## Most - Often - Needed <br>  <br> VOLUME TV-9 <br> Television <br> Servicing Information



Compiled by
M. N. BEITMAN

VOLUME TV-9
mest ${ }^{5}$

# Most - Often - Needed 1955 Television 

 Servicing Information

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Supreme Publications

## PREFACE

Practically all early 1955 television sets of all important manufacturers are covered in this Volume TV-9 of Supreme Publications television service manuals. This service material was originally prepared by various manufacturers to aid in servicing sets of their make. This material has been edited in part and selected with the thought of supplying you and other servicemen with the "most-often-needed" television servicing material at the lowest possible cost.

The list of Contents is given on pages 3 and 4 , while a detailed Index by manufacturers and model or chassis number begins on page 191. Refer to this list and index to find the TV material you need. A Master INDEX to all SUPREME television and radio manuals is available at $25 \%$, postpaid.

Our sincere thanks and appreciation is extended to every manufacturer whose products are covered by the material in this manual and who aided us in the preparation of this book.
M. N. Beitman

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# Admiral 20A2, 20A21, and 2002 CHASSIS 

# Models C2216AZ, K2216A, T2216A, K2217A, T2217A, F2226, C2236A <br> (Alignment material on pages 6 and 7; Circuit on pages 8 and 9) 

## CHASSIS NOTES

The 20A2 and 20A2Z chassis employ the same basic circuitry with the exception that the 20 A 2 Z chassis has the aluminized picture tube.

The 20A2 and 20A2Z chassis are used in TV only receivers while the 20 D 2 chassis, with a built-in two tube (AM) tuner, is used in combination models.

## HORIZONTAL OSCILLATOR \& DRIVE ADJ.

If the Horizontal Drive control (on rear of set) is not properly adjusted, it may be difficult to obtain sufficient picture width and brightness.

When switching channels, the Horizontal control (on front panel) should keep the picture in horizontal sync through at least three fourths of its range. If the picture does not remain in horizontal sync, then adjust the rear panel controls as follows:
a. Allow the receiver to warm up for a few minutes. Tune in a station, set the Brightness control at a lower than average setting. Turn Contrast control fully to the left. Important: Before proceeding, be sure that the DX Range Finder control (AGC) is adjusted according to the instructions given in this manual
b. Turn the Horizontal control (front panel) completely to the left. Turn the Horiz. Drive control fully to the right.
c. Turn the Horiz. Lock adjustment to the right until the picture falls out of sync. If the picture cannot be made to fall out of sync, momentarily interrupt the signal by switching the Channel control off channel and then back on.
d. With the picture out of sync, turn the Horiz. Lock adjustment slowly to the left until the picture just falls in sync.
e. Turn the Channel control to an unused channel. If a white vertical line(s) appears near the center of the screen, slowly turn the Horiz. Drive control to the left until the line(s) just disappears.
f. If, in step "e", the
 Horiz. Drive control required readjustment, tune in a station and repeat steps " $c$ " and " $d$ " to be sure of proper Horizontal Oscillator adjustment.
g. Adjustment should now be satisfactory. However, check adjustment by slowly rotating the Horizontal control in either direction while interrupting the television signal by switching the Channel control off channel and then back on. The picture should automatically fall in sync through at least half of the range of the


Picture Out of Horiz. Sync. Horizontal control. If necessary, repeat the above step.
TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (AB, BOTTOM SLUG OF T201)
Proceed as follows:
a. Turn set on and allow about 15 minutes for warm up.
b. Tune set for normal picture and sound.
c. Carefully insert a non-metallic alignment tool through the opening in T201. An alignment tool with a screwdriver blade or hexagonal end is required depending on the transformer used, see * note below. When the alignment tool engages the bottom tuning slug A8, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about $1 / 4$ to $1 / 2$ turn.
d. If necessary, repeat individual channel slug adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will not be necessary to repeat the ratio detector secondary adjustment after once correctly adjusting it.

## ALIGNMENT OF 4.5 MC TRAP A9, USING A TELEVISION SIGNAL

Beat interference ( 4.5 MC ) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting the slug A9 for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as instructed in step 3 under "4.5 MC Sound IF and Trap Alignment" procedure on page 7.

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## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

20A2, 20A2Z and 20D2 IMPORTANT ALIGNMENT HINTS

The following suggestions should be performed if difficulty is experienced during the alignment procedure.

1. IF CIRCUIT INSTABILITY: When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF reoponse curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning A2 (3rd IF transformer T303). To correct either of these conditions, the following alignment hints should be tried:
(a) Check the generator output leads to be certain that the unshielded portion (especially the grounded lead) be as short as practicable.
(b) Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible (see figure 10 ).
(c) Construct a special tube shield as shown in figure 7. This is made from an ordinary tube shield and four $10,000 \mathrm{ohm}$ resistors. Keep the spacing between the two halves of the shield at a minimum ( $1 / 8$ inch).
(d) The use of a non-metallic alignment tool, approximately eight inches long (part number 98A30-12), will permit adjustment without coming too near to the transformers.


Figure 7. Special Tube Shield for IF Alignment and IF Response Curve Check.


A5 23.1 MC MAX. MIXER PLATE
Figure 9. Top View of TV Tuner Showing Adjustment Locations.


Figure 10. Decoupling Filter.


Figure 11. Bottom View of Chassis Showing Test Point Connections and IF Alignment Data.

## IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point " $T$ ", see figure 11, positive to chassis. A $41 / 2$ volt battery is required for all steps below.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel Selector to channel 12 or other unassign-
ed high channel, to prevent interference during alignment.
- Set the Contrast control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

| Step | Signal Gen. Freq. | VTVM and Signal Generator Connections |
| :---: | :---: | :---: |
| 1 | *27.25 MC | VTVM high side to test point "V" through |
| 2 | 25.3 MC | common to chassis. |
| 3 | 23.1 MC | Generator high side to 6J6 (V102) special |
| 4 | *27.25 MC | part of the tube shield, see figure 7. |
| 5 | To insure correct IF alignment, make the "IF Response Curve |  |


| Instructions | Adjust |
| :---: | :---: |
| Connect a $41 / 2$ volt bias battery to test point "T". <br> Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. If unstable, refer to section 1 of the "Alignment Hints" | A1 for minimum. |
|  | A2 and A3 for maximum. |
|  | A4 and A5 for maximum. |
|  | Repeat step 1 above. |
| Check' given below. |  |

* Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.


## MOST-OFTEN-NEEDED 1955 THLEVISION SERVICLIG INFORMATION

IF RESPONSE CURVE CHECK

a measured from highest pear

Figure 12. Ideal IF Response Curve.


Figure 13. IF Response Curves, Incorrect Shope.
If it is necessary to adjust for approximate equal peaks and marker location, carefully adjust alignment slugs as instructed under the above figures. It should not be necessary to turn the slugs more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

### 4.5 MC SOUND IF AND TRAP ALIGNMENT <br> See page $\boldsymbol{S}^{5}$ for touch-up of ratio detector using television signal without test equipment.

a. Connect signal generator high side to pin 2 of V304 (6AL5) through a .01 mfd . capacitor, connect low side to chassis.
b. Allow about 15 minutes for receiver and test equipment to warm up.
c. Set Contrast control fully to the leff (counterclockwise).
d. Use a non-metallic alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adjustment $A 8$ can be made from top of chassis, if you use alignment tool, part number 98A30-12 obtainable from Admiral distributor.

| Step | Signal Gen. Freq. (MC) | VTVM Connections | Instructions | Adjust |
| :---: | :---: | :---: | :---: | :---: |
|  | When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle. <br> IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station and follow steps 1,2 and 3 below. If necessary use a higher scale on the VTVM. |  |  |  |
| 1 | Set to exactly 4.5 MC | High side to test point " Y "; common to chassis. | Use lowest DC scale on VTVM. | A6 and A7 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt). |
| 2 |  | High side to test point " $\mathrm{Z}^{\prime \prime}$; common to chassis. | Use zero center scale on VTVM, if available. | A8 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A6 was far off, repeat step 1. |
| 3 |  | High side to test point "Y"; common to chassis. | Connect a 10 mmfd. capacitor from pin 7 of V305 (12BY7) to pin 7 of V201 (6AU6). <br> Use lowest DC scale on VTVM. | A9 for minimum. |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Admiral Corp. Schematic for 20A2, 20A2Z and 20D2 Chassis.


NOTE: To read schematic for 20A2 and 20A2Z chassis, use sections in heavy solid lines; to read schematic for 20D2 chassis, use sections in heavy dotted lines and connect appropriate points indicated by dots coded


B1 B2
etc.
RADIO-PHONO SECTION

2002 CHASSIS


CIRCUIT BELON
Run numbers are rubber stamped at the rear of the chassis. connections.

## WAVEFORM DATA

## (Weveforms given on schematic)

Waveforms taken with Contrast control set fully to the right, all other controls set for normal picture (in sync). DX Range Finder control set fully to the left (at " 0 " position). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

Waveform at V407 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3 . When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

## TV VOLTAGE DATA

- Contrast control turned fully clockwise. Channel Selector set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at " 0 " position).
- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described ages at or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- Voltages marked with an asterisk (*) will vary widely with control setting. In combination models, $B+$ voltages in TV chassis will be slightly higher when set is switched to radio position. Alternate voltage readings for radio and TV are shown for sound output tube V204 (6Y6G) in 20D2 chassis.


## CAUTION

Pulsed high voltages are present on the cap of V405, pin 3 of V407 and on the filament terminals and cap of the 1B3GT tube. NO and on the SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIP. MENT.
Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only. with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 16.5 KV .


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICLNG INFORMATION



Models T1831, T1832, T1842, T2212B, T2242BZ, C2256, K2256, K2257<br>Since these chassis are very similar to 20 A 2 series chassis and in some respects are like the 19 series chassis (pages 5 to 9 , and 11 to 22 ), the important differences will be explained below. In servicing these chassis refer to the similar material as suggested below.

## CIRCUIT DIFFERENCES

Below is a brief description of circuit differences between the $20 \times 5$ series of chassis, and the previous 20 tube chassis.

TUNER: The VHF tuner used in VHF only models is nearly the same as that used in the equivalent late production 19 series or 20A2 series chassis. However, the plate voltage of the RF amplifier tube V101, 6BZ7, has been reduced to minimize failure of the tube.

IF AMPLIFIER: The IF amplifier is essentially the same as that used in the 19 series chassis, with one important exception. The adjacent channel sound trap, L301, was moved from the plate circuit of the lst video IF amplifier V301, to the grid circuit. This results in a more gradual slope of the IF response curve on the video carrier side, making the alignment of the $20 X 5$ series chassis less critical than that of either the 19 or 20A2 series chassis. Also, the adjustment of the FINE TUNING for the best picture is made easier.

VIDEO AMPLIFIER: The screen voltage of the video amplifier tube, $V 305$, a $6 C B 6$, has been increased, as compared to the 19 series chassis; thus decreasing the possibility of picture instability caused by overload of the receiver on very strong signals. The ability to operate on very strong signals is becoming increasingly important as stations continue to increase their power.

PRINTED CIRCUIT: The $20 \times 5$ series chassis utilizes a printed circuit assembly that includes the video detector and AGC tube, V304; video amplifier, V305; sound IF amplifier, V201; ratio detector, V202; sound amplifier, V203 and sound output, V204. The circuit and component values are the same whether the printed circuit or conventional wiring is used. Printed circuits offer the advantages of neatness and uniform quality. The possibility of incorrect wiring or poorly soldered connections is eliminated. The circuits are photo-etched on sensitized copper plates bonded to an insulating base. After all components, such as resistors, transformers and condensers, are assembled to the plate the latter is dipped briefly in a molten solder pot. The solder adheres to the etched circuit.

AGC: Extensive field tests have proven that incorrect adjustment of the DX RANGE FINDER control used on previous models of ten caused picture instability. To prevent this, the AGC circuit of the $20 X 5$ series chassis has been designed to provide the optimum AGC characteristic for this type of chassis; thus, making an external control unnecessary.

HORIZONTAL SYNC: The sync separator, sync inverter, horizontal sync discriminator, and horizontal oscillator circuitry is practically identical to that used in the 2OA2 chassis.

HORIZONTAL DRIVE CONTROL: The HORIZONTAL DRIVE control is a compression type trimmer capacitor used as a variable reactance in series with the horizontal output tube grid circuit. With maximum capacity, which is obtained with full clockwise rotation of the control, the horizontal drive will be maximum. In the 19 and 2OA2 series chassis, the HORIZONTAL DRIVE control was a trimmer capacitor in shunt with the grid of the horizontal output tube. Therefore, the action of the HORIZONTAL DRIVE control in the $20 X 5$ series chassis is opposite to that of the 19 and 20A2 series chassis.

HORIZONTAL OUTPUT: The use of a new horizontal output transformer and the horizontal deflection circuit deslgn, makes the use of HORIZONTAL WIDTH and LINEARITY controls unnecessary. The newly designed transformer provides adequate width, even at low line voltage; with very good linearity. Under abnormally low line voltage conditions, below 105 volts $A C$, the width can be increased by reducing the value of the horizontal output tube screen grid decoupling resistor R 439 , to a minimum of 12,000 ohms.

FOCUS: All $20 \times 5$ series chassis, use electrostatically focused picture tubes and do not require external focus assembly or control. However, the focus of the picture tube is affected by the position of the ion trap.

PICTURE TUBES: Since the picture tubes are electrostatically focused and require no external focus assembly or control, a simpler picture tube mounting assembly is used. The inherent focus of these tubes is uniform over the entire viewing area.

## ALIGNMENT PROCEDURE

In general, the alignment procedure is the same as that for the 2OA2 series chassis.

With the exception of the location of the adjacent channel trap L301, the chassis layout is almost identical to that of the 20A2 Chassis.

# 19L2, 19L2L, 19M2, 19N2L, 19R2, 19S2, 19T1, 19TIC, 19WI, 19WIA, 19WIB, 19WIC, 19YIA, and 2012 CHASSIS 

Models using the above listed chassis are: TA1811, TA1812, TA1822, TA2211, TA2212, CA2215Z, LA2215Z, TA2215, CA2216Z, HA2216Z, KA2216, LA2216Z, TA2216, - A, CA2217Z, HA2217Z, KA2217, LA2217Z, TA2217, TA2222, FA2226, KA2226, TA2226, KA2227, CA2236, -A, CA2237, TA2242, CA2246, and CA2526.

The service material below and continued through page 22 , with a few exceptions is applicable to all chassis listed above. The circuit diagram of the 19T1C chassis (with $17^{\prime \prime}$ picture tube), 19 W 1 B and 19 W 1 C chassis (with $21^{\prime \prime}$ picture tubes) is published on pages 16-17. These are all-channel receivers. Chassis 19T1, 19W1, and 19 W 1 A , also employ the same basic circuitry as do these other sets. The principal electrical difference is the inclusion of the DX Range Finder control in these additional sets. The partial circuit of 20L2 chassis printed on the next page, over, shows the wiring of DX Range Finder circuit. These various chassis use one-piece narrow chassis pan as do some of the later production 19 W 1 sets and others so described.

Chassis 19L2 and 19L2Z ( $Z$ means aluminized picture tube) differ in minor respects from the other sets and do have DX Range Finder control. These sets as well as many of the others have tone controls. Chassis $19 R 2$ uses a $24^{\prime \prime}$ picture tube and differs in a small way from the other sets. For example, 19R2 uses 12BY7 video amplifier, 6AV5 vertical output, 6CD6G horiz. output, and 6AU4GT damper tube.

Chassis 19 M 2 is a combination receiver of the same series and has a built-in 2 -tube AM radio tuner. The 19 N 2 Z chassis is a combination set having a separate 3 -tube AM radio (Model 3D1) with automatic recod changer RC600 combined in one assembly. These sets, of course, incorporate needed switching arrangement.

The 19Y1A and 19S2 chassis (both using $21^{\prime \prime}$ picture tubes) also use the same basic circuitry corresponding in the main to 19M2 and 19L2. However these newer sets omit DX Range Finder and employ one-piece narrow chassis pan. The circuit of 19 W 1 B chassis printed on pages 16-17 may be used for trouble-shooting these additional sets. Some minor part values may differ and there is a slight difference in tube location.

Chassis 20L2 uses type 21ZP4A picture tube and type 12BY video amplifier. Some of the voltage values differ from values shown in the circuit on pages 16-17. The sync circuits differ considerably and this portion of the circuit applicable to chassis 20L2 is printed on the next page, over.

In general, alignment information and other service data is applicable to all chassis types described on the pages that follow.

[^1]


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

19T1, 19W1, 19W1A, 19L2, 19L2Z, 19M2, 19N2Z and $19 R 2$

## SIMPLIFIED ALIGNMENT

After becoming familiar with alignment procedure, some servicemen simplify subsequent álignment of sets by merely using the essential alignment data given in figures below.

## ALIGNMENT TOOLS

The following alignment tools are required. They can be obtained from the Admiral distributor under the part numbers listed below:

Metal alignment screwdriver part number 98A30-9. Non-metallic (fiber) alignment screwdriver ( $111 / 2^{\prime \prime}$ long, $1 / 8^{\prime \prime}$ diameter) part number 98A30-10.

Non-metallic alignment wrench ( $9^{\prime \prime}$ long, for large hexagon core IF slugs) part number 98A30-12.

Non-metallic alignment wrench ( $9^{\prime \prime}$ long, for small hexagon core IF slugs) part number 98A30-14.

insulate
BOTTOM WITH
MASKING TAPE

Figure 29. Tube Shield for IF Alignment and IF Response Curve Check.


Figure 30. Illustration of 12 db Attenuation Pad for Viewing Over-all RF-IF Response Curve.


Figure 31. Top View of TV Tuner Showing Adjustment Locations.


Figure 32. Bottom View of 19T1, 19W1, and 19W1A Chassis Showing Test Point Connections and IF Alignment Data.


Figure 33. Decoupling Filter.


Figure 34. Bottom View of 19L2, 19L2Z, 19M2, 19 N 2 Z and 19R2 Chrsisis Showing Test Point Connections and IF Alignment Data.

## IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point " $T$ ", see figure 32 or 34 , positive to chassis. A $41 / 2$ volt battery is required for all steps below.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel Selector to channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Contrast control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Note: Since A2 and A3 are adjustments of an overcoupled double tuned circuit, adjustment of A3 is first made at 43.3 MC (step 3) and then at 45.3 MC (step 5), to obtain proper peak.

| Step | Signal Gen. Freq. | VTVM and Signal Generator Connections | Instructions | Adjust |
| :---: | :---: | :---: | :---: | :---: |
| * 1 | *47.25 MC | VTVM high side to test point " $V$ " through a decoupling filter; see figs. 32, 33 and 34 , common to chassis. <br> Generator high side to 6 U (V102) special tube shield. Connect low side to chassis near the tube shield, see figure 29. | Connect a $41 / 2$ volt bias battery to test point "T". <br> Use lowest DC scale on VTVM. <br> When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. If unstable, refer to section 1 of the "Alignment Hints" on page $\mathbf{I} \mathrm{S}$. | Al for minimum. |
| 2 | 45.3 MC |  |  | A2 for maximum. |
| 3 | 43.3 MC |  |  | A3 for maximum. |
| 4 | 45.3 MC |  |  | Repeat step 2. |
| 5 | 45.3 MC |  |  | Readjust <br> A3 for maximum. |
| 6 | 45.3 MC |  |  | A4 for maximum. |
| 7 | 43.3 MC |  |  | A5 for maximum. |
| 8 | 43.95 MC |  |  | A6 for maximum. |
| 9 | 43.95 MC | Connect VTVM as above. Generator high side to antenna terminals; full output may be required. | Follow above instructions. Set Channel selector to 2 or other low channel. | A7 for minimum. |
| 10 | To insure correct alignment, repeat step 1 and 6, then make the "IF Response Curve Check" given below. |  |  |  |

* Before proceeding with alignment, turn slugs A2 and A3 out fully (counterclockwise). Check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

| IF RESPONSE CURVE CHECK <br> (Using sweep generator and oscilloscope) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Receiver Controls and Bias Battery |  |  | Os | Instruc |
| Set Channel Selector on channel 12 or an unassigned high channel. Contrast control fully to the left. Connect negative of $4 \frac{1}{2}$ volt bias battery to test point " $T$ "; positive to chassis. | Connect high side to 6 U 8 mixer-osc. insu- lated tube shield, see fig. 29. Connect low side to chassis near tube shield. Set sweep frequency to 44.5 MC, and sweep width ap- proximately 7 MC . | If an external marker generator is used, loosely couple high side to sweep gener- ator lead on tube shield, low side to chassis. Marker fre- quencies indicated on IF Response Curve. | Connect to test point "V" through a de- coupling filter, see figs. 32,33 and 34. Marker pips on scope will be more distinct if a capacitor from 100 mmfd. to 1000 mmfd. is connected across the oscilloscope input. | Check curve obtained against ideal response curve in fig. 36. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touchup with IF slugs as |
| Figure 35. IF Response Curves, Incorrect Shape. <br> If it is necessary to adjust for approximate equal peaks and correct marker location, carefully adjust slug A2 and if necessary, adjust slug A3. It should not be necessary to turn the slugs more than one turn in either direction. <br> If the curve cannot be made to resemble the response curve shown at right, repeat all steps under "IF Anmplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carcfully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier wibes or cherk for a defective circuit component to be sure that each stage is operating properly. <br> Figure 36. Ideal IF Response Curve. |  |  |  |  |

# 4.5 MC SOUND IF AND TRAP ALIGNMENT <br> See below for touch-up of ratio detector using television signal without test equipment. 

