

The number 7 Telekit was developed primarily by Electro-Technical Industries for use in technical schools as a training project, but has since been marketed to experimenters as well. The features of the number 7 Telekit are simplicity of design, compact size, excellent sensitivity and good definition. Sound detection is true F. M. and the rapid method of stagger tuning the video I. F. amplifiers by means of a A. M. Signal Generator and earphones is unique in that pictures of good horizontal and vertical resolution are assured in a minimum of time. The Telekit also readily lends itself to visual alignment by sweep generator and oscilloscope for more advanced trainees. Inexperienced Telekit builders can easily align the finished receiver by means of the static test patterns and tone signals provided by the Television Stations without any equipment excepting earphones.

#### Circuit Description.

The R. F. and Oscillator section of the Number 7 TELEKIT have been designed for maximum sensitivity by utilizing two sections of the 6J6 twin Triode Oscillator Tube connected in parallel in order to develop maximum oscillator voltage. This signal is injected into the grid of the mixer through a small ceramic condenser. The Mixer Stage utilizes an 1852 tube which provides excellent conversion conductance. The Oscillator is a reliable Hartley circuit which employs a fixed inductance and is tuned by variable capacitors which are switched across the tank coil for channel changing. Three channels are provided which can be adjusted to cover the lower six Television Bands. The Mixer Coil is a fixed inductance which is also tuned by adjustable capacitors. The antenna works into a two turn primary winding on the Mixer Coil with a characteristic impedance of 73 ohms. The high value of grid resistor on the mixer tube insures maximum sensitivity without sacrifice in band pass. The fixed vernier tuner is connected directly across the Oscillator Tank Coil for fine adjustment of sound carrier. This section of the receiver is excellent from the standpoint of student training by virtue of its simplicity and has long been a standard with TELEKITS. Present models of TELEKIT are now equipped with the #13 TELEKIT Tuner which gives full coverage of the Television Spectrum. The TELEKIT Tuner will be described in another section.

The Video I. F. portion of the #7 TELEKIT utilizes high gain 1852 tubes impedance coupled and highly damped to provide sufficient bandpass. Slug tuning is employed in the I. F. Coils and sound is separated from the picture by virtue of the absorption trap which is tuned to the sound I. F. frequency. This sound trap is directly across the input of the sound I. F. tube so that the voltage developed across this coil is utilized for the sound portion of the receiver. The TELEKIT sound detector (7X7 tube) is wired into a modified Foster-Seely discriminator circuit which is very simple in design and is extremely easy to align with an A. M. Signal Generator for null point. A two stage Audio Amplifier follows the Discriminator and a five inch P. M. Speaker is employed for sound reproduction. The Number 7 TELEKIT will drive any P. M. Speaker up to 15 inches. The 5 inch speaker is provided as a space saving feature.

The Video Detector is one-half the 6SN7 twin triode, used as a diode. The output of this detector is positive picture phase inasmuch as two Video Amplifiers follow. The entire Video Amplifier is compensated for both high and low frequencies and will pass the band necessary for good definition without phase shift or undue discrimination between frequencies. The main features of the Video Amplifier are the use of two stages of picture amplification and direct coupling into the picture tube grid which will provide pictures of excellent contrast.

The Sync Separator is a Triode Tube operated at low plate voltage and unbiased in absence of a signal. This tube clips the Sync Pulses from the composite Video Signal and inverts their phase in order to properly trigger the horizontal and vertical oscillators.

The differentiation circuit network on the input of the Horizontal Oscillator is unique in that a trimmer is utilized to control the amplitude of the trigger pulses. In locations where strong Television signals are available the capacitance can be reduced in order to prevent picture signal from entering the Oscillator and disturbing the correct timing. The integrator circuit network utilizes resistors which in conjunction with the distributed capacity of the tube and circuit provides the long time constant necessary to insure stable vertical synchronization.

The Horizontal and Vertical Oscillators are of the multivibrator type with unbypassed Cathode resistor feedback. This type of Oscillator was chosen because it is easily controlled by external voltage pulses whose frequency approaches the natural frequency of the Oscillator. The natural or free running frequency of these Oscillators is adjustable by varying the value of the grid resistor. These resistors are manually variable and are used as the hold or synchronizing controls. The horizontal timing condenser (.001 MFD.) is employed to produce the linear sawtooth voltage wave which is necessary for proper electrostatic scanning. Its small size will enable it to charge to the proper voltage and discharge with the necessary speed through the discharge tube ( $\frac{1}{2}$  6SN7 OSCILLATOR TUBE) in order to produce the sawtooth wave at the Horizontal Scanning Frequency (15,750). The amplitude of this wave which is put across the input of the horizontal output tube is controlled by the variable plate load which is the width or horizontal size control. The horizontal output tube (6SN7) is a push pull audio voltage amplifier which insures maximum voltage output (width) with good linearity (no distortion).

The vertical oscillator, timing condenser and push pull output perform identically with the exception of the much slower free running period of the oscillator and the longer time constants of the components. This circuit provides the necessary sawtooth wave for the vertical scanning rate of 60 C. P. S. The bias resistor and large bypass condenser used in conjunction with the vertical output tube prevents degeneration at this low audio frequency and insures good vertical linearity.

The low voltage power supply is conventional in that it provides all tubes with the necessary potentials to function properly. Dropping resistors are employed in all circuits in order to set the correct operating points for the tubes. All dropping resistors are decoupled from the A. C. circuits by the proper value bypass condensers for the frequencies involved. This prevents regenerative coupling between stages by way of the power supply and is a means of returning all signals to the tube cathode where generated by proper wiring.

The high voltage power supply employs a 60 cycle step-up power transformer which has an A. C. output of 2700 volts and which is rectified by the 2X2 tube for positive high voltage output.

The current requirements of this supply are extremely low and the use of large filter condensers and choke are eliminated. The high voltage bleeder network is tapped to provide the proper potentials for the picture tube elements with the low side of the bleeder (B-) connected

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to the low voltage B+ supply. The arrangement permits the use of a variable cathode bias resistor (brightness control) for the picture tube in the low voltage circuit and thus will prevent defocussing of the picture with variations in picture brightness.

The Cathode Ray Tube utilized in the Number 7 TELEKIT is the 7JP4 type kinescope. This tube is employed because of its superior screen brightness and deflection sensitivity as compared with electrostatic tubes of similar size.

The servicing of these sets is extremely simple and thus is an ideal project for all beginners in Television.

## Number 13 Tuner

The Number 13 Tuner was designed by Electro-Technical Industries to fill the need for a small unit which would be capable of tuning all of the Television channels, both low and high band. It is pre-wired and factory aligned and is standard equipment with all present model TELEKITS.

## CIRCUIT DESCRIPTION

The Antenna lead-in is coupled directly across the grid resistor of the R.F. stage ( $\frac{1}{2}$  6J6) which is designed for 300 ohm lead-in matching. The R.F. plate circuit is tuned by means of switching taps on the plate coil. The unused turns on the higher channels are short circuited by the switch. The R.F. voltage developed across the plate coil is fed across the input of the mixer tube ( $\frac{1}{2}$  12AT7).

