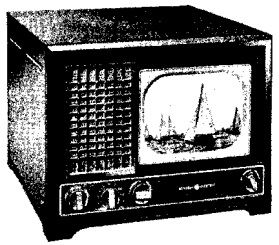


SPECIFICATIONS

OVER-ALL DIMENSIONS:

Height	14⅞ inches
Width	19 inches
Depth	20⅛ inches

ELECTRICAL RATING:

Frequency	60 cycles
Voltage	115 volts
Wattage	220 watts

R-F FREQUENCY RANGE:

Channel Selector Position	Frequency Range	Picture Carrier	Sound Carrier
#2	54–60 MC	55.25	59.75
#3	60–66 MC	61.25	65.75
#4	66–72 MC	67.25	71.75
#5	76–82 MC	77.25	81.75
#6	82–88 MC	83.25	87.75
#7	174–180 MC	175.25	179.75
#8-9	180–186 MC	181.25	185.75
#8-9	186–192 MC	187.25	191.75
#10-11	192–198 MC	193.25	197.75
#10-11	198–204 MC	199.25	203.75
#12-13	204–210 MC	205.25	209.75
#12-13	210–216 MC	211.25	215.75

INTERMEDIATE FREQUENCIES:

Video (Carrier Equivalent)	26.3 mc
Audio	21.8 mc

AUDIO OUTPUT:

Undistorted	1.5 watts
Maximum	4.0 watts

LOUDSPEAKER:

Type	Alnico PM Dynamic
Cone Diameter	5¼ inches
Voice Coil Impedance (400 cycles)	3.2 ohms

PICTURE SIZE:

Height	6⅜ inches
Width	8½ inches

ANTENNA REQUIREMENTS:

Type	Folded dipole or equivalent
Impedance	300 ohms

TUBE COMPLEMENT (22, INCLUDING RECTIFIERS)

Symbol	Purpose	Type
V1	R-F Amplifier	6AU6
V2	Converter-Oscillator	12AT7
V3	1st Video I-F Amplifier	6AU6
V4	2nd Video I-F Amplifier	6AU6
V5	3rd Video I-F Amplifier	6AU6
V6	Video Detector—Clipper Rectifier	6AL5
V7	Video Amplifier—Limiter	12AU7
V8	Picture Tube	10FP4
V9	Vertical Sweep Generator	6SN7GT
V10	Vertical Sweep Output	6V6GT
V11	Phase Inverter—Clipper	6SN7GT
V12	Horizontal AFC—Sweep Generator	6SN7GT
V13	Horizontal Sweep Output	6BG6-G
V14	High Voltage Rectifier	1B3GT/8016
V15	Horizontal Damping	5V4G
V16	Rectifier	5U4G
V17	Audio I-F Amplifier	6AU6
V18	Audio I-F Limiter	6SH7
V19	Audio Discriminator—Amplifier	6AQ7GT
V20	Audio Output	6K6GT/G
V21	Rectifier	5Y3GT
V22	Audio I-F Amplifier	6AU6

GENERAL INFORMATION

The General Electric television receiver is a table model type, using 22 tubes to provide reception in the 12 commercial television channels. The television picture is reproduced on a 10-inch electromagnetically deflected picture tube.

Features of the television receiver include a constant input impedance r-f amplifier with a balanced input, safe high-voltage power supply, automatic frequency control for horizontal synchronization, ten-inch picture tube with aluminumized screen and a high fidelity FM audio system. In a later production, automatic Gain Control has been added.

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 (9000 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 [illegible] HARMLESS SHOCKS HAVE BEEN KNOWN TO CAUSE INJURY. SINCE THE HIGH VOLTAGE IS OBTAINED FROM THE B + VOLTAGE, CARE [illegible] THE HIGH VOLTAGE GENERATING CIRCUIT ARE DANGEROUS AND EXTREME PRECAUTIONS SHOULD BE OBSERVED.

THE PICTURE TUBE IS HIGHLY EVACUATED AND IF BROKEN, GLASS FRAGMENTS WILL BE VIOLENTLY EXPELLED. IF IT IS NECESSARY TO REMOVE THE PICTURE TUBE, USE SAFETY GOGGLES AND GLOVES. ALWAYS WEAR GOGGLES WHEN CHASSIS IS REMOVED FROM CABINET.

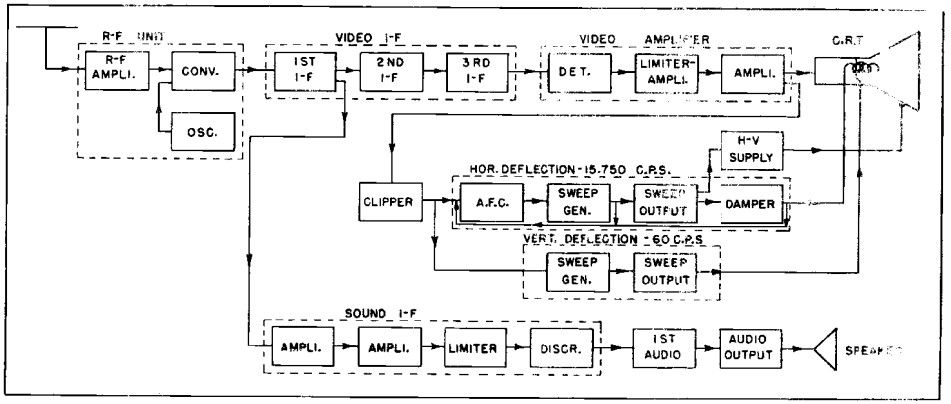


Fig. 1. Block Diagram, Model 835

DESCRIPTION—TELEVISION 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 separation.
5. Horizontal sweep generator and AFC sync.
6. Horizontal sweep output.
7. Vertical sweep generator and output.
8. High voltage power supply.
9. Low voltage power supply.

A brief description of the operation of each section is described in the following paragraphs. This is supplemented by simplified circuit diagrams of each portion of the circuit under discussion. Reference is also made to the complete schematic diagram as shown in Figure 38.

Some of the following circuits are somewhat modified in the later production of receivers incorporating Automatic Gain Control. These chassis are identified by the letter "R" stamped upon the front apron adjacent to the contrast control shaft.

A block diagram of the complete Model 835 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 FIGURE 2)—The r-f amplifier makes use of a Type 6AU6 pentode tube connected as a triode grounded grid amplifier. The antenna is connected into the cathode circuit of the tube through a transformer, T1, so as to provide a substantially constant input impedance of 300 ohms to the antenna and lead-in at all frequencies. The transformer, T1, is balanced to ground in the primary winding providing cancellation of noise pick-up on the antenna lead-in. An electrostatic shield is incorporated between the primary and secondary windings to prevent noise being transferred from primary to secondary by capacity effect. R1 is the normal bias resistor for V1. A choke (L_K in Figure 2) is placed in series with this cathode resistor to prevent the input impedance from being lowered by the shunting effect of the cathode bias resistor and by-pass capacitor, R1 and C2. It also neutralizes the total cathode capacity, thus preventing it from affecting the input impedance. The choke value is changed when switching from the lower five to the upper seven channels. L1 is a series compensating choke which prevents a loss in gain on the high frequency channels.

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 self-tuned by the distributed and tube capacities to provide optimum gain. Variable trimmers C5 and C6 are shunted across the primary and secondary windings of the r-f transformer, respectively, to permit compensation for misalignment resulting from differences of tube capacities when a tube change is necessary. On Channel No. 2, Fig. 38, the transformer is triple tuned to provide better image frequency attenuation of the 88-108 mc FM band. Three of the transformers, T8, T9, and T10, are used to cover the upper six channels. Each transformer is made sufficiently broad-band to accept two television channels.

The triode converter is one section of a Type 12AT7 dual triode, V2B. Bias for this tube is developed by the oscillator voltage appearing in the grid of V2B, causing grid rectification charging the grid resistor-capacitor combination, R [illegible] C7.

The oscillator makes use of the remaining half of the Type 12AT7 tube, V2A, and is capacity coupled to the converter tube through the capacitor, C8. The oscillator is a modified Colpitts oscillator, oscillation being produced by the grid-to-cathode capacitor, C32, and the plate-to-cathode interelectrode capacity, C_p, of the oscillator tube. The choke, L4, provides a path to ground to the cathode of the oscillator tube and 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 channels. Three oscillator coils, L11, L12 and L13, are used to cover the upper six channels, the frequency range of the oscillator circuit at each coil switching being sufficient to tune two channels.

To prevent hum modulation by the local oscillator when operating on the high frequency channels, the heater supply to V2A is rectified by a selenium rectifier and filtered.

The r-f amplifier, converter and oscillator section is constructed as a complete unit sub-assembly which can be readily demounted from the main chassis.

2. VIDEO AND AUDIO I-F AMPLIFIERS (SEE FIGURE 3)—The video i-f amplifier makes use of a three-stage bandpass amplifier using three Type 6AU6 tubes. The transformers, T11, T12, T13, and T14, are overcoupled and then loaded with resistance in the

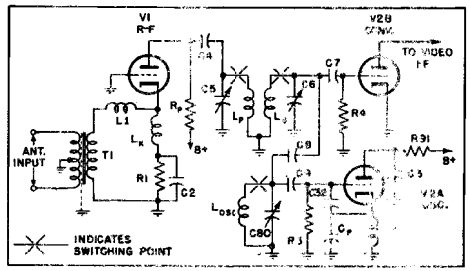


Fig. 2. R-F Amplifier, Converter and Oscillator

secondary circuits to give an adequate bandpass frequency characteristic. A single movable powdered iron core is used in transformers, T11, T12 and T13, for tuning. This adjusts the secondary sice. The transformer T14 uses two tuning slugs to tune both primary and secondary. A tertiary winding is incorporated on T11 which connects to a series resonant trap circuit to permit adjustment of the slope of the high frequency end of the bandpass. It is adjusted so that 26.3 mc falls at the 50 per cent point on the curve to compensate for the sesqui-sideband transmission of the video carrier frequencies.

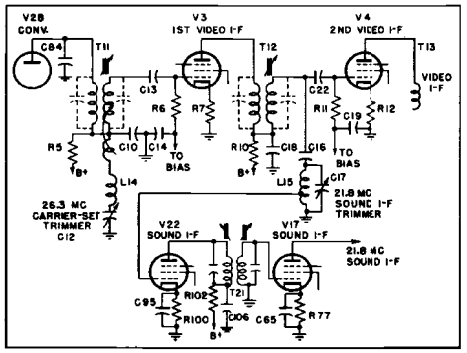


Fig. 3. Video and Audio I-F Amplifier

A series-tuned trap circuit consisting of C16, and the parallel combination of L15 and C17 is connected across the secondary of T12 and tuned for maximum attenuation of 21.8 mc in the video amplifier. This affords the necessary attenuation of the accompanying sound i-f from being passed through the video i-f and in addition is used to take-off the sound i-f for the audio i-f channel. The audio i-f is taken off at a tap on the inductance, L15, and then applied directly to the grid of the audio i-f amplifier tube V22. Additional i-f gain and selectivity is provided by two stages of amplification. Since the television audio is frequency modulated, the transformer T19 functions with the diode section of V19 as the discriminator.

Bias voltage derived from the grid return circuit of the horizontal blocking oscillator, is applied to the grid circuits of the video i-f amplifier tubes, V3, V4 and V5. A potentiometer (Contrast) control, permits this voltage to be changed on V3 and V4 so as to vary the gain of the video i-f amplifier.

3. VIDEO DETECTOR AND AMPLIFIER (SEE FIGURE 4)—The video i-f amplifier output is applied to one section of a 6AL5 dual diode, V6A, which is connected as a shunt diode so as to develop a negative-going signal across the diode load resistance, R19. The signal is then amplified by two triode amplifier stages using a Type 12AU7 dual triode tube, V7. L16 and L23 are series compensating coils, while L22 and L17 are shunt compensating coils. These are used to obtain good high frequency response and provide sharp cut-off at frequencies above the usable pass band. L16 also helps prevent harmonics of the i-f frequency from being passed through the video amplifier.

In addition to amplification, the first video amplifier tube, V7A, operates as a noise limiter. The B+ voltage applied to the plate circuit is low and the video signal from the detector is negative-going. Any large excursions of voltage above sync level such as introduced by transient noise, will drive the grid to plate current cut-off. Thus, the interference will be limited close to the level of the super-sync signal. This improves the signal to transient noise interference ratio without affecting the video signal.

With the use of capacity coupling in the video amplifier, the d-c component of the video signal must be restored to maintain proper background illumination. This is accomplished in the grid circuit of V7B. The video signal at this grid is positive-going so that with the resultant grid current flow, the capacitor C28 charges up to the peak value of the sync pulse. Since this charge will vary with the amplitude of the pulse, the resulting bias change will provide the required restoration of the d-c. This restoration in the grid circuit of V7B, necessitates direct coupling of the picture tube, V8, grid to the plate circuit of V7B. By connecting the cathode of V8 to a variable B+ source, the proper bias may be maintained on the picture tube and the brilliance may be changed.