- Connect signal generator high side to pin 2 of V304 (6AL5) through a .01 mfd . capacitor, connect low side to chassis.
- Allow about 15 minutes for receiver and test equipment to warm up.
- Set Contrast control fully to the left (counterclockwise).
- Use a non-metallic alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adiustment A8 can be made from top of chassis, if you use alignment tool, part number 98A30-12 obtainable from Admiral distributor.

| Step | Signal Gen. Freq. (MC) | VTVM Connections | Instructions | Adjust |
| :---: | :---: | :---: | :---: | :---: |
|  | When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC . Accuracy required is within one kilocycle. <br> IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station ond follow steps 1, 2 and 3 below. If necessary use a higher scale on the VTVM. |  |  |  |
| 1 | Set to exactly 4.5 MC | High side to test point " Y " common to chassis. | Use lowest DC scale on VTVM. | A8 and A9 for maximum (keep reducing generator output to keep VTVM at approx. 1 valt). |
| 2 |  | High side to test point "Z" common to chassis. | Use zero center scale on VTVM, if available. | Al0 for zero on VIVM (the correct zero point is located between a positive and a negative maximum). If A8 was far off, repeot step 1. |
| 3 |  | High side to test point "Y": common to chassis. | *Connect a 10 mmfd . capacitor from pin 5 of V305 (6CB6) to pin 7 of V201 (6AU6). Use lowest DC scale on VIVM. | All for minimum. |

* In 19R2 chassis, connect 10 mmfd. capacitor from pin 7 of V305 (12 BY7) to pin 7 of V201 (6AU6).


## TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (A10, BOTTOM SLUG OF T201)

"Adjustment Al0 is accessible through the $1 / 4$ " hole (just below T201) in bottom of the cabinet or the chassis mounting shelf, located toward the left side facing the rear of the set. See figures 32 and 34. Removal of the chassis is therefore not required. Adjustment need be made on one channel only. Proceed as follows:
a. Turn set on and allow about 15 minutes for warm up.
b. Tune set for normal picture and sound.
c. Carefully insert a non-metallic alignment tool through the opening in cabinet bottom below T201. An alignment tool with a screwdriver blade or hexagonal end is required depending on the transformer used, see * note below. When the alignment tool engages the bottom tuning slug Al0, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about $1 / 4$ to $1 / 2$ turn.

## ALIGNMENT OF 4.5 MC TRAP A11, USING A TELEVISION SIGNAL

Beat interference ( 4.5 MC ) appears in picture as very fine vertical or diagonal lines, very close together having
a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting slug All for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as instructed in step 3 of the " 4.5 MC Sound IF and Trap Alignment".

## IMPORTANT ALIGNMENT HINTS

The following suggestions should be followed if difficulty is experienced during the alignment procedure.

1. IF CIRCUIT INSTABILITY: When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF response curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning A6 (3rd JF transformer T303). To correct either of these conditions, the following alignment hints should be tried:
(a) Check the generator output leads to be certain that the unshielded portion (especially the grounded lead) be as short as practicable.
(b) Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible (See figure 33).
(c) For injecting IF signal use an insulated tube shield over V102 (6U8) Oscillator-Mixer tube. Insulate bottom inside of tube shield with masking tape; see figure 29.
(d) The use of a non-metallic alignment tool, approximately eight inches long (part number 98A30-12), will permit adjustment without coming too near to the transformers.
[^2]
## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## Admiral Corp. Schematic for 19T1C, 19W1B and 19WIC VHF-UHF Television Chassis.



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## Admiral 19T1, 197IC, 19WI, 19WIA, 19WIB, 19WIC, 19YIA, 19L2, 1922L, 19M2, 19N2L, 19R2, and 19S2 CHASSIS



## VHF TUNER RF AND MIXER ALIGNMENT

- Connect negative of $41 / 2$ volt bias battery to AGC buss (test point " $T$ '), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point " T " to chassis.
- Connect sweep generator (with 300 ohm output) to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker
generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
- Connect oscilloscope to test point "W" on tuner (figure 38). Keep scope leads away from chassis.
- Allow about 15 minutes for receiver and test equipment to warm up.

| Step | Marker Gen. <br> Freq. (MC) Sweep Gen. <br> Frequency | Instructions |
| :---: | :---: | :---: |
| 1 | 193.25 MC Sweeping <br> (Video Carrier) Channel 10. <br> 197.75 MC See frequency <br> (Sound Carrier) table below. | Alternately adjust A12 and A13 (figure 38) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location; see figure 37. |
| 2 | 83.25 MC Sweeping <br> (Video Carrier) Channel 6. <br> 87.75 MC See frequency <br> (Sound Carrier) table below. | Adjust A14 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper band width and correct marker location; see figure 37. After completing adjustment, recheck adjustment of step 1 . |
| 3 | Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency. | Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular low channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected. |



Full skirt of curve will not be visible unless generator sweep width extends beyond 12 MC .
Figure 37. RF Response Curve.


Figure 38. Top of Tuners, Showing VHF Adjustment Locotions.

VHF FREQUENCY TABLE

|  | Channel <br> Freq., | Video <br> Carrier, | Sound <br> Carrier, | HF Osc., |
| :---: | :---: | :---: | :---: | :---: |
| Channel | MC | MC | MC |  |
| Number | MC | 55.25 | 59.75 | 101 |
| 2 | 54.60 | 61.25 | 65.75 | 107 |
| 3 | $60-66$ | 67.25 | 71.75 | 113 |
| 4 | 66.72 | 77.25 | 81.75 | 123 |
| 5 | 76.82 | 83.25 | 87.75 | 129 |
| 6 | 82.88 | 175.25 | 179.75 | 221 |
| 7 | 174.180 | 185.75 | 227 |  |
| 8 | 180.186 | 181.25 | 185.75 |  |
| 9 | 186.192 | 187.25 | 191.75 | 233 |
| 10 | 192.198 | 193.25 | 197.75 | 239 |
| 11 | $198-204$ | 199.25 | 203.75 | 245 |
| 12 | 204.210 | 205.25 | 209.75 | 251 |
| 13 | 210.216 | 211.25 | 215.75 | 257 |



Figure 39. Front View of Tuner.


Curves must have approximate equal peaks and correct marker location. If it is necessary to adjust for approximate equal peaks and marker location, carefully adjust slug A2 and if necessary adjust slug A3. It should not be necessary to turn the slugs more than one turn in either direction.

Figure 41. Over-all RF and IF Response Curves, Incorrect Shape.

## HORIZONTAL SYNC ADJUSTMENT

A receiver which requires horizontal sync adjustment can be corrected only by following in exact detail the step-by-step procedure given here.

Check whether adjustment is necessary by rotating the Horizontal control (A) on the front panel from one end to the other; the picture should hold as follows:
a. For strong or medium signals, the picture should remain in sync over the entire rotation of the Horizontal control. Horizontal sync adjustment is required if the pic. ture falls out of sync, bends at the top (jitters), or doubles up on the side. See illustrations at upper right.
b. For weak or fringe area signals, the picture should remain in sync over $1 / 2$ to $3 / 4$ of the rotation of the Horizontal control. Horizontal sync adjustment is required if the picture falls out of sync, bends at the top (jitters), or doubles up on the side. See illustrations below.


Picture Out of Horiz. Sync.


Bending or Jitter at Top.

Make Horizontal Sync Adjustment as follows:

1. Set the DX Range Finder at " 0 " position (see chassis illustrations) and set the Contrast control (on front panel) for normal picture.
2. Important: Before making these adjustments, be sure that the picture can be made to sync vertically (remain stationary up and down) as lack of both vertical and horizontal sync is an indication of trouble in the sync circuits. If replacement of tubes V303, V401, V403 does not eliminate sync trouble, check for other trouble in the sync circuits.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

19T1, 19W1, 19W1A, 19L2, 19L2Z, 19M2, 19 N 22 and $19 R 2$
HORIZONTAL COWTROL (A
(ON FRONT PANEL)


Figure 10. Rear View of Chassis Showing Horizontal Sync Adjustments.
3. With the picture in sync, rotate Horizontal control (A) on front panel from one end to the other. If picture does not hold sync as described in paragraphs "a" or "b" at left, set the Horizontal control (A) at the point where the picture just loses sync or becomes unstable, and slowly adjust the Horizontal Frequency (B) until the picture just falls back into sync. It may require several turns of adjustment (B). Repeat this procedure until the picture holds as described in paragraphs " $a$ " or " $b$ " at left. If the picture can be made to hold sync with adjustment of $(B)$, adjustment is complete.
4. If horizontal sync is still unsatisfactory, carefully repeat entire procedure. Try replacing tube V403. It may be necessary to make Complete Horizontal Oscillator Alignment (using an oscilloscope).

## COMPLETE HORIZONTAL OSCILLATOR ALIGNMENT <br> (Requires Oscilloscope)

1. IMPORTANT: Set the DX Range Finder at " 0 " position and set the Contrast control (on front panel) for normal picture.
2. Connect oscilloscope high side through a $\mathbf{1 0} \mathbf{~ m m f d}$. capacitor to terminal marked "C" or " 2 " on the horizontal oscillator transformer T404 (see figure 11). It is important to use short leads and a very low capacity capacitor (at least 10 mmfd .) to avoid loading the circuit and thus distorting the waveform.


Figure 11. Bottom View of Chassis Showing Morizontal Sync Adjustments.
3. Set the oscilloscope sweep to 15.75 KC or a sub-multiple of it.


Figure 12. Horizontal Oscillator Waveform.
4. Adjust the Horizontal Lock slug (D) (see figure 11) until the oscilloscope waveform pattern appears as in figure 12. The rounded and pointed peaks of the waveform must have equal height. The picture must be kept in sync to obtain the proper oscilloscope waveform pattern. Keep the picture in sync by adjusting the Horizontal Frequency adjustment (B). If the picture still will not sync, check for a defective tube, components, or wiring, before continuing further.
5. Disconnect the oscilloscope leads.
6. Set the Horizontal control (A) fully counterclockwise to break sync. If the picture does not go out of sync, momentarily interrupt the channel selector, or adjust the Horizontal Frequency (B) until several bars appear sloping downward to the left (see figure 13), then adjust the Horizontal Frequency (B) until the picture falls back into sync.


Figure 13. Picture Out of Horizontal Sync.
7. Rotate Horizontal control (A) on the front panel from one end to the other. The picture should hold sync as follows:
a. For strong or medium signals, the picture should remain in sync over the entire rotation of the Horizontal control. If it falls out of sync, bends at the top (jitters), or doubles up on the side; sync adjustment is required; see step 8 below.
b. For weak or fringe area signals, the picture should remain in sync over $1 / 2$ to $3 / 4$ of the rotation of the Horizontal control. If it falls out of sync, bends at the top (jitters), or doubles up on the side; sync adjustment is required; see step 8 below.
8. If picture does not hold sync as described in paragraphs " $a$ " or " $b$ " above, set the Horizontal control (A) at the point where the picture just loses sync or becomes unstable and adjust the Horizontal Frequency (B) until the picture just falls back into sync. It may require several turns of adjustment (B). Repeat this procedure until the picture holds as described in paragraphs "a" or "b" of step 7 .

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## TUNING CONTROL

Components on the underside of the tuner are easily accessible for replacement after removing three or four sets of channel coils. However, resistors R110 ( 15,000 ohms) and R116 ( 10,000 ohms) may be difficuit to replace, since they are located under the stationary contact strip. If resistors Rll0 or Rll6 require replacement, it is suggested that the entire tuner be returned to the Admiral distributor for replacement.

## RESISTOR CHANGED TO INCREASE HORIZONTAL SYNC

## Run 6 in Television Only Receivers

Resistor R406 was changed from 18,000 ohms, $1 / 2$ watt to $22,000 \mathrm{ohms}, 1 / 2$ watt in all television only receivers stamped Run 6 and higher.
This change was made to increase the amount of horizontal sync available at pin 1 of the sync clipper tube (V303B).

## SERVICE HINTS

## TROUBLE SHOOTING

The sound output tube V204 (6Y6G or 6AS5) functions as a voltage dropping tube in addition to being a sound output tube. The cathode of the sound output tube operates at approximately 140 volts above chassis ground for TV operation. If the sound output stage becomes defective, B + voltage to the TV tuner, sync separator and clipper, video amplifier and AGC delay circuit will be affected.

It is important to note that the plate and screen voltages at the first and second IF amplifier stages V301 and V302, may vary over a wide range, depending on the strength of the TV signal. The voltages shown on the schematics are taken with the antenna disconnected and antenna terminals shorted; see Voltage Data on schematic pages.


Figure 14. Basic B+ Distribution.

19T1, 19W1, 19W1A, 19L2, 192Z, 19M2, 19 N 2 Z and $19 R 2$
In the cascode VHF tuner, the triode sections of the RF amplifier (V101) are in series. The cathode of the second triode section is operated at approximately 120 volts above chassis ground. If the tube should become defective or be removed from the socket, there will be no $B+$ voltage on the plate of the first triode section.

## B + DISTRIBUTION IN TELEVISION CHASSIS

Figure 14 illustrates the basic $B+$ distribution used in these chassis. Note: There are variations in the $\mathrm{B}+$ circuits of TV and combination models.

## SERVICE HINTS FOR HORIZONTAL SYNC

The horizontal oscillator control circuit controls the horizontal oscillator by a method called "Pulse Width Modulation". This method is so called, because the width of the pulse applied to the grid of the horizontal oscillator control section determines the length of time that current flows through this section. The duration of current flow through the control section determines the DC control voltage applied to the grid of the horizontal oscillator, thereby controlling the frequency.
The waveshape applied to the grid of the horizontal oscillator control section is formed by combining a partially integrated pulse from the horizontal oscillator output and the horizontal sync pulse. If these two pulses combine properly, the waveshape shown in figure 15 will be developed and the horizontal oscillator will be in sync.

With no sync input, the waveform at the horizontal oscil-


Figure 15. Waveform on Grid Pin 1 of V403 With Sync Pulse.


Figure 16. Waveform on Grid Pin 1 of V403 Without Sync Pulse.
lator control grid should appear as shown in figure 16. Since the horizontal oscillator control voltage is dependent upon a waveshape formed at the horizontal output stages (V404, V405 and V406), a defective component in one of these stages may cause sync trouble. If the waveform shown in figure 16 can be obtained, this will indicate proper operation of the horizontal sweep circuit.

When the horizontal oscillator is out of sync, it may be difficult to observe this waveform (figure 16) on an oscilloscope due to the presence of out-of-phase sync pulses. In this case, remove the sync separator and sync clipper tube V401. If the waveshape shown in figure 16 is obtained,

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## 19T1, 19W1, 19W1A, 1912, 19L2Z, 19M2, 19 N 22 and $19 R 2$

place the sync and separator tube back into its socket. Then, remove the horizontal oscillator and control tube V403 ( 6 SN 7 GT ). Conventional, well-shaped sync pulses should appear at control grid (pin 1) of V403.

If there are no sync pulses, or the pulses are of low or varying amplitude, accompanied with noise, the sync circuits should be checked. However, if the sync pulses are well-shaped and of constant amplitude, the horizontal oscillator may be misaligned. Place V403 back into its socket and make "Complete Horizontal Oscillator Alignment" given on page 20.

If it is impossible to sync the picture, or obtain the correct waveform at terminal "C", check for a defective component.

## HORIZONTAL SYNC INSTABILITY

Horizontal sync instability occurring after the receiver has been operated for a short period of time, may be due to change in capacitor C418 $(.01 \mathrm{mfd}, 400$ volts, paper, $10 \%$ ). The slight change in capacity that occurs with temperature rise, may be enough to cause the circuit to become unstable. To minimize this possible trouble, a capacitor (with negative temperature coefficient) is used for capacitor C418, part number 64A2-16.
If capacitor C418 is suspected as being the cause of horizontal sync instability, it should be replaced only with a $.01 \mathrm{mfd}, 10 \%$, paper capacitor, Admiral part number 64A2-16 or Sprague part number 68P8. Important: After replacing capacitor C 418 , it may be necessary to make "Complete Horizontal Oscillator Alignment" (using an oscilloscope) as instructed on page 20.

## miscellaneous trouble due to FAULTY TUBES

Faulty tubes cause the majority of receiver troubles. The list below contains most common troubles which are generally due to faulty tubes.
a. Poor fringe area reception due to low B plus voltage. Check the 5 U 4 G tube.
b. Poor fringe area reception due to low sensitivity. Check the 6 BQ 7 A or $6 \mathrm{BZ7}$ tube in VHF tuner.
c. Picture and sound separated due to IF oscillation. Check the 6CB6 and 6U8 tubes in IF amplifier.
d. Picture bending caused by leakage between tube elements. Check 6CB6 tube in IF amplifier.
e. Poor sync stability, usually more noticeable in vertical circuit. Check 6U8 and 12AU7 tubes (V303 and V401).
f. Washed out picture due to negative grid current. Check 6CB6 or 12BY7 tube (V305).

## EXCESSIVE SNOW IN PICTURE DUE TO FAULTY TUBES

Excessive snow in the picture can be caused by faulty tubes in the receiver. Check receiver as follows:

Short circuit the antenna terminals and turn the Contrast control fully clockwise.

Connect a vacuum tube voltmeter from test point " $V$ " to chassis. Set the channel selector on an unassigned channel. If the voltmeter reading exceeds .6 volt negative, excessive receiver (tube) noise is indicated. This condition can usually be corrected by tube substitution. Substitute tubes in the following order: Video detector tube V304, RF oscillator tube V102, RF amplifier tube V101 and IF amplifier tubes V301, V302 and V303.

Corona or arcing in the second anode supply can also cause a high noise reading at the video detector resulting in excessive snow in weak signal areas.

## ELIMINATING RF INTERFERENCE BY ALIGNMENT OF 43.95 MC TRAP A7

Antenna trap L103 (adjustment A7, figures 32 and 34) is aligned for minimum response at 43.95 MC , see IF Amplifier and Trap Alignment on page 24. Trap L103 attenuates interfering signals in the 41 MC IF frequency range. The antenna trap should generally never require realignment in the field. However, if RF interference is experienced from radio transmitters or other sources at frequencies (harmonics or fundamentals) in the 41 MC range, the trap may be realigned to minimize the interference. The trap must be tuned when the interference appears. If the interference is intermittent, tuning the trap may be difficult.

To tune trap, use a non-metallic alignment wrench with a $5 / 16^{\prime \prime}$ hexagonal shank, part number 98A30-12. In some tuners a non-metallic alignment screwdriver with a $1 / 8^{\prime \prime}$ wide blade is required. Tune trap by observing the picture and adjusting slug A7 for minimum of interference. It should not be necessary to turn the slug A7 more than a few turns in either direction. IMPORTANT: Do not turn the slug completely counterclockwise as channel 2 interference may result.