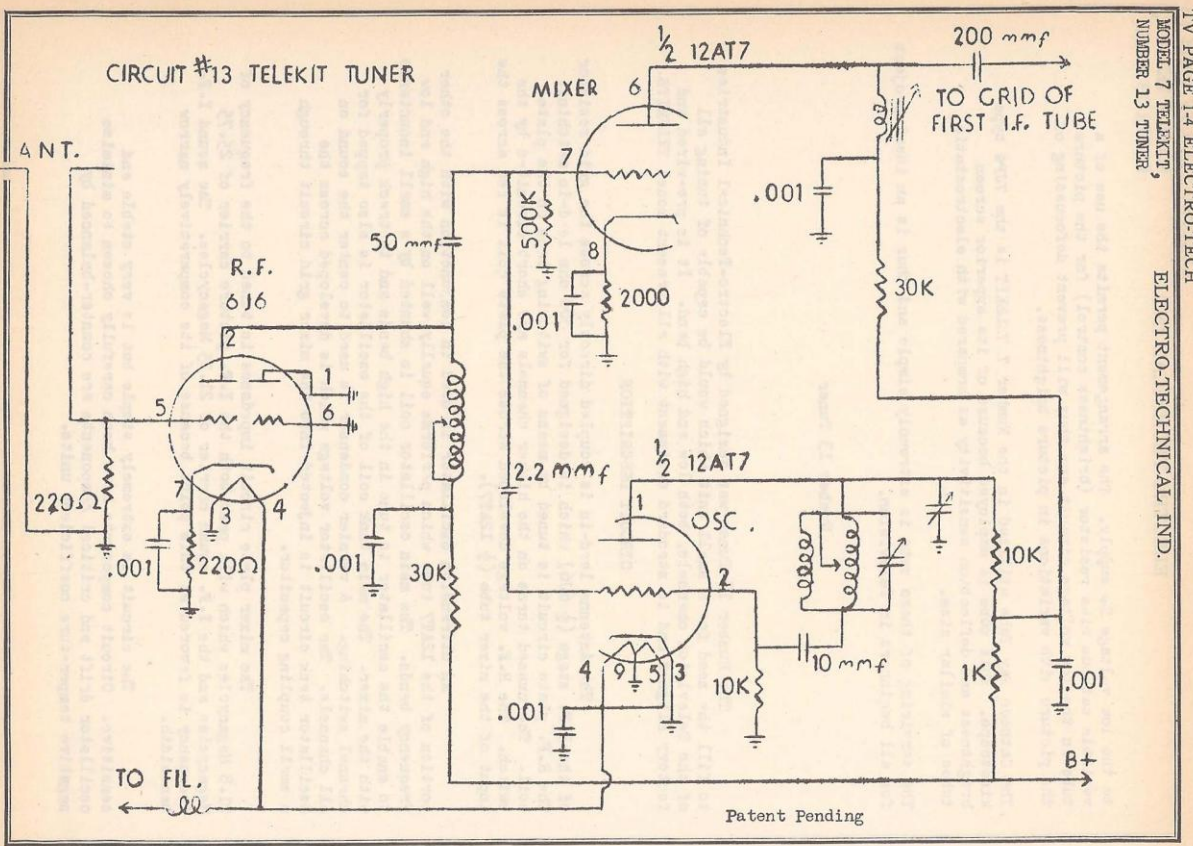
An ultraudion oscillator is used in conjunction with the other portion of the 12AT7 tube which performs equally well on the high and low frequency bands. The main oscillator coil is shunted by a small inductance to enable the oscillator to tune in the high bands and to track properly with the mixer. The main tank coil of the oscillator is also tapped for channel switching. A vernier condenser is used to center the sound on all channels. The oscillator voltage which is developed across the oscillator tank circuit is injected into the mixer grid circuit through a small coupling capacitor.

The mixer plate circuit impedance is tuned to the frequency of 21.8 Megacycles which will pass both the I.F. picture carrier of 25.75 Megacycles and the I.F. sound carrier of 21.25 Megacycles. The sound I.F. frequency is favored at this point because of its comparatively narrow bandwidth.

The circuit is extremely simple but is very stable and sensitive. Circuit components have been carefully chosen to minimize oscillator drift and critical components are counter-balanced by negative temperature coefficient units.

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### CIRCUIT #13 TELEKIT TUNER



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MODEL 7 TELEKIT

Preliminary Checks

## Alignment and Operating Instructions

1. Retrace all steps in the instruction sheets and layout figures.
2. Check all connections with the aid of the schematic diagram. Do not be alarmed when you find unused lugs on some tube sockets.
3. Be absolutely certain that there are no crossed bare wires and that all joints are securely soldered.
4. Turn set over, pick up and shake vigorously in order to remove all snippings of wire, bits of solder and other debris which accumulates during construction. These small bits are "poison" to a television receiver because they can cause "shorts" when the power is applied and ruin expensive components.
5. Be sure that all controls are securely fastened to the chassis and that transformers, can condensers, coils, etc., are seated firmly in their respective places.

Location and Function of Controls

1. Sound Volume:  
This control is mounted in hole 5 on front apron and its function is identical to that on radio receivers. By turning knob clockwise the volume of received sound will increase.
2. Contrast:  
This control is mounted in hole 4 on front apron and its function is to control picture gain. By advancing the control clockwise the intensity of the picture elements (blacks and whites) will increase.
3. Station Selector:  
This control is mounted in hole 3 on front apron and its function is to switch in the desired television channel. This receiver is equipped to receive three channels.
4. Fine Tuning:  
This control is mounted in hole 2 on front apron and its function is to give fine adjustment to the particular channel selected by the station selector. This control will also center the sound properly with the picture. Any deviation in sound as would be evidenced by fuzzy or distorted sound reception can be easily corrected by merely adjusting this control.
5. Brightness and A. C. Switch  
This control is mounted in hole 1 on front apron and its function is to adjust the over all brightness to the viewer's satisfaction. Whenever the contrast control is adjusted the brightness control should also be adjusted in order to insure perfect picture reception. Never use this control at full clockwise setting. The A.C. power switch is also mounted on this control.
6. Focus:  
This control is mounted in hole 6 on rear apron and its function is to sharpen the line formation of the raster which will insure clearest picture. Always adjust this control with an insulated tuning stick. (or any wooden or fibre stick shaped like screw driver)
7. Centering Controls:  
These controls are mounted in holes 7 and 8. The function of these controls is to center the picture both horizontally and vertically. Warning: The shafts of these controls are hot! That is, they are charged with electrostatic voltage. Make all adjustments to these controls with knobs on shafts! Always use one hand while making adjustments. Do not place other hand on chassis at any time!

## 8. Horizontal Hold:

This control is mounted in hole 2 on rear apron and its function is to control the speed of the line scans. The proper setting of this control can only be achieved while a picture is being transmitted by the local station. When adjusted the picture elements will fall in their proper places and one picture will be observed. When out of adjustment the elements will race across the screen or two pictures side by side will appear. A little practice with this control will soon acquaint user with its proper manipulation. After it is once set so that the picture is properly synchronized no further adjustments need be made.

## 9. Horizontal Size:

This control is mounted in hole 11 on rear apron and its function is to control the width of the picture in a horizontal direction. After picture is "synched" with the horizontal hold control its horizontal width can be adjusted to viewer's satisfaction by adjusting this control. Once proper width is achieved no further adjustments need be made to this control.

