CHARACTERISTICS

Picture area
Models 410 & 710: 60 sq. in.
(early production 52 sq. in.)
Models 512 & 612: 90 sq. in.
(early production 75 sq. in.)
Speakers
4 by 6 inch PM (410 & 512)
8 inch PM (710)
10 inch PM (612)
Voice-coil impedance
3.2 ohms - 400 cycles
Antenna type
Folded dipole with reflector
Antenna impedance
300 ohms input impedance to receiver
I-F frequencies
Video, 26.1 mc
Sound, 21.6 mc
Audio strip, 4.5 mc
Power supply
117 volts, 60 cycles, a.c.
Power consumption
180 Watts
Dimensions
Model 410: 15-1/4 inches high
21-1/2 inches wide
19-1/4 inches deep
Model 512: 18-1/2 inches high
24-1/4 inches wide
20-1/4 inches deep
Model 710: 40-1/2 inches high
21 inches wide
19-3/4 inches deep
Model 612: 41-1/2 inches high
23 inches wide
19-3/4 inches deep
Tube complement
See parts list

CIRCUIT ANALYSIS

The Tele-King Television Receivers, models 410, 512, 612 and 710, consist of 20 tubes, including the rectifiers and the picture tube. All components are contained in a single chassis. Models 410 and 512 are table sets and models 612 and 710 are console sets. A 10BP4 kinescope is used in models 410 and 710 and a 12LP4 is employed in models 512 and 612. All models use one chassis, namely TVC-200 series.

The R-F Tuner

One of two r-f tuners is used with any of these receivers. Schematics of each tuner are included. Each tuner is a complete assembly in itself. Both tuners employ a 6BH6 tube as an r-f amplifier and a 6AG5 tube as a mixer. However, tuner TT-1 (see Fig. 7) uses a 6C4 tube as the local oscillator, whereas tuner TT-3 (see Fig. 8) employs a 6J6 tube. A fine tuning control is incorporated in each tuner. Component parts of the tuners are omitted from the parts list. It is suggested that if any trouble is suspected in the tuner, it be returned to the factory for repair.

The Video System

Three video i-f amplifiers, V-4, V-5, and V-6, each a 6AU6 tube, are employed. (The schematic, Fig. 9, should be consulted while reading the rest of the circuit analysis.) Four staggered-tuned i-f transformers, L4, L6, L9, and L12, are employed to produce the necessary bandwidth. Both the video and sound i-f signals are passed through this complete amplifier section which functions as a combined i-f system. There is no separation of the sound i-f signal from the video i-f signal, and they are both fed directly into V-7, the video detector. This is the basis upon which the intercarrier system operates. The over-all response of the i-f section is such that the amplitude of the sound i-f carrier is a very small percentage of the video i-f carrier when they are both fed to the video detector, which is one half of a 6AL5 tube. No sound traps are employed. Response shaping is discussed in the alignment section.

The video detector considers the sound i-f signal as a high-frequency sideband of the video i-f signal and detection occurs in the normal manner. The sound and video i-f carriers can be considered as beating together inside the video detector. The carriers of these two i-f signals are always separated by 4.5 mc, so that after detection their difference frequency of 4.5 mc appears in the output of the video detector. This 4.5-mc beat note contains all of the f-m characteristics of the input f-m sound i-f signal and very little a.m. effects. It is the amplitude relationship between the two input i-f signals that determines the character of the 4.5-mc output signal.

The 4.5-mc f-m signal as well as the video signal output from the detector is directly coupled to the grid of V-8, a 6AG7 video amplifier, through an L-R high-frequency compensating network. In this manner, the 4.5-mc signal receives additional amplification. In the plate of the video amplifier is the primary parallel-tuned circuit of a double-tuned 4.5-mc transformer, L2, which selects the f-m 4.5-mc signal to be fed to the sound section of the receiver. The video signal output is fed directly to the grid of the picture tube V-10, through peaking coil L3 and capacitor C223.

AGC and Contrast

The video i-f signal output from the third video i-f stage, V-6, is fed to the plate, pin 7, of the other half of the 6AL5 tube, V-7, which serves as a delayed AGC rectifier. The AGC voltage is supplied to the r-f and first and second video i-f amplifiers. A small positive voltage on the cathode of this diode prevents rectification of the video i-f signal until the i-f signal voltage on the diode plate exceeds whatever voltage is on the cathode. The contrast control, P14, which is in the cathode circuit of the video amplifier, V-8, besides controlling the bias and hence the gain of this stage, also controls the amount of delay voltage on the cathode of the AGC tube. The influence of the contrast control is such that the delay voltage will be greatest at the time the gain of the video amplifier is greatest. This makes for a better over-all control of the picture contrast.