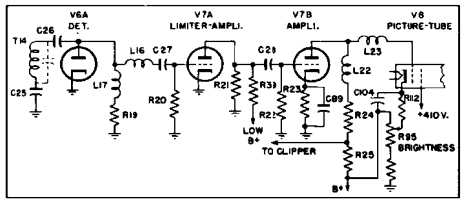


Fig. 4. Video Detector and Amplifier

4. SYNC SEPARATION (SEE FIGURE 5)—Amplification and separation of the sync pulse from the composite video signal is accomplished by tube sections, V11A, V6B, and V11B.

Triode section, V11A, is used to amplify and invert the phase of the composite video signal applied to its grid circuit and also to further limit the transient noise. This produces a video signal in the plate of V11A wherein the sync pulses are the most positive portion of the voltage waveform. This positive-going signal is applied across the diode section, V6B, which rectifies the positive portion and charges the capacitor C42 negatively in proportion to the amplitude of the sync pulses. This diode thus establishes a bias for tube V11B and also clamps the sync so that each recurring pulse originates at the zero voltage axis.

The clamped composite video waveshape applied to the grid of tube section V11B, which is biased by the diode V6B, causes the negative portion of this waveshape to be cut off in the cathode and plate circuits of V11B, leaving only the sync pulses. The horizontal synchronizing pulses are developed across R92 in the cathode of V11B and are positive-going. The vertical pulses are developed at the plate of V11B and are negative-going.

An integrating network consisting of C39, R37, C38, R36, and C37, is used to separate the horizontal sync from the vertical sync pulses before passage of the sync signal to the vertical sweep generator.

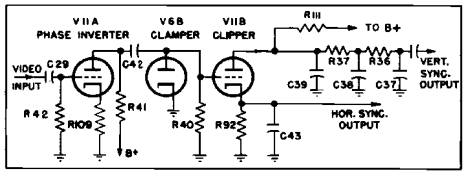


Fig. 5. Sync Separator Circuit

5. HORIZONTAL SWEEP GENERATOR AND AFC SYNC (SEE FIGURE 6)—The horizontal sawtooth generator makes use of one section of a Type 6SN7GT tube, V12B, connected in a blocking oscillator circuit. Instead of its frequency being controlled directly by the horizontal sync pulses, it is controlled by a d-c voltage on its grid, which is the resultant of the phase difference between the incoming sync signal and a voltage wave derived from the output of the sweep generator. The resultant d-c voltage produced by the tube V12A is called an automatic frequency control (AFC) voltage.

The tube V12A obtains its operating bias through its connection to the grid circuit of the blocking oscillator tube, V12B, through resistor, R51. The blocking oscillator produces a large negative bias in its grid circuit during its normal operating cycle. When the horizontal sync pulses or the combined output voltage (shown at lower left of Figure 6) are impressed separately on the grid of tube V12A, they do not have sufficient positive amplitude to cause appreciable plate current flow in tube V12A. However, if they are combined and phased properly as shown in Figure 7A, 7B, or 7C, their composite amplitude is sufficient to cause plate current to flow during that portion of the cycle where the waveshape is above the dash line axis in Figure 7. During the time that conduction takes place, the capacitors C86 and C78 become charged positive in respect to ground, the magnitude of the charge and the resultant voltage thereon, being dependent upon the duration of the flow of plate current in tube V12A.

Since the resistor R50 is in the bleeder circuit across the filter and also forms a part of the grid return circuit for the sweep generator tube V12B, any change in voltage across R50 will thus result in a change of frequency in the sweep generator. Thus if the contributing voltage of R50 makes the grid of V12B less

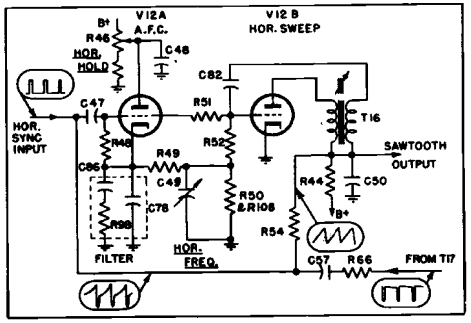


Fig. 6. Horizontal Sweep and A.F.C. Sync

negative, the frequency will be raised; likewise, if the contributing voltages make the grid of V12B more negative, the frequency will be lowered. Thus, it will be seen that the longer the conduction period of tube V12A, the higher will be the frequency of the blocking oscillator and its sawtooth output.

Referring to Figure 7, the (B) curve shows a sync pulse phased so that about 50 per cent of the pulse width is riding on top the integrated sawtooth, while the remainder of the pulse after point (x) falls down into the trough, making the conducting portion have a width which is an average between curves represented by (A) and (C). If each successive sync pulse falls in the same phase relation as shown in curve (B), the Horizontal Hold control which controls the amount of current flow through V12A is set so that this phase relation does not change. This would cause the sweep generator V12B to be running at the same frequency as that of the transmitted signal. Under this condition, if the sweep generator tends to run slower than the incoming sync signal, the conduction period will be made longer through tube V12A because the pulse will move forward in relation to the integrated sawtooth wave with a result as shown in Figure 7 (A). It will be noted that the conduction pulse is of greater duration (wider) than in curve (B). Therefore, tube V12A will conduct for a greater period of time, thus decreasing the negative potential across R50. This greater conduction period causes the sweep generator to speed up until it attains the condition in (B). Likewise, if the sweep generator is operating at too high a frequency, the pulse will advance along the integrated sawtooth wave until a large portion of it falls down into the trough of the waveshape, as shown in Figure 7 (C), with the resultant shortening (narrowing) of the conducting pulse. This causes the frequency of the sweep generator to be reduced until the condition in Figure 7 (B) is again restored.

The Horizontal Frequency Control, C49, is a capacitor that forms a part of the discharge circuit in the grid of the blocking oscillator, V12B. By varying its value, the free running speed of this oscillator can be adjusted to supplement and act as a course control for the Horizontal Hold control on the front panel. The free running speed of the blocking oscillator is also adjusted by the inductance variation of the blocking oscillator coil, T16.

6. HORIZONTAL SWEEP OUTPUT (SEE FIGURE 8)—The horizontal sawtooth voltage generated by the blocking oscillator,

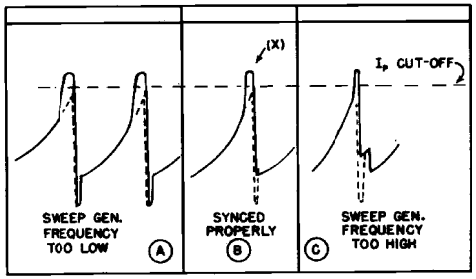


Fig. 7. A.F.C. Waveshapes

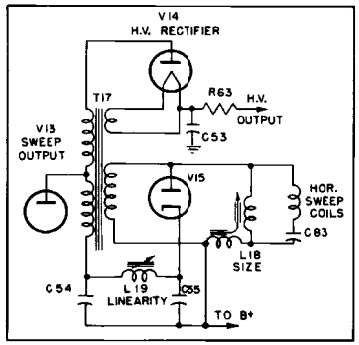


Fig. 8. Horizontal Sweep Output

V12B, is shaped and then amplified by a Type 6BG6G tube, V13. The output of this tube is coupled to the horizontal deflection coils through an impedance matching transformer, T17. The damping tube diode, V15, is used principally to remove a transient oscillation created by the rapid retrace of the current in the high inductance of T17 and still retain the positive overshoot in the primary winding for use in the high voltage supply. It also is used to provide a linear trace and to recover some of the energy from the inductive kick-back and use it to help supply the B+ requirements of the output tube. During conduction of V15, capacitors C54 and C55 are charged up and since they are in series with the B+ voltage to tube V13, they contribute a sizeable portion of the plate voltage. The variable inductance, L19, and C54, constitute a phase shift network which alters the phase of the ripple voltage developed across C55. This means of changing the ripple voltage which also supplies part of the B+ to the output tube provides a method of controlling the linearity.

A horizontal drive control, C81, Fig. 38, forms a capacity voltage divider in conjunction with capacitor C51 so as to control the amount of sawtooth voltage supplied to the grid of V13. This permits adjustment of the grid sawtooth voltage to compensate for variations in output tubes.

The Horizontal Width Control, L18, forms a series-parallel circuit in respect to the output to the yoke. The inductance is variable in both coils of this control; the inductance of the series choke is maximum when the parallel choke is minimum and vice versa. The parallel circuit shunts the current around the deflection coil, depending upon its inductance, and the series coil attenuates the current by changing the impedance of the series circuit. This type of control provides a uniform impedance to the output transformer over a wide range of adjustment.

7. VERTICAL SWEEP GENERATOR AND OUTPUT (SEE FIGURE 9)—The vertical sawtooth voltage is generated by a Type 6SN7GT tube, V9, connected as a multivibrator. This voltage is coupled directly to a Type 6V6G vertical sweep output amplifier tube, V10, and then to the vertical sweep yoke, D1, through the impedance matching transformer, T15. Vertical speed is controlled by changing the time constant of the multivibrator grid circuit by the potentiometer, R29. Sweep size or height of picture is changed by the potentiometer, R31, which changes the B+ voltage applied to the charging network (R30, C34) of tube V9 simultaneously with the screen voltage on tube V10. Vertical linearity is controlled by feeding back correcting voltage developed in the cathode circuit of V10 through C34 into the grid

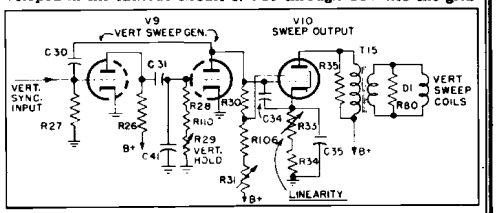


Fig. 9. Vertical Sweep and Output

circuit of the output tube, V10. The cathode voltage of V10 which is fed back through C34 has an opposite curvature corresponding to the non-linear portion of the generated sawtooth output of V9 so that by combining these voltages in the grid of V10 correction may be affected. The amount of the correction voltage is controlled by the Vertical Linearity potentiometer, R33, in the cathode of V10.

8. HIGH VOLTAGE SUPPLY (SEE FIGURE 8)—The high voltage for the second anode of the picture tube is derived by making use of the inductive "kick" voltage produced during retrace in the horizontal output transformer, T17. This kick voltage has a magnitude of several thousand volts and is positive-going, appearing between the plate of V11 and ground. Since this voltage in itself is not sufficient to produce the required anode potential, an additional winding connected electrically and magnetically with the primary is added to provide further step-up of this voltage. The top of this autotransformer is connected to the plate of a rectifier tube, V14. This tube is a Type 1B3GT/8016 which derives its filament voltage from the horizontal sweep transformer T17 by a single turn around the core. Since the frequency supplied the rectifier tube is high (15,750 cps), a 500 mmf. filter capacitor is more than adequate to give a smooth d-c output. Due to the small capacity of the filter, this supply is relatively safe to handle.

9. LOW VOLTAGE POWER SUPPLY (SEE FIGURE 38)—Two rectifier tubes, V16 and V21 (type 5U4G and 5Y3GT respectively), are used to supply the required plate current for the receiver. Each tube is used in a separate and complete rectifier circuit to supply two values of output B+ voltage, 290 volts and 360 volts. The Focus coil which is a combination permanent and electro magnet is connected in series with a portion of the output current path in the lower voltage supply, the current through it being controlled by the Focus Control potentiometer, R72.

CIRCUIT ALIGNMENT

GENERAL—A complete alignment of the receiver tuned circuits consists of the following individual alignment procedures. These are listed below in the correct sequence of alignment. However, any one section alignment may be performed without the necessity of realignment of any one of the other sectional alignments.

1. Sound I-F Alignment.
2. Video I-F Alignment.
3. R-F Alignment.
4. Oscillator Adjustments.

The alignment procedure is shown in table form
Read the following detailed instructions before attempting alignment as given in the table.

TEST EQUIPMENT—To provide alignment as outlined above, the following test equipment is required:

1. R-F Sweep Generator.

(a) Frequency Requirements.
20 to 30 mc with 10 mc sweep width.
40 to 90 mc with 15 mc sweep width.
170 to 220 mc with 25 mc sweep width.

(b) Constant output over sweep width range.

(c) At least 0.1 volt output.

2. Signal Generator—Must have good frequency stability and be accurately calibrated. It should be capable of tone modulation over the following frequency ranges:

21.8 mc for sound i-f.
22.9 mc for video i-f marker.
23.4 mc for video i-f marker.
25.55 mc for video i-f marker.
26.3 mc for video i-f marker.
45–88 mc and 174–216 mc for oscillator adjustment and markers for the r-f channel bandwidth measurements.

3. Oscilloscope—This oscilloscope should preferably have a 5-inch screen and have good wide-band frequency response on the vertical deflection. Although the high frequency response is unnecessary for alignment, it will be useful when making the waveform measurements shown in Figure 19

4. Crystal Calibrator—This unit is essential to establish calibration check points for the signal generator so as to provide good accuracy of calibration.

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 alignment adjustments in the sound and video i-f amplifier, are available from the top of the chassis with the exception of the sound 1st i-f secondary, discriminator secondary and the last video i-f primary. The location of the

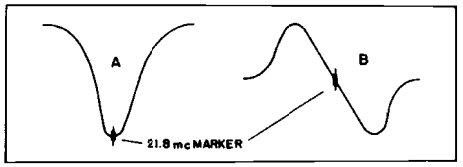


Fig. 10. Audio I-F Curves

adjustments is shown in Figure 16. Remove the chassis from the cabinet. When it is necessary to make adjustment from the bottom of the chassis, the chassis may be rested on its side so that the power transformer is down. The following suggestions apply to each individual alignment procedure.