## 10. Vertical Hold:

This control is mounted in hole 10 on rear apron and its function is to hold the picture in a vertical direction. When improperly adjusted the picture will be observed to slip either upwards or downwards or perhaps fold back from the top so that may bright lines will appear on the picture. Adjust control until a stationary frame appears on screen.

## 11. Vertical Size:

This control is mounted in hole 9 on the rear apron and its function is to adjust the height of the picture to the viewer's satisfaction.

All controls on the rear apron of the receiver should be adjusted properly when the receiver is located in its permanent place. Under normal circumstances they should not require readjustment thereafter.

First Hot Check (Heaters) For all troubles refer to service notes in technical section.

1. Remove the 5U4G and the 2 x 2 from their respective sockets and with friction tape cover the bakelite cap which connects to the top of the 2 x 2. This is a precaution which is necessary because this cap carries a charge of 2000 volts A.C. and constitutes a dangerous shock hazard if accidentally touched.
2. Plug in A.C. cord to outlet. Turn on A.C. switch. Observe the glass tubes closely and look for the heaters to light up. If a short exists in this circuit a sharp hum will be heard in the low voltage transformer and heaters will not light. If so turn off set immediately and check entire heater circuit. If O.K. proceed to second hot check.

Second Hot Check (low voltage) For all troubles refer to service notes in technical section.

1. With switch off replace 5U4G tube in its proper socket. Now connect loud speaker leads (red and blue) to twisted leads which come through hole 20 of chassis. If already connected, disregard. Advance volume control fully clockwise and stand chassis in such a way so that the 5U4G can be observed as well as the underside components of the chassis. Turn on switch and observe 5U4G tube closely. Heaters inside glass envelope should be observed to light up but the heavy plates should not begin to glow. If plates begin to glow inside 5U4G it indicates a short circuit. Turn set off immediately. If O.K. glance at underside components. If any component is observed to sizzle or smoke turn set off immediately. This also indicates a short circuit. Recheck entire circuit and see that tubes are in proper sockets. If O.K. and none of these warning signs occur then take screw driver and tap metal end around lugs on station selector. If sharp scratching noises are heard in speaker then this indicates that the set is hot. In other words you are ready for the third hot check. Turn off set. Pull out plug!

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Third Hot Check (high voltage) For all troubles refer to service notes in technical section.

1. Place 2 x 2 tube in its socket and remove tape from bakelite cap. Place bakelite cap on top of 2 x 2 tube. Very carefully remove 7GP4 picture tube from carton but leave cardboard collar on tube. Place picture tube socket on base of picture tube very firmly. Check high voltage circuit visually and be sure all components are not too close to chassis. With switch off replace A.C. plug in outlet. Keep hands off set! Turn on A. C. switch and observe neck of picture tube closely to see heater glow. Also observe high voltage circuit to detect any arcing or smoke. If O.K. observe screen of picture tube for appearance of white spot. If spot appears and remains stationary for more than five seconds then turn off set and adjust horizontal and vertical hold controls. Try again. Spot should begin to move and then trace out a square of light which fills face of tube. This is known as the raster. If a single vertical line appears then manipulate horizontal hold control to get raster. If a single horizontal line appears then manipulate vertical hold control to get raster. Keep brightness control retarded so that screen will not burn a spot, a horizontal line or a vertical line. After raster appears adjust focus control for clearest line formation and size controls for the desired raster size. If raster is off center, then adjust centering controls. You are now ready for the alignment of the receiver for sight and sound.

Alignment of Picture and Sound

Before attempting alignment be sure that your antenna lead-in is connected.

1. Check with your local television station to find what hours during the day the static test pattern and sound signal is being transmitted. The station provides this service to assist in the alignment of receivers.
2. Procure these items:
  - 1 pair earphones.
  - 1 .1 condenser at 400V.
  - 1 tuning stick.
3. Proceed to align receiver as follows:
  - (a) Turn set off. Connect the .1 condenser to one of the earphone leads. Leave the other lead of the condenser open. Attach an alligator or similar clip to the other earphone lead and a clip to the open lead of the condenser. Clip the earphone lead to the chassis and the condenser lead to the 5 lug of socket "G". Turn set on. You can now "listen in" on the picture signal when it comes through. Be sure that volume control and contrast control are at full clockwise setting.
  - (b) Rotate selector switch to position 3. That is, its extreme clockwise position. This activates the trimmer condensers which are connected to the 4 and 8 lugs of the selector switch. Be sure that picture tube is connected to socket. Place phones on head and turn on set. Allow a full minute for warm-up.
  - (c) Tap mixer coil lead and observe raster. If it jumps, circuit is functioning. If not this indicates that something is wrong in one of the video stages. (see technical section). This should also produce noise in earphones.
  - (d) With tuning stick slowly turn trimmer screw of the trimmer in 4 lug of switch counter clockwise and at the same time rotate the fine tuning condenser slowly. Listen for a loud buzz in phones.
  - (e) If results are negative then turn trimmer screw of the one in 8 lug of switch counter clockwise about one half turn and repeat tuning with trimmer in 4 lug.
  - (f) When buzz is heard, center its loudest intensity with fine tuning control plates about three-fourths meshed. Return to trimmer in 8 lug of switch and adjust

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- screw for maximum buzz. If buzz gets too loud or cuts off reduce contrast control setting. Keep brightness very low. Do not touch trimmer on 4 lug after this adjustment is made.
- (g) Picture content should appear on raster but probably will be streaking or jumping. Adjust hold controls until one picture is on screen. Adjust size controls until desired size is achieved and center picture with centering controls. Adjust brightness control until satisfactory brilliance is attained. Focus picture until sharpest detail is observed.
- (h) Remove earphones but do not disturb picture adjustments. Locate trimmer which is mounted on 4 lug of socket "K". Turn screw of this trimmer until the associated sound is heard in speaker. Adjust for maximum volume. Turn to trimmer which is mounted on top of sound coil. Adjust this trimmer until best quality of sound is received with least incidental noise.
- (i) If picture breaks or streaks horizontally adjust trimmer which is connected to 1 lug of tube "H" and at the same time delicately adjust the horizontal hold control. Between these two adjustments satisfactory results should be attained. Note: All these adjustments should be made before receiver is placed in cabinet.
- (j) By turning the station selector one position counter-clockwise the same or a different station can be tuned in. This middle setting activates trimmers 3 and 7. Follow the same procedure in adjusting these trimmers. Bring the station "in" with trimmer 3. "Peak it up" with trimmer 7. Position 1 of selector switch activates trimmers 2 and 6. Follow the prescribed procedure.
- (k) For all difficulties encountered refer to the technical section for service notes.
- (l) Note: It is possible to get the picture on the screen but the wrong sound carrier. Some F.M. station may come through with the picture. If this happens return to trimmer in lug 4 (see note "b") and turn screw about 1 1/2 to 2 turns counter-clockwise. The picture will disappear but should reappear with this new setting accompanied by its associated sound carrier. The first picture signal which you may have received is known as an "image".
- (m) After picture is satisfactorily received it is necessary to tune the tuner away from each "side" of picture. You will notice that at a certain setting picture will be strongest. Turning this control one way will reduce its strength but will not improve its quality. Turning this control the other way will reduce its strength but will improve its quality. This is the desired picture. Increase its strength by adjusting the contrast control clockwise.
- (n) If it is found that picture and sound are slightly off, that is, that they come in on different settings of the tuner then set tuner to the point where sound comes in best and turn slugs of third and fourth video I.F. coils. This should bring the picture in with the sound. Notice the small holed nuts on each coil form. Whenever adjustments are made to the slugs, loosen the small holed nuts. When final adjustments are made tighten small holed nuts finger tight.
- (o) The television receiver will perform best with a television antenna kit and a 300 ohm lead-in line. These may be purchased for a small cost from your jobber. For urban use a single dipole kit or a folded dipole kit may be used. For suburban use a multi-element antenna kit. Full instructions on installation should be furnished with each kit.
- (p) Always locate your television receiver in a part of the room where no direct sunlight or window light falls on screen. After set is mounted in cabinet it should be placed in its permanent place and should not be moved about. Always be sure to turn your set off when not in use. This will extend the life of the picture tube.