## IMPROVING UHF RECEPTION WHEN ONLY ONE OR TWO CHANNELS ARE RECEIVED

If only one or two UHF channels are being received, reception can often be improved by adjusting the oscillator trimmer which is located at the rear of the tuner; trimmer at lower right hand side. This is especially true if the UHF oscillator tube Vl (6AF4) has been changed and the channels are below 55.

Adjust trimmer while observing picture, tune trımmer for best picture with minimum of snow. Retune receiver and repeat adjustment.

## REPAIRING KNOBS WITH METAL RIM

The metal rim of some television or radio tuning knobs may become loose and slip as the knob is rotated. To repair such knobs, merely punch an indentation in the rim of the knob using a center-punch (preferably automatic). As an alternative, a soldering iron can be used by applying the tip to the rear edge of the knob in order to flow the plastic into full contact with the metal rim.

It is recommended that the knobs be repaired rather than replaced, since there may be dimensional differences in some replacement knobs. Changes have been made to knobs of later production receivers to prevent slipping of the metal rim.

## MOST-OFTEN-NEEDED 1955 TRLEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## ARVIN TELEVISION M O D E L S 21-550, 551, 552, 553

## C H A S S I S "D" 379-UHF, "D" 382-VHF

## StagGer-tuned 1.f. Alignment procedure

1. Set tuner to channel 9-10 or 11 .
2. Pull AGC tube V10 out

Connect variable bias supply to junction R 304 k R306. Adjuat bian for -2 volts junction R202 \& R 205
Connect VTVM acrose R212. Isolate VTVM with 18 K reision. Use -5 V scale.
Connect RF ignal generator to mixer tube ohield (V20 6X8). Lift mixer tube shield until it is just ungrounded.
6. Good R.F. grounding between TV receiver on test and test equpment in necessary. A metal suriace bench top. -hould be ueed to insure proper RF grounding.

| STEP | FREQUENCY | ADJUSTMENT | INSTRUCTIONS |
| :---: | :---: | :---: | :---: |
| 1. | 39.75 mc | Top 2202 tor min. |  |
| 2 | 47.25 mc , | Top L201 for min. | Outer peak |
| 3. | 41.25 mc . | Top T201 for mip. | Outer peak |
| 4. | 42.9 mc . | Tuner coil for max. |  |
| 5. | 45.2 mc . | Bottom T201 for max. | Outer peak--recheck ateps 4 and 5. |
| 6. | 42.1 mc . | Top 1202 for max. | Outer peak |
| 7. | 45.7 mc . | Top T 203 for max. | Outer peak |
| 8. | 44.1 mc . | Bottom T204 for max. | Recheck steps 6, 7 and 8 |

OVERALL SWEEP CHECK

1. Connect RF signal generator to chassie near $V 4$ for marker generator. Push shield down on mixer cube.
2. Connect oscilloacope acrosi R2l2. Isolate oucilloscope lead with $300 \mu \mu \mathrm{f}$ to ground and 18 K
resistor in series. 5 volts at junction R202\& R205 Tochassis_ Toscope
3. Increase bias to $\mathbf{- 3 . 5}$ volts at junction R202 \& R205
or tuner to channel $10 . \frac{1}{I}$
CURVE

| ADJUSTMENT | INSTRUCTIONS |
| :--- | :--- |
| T203 | T203 positions 45.75 marker |
| T202 | T202 positions 42.25 |
| T204 | T204adjuats till of curve |
| Note: If desired curve cannot be obtained. slight adjustment of tuner |  |
| coil and bottom T201 may be neceasary. |  |

SOUND AND 4.5 MC TRAP ALIGNMENT

1. Tune in available TV station and reduce aigral into set until hiss is heard with aound. This can be done by inacring an attenutor in the antenna lead-in or by removng antenna lead-in from the aet and stray feeding in signal by placing lead-in in close proximity of the set,
2. Set buxz control in the maddle of ite range. Adjuat take off coil (top T205), top and bottom T101, Quadrature coil (L102) and buxi control for cleanest sound and mimmum buax, If any adjustment caute hifa to disappear reduce signal anto set until hisa reappeara and continue with adjustmenti.

Note: If difficulty in encountered either in reducing sagnal sufficiently or adjutmente being very broad. The following proceedurs may be used.

| STEP | EQUIPMENT | CONNECTION | FREQUENCY | ALJUSTMENT | INSTRUCTIONS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1. | Det. jig * | Input of jig to pin 2 of $\mathbf{V} 2$ |  |  | Keeplead between 15 K ressator and pin 2 as ahort a : possible |
| 2. | VTVM | Output of jig | Tune in available channel | T205 Top (anly), T101 (top and bottom) for max. |  |
| 3. |  | Remove jit | Same | Onadrature coil (Lied) for max. sound | Set buss control in middle of its range before adjusting 1.102 |
| 4. |  |  | Sme | Bana centrol for mindimen busy | Correct adjustment of buxz control is approx, middle of its range |
| 5. | Det. jig * | Junction C321 and R333 |  |  | Connect VTVM to output of jig |
| 6. | RF aignal generator | Pin 1 (V7) | 4.5 mc | Tupe 4. 5 mc trap Detern T2es for min. |  |

- Detector Jig


(Circuit diagram is printed on page 30. )

Arvin industries, inc.



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## CAPEHART-FARNSWORTH COMPANY

a division of international telephone a telegraph corporation


CHASSIS IDENTIFICATION
CX-37 Series-(Early Version)

| Chassis Number CT75 CT77 <br> CT81 | CRT Size  <br> 17"' Rect. Described <br> 21" Rect. Servicing | Remarks d on page 33, in 1953 Television Manual (Supreme Publications). |
| :---: | :---: | :---: |
| CX-37 | Series-(With Hinged | Secondary Control Cover) |
| CT89 | 17"' Rect. |  |
| CT90 |  |  |
| CT115 | $21^{\prime \prime}$ ", Rect.-Aluminized |  |
| CT133 | $21^{\prime \prime} \text { Rect.-Aluminized }$ $24^{\prime \prime} \text { or } 27^{\prime \prime} \text { Rect. }$ | Less Audio, used with separate radio chassis $90^{\circ}$ Deflection-6AV6 and 6AQ5 Audio Circuit |
| ${ }_{\text {CT130 }}$ |  | $90^{\circ}$ Deflection-6BK5 Audio Circuit |

## CX-37-1 Series-(With 82 Channel UHF/VHF Tuner and Hinged Secondary Control Cover)

| CT110 | $17^{\prime \prime}$ Rect. |
| :--- | :--- |
| CT108 | 21" Rect. |
| CT16 | $21^{\prime \prime}$ Rect.-Aluminized |
| CT134 | $2^{21^{\prime \prime}}$ Rect."Aluminized |
| CT12 | $24^{\prime \prime}$ or 27" Rect. |
| CT131 | $24^{\prime \prime}$ Rect. |

Less Audio, used with separate radio chassis $90^{\circ}$ Deflection-6AV6 and 6AQ5 Audio Circuit $90^{\circ}$ Deflection-6BK5 Audio Circuit

For alignment information please see pages 33 and 36 , in the 1953 Television Manual.

## General Description

The Capehart CX-37 Series TV chassis are all basically the same. These chassis are composed of two sections; the front section referred to as the RF-IF Chassis and the rear section, the Deflection Chassis. The RF-IF chassis bolts to the Deflection chassis providing a basic 21 tube chassis including the picture tube and two rectifiers. The chassis features a tilted IF strip for ease in adjustment and replacing of tubes. Complete isolation is obtained between these sections with all connections being made by a male plug inserted into the receptacle provided on the deflection chassis.
The front portion of the RF-IF Unit forms a solid mount for the picture tube while the H.V. Section serves as a rear mount for the CRT and Deflection Yoke. The H.V. Section is a separate unit which is easily removable from the chassis for servicing. There are three basic versions of each the CX-37, CX-37R and CX-37-1 TV series chassis. A chart has been provided which lists the various versions as well as the information necessary to determine the correct chassis. The chassis can be identified by stamping on the chassis rear apron which can be either "CX-37", "CX-37R" or "CX-37-1".
The latest additions to the Capehart $\dot{C} X-37$ and CX-37-1 Series Instruments are those employing the " $90^{\circ}$ Deflection" $24^{\prime \prime}$ and $27^{\prime \prime}$ Rectangular Picture Tubes. The chassis employed in these models is similar to the basic chassis with exception of the deflection circuits which have been modified for the $90^{\circ}$ deflection angle tubes. The basic changes in the chassis itself are:
(1) The addition of a second 5U4G Rectifier.
(2) Revision of the Horizontal Output and H.V. Rectifier circuit by use of a 6CD6G tube as Horizontal Output, an improved Horizontal Flyback Trans. and two $6 \mathrm{~A} \times 4 \mathrm{GT}$ tubes as Dampers. These changes provide the additional scan necessary and 20 KV of Second Anode Voltage.
(3) The use of a 6AV5GT tube as Vertical Output.
(4) The addition of an external magnetic (PM) focuser for use with magnetically focused 24 CP 4 and 27 GP 4 Picture Tubes.
In addition to these changes the chassis used in higher priced $24^{\prime \prime}$ and $27^{\prime \prime}$ models incorporate an improved audio circuit using a 6AV6 1st audio stage and 6AQ5 audio output stage with a continuously variable tone control. $24^{\prime \prime}$ models in the lower price bracket use the standard CX-37 audio circuit employing the 6BK5 audio output.

Chassis-Model Cross Reference

| Modal | Chassis |
| :---: | :---: |
| ITI74MS | CT. 126 |
| 17748S | CT. 126 |
| 1T174M-1 | CT. 110 |
| 1T1748-1 | CT-110 |
| 1T174MS-1 | CT. 127 |
| 1T1748S-1 | CT-127 |
| 2T214M-1 | CT-108 |
| 2T2148.1 | CT-108 |
| 2T214MD | CT-115 |
| 2T214MD-1 | CT-116 |
| 2T214MS | CT-128 |
| 27214BS | CT- 128 |
| 2T214MS. 1 | CT- 129 |
| 2T2148S-1 | CT: 129 |
| 4C174M-1 | CT. 110 |
| 4C174MD | CT. 99 |
| 4C174MS | CT-99 |


| 4C174MS-1 | CT-110 |
| :---: | :---: |
| 5C214M | CT-121 |
| 5C214B | CT-121 |
| 5C214M-1 | CT-123 |
| 5C214B-1 | CT-123 |
| 5C214MD | CT-115 |
| 5C214MD. 1 | CT-116 |
| 7H214M | CT-121 |
| 7H214B | CT-121 |
| 7H214M-1 | CT. 123 |
| 7H2148-1 | CT-123 |
| 9F214MD | CT-115 |
| 9F214MD-1 | CT. 116 |
| 9F214BD | CT-115 |
| 9F214BD-1 | CT-116 |
| 11F244M | CT. 95 |
| 11F244M-1 | CT-112 |
| 11 F2448 | CT. 95 |

MS-Mahogany Floratone BS-Bisque Floratone M-Mahogany B-Bisque
MD-Highly Polished Mahogony BD-Highly Polished Bisqua FD-Highly Polished Fruitwood.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## CAPEHART "CX-37" \& "CX-37-1" SERIES TV

(17"'21" CRT Version)



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## Copehart

## "CX-37" SERIES

 TELEVISION RECEIVER CHASSIS(Continued on Next Page)


## MOST-OFTEN-NEEDED 1955 TRLEVISION SERVICING INFORMATION

## Capehart TROUBLE-SHOOTING NOTES ON THE CX-37 SERIES TV CHASSIS

## Picture Circuits

No Picture, No Sound, Raster Present
Use oscilloscope to trace video signal. If video is not present at output of Video Detector check:
(A) R-F Tubes V101 and V102 or I-F tubes V201, 202, 203 and 204.
(B) Video Detector Crystal (IN64) and associated components.
(C) Voltage Readings on all R-F and I-F tubes.
(D) Plate and Screen load resistors and by pass capacitors in R-F and I-F Stages.
If video signal at Video Detector is normal check:
(A) Voltage readings on 1st Video Amp. (1/26X8) V205B.
(B) Resistors R219, R220, R224, R225 and R226.
(C) Peaking Coil L206 for open.

## Horizontal Sync-AFC and Sweep Circuits

1. Loss of Horizontal Sync:

If Vertical Sync is critical also check:
(A) Sync Sep. 6BE6 or 6CS6 (V402) and Phase Splitter, 12AU7 (V403) tubes.
(B) Sync Coupling Capacitors C406 and C408. (Note:

C408 not used in chassis coded "D-3" or later.)
(C) Open Resistors R222, R419, R418, R422, R423 or R424.
If Vertical Sync is normal check:
(A) Open Capacitors, C510 or C506.
(B) Open Resistors R505, R502 or R507.
2. "Jittery" Horizontal Sync:

Check:
(A) Horiz. Phase Det., 12AU7 (V403B) tube.
(B) Value of resistors R503, R504 and R508.
(C) Capacitor C513 for open.
3. Extreme Horiz. Sweep Distortion (Picture Distorted - Horiz. Syne critical).

Check:
(A) Horiz. Phase Det. 12AU7 (V403B) and Horiz. Osc., 12AU7 (V503) tubes for Heater to Cathode leakage.
4. Three Overlapping Pictures (Horiz. Osc. frequency too high).
If adjustment of Horiz. Osc. cannot correct condition, check:
(A) Horiz. Osc., 12AU7 (V503) tube by substitution.
(B) Capacitor C517 for open.
(C) Resistor R515 for open.
5. Tearing at top of Picture.

If adjustments of Horiz. Osc., AGC and Pix Lock Control do not correct condition, check:
(A) Capacitor C515 for open.
6. No Raster - No High Voltage.

Use oscilloscope to check waveform at grid (pin 5) of Horiz. Output 6BQ6GT (V504). If waveform is normal, check:
(A) Horiz. Output 6BQ6GT (V504), H: V. Rectifier 1B3GT (V505) and Damper 6W4GT (V506) tubes.
(B) H. V. Circuit fuse (. 2 amp .) for open.
(C) Horiz. Winding of Defl. Yoke and Horiz. Output Trans. (T502) for open.
(D) Parallel Resistor R522 and Capacitor C523 for open.
(E) 6BQ6GT Screen Load Resistor R519 for open.

If waveform at grid (pin 5) of 6BQ6GT (V504) is not normal, check:
(A) Horiz. Osc., 12AU7 (V503) tube.
(B) Coupling Capacitor C518 and Resistor R517 for open.
(C) Horiz. Osc. plate load resistors R509 and R514 for open.
(D) Horiz. Ringing Coil L501 for open. Also check values of other components in Horiz. Osc. circuit.
7. Insufficient Horiz. Sweep.

If condition cannot be corrected by adjustment of Horiz. Drive and Width, check:
(A) Horiz. Osc. 12AU7 (V503), Horiz. Output 6BQ6GT (V504) and Damper 6W4GT (V506) tubes.
(B) Voltage readings on Horiz. Osc. 12AU7 and Horiz. Output 6BQ6GT.
(C) Value of Capacitor C524 in Damper circuit, also capacitors C518, C517 and other components in Horiz. Osc. circuit.
(D) Capacitor C520 for open.
8. Insufficient Horiz. Sweep with Foldover on Right Side. Check:
(A) Capacitor C518 for leakage.
9. Horiz. Foldover in Center of Picture.

Check:
(A) Capacitor C520 for leakage.
10. Trapezoidal Raster-Horiz. Sweep Decreased.

Check:
(A) Horiz. Winding of Defl. Yoke for partial short.
(B) Capacitor C528 (across $1 / 2$ of yoke winding) for short.

## Vertical Sync and Sweep Circuits

1. Loss of Vertical Sync or Critical Hold.

Use oscilloscope to check sync signal at grid (pin 1) of Vertical Osc., 6BF6 (V501). If sync signal is normal, check:
(A) Values of capacitors C534, C530, C535, C529, Resistors R540 and R542 and other components in Vertical Osc. circuit.
If sync signal is not normal, check:
(A) Sync Separator 6BE6 or 6CS6 (V402) and Phase

Splitter $1 / 212 A U 7$ (V403A) tubes by substitution.
(B) Voltage readings and waveforms in Sync Separator and Phase Splitter circuits.
(C) Integrating Network (PC501).
(D) Coupling Capacitors C408 and C537 for open.
(E) Resistor R413 for open.
2. Loss of Vertical Sweep

Check:
(A) Vertical Oscillator 6BF6 (V501) and Vert. Output 6V6 (V502) tubes by substitution. Use oscilloscope to check waveform at plate (pin 3) of Vertical Output, 6V6 (V502). If waveform is normal, check:
(A) Vertical Winding of Deflection Yoke.
(B) Vertical Output Transformer T501.
(C) Capacitor C541 for short.

If waveform is not normal, check:
(A) Voltage Reading in Vertical Osc. (V501) and Vertical Output (V502) circuits.
(B) Vertical Output Transformer T501 for open primary.
(C) Resistors R527, R529, R531, R532, Capacitors C603B, C530, C532, C536 for open also check other components in Vertical Osc. circuit.
3. Insufficient Vertical Scan

Use oscilloscope to check waveform at plate (pin 3) of Vertical Output, 6 V 6 (V502). If waveform is normal, check:
(A) Vertical Winding of Deflection Yoke for partial short.
(B) Vertical Output Transformer T501 for partial short.
(C) Capacitor, C541 for leak.

If waveform is not normal, check:
(A) Vertical Osc., 6BF6 (V501) and Vertical Output, 6V6 (V502) tubes by substitution.
(B) Voltage readings on V501 and V502.
(C) Capacitor C603C for open.
(D) Capacitors C529, C530, C532, Resistors R527, R529, R531, R532 and other components associated with V501 and V502.
4. Extreme compression of Scan Lines at Bottom with Stretching at top.
Chech:
(A) Adjustments of Vert. Hold, Linearity and Height.
(B) Capacitor C534 for open.
5. Vertical Foldover at top-poor Vert. Linearity.

Check:
(A) Value of Resistor, R535 and Capacitor, C533.
6. Two Pictures Vertically-Linearity Distorted.

Adjust Vertical Hold to stop roll, check:
(A) Capacitor C529 for leakage.
7. Vertical Scan Reduced with Stretching at Top. Check:
(A) Adjustment of Vert. Hold, Linearity and Height.
(B) Capacitors C534 and C533 for change in value.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING IMFORMATION

## CBS=Columbia <br> Chassis <br> 921-11 <br> 921-13 <br> 921-14 <br> Models <br> U22C05, U22C07, U22C07B, U22T09, U22T09B, U22T09EB <br> U22T19, U22T19B <br> 22C09, 22C09B, 22T19. 22T19B

The service material on this page and the next three pages is exact for chassis listed above. The additional chassis 921-12 and 921-94, used in models listed below, are very similar in most respects to chassis covered. Different tuners are used, and other types of $21^{\text {" }}$ picture tubes may be employed.

| Chassis | Models | Chassis | Models |
| :--- | :--- | :--- | :--- |
| $921-12$ | $22 \mathrm{~T} 09,22 \mathrm{~T} 09 \mathrm{~B}, 22 \mathrm{~T} 09 \mathrm{~EB}$, | $921-94$ | 23C49L, 23C49LB, 23C59 |
|  | $22 \mathrm{C} 07 \mathrm{~B}, 22 \mathrm{C} 07,22 \mathrm{C} 05$ |  | 23C59B, 23C49S, 23C49SB |

PICTURE TUBE HANDLING PRECAUTIONS
The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An ab. normal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.


HIGH VOLTAGE WARNING
Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

> CBS - Columbia Circuit Diagram for Chassis

921-11, 921-13 and 921-14

921.11 13 TUNERS

## NOTES

1. C135 is 180 MMF, port \# 23004650 in 921.11 \& 13 chassis.
2. R244. R245, R242 and S47 are used only in 921.11 \& 13 chassis.
3. R307 is 22 K . IW in some chassis.
4. Unless otherwise noted:

Capacitors marked less thon 1 are in mid.
Copacitors marked more than 1 are in mmf .
Capacitors are rated at 600 V .
Resistors are in ohms.
All resistors $1 / 2 \mathrm{Watt}$
DC voltages measured with a VTVM between socket terminals and ground.

- Indicates scope synced at vertical sweep rate.
-"Indicates scope synced at horizontal sweep rate.