1. Sound I-F Alignment—The sweep generator is connected through a 500 mmf. capacitor to the grid of the tube preceding the sound i-f coil to be aligned. Connect the oscilloscope through a 100,000-ohm resistor across the resistor, R104, in the limiter tube, V18 grid. Insert a 21.8 mc marker signal from an unmodulated signal generator into the grid of V3. Keep the marker signal attenuated so that it just shows a marker on the sweep curve. Adjust L21 and T21, respectively, as you advance progressively one stage at a time, for maximum gain and symmetry of the response curve about the 21.8 mc marker. The curve should be similar to that shown in Figure 10(A). With input at the 1st audio i-f, V22, the bandwidth should be approximately 300 kc at the 70% response point.

Excessive sweep generator input will cause the sound i-f amplifier to overload and the response curve to broaden, resulting in slight misadjustment of the tuned circuits. During each alignment step, keep the signal input to each stage limited to a value which develops not more than a ¾ volt peak at the limiter grid (junction R104 and C100), as measured by a calibrated oscilloscope.

For discriminator alignment, apply the signal generator output to the grid of V22 and connect the oscilloscope to the junction of C74 and R86. The secondary core of the discriminator transformer, T19, is aligned by using an amplitude-modulated signal. The adjustment is made for minimum output, as indicated visually at the oscilloscope or by merely listening for the tone modulation at the speaker. The discriminator primary slug is adjusted for a maximum peak-to-peak amplitude response curve of the frequency-modulated signal input, as shown in Figure 10-E.

2. Video I-F Alignment—The video i-f amplifier uses transformers which are coupled and loaded to give the proper band-pass characteristics.

IMPORTANT:—On early production receivers, the contrast control should be set at −4 volts bias measured at the junction of R6, R8, and C14 with a vacuum tube voltmeter. For i-f alignment of receivers incorporating Automatic Gain Control, marked "R," it is necessary to apply a −4 volts battery bias to the 1st and 2nd video i-f tubes at the junction of R6 and R11. If a battery is not available, C42 may be shunted with a .1 mfd. capacitor and the contrast control adjusted to produce the required −4 volts as measured with a vacuum tube voltmeter at the junction of R6 and R11.

Stage-by-stage alignment should be performed so as to duplicate as closely as possible the curves as shown in Figure 11A,B, C, and D. The markers supplied by an accurately calibrated signal generator are used to establish the correct bandwidth and frequency limits.

Connect the sweep generator to the tube grid preceding the transformer to be aligned and the oscilloscope to the junction of L16 and C27 in series with a 10,000 ohm resistor. Set the channel selector switch to channel #4. Adjust the sweep width for a minimum of 10 mc about the center frequency of the video response curve. The sweep output cable should be shielded and preferably terminated in its characteristic impedance and then connected with as short a lead as possible through a 500 mmf. capacitor; the ground lead of the cable should be short and grounded to the chassis as near as possible to where the signal is applied. Sufficient marker signal may be supplied in most cases, except at the last stage by merely connecting the high side of the signal generator to the television chassis. At the last stage, couple the marker generator through a small capacitor approximately 50 to 100 mmf. in parallel with the sweep input; keep the input low enough so that it doesn't influence the shape of the response curve.

The primary of the transformer preceding the grid where the signal is applied will act as a tuned trap, placing a dip in the alignment curve as viewed on the scope, unless it is detuned sufficiently to throw it out of the video i-f pass-band. To detune this transformer merely remove the tube which feeds the primary

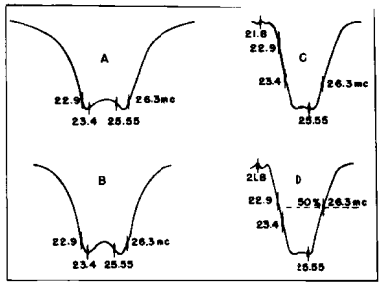


Fig. 11. Video I-F Curves

winding, as indicated in Steps 6, 7 and 8. ***Be sure to replace the tube after the stage is aligned.*** Another method of detuning is to slip an iron core slug in the primary side of the i-f transformer. The audio take-off trap trimmer C17 should be aligned for minimum 21.8 mc audio i-f frequency in the video i-f amplifier, as in step 8 of video i-f alignment.

The sweep generator should then be set to give ¾ volts peak, as measured with a calibrated oscilloscope between the junction of L16 and C27 and chassis.

When making the video i-f alignment, the 26.3 mc marker should be at 50% or slightly lower than 50% for maximum picture detail. The 26.3 mc marker should never be more than 50% of the distance from the base line to the flat portion of the curve. Prior to the alignment of transformer T11 in step (10), turn the carrier set trimmer, C12, to its minimum capacity.

Proper video i-f curves with correct marker positions are shown above in Figure 11.

If the response is peaked on low frequency end of response curve and cannot be brought down to the proper relationship with high frequency end by means of the tuning slug, change the 6AU6 tube into which the signal is fed. It may be that the 6AU6 has an above average plate capacity which would cause this trouble.

3. R-F Alignment—The r-f coil and switch 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.

The minimum requirements for correct r-f alignment are (1) to provide the correct bandwidth, (2) for the response curve to be centered within the limit frequencies shown for each of the individual channels as in Figure 14, and (3) for the response curve to be adjusted for maximum amplitude consistent with correct bandwidth. To provide these minimum requirements, the r-f coils are overcoupled and loaded with resistance. Tuning of the coils is effected by changing inductance of the individual coils. Except

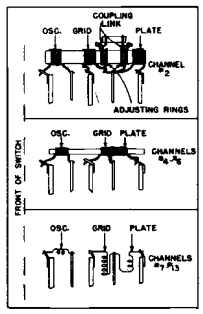


Fig. 12. R-F Coil Assembly

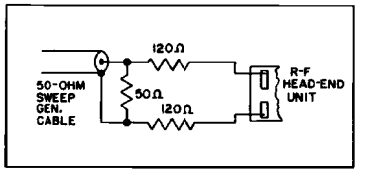


Fig. 13. Sweep Generator Termination

for the Channels #2 and #3 coils, the coupling is fixed by the design of the coil and switch wafers.

The physical assembly of the coils in the band switch locates the r-f amplifier plate coil at the rear of the switch assembly, while the oscillator coil is switched by the front wafer. Three different types of coils are used. These are shown in Figure 12. On all channels except Channels #7 through #13, the r-f, converter, and oscillator coils are wound on a single coil form. Mutual inductance between turns of the converter and r-f coils provides the desired coupling. On Channel #2, the converter and r-f coils are spaced for loose coupling and the mutual is increased by inserting a tertiary link winding between the coils. By adjusting the link, the mutual can be changed and better image rejection of the FM band (88 to 108 mc) signals results. Tuning of the link circuit is accomplished by adjusting two movable copper rings. The Channel #3 plate and grid coils are overcoupled by spacing of the two coils in relationship to each other and are tuned by spacing of the component turns. The Channels #4 through #6 transformers are wound so that the converter and r-f coils are wound as a continuous winding, the a-c ground return for the two coils being a tapped turn on this winding. This tight spacing affords a good uniformity in mutual coupling. The tuning is accomplished by moving turns. The upper six channels, #7 through #13, are tuned by four sets of coils. Each converter and r-f coil is overcoupled to give adequate bandpass so that two channels may be covered by each set of coils except channel #7. Instead of magnetically coupling the r-f and converter coils in relation to each other, they are physically located on the channel switch so that the only coupling is afforded by the common a-c ground return of each coil. This ground return is made through a special shaped metal wafer on the channel switch.

The input sweep signal is applied to the antenna terminal board at the r-f unit. Disconnect the 300-ohm cable between the antenna terminal board and the r-f amplifer input. To prevent distortion of the r-f response curve by standing waves, the unbalanced shielded cable of the signal generator should be terminated as shown in Figure 13. The resistors used should be non-inductive. The marker signal generator may be loosely coupled through a small capacitor to the same point of input as the sweep generator.

The output r-f response curve is taken off at the junction of R5 and C10 through a 10,000 ohm resistor. Disconnect C10. The Contrast control is set for a minimum for all r-f alignments.

For Channels #2 and #3, the r-f coils should be aligned to give approximately the curve shown in Figure 14(A) and 14(B). The "P" marker represents the video carrier marker, while the "S" marker is the sound marker. The frequency of these markers is indicated for each step of the alignment procedure. Adjustment of the bandwidth is made by moving the plate coil closer to the grid coil or vice-versa. On Channel #2, 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 to change frequency. Spreading turns results in a raising of the frequency; while squeezing turns lowers the frequency.

For Channels #4 through #6, the coupling is fixed by the tight coupling between the primary and secondary turns. How-

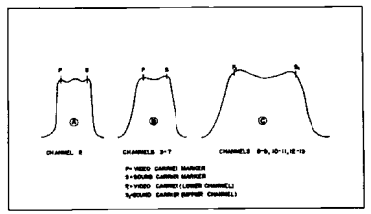


Fig. 14. R-F Alignment Curves

ever, this can be controlled to a certain degree along with the frequency by either spreading or squeezing the end turns of the combination converter and r-f coil. On the upper four coil assemblies covering the channels #7 through #13, the coupling cannot be changed as it is fixed by the common ground wafer located between the r-f and converter coil switching wafer. This ground wafer is cut to give the proper amount of coupling at the time of manufacture. Tuning of these upper frequency coils is effected by the brass adjustment screws which form a shorted turn in the coil. The further the screw is introduced into the coil field, the higher will be the frequency and vice versa.

The variable capacitors C5 and C6 are used to compensate for the slight differences in tube capacities which affect tuning when it is necessary to change the r-f or converter tube in the field. These trimmers are adjusted for Channel #6, as indicated in the Alignment Table, and then are not readjusted until a new tube is substituted for either V1 or V2.

Note: When making r-f alignment, the tuning control should be set so that the oscillator frequency is approximately correct. This may be checked by tuning in the sound frequency for that particular channel for maximum audio output. A 200 to 300 ohm resistor should be shunted across the primary of T11 or R103. This is done to prevent the oscillator voltage from upsetting the r-f alignment curve.

4. Oscillator Adjustments—The oscillator coils for Channels #2 through #7 are adjusted so that the Tuning control, C80, will tune the station at the mid-rotation position for each of these channels. Since the other remaining six channels, #8 through #13, are combined so as to be covered by only three switching positions, the oscillator coils are adjusted so that the Tuning control will tune in the two channels assigned each switch position at two points equi-distant from the two extremes of its rotation. With the Tuning control set to its mid-position, the oscillator coil is adjusted to give a maximum output when a modulated r-f signal at the test frequency specified is fed into the antenna terminals. The oscillator coils are adjusted by spreading turns to raise frequency or compressing turns to lower frequency.

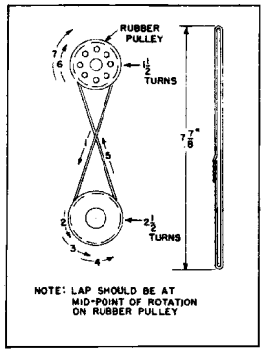


Fig. 15. Focus Control Stringing

Apply the signal generator with tone modulation to the antenna input terminals and set the generator to the frequency specified in the Alignment Table for each switch position. 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 then 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 station may be heard through the loudspeaker.

The oscillator coil is located on the coil form or switch assembly nearest to the front of the r-f unit. This is shown in Figures 12 and 17.