The Sweep and Sync Circuits

One half of V-9, a 12AU7 tube, serves as the d-c restorer and sync clipper. The sync voltage output from this section is fed to the grid of the other half of V-9, which functions as a sync amplifier to the vertical sync pulses and as a phase splitter to the horizontal sync pulses. The positive sync output signal is taken directly from the plate, pin 6 of V-9, and applied to an integrating network which consists of C301, R301, C302, R302, and C303. This integrating network separates the vertical sync pulses from the horizontal and applies the former to the grid circuit, pin 1, of the vertical sweep oscillator, V-13. This latter circuit utilizes one half of a 6SN7-GT tube as a blocking oscillator. The other half of V-13 functions as the vertical sweep output amplifier. The output from this amplifier feeds into the vertical output transformer, T4, and then to the vertical deflection yoke.

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The 1-megohm potentiometer (of dual-control unit PD5) in the grid circuit, pin 1, of the vertical sweep oscillator, controls the frequency of operations and is termed the VERT. HOLD control. The VERT. LINEARITY control is the 5000-ohm potentiometer, P2, in the cathode circuit, pin 6, of the vertical sweep output amplifier. The VERT. SIZE control is a 2.5-megohm potentiometer, P5, located in the B-supply lead to the plate of the vertical sweep oscillator.

The type 6SN7-GT tube, V-14, which is the horizontal sweep oscillator, is employed as a combined cathode-coupled sine wave oscillator and multivibrator. The output from the plate, pin 5, of this oscillator is coupled to the grid of V-15, a 6BG6-G tube serving as the horizontal sweep output amplifier. The output from the plate of this latter tube is fed to tap 2 on the primary of the horizontal output transformer, T5. From the high side of the primary of this transformer, tap 3, the horizontal sweep signal is fed to the plate of V-16, a 1B3-GT tube, serving as the high-voltage rectifier. This rectifier is employed in a kick-back type of high-voltage power supply, which supplies voltage for the second anode of the kinescope.

The secondary of T5 consists of taps 4, 5, and 6, and feeds the horizontal deflection yoke. A 6W4-GT tube, V-17, serves as the horizontal damper. From tap 6 of T5, some of the horizontal sweep signal is applied to the cathode and plate (pins 1 and 2 which are tied together) of the horizontal phase detector, V-11, through an integrating network essentially consisting of R327 and C322. The horizontal sync pulses from the V9 phase splitter is applied to the other cathode and plate sections of the horizontal phase detector and these sync pulses are compared with the phase of the horizontal sweep input. If their phases are different, an afc voltage is developed across R323 and then applied to the grid circuit, pin 1, of the horizontal sweep oscillator.

The 50,000-ohm potentiometer, PD5, in the grid circuit, pin 4, of V-14, regulates the horizontal sweep frequency and is called the HOR. HOLD control, and trimmer capacitor C325 between V-14 and V-15 is the HOR. DRIVE control. Coil L21 in the cathode circuit of the horizontal damper tube V-17 is the HOR. LINEARITY control and coil L20 across taps 5 and 6 of the horizontal output transformer functions as the horizontal WIDTH control.

The Sound Section

The 4.5-mc f-m signal from the secondary of the takeoff transformer L2 is fed to the grid circuit of the ratio detector driver and limiter, V-3, a 6AU6 tube. The output from this driver tube feeds the primary of the ratio detector transformer L1, which is tuned to 4.5 mc. The double diode section of a 6T8 tube, V-2, is used as the ratio detector, and the triode section of this same tube is used as the first audio amplifier. The 500,000-ohm potentiometer P7 in the output circuit of the ratio detector is the VOLUME control. The output from the first audio amplifier is R-C coupled to the grid of V-1, a 6AQ5 tube which is the audio output amplifier. The audio signal output from this latter stage is fed to the audio output transformer, T1, and then to the speaker.