$\vee 3$

$6 C B 6$ | ist 1.5 F |
| :---: |
| 120 y |



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## Alignment Information for CBS-Columbia Chassis 921-11, etc. (Continued)

## If ALIGNMENT

1-Connect negative of 3 V battery to AGC bus (R102. C104, R106 junction near V3 is readily accessible) or to test socket pin 8. positive to chassis.

2-Remove mixer tube shield, connect Signal Generator, to it and replace over mixer tube so shield does not contact chassis.

3-Connect VTVM lead through a 22 K resistor to grid of first video amplifier (Pin 2. V7, 12BH7) or to test socket pin 5 and negative lead to chassis.

4-Turn receiver on and allow it to warm up a few minutes.

5-Set VTVM on -5 volt range and signal generator to 44.2 mc unmodulated.

6-Adjust 4th IF transformer Tl04 bottom slug for maximum output, setting signal generator attenuator to produce no more than a 3 volt reading on the VTVM.

7-Set signal generator to 39.75 mc unmodulated and adjust Tl04 trap. top slug, for minimum reading on the VTVM

8-Set signal generator to 45.6 mc unmodulated and adjust bottom slug of 3rd IF transformer T103, for maximum output as in (6).

9-Set signal generator to 47.25 mc unmodulated and adjust trap Tl03, top slug for a minimum reading on VTVM.

10-Set signal generator to 42.7 mc unmodulated and adjust bottom slug of T102 for a maximum VTVM reading as in (6).

11--Set signal generator to 41.25 mc unmodulated and adjust trap T102, top slug, for a minimum VTVM reading.

12-Set signal generator to 44.2 mc unmodulated and detune the tuner IF coil L3. Then adjust the lst IF coil. T101 for a maximum VTVM reading as in (6).

13--Disconnect the signal generator from the tube shield.
14-Connect Sweep Generator to mixer tube shield and an oscilloscope, calibrated for 3 volts peak to peak as reference output level, in place of the VTVM.

15-Loosely couple Marker Generator to input of the Sweep Generator.

16-Adjust Sweep Gentrator dial and attenuator to show an IF response curve not over 3 volts peak to peak on the calibrated oscilloscope screen. (Exceeding this value will give a distorted response curve.)

17-Adjust tuner IF coil L3 and lst IF coil T101 to obtain the response curve shown below.


USUALLY: To set 45.75 marker, at $50 \%$ point adjust tuner IF coil.
To compensate for tilt adjust list IF Coil Tl01. Adjust for maximum bandwith at the $50 \%$ point.

## VHF TUNER OSCILLATOR

If all channels are not within range of FINE TUNING control, set FINE TUNING in center of its range and adjust slug reached through front of RF tuner unit for adjustment of each channel. CAUTION: Do not touch adjustment on top of RF tuner unit, other than converter plate coil. L14, during IF alignment.

## SOUND ALIGNMENT

1-Connect 4.5 megacycle signal generator to pin 2 of 12BH7 (V7) video amplifier, or to test socket pin 5.
2-Connect DC VTVM (negative polarity) to pin 7 of 6AL5 (V9) ratio detector, or to test socket pin 6. Connect negative lead to chassis.

3-Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on VTVM.

4 -Adjust L106 and bottom of Tl06 for maximum deflection on VTVM. Keep VTVM reading below 10 volts at all times.

5-Attach two series-connected $100 \mathrm{~K}( \pm 1 \%)$ resistors across R126 (Ratio Detector Load Resistor). Connect DC VTVM to center-tap of 100 K resistors, and connect ground wire of VTVM to junction of Cl 22 and C124 (Audio Take.Off of T106), or to test socket pin 3.

6-Adjust top of Tl06 for zero reading on VTVM between a plus and a minus peak.

## HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the Horizontal Hold control in the center of its range and sync the picture with the horizontal AFC adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



CHASSIS 426
(without UHF Converter)
Models:
G-17TOMH
G-17TOBH
G-17TOWH
G-17TOBKH
G-17TOWEH

CHASSIS 426
(with UHF Converter)
Models: G-17TOMU
G-17TOBU
G-I7TOWU

Chassis 431, used in Models G-21TOBH, G-21TOMH, G-21TOWH, and Chassis 431-2, used in Models H-21COBH, H-21COBU, H-21COMH, H-21COMU, H-21COSBH, H-21COSH, H-21COWH, H-21COWU, H-21HCBH, H-21HCBU, H-21HCMU, H-21HCWH, employ 21ATP4 picture tubes, while Chassis 432, used in Models H-17TOBH, H-17TOBU, H-17TOMH, H-17TOWH, $\mathrm{H}-17 \mathrm{TOMU}, \mathrm{H}-17 \mathrm{TOWU}$, employs a 17AVP4 picture tube. All these sets are similar to Chassis 426. Chassis 443, used in Models H-21HPBHa and H-21HPWHa, Chassis 443-3, used in Models H-21HPBHd and H-21HPWHd, and Chassis 445 are also similar. Aside from minor differences (such as the use of 25 CU 6 hor. output tube, added 3AV6 stage on some sets, and the use of other tuners) these chassis are so similar that the same material will apply to all these sets.

## R.F. AND MIXER ALIGNMENT

| Step <br> No. | Station Selector | Oscilloscope | Bias | Signal Generator To | Adjust |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1. | Chan.\#10 | High side through a 10,000 ohm resistor to TP1 on Tuner. Ground lead to Tuner Case. | $-1.5$ <br> volts to white lead on tuner. | Signal Generator set to 195.5 MC., 400 cycle $30 \%$ AM modulated. Through Dummy Antenna to the Antenna lead-in. | C-3 for maximum 400 cycle response on scope. Remove signal Generator. |
| 2. | " | - " | , | Sweep Generator to Antenna lead-in through dummy antenna. Set Generator to sweep Channel 10 freq. Loosely couple Marker Generator to sweep output cable. Set marker to either 21.9 or 26.4 mc . | Adjust C5 \& C9, to produce a response curve similar to R.F. and Mixer Response Curve. |
|  |  |  |  | R. F. \& MIXER RESPONSE CURVE |  |

Without disturbing the R.F. grid, R.F. plate, and mixer-grid trimmer, check the response on the other VHF TV channels by setting the station selector to the desired channel and changing the frequency of the sweep generator to correspond to the channel being checked. The response curve should be essentially the same on all channels and the markers should fall in similar positions on the response curve. A slight amount of tilt can be tolerated. The amount of tilt indicated by the relative amplitudes of the response curves where the picture and sound I.F. Markers rest should not exceed $30 \%$ of the over-all response curve amplitude. (Service material continued on the next 7 pages.)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## CROSLEY Chassis 426 (Continued)

## I.F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes.
The rear side of the chassis means the side on which the tubes are mounted.
VIDEO I. F. ALIGNMENT (with VIVM)
In the I.F. Alignment, limit input of signal generator so that reading on VTVM does not exceed -2 volts.

| Step | Connect Signal Generator Through a . 01 Capacitor | Signal Gen. Freq. MC. | Connect VTVM | Miscellaneous Connections and Instructions | Adjust |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1. | Test Point No. 2 on Tuner (closest to L9 slug adjustment). | 24.4 mc . | Junction of R118 and C113 and chassis. | Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis | T101 for maximum indication on meter, limit input to make peak less than -2 volts D.C. on VTVM. |
| 2. | - | 22.9 mc . | " | " | L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil. |
| 3. | " | 21.9 mc . | " | " | L103 (front slug) for minimum. Input level should be high enough to produce at least . 5 volts at null on VTVM. Use first null obtained from end of coil form opposite tinnerman clip. |
| 4. Repeat steps 2 and 3. |  |  |  |  |  |
| 5. | - | 25.5 mc . | " | " | L102 for maximum. |
| 6. | " | 25.1 mc. | " | " | L101 (front slug) for maximum. Use first peak from tinnerman clip end of coil. |
| 7. | " | 27.9 mc . | " | " | See Note 1. <br> L101 (rear slug) for minimum deflection on VTVM. Use first null obtained from end of coil form opposite tinnerman clip. |
| 8. Repeat step 6 (and 7, if adjacent channel trap is used). |  |  |  |  |  |
| 9. | Test Point No. 1 on Tuner (closest to C21 trimmer screw). | 25.1 mc. | " | Connect a 100 ohm resistor in series with a 1000 mmf. cap. across L101. | L9 (brass screw) on the Tuner for maximum. |

Note 1. This adjustment can be made only on receivers where the Adjacent Channel Trap has been added.

## TO CHECK I. F. ALIGNMENT (with scope)

Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form.
Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

| Sweep Gen. <br> Connected to | Scope Connected <br> to | Bias | Sweep Gen. <br> Set to |
| :--- | :--- | :--- | :--- |
| Ungrounded <br> shield of V2 <br> and chassis. | High side of <br> contrast con- <br> trol and chas- <br> sis. Contrast <br> control at mini- <br> mum contrast. | Connect 3 volt <br> bias battery <br> negative lead <br> to white lead <br> from tuner, <br> positive lead <br> to chassis. | Sweep from <br> megacycles. <br> mega |

CROSLEY Chassis 426 (Continued)


FRONT VIEW OF CHASSIS 426
(Tube \& Alignment Locations)


REAR VIEW OF CHASSIS 426
(Tube \& Alignment Locations \& Tube Filament Wiring)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

CROSLEY

## VHF OSCILLATOR ALIGNMENT

OSCILLATOR ALIGNMENT (using scope)

| Step <br> No. | Oscilloscope | Channel Selector | Sweep Generator | Marker <br> Generator | Adjust |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1. | High side of scope to high side of R120 contrast control. Low side to chassis. See Note. | Chan. \#2 | To sweep Channel 2 frequencies. Connect Gen. output in series with dummy antenna to antenna lead-in. | 59.75. Sound <br> I. F. Carrier. | Channel 2 oscillator slug so that marker falls into bottom of valley on curve (the point corresponding to the 21.9 mc . marker as shown on Nominal Overall I. F. Response Curve sketch.) Be sure that the Fine Tuning Control is set to the center of its range. |

2. Repeat the above procedure for each of the remaining channels, by resetting the sweep generator and the marker generator to the correct frequencies for each channel that is to be adjusted.

Note: Apply a -3.0 volts negative bias to Junction of C111 and R117 or to white lead from VHF R. F. Tunt Use whichever is the most convenient ppint.

## SOUND ALIGNMENT

The 4.5 mc . trap (front of L 109 ) must be aligned first, regardless of which procedure is used for the remainder of the alignment (Procedure A or B).

| Step <br> No. | Channel <br> Set To | Adjust | Remarks |
| :--- | :--- | :--- | :--- |
| 1. | Any <br> unused <br> channel | Connect a crystal controlled 4.5 mc., 400 <br> cycle amplitude modulated signal ( $30 \%$ <br> or greater) between pin 8 of V104 and <br> chassis. Connect high side of scope <br> through a detector probe to cathode of <br> picture tube, low side to chassis. Adjust | Remove signal generator and scope from the receiver. |
| L109 (rear slug) for minimum 400 cycle <br> indication on scope. |  |  |  |

## PROCEDURE A (with signal from station)

| Step No. | Channel Set To | Adjust | Remarks |
| :---: | :---: | :---: | :---: |
| 1. | Strong <br> signal | L106 for maximum sound output. | Set Buzz Control (R132) approximately $90^{\circ}$ from clockwise stop. |
| 2. | Weak signal | L111 and L109 (front slug) for maximum sound output. | If the signal in the area is too strong to obtain these peaks, remove the antenna from the receiver. |
| 3. | Weak signal | Buzz Control (R132) for minimum noise (hash). | This signal shouldbe weak enough to allow noise (hash) to come through along with the sound. |
| 4. | Strong signal | L106 again for maximum sound output. | Limit the volume control setting so that this peak can be heard. |

## PROCEDURE B (with alignment equipment)

| Step <br> No. | Connect <br> Signal Gen. | Signal Gen. <br> Freq. MC. | Connect <br> Scope |  | Miscellaneous Instructions |
| :--- | :--- | :--- | :--- | :--- | :--- |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## CROSLEY Chassis 426 (Continued)

## HORIZONTAL BLOCKING OSCILLATOR ALIGNMENT

Tune Receiver to TV signal, adjust contrast control for normal picture below limiting in the Video Amplifier, and proceed as follows:

| $\begin{aligned} & \text { Stp } \\ & \text { No. } \end{aligned}$ | Contrast Control Set For | Miscellaneous | Adjust |
| :---: | :---: | :---: | :---: |
| 1. | Normal Picture | --------------------- | Horizontal Hold Control (R164) and Horizontal Frequency Adjustment (rear slug of T108) until picture is in sync. |
| 2. | " | Connect scope in series with 10 mmf . to lug 4 of T108. | Adjust Horizontal BTO Trap(front slug of T108) to obtain the waveform shown below. Keep the picture in sync at all times by readjusting the Horizontal Hold, Horizontal Frequency and/or Horizontal Lock Trimmer (C142). |
| 3. | " | Horizontal Hold set fully clock-wise. | Adjust Horizontal Frequency (rear slug of T108) by turning out until the picture is just out of sync. Then turn the control slowly in until the picture is just ready to fall into sync (indicated by a wide black vertical or diagonal horizontal blanking bar). |
| 4. | $"$ | Horizontal Hold set fully counter-clockwise. | Picture should normally be in sync. Remove the signal by tuning off and then re-tuning to the station. If more than seven bars are present, adjust the Horizontal Lock Trimmer slightly counterclockwise until three or four bars appear when the receiver is tuned off and then re-tuned to the station (Horizontal Hold Control still set fully counter-clockwise). If less than three bars are present, adjust the Horizontal Lock Trimmer counter-clockwise to obtain the three or four bars as described above. <br> Since the Horizontal Lock Trimmer adjustment affects the horizontal frequency, the adjustments of both the Horizontal Frequency Adjustment and the Horizontal Lock Trimmer must be repeated until the conditions outlined in steps 3 and 4 exist simultaneously at the extreme positions of the Horizontal Hold control. <br> Check pull-in range, which should be normally $60^{\circ}$ to $120^{\circ}$. |
| 5. | Weak Picture | ---------------------- | Set the Horizontal Hold Control so that when the receiver is tuned off and then re-tuned to the station, the picture returns completely in sync. |

## TABLE OF SOCKET VOLTAGES

The following voltages were measured with an electronic voltmeter while the set was operating on 117 volts, 60 cycle a.c. with no signal input, antenna terminals shorted, Station Selector set to channel 3, and the Brightness and Contrast Controls at minimum setting. Electronic voltmeter connected between socket lug and chassis. * AC. voltages. Voltages may vary depending upon the setting of other controls.
D. C. current at junction of L108 and C132B, with contrast control in the maximum counter-clockwise position, 190 ma. With contrast set at maximum clockwise position, D. C. current at this point is 200 ma.

| SYMBOL | TYPE | PIN 1 | PIN 2 | PIN 3 | PIN 4 | PIN 5 | PIN 6 | PIN 7 | PIN 8 | PIN 8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| V101 | 6CB6 | -0.7 | -0.7 | -50.4 | *44.1 | +129 | +131 | 0 | -- | --- |
| V102 | 8С ${ }^{\text {B6 }}$ | -0.9 | +1.0 | -44.1 | *37.8 | +131 | +133 | 0 | --- | --- |
| V103 | 6AM8 | +1.0 | --- | +132 | * 37.8 | *31.5 | $+135$ | 0 | -1.1 | 0 |
| V104 | GANB | +7.2 | -1.1 | 0 | -31.5 | *25.2 | $+240$ | +230 | +1.7 | +5.8 |
| V105 | 648 | +72 | --- | +58 | *25.2 | * 18.9 | +58 | +0.7 | 0 | -0.5 |
| V106 | 6BN6 | +2.2 | --- | -44.1 | *37.8 | +95 | --- | +104 | --- | --- |
| V107 | 6SN7GT | +12 | $\begin{gathered} +64 \text { to } \\ +120 \end{gathered}$ | +5.0 | -83 | +210 | 0 | *12.6 | -8.3 | --- |
| V108 | 25L6GT | --- | *81.7 | +250 | +265 | +145 | --- | *56.7 | +150 | --- |
| V109 | 25BP6 | --- | *81.7 | --- | $+130$ | -27 | --- | -56.7 | 0 | Cap - High Voltage |
| V110 | 12BH7 | +100 | -22 | 0 | -18.9 | -18.9 | +470 | $+100$ | +120 | *12.6 |
| V111 | 12AX4 | --- | --- | +470 | -.- | +260 | --- | -81.7 | *94 | --- |
| V112 | $1 \times 2 \mathrm{~B}$ | -- | -- | --- | -- | --- | --- | -- | $\begin{gathered} \text { H.V. } \\ \text { 13KV } \end{gathered}$ | --- |
| V113 | $17 \mathrm{HP4}$ | * 0 | -- | --- | --- | --- | +150 | $\begin{gathered} (\text { Pin } 10) \\ +320 \end{gathered}$ | $\begin{gathered} (\operatorname{Pin} 11) \\ +150 \end{gathered}$ | $\underset{* 6.3}{\left(P_{\ln 12}\right)}$ |
| V1 | $6 \mathrm{BC5}$ | --- | 0 | *44.1 | -50.4 | +125 | +125 | 0 | --- | --- |
| V2 | 6 J 6 | +80 | +90 | * 50.4 | *56.7 | --- | -5 | 0 | --- | --- |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

CROSLEY Chassis 426 Circuit Diagram


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## SCHEMATIC WIRING DIAGRAM CHASSIS 426



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## CROSLEY Chassis 426 (Continued)

NOTES

1. All D.C. voltages measured with an electronic voltmeter connected from socket lug to chassis. Some voltages are variable depending upon signal input. Voltages shown were measured with a signal voltage of 850,000 microvolts and with a normal picture on the picture tube and the contrast and brightness controls set for 50 volts peak to peak on the cathode (pin 11) of the picture tube. Socket voltage tolerance $10 \%$. l
2. Supply voltage, 117 volts, 60 cycle AC.
3. $K=1000$.
4. On all capacitance values in mmf. and all resistance values in ohms unless otherwise noted.
5. R171 is a special 2 watt resistor capable of standing overload for limited periods of time. Replace with part number 156911-3.
6. Better focus may be obtained with replacement picture tubes if the electronic focus anode is connected to a point other than +150 volts. Suggested points to try are: chassis ground, +260 volts, +300 (picture tube, pin 10) and +480 volts.
7. R173 was added on some receivers to minimize horizontal overdrive, noticeable by a vertical white band slightly left of the center of the raster. Because of individual tube characteristics, overdrive may be introduced when the 25 BQ6GT tube is replaced in a set that is not provided with R173. In this case it will be necessary to correct the overdrive condition by adding a 22 ohm, $10 \%, 1 / 2$ watt resistor, part number 39374-5. Disconnect tube socket, pin 8, from ground and insert the resistor between the pin and the chassis.
8. In some sets R128 is a 12,000 ohm, $10 \%$, 2 watt resistor (part No. 39374-214). In such cases R148 is a 18,000 ohm, $10 \%, 2$ watt resistor (part No. $39374-216$ ) or a 22,000 ohm, $10 \%, 2$ watt resistor (part No. 39374-217).
9. In some sets R169 is a $15,000 \mathrm{ohm}, 10 \%, 1 / 2$ watt resistor (part No. 39374-39).
10. In some later production sets, Horizontal Hold control R164 has an overall resistance of 145,000 ohms, with a 70,000 ohm stop. This control will be marked with part No. B-157802-1-2 or B-157802-1-3. It is directly interchangeable with the earlier control marked B-157802-1-1, which has an overall resistance of 170,000 ohms with a 70,000 ohm stop. It will be noticed, however, that the control with the lower overall resistance gives a somewhat wider hold range.
11. On the Vertical Integrating Network C131, leads 2 and 3 are closely spaced, and lead 2 is the middle lead. On the Sync Take-Off Network C129, leads 1 and 2 are closely spaced, and lead 2 is the middle one. When replacing either of these units, theleads must be connected as shown in the schematic in order to obtain satisfactory operation.
12. CODE CHANGE - The schematic and parts list as given are for chassis 426, Code C. This chassis incorporated a change (not found in the Code $B$ chassis) to improve the operation of the horizontal output circuit. In the Code B chassis the Horizontal Deflection Transformer was of an earlier design. C152 was either one 22 mmf ., $10 \%$, 3 KV , Disc Capacitor (part No. 157811-1), or two 22 mmf . capacitors wired in parallel.
When it is necessary to install a new transformer (part No. 157820-6) in a Code B chassis, it will be necessary to increase the total capacity of $C 152$ to 68 mmf . $\pm 10 \%$, at 3 KV . working voltage. This may be done by adding either one or two 22 mmf ., capacitors in parallel to the existing capacitors, or by replacing them with a $68 \mathrm{mmf} ., 10 \%, 3 \mathrm{KV}$. capacitor (part No. 158215-3).
13. Vertical jitter may be caused by an intermittent contact between ground spring and picture tube, particularly on early production sets that used the brass spring. The trouble may be corrected by replacing the spring with the new type wire spring, part number 158197 . An alternate method is to use a small ( $1^{\prime \prime}$ ) square of copper screening between the brass spring and the picture tube, taping the screen to the tube with a plastic tape such as "Scotch" tape.

