—6800 ohms, ½ w., carbon	
URD-073	R10, 11, 19, 24, 54, 85, 91, 118	RESISTOR—10,000 ohms, ½ w., carbon	
URD-077	R27	RESISTOR—15,000 ohms, ½ w., carbon	
URD-081	R55, 74, 136	RESISTOR—22,000 ohms, ½ w., carbon	
URD-083	R102	RESISTOR—27,000 ohms, ½ w., carbon	
URD-085	R22, 63, 95, 117	RESISTOR—33,000 ohms, ½ w., carbon	
URD-089	R71	RESISTOR—47,000 ohms, ½ w., carbon	
URD-091	R28	RESISTOR—56,000 ohms, ½ w., carbon	
URD-093	R44, 81, 116, 194	RESISTOR—68,000 ohms, ½ w., carbon	
URD-095	R106, 111	RESISTOR—82,000 ohms, ½ w., carbon	
URD-097	R5, 8, 52, 76	RESISTOR—100,000 ohms, ½ w., carbon	
URD-099	R79, 80	RESISTOR—120,000 ohms, ½ w., carbon	
URD-101	R82	RESISTOR—150,000 ohms, ½ w., carbon	
URD-103	R103	RESISTOR—180,000 ohms, ½ w., carbon	
URD-104	R98	RESISTOR—200,000 ohms, ½ w., carbon	
URD-105	R21, 45, 69, 110, 126	RESISTOR—220,000 ohms, ½ w., carbon	
URD-109	R29, 47, 84	RESISTOR—330,000 ohms, ½ w., carbon	
URD-111	R62	RESISTOR—390,000 ohms, ½ w., carbon	
URD-113	R83, 113	RESISTOR—470,000 ohms, ½ w., carbon	
URD-119	R72	RESISTOR—820,000 ohms, ½ w., carbon	
URD-121	R25, 77, 96, 134	RESISTOR—1.0 meg., ½ w., carbon	
URD-125	R105	RESISTOR—1.5 meg., ½ w., carbon	
URD-129	R30, 31, 65	RESISTOR—2.2 meg., ½ w., carbon	
URD-133	R100, 101	RESISTOR—3.3 meg., ½ w., carbon	
URD-137	R73	RESISTOR—4.7 meg., ½ w., carbon	
URD-145	R109	RESISTOR—10 meg., ½ w., carbon	

UNIVERSAL REPLACEMENT PARTS (Cont'd)

Cat. No.	Symbol	Description
URD-1027	R70	RESISTOR—120 ohms, ½ w., carbon
URD-1032	R2	RESISTOR—200 ohms, ½ w., carbon
URD-1041	R40	RESISTOR—470 ohms, ½ w., carbon
URD-1051	R41	RESISTOR—1200 ohms, ½ w., carbon
URD-1063	R16	RESISTOR—3900 ohms, ½ w., carbon
URD-1067	R17	RESISTOR—5600 ohms, ½ w., carbon
URD-1081	R35, 36, 92	RESISTOR—22,000 ohms, ½ w., carbon
URD-1082	R61	RESISTOR—24,000 ohms, ½ w., carbon
URD-1092	R57	RESISTOR—62,000 ohms, ½ w., carbon
URD-1097	R37, 38, 42, 43	RESISTOR—100,000 ohms, ½ w., carbon
URD-1105	R3	RESISTOR—220,000 ohms, ½ w., carbon
URD-1127	R48	RESISTOR—1.8 meg., ½ w., carbon
URE-035	R112	RESISTOR—270 ohms, 1 w., carbon
URE-041	R59	RESISTOR—470 ohms, 1 w., carbon
URE-045	R51	RESISTOR—680 ohms, 1 w., carbon
URE-065	R50	RESISTOR—4700 ohms, 1 w., carbon
URE-067	R34	RESISTOR—5600 ohms, 1 w., carbon
URE-089	R4, 90	RESISTOR—47,000 ohms, 1 w., carbon
URE-097	R53, 122	RESISTOR—100,000 ohms, 1 w., carbon
URE-099	R66	RESISTOR—120,000 ohms, 1 w., carbon
URE-1056	R133	RESISTOR—2000 ohms, 1 w., carbon
URE-1058	R75	RESISTOR—2400 ohms, 1 w., carbon
URE-1063	R12, 15, 136	RESISTOR—3900 ohms, 1 w., carbon
URE-1073	R93, 129	RESISTOR—10,000 ohms, 1 w., carbon
URF-033	R104	RESISTOR—220 ohms, 2 w., carbon
URF-037	R89, 127	RESISTOR—330 ohms, 2 w., carbon
URF-041	R14	RESISTOR—470 ohms, 2 w., carbon
URF-071	R114	RESISTOR—8200 ohms, 2 w., carbon
URF-1061	R23	RESISTOR—3300 ohms, 2 w., carbon
URF-1063	R7	RESISTOR—3900 ohms, 2 w., carbon
URF-1080	R64	RESISTOR—20,000 ohms, 2 w., carbon