Power Supply and Voltage Regulation

The low-voltage supply incorporates a 5U4-G tube, V-12, as the rectifier. Coil L17 in the output filter system is the focus coil and connected across this coil is the FOCUS control, P6, a 1500-ohm potentiometer. This low-voltage power supply provides a positive 360-volt B-plus source and a negative 2-1/2 volt bias supply. For the r-f and i-f section of the receiver the 360-volt output is decreased to 140 volts for the screens and plates of these tubes while the cathodes are returned to chassis ground. The 360-volt supply is used directly for the deflection circuits and also for the plates and screens of the tubes in the sound section. However, the cathodes of these audio tubes are connected in series with the B supply for the r-f and i-f tubes, which means that the cathodes of the audio section are 140 volts positive with respect to ground. Thus, the effective B supply between the plate and cathode of the tubes in the sound section is 360 less 140, or 220 volts.

The interesting thing about the 6AQ5 tube circuit, V-1, is that it functions as a series automatic voltage regulator for the 140-volt supply and prevents any current variations in the r-f and i-f circuit from changing this voltage. The grid of the 6AQ5 tube is connected to the 360-volt supply through a voltage divider. A positive voltage of 123 volts is applied to the grid, but since the cathode is 140 volts positive, the grid has an effective bias of -17 volts. Any change in the 140 volts will tend to change the bias of the 6AQ5 tube. This, in turn, will cause the tube current to change, which means that the voltage drop across the cathode load will likewise vary. This voltage drop will be such that it will bring the cathode back to the 140 volts.

For instance, if the voltage increases beyond 140 volts, the bias on the 6AQ5 tube will become more negative. Less current will flow in the tube and a smaller voltage drop will occur across the complete cathode load. This decrease in voltage drop will be just enough to offset the previous increase in the cathode voltage.

FUNCTIONING OF CONTROLS

The controls of the receiver are divided into two groups, the front panel operating controls and the rear panel pre-set controls.

FRONT PANEL OPERATING CONTROLS

There are seven front panel operating controls as indicated in Fig. 1, each operating independently of the other. Reading from left to right, the controls and their functions are as follows:

On-Off and Volume

This is a single control. The knob should be turned clockwise, until a click is heard. This supplies a.c. to the receiver. Further clockwise rotation of the control varies the input to the audio amplifier, and, consequently, controls the volume of sound output.

Vertical Hold

This control functions to keep the picture stationary in the vertical direction. Electrically it is a variable resistor which controls the frequency of the vertical sweep oscillator.

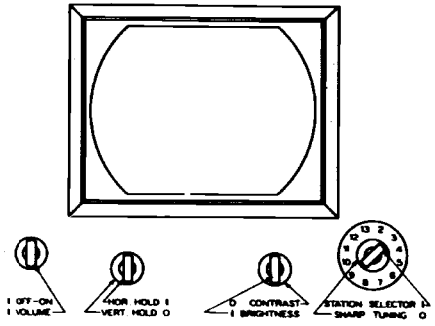

FIG. 1— OPERATING CONTROLS

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If the sloping bar effect is as stated, then the picture should remain in sync over 1/4 rotation of the horizontal hold range and drop out of sync on either end of this range.

Horizontal Drive

This trimmer capacitor affects the height of the horizontal pulse, varying the horizontal linearity principally on the left side of the picture.

Focus

A variable resistor which controls the current flow through the focus coil on the neck of the tube.

Width

This slug adjustment inside the high-voltage cage affects the right side of the horizontal axis.

NOTE: There are no horizontal or vertical positioning controls. Centering of the picture is accomplished by positioning of the focus coil. The deflection yoke should be placed on the neck of the tube as far forward as possible.

ALIGNMENT PROCEDURE

Test Equipment

The test equipment required for the alignment of this receiver is as follows:

Marker Generator (RCA WR-39A, or equivalent)
Sweep Generator (RCA WR-59A, or equivalent)
Oscilloscope (RCA WO-55A, or equivalent)
VTVM (RCA Junior VoltOhmyst, or equivalent)
Volt-Ohmmeter (Simpson 260, or any 20,000 ohm-per-volt meter)

The marker generator is an r-f signal generator used for peaking the i-f coils and also to supply marker pips on the response pattern. The required frequency range of this generator is approximately from 20 to 30 mc and must also have provision for a 4.5 mc output. The accuracy of the frequency calibration of this generator is very important. It must also have provision for an amplitude modulated, as well as an unmodulated, r-f output.

The sweep generator has its output continually variable in frequency. In this alignment, only one output sweep signal is needed, that sweeping between 20 to 30 mc.

The oscilloscope used is a high-gain, general purpose type employed for test purposes. The size of the screen is unimportant.