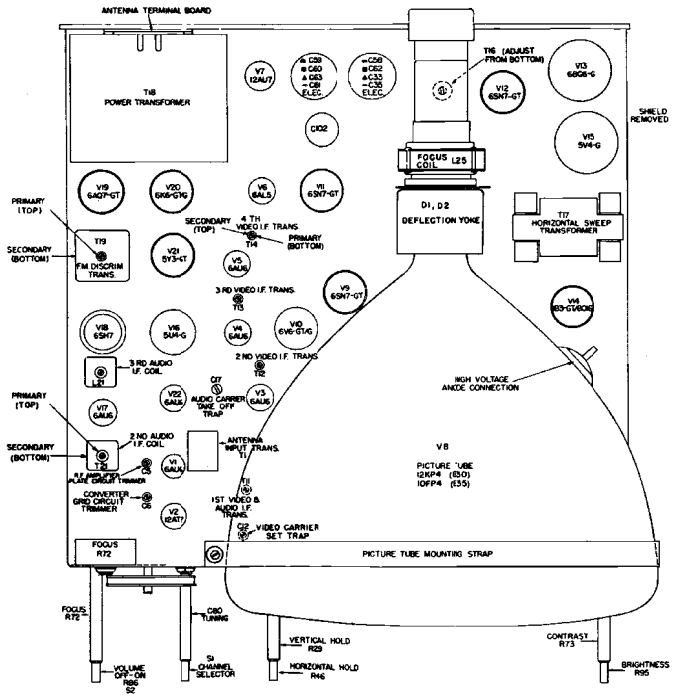


Fig. 16. Component and Trimmer Location

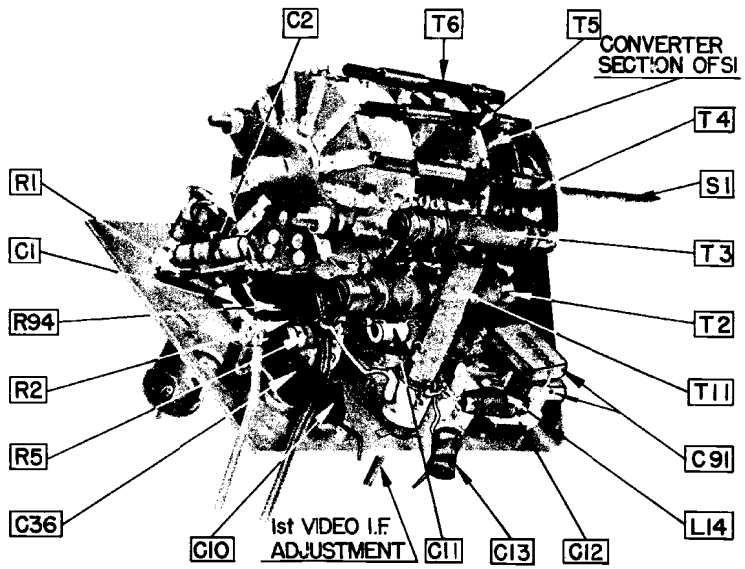


Fig. 17. R-F Head-end Assembly, Oblique View

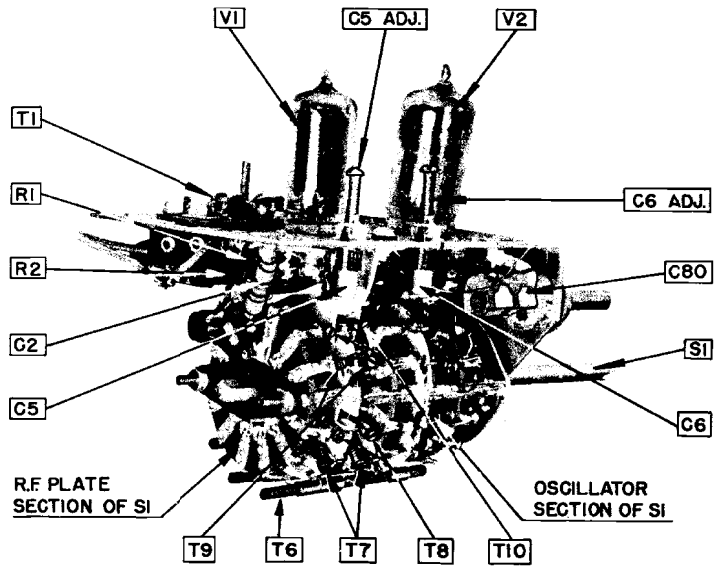


Fig. 18. R-F Head-end Assembly, Side View

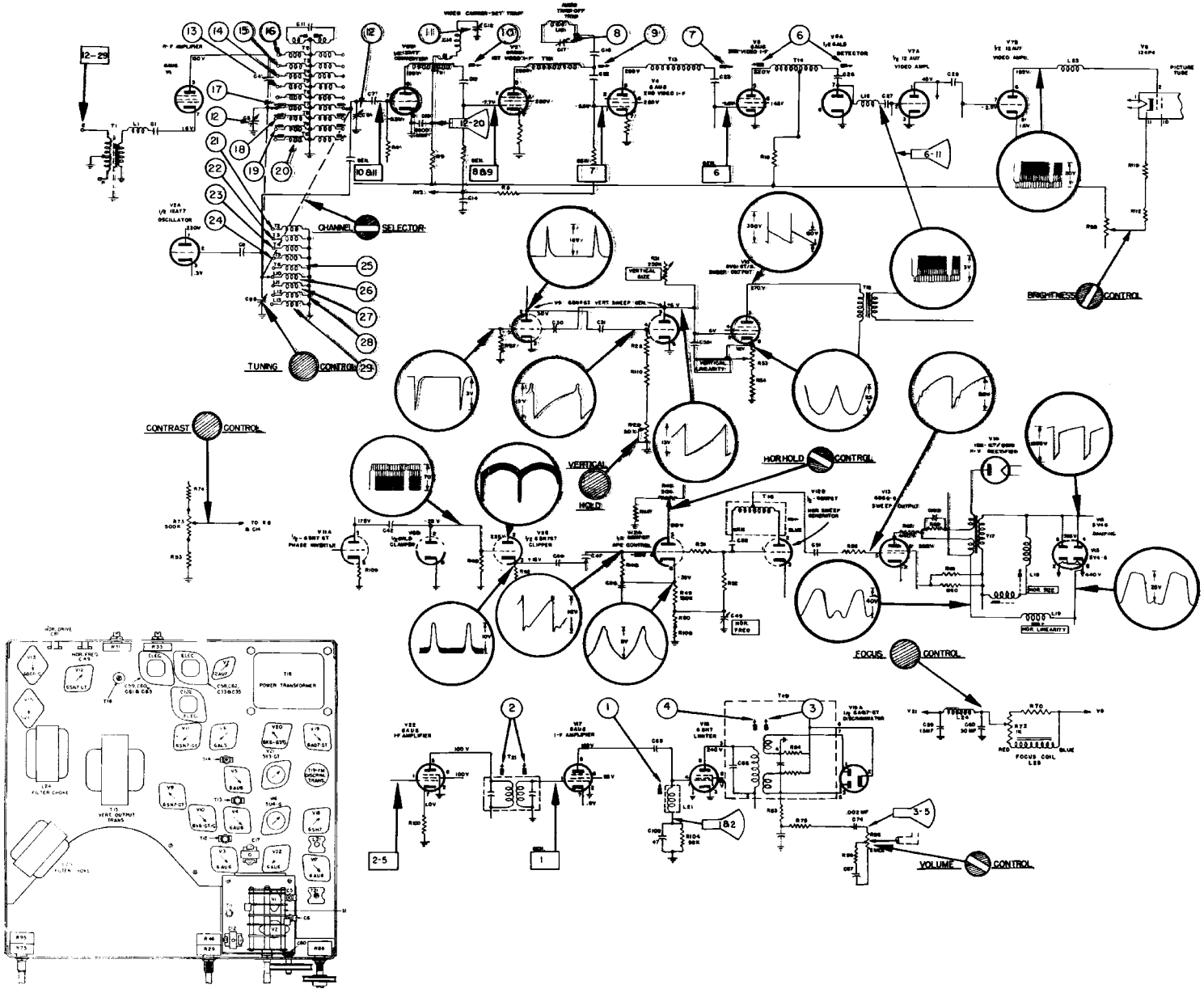


DIAGRAM OF ALIGNMENT AND WAVESHAPES—This diagram shows the connection points of signal generator and oscilloscope, and points of adjustment; numbered to correspond directly to the steps and order of the alignment procedure given in the Alignment Chart. The small-circled numbers are the adjustment points and the signal generator is symbolized by the square, while the symbol for a cathode-ray tube represents the oscilloscope.

As an aid to circuit trouble shooting; typical waveshapes for the average television receiver adjusted for a normal picture with correct contrast, height, width, and linearity are shown by the largest circled insets. Most measurements must be made when a signal is being received. A calibrated oscilloscope is used to measure the waveshape amplitude and synced at half of the respective sweep circuit speed. The tube socket pin voltages shown also increase the value of this diagram for use in trouble shooting.

The layout of major components, shown at the left-hand section of the diagram, is included for quick reference to test points at the chassis.

Fig. 19. Alignment and Waveshape Diagram

ALIGNMENT TABLE

Before attempting the following tabular alignment procedure, read the preceding section "Alignment Suggestions" The diagram of alignment and waveshapes Fig. 19, on opposite page will be found helpful in alignment procedure.

STEP NO.	SIGNAL GEN. FREQ.	SWEEP GENERATOR FREQUENCY	SIGNAL INPUT (See Fig. 19)	CONNECT OSCILLOSCOPE TO CHASSIS AND JUNCTION OF (See Fig. 19)	CHANNEL SWITCH	ADJUST (See Fig. 19)	REMARKS
(1) SOUND I-F ALIGNMENT							
1	21.8 mc marker	21.8 mc with 1 mc sweep	Grid (1) of V17 thru 500 mmf.	R104 and C100 thru 100K resistor	Channel #4	L21 for max. amplitude and symmetry about marker.	See Fig. 10A for resultant curve.
2	21.8 mc marker	21.8 mc with 1 mc sweep	Grid (1) of V22 thru 500 mmf.	R104 and C100 thru 100K ohm resistor	Channel #4	Top and bottom tuning cores of T21 for max. amplitude and symmetry about marker.	
3	21.8 mc with 400 cycle modulation	Not used	Grid (1) of V22 thru 500 mmf.	C74 and R86 thru 10,000-ohm resistor	Channel #4	Secondary slug of T19 for min. sine wave amplitude or listen for min. tone.	Turn Volume control half-way up.
4	Not used	21.8 mc with 1 mc sweep	Grid (1) of V22 thru 500 mmf.	C74 and R86 thru 10,000-ohm resistor	Channel #4	Primary slug of T19 for max. peak-to-peak amplitude and symmetry of peaks about base line.	See Fig. 10B for resultant curve.
5	Recheck Steps 3 and 4.						
(2) VIDEO I-F ALIGNMENT							
6	22.9 mc, 26.3 mc markers	20–30 mc	Grid (1) of V5 thru 500 mmf.	L16 and C27 thru 10,000-ohm resistor	Channel #4	Adjust primary and secondary slugs of T14 for max. amplitude and flat response with markers as shown in Fig. 11A.	Remove tube V4. Contrast control set at −4 volts. For special note regarding "R" chassis see Alignment Suggestions, Section 2.
7	22.9 mc, 25.55 mc, 26.3 mc markers	20–30 mc	Grid (1) of V4 thru 500 mmf.	L16 and C27 thru 10,000-ohm resistor	Channel #4	Adjust slug of T13 for max. amplitude and flat response with markers as shown in Fig. 11B.	Remove tube V3 and replace V4.
8	21.8 mc with 400 cycle modulation	—	Grid (pin 1) of V3 thru 500 mmf.	L16 and C27 thru 10,000-ohm resistor	Channel #4	Adjust C17 for minimum 400 cycle amplitude.	Replace V3 and remove V2.
9	22.9 mc, 23.4 mc, 25.55 mc, 26.3 mc markers	20–30 mc	Grid (1) of V3 thru 500 mmf.	L16 and C27 thru 10,000-ohm resistor	Channel #4	Adjust slug of T12 for max. amplitude and flat response with markers as shown in Fig. 11C.	
10	22.9 mc, 23.4 mc, 25.55 mc, 26.3 mc markers	20–30 mc	Grid (7) of V2 thru 500 mmf.	L16 and C27 thru 10,000-ohm resistor	Channel #4	Adjust slug of T11 for max. amplitude and flat response with markers as shown in Fig. 11C.	Turn carrier set trimmer C12 to minimum capacity. Replace tube V2.
11	22.9 mc, 23.4 mc, 25.55 mc, 26.3 mc markers	20–30 mc	Grid (7) of V2 thru 500 mmf.	L16 and C27 thru 10,000-ohm resistor	Channel #4	Adjust C12 until 26.3 mc marker is 50% above baseline. 25.55 mc and 22.9 mc markers should be as shown in Fig. 11D.	
(3) R-F ALIGNMENT							
12	83.25 mc and 87.75 mc markers	Channel #6 with 15 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #6	C5 and C6 for max. amplitude and flat response with correct marker location.	See Fig. 14B for resultant alignment curve.