SPECIALIZED REPLACEMENT PARTS

Cat. No.	Symbol	Description
RAB-041		BACK—Cabinet back assembly
RAL-001		BEZEL—Cabinet pilot lamp bezel
RCC-001	C24, 41, 82	CAPACITOR—.006 mfd., 600 v., paper
RCC-086	C99	CAPACITOR—.05 mfd., 200 v., oil filled paper
RCE-002	C122A, B	CAPACITOR—15 mfd., 350 v.; 15 mfd., 350 v., electrolytic
RCE-017	C106	CAPACITOR—90 mfd., 450 v., electrolytic
RCE-018	C50B, C	CAPACITOR—40 mfd., 25 v.; 40 mfd., 25 v., electrolytic
RCE-043	C27A, B, C, D C45A, B, C, D	CAPACITOR—30 mfd., 300 v.; 30 mfd., 300 v.; 15 mfd., 300 v.; 30 mfd., 50 v.; electrolytic
RCE-044	C40A, B, C, D	CAPACITOR—30 mfd., 300 v.; 15 mfd., 300 v.; 15 mfd., 300 v.; 15 mfd., 300 v., electrolytic
RCE-045	C107, 108	CAPACITOR—30 mfd., 300 v., electrolytic
RCN-011	C118	CAPACITOR—500 mmf., lectrofilm, high voltage
RCW-019	C52, 53	CAPACITOR—3 mmf., ceramic
RCW-1002	C58	CAPACITOR—6 mmf., ceramic
RCW-2008	C7	CAPACITOR—30 mmf., ceramic
RCW-023	C91, 104, 105	CAPACITOR—6 mmf., ceramic
RCW-026	C142, 149	CAPACITOR—1500 mmf., ceramic
RCW-1028	C6, 153	CAPACITOR—100 mmf., ceramic
RCW-1045	C126	CAPACITOR—1.5 mmf., ceramic
RCW-1046	C13	CAPACITOR—8 mmf., mica
RCY-015	C101	CAPACITOR—Television tuning capacitor
RCY-029	C8, 100	CAPACITOR—1 to 8 mmf., trimmer
RDC-032		CORD—Dial drive cord (bulk)
RDD-007		DRUM—Television tuning condenser drive drum assembly
RDD-010		DRUM—Tuner plate drive drum (large drum)
RDK-071		KNOB—Control knob for OFF-Tone, Volume, and FM Radio Tuning
RDK-072		KNOB—Control knob for television tuning
RDK-073		KNOB—Control knob for Service Selector
RDK-074		KNOB—Control knob for Contrast
RDK-075		KNOB—Control knob for Brightness
RDK-105		KNOB—Control knob for Focus
RDM-006		MASK—Picture tube mask
RDP-023		POINTER—Radio tuning dial pointer assembly
RDS-034		GLASS—Dial scale glass
RDS-064		SCALE—Dial scale and backplate
RDW-004		GLASS—Picture tube safety glass
RDX-038		DRUM—Dial pointer drive shaft and drum assembly
REI-006		CORE—Powdered iron core for L16 and L17
REI-012		CORE—Powdered iron core for Horizontal Size control
REI-013		CORE—Powdered iron core for L33
RET-001		TRAP—Ion trap assembly
RHB-001		BASE—Base for miniature tube shield
RHC-010		SPRING CLIP—Holds mounting insulators of L9 and L19