The VTVM is of the standard type with a high input impedance. It should have provision for a-c and d-c measurements. A 20,000 ohm-per-volt meter should be used for d-c indications if the VTVM can only measure a.c.

Alignment

For the alignment points refer to the figure indicated in the discussion. Most of the adjustments are located on top of the chassis. The r-f marker generator is used in making most of the alignment adjustments. It is recommended that the order of alignment in the following procedure be adhered to if alignment is found necessary. The ground leads of the test instruments should be connected to the receiver chassis.

Horizontal Hold

The function of this control is to keep the picture stationary in the horizontal direction. It is a variable resistor which affects the frequency of the horizontal sweep oscillator.

Brightness

This control, which is also a variable resistor, affects the cathode voltage on the kinescope, thereby regulating the brightness of the picture.

Contrast

The contrast control provides a means for varying the relative intensities of black and white in the picture. Advancing this control toward excessive contrast will introduce a loud buzz.

Station Selector

This control permits selection of the channel desired.

Fine Tuning

This control varies the frequency of the r-f heterodyne oscillator. It is adjusted for best picture quality and is not used to tune in the sound.

REAR PANEL PRE-SET CONTROLS

There are six so-called pre-set controls at the rear of the chassis as indicated in Fig. 2. They are all screw driver adjustments. The SOUND DISC. is the alignment screw for the secondary of the ratio detector transformer L1, and is not considered a pre-set control.

Vertical Linearity

This control is a variable resistor in the cathode circuit of the vertical sweep output tube. Manipulation of this control affects the upper portion of the picture.

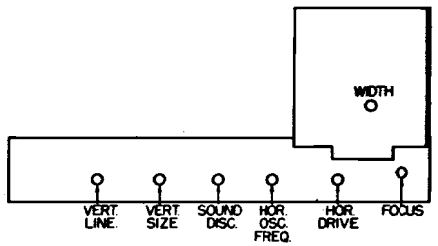

FIG. 2- PRE-SET CONTROLS

Vertical Size

The vertical size control varies the plate voltage of the vertical sweep oscillator. It primarily causes a change in height of the picture but it also interacts with the vertical linearity so that these controls must be used in conjunction with each other.

Horizontal Oscillator Frequency

This control is a slug adjustment for L18 which controls the frequency of the horizontal oscillator. To set this control properly, connect an antenna to the receiver and tune in a station, preferably one with a test pattern on the air. Center the horizontal hold control. Adjust the L18 slug until the picture locks in. Set the horizontal hold control in the full clockwise position and slowly rotate it in the opposite direction. Just before the picture falls into sync, 3 or 4 black and white bars should appear sloping downward to the right. Repeat the process, but with the horizontal hold control in the full counterclockwise position. The same conditions should be observed except that the bars will slope downward to the left.

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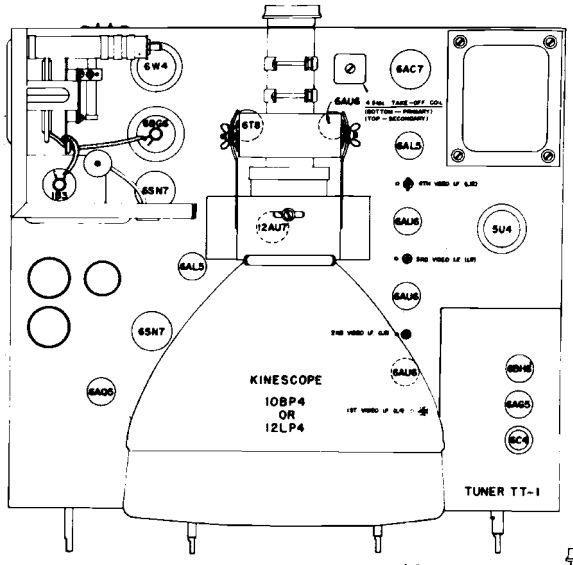
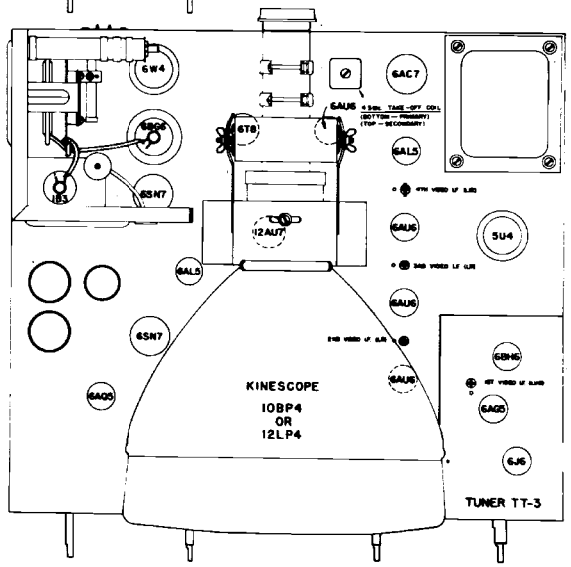