ALIGNMENT TABLE (Continued)

STEP NO.	SIGNAL GEN. FREQ.	SWEEP GENERATOR FREQUENCY	SIGNAL INPUT (See Fig. 19)	CONNECT OSCILLOSCOPE TO CHASSIS AND JUNCTION OF (See Fig. 19)	CHANNEL SWITCH	ADJUST (See Fig. 19)	REMARKS
(3) R-F ALIGNMENT (Continued)							
13	77.25 mc and 81.75 mc markers	Channel #5 with 15 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #5	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	See Fig. 14B for resultant alignment curve.
14	67.25 mc and 71.75 mc markers	Channel #4 with 15 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #4	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	
15	61.25 mc and 65.75 mc markers	Channel #3 with 15 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #3	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	
16	55.25 mc and 59.75 mc markers	Channel #2 with 15 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #2	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	Adjust inductance by moving copper rings. See Fig. 14A for resultant alignment curve.
17	175.25 mc and 179.75 mc markers	Channel #7 with 15 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #7	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	Adjust inductance by brass screws in coils. See Fig. 14B for resultant curve.
18	181.25 mc and 191.75 mc markers	186.5 mc with 25 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #8–#9	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	Adjust inductance by brass screws in coils. See Fig. 14C for resultant curve.
19	193.25 mc and 203.75 mc markers	198.5 mc with 25 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #10–#11	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	
20	205.25 mc and 215.75 mc markers	210.5 mc with 25 mc sweep	Antenna terminals at r-f amplifier	R5 and C10 thru 10,000-ohm resistor. Disconnect C10.	Channel #12–#13	Check and adjust inductance if necessary for max. amplitude and flat response with correct marker location.	
(4) OSCILLATOR ADJUSTMENTS							
21	59.75 mc with tone modulation	—	Antenna terminals	—	Channel #2	Squeeze or spread turns of osc. coil of T2	Volume control at mid-position. Set Tuning control at mid-position of travel. Use sound output as indicator.
22	65.75 mc with tone modulation	—	Antenna terminals	—	Channel #3	Squeeze or spread turns of osc. coil of T3	
23	71.75 mc with tone modulation	—	Antenna terminals	—	Channel #4	Squeeze or spread turns of osc. coil of T4	
24	81.75 mc with tone modulation	—	Antenna terminals	—	Channel #5	Squeeze or spread turns of osc. coil of T5	
25	87.75 mc with tone modulation	—	Antenna terminals	—	Channel #6	Squeeze or spread turns of osc. coil of T6	

ALIGNMENT TABLE (Continued)

STEP NO.	SIGNAL GEN. FREQ.	SWEEP GENERATOR FREQUENCY	SIGNAL INPUT (See Fig. 19)	CONNECT OSCILLOSCOPE TO CHASSIS AND JUNCTION OF (See Fig. 19)	CHANNEL SWITCH	ADJUST (See Fig. 19)	REMARKS
			(4) OSCILLATOR ADJUSTMENTS (Continued)				
26	179.75 mc with tone modulation	—	Antenna terminals	—	Channel #7	Squeeze or spread turns of osc. coil of L10	Volume control at mid-position. Set Tuning control at mid-position of travel. Use sound output as indicator.
27	188.75 mc with tone modulation	—	Antenna terminals	—	Channel #8–#9	Squeeze or spread turns of osc. coil of L11	
28	200.75 mc with tone modulation	—	Antenna terminals	—	Channel #10–#11	Squeeze or spread turns of osc. coil of L12	
29	212.75 mc with tone modulation	—	Antenna terminals	—	Channel #12–#13	Squeeze or spread turns of osc. coil of L13	

MISCELLANEOUS INSTALLATION AND SERVICE ADJUSTMENTS

NOTE: The unpacking, set-up instructions, antenna installation, and installation adjustments for the Model 835 receiver, are covered in the INSTALLATION INSTRUCTIONS, ER-A-835. Some of this data is repeated in this publication.

REPLACEMENT OF PICTURE TUBE.

Precaution—Do not handle, remove, or install a picture tube unless shatterproof goggles and heavy gloves are worn.

To replace the picture tube it is necessary to remove the chassis from the cabinet. Remove the picture tube socket, the high-voltage anode cap, and then partially loosen the setscrews that clamp the picture tube front mounting strap. The fiber centering gasket should be slid off the neck of the picture tube. Carefully pull the picture tube out through the focus and deflection coils.

Install the new picture tube from the front of chassis by inserting the base of tube through the deflection yoke and focus coil assembly. The tube should be moved back so that the front surface of the picture tube is approximately 1⅝ inches in front of the chassis front apron. The rim of the bulb should rest on the channel rubbers and then the tube is clamped firm but not tight in place by the picture tube mounting strap. The picture tube should be rotated until the keyway at the base of the tube points approximately towards the Vertical Linearity control, as shown in Figure 20. Install the high voltage anode cap onto the high voltage anode of the picture tube.

Replace the chassis in the cabinet and secure by the cabinet mounting screws. Now push the picture tube forward on the chassis until the face of the tube is tight within the picture tube mask. Push the deflection yoke assembly forward as far as it will go. The front of the deflection coil should butt up against the bulb portion of the picture tube. Insert the fiber gasket between the neck of the picture tube and the focus coil, as shown in Figure 20. This centers the neck of the tube where it passes through the deflection yoke assembly. Install the picture tube socket onto the base of the picture tube.

Wipe the screen surface of the picture tube so as to remove finger marks and dirt.

VENTILATION PRECAUTION.

Air circulation about the chassis is provided through ventilation slots cut in the bottom, side, end back cover of the cabinet. Do not cover or partially obstruct these slots in any way.

ANTENNA.

The proper antenna and lead-in installation is of the utmost importance in order to obtain optimum signal strength with freedom from noise

This receiver is designed for use with a 300 ohm balanced antenna and lead-in system. Any one of the following G-E antennas with the G-E 300-ohm television transmission line may be used.

Stock No. UKA-005 is a simple folded dipole which is easy to install and provides good reception from all twelve channels in medium and high signal strength areas.

Stock No. UKR-005 makes use of the above antenna with a reflector added. This provides better attenuation if reflections are encountered and provides more signal gain and less noise.

Stock No. UKR-007 is a stacked array antenna which gives considerable signal gain over the above antennas. This antenna gives uniform reception of most of the lower frequency channels and is used on fringe areas where the above antennas are not quite adequate.

A lightning arrester, Stock No. REM-001, should be installed for each antenna installation made on the outside of the house. If the mast is metal, this should be grounded as directly as possible. Use a metal strap or a heavy cable for grounding.

PICTURE CENTERING ADJUSTMENT.

The picture centering assembly is shown in Fig. 20 and is located on the neck of the picture tube between the focus coil and deflecting yoke. The assembly consists of a metal sleeve with two tabs at its end, adjacent to the deflecting yoke. Two centering magnet rings complete the assembly, one being the larger and movable ring over the sleeve, while the smaller ring is soldered within and at the tab end of the sleeve. Normal range of deflection is attained when the flux fields of the two magnets are opposing (open ends of rings adjacent to each other). For an extended range in deflection, the larger and movable ring may be turned 180 degrees so that its open end is opposite that of the smaller ring and the ring fluxes are aiding.

With the large magnet ring set for normal deflection, rotate the assembly by its tabs to the point where proper direction of centering is obtained, and then slide the magnet ring closer to, or further from, the fixed smaller ring until picture is centered. Should the normal deflection range be inadequate to bring the picture to center, rotate the larger and movable ring 180 degrees to produce aiding magnetic fluxes and extended deflection range. Center picture by rotating assembly and sliding movable ring as given for normal setting of magnet rings.

TILT CONTROL.

This adjustment must be made with the cabinet back removed. If the picture is slightly tilted and does not square with the picture tube mask, rotate the deflection yoke in its clamp bracket until it is aligned. The deflection yoke is held in its clamp bracket by spring pressure.

HORIZONTAL LINEARITY AND HOR. DRIVE.

These controls are used to adjust the linearity. First, adjust the Hor. Drive control to minimum capacity setting (full counterclockwise). With Horizontal Size at approximately its correct setting, adjust the Horizontal Linearity until the picture shows correct horizontal proportions. A maladjustment shows up as an elongation or crowding of either side of the picture. This is best adjusted when a test pattern is being broadcasted by adjusting the control until the distance from the center of the test pattern to the left-hand and right-hand edges measures the same. If the Horizontal Linearity control will not give the proper linearity adjustment, turn the Hor. Drive control slightly clockwise and repeat adjustment of Hor. Linearity. Always leave the Hor. Drive control at maximum counterclockwise position consistent with good linearity. If there is any fold-over of pattern at center of picture which shows up as a lighter area about ¼ to ½ inch wide running vertically on screen, the Hor. Drive control should be turned clockwise until it disappears.

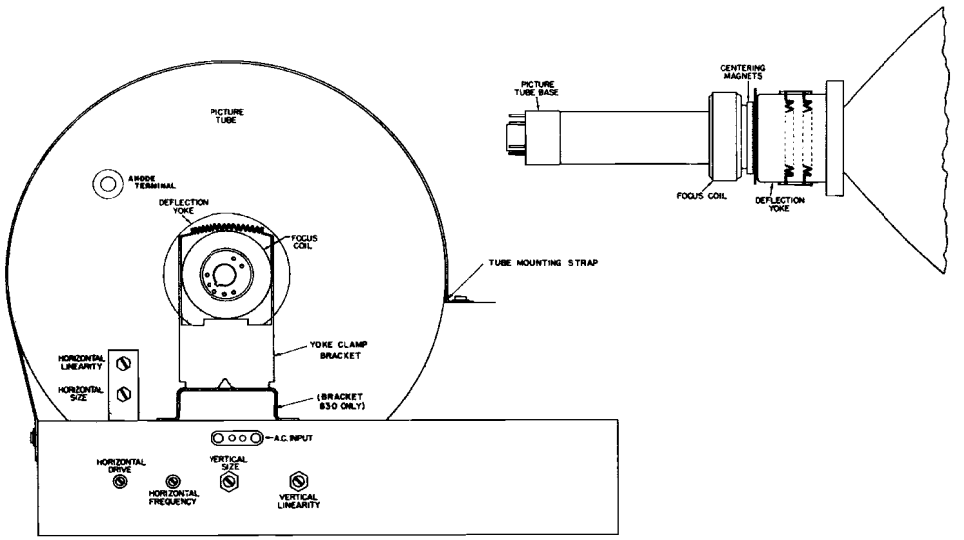


Fig. 20. Location of Preset Adjustment Controls

HORIZONTAL SIZE.

This control changes the horizontal size of the picture. When adjusted to the recommended width, the picture should extend for approximately ⅛ inch beyond the edge of the picture tube mask so that the left and right edges of the picture are not visible. In the picture showing incorrect adjustment of the Width control, it will be noted that this condition makes the inner circle of the test pattern an egg shape instead of a perfect circle.

VERTICAL LINEARITY.

This control gives the proper vertical proportions to the picture. Improper adjustment will either crowd the lower or upper half of the picture as shown in the illustration. This is best adjusted on the test pattern by adjusting the Vertical Linearity control until the distance from the center of the test pattern to the top or bottom edges measures the same. The adjustment of this control will alter the height of the picture slightly making it necessary to re-adjust the Vertical Size control.

VERTICAL SIZE.

This control changes the picture height. When adjusted to the correct height, the picture should extend for approximately ⅛ inch beyond the edge of the picture tube mask so that the top and bottom edges of the picture are not visible.

HOR. FREQUENCY.

This is a coarse adjustment that supplements the Horizontal Hold control adjustment on the front panel. It is adjusted to the position which permits the Horizontal Hold control on the front panel to go through its proper adjustment at about its mid-rotation position.

T16 ADJUSTMENT.

The core of the horizontal sweep generator transformer, T16, changes the frequency of this circuit. Its adjustment for early production receivers is made as follows: Connect a VTVM to measure the voltage from the junction of R74 and potentiometer R73 to ground. Tune the receiver to any suitable television signal. Set the front panel Horizontal Hold control, R46, to the midpoint of its resistance range, then adjust the iron core of the blocking oscillator transformer T16 and the setting of the Horizontal Frequency control trimmer C49 to bring the picture into horizontal synchronization and to develop −12 ±1.0 volts across the contrast control as measured by the VTVM. The iron core adjustment and the trimmer setting are interlocking and, therefore, it will be necessary to readjust each of these controls in turn to bring the picture in sync and also to obtain −12 volts.

For later production receivers incorporating Automatic Gain Control (chassis marked "R"); reference to, and measurement of the −12 volts developed by the blocking oscillator is not a part of T16 adjustment procedure. It is only necessary to set the front panel Horizontal Hold control to its mid-point range, the Horizontal Frequency control, C49, to an arbitrary setting of approximately one-half turn from maximum capacity, and adjust core of T16 to bring the picture into sync. The arbitrary setting of C49 is to allow enough range for future readjustment of sync directly from the chassis back apron.

The sync range should fall in the approximate center of the front panel Horizontal Hold control range, and it should be possible to throw the circuit out of sync by turning the control to either end of its range.

PICTURE DEFECTS

The following illustrations show picture defects which are caused by incorrect setting of the operating and/or preset controls or by interference picked up by the antenna. The correction is indicated for each control maladjustment.

The adjustment of the controls is most efficiently accomplished by the use of a test pattern, similar to that illustrated, which is normally transmitted just prior to the scheduled program.

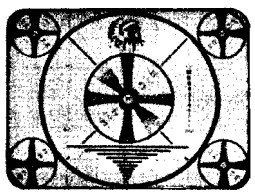


FIG. 21

NORMAL PICTURE

The normal picture should show good focus and a good contrast between black and white picture elements with the intermediate shades of gray. The picture should not tend to either move vertically or horizontally.

PICTURE DEFECTS (Cont'd)

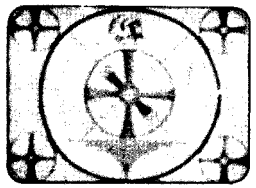


FIG. 22

BLURRED PICTURE

This indicates that the picture is out of focus. Adjust Focus control until the picture detail is sharp and clear.

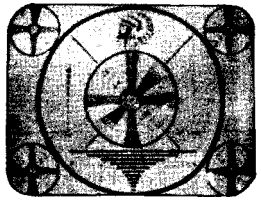


FIG. 23

TOO LITTLE CONTRAST

The picture seems to be composed entirely of grays. Turn the Contrast control slightly clockwise and/or turn Brightness control slightly counterclockwise until a good contrast ratio exists between the black and white picture elements.