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REPLACEMENT PARTS LIST (Cont'd)

SPECIALIZED REPLACEMENT PARTS (Cont'd)

Cat. No.	Symbol	Description	Suggested Unit List Price
RHC-014		CLIP—High voltage filter capacitor spring clip	
RHM-027	L9	GUILLOTINE—Oscillator inductance	
RHM-042	L19	GUILLOTINE—Inductance for R-F guillotine	
RHS-017		SHIELD—Miniature tube shield	
RJB-019		BOARD—High voltage rectifier socket mounting board	
RJC-001		PLUG—Speaker lead terminal plug	
RJC-007		CONNECTOR—Picture tube high voltage anode connector	
RJJ-005	S4	RECEPTACLE—A-c receptacle (male) on chassis	
RJP-004		PLUG—Phono lead plug	
RJP-015		PLUG—A-C (female) plug on cabinet back cover	
RJS-012		PLATE—Mounting plate for electrolytic (small size)	
RJS-030		SOCKET—Octal base tube socket—standard	
RJS-035		SOCKET—Octal tube socket—mica (For V10, V11, and V22)	
RJS-037		PLATE—Mounting plate for electrolytic (large size)	
RJS-042		SOCKET—Loctal tube socket for 7F8	
RJS-049		PLUG—A-c phono motor plug	
RJS-058		SOCKET—Picture tube socket	
RJS-059		SOCKET—Radio dial scale pilot lamp socket	
RJS-107		SOCKET—Miniature tube socket (6AU6, 6BE6)	
RJS-085		SOCKET—Cushioned tube socket (6SC7)	
RJS-087		SOCKET—High voltage rectifier tube socket	
RJS-088		CAP—Protector cap for base of high voltage rectifier	
RJS-101		SOCKET—Bezel pilot lamp socket	
RJX-002		SOCKET—Phono motor power cord socket	
RJX-003		JACK—Phono jack and insulator	
RJX-021	S1	SWITCH—R-F coil and switch assembly completely wired and aligned (including tubes)	
RHC-008		CLIP—Clip for holding tubular electrolytic capacitor	
RHM-016		CLIP—B-C oscillator coil (L18) clip	
RII-001		INSULATOR—Supports Guillotine inductance	
RLA-013	L16	COIL—B-C antenna coil	
RLC-023	L17	COIL—B-C oscillator coil	
RLD-001	L12	COIL—Horizontal and vertical deflection coil assembly	
RLF-005	L22	CHOKE—7 henry, 75 ma., filter	
RLF-006	L21	CHOKE—7 henry, 140 ma., filter	
RLF-008	L13	COIL—Focus coil	
RLF-009	L1	CHOKE—Antenna choke	
RLI-003	L7	CHOKE—R-F cathode choke	
RLI-006	L4, 8, 30	CHOKE—R-F choke	
RLI-009	L10	CHOKE—Video coupling choke	
RLI-035	T1	COIL—R-F and oscillator coil (Channel 1)	
RLI-036	T2	COIL—R-F and oscillator coil (Channel 2)	
RLI-022	T3	COIL—R-F and oscillator coil (Channel 3)	
RLI-023	T4	COIL—R-F and oscillator coil (Channel 4)	
RLI-024	T5	COIL—R-F and oscillator coil (Channel 5)	
RLI-025	T6	COIL—R-F and oscillator coil (Channel 6)	
RLI-019	L20	CHOKE—Oscillator cathode choke	
RLI-033	L24	CHOKE—I-f cathode choke	
RLI-038	L15	CHOKE—165 uh choke	
RLI-039	L14, R132	CHOKE—270 uh choke and 68,000-ohm resistor	
RLI-048	T7	COIL—R-F and oscillator coil (Channel 7)	
RLI-049	T8	COIL—R-F and oscillator coil (Channel 8)	
RLI-050	T9	COIL—R-F and oscillator coil (Channel 9)	
RLI-051	T10	COIL—R-F and oscillator coil (Channel 10)	
RLI-052	T11	COIL—R-F and oscillator coil (Channel 11)	
RLI-053	T12	COIL—R-F and oscillator coil (Channel 12)	
RLI-054	T13	COIL—R-F and oscillator coil (Channel 13)	
RLI-034	L2, 25, 26, 27	CHOKE—Filament choke	