(A)- RECEIVER INCORPORATING TUNER TT-1.



(B)- RECEIVER INCORPORATING TUNER TT-3

FIG. 3 - TOP VIEW OF CHASSIS

Picture I-F Alignment (Fig. 3)

Connect the VTVM (a-c scale), or oscilloscope to the grid of the kinescope at the junction of C223 and R222. (Do not attempt to take readings with the VTVM at the video detector.) Adjust the contrast control about 1/8 turn below its maximum setting. Connect the output of the signal generator (marker) to the nipple on top of the 6AG5 mixer tube of either tuner.

Set the generator at 25.6 mc, amplitude-modulated at approximately 400 cycles, and adjust the first and third video i-f coils for maximum response. For those receivers employing tuner TT-1, the first video i-f coil is L4 as indicated in Fig. 3(A). When tuner TT-3 is used, the first video i-f coil is LV-6 and is incorporated in the tuner and not the receiver proper, as shown in Fig. 3(B). Reset the generator to 23.4 mc, still amplitude-modulated, and tune the second and fourth video i-f coils, L6 and L12 respectively, for maximum response. Repeat the above process for fine adjustments of settings.

Over-all Picture Response

With the sweep generator adjusted for a 10-mc sweep, using a center frequency of about 25 mc, connect the generator to nipple of the 6AG5 mixer tube of either tuner. Loosely couple the marker generator to the same mixer tube. The oscilloscope should remain at the grid of the kinescope. Inject individual markers of 26.1 mc, 25.6 mc, 22.6 mc, and 21.6 mc in the order indicated and note positions of marker pips on response curve. Turning the adjustments very slowly, retune the four video i-f coils again for an over-all picture i-f response as indicated in Fig. 4.

NOTE: A 30% variation in amplitude between peaks and from peak to valley, of the response curve is permissible. The most important considerations here are that the video i-f carrier of 26.1 mc is approximately halfway down the right hand slope, and that the sound i-f carrier of 21.6 mc is 20 times down at the other end of the curve.

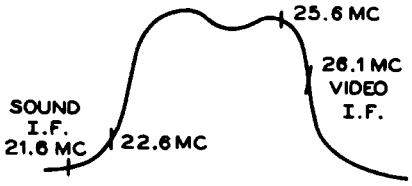


FIG. 4 - OVER-ALL I-F RESPONSE CURVE.

Sound Takeoff and Detector Transformer Alignment

Move the signal generator (marker) output lead to the junction of L13 and R217, between the video detector, V-7, and video amplifier V-8. Set the generator to a 4.5-mc unmodulated signal output. Connect the VTVM (d-c scale) or the 20,000 ohm-per-volt meter across C107 in the output circuit

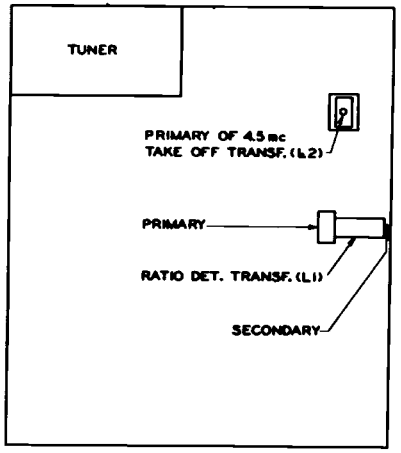


FIG. 5 - BOTTOM VIEW SHOWING ALIGNMENT POINTS FOR L1 AND PRIMARY OF L2

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of the ratio detector, V-2. .(Remember that the negative lead at this point is actually above -140 volts with respect to ground.)