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## T Y P I C A L

## TROUBLES AND CURES

-on-

## 7 INCH TELEKIT

Symptoms	Possible Cause	Remedy
(A) No light, or light not properly centered on picture tube and cannot be properly centered by center control, yet voltages are O.K.	(a) One or more leaky or shorted 2000 volt coupling condenser in coupling circuit; (b) Wires leading to plates of picture tube are squeezed against chassis; or (c) Wires to picture tube socket are not adequately insulated;	(a) Replace condenser or condensers; (c) Dress wires; (d) Insulate wires;
(B) PICTURE JUMPS VERTICALLY.	(a) Filtering of sync. separator circuit is not adequate for receiving conditions in this particular location; or  (b) Leaking coupling condenser either in sync separator circuit or vertical oscillator circuit or vertical amplifier circuit.	(a) Increase one meg. resistor to a 2 meg. resistor, or add a .05 condenser to input grid of vertical oscillator tube; (b) Replace leaking condenser.
(C) PICTURE TEARS HORIZONTALLY, or HORIZONTAL HOLD CONTROL IS CRITICAL	(a) Bad separator tube; or (b) A leaking coupling condenser between first video and second video tubes; or between first video and separator tubes; or between separator tube and horizontal oscillator tube; or between horizontal oscillator tube and horizontal amplifier tube or tubes; or  (c) Abnormal low plate voltage in sync separator tube;	(a) Replace; (b) Replace;  (c) Increase plate voltage.

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(D) HUM OR RIPPLE ON SCREEN.

- (a) Open condenser in high or low voltage circuits; or
- (b) Shorted or leaking coupling condensers in deflection circuits or in video circuit; or
- (c) By 14 and 1,2 wires being reversed.

(a) Repair or Replace;

(b) Replace;

(c) Check if 14 and 1,2 wires on picture tube socket are connected to their proper places.

(E) OSCILLATION OR INTERFERENCE IN VIDEO OUTPUT.

MOST NOTICEABLE WHEN CONTRAST CONTROLS ARE TURNED ON FULL.

- (a) Condenser is open between 1000 ohm resistor and ground in circuit feeding B+ to mixer tube.

- (b) Condenser is open in screen grid of I.F. circuits; or
- (c) Condenser is open between 1000 ohm resistor and ground in plate circuits of the I.F.; or
- (d) Wrong value or defective resistor between grid and ground of video I.F. tube; or
- (e) Open condenser between cathode and ground of the I.F. tubes;
- (f) Outside interference such as excessive auto ignition interference, diathermy interference, beat frequency interference.

(a) If condenser is open due to rosin connection, resolder it; if defective replace it;

(b) Same as (a);

(c) Same as (a);

(d) Replace resistor with one of correct value;

(e) Same as (a);

(f) To verify if trouble is caused by outside interference, disconnect the aerial. If raster is O.K., the trouble is interference; if raster is not clear, then the remedy is found in (a) to (e).

NOTE: Never take out second video 6SN7 while power is on. If this tube is removed there will be no current drain on the plate of the second video. This will cause a high positive voltage on the grid of picture which might temporarily cause image distortion.

(F) WHEN DETAIL IS MILKY, OR NOT SHARP.

NOTE: Before proceeding make sure focus control is properly set.

If focus is O.K. and symptom continues:

- (a) Loss of high video frequencies due to I.F. coils being tuned too sharply; or
- (b) the Video amplifiers lack the range to amplify all the frequencies necessary for good picture reproduction; or
- (c) the resistors connected to the plate of the 1st and 2nd video output tubes may be off value. The resistor to the plate of the 1st video output tube should be of 2000 ohms; to the plate of 2nd video output tube should be of 3000 ohms.

(a) Replace resistor which is connected to the grid of the 1st video and resistor which is connected to grid of 2nd video with resistors of lower value (from 3000 to 2000 ohms);

(b) Replace 3000 ohms resistor which is connected to the plate of 1st video amplifier with a 2000 ohm resistor;

(c) Replace resistors with others of specific value.

(a) Change to proper value;

(b) Check Wiring;

(c) If off-value, change to proper value, if it is of the specified value, change to a resistor of lower value (5,000 ohms). This will slightly reduce size of picture, but will make it sharper.

When Detail is Milky, or Not Sharp, and Focus is O.K., but symptom continues....

- (a) The two 500,000 ohm resistors in the 2000 volt bleeder circuit are off value; or
- (b) The fault may be in the focus control wiring; or
- (c) The "safety" resistor leading from the 879 tube filament to the 2000 volt filter network may be off value;

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- (G) IF RASTER OF LIGHT FADES AFTER APPEARING FOR A FEW SECONDS, Check tube (6SN7) in the second video circuit.
- (H) IF PICTURE FOLDS HORIZONTAL
- (I) IF THERE IS A NON-LINEAR HORIZONTAL CONDITION.
- (J) PICTURE IS TOO LARGE. (Runs over the face of the tube) AND CANNOT BE SUFFICIENTLY REDUCED.
- (K) IF PICTURE IS TOO SMALL
- (L) VERTICAL HOLD CONTROL SEEMS CRITICAL
- (M) TOO MUCH BLACK OR TOO MUCH CONTRAST
- (a) Weak or defective 6SN7 tube. (a) Change tube.
- (a) The .001 Timing condenser in the horizontal oscillator circuit is defective or off-value; or (a) Change condenser.
- (b) There may be a leaking coupling condenser in the horizontal deflection circuit; or (b) Change condenser.
- (c) One of the resistors in the horizontal deflection circuit off-value, most likely in one of the plate circuits. (c) Change resistor.
- (a) Open or off-value timing condenser in the horizontal oscillator circuit; or (a) Change condenser;
- (b) One or more of the coupling condensers in deflection circuits may be too high in capacity; or (b) Change it to a condenser of smaller value.
- (c) Wrong value grid of plate resistors in the deflection circuits. (c) Replace with correct value.
- (a) Too low voltage on the plates of tubes of deflection circuits, caused by resistor being off-value or by leaking or shorted condenser; or (a) Replace resistor or condenser.
- (b) Wrong value resistors on grids of the tubes of the deflection circuit; or (b) Replace resistors;
- (c) One or more coupling condensers in the deflection circuits may be open or too small capacity. (c) Replace condensers.
- (a) Open or off-value condenser connected to plate of separator tube leading to vertical oscillator circuit; or (a) Replace condenser;
- (b) Open or off-value resistor leading to grid input of vertical oscillator tube; or (b) Replace resistor;
- (c) Bad vertical oscillator tube (c) Replace tube.
- (a) Resistor connected to plate of 1st video tube and the resistor connected to the plate of the second video tube are too high in value for the particular location of the receiver (when abnormally strong video (a) Replace resistor to 1st video with one of 2000 ohms, 1 watt; and replace resistor to 2nd video with one of 2000 ohms, 1 watt.