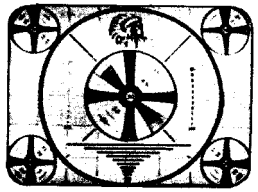


FIG. 24

TOO MUCH CONTRAST

In this illustration the intermediate shades of contrast are dark and do not contrast with the shades which are a true representation of the black picture elements.

Turn Contrast control slightly counterclockwise and/or turn Brightness control clockwise.

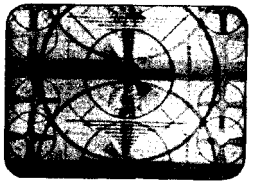


FIG. 25

PICTURE MOVES UP OR DOWN

Adjustment of Vertical Hold control will stop any vertical roll of picture.

FIG. 26

PICTURE TILTS OR MOVES SIDEWAYS

Adjust Horizontal Hold until picture straightens up and locks into position so there is no sideways motion. If movement persists, adjust the Horizontal Frequency control.

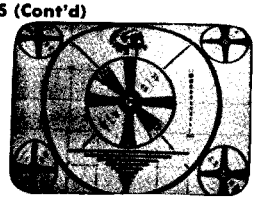


FIG. 27

PICTURE NOT LINEAR VERTICALLY

Adjust Vertical Linearity control so that the vertical radius from top to center and center to bottom radius are equal. This adjustment may alter the vertical size.

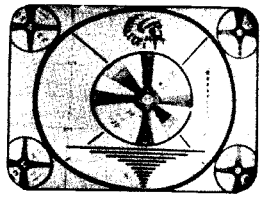


FIG. 28

PICTURE NOT LINEAR HORIZONTALLY

Adjust Horizontal Linearity control so that the horizontal radius from center to left side is equal to radius from center to right side. This may alter the horizontal size.

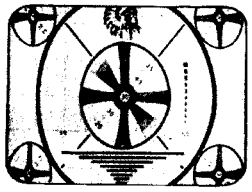


FIG. 29

PICTURE TOO TALL

Adjust Vertical Size control so that the top and bottom picture edges are just covered by mask.

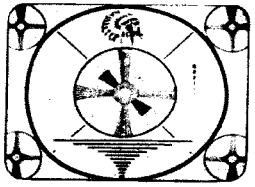


FIG. 30

PICTURE TOO WIDE

Adjust Horizontal Size control so that the right and left picture edges are just covered by the mask.

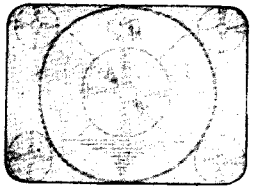


FIG. 31

HERRINGBONE PATTERN OVER PICTURE

This is caused by r-f interference such as that created by "amateur" stations.

PICTURE DEFECTS (Cont'd)

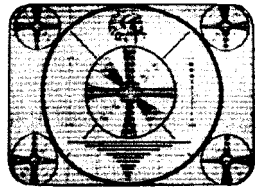


FIG. 32

HORIZONTAL BARS ON PICTURE

This interference is caused by adjacent channel sound or microphonics in the receiver.

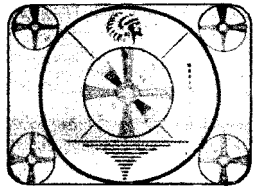


FIG. 33

INTERFERENCE

This is representative of diathermy interference being picked up by the antenna. Nothing can be done at receiver to eliminate it.

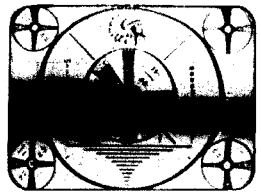


FIG. 34

INTERFERENCE

This can be the same type of interference as illustrated to the left; however, it is of much greater intensity. It may also be due to hum pickup in receiver.

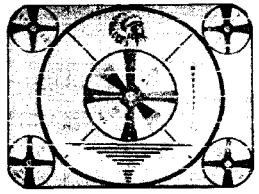


FIG. 35

IGNITION INTERFERENCE

Ignition interference from trucks, automobiles and airplanes may be identified by the splashes of white on the picture. This interference is usually most severe from trucks.

CRITICAL LEAD DRESS AND COMPONENT REPLACEMENT

Since the operating frequencies are relatively high in a television receiver, it is essential that all components be replaced in exactly the same position they occupied when they left the factory, all leads be made as short as possible and exact replacement parts be used when service is required. Leads in wiring between components are usually critical as to placement against chassis or proximity to other components. Some of critical wiring precautions are listed below:

1. Discriminator (T19) Leads—Dress primary and secondary leads of the discriminator transformer close to chassis.

2. Head-end Unit—All leads which run between head-end unit coil assembly and front apron of chassis should be dressed as far as possible from the oscillator coils.

3. Plate Lead of 6K6—The plate lead (blue) of 6K6(V20) should be dressed as far away from the 6AQ7GT(V19B) as possible.

4. Electrolytic C102—When replacing this V2 filament rectifier electrolytic capacitor, C102, connect the ground lug of the capacitor as directly to chassis ground as possible.

5. Picture Tube Anode Lead—Lead must clear aquadag coating of picture tube and all objects for isolation to prevent corona, causing eventual breakdown in lead. Orient tube position to allow lead to be dressed away from all component parts.

TROUBLE SHOOTING

The following is a listing of possible troubles and their cures. This is not intended as a comprehensive coverage but will merely serve as a guide in locating some of the more difficult problems that may be experienced. From time to time this information will be supplemented by a service bulletin.

1. NO RASTER ON PICTURE TUBE.

(a) Check for waveform on oscilloscope at output of T17. If present, the trouble is probably in the Type 1B3GT rectifier tube, filter circuit, or picture tube. Check for open circuit in high voltage winding of R62 of T17. If the filament of V14 glows orange, high voltage is being generated and the trouble will possibly exist in the picture tube, V8.

(b) If there is no waveform at output of T17, check operation of V13, and sawtooth generator, V12B, by oscilloscope waveform measurement.

(c) Check that high voltage anode cap is contacting the anode terminal of the picture tube.

(d) Open in Brightness control, R95 or R32 or R43.

(e) Defective V7B tube.

(f) If anode voltage is very low, check deflection yoke for continuity or shorted turns, check Hor. size control for continuity.

2. RASTER NORMAL, NO PICTURE OR SOUND.

(a) Oscillator V2A defective, or oscillator coil resonates outside of channel.

(b) Defective antenna or lead-in. With contrast full up if antenna system is working satisfactorily, noise pattern should be seen on screen and heard in speaker.

(c) Converter, r-f amplifier, or first video i-f amplifier stage defective.

3. PICTURE NORMAL, NO SOUND.

(a) Audio i-f amplifier, audio discriminator detector, or audio amplifier defective.

(b) Defective speaker.

(c) Oscillator V2A off frequency.

4. RASTER NORMAL, SOUND NORMAL, NO PICTURE.

(a) Video i-f amplifier (after 1st i-f) inoperative.

(b) Video amplifier tube V7 defective.

(c) Grid lead to picture tube open.

(d) Defective picture tube.

5. NORMAL PICTURE AND SOUND, NO HOR. OR VERT. SYNC.

(a) Check for signal waveform at grid (4) of V11A and grid (1) of V11B.

(b) Tube V7A plate circuit components improper value.

(c) Open capacitor, C29.

6. PICTURE NORMAL, NO VERTICAL SYNC.

(a) Check grid (1) of V9 for vertical sync pulses.

(b) Check frequency of vertical sweep generator. This should be capable of free running frequency of slightly less than 60 cps.

(c) Check sweep generator tube, V9, components.

7. PICTURE NORMAL, NO HORIZONTAL SYNC.

(a) Check grid (4) of V12A for horizontal sync pulse. Disconnect leads from R54 and C57 to examine this.

(b) Check tube V12A and its circuit components.

(c) Check sweep generator V12B and circuit components.

(d) Open capacitor, C57.

8. RASTER EDGE NOT STRAIGHT—KEYSTONING.

(a) Defective deflection yoke.

9. PICTURE JUMPY.

(a) Operation at too high a Contrast control setting.

(b) Gassy or noisy 6BG6G (V13) or 6V6GT (V10) tubes.

(c) Noisy sweep or sync circuit tubes.

(d) Excess noise received by antenna system.

10. POOR PICTURE DETAIL.

(a) Mismatch in antenna and lead-in system.

(b) Misalignment of i-f and r-f circuits.

(c) Defective video chokes.

(d) Make sure focus control goes through focus.

(e) Overload of video amplifier. Check Contrast control operation.

11. AUDIO MOTOR BOATING.

(a) Dress V20 plate lead (blue) as far away as possible from V19B tube circuit components.

12. HUM MODULATION.

(a) Defective filter capacitor, C102.

(b) Defective rectifier, SR1.

(c) Defective tubes in R-F or sound I-F amplifiers.

13. CLICK IN SPEAKER WHEN TUNING.

(a) Bypass B+ with 5000 mmf capacitor at terminal board located between V18 and T19, between junction of R81, R82 and ground.

14. LOW SENSITIVITY, "R" CHASSIS RECEIVERS.

(a) Change 1000 ohm resistor, R8, in cathode of V5, to 100 ohms.

15. BUZZ MODULATION.

(a) Excessive signal applied to converter grid. Reduce by antenna pad.

(b) Transformer, T21, not tuned properly.

PRODUCTION CHANGES

AUTOMATIC GAIN CONTROL.

AGC (Automatic Gain Control) is incorporated in most production receivers except for an approximate 1000 early production units. To identify electrically the chassis having AGC, a letter "R" is stamped on the front apron of those chassis.

Figure 36 shows a simplified schematic of the AGC circuit only. All parts with the value of component indicated, are common to AGC circuit only. The dash line represents bias to the converter grid which was used on some of the receivers. Figure 38 shows the complete schematic of early production receivers without AGC; while Figure 39 shows the "R" version receiver schematic.

The AGC voltage is derived from the diode detector and clipper grid circuit. By connecting the contrast control into the clipper grid circuit, it provides a source of high bias voltage which varies directly with the amplitude of the video carrier. The other end of the contrast control connects to the video detector load resistor to provide a lower potential bias source with the same characteristic so that it will provide for a minimum AGC bias when operating at weak signal strengths.

AGC provides for greater ease in tuning, as it eliminates to a large extent the necessity of resetting the contrast control each time a new station is selected. It minimizes airplane flutter and other signal strength changes which would otherwise affect the picture.

BIAS RESISTOR, R8, OF V5 ("R" CHASSIS RECEIVERS).

On some "R" chassis receivers, the bias resistor R8 was 1000 ohms. This was decreased to 100 ohms to increase sensitivity.

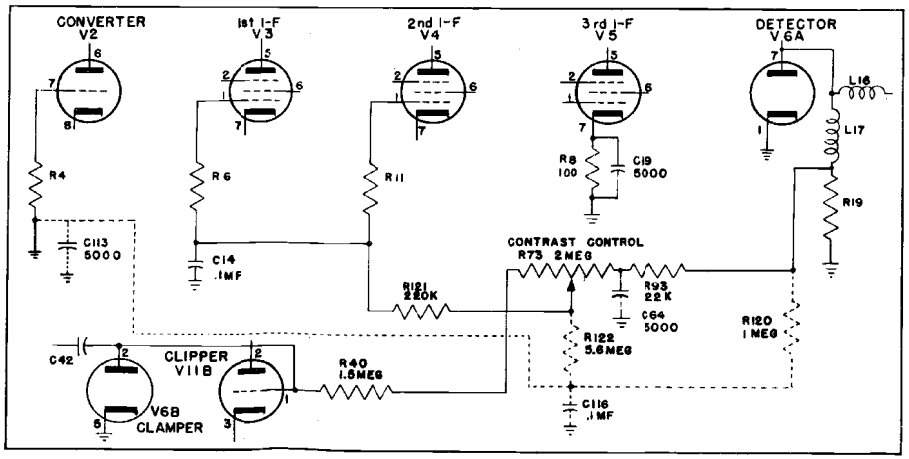


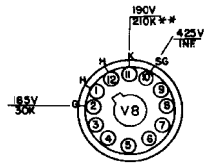
Fig. 36. A.G.C. Control Circuit

PRODUCTION CHANGES (Continued)

REMOVAL OF RETRACE LINES.

By supplying to the picture tube cathode a relatively high positive voltage derived from the vertical sweep output circuit during vertical retrace, the picture tube is biased to cut-off, resulting in most of the retrace lines being eliminated from the screen. This is an operating advantage since it eliminates the need for readjustment of the Brightness or Contrast Control to remove retrace lines from the screen which oftentimes accompany a change in cameras or program material that takes place at the transmitter.

The early production schematic, Figure 38, shows the circuit prior to this addition; while Figure 39 shows the additional components and wiring change. The components added for this change were R118, R119, C85, and C110. A portion of the earlier "R" receivers do not include this change.