Adjust the following for maximum reading on the meter in the order indicated. The primary of L1 (the ratio detector transformer), the adjustment of which is shown in Fig. 5. Next tune the secondary of L1; this adjustment, shown in Fig. 5, is also shown in Fig. 2 and indicated as SOUND DISC. Then adjust the primary L2, the 4.5-mc takeoff transformer; see Fig. 5. Next adjust the secondary of L2, shown in Fig. 3. Decrease the signal output from the generator to the minimum required to give a readable deflection on the meter and then repeat the sound alignment process.

After the alignment is complete, remove the generators and meters. Tune in a station. Turn up the contrast control until a buzz is heard. Adjust the secondary of the detector transformer (see Figs. 2 and 5) for minimum buzz.

NOTE: Alignment of the r-f and oscillator sections are not recommended and are therefore not included. If any misalignment of these sections is suspected, consult the manufacturer.

SERVICE NOTES

No Raster

Defective picture tube or misadjusted ion trap magnet.
No high voltage. Check tubes V-14, V-15, V-16, and V-17.
Check horizontal output transformer, T211T3; and also check C335, R326, and R336.
Check all voltages and waveforms in sweep section. Do not check voltage directly on plate of V-16.

Raster Present -- No Sound or Picture

Open transmission line.
Defective tube in r-f unit, or defective r-f unit.
Check B+ supply for sound and picture sections.
Check tubes V-1, V-2, V-3, V-4, V-5, V-6, V-7, and V-8.

Raster and Sound -- No Picture

Open green lead from picture tube socket.
Check tube V-8 and associated circuit.
Open C223.

Raster and Picture -- No Sound

Defective sound takeoff transformer, T2, or ratio detector transformer, T1.
Check tubes V-1, V-2, and V-3.
Defective audio output transformer, T1, or speaker.

Unable to Synchronize Vertically or Horizontally

Check tube V-9 and associated circuit.

Unable to Synchronize Vertically

Check tube V-13.
Defective vertical oscillator transformer, T3, or vertical output transformer, T4.

Unable to Synchronize Horizontally

Horizontal sweep oscillator coil L18 misadjusted.
Coil L18 or capacitor C315 defective.
Defective tubes V-11 or V-14, or feedback capacitor C330.
Check voltages, resistances, and waveforms in horizontal sync section.