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- signal is obtained, usually when receiver is located close to transmitter).
- (N) IF NO RASTER OF LIGHT.
- (a) No voltage on filament of picture tube; or  
 (b) Leaking coupling condenser leading to plates of picture tube; or  
 (c) No voltage on the plate of the second video tube; or  
 (d) Bad connection on picture tube socket; or  
 (e) Bad 879 tube; or  
 (f) Shorted condenser in the 2000 volt filter circuit; or  
 (g) Open resistor in the 2000 volt bleeder circuit.
- (a) Check wiring.  
 (b) Change condenser.  
 (c) Check for open peaking coil or resistor leading to plate of picture tube and replace if necessary;  
 (d) Repair;  
 (e) Replace;  
 (f) Replace;  
 (g) Replace.
- (O) IF SIGHT AND SOUND DO NOT SYNCHRONIZE
- (a) Sight and sound may not be tuned to their proper frequencies. They should be 4.5 megacycles apart.  
 (b) The 6J6 oscillator may not be tuned to the fundamental frequency of the station being tuned in.
- (a) Realign sight and sound IF coils;  
 (b) Realign the oscillator to the fundamental frequency of the station being tuned in.
- (P) LINES CROWDED AT THE TOP OR AT THE BOTTOM, or at BOTH TOP AND BOTTOM, (Vertical nonlinear), giving compressed image at top or bottom, or at both top and bottom.
- (a) Leaking vertical coupling condenser in the vertical deflection circuit; or  
 (b) Defective or wrong value resistors in the plates or grids of the circuits of the vertical deflection tubes; or  
 (c) Defective vertical oscillator or vertical amplifier tubes; or  
 (d) May require a larger coupling condenser from vertical oscillator to vertical amplifier.
- (a) Replace;  
 (b) Replace;  
 (c) Replace;  
 (d) Replace with a .1 or .25 condenser, whichever is larger than the condenser replaced.

## NOTE:

If the condenser, resistors, or tubes are OK then increase the resistance in the vertical amplifier cathode circuit from 5000 to 7000 ohms; also decrease the resistance of one of the two 250,000 ohm resistors in the plates of the vertical amplifier tube circuit to about 100,000 ohms.

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(Q) SINE WAVE PATTERN  
INSTEAD OF RASTER.

(a) Open or bad connection in .25  
condenser connected to plate of  
vertical oscillator.

(a) Check condensers;  
repair or replace.

(R) NOISY FOCUS CONTROL  
or NOISY BRIGHTNESS  
CONTROL

(a) May be caused by picture tube  
leads pressed against chassis or  
wires not properly insulated at  
picture tube socket.

(a) Separate wires  
from chassis or  
insulate wires.

(S) RASTER COLLAPSES  
TO FORM A STRAIGHT  
VERTICAL OR STRAIGHT  
HORIZONTAL LINE.

(a) Either the oscillator or  
amplifier in either the vertical  
or horizontal deflection circuit  
is not working.

(a) If Vertical line  
collapsed, use the  
following procedure;

1. Remove grid lead of  
vertical amplifier;  
place finger on the grid  
of the vertical amplifier..  
if this produces a raster,  
the trouble is in the  
vertical oscillator circuit  
and all voltages, parts  
and tubes in the vertical  
oscillator circuit must  
be checked; .. if this does  
not produce a raster, then  
the trouble is in the ver-  
tical amplifier circuit  
and all voltages, parts  
and tube in the vertical  
amplifier must be checked;  
if horizontal line is  
collapsed use the same  
procedure as above in the  
horizontal circuits.

(a) Replace condenser.

(T) PICTURE CANNOT BE  
CENTERED

(a) A small leak in one of the  
2000 volt coupling condensers;

or

(b) Off-value in one of the 5  
meg resistors leading to the  
2000 volt coupling condensers;

or

(c) Off-value in the two 100,000  
ohm resistors which are in  
parallel with the centering con-  
trols;

(b) Replace resistors  
with new ones of correct  
value.

(c) Replace resistors  
with new ones of  
correct value.

(U) VERTICAL BAND  
ACROSS PICTURE THAT IS  
BRIGHTER THAN REMAIN-  
DER OF PICTURE.

(a) Leaking coupling condenser  
in vertical deflection circuit;

or

(b) Hold control improperly set.