## PRODUCTION CHANGES

The following changes have been incorporated in later production Chassis 426:

1. R156, R157, and R158, filament shunt resistors ( $43 \mathrm{ohm}, 10 \%, 2$ watt), are replaced by R174, $128 \mathrm{ohm}, 10 \%$, 10 watt resistor, Part No. 158230 . The change in the achematic is given in Figure 1. Chassis 426 incorporating this change are stamped with code letter $F$ or later.


FIG. 2
2. On Chassis 428 (Code Letter D or later) R132 is a 500 ohm control, Part No. 157955-2. Chassis with earlier code letters have a 1000 ohm control, Part No. 157955-1. The change simplifies the sound alignment. When adjusting the Buzz Control for a null, the low value resistance makes it easier to tind the null.
3. On Chassis 426 (Code Letter $D$ or later) a wiring change was made in the vertical circuit to avoid excessive height by reducing the plate voltage on ViloA (vertical oscillator tube). However, no parts were added or deleted. The change on the schematic is shown in Figure 2.
If it is desired to make this change on earlier chassis, remove the red lead wire between the positive terminal of the electrolytic capacitor C138 and lug 2 of the Height Control R146. Then connect a length of hookup wire from positive terminal of C138 to the junction of R150 and R151 (on the terminal board directly above the Height Control).
NOTE: On some chassis which did not incorporate the above change, a 1 megohm, 10\%, $1 / 2$ watt resistor (Part No. 39374-61) has been inserted between lug 3 ot the Height Control R146 and the grid (pin 7) of the V110B. Since this is not used on all chassis, no code letter was assigned. The 1 megohm resistor compensates for the low overall resistance value of the control when that resistance approaches 4 megohms (lower limit at $20 \%$ tolerance). When installing a replacement contral which has a similar low overall resistance, either of the above methods may be used to decrease the height of the picture.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

# RA-312, 313 CHASSIS 

(Courtesy of Allen B. Du Mont Laboratories)

The RA-312 is designed to receive only the VHF channels and the RA-313 is designed to receive all 82 UHF and VHF channels. The circuitry of both chassis is of similar design, and some models include a Tone control, plus provisions for the attachment of a phonograph with a conveniently located Phono-TV switch.

A 41 mc video i-f strip is employed. The video i-f carrier frequency is 45.75 mc and the sound is at 41.25 mc . The video i-f system consists of 3 stagger-tuned bifilarwound transformer stages utilizing high-gain 6CB6s. Broadband coupling is used between the mixer output and the first video i-f stage.


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## NOTES

1. All waveforms and voltages were taken under operating conditione, The receiver was tuned to an average strength TV signal, the Contrast control rotated fully clockwise and the Noise control was rotated fully counler-clockwise.
2. The Noise control and Local-Distance switch consists of a potentiometer, R319, and a snap switch, S202. When R319 is rotated fully counter-clockwise S 202 opens (Local position as shown in the schematic).
3. Voltages $\pm 20 \%$ of those shown are normal.

All resistors are $10 \%$, one-half watt, unless otherwise indicated. W. W. indicates wire wound resistor.
5. All capacitors are $20 \%, 500 \mathrm{~V}$. unless otherwise indicated. All capacitors are ceramic, unless indicated as follows: M-mica, P-paper, $\pm$ -electrolytic, MP-Molded Paper.
6. Tuner 89013461 is used in RA.312 chassis with Phono switch and Tone control. Tuner 89013561 is used in RA-312 chossis without Phono switch and Tone control. Tuner 89012912 and filter N202 are used with UHF tuner 89013293 in RA-313 chassis.
7. In some of the earlier chassis the circuit is as follows:

Pin 6 of the 6CB6 2nd video i-f is connected to the junction of R210 and 2203. C218, R206 are not used. R222 is a $4.7 \mathrm{~K} 10 \% 2 \mathrm{~W}$ resistor connecting to the +235 volt line. R262 is a $120 \mathrm{~K} 10 \% 1 / 2 \mathrm{~W}$ resistor, R258 is a $220 \mathrm{~K} 10 \% 1 / 2 \mathrm{~W}$ resistor and R266 is a $1.8 \mathrm{Meg} .10 \% 1 / 2 \mathrm{~W}$ resisior. A $180 \mathrm{~K} 10 \% 1 / 2 \mathrm{~W}$ resistor is connected between the junction of R261, R262 and the junction of R260 and R266. R300 is connected to pin 3 of the 12BH7 Vertical Deflection Amplifier.

 | $T$ |
| :---: |
| $\substack{T \\ \hline \\ \hline \\ \hline}$ |



VIDE
V204A
These points $1,2,3, \& 4$, connect to correspondingly numbered points circuit on the preceding page. This venience only

$\underbrace{\mathrm{V} 204 \mathrm{~A}}{ }^{1 / 3}$



3
venience only


Du Mont Laboratories
Chassis RA-312, RA-313


USE SOR NODELLS WITM PRONO SWITCM
SZOS AND TONE CONTRCL R321


# MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION 




This is a part of the main circuit shown on previous pages.
UNDERCHASSIS VOLTAGE POINTS


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



TUBE TROUBLE ANALYSIS CHART FOR CHASSIS 120179-B 120203-B, 120204-B, 120205-B

| SYMPTOM | CHECK |
| :---: | :---: |
| Weak or no sound nor video (picture), raster normal - UHF only | $V-25, \mathrm{D}-1, \mathrm{D}-2$ * |
| Weak or no sound nor video (picture), raster normal - UHF and or VHF | $V-22, V-23, V-1, V-2, V-3, V-4$ * |
| Weak or no sound - Video and raster normal - - - - UHF and or VHF | $V-6, V-7, V-8, V-9, V-10$ |
| Weak or no video - Sound and raster normal -...-UHF and or VHF | $V-5, V-24$ |
| Poor or no horizontal nor vertical sync - sound and video normal (contrast control makes video darker or lighter) ............................... UHF and or VHF | $V-11, V-17$ |
| Poor or no horizontal nor vertical sync - Video weak or distorted, raster normal - sound may or may not be normal ................................................................ | $V-22, V-23, V-1, V-2, V-3, V-4$ |
| Poor or no horizontal sync - raster normal and sound normal (picture locks in vertically) ...........UHF and or VHF | $V-11, V-12, V-13, V-17$ |
| Poor or no vertical sync - raster normal and sound normal (picture locks in horizontally) .......... UHF and or VHF | $V-11, V-17, V-18$ |
| Horizontal line (no vertical sweep) - sound normal - UHF and or VHF | $V-18, V-19$ |
| Insufficient horizontal size, sound \& video normal - UHF and or VHF | $V-14, V-16, V-20, V-21 V-26^{* *}$ |
| Insufficient vertical size, or white horizontal bar in picture, horizontal size OK….......UHF and or VHF | $V-19$ |
| No sound, no raster - tubes lit $\ldots \ldots \ldots$, | Fuse, V-20, V-21 |
| No sound, no roster - tubes not lit m........ UHF and or VHF | Plug connection in wall socket, ON-OFF switch, line cord. |

By raster we mean the illuminated scanning lines.

* Another very common fault is a shorted or open circuit antenna connection to set.
** Some 120179-B chassis used two 6AX4GT tubes (V-16, V-26) instead of one 6AU4G (V-16).




## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

EMERSON Television Chassis 120179-B, 120203-B, 120204-B, 120205-B, continued
Models 7483, 784C, 787A, 787 B and 786C incorporating chass is 120179-B and 120203-B are "ALL CHANNEL UHF - VHF RECEIVERS.* Combination VHF and UHF tuning is achieved through the use of two tuners which are connected to the same tuning knobs making VHF or UHF channel tuning very simple. The VHF cascode turret tuner has 13 positions (one more than the conventional type), 12 being used for VHF reception, (channels 2 to 13), while the 13th or UHF position is used to activate the proper UHF circuits and provides additional amplification for the converted 40 mc UHF signals.

Models 777B, 797B, 797C and 798B incorporating chassis 120204-B and 120205-B are VHF receivers which can, if desired, be easily adapted to UHF by means of interchangeable channel strips or by use of an external converter.


SCHEMATIC DIAGRAM OF VHF TUNER 470712 USED ON UHF-VHF CHASSIS 120179-B, 120203-B


SCHEMATIC DIAGRAM OF TURRET TYPE TUNER USED ON VHF CHASSIS 120204-B, 120205-B

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

EMERSON Television Chassis 120179B, 120203B, 120204B, 120205B, (Continued)

## ALIGNMENT V.H.F.

aligr'ment
o. Equipment Required - A sweep generator, (10 MC. swoep with center frequency of 44 MC . plus all necessary R.F. sweep frequencies as listed in R.F. Table), occurd́te morker generator, ascilloscope and V.T. V.M. are required for alignment. The marker generotor must supply frequencies of $\mathbf{4 . 5}$ MC., 40 to 48 MC. and 50 to 216 MC.
b. Alignment Points - The location of all I.F. transformers, Tuned Circuits, and Irimmers shown in Figure 9.

TVR.F. 8 MIXER ALIGNMENT (V.H.F.)
Comect 3 volt bios battery to both I.F. and R.F. AGC. circuits, positive terminal to chassis, negative terminal to junction of R-19, C-19, C-18. Add o jumper wire from this junction to junction of R-10, R-16, C-8 so that the bios battery is also applied to I.F. AGC.


Figure 5 . GENERATOR CONNECTIONS FOR TELEVISION R.F. CHANNEL ALIGNMENT.

| SWEEP \& MARKER GENERATOR |  | MARKER GEN. <br> FREQ. | OSCILLOSCOPE CONNECT ONS | miscellaneous INSTRUCTIONS | TRIMMER OR SLUG | TYPE OF ADJUSTMENT AND OUTPUT INDICATION |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CONNECTIONS | FREQ. RANGE |  |  |  |  |  |
| Connect as shown in Fig. 5 and adjust sweep controls for width so that complete chonnal response may be observed as shown in Fig. 6 | Channel 12 <br> 207 MC. Center Freq. | 209.75 MC . Sound Corrier <br> 205.25 MC. <br> Pix Corrier | Vert. input of scope through 10K resistor to test point on tuner Fig. 9 Low side to chossis | Set Chonnel Selector to $\$ 12$ <br> NOTE <br> Keep output of R.F. Marker Generator of o level that provides a readable marker but does not distort the curve that is being observed on the scope. | C-2 <br> R.F. Amp. Input Trimmer | Adjust Trimmers C-2, C-5 ond C-6 to obtoin response shown in Fig. 6 <br> IMPORTANT: When adiusting trimmers C-2, C-5 and C-6 it will be noted that the band pass charocteristic con be broadened by socrificing omplitude. It is undesiroble to overly broaden the curve as that would result in o loss of sensitivity. |
|  |  |  |  |  | C-5 <br> R.F. Plate Trimmer |  |
|  |  |  |  |  | c-b <br> Mixer Grid Trimmer |  |
| $\begin{gathered} \text { Some } \\ \text { as } \\ \text { Above } \end{gathered}$ | $\begin{gathered} 113 \\ 213 \mathrm{MC} . \end{gathered}$ | $\begin{array}{r} \text { * } 215.75 \mathrm{MC} . \\ \text { **211.25 MC. } \end{array}$ | $\begin{aligned} & \text { Some } \\ & \text { os } \\ & \text { Above } \end{aligned}$ | Set Channel Selector to 113 (See Nate Above) | The r-f band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers $\mathrm{C}-2, \mathrm{C}-5$ ond $\mathrm{C}-6$. Adjust the $\mathrm{r}-\mathrm{f}$ sweep generotor ond morker generotor for operotion on the other television channels, observing position of bath the sound carrier and picture carrier markers. |  |
|  | $\begin{gathered} 111 \\ 201 \mathrm{MC} . \\ \hline \end{gathered}$ | $\begin{array}{r} \text { * } 203.75 \mathrm{MC} . \\ \text { ** } 199.25 \mathrm{MC} . \\ \hline \end{array}$ |  | Set Chonnel Selector to 11 (See Nate Above) |  |  |  |
|  | $\begin{gathered} 10 \\ 195 \mathrm{MC} . \end{gathered}$ | $\begin{array}{r} \text { } 197.75 \mathrm{MC} . \\ * 193.25 \mathrm{MC} . \\ \hline \end{array}$ |  | Set Channel Selector to $\$ 10$ (See Note Above) |  |  |  |
|  | $\begin{array}{\|c\|} \hline 19 \\ 189 \mathrm{MC} \\ \hline \end{array}$ | $\begin{aligned} & * 191.75 \mathrm{MC} . \\ & =187.25 \mathrm{MC} . \end{aligned}$ |  | Set Chonnel Selector to $\%$ (See Note Above) |  | F-IImamanty nore |
|  | $\begin{array}{\|c\|} \hline 18 \\ 183 \mathrm{MC} \\ \hline \end{array}$ | $\begin{array}{r} \quad 185.75 \mathrm{MC} . \\ -181.25 \mathrm{MC} . \\ \hline \end{array}$ |  | Set Chonnel Selector to 18 (See Note Above) | E. |  |
|  | $\begin{gathered} 17 \\ 177 \mathrm{MC} . \\ \hline \end{gathered}$ | $\begin{array}{r} * 179.75 \mathrm{MC} \\ \times 175.25 \mathrm{MC} \\ \hline \end{array}$ |  | Set Chonnel Selector to 17 (See Note Above) | 倉 |  |
|  | $\begin{aligned} & 16 \\ & 85 \mathrm{MC} . \end{aligned}$ | $\begin{aligned} & \quad 87.75 \mathrm{MC} \\ & * 83.25 \mathrm{MC} . \\ & \hline \end{aligned}$ |  | Set Chonnel Selector to 16 (See Note Above) | $\sum_{n}$ |  |
|  | $\begin{aligned} & 15 \\ & 79 \mathrm{MC} . \end{aligned}$ | $\begin{array}{r} .81 .75 \mathrm{MC} \\ \because \quad 77.25 \mathrm{MC} \\ \hline \end{array}$ |  | Set Chonnel Selector to $\$$ (See Note Above) | E | $\square$ |
|  | $64 \mathrm{MC} .$ | $\begin{aligned} & * 71.75 \mathrm{MC} . \\ & * \quad 67.25 \mathrm{MC} . \end{aligned}$ |  | Set Chonnel Selector to $\$ 4$ (See Note Above) | Figure 6 | - tuner response ourve HOWING BAND-PASS LIMITS. |
|  | $\begin{gathered} 13 \\ 63 \mathrm{MC} . \end{gathered}$ | $\begin{aligned} & * 65.75 \mathrm{MC} \\ & * \quad 61.25 \mathrm{MC} \\ & \hline \end{aligned}$ |  | Set Chonnel Selector to 13 (See Note Above) | The respons the requirer necessary to | for all chonnels should moet with nents of Fig. 6. To do so it may be compromise by slightly changing |
|  | $\begin{aligned} & 12 \\ & 57 \mathrm{MC} . \end{aligned}$ | $\begin{aligned} & +59.75 \mathrm{MC} . \\ & * 55.25 \mathrm{MC} \end{aligned}$ |  | Set Chonnel Selector to $\mathbf{1 2}$ (See Note Above) | the initial $C-5$ and $C$ does not co | channel $1 \mathbf{1 2}$ adjustments of $\mathrm{C}-2$, 6 while switched to channel which form. |

[^3]
## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## EMERSON Television Chassis 120179B, 120203B, 120204B, 120205B Alignment Information, Continued

## I.F. ALIGNMENT

1) Tune receiver to unused Channel 10 or 12.
2) Connect 3 volt bias battery with negative terminal to I.F. AGC. (Junction R-10, C-8, R-16) positive terminal to chassis.
3) Connect D.C. V.T.V.M. to video test point, low side to chassis.
4) Connect terminated marker generator to floating shield of converted tube V-236J6. (Shield raised slightly so that it does not make contact with chassis). Use unmodulated marker. See Fig. 8.

| MARKER GENERATOR | ADJUST | PROCEDURE |
| :---: | :---: | :---: |
| 45.75 MC. Unmodulated | T-4 | Peak for maximum response. Adjust output of signal generator so that maximum response does not produce more than -2V. D.C. on V.T.V.M. |
| 43.2 MC . Unmodulated | T-3 |  |
| 42.0 MC . Unmodulated | T-2 |  |
| 45.0 MC . Unmodulated | $\begin{aligned} & \mathrm{L}-3 \\ & \mathrm{~T}-1 \\ & \hline \end{aligned}$ |  |
| 41.25 MC . Unmodulated | L-2 | Adjust trap for minimum response. Increase output from signal generator so that a true minimum position can be found. |

5) Connect vertical input of an oscilloscope instead of V.T.V.M. to video test point with vertical scope gain set at, or near, maximum. (Horizontal scope sweep set at 400 cycles ).

| MARKER <br> GENERATOR | AD JUST |  |
| :---: | :---: | :--- |
| 47.25 MC. <br> 400 Cycles <br> Amp. Mod. | $\mathrm{L}-1$ | With signal generator set at maximum output, adjust $\mathrm{L}-1$ for minimum vertical re- <br> sponse on scope. |

6) Now that all the I.F. coils and transformers have been set, the overall response can be observed and adjusted if necessary.

| SIGNAL GENERATOR INPUT |  |  | MEASURING INSTRUMENT | ADJUST | PROCEDURE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CONNECTION | FREQUENCY |  |  |  |  |
|  | SWEEP | MARKER |  |  |  |
| Connect terminated sweep and marker as shown in Fig. 8 | Center frequency 44 MC. 10 MC . Sweep | 45.75 MC. | Scope connected to Video Test Point low side to chassis | T-4 | If 45.75 MC. doesn't lie from 60 to $70 \%$ down adjust T-4 (see fig. 7 ) for tolerances. |

Providing overall curve is within tolerances as shown below, no further adjustments are needed. If band width or tilt is not as specified, repeat entire alignment procedure. If still out then a slight retouching is permissible. TRAPS L-1 and L-2 MUST BE ADJUSTED AS INDICATED ABOVE. DO NOT RE-ADJUST WHILE OBSERVING OVERALL I.F. RESPONSE CURVE.
*KEEP OUTPUT OF SIGNAL GENERATOR AS LOW AS POSSIBLE WHEN OBSERVING THE OVERALL I.F. Shape Since tube overload might result and the response will appear incorrectly flat and wide.


NOTE: It may be impossible to observe the 47.25 MC. marker with the average service equipment due to the high attenuation of trap L-I (adjacent sound).

Figure 7. OVERALL I.F. RESPONSE CURVE

## MOST-OF'TEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



Figure 8. CONNECTIONS FOR I.F. ALIGNMENT
All instrument leads should be dressed as shown and kept as short as possible to prevent interaction between inpur and output leads. Failure to do this may result in an unstable response indication.

NOTE: It is important that the output cable of the sweep and marker generator be properly terminated in the ir characteristic impedance which is usually from 50 to 75 ohms. If this termination has not been built into the end of the cable by the instrument manufacturer * then a resistor of the proper value (characteristic impedance) should be connected across the output of each generator cable as shown above.

## EMERSON Television

Chassis 120179B, 120203B, 120204B, 120205B

Alignment Information
(Continued)


FIGURE 8A
*If in doubt check your instruction book which is issued by the test equipment manufacturer.