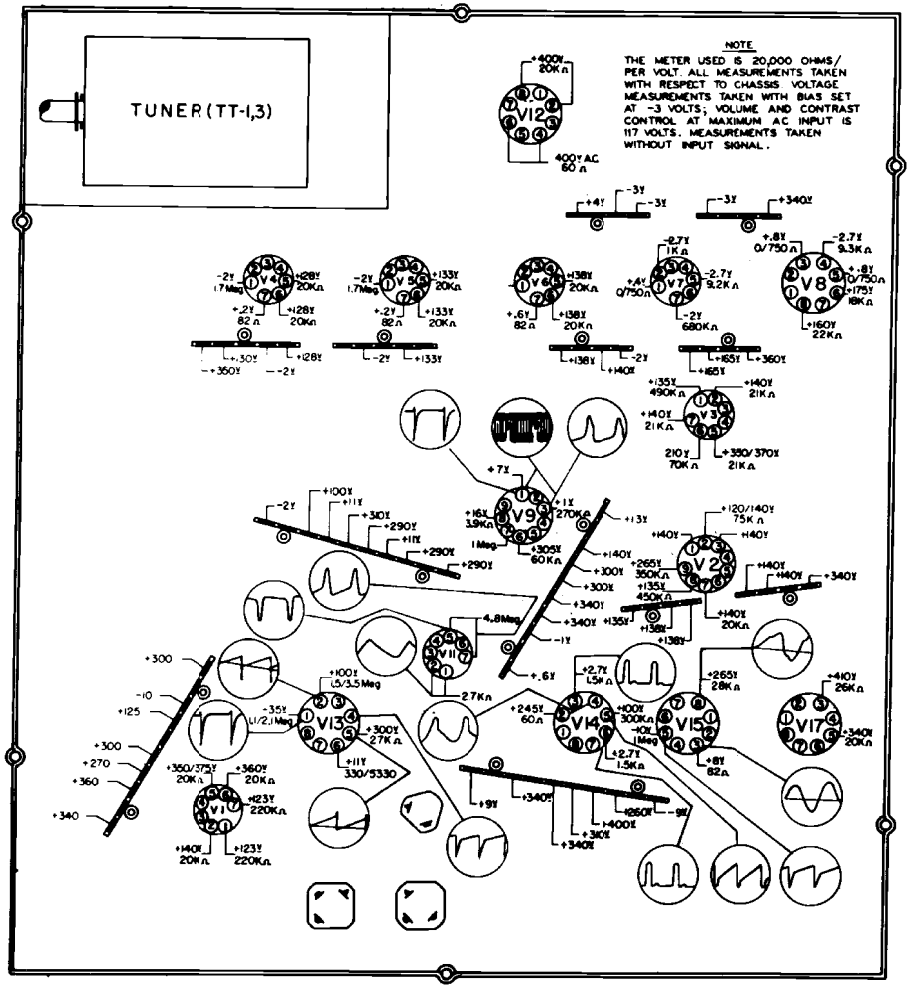

FIG. 6- BOTTOM VIEW INDICATING VOLTAGE AND RESISTANCE VALUES AND ALSO WAVE FORMS.

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Insufficient Height

Defective vertical oscillator transformer, T3.
C313 increasing in capacity.
R304 and R310 changing in value.

Inability to Center Picture

Blanking on left side may be due to leaky C313.
Carefully try turning CR Tube.

NOTE: Entire audio circuit is at a potential of 140 volts above ground and the grids are hot. Also, V-1, 6AQ5, functions as a series voltage regulator to this 140 volts, as well as an audio output tube. Proper operation of this tube affects B+, and is, therefore, vital to normal operation of other circuits. A primary check of this circuit should be instituted when starting to service receiver.

For voltage and resistance analysis and waveforms, see Fig. 6.

DISASSEMBLY

To remove chassis from the cabinet, first pull off all knobs from controls in front of cabinet. Remove the six mounting bolts to be found underneath the cabinet and lift the chassis from the cabinet. Use care to prevent damage to the kinescope.

The kinescope is mounted on the chassis itself. It is held in place by a strap that is fastened over the outer rim of the bell of the kinescope.