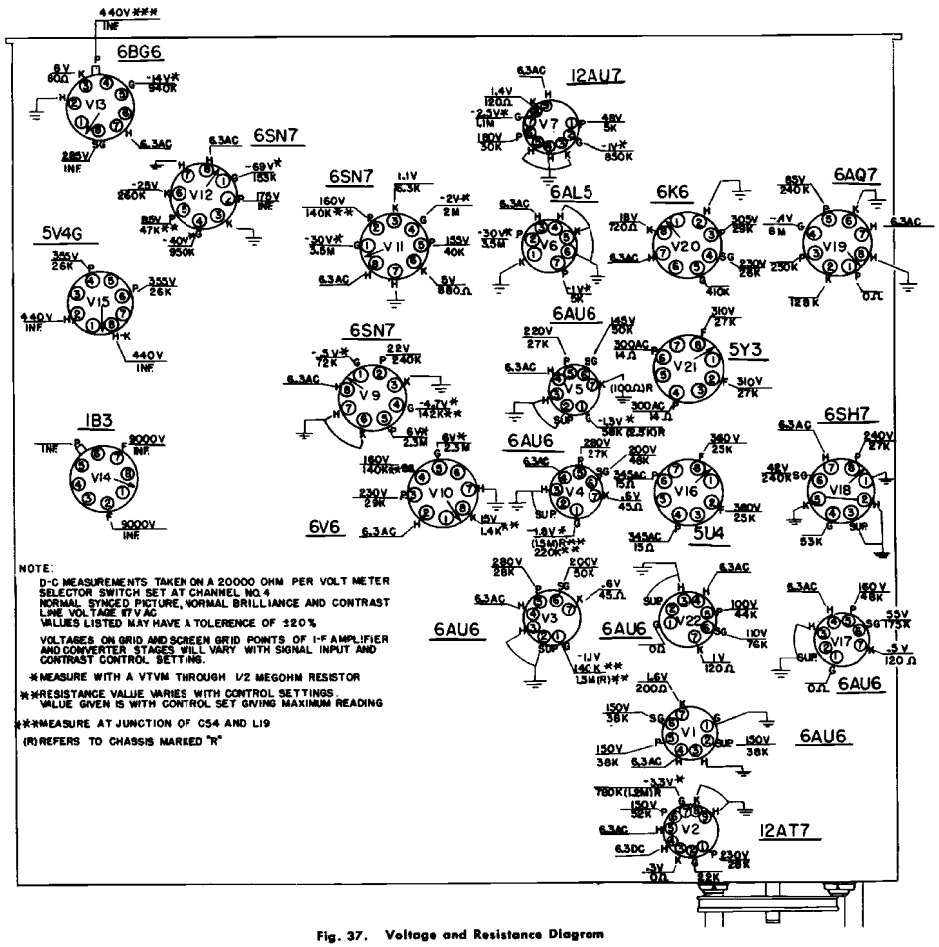


Fig. 37. Voltage and Resistance Diagram

MODEL 835

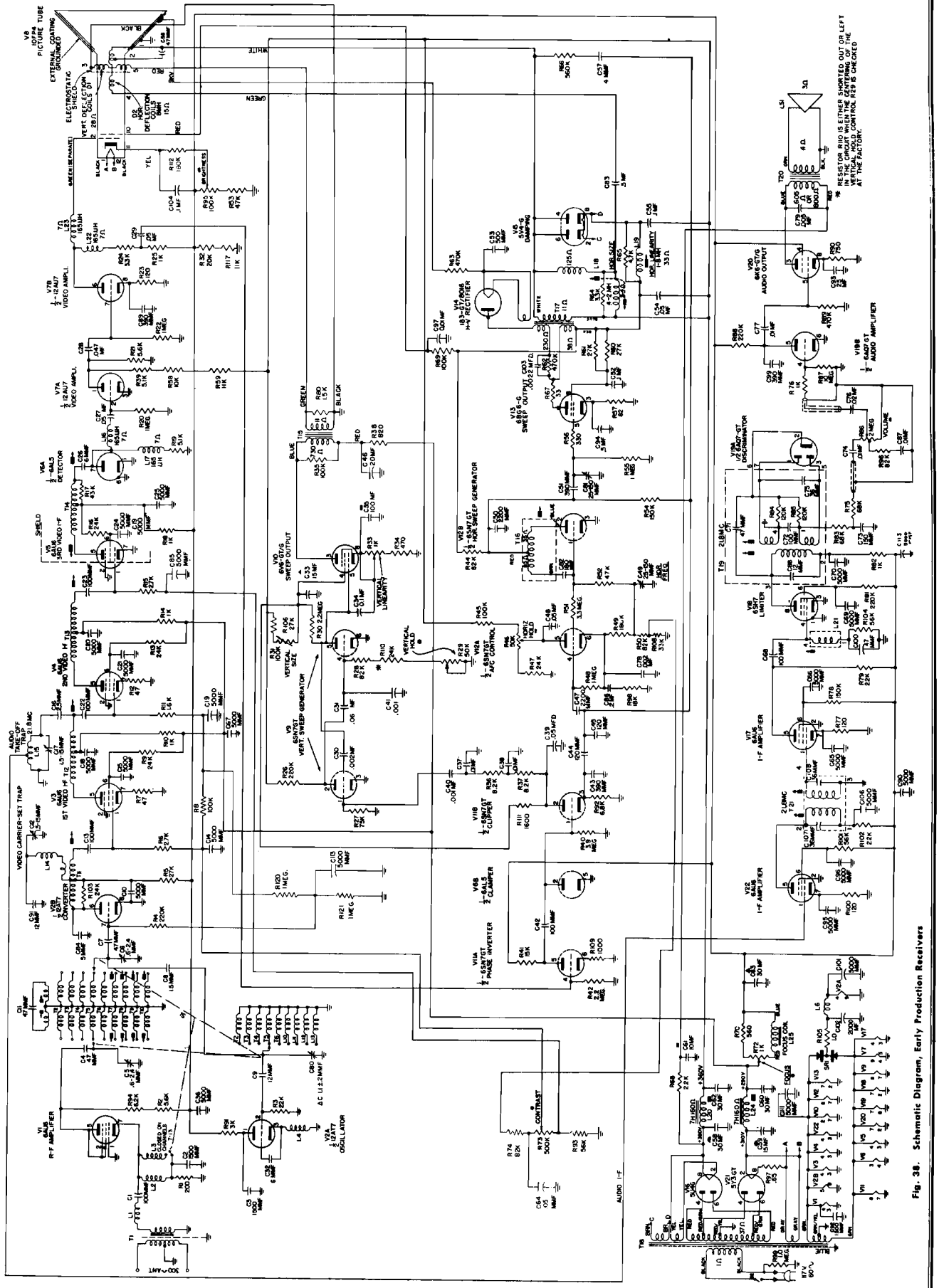


Fig. 38. Schematic Diagram, Early Production Receivers

MODEL 835

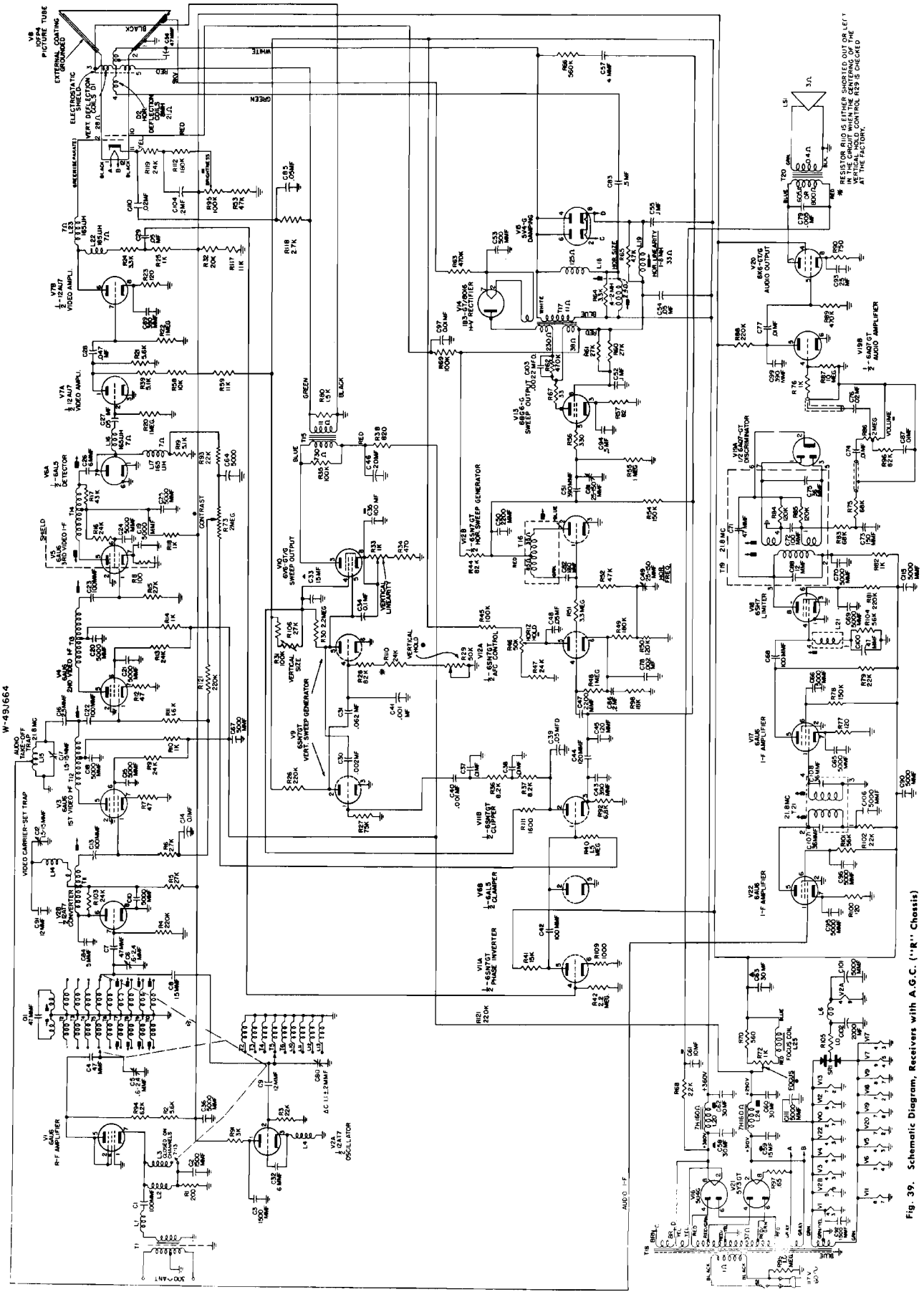


Fig. 39. Schematic Diagram, Receivers with A.G.C. ("R" Chassis)