Figure 9. LOCATION OF ALIGNMENT POINTS (TOP VIEW)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

EMERSON Television Chassis 120179B, 120203B, 120204B, 120205B, (Continued)

## R.F. OSCILLATOR ALIGNMENT (V.H.F.)

1. Connect maker and sweep generator as shown in Figure 5, low side to chassis.
2. Connect scope to junction L-8, R-22, low side to chassis or video test point.
3. Connect 3 volt bias battery as described under R.F. alignment Page 8.
4. Before undertaking oscillator alignment be sure I.F. circuits are correctly aligned for band pass characteristic and trap settings.
5. During oscillator alignment, it is necessary to set the fine tuning control so that the tooth on the fine funing cam points downward. On the 470712 tuner the flat of the fine tuning shaft should point downward with respect to the bottom of the choss is.

[^4]
## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## EMERSON Television Chassis 120179B, 120203B, 120204B, 120205B, Alignment Information, Continued

## SOUND ALIGNMENT

(A) USING 4.5 mc UNMODULATED SIGNAL GENERATOR

1) Short pin \#l of V-3 Chassis with short jumper wire.
2) Keep autput of signal generator low so as to provide a sharp meter indication with adiustment of transformers.
(B) USING TRANSMITTED TV AIR SIGNAL
3) Connect antenna and tune to a good on the air TV station.
4) Adiust fine tuning contral for best picture.
5) Adiust antenna coupling for moderate signal so as to provide a sharp meter indicotion with adiustment af tronsformers.
6) Meter reoding may pulsate due to changes in signal strength; do not confuse with a peak adiustment.

| STEP | SIGNAL GENERATOR INPUT |  | MEASURING INSTRUMENT | ADJUST | PROCEDURE |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | CONNECTION | FREQUENCY |  |  |  |
| 1 | Marker Gen. through . 01 MiF to Pin 7 of V. 4 low side to chassis. <br> - or - <br> Connect antenna and tune in a good transmitted TV. signal (any channel) | $4.5 \mathrm{MC}$ <br> (Unmodulaied) <br> - or - <br> A good on the oir TV. channel | Conntec D.C.V.T.V.M. (negative scale) through 10K Resistor 1o Junction of C. 30 , R-35, R-36 - low side to chossis. | T. 5 <br> Top <br> or <br> Botiom <br> T-6 <br> Top and Bottom | Peak for maximum voltage. Adjust output of signal generator to produce about a one volt D.C. rise on meter (1 volt above noise* voltage) <br> If T.V. signal is used adjust ant. coupling to receiver to produce about the same voltage rise. |
| 2 | Same as above. | Same as above. | Connect V.T.V.M. through 10K Resistor to Junction of R-44, C. 34 - low side to chossis. | T-7 <br> Top and Bottom (Dis. criminator on top) | A) Detune Discriminator secondary T-7 for maximum negative meter reading. <br> B) Adjust primary T-7 for maximum negative mefer reading. <br> C) Readiust Discriminator secondary (towards original sotting) for zero D.C. reading on V.T.Y.M. <br> D) Check Audio, if distarted repeat steps $A-C$. |

* The noise voltage is measured under no signal conditions (antenna terminals shorted directly at tuner by means of a short jumper wire; or disconnect 4.5 MC . generator if procedure ( A ) above is followed.)


### 4.5 MC VIDEO TRAP ALIGNMENT (L-12)

1. Connect crystal controlled 4.5 mc . signal generotor through a .01 mf . condenser to the grid of the video amplifier rube (Pin 1 of $\mathrm{V}-5,6 \mathrm{CB6}$ ) low side to chassis.
2. Set contrast control for maximum contrast (fully clockwise).
3. Connect a V.T.V.M. (D.C. scale) through on R.F. probe to the cathode of the picture tube (Pin ll, yellow lead) low side to chossis.
4. Adjust the 4.5 mc . trop $L-12$ for minimum reading on the V.T.V.M.

If a crystal controlled generator is not available the video trap can be adiusted in the field by setting the fine tuning control for maximum 4.5 mc . in picture and adjusting the 4.5 mc . Prop ( $L-12$ ) until this 4.5 mc . beat note is reduced. Be sure that video ringing is not introduced from this odjustment since this indicotes the trop was aligned at too low a frequency.

## ALIGNMENT (UHF TUNER)

The alignment of the tuner is factory set and will actually not require any odditional adjustments other than to compensate for differences in 656 cascillator tubes. Because of this fact, the only adjustment to be made in the field is trimmer $\mathrm{C}-7$ which is located next to the 6 J 6 oscillator tube. (See Figure 9)

This trimmer is normally set at the factory to track the highest U.H.F. channel (83). This must be done with o U.H.F. sweep and marker generator. In the field however, this equipment is not readily available and C-7 should therefore be used to track the highest U.H.F. channel received in the areo. It is usually best to try a fow 6 J 6 tubes until one is found which more nearly resembles the original, thus requiring only a slight adjustment of $\mathrm{C}-7$.

## MOST－OFTEN－NEEDED 1955 TELEVISION SERVICLING INFORMATION

EMERSON Television Chassis 120179B，120203B，120204B，120205B，（Continued）

## CONDITIONS FOR TAKING VOLTAGE AND RESISTANCE READINGS

The voltage and resistance measurements listed were taken on chassis 120205－B，coded with a triangle．A
Due to component varigtions，voltage and resistance readings may vory slightly from those given here．Slight variations may also be noticed if chassis is not coded as mentioned above．Slight variations may be noticed on chassis 120179－B，120203－B \＆120204－B due to difference in coding for same triangle change．

The deflection yoke and high voltage circuits were connected to take the following readings and waveshapes．
1．Antenna disconnected and antenna terminals shorted on tuner and connected to chassis（use short leads）．
2．Line voltage 117 volts（Disconnect power for resistance readings）．
3． 3 volt bias battery connected to A．G．C．circuit，positive terminal to chassis，negative terminal to junction of R－10，C－8，R－16 BIAS BATTERY USED FOR VOLTAGE READINGS ONLY．
4．All controls in position for normal picture．（Varied when it directly effects reading）．
5．All measurements taken with a vacuum tube voltmeter and ohmmetor．
6．All readings listed in tables were token between points shown and chassis．
7．Resistance readings are given in ohms unless otherwise noted．
8．N．C．denoles no connection．

## WAVE SHAPE ANALYSIS CHART

The waveshopes shown were taken on chassis 120205－B coded triangle．A
Slight peak to peok voltage differences may be noticed on chassis of later triangle codes．
When taking waveshapes on chassis 120179－B，120203－B and 120204－B bear in mind that a slight peak to peak variations are pos－ sible due to differences in chassis coding for the same change．See Production changes on Page 24 for further information．

The peak to peak voltage given may also vary slightly depending on signal strength and component variations．
Ta occurately observe the wove shapes，the relativaly high input capocity of on oscilloscope must be reduced so as not to change the operating characteristics of the television set．
1．Connect antenno ond tune receiver to channel where best reception hos been obtained in the past．
2．Low end of the probe is connected to CHASSIS and the contrast control is set at MAXIMUM CONTRAST．
3．The 30 and 7875 C．P．S．oscilloscope sweep settings are used so as to permit the servicemon to observe two cycles of the wave shape．
NOTE：A wave shape seen in your oscilloscope moy be upside down from some wave shape shown here．This will depend on the number of stages af amplification in the oscilloscope used．

| 3Yumbl | TUGE PIW Mumiens |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | PW 1 | PW 2 | P\％ 3 | P明 4 | PIN 5 | PW 6 | PW 7 | PIN | PM＊ |
| Y． 1 | 1 － | 47 | 0 | 0 | 1\％ | 1\％ | O |  |  |
| － 7 | 14．4．2． | 47 | 0 | 0 | ${ }_{1} 12$ | ${ }^{13}$ | 9 |  |  |
| V 3 | O | 10 | ， 9 | 0 | ${ }^{1}$ 13 | －13 | O |  |  |
| V4 | 泉 | 1 MEG． | ， | 0 | 15\％ | 0 | 4.5 |  |  |
| V． 5 | 1 web． | CONTRAST Ote 1．5x | ． 02 | － | －223 | ${ }^{\text {－13K }}$ | $\begin{aligned} & \text { CONTRAST } \\ & \text { OMISR } \end{aligned}$ |  |  |
|  | T，05 ME． | 0 | 0 | 㗊 | －13 | －13 | 29 |  |  |
| － 7. | 47\％ | 0 | 6 | ．${ }^{1}$ | 1\％ | Lix | 5 |  |  |
| V | 6 | ITM | 6 | ． | － 10 | 0 | IKK |  |  |
| V－9 | 10．4iti | 0 | 0 | m | 1，5meg． | 1.5 Wect， | 2338 |  |  |
| V． 10 | N．C． | ． 04 | ＊16．5K | －16．5K | 470\％ | V．COWTROL． 0 to 210\％ | 0 | 470 |  |
| V．11 | Os\％ | 14．75 | 0 | 9 | 9 | S．N | 231 Heg． | 0 | 0 |
| V－12 | $34 \%$ | 2645 | 100\％ | 0 | 9 | －1\％ | $32 \times$ | 9．7k | 3 |
| V．13 | 2.4 WEC． | ＊37K | 1．2K | $\begin{aligned} & \text { HORIZ. HOLD } \\ & \text { CONTROL } \\ & \text { HON. } 140 \mathrm{~K} \end{aligned}$ | 440\％ | 1.2 K | ． 02 | － |  |
| V． 14 | M．C． | － | 100 | －22x | 474 | 100 | ． 02 | －23K | $\begin{aligned} & \text { PLATE CAP OF } \\ & \text { HCDG } \\ & =j 06 \end{aligned}$ |
| Y． 15 |  |  |  | Pins |  | － 308. |  |  |  |
| v． 16 | ＊32K | N．C． | －32\％ | N．C． | ${ }^{-14}$ | N．C． | ． 05 | 0 | $\begin{aligned} & \text { GUUGGT } \\ & \text { USED } \end{aligned}$ |
| v． 18 | 163K | 2.2 MEG | $\begin{aligned} & \text { FRMNGE } \\ & \text { COMPENSATOR } \\ & \text { OFF IRE } \end{aligned}$ | 0 | 0 | 2.2 MEG． | 470\％ |  | ENT |
| Y－18 | 100K | 143k | 2．2k | VERT．HOLD CONTRA． 829 te t． | vert．size COHTROL 1.3 MEG． 3.2 Heg | 2．2\％ | ． 10 | － |  |
| v－19 | N．C． | 0 | －14．2K | 14．3x | 2.5 MEG． | N．C． | ． 12 | $\begin{aligned} & \text { VERT, LAN. } \\ & \text { CONTR } \\ & 470 \mathrm{aH} \\ & 5.4 \mathrm{~K} \\ & \hline \end{aligned}$ |  |
| $\frac{y}{y-39}$ | N． | $\frac{.145}{14 x}$ | $\text { N. } \mathrm{C}_{2}$ $\mathrm{MC}$ | $-\frac{15}{15}$ | W．6． | 15 | N．C． | $\frac{11}{14}$ |  |


|  | PW 1 | PLI 2 | PIN 10 | PW11 | PIN 12 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| V．24 | 0 | 0 | 820\％ | ERIGHTMESI COWTROL 2200 no 200 To 2now | ．02 |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

# GENERAL (6) ELECTRIC <br> ("F'' SERIES CHASSIS) <br> Models $17 \mathrm{Cl} 27,17 \mathrm{T15}-17,21 \mathrm{Cl14-Cl15-Cl16-Cl17-Cl19}$ 21C120-Cl21, 21T10-T11-T12-T14-T15-T19 

UHF-17T15, UHF-17T17, UHF-17C127, UHF-21C115, UHF-21C116, UHF-21C117, UHF-21C119, UHF-21C120, UHF-21C121, UHF-21T10, UHF-21T11, UHF-21T12, UHF-21T19.

These receivers are 12 -channel models, into some of which the General Electric model UHF-70, UHF-80 or UHF-90 tuner has been installed.

These models are UL listed and incorporate 18 tubes and 4 rectifiers (two power rectifiers and one high-voltage rectifier and a crystal diode). Receivers equipped with a UHF tuner unit contain two additional tubes and one additional crystal diode.
(Service material on pages 57 to 62 .)
HORIZONTAL STASUUZER COIL-The coil, L251, should be adjusted so that the horizontal sync will remain locked over the entire range of the horizontal hold control, R264. Also, the "pull-in" range of sync should be evenly distributed on each end of the horizontal hold control range. This may be checked by switching off and on a station and observing the "pull-in" ability at different settings of the control.

In order to adjust the coil properly follow the given procedure:

1. Remove tube V106. Tune in a very weak television signal.
2. Short circuit terminals of stabilizer coil, L251.
3. Adjust horizontal hold control, R264, to bring received picture closely into sync.
4. Remove short circuit from across terminals of L251.
5. Tune the stabilizer coil to bring picture back into a closely synced condition. The stabilizer coil will tune to two positions which will bring the picture into sync. The correct position is the one with the core almost all the way into the coil.
6. Replace tube V106; check lock-in ability of horizontal sync on available channels.

It is absolutely essential that the stabilizer coil and the horizontal hold control be correctly adjusted, and once adjusted, be left alone.

It should be noted that in some receivers the stabilizer coil has been relocated and is available at the top rear of the chassis.

## To Remove Safety Glass

MODELS 17T15, 21 T10-TII-T12

1. Remove the two buttons holding the corner brackets, see Fig. 10.
2. Unscrew the two screws securing the corner brackets to the cabinet and remove brackets.
3. Tilt top of safety glass away from cabinet and lift glass out of the bottom slots. To replace safety glass, use above order in reverse.


Fig. 10. Darail of Pictur tube Mount (Models 17TI5, 21TIO-TII-TI2)


Chassis and Picture Tube Assembly (External Magnetic Focus)


Chassis and Picture Tube Assembly (Electrostatic Picture Tubo)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICLNG INFORMATION

GENERAL ELECTRIC "F" Series, Continued

## VIDEO I-F ALIGNMENT

The following alignment data is divided into two separate procedures. Because of the large trap attenuation, the conventional method of sweep observation of these traps sometimes becomes difficult. Hence all traps should be pretuned by the application of an amplitude-modulated signal and then adjusted for minimum signal output.

The second portion of this procedure involves the shaping of the i-f response curve in the conventional manner by the application of a sweep generator signal. During this procedure observe the usual precautions regarding warm-up time, equipment cable lead dress and generator output cable termination.


Fig. 20. I-F Sweep Equipment Comeection Diogrom

## TRAP ALIGNMENT

GENERAL:
As noted above, an AM signal is required for trap alignment. In many cases, the technician will have a suitable AM signal generator available. It should cover the range of 40.0 to 48 megacycles at fundamental frequency, with available internal 400 -cycle modulation. When this type of signal is used, the traps should be adjusted for minimum 400 -cycle signal as observed on the oscilloscope.

Users of General Electric sweep alignment equipment may obtain the required amplitude-modulated carrier frequencies by a simple manipulation of the equipment controls

Those technicians who do not have either of the above equipment available are advised to omit the trap alignment procedure. With the exception of the video amplifier 4.5 mc trap L 156 , the traps will not become seriously misaligned due to tube changes. The above-mentioned 4.5 mc trap may be sweep-aligned, if desired, in which case a 4.5 mc sweep signal should be used in step 2, of the alignment chart. The trap may then be tuned to minimum response at 4.5 mc , which should be crystal marker calibrated.

## NOTES:

1. Allow receiver and alignment equipment to warm up for 15 minutes before proceeding.
2. Set channel selector switch to Channel 11 position. Turn the fine-tuning control fully clockwise.
3. Turn the volume control and the area control fully counterclockwise. Turn the picture contrast control fully clockwise.
4. Observe alignment wave forms at test point $V$ (picture tube).
5. Remove V106 and V113 during alignment.


Fig. 33. Datector Network


Fig. 32. Tube and Timmer Location

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

GENERAL ELECTRIC "F" Series
RECEIVER ALIGNMENT (Cont'd)
TRAP ALIGNMENT CHART

| STEP | AM-GENERATOR <br> INPUT POINT | AM-GENERATOR <br> FREQUENCY | ADJUST FOR <br> MINIMUM OUTPUT |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Test Point I |  |  |  |
| (R-F Tuner Unit) |  |  |  |
| See Fig. 28 |  |  |  |

## I-F SYSTEM SWEEP ALIGNMENT

## GENERAL:

After the traps have been set at their proper frequencies the i-f curve may be shaped.

The following procedure requires the use of a simple sweep signal coupling jig as depicted in Fig. 24. This device is made from a tube shield cut in two halves, between which are soldered two 120 -ohm resistors. The shield is placed over the 6 J 6 oscillator converter tube during the i-f alignment and hence provides loose capacitive coupling to the 6 J 6 i -f plate circuit. The resistors perform the dual function of supporting the upper half-shield and terminating the sweep output cable. The generator cable shield should be connected to the lower half shield, and the "signal" lead connected to the upper half-shield.

## NOTES:

1. Turn picture contrast control to minimum.
2. Observe sweep waveform at test point III through a $\mathbf{1 0 , 0 0 0}$ ohm resistor. Oscilloscope should be calibrated so that $3 / 4$-volt signal will provide 2 -inch vertical deflection.
3. Apply a negative 5 -volt battery bias voltage to test point VIII. Connect positive lead of battery to chassis.
4. Note that the following procedure uses 45.0 mc as the $100 \%$ reference point. Maintain the sweep generator output level so that the baseline to 45 mc marker amplitude equals two inches.

## PRE-PEAKING:

Should difficulty be experienced in obtaining the proper video i-f response, the tuning of the individual coils may be checked.

If the coils are each peaked at the below-specified frequencies, an over-all i-f response curve which closely approximates the proper curve will be achieved. After this is done, the sweep method may be used to thus permit proper final curve shaping. This peaking may be done by using an AM signal as prescribed for setting the traps or the sweep method may be used by adjusting the coils for maximum amplitude at the desired marker points.

| PEAKING FREQUENCIES |
| :---: |
| L103- 44.15 mc |
| L152-44.15 mc |
| T153-44.15 mc |
| T151- 45.25 mc |
| T152-42.9 mc |

VIDEO I-F ALIGNMENT CHART

| CONNECT SWEEP GENERATOR | ADJUST | DESIRED RESPONSE | REMARKS |
| :---: | :---: | :---: | :---: |
| Into alignment shield jig and r-f tuner chassis, see Fig. 24 | Peak T153, L103 <br> L152 at 44.15 mc <br> T152 set 42.5 mc @ $55^{c} \%$ <br> T151 set 45.75 mc @ $40 \%$ |  | T153, L103 and L152 should be readjusted slightly, if necessary, to shape peak region of curve as shown. Peak of curve may fall anywhere between the limits of $110 \%$ and $140 \%$ of $45 \mathrm{mc} 100 \%$ reference point. |

## AUDIO I-F ALIGNMENT

notes:

1. Tune in a television signal. This will provide a 4.5 mc signal source for audio i-f alignment. Keep the volume control turned down unless the speaker is connected.
2. Step 3 below requires a meter connection to the electrical midpoint of the ratio detector load circuit. To do this, connect two 100,000 -ohm resistors in series between V118A (6T8) pin 2 and chassis. These two resistors should be chosen, as accurately as possible, for equal resistance.