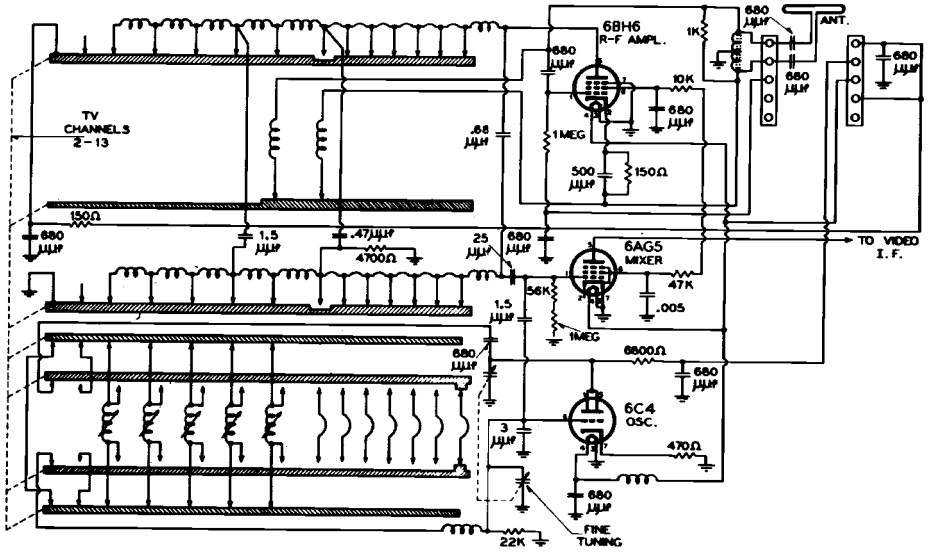

FIG. 7- SCHEMATIC OF TT-1 TUNER

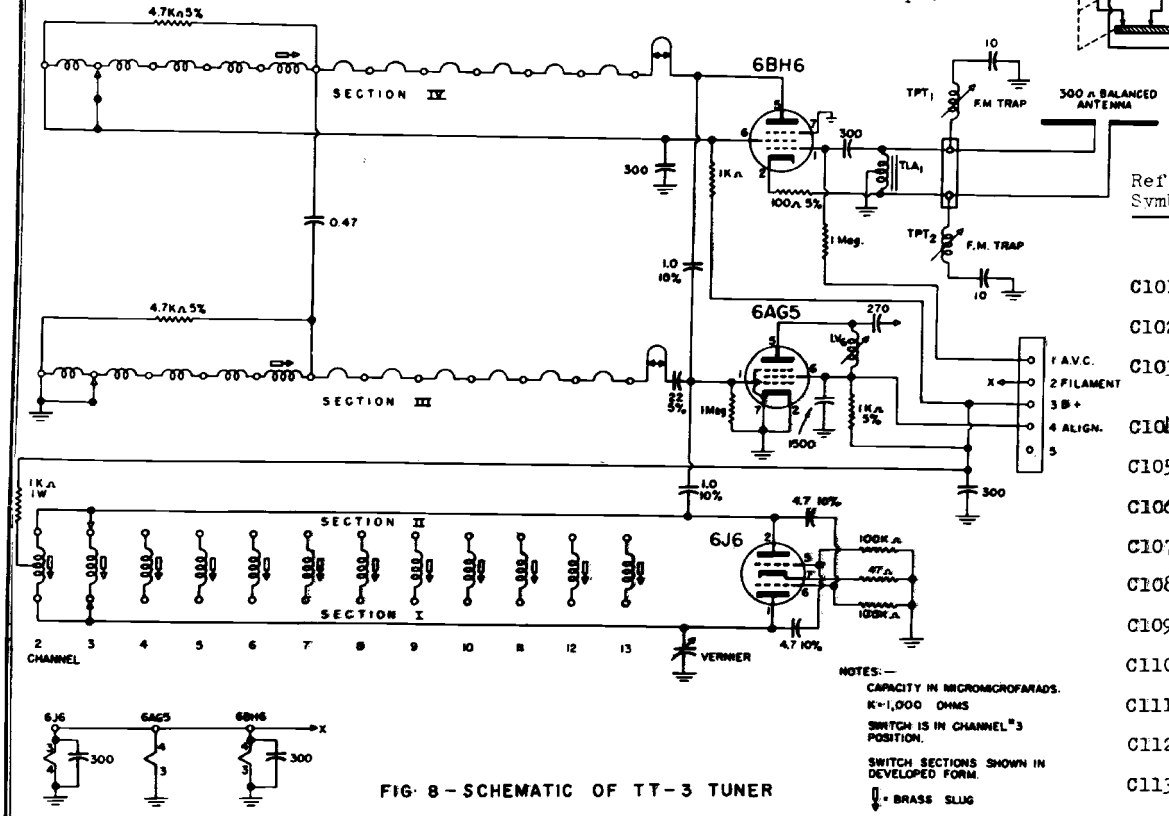

FIG. 8 - SCHEMATIC OF TT-3 TUNER

PARTS LIST

Ref Symbol	Description	Part No.
	CAPACITORS	
C101	Paper: 0.005 µf, 400 V	CP-4-25
C102	Tubular elect: 40 µf, strap mounting, 450 V	CET-4
C103	Can elect: 2-sect; 50 µf, 150 V; 500 µf, 5 V; size 1"	CEM-7
C104	Paper: 0.02 µf, 400 V	CP-4-12
C105	Paper: 0.05 µf, 400 V	CP-4-15
C106	Paper: 0.005 µf, 400 V	CP-4-25
C107	Tubular elect: 1 µf, 25 V	CET-6
C108	Paper: 0.005 µf, 400 V	CP-4-25
C109	Paper: 0.001 µf, 400 V	CP-4-21
C110	Paper: 0.02 µf, 400 V	CP-4-12
C111	Paper: 0.005 µf, 400 V	CP-4-25
C112	Paper: 0.02 µf, 400 V	CP-4-12
C113	Ceramic: 39 µµf, 20%	CC-439
C114	Paper: 0.1 µf, 400 V	CP-4-01
C115	Paper: 0.002 µf, 400 V	CP-4-22
C201	Ceramic: 100 µµf, GMV	CC-31
C202 C203 C204 C205 C206	Ceramic: Herlec GMV, 2-sect; each 0.002 µf	CCD-22
C207	Ceramic: GMV, 100 µµf	CC-31
C208 C209	Ceramic: Herlec GMV, 2-sect; each 0.002 µf	CCD-22
C210	Paper: 0.1 µf, 400 V	CP-4-01
C211	Ceramic: Herlec GMV, 2-sect; each 0.002 µf	CCD-22
C212	Ceramic: Herlec GMV, 0.002 µf	CC-22
C213	Ceramic: Herlec GMV, 2-sect; each 0.002 µf	CCD-22
C214	Ceramic: GMV, 120 µµf	CC-312
C215	Ceramic: GMV, 100 µµf	CC-31

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