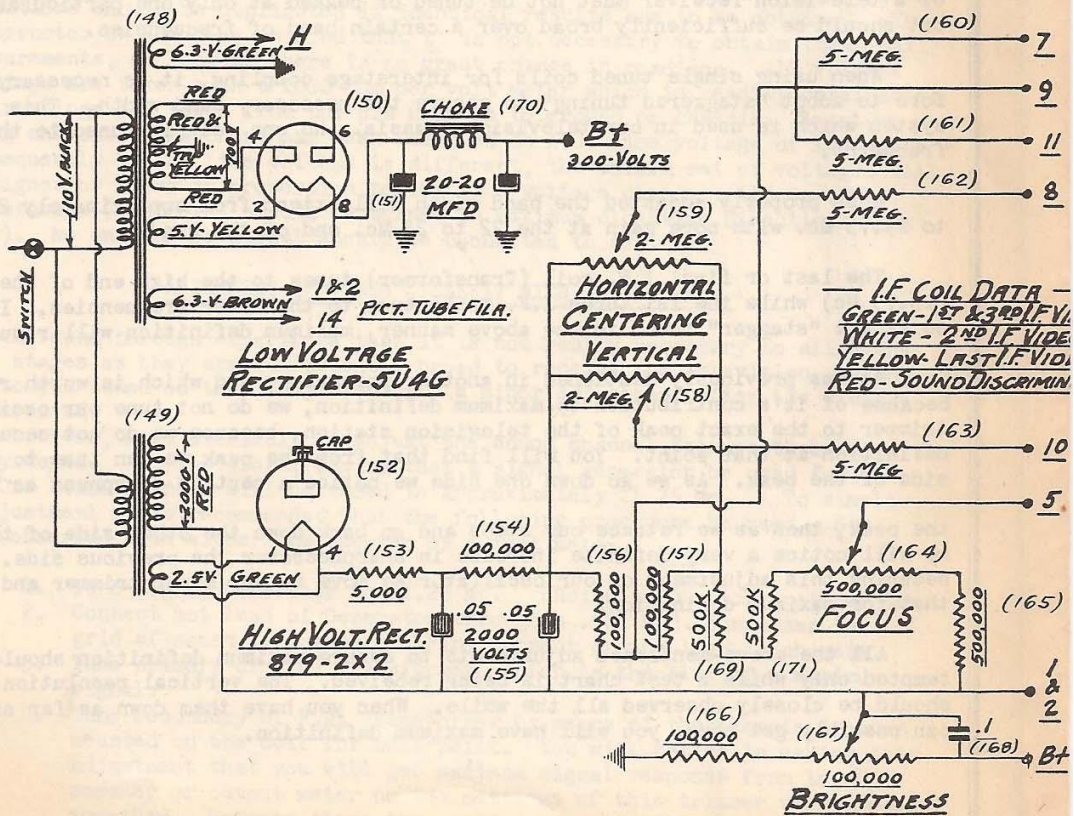
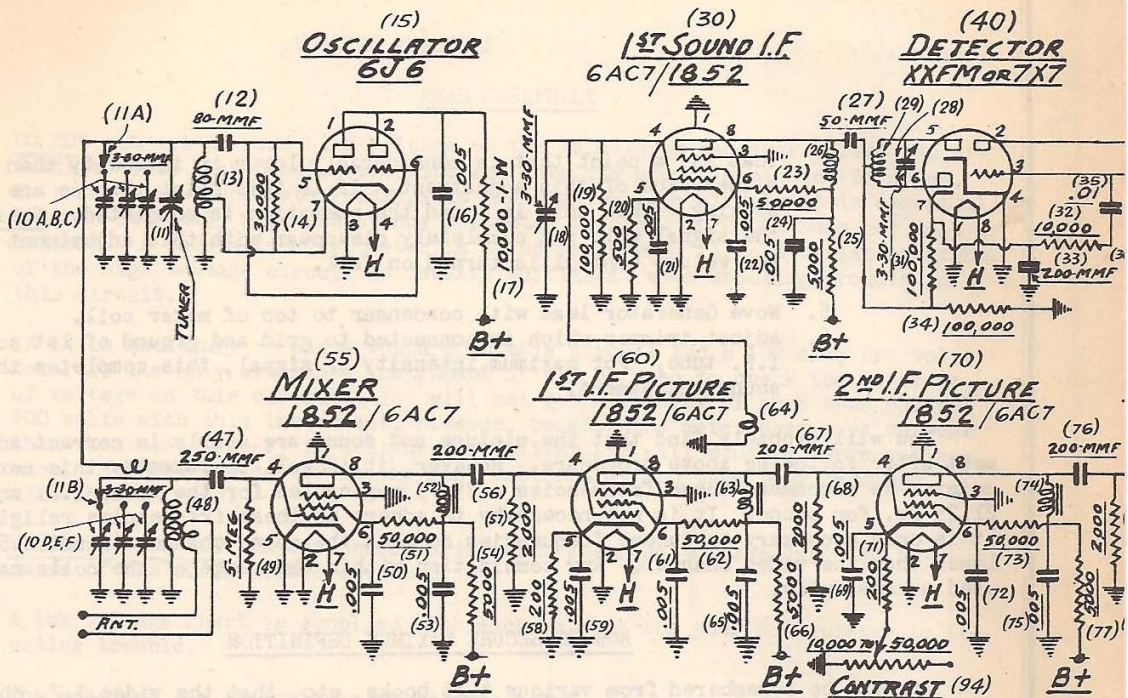
(b) Set hold control.

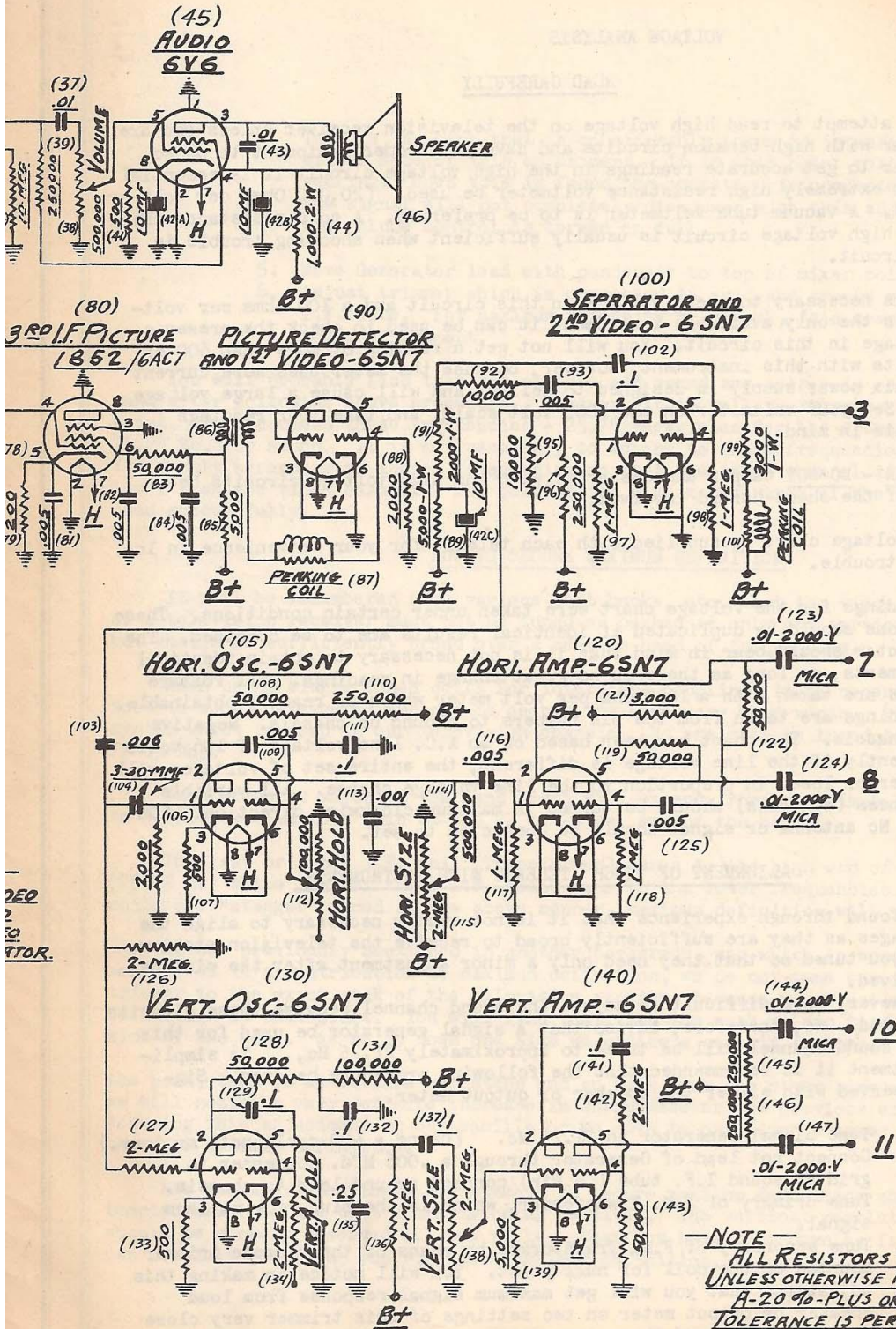
VOLTAGE CHART

All Voltage Readings Taken  
With 1000 Ohm per volt Meter

Voltages Present on Pin Numbers  
With respect to Ground (Chassis)