AUDIO I-F ALIGNMENT CHART

| STEP | CONNECT VTVM OR 20,000 OHMS/VOLTMETER | ADJUST | METER INDICATION | REMARKS |
| :---: | :---: | :---: | :---: | :---: |
| 1 | To Test Point VI and chassis | T301 (top and bottom core*) | Adjust for maximum deflection. | Voltage to be read is negative with respect to chassis. |
| 2 | V118A, pin 2 and chassis | T302 primary (bottom core) |  |  |
| 3 | Between Test Point VII and center of two 100,000 -ohm resistors, see note 2 . | T302 secondary (top core). | Adjust for zero volts d-c output | Repeat steps 1, 2 and 3 to assure proper final adjustment. |

[^5]
## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

GENERAL ELECTRIC "F" Series Circuit Diagram



## MOST-OFTEN-NEEDED 1955 THLEVISION SERVICING INFORMATION

GENERAL ELECTRIC "F" Series
TROUBLE SHOOTING (Cont'd)

| SYMPTOM | CHECK FOR |
| :---: | :---: |
| DEFECTS OF THE SYNC SECTION |  |
| A. Weak or no horizontal sync; vertical sync, picture and sound satisfactory | 1. Sync amplitude at input to discriminator tube, V107B <br> 2. Defective multivibrator components, C260, R263, R264 and R266 <br> 3. Leaky or shorted capacitor, C260 <br> 4. Wave form feedback components, R257, R267, C255, C262 <br> 5. Defective L251 <br> 6. Open C259 or R260 |
| B. Weak or no composite sync, otherwise picture and sound normal | 1. Defective coupling capacitor, C252 or C253 <br> 2. Incorrect value of plate resistor, R255 or R256 <br> 3. Insufficient amplitude of composite signal applied to sync amplifier from video detector; check video detector circuit |
| C. No vertical sync, horizontal sync satisfactory | 1. Sync pulse at input of vert. oscillator, check integrator circuit <br> 2. Vertical oscillator frequency, if far off from 60 cps , check vertical oscillator components such as C207, R204, R209 and R218 <br> 3. Leakage in feedback capacitor, C206 |
| D. Picture displaced to left, right edge wavy | 1. Open or low value of capacitor, C253 |
| E. "Gear Tooth" effect | 1. Open or low value capacity of C258 <br> 2. Open or high resistance of R261 |
| F. Noise "tearing" picture (noise inverter failure) | 1. Low value, R169 <br> 2. Open C167. <br> 3. Open or high value, R167 |
| G. Weak composite sync (attributable to excessive noise inverter clipping) | 1. Low value of R167 <br> 2. Leaky or shorted C167 |

## DEFECTS OF THE HORIZONTAL DEFLECTION CIRCUITS

A. Too great sweep width, reception normal otherwise
B. Inadequate picture width
C. Single vertical line in center, sound normal
D. Poor horizontal linearity

1. Open width control coil (shunt section)
2. Open winding between width coil shunt section taps on horizontal output transformer, T251
3. Correct waveshape and amplitude of input "drive" voltage at grid of V113
4. Leaky capacitor C265
5. Shorted width control L252 shunt section or defective deflection coil, D251
6. Defective output transformer T251 shorted turns or arc-over
7. Low emission of tube, V113, V115
8. Low B+ voltage to tubes V112, V1 13
9. Open horizontal deflection coils, D251
10. Open yoke plug connection
11. Open width coil (series section)
12. Shorted linearity control
13. Defective yoke, D251
14. Defective capacitors C265, C266

## DEFECTS OF THE VERTICAL DEFLECTION CIRCUIT

A. Poor vertical linearity, inadequate height
B. Inadequate picture height
C. No vertical deflection
D. Poor vertical linearity, height satisfactory

1. Low emission of sweep output tube, V111
2. Improper grid input "drive" voltage at V111
3. Defective sweep output transformer, T201
4. Low B+ voltage to sweep output tube V111
5. Low value of cathode capacitor, C401D
6. Rise in resistance value of vert. oscillator plate resistor, R206 or R215
7. Incorrect value of plate voltage on output tube, V111
8. Low value capacitor in cathode of vert. output tube, C401D (This often results in poor linearity)
9. Weak vertical deflection tube, V110 or V111
10. Open vertical deflection coils, D201
11. Defective sweep output transformer, T201
12. Shorted capacitor C205
13. Poor contacts in yoke plug
14. Low value capacitor, C205
15. Vertical output tube, V111


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

GENERAL ELECTRIC "G" Line, Models 17T20, 21C103, 21C104, 21T22 to 21T25


PICTURE TUBE REMOVAL AND INSTALLATION
Details regarding picture tube rods, tube holder, focus unit mounting hardware and ion trap do not apply where internal magnetic focus tubes are used. The shunt focus control and deflection yoke with picture centering assembly are simply withdrawn over the neck of the I.M.F. tube-- the yoke clamp wing nut is loosened to allow removal of the deflection yoke.

## Removal Of Picture Tube

ASSEMBLIES IN PLASTIC CABINET:

1. Remove the chassis.
2. Lay cabinet, face downard, on padded nonscratching surface.
3. Remove ion trap.
4. Remove the two focus unit mounting nuts and slide focus unit off tube neck.
5. Loosen yoke clamp ring wingnut and slide deflection yoke off tube neck.
6. Loosen the four picture tube rod nuts. Remove rods, and picture tube holder with focus unit mount.
7. Remove mounting nuts and washers securing tube harness assembly at the bottom and in the two upper inside corners of the cabinet.
8. Carefully remove tube and harness assembly from cabinet. Lay tube, face downward, on bench.
9. Loosen spade bolt nut and lift tube from harness assembly.

## ASSEMBIIESS IN WOOD CABINET:

1. Use same procedure of steps 1 through 6 described above for tube assemblies in plastic cabinets. Then continue disassembly as follows.
2. Remove Phillips screws at lower corners of picture mask. Move tube and mask slightly toward bottom of cabinet to free mask from cabinet top rail. Remove and place tube, face downward on bench.
3. Loosen spade bolt nut and lift tube from harness strap assembly.
To reinstall a picture tube the applicable (plastic or wood cabinet) tube removal instruction procedures may be applied in reverse.



GENERAL ELECTRIC "J" Line, Models 21C350, 21C351, 21 T 30 , and 21T31


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

GENERAL ELECTRIC "J" Line, Models 21C350, 21C351, 21T30, and 21T31


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

 hallicrafters cocssss becoo| *CHASSIS TYPE NUMBER | MODELS CHASSIS MAY BE USED IN |
| :---: | :--- |
| A1600D | $17 \mathrm{~T} 310 \mathrm{~W}, 17 \mathrm{~T} 310 \mathrm{M}, 17 \mathrm{~T} 310 \mathrm{~B}$ |
| B1600D | $21 \mathrm{~T} 320 \mathrm{~W}, 21 \mathrm{~T} 320 \mathrm{M}, 21 \mathrm{~T} 320 \mathrm{~B}$ |
|  | $21 \mathrm{~K} 330 \mathrm{M}, 21 \mathrm{~K} 330 \mathrm{~B}$ |

The A1600D chassis differs from the B1600D circuit primarily in the deflection circuits. A 6CU6 is used for the horizontal output tube, a different vertical output transformer and deflection yoke are employed and a few components change in value. For full details consult horizontal and vertical output stages on the schematics,


## REMOVAL OF CHASSIS FROM CABINET

The chassis and chassis board are removable as one unit.

1. Remove the control knobs, the cabinet back, the antenna terminal strip, and the wires from the speaker.
2. Remove the two wood screws on the inside rear corners that hold the chassis board to the wood supports on the bottom of each side.
3. Remove the hex head screws and lockwashers that connect the cabinet to the base board along each side from underneath. Also remove the wood screw (two wood screws on 21" models) from the center front.
4. Lift the cabinet up and off the chassis board.
(Continued on the next three pages.)

MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Hallicrafters Inc. Chassis A1600D and B1600D (continued)

LAYOUT OF CHASSIS


Tube and Alignment Locations 17" 16000 Chassis


Tube and Alignment Locations 21" 16000 Chassis


Chassis Series 123, used in Models 78, 78A, 79.
Chassis Series 124, used in Models 81, 82, 83, 84, 85.
Chassis Series 124-2, used in Models 86, 88.

## DEFLECTION YOKE ADJUSTMENT

1. Loosen the wing thumb screw located at the top of the deflection yoke frame.
2. Check to see that the deflection yoke mounting bracket rubber cushions press firmly against the flare of the tube.
3. Press the yoke firmly against the flare of the tube.
4. Rotate the yoke until the lines of the raster are horizontal and squared with the picture mask, and tighten the wing screw.


| Symbol | Tube Type | Pin No. 1 | Pin No. 2 | Pin No. 3 | Pin No. 4 | Pin No. 5 | Pin No. 6 | Pin No. 7 | Pin Mo. 8 | Pin No. 9 | NOTES FOR VOLTAGE CHART |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| V1 | 6BQ7 | 165 | -1 | 0 | 6.3AC | 0 | 265 | 160 | 165 | 0 |  |
| V2 | 616 | 75 | 135 | 6.3VAC | 0 | -3 to -5 | -4 to -9 | 0 | - | - | 1. Tune receiver to unused chan. - no signal applied. |
| V3 | 6CB6 | -1 | . 55 | 0 | 6.3AC | 100 | 100 | 0 | - | - | 2. All front panel controls at maximum clockwise |
| $V_{4}$ | 6CB6 | -1 | . 55 | 0 | 6.3AC | 101 | 101 | 0 | - | - |  |
| V5 | 6AU6 | 0 | 0 | 0 | 6.3AC | 102 | 102 | 1 | - | - | 3. Screwdriver service adjustments - adjusted for |
| V6 | 6AL5 | 0 | $-.75$ | 6.3AC | 0 | 0 | 0 | -. 35 | - | - |  |
| V7 | 12BH7 | 152 | 0 | 0 | 6.3AC | 6.3AC | 57 | -. 35 | 0 | - | 4. Maintain line voltage at 117 volts A.C. |
| V8 | 6AU6 | 0 | 0 | 0 | 6.3AC | 105 | 105 | . 9 | - | - | 5. All voltage measured with V.T.V.M. unless other- |
| V9 | $6 \mathrm{T8}$ | -. 35 | -1.7 | -. 35 | 6.3AC | 0 | 0 | 0 | -. 35 | 40 | wise specified. |
| V10 | $6 \mathrm{K6}$ | NC | 0 | 210 | 219 | 0 | N.C. | 6.3AC | 14 | - | 6. Values shown are D.C. voltages measured from |
| V11 | 6SN7 | 0 | 28 | 2.4 | 28 | 74 | 28 | 6.3AC | 0 | - | socket to ground unless otherwise specified. |
| V12 | $6 \mathrm{C4}$ | 144 | 0 | 0 | 6.3AC | 144 | -34 | 0 | - | - | 7. N.C. designates no connection. |
| V13 | 6V6 | NC | 6.3AC | 275 | 275 | -24 | - | 0 | 5 | - | 8. A dash designates the non existence of socket |
| V14 | 6SN7 | -3.5 | 175 | 12 | -65 | 188 | 0 | 0 | 6.3AC |  | 8. A dash designates the non existence of socket connections. |
| V15 | 6AV5 | -25 | 6.3AC | 0 | - | Do Not Measure | - | 0 | 145 |  | 9. "Local distance" switch in "local" position. |
| V16 | 6W4 | NC | NC | 470 | - | 225 | - | 290 | $\frac{290 \dagger}{6.3 A C} \dagger$ |  | * Use high voltage insulsted probe only. |
| V17 | 183 | 13.5KV* | $13.5 \mathrm{KV} *$ | 13.5KV* | - | 13.5 KV * | - | 13.5KV* | 13.5 KV * |  | Top value is D.C. voltage to ground. Bottom value connect A.C. meter across socket connections 7 |
| V18 | 504 | NC | 310** | NC | 305AC | 290 | 305AC | 290 | 310 |  | and 8. <br> Top value is D.C. voltage to ground. Bottom value |
| V19 | CRT | 0 | 5 | Pin 10 |  | Pin 11 |  | $\frac{\text { Pin } 12}{\text { 6.3AC }}$ |  |  | connect A.C. meter across socket connections 2 and 8. |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TGLEVISION SERVICLNG INFORMATION

Majestic Series 123, 124, 124-2

## Alignment Instructions

## TV I-F ALIGNMENT

1. Tune receiver to quiet portion of TV High Band.
2. Set contrast control fully counterclockwise.
3. Apply 3 v. negative bias between the A.G.C. bus (at C22A) and ground. (Use 2-11/2 v. cells.)
4. Connect TV I-F Signal Generator through a 1500 MMF condenser to Test Point (A) of tuner unit; low side to ground. (See schematic diagram.)
5. Connect negative lead of V.T.V.M. (or meter of 20,000 ohms-per-volt, or better) to 4.7 K diode load resistor TEST POINT (B); positive lead to ground. (See schematic diagram.)
6. Feed $23.2 \mathrm{MC}[23.3]^{*}$ ( $\pm .05 \mathrm{MC}$ ) from Signal Generator, and adjust T4 for maximum deflection on meter. Maintain Signal Generator output so low that meter reads no more than 1.5 volts at peak.
7. Feed 21.8 MC [21.8]* ( $\pm .05 \mathrm{MC}$ ) from Signal Generator, and adjust T3 as above.
8. Feed 24.0 MC [23.9]* ( $\pm .05 \mathrm{MC}$ ) from Signal Generator, and adjust T 2 as above.
9. Feed 24.7 MC [24.5]* ( $\pm .05 \mathrm{MC}$ ) from Signal Generator, and adjust T1 as above.
10. Replace the meter with the vertical input of an Oscilloscope through a 10 K isolating resistor, low side to ground.
11. Remove Signal Generator. Feed a video I-F Sweep Generator ( 20 to 28 MC ) through loosely coupled shield of 6 J 6 converter tube, making sure shield is not grounded. (Refer to Fig. 3.)
12. Loosely couple high side of a TV I-F Marker Generator to the high Sweep Generator Lead; low side to ground.
13. Feed I-F Sweep, and observe response on 'scope. (See Pig. 5.) Use marker frequencies 20.25, 21.75 and 24.75 MC .
14. If response does not approximate that shown in Fig. 5, repeat steps 4 to 9 , making sure that frequencies are precise, and that the Signal Generator ouput voltage is kept low. Continue with steps 10 to 13. A slight touch-up of individual slugs may be required to approximate the rec ommended curve of Fig. 5.
*NOTE: If $3 v$ fixed bias is unavailable and zero fixed bias is used, set signal generator at [] bracketed frequencies values.
IMPORTANT: Keep the sweep generator and marker generator outputs at minimum to avoid curve distortion. Marker pips should be kept barely visible.


Fig. 3. IF ALHONMENT ELOCK DACRAM


## TV SOUND ALIGNMENT

1. Connect a 4.5 MC Signal Generator ( $\pm .01 \mathrm{MC}$ ) through a 1500 MMF condenser to the grid, Pin 7 of V7, 12BH7; low side to ground. See schematic diagram.
2. Obtain two resistors of approximately 100,000 ohms each, whose resistances have been matched accurately with an ohmmeter. Connect them in series across the 18 K resistor (R107) at the 6T8 tube socket (V9A).
3. Connect negative lead of V.T.V.M. to junction of matched resistors of step 2 ; positive lead to ground.
4. Feed 4.5 MC ( $\pm .01 \mathrm{MC}$ ) from signal generator, and adjust L22, sound take-off coil, for maximum deflection on V.T.V.M.
5. Adjust the bottom slug of $\mathbf{T 1 0}$ for maximum deflection on V.T.V.M.
6. Connect positive lead of V.T.V.M. to junction of C98, and R106 TEST POINT (C), leaving negative lead of V.T.V.M. connected as in step 3. See schematic diagram.
7. Adjust top slug of T10 for zero output on V.T.V.M. between two opposite polarity peaks.


F1B. 3. חICOMMENDED merowne CunVIs.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## M

 0 N T G $0 \quad M$ E R W A R
## PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-18 becomes $47 \times 570 \quad 330 \mathrm{mmf}$ molded mica condenser
R-15 becomes 884333 33K ohms 0.5 W carbon resistor
R-18
R-19\} become B83103 10K ohm 0.5 W carbon resistors
In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphaberical identification (A, B, C etc.)

## TELEVISION RECEIVERS

mODELS
WG-3071E\&F
WG-3073E\&F
WG-3075D\&
WG-3077D\&E
WG-3079D\&E

Circuit diagram printed below and on page 78. This division is made to simplify printing and is not an actual physical separation.


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## MONTGOMERY WARD \& CO. <br> (Continued)

Models 35WG-3071E \& $F$, and 35WG-3073E \& $F$ are identical to models 35WG-3071D \& 3073D except for the following changes.

1. The $21^{\prime \prime}$ glass rectangular picture tube (21FP4A) has been replaced with a 21 " metal rectangular picture tube ( 21 MP 4 ).
2. Change in values of a few resistors were made in addition to the picture tube change.

Models WG-3075D \& E, WG-3077D \& E and WG-3079D
\& E are identical to models 25WG-3075C, 25WG-3077C and 25WG-3079C except for the following changes:

1. Beginning with the issue " $D$ " receivers, V-18 6W4GT damper tube was replaced with a 6AX4-GT damper tube.
2. Slight changes in cabinet construction and design were also made on the issue " D " and issue " E " models. This change affects pix crystals, masks, etc.



RECEIVER MODEL BREAKDOWN CHART

| Model | Description | $\mathrm{TV}$ <br> Chassis | Model | Description | TV <br> Chassis |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 21 C 3 | Table, red-brn mahogany: masonite; with detachable console-height legs | TS-528 | 21K23B | Console, limed oak: masonite; with turntable mounted on wooden legs | TS-528 |
| Y 2103 | Table, red-brn mahogany: masonite; with detachable console-height legs | TS-528Y | Y 21 K 23 E | Console, limed oak: masonite; with turntable mounted on wooden legs | TS -528Y |
| 21C3B | Table, limed oak: masonite; with detachable console-height legs | TS-528 | 21 K 24 | Console, white birch: wood; with lift door | TS-528 |
| Y21C3B | Table, limed oak: masonite; with detachable console-height legs | TS-528Y | Y2 1K24 | Console, white birch: wood; with lift door | TS-528Y |
| 21 K 20 | Console, red-brn mahogany: masonite | WTS-525 | 21T18 | Table, red-brn mahogany: masonite | RTS-525 |
| Y 21 K 20 | Console, red-brn mahogany: masonite | WTS-525Y | Y21T18 | Table, red-brn mahogany: masonite | RTS-525Y |
| $21 \mathrm{K20B}$ | Console, limed oak: masonite | WTS-525 | 21T18B | Table, limed oak: masonite | RTS-525 |
| Y $21 \mathrm{K20B}$ | Console, limed oak: masonite | WTS-525Y | Y21718B | Table, limed oak: masonite | RTS-525Y |
| 21 K 21 | Console, red-brn mahogany: masonite | TS-528 | 21719 | Table, red-brn mahogany: masonite | TS-528 |
| Y21K21 | Console, red-brn mahogany: masonite | TS -528Y | Y21T19 | Table, red-brn mahogany: masonite | TS 528 Y |
| 21K21B | Console, limed oak: masonite | TS-528 | 21T19B | Table, limed oak: masonite | TS-528 |
| Y21K21B | Console, limed oak: masonite | TS-528Y | Y21T19B | Table, limed oak: masonite | TS -528Y |
| 21 K 22 | Console, white birch: wood; with | TS-528 | 24 K 4 | Console, red-brn mahogany: masonite | TS -603 |
|  | wrought iron stand |  | Y 24 K 4 | Console, red-brn mahogany: masonite | TS-603Y |
| Y21K22 | Console, white birch: wood; with | TS-528Y | 24K4B | Console, limed oak: masonite | TS -603 |
|  | wrought ir on stand |  | Y24K4B | Console, limed oak: masonite | TS -603Y |
| 21 K 23 | Console, red-brn mahogany: masonite; | TS-528 | 24 K 5 | Console, red-brn mahogany: masonite | TS -603 |
|  | with turntable mounted on wooden legs |  | Y24K5 | Console, red-brn mahogany: masonite | TS -603Y |
| Y21K23 | Console, red-brn mahogany: masonite; | TS -528Y | 24K5B | Console, limed oak: masonite | TS-603 |
|  | with turntable mounted on wooden legs |  | Y 24 K 5 B | Console, limed oak: masonite | TS-603Y |

CRASSIS BREAMDOWN CHART

| Chassis | Picture <br> Tube | VHF <br> Tuner | UHF <br> Tuner | UHF Con- <br> version Kit |
| :--- | :--- | :--- | :--- | :--- |
| RTS-525 | 21YP4A | TT-70Y |  | WTK-35 |
| RTS-525Y | 21YP4A | TT-70Y | WTT-37 | WTK-35 |
| WTS-525 | 21YP4A | TT-70 |  | WTK |
| WTS-525Y | 21YP4A | TT-70Y | WTT-37 | WTK-35 |
| TS-528 | 21ALP4A | TT-70 |  | WTK- |


| Chassis | Picture <br> Tube | VHF <br> Tuner | UHF <br> Tuner | UHF Con- <br> version Kit |
| :--- | :--- | :--- | :--- | :--- |
| TS-528Y | 21ALP4A | TT-70Y | WTT-37 |  |
| TS-603 | 24DP4A | TT-70 |  | WTK-35 |
| TS-603Y | 24DP4A | TT-70Y | WTT-37 |  |

NOTE: For UHF Tuner Service Information refer to separate UHF tuner service manual.
CHASSIS DESCRIPTION

RTS-525 18 circuit tubes, a $21 Y$ P4A rectangular $21^{\prime \prime}$ aluminized picture tube ( $70^{\circ}$ deflection angle) plus a germanium diode detector and selenium rectifiers. A single chassis contains the picture, sound, and scanning circuits plus the filament and " $B$ " supply.