REPLACEMENT PARTS LIST

Cat. No.	Symbol	Description
UNIVERSAL REPLACEMENT PARTS		
UCC-014	C86, 104*	CAPACITOR—.2 mfd., 600 v., paper
UCC-620	C40, 41	CAPACITOR—.001 mfd., 600 v., paper
UCC-621	C30, 47, 78	CAPACITOR—.002 mfd., 600 v., paper
UCC-630	C37, 38, 74, 87	CAPACITOR—.01 mfd., 600 v., paper
UCC-631	C76, 110*	CAPACITOR—.02 mfd., 600 v., paper
UCC-635	C27, 29, 39, 48, 54, 64†, 85*	CAPACITOR—.05 mfd., 600 v., paper
UCC-640	C34, 52, 14*, 55, 104†, 116*	CAPACITOR—.1 mfd., 600 v., paper
UCU-1506	C91	CAPACITOR—12 mmf., mica
UCU-1528	C42, 68, 98	CAPACITOR—100 mmf., mica
UCU-1530	C44, 45, 46	CAPACITOR—120 mmf., mica
UCU-1532	C73	CAPACITOR—150 mmf., mica
UCU-1542	C43, 51, 89, 99	CAPACITOR—390 mmf., mica
UCU-2534	C82	CAPACITOR—180 mmf., mica
UCU-2560	C47, 50	CAPACITOR—2200 mmf., mica
UJB-004		BOARD—Antenna terminal board
UOP-577	LS1	LOUDSPEAKER—5¼-inch PM speaker
URD-025	R8*	RESISTOR—100 ohms, ½ w., carbon
URD-037	R56	RESISTOR—330 ohms, ½ w., carbon
URD-049	R10, 14, 18, 76, 82, 109	RESISTOR—1000 ohms, ½ w., carbon
URD-053	R80	RESISTOR—1500 ohms, ½ w., carbon
URD-059*	R118	RESISTOR—2700 ohms, ½ w., carbon
URD-065	R65	RESISTOR—4700 ohms, ½ w., carbon
URD-069	R92	RESISTOR—6800 ohms, ½ w., carbon
URD-071	R36, 37	RESISTOR—8200 ohms, ½ w., carbon
URD-079	R98	RESISTOR—18,000 ohms, ½ w., carbon
URD-081	R93*	RESISTOR—22,000 ohms, ½ w., carbon
URD-089	R52	RESISTOR—47,000 ohms, ½ w., carbon
URD-091	R93†, 101, 104	RESISTOR—56,000 ohms, ½ w., carbon
URD-093	R75, 83	RESISTOR—68,000 ohms, ½ w., carbon
URD-095	R74†, 96	RESISTOR—82,000 ohms, ½ w., carbon
URD-097	R8†, 35, 69	RESISTOR—100,000 ohms, ½ w., carbon
URD-099	R50*, 84, 85	RESISTOR—120,000 ohms, ½ w., carbon
URD-101	R54, 78	RESISTOR—150,000 ohms, ½ w., carbon
URD-103	R112	RESISTOR—180,000 ohms, ½ w., carbon
URD-105	R81, 88, 121*	RESISTOR—220,000 ohms, ½ w., carbon
URD-113	R62, 63, 89	RESISTOR—470,000 ohms, ½ w., carbon
URD-115	R66	RESISTOR—560,000 ohms, ½ w., carbon
URD-121	R20, 22, 55, 99, 120†	RESISTOR—1 meg., ½ w., carbon
URD-125	R40*	RESISTOR—1.5 meg., ½ w., carbon
URD-129	R42	RESISTOR—2.2 meg., ½ w., carbon
URD-135	R40†	RESISTOR—3.9 meg., ½ w., carbon
URD-145	R87	RESISTOR—10 meg., ½ w., carbon
URD-139	R122*	RESISTOR—5.6 meg., ½ w., carbon. (Note: R122—this value used only on limited quantity "R" chassis receivers.)
URD-1017	R7, 12	RESISTOR—47 ohms, ½ w., carbon
URD-1027	R23, 77, 100	RESISTOR—120 ohms, ½ w., carbon
URD-1032	R1	RESISTOR—200 ohms, ½ w., carbon
URD-1041	R34	RESISTOR—470 ohms, ½ w., carbon
URD-1049	R25	RESISTOR—1000 ohms, ½ w., carbon
URD-1054	R11, 111	RESISTOR—1600 ohms, ½ w., carbon
URD-1059	R6, 15	RESISTOR—2700 ohms, ½ w., carbon
URD-1066	R19	RESISTOR—5100 ohms, ½ w., carbon
URD-1067	R21	RESISTOR—5600 ohms, ½ w., carbon
URD-1081	R3	RESISTOR—22,000 ohms, ½ w., carbon
URD-1082	R9*, 13*, 16, 47, 103, 110, 119*	RESISTOR—24,000 ohms, ½ w., carbon
URD-1085	R108†	RESISTOR—33,000 ohms, ½ w., carbon
URD-1088	R17	RESISTOR—43,000 ohms, ½ w., carbon
URD-1089	R53	RESISTOR—47,000 ohms, ½ w., carbon
URD-1094	R27	RESISTOR—75,000 ohms, ½ w., carbon
URD-1095	R28, 50†	RESISTOR—82,000 ohms, ½ w., carbon
URD-1103	R49	RESISTOR—180,000 ohms, ½ w., carbon
URD-1105	R4, 26	RESISTOR—220,000 ohms, ½ w., carbon
URD-1121	R48	RESISTOR—1.0 meg., ½ w., carbon
URD-1129	R30	RESISTOR—2.2 meg., ½ w., carbon
URE-013	R67	RESISTOR—33 ohms, 1 w., carbon
URE-077	R41	RESISTOR—15,000 ohms, 1 w., carbon
URF-083	R60, 61	RESISTOR—27,000 ohms, 2 w., carbon
URF-1023	R57	RESISTOR—82 ohms, 2 w., carbon
URF-1074	R59, 117	RESISTOR—11,000 ohms, 2 w., carbon
SPECIALIZED REPLACEMENT PARTS		
RAB-092		BACK—Cabinet back cover
RAV-083★		CABINET—Television receiver cabinet
RAX-024		CENTERING ASSEMBLY—Centering ring assembly, includes magnet rings, and split fiber tube
RCC-016	C83, 94	CAPACITOR—.5 mfd., 200 v., paper
RCC-040	C77, 97	CAPACITOR—.01 mf., 600 v., paper
RCC-045	C31	CAPACITOR—.06 mt., 600 v., molded paper
RCC-097	C38	CAPACITOR—.002 mf., 600 v., paper
RCE-071	C59, 60, 61, 63	CAPACITOR—15 mfd., 450 v.; 30 mfd., 450 v.; 10 mfd., 450 v.; 30 mfd., 450 v.; electrolytic
RCE-083	C102	CAPACITOR—2000 mfd., electrolytic
RCE-085	C33, 35, 58, 62	CAPACITOR—Electrolytic
RCE-086	C93	CAPACITOR—25 mf., 25 v., electrolytic
RCE-093	C46	CAPACITOR—20 mf., 450 v., electrolytic
RCN-023	C53	CAPACITOR—500 mmf., 20,000 v., molded
RCN-014	C28	CAPACITOR—.047 mfd., 600 v., paper (molded)
RCN-019	C103	CAPACITOR—.0022 mfd., 1000 v., paper (molded)
RCN-020	C57	CAPACITOR—4 mmf., 800 v., mica
RCN-021	C56	CAPACITOR—47 mmf., 800 v., mica
RCW-006	C88	CAPACITOR—12 mmf., ceramic
RCW-026	C2, 3, 92	CAPACITOR—1500 mmf., ceramic
RCW-1002	C26	CAPACITOR—6 mmf., ceramic
RCW-1043	C100	CAPACITOR—47 mmf., 500 v., ceramic
RCW-1045	C8	CAPACITOR—1.5 mmf., ceramic
RCW-1047	C1, 13, 22, 23, 72	CAPACITOR—100 mmf., ceramic
RCW-1052	C4, 7, 100	CAPACITOR—47 mmf., ceramic
RCW-2006	C9	CAPACITOR—12 mmf., ceramic
RCW-2010	C11, 71	CAPACITOR—47 mmf., ceramic
RCW-2019	C75, 102, 108	CAPACITOR—36 mmf., ceramic
RCW-2030	C32	CAPACITOR—6 mmf., ceramic
RCW-2035	C84	CAPACITOR—5 mmf., ceramic
RCW-3014	C10, 14†, 15, 18, 19, 20, 21, 24, 25, 36, 64†, 65, 66, 67, 69, 70, 85†, 90, 95, 96, 101, 106, 111, 113, 115	CAPACITOR—500 mmf., ceramic
RCW-3017	C16	CAPACITOR—2.5 mmf., ceramic
RCY-045	C49, 81	CAPACITOR—25-150 mmf., mica trimmer
RCY-046	C80	CAPACITOR—1.25 mmf., variable tuning condenser
RCY-047	C12, 17	CAPACITOR—1.5-15 mmf., mica trimmer
RCY-048	C5, 6	CAPACITOR—0.4-2.4 mmf., trimmer
RDC-032		CORD—For focus control drive, 25 yds bulk
RDK-152		KNOB—Vertical speed, contrast control knobs

REPLACEMENT PARTS LIST (Continued)

Cat. No.	Symbol	Description
SPECIALIZED REPLACEMENT PARTS (Continued)		
RDK-153		KNOB—Horizontal speed, brightness control knobs
RDK-154		KNOB—Focus, tuning control knobs
RDK-155		KNOB—On-Off switch and volume, channel selector control knobs
RDW-019		SAFETY GLASS—Cabinet glass protects picture tube
REI-014		SLUG—R-f and converter coil tuning slugs for T7, T8, T9, and T10
REI-015		CORE—Adjustment core for blocking oscillator coil T16
REI-016		CORE—Tuning core for T11, T12, T13, T14 video i-f and L21, T21 secondary
REI-017		CORE—Adjustment core for horizontal linearity L19
REI-018		CORE—Adjustment core for horizontal size control L18
REI-019		CORE—Tuning core for sound discriminator T19
REI-026		CORE—Plate winding core for T14
RER-003	SR1	RECTIFIER—Selenium rectifier
RHM-025		WASHER—"C" washer, retains tuning shaft or focus control shaft
RHM-047		CLIP—Speed clip for mounting capacitor C53
RHM-054		SLEEVE—Fiber sleeve centers focus coil assembly with tube neck
RJC-001		CONNECTOR—Speaker connector
RJC-002		CONNECTOR—Speaker contact clip
RJC-008		CONNECTOR—Picture tube anode connector assembly
RJF-003		CONNECTOR—Connector cap for V14
RJJ-007		RECEPTACLE—A-C power receptacle
RJS-003		SOCKET—Tube socket for V9, V10, V11, V18, V19, and V20
RJS-015		SOCKET—Tube socket for V12
RJS-017		SOCKET—Tube socket for V13, V15, V16, and V21
RJS-030		SOCKET—Tube socket for V14
RJS-092		SOCKET—Tube socket for V3, V4, V5, V6, V17, and V22
RJS-107		SOCKET—Tube socket for V1
RJS-119		SOCKET—Picture tube socket
RJS-120		SOCKET—Tube socket for V7
RJS-127		SOCKET—Tube socket for V2
RJX-023		HEAD-END UNIT—R-f head-end unit (includes tubes) completely aligned
RLA-031	T1	TRANSFORMER—Antenna input
RLA-032	T7, 8, 9, 10	COIL—R-f and converter (Channel nel 7, 8-9, 10-11, 12-13)
RLC-069	T2	COIL—R-f, converter, and oscillator (Channel 2)
RLC-070	T3	COIL—R-f, converter, and oscillator (Channel 3)
RLC-071	T4	COIL—R-f, converter, and oscillator (Channel 4)
RLC-072	T5	COIL—R-f, converter, and oscillator (Channel 5)
RLC-073	T6	COIL—R-f, converter, and oscillator (Channel 6)
RLC-074	L10	COIL—Oscillator (Channel 7) (no code dot)
RLC-075	L11	COIL—Oscillator (Channel 8-9) (red code dot)
RLC-076	L12	COIL—Oscillator (Channel 10-11) (orange code dot)
RLC-077	L13	COIL—Oscillator (Channel 12-13) (yellow code dot)
RLD-004	L18	COIL—Horizontal size control
RLD-005	L19	COIL—Horizontal linearity control
RLD-006	D1, 2	SWEEP YOKE—Vertical and horizontal deflecting coils
RLF-013	L25	FOCUS COIL—Coil and PM magnet
RLI-003	L2	CHOKE—R-f choke (V2 cathode)
RLI-005	L6, 14	CHOKE—Video carrier-set trap
RLI-006	L1, 3	CHOKE—R-f input V2 cathode
RLI-019	R4	CHOKE—V2-A oscillator cathode
RLI-038	L16, 17, 22, 23	CHOKE—Video choke, 165 henry
RLI-059	L20	CHOKE—7 henry, high voltage supply filter choke
RLI-060	L24	CHOKE—7 henry, low voltage supply filter choke
RLI-061	L15	CHOKE—Television audio take-off trap
RLT-003	T17	COILS—Primary and secondary windings only, for horizontal sweep and high voltage transformer
RMB-015		BALL—Detent spring ball, on selector switch shaft
RMF-003		CLAMP—Tube clamp for V13 and V16
RMF-011		CLAMP—Picture tube mounting strap
RMM-081		CUSHION—Rubber cushion for picture tube mounting
RMS-164		SPRING—Detent spring, on selector switch shaft
RMU-043		SHAFT—Tubular shaft for focus control
RMU-046		DRIVE SHAFT—Focus control drive drum and shaft
RMU-047		SHAFT—Selector switch shaft
RMU-048		SHAFT—Tubular shaft for tuning control
RMW-044		DRIVE WHEEL—Rubber friction drive for focus control
RMW-045		PULLEY—Pulley and hub assembly for tuning control
RMW-054		DRIVE WHEEL—Rubber friction drive for tuning control
RRC-086	R33	POTENTIOMETER—1000 ohms, 2 w., w.w. (vertical linearity)
RRC-087	R31	POTENTIOMETER — 100,000 ohms, composition (vertical size)
RRC-088	R72	POTENTIOMETER—1000 ohms, 4 w., w.w. (focus)
RRC-101†	R73, 95	POTENTIOMETER — 500,000 ohms—100,000 ohms, composition (Dual, Contrast—Brightness)
RRC-090	R29, 46	POTENTIOMETER — 50,000 ohms—50,000 ohms, composition (Dual, Vertical Hold—Horizontal Hold)
RRC-091	R86, S2	POTENTIOMETER — 2 meg., composition (Volume and ON-OFF switch)
RRC-105*	R73, 95	POTENTIOMETER — 2 meg., 100,000 ohms, Contrast and Brightness
RRW-028	R70	RESISTOR—560 ohms, 7 w., w.w.
RRW-029	R97	RESISTOR—.65 ohm, 4 w., w.w.
RRW-034	R105	RESISTOR—1.0 ohm, ½ w., w.w.
RTD-007	T19	TRANSFORMER—Audio discriminator
RTL-081	T11	TRANSFORMER—1st video i-f
RTL-082	T12	TRANSFORMER—2nd video i-f
RTL-083	T13	TRANSFORMER—3rd video i-f
RTL-085	L5, 21	COIL—Television audio 1st i-f, 2nd i-f
RTL-089	T14	TRANSFORMER—4th video i-f
RTL-090	T21	TRANSFORMER—1st audio i-f
RTM-003	T16	TRANSFORMER — Horizontal sweep blocking oscillator
RTO-052	T20	TRANSFORMER—Audio output
RTO-061	T15	TRANSFORMER—Vertical sweep output
RTP-062	T18	TRANSFORMER—Power transformer, 60 cycle
RWL-019		POWER CORD AND PLUG

NOTE: The following notes of catalog numbers and listed values are given below.

* Used only in chassis marked "R."

† Not used in chassis marked "R."

★Special discounts apply.