STAGE	TUBE	1	2	3	4	5	6	7	8
OSCILLATOR	6J6	175	175	0	6.3 A.C.	0	0	0	
MIXER	6AC7 (1852)	0	0	0	0	0	175	6.3 A.C.	280
1st PICT. I.F.	6AC7 (1852)	0	0	0	0	3	165	6.3 A.C.	280
2nd PICT. I.F.	6AC7 (1852)	0	0	0	0	3	175	6.3 A.C.	280
3rd PICT. I.F.	6AC7 (1852)	0	0	0	0	3	175	6.3 A.C.	280
PICT. DET. and 1st VIDEO	6SN7	0	0	0	0	175V	0	6.3 A.C.	0
2nd VIDEO AND SEPARATOR	6SN7	0	10 to 15 Volts	0	0	240	0	6.3 A.C.	0
1st SOUND I.F.	6AC7 (1552)	0	0	0	0	3	175	6.3 A.C.	280
SOUND DETECTOR AND 1st AUDIO	6XFM (7X7)	0	110	0	0	0	0	0	6.3 A.C.
AUDIO OUTPUT	6V6	0	0	290	300	0	0	6.3 A.C.	15 to 20 V.
HORIZONTAL OSCILLATOR	6SN7	0	20V	0	0	20V	0	6.3 A.C.	0
HORIZONTAL AMPLIFIER	6SN7	0	225V	0	0	225V	0	6.3 A.C.	0
VERTICAL OSCILLATOR	6SN7	0	40V	0	0	20V	0	6.3 A.C.	0
VERTICAL AMPLIFIER	6SN7	0	140V	6V	0	140V	0	6.3 A.C.	0
LOW VOLTAGE RECTIFIER	5U4	0	350V D.C.	0	340 A.C.	0	340 A.C.	0	350 D.C.







## ELECTRO-TECHNICAL IND.

MODEL 7 TELEKIT

## VOLTAGE ANALYSIS

READ CAREFULLY

1. DO NOT attempt to read high voltage on the television receiver unless you are familiar with high tension circuits and have the proper equipment to do so. In order to get accurate readings in the high voltage circuit it is essential that an extremely high resistance voltmeter be used. (20,000 Ohms per volt or better). A vacuum tube voltmeter is to be preferred. A cold resistance check of the high voltage circuit is usually sufficient when shooting trouble in this circuit.
2. If it is necessary to check voltage in this circuit and a 100 ohms per volt-meter is the only available instrument it can be used to check the presence of voltage in this circuit. You will not get a reading of more than 600 or 700 volts with this instrument, however, because the meter uses more current than this power supply is designed to deliver and will cause a large voltage drop. Set your voltmeter on the 1000 volt scale, and take your readings with this in mind.
3. REMEMBER - DO NOT tamper unnecessarily with the high voltage circuits because of the shock hazard involved.
4. A low voltage chart is supplied with each telekit for your convenience in locating trouble.
5. The readings for the voltage chart were taken under certain conditions. These conditions should be duplicated if identical results are to be obtained. The constructor should bear in mind that it is not necessary to obtain identical measurements, so long as there is no great change in readings. All voltage readings are taken with a 1000 ohm per volt meter which is readily obtainable. The readings are taken from the pin numbers to ground or chassis. Negative being chassis. The chart has been based on an A.C. line voltage of 106 volts - consequently if the line voltage is different, the entire set of voltages will be higher or lower in proportion to the line voltage change. All variable resistances (controls) should be turned in maximum clockwise direction. (On full). No antenna or signal should be connected to set.

ALIGNMENT OF 7 INCH TELEKIT WITH INSTRUMENTS

We have found through experience that it is not really necessary to align the video I.F. stages as they are sufficiently broad to receive the television station. They come to you tuned so that they need only a minor adjustment after the picture has been received.

It is however, more difficult to adjust the sound channel because these circuits are sharply tuned. We, therefore, advise that a signal generator be used for this purpose. Our sound channel will be tuned to approximately 21.25 Mc. To simplify this adjustment it is recommended that the following procedure be used. Signal can be observed with either the speaker or output meter.

1. Tune Signal Generator to 21.25 Mc. (Using a 400 cycle note or tone.)
2. Connect hot lead of Generator through a .006 Mfd. condenser to grid of sound I.F. tube ( 4 Pin) connect ground lead to chassis.
3. Tune primary of F.M. Transformer, which is the slug, for maximum signal.
4. Tune secondary of F.M. Transformer by means of the ceramic trimmer mounted on the coil for null point. You will notice in making this adjustment that you will get maximum signal response from loud speaker or output meter on two settings of this trimmer very close together. Between these two settings there will be a null point;

That is, a point that is considerably lower in intensity than on either side of this adjustment. If is this point that we are seeking. When this is found the operation is completed. Notice the signal will not completely disappear with this adjustment if the volume control is turned on full.

5. Move Generator lead with condenser to top of mixer coil.
6. Adjust trimmer which is connected to grid and ground of 1st sound I.F. tube. For maximum intensity of signal, this completes the sound adjustment.

You will probably find that the picture and sound are nearly in correct adjustment after following above procedure. However, it is well to remember this next point. We recommend these frequencies - 25.75 megacycles for the video I.F. and 21.25 Mc. for sound. It is not necessary to adhere to these frequencies religiously. It is only necessary to choose frequencies so that the sound channel is set 4.5 Mc. lower than the video channel. Any combination within the range of the coils may be used successfully.

#### HOW TO SECURE MAXIMUM DEFINITION

It will be remembered from various text books, etc. that the video I.F. channel of a television receiver must not be tuned or peaked at only one particular frequency, but should be sufficiently broad over a certain band of frequencies.

When using single tuned coils for interstage coupling, it is necessary, therefore to adopt "staggered tuning" to secure the necessary band width. This is the system which is used in our television chassis. No one coil is tuned to the same frequency.

When properly adjusted the band width will extend from approximately 22Mc. to 25.75 Mc. with more gain at the 22 to 23 Mc. end of the band.