SPECIALIZED REPLACEMENT PARTS (Cont'd)

Cat. No.	Symbol	Description
RLM-007	L18	COIL—B-C padder coil
RLM-010	L11	COIL—FM oscillator padder
RLM-011	C56, 98, 127, L132	TRIMMER STRIP—B-C r-f and oscillator and 27.9 mc trap trimmer and coil assembly
RLW-002	L36	COIL—21.9 mc trap coil
RMK-005		COUPLING—Focus control flexible coupling
RMM-056		SPACER—High voltage rectifier socket stand-off spacer
RMM-057		CUSHION—Picture tube cushion
RMM-058		VANE—Oscillator guillotine (L19) tuning vane and wire assembly
RMM-059		VANE—R-F guillotine (L9) tuning vane and wire assembly
RMR-004		RUBBER—Channel rubber for dial
RMS-004		SPRING—Television tuning drive cord spring
RMS-043		SCREW—Iron core (B-C tuning coils) adjusting screws
RMS-109		SPRING—Focus coil tension spring
RMS-110		STRAP—Picture tube clamping strap
RMS-119		SPRING—Radio tuning drive cord tension spring
RMS-128		SPRING—Picture tube external coating ground spring
RMS-129		STRAP—Tuning strap (includes elevator platforms for B-C and FM tuning members)
RMU-039		SHAFT—Radio tuning shaft
RMW-041		PULLEY—Idler pulley for elevator drive strap (at top of guillotine)
RMX-107		SHAFT—Television tuning shaft and pulley (includes "C" washer)
RMX-106		SHAFT—Tuner plate drive shaft and elevator strap drive drum
RPX-010		PICK-UP—Variable reluctance pick-up
RRC-034	L32	CHOKE—Variable choke (Horizontal size)
RRC-040	R107, S2	POTENTIOMETER—500,000 ohms (Tone control and Power switch)
RRC-041	R49, 86	POTENTIOMETER—100,000 ohms (Vertical Height and Horizontal Hold control)
RRC-042	R46, 115	POTENTIOMETER—250,000 ohms (Horizontal Linearity & Vertical Hold controls)
RRC-043	R58	POTENTIOMETER—1000 ohms, 2 w. (Vertical Linearity control)
RRC-045	R135	POTENTIOMETER—2 meg. (volume control)
RRC-051	R108A, B	POTENTIOMETER—500,000 ohms dual (Contrast and Brilliance)
RRC-057	R20	POTENTIOMETER—5000 ohms, 4 w. (Focus)
URD-049	R88	RESISTOR—1000 ohms, ½ w., carbon
RRW-011	R123	RESISTOR—300 ohms, wirewound
RRW-012	R119	RESISTOR—3000 ohms, wirewound
RSW-038		SWITCH—Coarse focus control switch (not on early production receivers)
RTD-005	T24	TRANSFORMER—FM discriminator
RTL-037	T22	TRANSFORMER—1st FM and BC i-f
RTL-038	T23	TRANSFORMER—2nd FM and B-C i-f
RTL-046	T15	TRANSFORMER—1st video i-f
RTL-047	T16	TRANSFORMER—2nd video i-f
RTL-049	T18	TRANSFORMER—4th video i-f
RTL-055	T17	TRANSFORMER—3rd video i-f
RTM-001	T19	TRANSFORMER—Horizontal AFC transformer
RTO-016	T20	TRANSFORMER—Vertical output transformer
RTO-027	T27	TRANSFORMER—Audio output
RTO-032	T25	TRANSFORMER—Horizontal sweep output and H.V.
RTP-030	T26	TRANSFORMER—Power transformer, 117 v., 60 cycles
RWL-010	S4	CORD—Power cord assembly, includes interlock plug

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