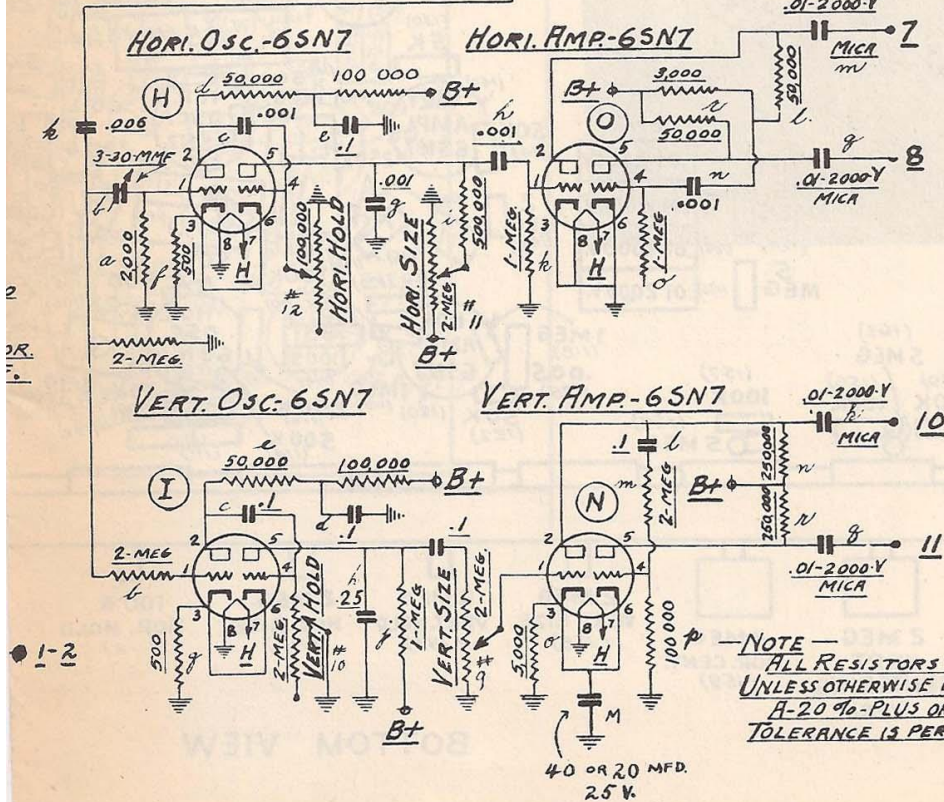
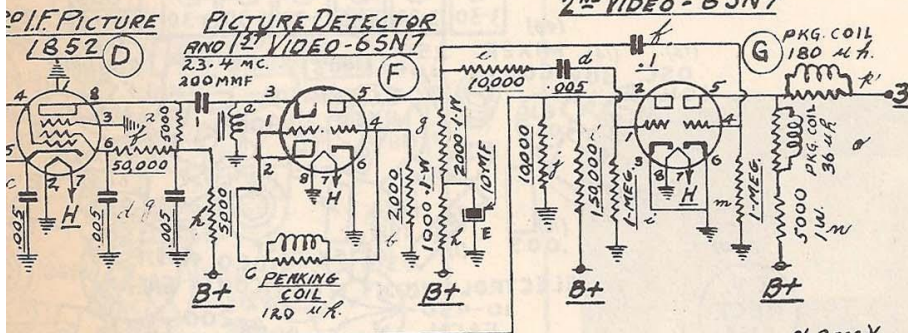
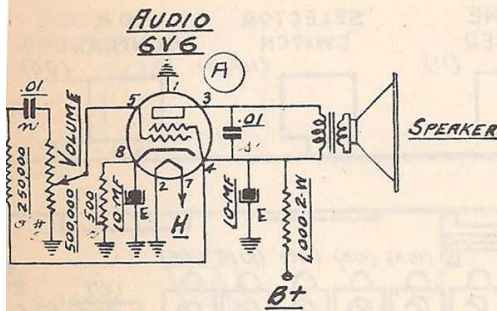
The last or final I.F. coil (Transformer) tunes to the high end of the band (25.75 Mc) while the 1st three I.F. coils tune to the lower frequencies. If the coils are "stagger" tuned in the above manner, maximum definition will result.

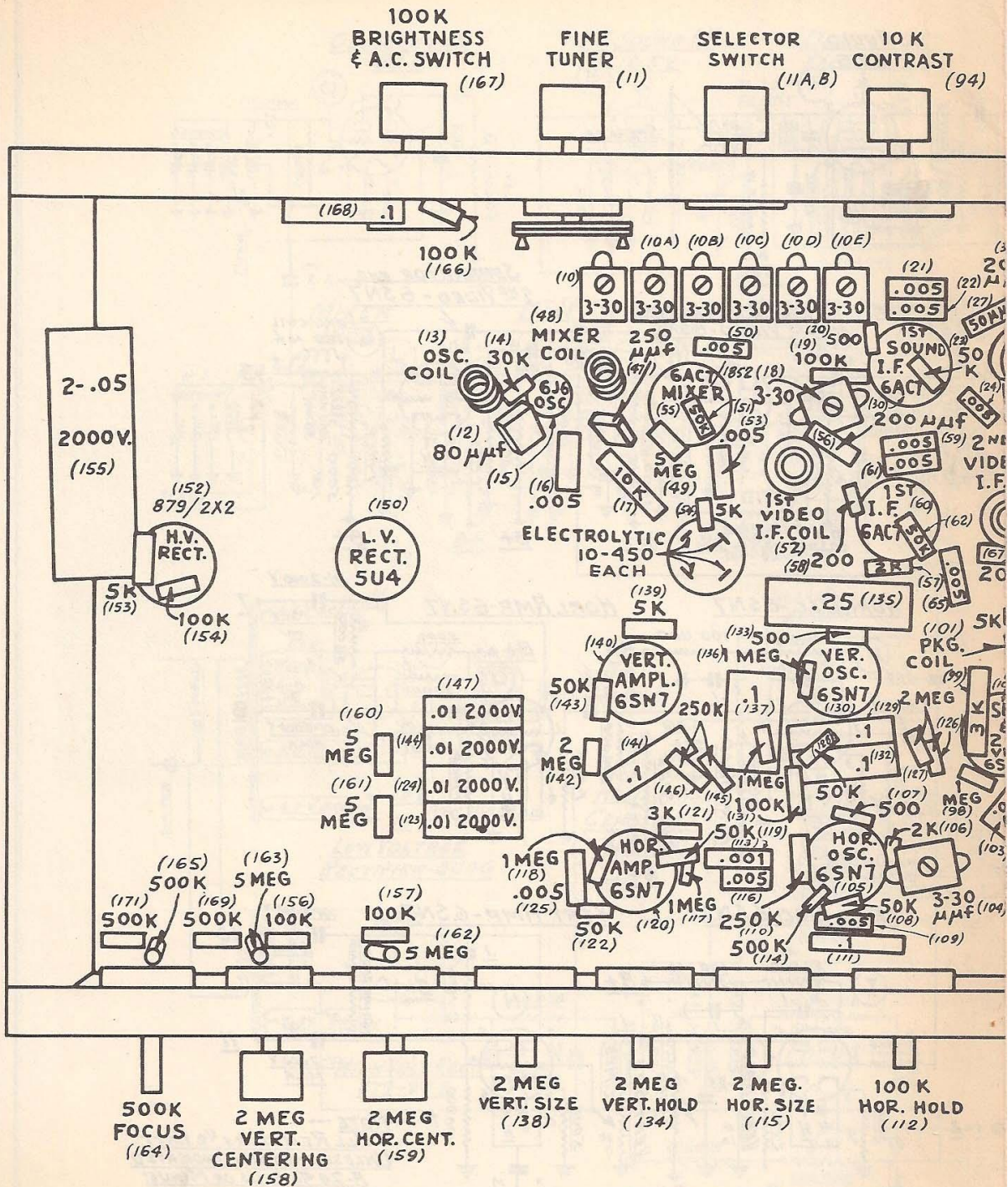
As was previously mentioned in another paragraph, and which is worth repeating because of it's contribution to maximum definition, we do not tune our oscillator trimmer to the exact peak of the television station, because we do not secure maximum definition at that point. You will find that from the peak we can tune to either side of the peak. As we go down one side we notice a certain sharpness as compared to

the peak, then as we retrace our steps and go back down the other side of the peak we will notice a very definite increase in sharpness over the previous side. After securing this adjustment on our oscillator we move to our mixer trimmer and adjust that for maximum definition.

All the above-mentioned adjustments to secure maximum definition should be attempted only while a test chart is being received. The vertical resolution wedges should be closely observed all the while. When you have them down as far as you can possibly get them, you will have maximum definition.







BOTTOM VIEW

500 K  
VOLUME  
(38)