A switch type VHF tuner incorporating a cascode type amplifier is used. Chassis with a "Y" suffix have, in addition, a built-in continuous tuning UHF tuner.

The IF strip consists of three stagger-tuned, transformer coupled,stages while the sound system uses a ratio detector and limiter driven by one stage of IF amplification.

The video circuit uses direct coupling and provides full DC restoration. A keyed, delayed AGC circuit is used.

The heater voltage, for all tubes except the high voltage rectifier, is supplied by a filament transformer. The selenium rectifiers, operating as full-wave doublers, supply the low voltage " $B$ " supplies.

WTS-525 Same as RTS-525 except picture tube is mounted with a 5 degree tilt.

TS-528 Same as RTS-525except for 2lALP4A, a 2l" aluminized rectangular ( $90^{\circ}$ deflection angle) picture tube. The vertical and horizontal output and damping diode tubes are also different types. An external horizontal centering control has been added to rear panel.

TS-603 Same as TS-528 except for 24DP4A, a 24" aluminized rectangular ( $90^{\circ}$ deflection angle) picture tube.
(Continued on the next five pages)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Alignment Information for Motorola TS-525, TS-528, and TS-603 Series


FIGURE 8. TUBE LOCATIONS \& IF ALIGNMENT DETAIL

IF AND MIXER ALIGNMENT

1. Remove horizontal output tube ( $\mathrm{V}-16$ ) to eliminate RF interference. Connect a 2500 ohm 10 watt resistor from chas sis ground to B++ ( 250 V bus) to normalize voltages.
2. Remove antenna and make following connections: (See Figure 8).
a. Connect a 6 volt battery between pin 1 (LF AGC bus) of service test receptacle and ground. Positive side of battery goes to ground.
b. Disable tuner oscillator by grounding pin 9 of V-2 (6U8) and turn channel selector to channel 13.
c. Connect sweep generator to IF test receptacle and oscilloscope to detector load resistor (pin 3 of service test receptacle).
3. Center sweep frequency at 44 Mc with a sweep width of 10 Mc and adjust generator output below point of receiver limiting (approximately 3 volts peak-to-peak at deiector load).
4. 

| Adjust | At Marker Freq. | For |
| :---: | :---: | :---: |
| T-5 top | 41.25 Mc | Minimum, See Figure 8 |
| T-6 top | 47.25 Mc | Minimum, See Figure 8 |
| T-5 bot | 42.25 Mc | Marker at Droper point, <br> See Figure 8 |
| T-6 bot | 45.75 Mc | Marker at proper point, <br> See Figure 8 |
| T-7 bot | top of curve | Flat top, See Figure 8 |

As some adjustments interact, repeat as necessary to obtain proper curve.
5. Move generator to mixer test receptacle and short across R-10 (4.7K ohms). See Figure 9 for R-10 location.

| L-19\& | $42.25-$ |  |
| :---: | :---: | :--- |
| L-25 | 45.75 Mc | Proper curve, See Figure 8 <br> If desired overall response <br> cannot be obtained, check | cannot be obtained, check dressing of bypass capacitors, especially the acreen bypasaing of the lst \& 2nd IF tubes. These lead lengths are critical and should be kept short and dressed to obtain proper response.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## MOTOROLA TS-525, TS-528, TS-603, Alignment and Service Data, Continued

## CHECKS

Bandwi.fth may be determined by noting the frequencies at which the markers fall at the $50 \%$ points. Mixer and IF bandwidth over 3.7 Mc may cause sound bars or burble in the picture; if less than 3 Mc , a loss of resolution or fine detail in the picture may be noticed.
6. Decrease generator signal until there is a marked decrease in the oscilloscope waveform. Unwanted regeneration will be indicated by sharp peaks on the overall response curve. If regeneration is present, check IF cathode resistors, screen bypass capacitors, and lead dress. Improper alignment may also cause regeneration.

## AUDIO ALIGNMENT

This alignment may be made by injecting an accurate 4.5 Mc signal in at the video amplifier grid. However, the station alignment method which follows is much more accurate and should be used whenever possible.

1. With receiver in operating condition, tune in station.
2. Connec: VTVM from positive terminal of electrolytic capacitor C-50B to ground.
3. Maintain 5 volts, or less, at VTVM by adjustment of fine tuning and contrast control (or by removal of antenna, if necessary) while peaking $T-8$ primary (top) and $\mathbb{L}-38$ \& L-39 for maximum output. (See Figure 8.)
4. Tune for normal picture and carefully note voltage developed at the positive terminal of $\mathrm{C}-50 \mathrm{~B}$.
5. Move meter to junction of $R-54$ \& $R-56$ (dummy pin on V-9 socket, marked " X " in Figure 8).
6. Adjust $T-8$ secondary (bottom) to give a reading on the VTVM of ezactly one-half of reading in step 4.

### 4.5 MC TRAP ADJUSTMENT

Tune receiver to a local station and adjust 4.5 Mc trap L- 34 for minimum beat interference in the picture by locating the two points of adjustment at which the beat is just noticeable. Rotate the core toward the center of these two points. Use the minimum amount of inductance (core out of coil) that will result in no apparent beat interference.

## HORIZONTAL HOLD ADJUSTEENT

The HORIZONTAL HOLD control should have async range of approximately $20^{\circ}$. If the control is too critical. adjust as follows:

1. Shunt the HORIZONTAL OSCILLATOR coil I.-40 to ground with a .25 mf 400 V capacitor. This may be done with the chassis in the cabinet by placing the capacitor across the two-pin HORIZONTAL OSCILLATOR TEST RECEPTACLE.

Increase brightnesa.
2. With the HORIZONTAL SIZE control, reduce the picture size so that the right edge of the raster can be seen as viewed frcm the front of the set. Adjust the HORIZONTAL HOLD cortrol for about $1 / 16^{\prime \prime}$ of sync pulse. (The sync pulse appears as a darker gray bar at the right edge of the blanking fulse. The blanking pulse is the gray bar at the right edge of the raster.
3. Remove the .25 mf capacitor from across the HORIZONTAL OSCILLATOR coil.
4. Adjust the HORIZONTAL OSCILLATOR coll until the same amount of sync pulse can be seen as was noted in step 2.

If the deflection yoke shifts, the picture will be tilted. To correct, loosen the thumbscrew on top of the deflection yoke and rotate yoke until the picture is straight. Before tightening the thumbscrew, make certain that the deflection yoke is as far forward as possible.

## ION TRAP ADJUSTMENT

1. Turn on the receiver and set brightness control at midrange.
2. Rotate the ion trap from left to right, and position back and forth until the brightest raster is obtained.
3. Adjust for proper screen coverage regarding size, contering, tilt and shadow.
4. Readjust ion trap for maximum brightness with contrast control set for maximum usable contrast and brightness control set for proper black background in plcture.

NOTE: The ion trap should be of the proper magnetic strength, so that the ion trapmagnet does not touch the base of the picture tube, or be positioned forward of the slash in the gun structure at proper setting. If either of these conditions exist, full brightness may not be obtained, and the Hfe of the picture tube may be shortened if the ion trap is not replaced with one of correct strength.

## PRODUCTION CHANGES

The first production chassis number carries the suffix "A-00" (i.e., TS-525A-00). With the first minor electrical revision, the suffix becomes "A-01" and with each subsequent minor change 'A-02", "A-03', etc. The first major revision changes the suffix to " $\mathrm{B}-00$ " and, as before, each following minor change is labeled " $\mathrm{B}-01$ ", etc.

Mechanical differences between chassis are indicated by addition of a prefix to the basic chassis (i.e., RTS-525A-00). These prefixes may be assigned in random sequence but will be confined to the end of the alphabet to avoid confusion with the $A, B, C$, etc., electrical change suffixes.

A "Y" suffix added to basic chassis (i.e., TS-525YA-00, etc.) indicates that the chassis contains a factory-installed UHF tuner.

| Chassis <br> Coding | Changes |
| :--- | :---: |

(TS-525 Series Only)
A-01 $\mid$ Toimprove the F response $\mathrm{C}-38(470 \mathrm{mmf})$ changed to $.001 \mathrm{mf} ; \mathrm{C}-40(560 \mathrm{mmf})$ moved to a diract chas sis ground.

A-02 To aid the magnetic centering device in horizontal centering and reduce neck shadows, a non-adjustable horizontal centering circuit is added as follows:

1. C- $106(.1 \mathrm{mf})$ replaced with linearity coil L-44 to provide a DC path through the horizontal deflec tion yoke.
2. Connection between lugs 4 and 5 of the horizontal output transformer ( $T$-13) removed and an 18 ohm resistor inserted between lugs 4 and 5 to force current through yoke.
3. Leads of L-41 (RF choke) and R-83 (150K resistor) connect to lug 4 of the output transformer; the lead of L-44 connects to lug 5 .

A-03 R-66(4.7Mgrid to ground resistor of 1 st sync separator) changed to 1.5 M and ground end re-connected to cathode (pin 3) of V-13 to improve sync range at high contrast levels.

TROUBLE-FINDING CHART for Motorola TS-525, TS-528, and TS-603.

| SYMPTOM | CONTROLS | CHECK OR ADJUST | TUBES | MISCELLANEOUS CHECKS |
| :---: | :---: | :---: | :---: | :---: |
| SET DEAD (tubes not lighting) | Off-On volume | Is set plugged in? is back cover on? Is AC line voltage available at outlet? (Check with lamp) |  | Filament fuse F-1 |
| (tubes are lit) |  | Power fuse, R-64. Is speaker plugged in? Replace any tubes that do not light. | V-11 |  |
| NORMAL RASTER <br> NO PICTURE. <br> NO SOUND | Channel selector (on station?) | Antenna connections, Is station on air? | $\begin{aligned} & V-1,2,3,4,5 \\ & 11 \& 12 \end{aligned}$ | $B+$ voltage. Video detector, CR-1. AGC voltage. RF, IF or mixer stages. |
| WEAK PICTURE (insufficient contrast) | Contrast. Fine tuning. Channel selector on correct channel? | Antenna connections | $\begin{aligned} & V-1,2,3,4,5, \\ & 6 \& 12 \end{aligned}$ | AGC voltage. Contrast control. RF, IF, mixer \& AGC stages |
| LOW BRIGHTNESS OR NO RASTER | Brightness. | Ion trap magnet | $\begin{aligned} & V-15,16,17,18, \\ & 19 \& 11 \end{aligned}$ | High voltage at picture tube anode. Drịe voltage, pin $5 \mathrm{~V}-16$. Bootstrap voltage. $B+, B++$ and CRT voltages. Solder connections, base of CRT. Voltages \& waveforms in V-15 \& V-16 circuits. Horizontal output transformer \& deflection yoke. |
| POOR VERTICAL LINEARITY AND/OR SIZE.HORIZ. WHITE LINE. (no vert. sweep) | Vertical size. Vert lin. Reduce brightness \& return to normal when trouble is cleared. |  | V-14. | Bootstrap voltage. Voltages in V-14 circuit. Electrolytics, C-99 \& C-74C. Vertical output transformer \& deflection yoke. |
| VERTICAL INSTABILITY, PICTURE ROLLS | Vertical hold |  | V-13, 14 | AGC voltage, Voltages in V-13 \& V-14A circuit. <br> Interference. Sync clipping at video amplifier. Refer to tests under WEAK PICTURE. Abnormal power supply ripple. Insufficient bootstrap filter ing. Video detector. |
| BUZZ IN SOUND | Fine tuning contrast | Excessive signal | $\begin{aligned} & v-7,8,9,10 \& \\ & 11 \end{aligned}$ | Ratio det. alignment. Sync clipping in video section. Improper AGC action. <br> Power aupply filter \& sweep circult bypase capacitors. Heater -cathode shorts in nound tubes. |
| EXCESSIVE CONTRAST, NEGATIVE PICTURE | Contrast |  | $\begin{aligned} & V=1,2,3,4,5, \\ & 6 \& 12 \end{aligned}$ | AGC voltage and AGC circult. Video det. Video det. load resiator. Leakage between prim. \& sec. in video $[F$ colls. Proper pulse from horiz. output to AGC tube. Pulse coupling capacitor to AGC tube C-107 |
| WDE HORI2. BAR OR GRADUATION IN SHADING VERTICALLY (Sat may have poor vert. syac) |  |  | $\begin{aligned} & v-1,2,3,4,5, \\ & \& 6 \end{aligned}$ | Heater-cathodo short in any video circuit. Exces. sive power aupply ripple (may have hum in audio). Selenium rectifiora. <br> Heater-cathode.ghort in V-10A (loud hum in audio). Picture tabe. |



CHASSIS TS-418 \& 518 SERIES

TV CHASSIS - Chassis WTS -518 contains 16 circuit tubes plus a $21 Y P 4$ 21" glass, rectangular, spherical face, electrostatically focused picture tube. The picture, sound, and scanning circuits, together with a selenium rectifier halfwave doubler "B" supply, are contained on a single chassis. A series heater cireuit is used. The 300 ohm input impedance is matched to the 75 ohm TT-69 tuner impedance by use of a balun line. Field installation of UHF convertor in this chassis is not recommended.

The suffix "Y"indicates that the TV chassis has a built-in VTT -50MA UHF tuner and uses a WTT-24AY VHF tuner.

TS-418 - Same as WTS-518 except uses a 17HP4B aluminized picture tube. The picture tube mounting perts are changed to accommodate smaller tube.

VTS-418 - Same as TS-4 18 except uses a 17 HP 4 non-alumimized picture tube.

VTS-518 - Same as WTS-518 except for 21YP4A aluminized picture tube.

## ALIGNMENT

## NOTES: IMPORTANT

NEVER GROUND THE RECEIVER CHASSIS DURING TESTING OPERATIONS OR INSTALLATION UNLESS AN ISOLATION TRANSFORMER IS USED.

At all times, keep the marker generator output low enough to prevent the marker from distorting the response curve.

Some coils resonate at two settings of the core, the correct setting is at the outer end of the winding.

For complete receiver alignment, use the following procedure in sequence. Line voltage must be 117 volts $A C$; if not, adjust with variac.

## IF AND MIXER ALIGNMENT

1. Remove horizontal output tube ( $V-15$ ) to eliminate RF interference. Complete filament circuit with a 25BQb tube or other type with similar filament characteristics and base connections, with all pins clipped off except heaters.
2. Remove antenna and make following connections: (See Figure 4).
a. Connect a 3 volt battery to pin 1 (AGC bus) of service test receptacle.

RECEIVER MODEL BREAKDOWN CHART

| Model | Deacription | TV Chassis |
| :--- | :--- | :--- |
| $17 T 20$ | Table, mahogany-metal | TS-418 |
| Y17T20 | Table, mahogany-metal | TS-418Y |
| 17T20B | Table, beige-metal | VTS-418 |
| Y17T20B | Table, beige-metal | VTS-418Y |
| 17T20E | Table, ebony-metal | VTS-418 |
| Y17T20E | Table, ebony-metal | VTS-418Y |
| 17T20M | Table, maroon-metal | VTS-418 |
| Y17T20M | Table, maroon-metal | VTS-418Y |
| 21T16 | Table, mahogany-metal | WTS-518 |
| Y21T16 | Table, mahogany-metal | WTS-518Y |
| 21T16B | Table, beige-metal | WTS-518 |
| Y21T16B | Table, beige-metal | WTS-518Y |
| 21T16E | Table, ebony-metal | WTS-518 |
| Y21T16E | Table, ebony-metal | WTS-518Y |
| 21T17 | Table, mahogany-masonite | VTS-518 |
| Y21T17 | Table, mahogany-masonite | VTS-518Y |
| 21T17B | Table, limed oak-masonite | VTS-518 |
| Y21T17B | Table, limed oak-masonite | VTS-518Y |
| 21K19 | Console, mahogany-masonite | WTS-518 |
| Y21K19 | Console, mahogany-masonite | WTS-518Y |
| 21K19B | Console, limed oak-masonite | WTS-518 |
| Y21K19B | Console, limed oak-masonite | WTS-518Y |
| 21T15 | Table, maroon | WTS-518 |
| Y21T15 | Table, maroon |  |

b. Disable tuner oscillator by grounding pin 9 of $\mathrm{V}-2$ (6UB).
c. Connect sweep generator to IF test receptacle, and oscilloscope to video detector load.
3. Center sweep generator frequency at 24.6 Mc with a sweep width of 10 Mc and adjust generator output below point of receiver limiting (approximately 3 volts peak-topeak at video detector load).

| 4. Adjust | At Marker Freq |  |
| :---: | :---: | :---: |
| L-12 | 21.9 Mc | min output (See IF response curve -Figure 4) |
| T-4 | 26.6 Mc | $\begin{aligned} & \text { 26.6 Mc marker (See IF re- } \\ & \text { sponse curve - Figure 4) } \end{aligned}$ |
| T-6 | at top of curve | flat response (See IF response curve -Figure 4) |
| T-5 | 22.9 Mc | $\begin{aligned} & \text { 22.9 Mc marker (See IF re- } \\ & \text { sponse curve -Figure 4) } \\ & \hline \end{aligned}$ |
| T-6 | at top of curve | flat response (See IF response -Figure 4) |
| As some adjustments interact, repeat as necessary to obtain proper curve. (Move generator to mixer test receptacle and short across R-11 ( 4700 ohms). |  |  |
| $\begin{gathered} \mathrm{T}-3 \mathrm{~A} \\ \& \mathrm{~B} \end{gathered}$ | 26.4 \& 22.9 Mc | See mixer response curve -Figure 4. As adjustments interact, adjustsimultaneously. |

NOTE: If desired response cannot be obtained, recheck tuning of 21.9 Mc trap (L-12). Accuracy of this adjustment is important
(Alignment continued on the page after the double-page circuit.)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

MOTOROLA TS-418 and TS-518B-00 Series


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## MOTOROLA TS-418 and TS-518 Series, Alignment Information Continued

Bandwidth may be determined by noting the frequencies at which the markers fall at the $50 \%$ points. Mixer and IF bandwidth over 3.5 Mc may cause loss of picture quality, and less than 3.2 Mc , a loss of audio.
5. Remove AGC bias battery, BANDWIDTH SHOULD NOT CHANGE OVER . 2 Mc .
6. Decrease generator signal until there is a marked decrease in the oscilloscope waveform. Unwanted regenerationwill be indicated by sharp peaks on the overall response curve.

## AUDIO ALIGNMENT

This alignment may be made by injecting an accurate 4.5 Mc signal at the video amplifier grid; however, the station alignment method is much more accurate and should be used whenever possible. Station alignment method follows:

1. With receiver in good operating condition, tune in station.
2. Connect VTVM from positive terminal of C-54, electrolytic capacitor to ground.
3. Maintain 5 volts, or less, at VTVM by adjustment of fine tuning and contrast control (or by removal of antenna, if necessary) while peaking L-20 and T-7 primary (top) for maximum output.
4. Move VTVM connection to junction of $\mathbf{C}-2$ ( 1000 mmf ) and $R-45(33 \mathrm{~K})$. Set fine tuning for normal picture.
5. Adjust T-7 secondary (bottom) for zero reading on VTVM.
6. Recheck as in steps 2 and 3 and, if necessary, readjust primary of T-7.

### 4.5 MC TRAP ADJUSTMENT

Tune receiver to a local station and adjust 4.5 Mc trap (L-17) for minimum beat interference in picture by locating the two points of adjustment at which the beat is first noticeable, and rotating core to the center of these two points. Use the minimum amount of inductance (core out of coil) that will result in no apparent beat interference.

If astationsignal is not present, use the following meth od, which requires proper alignment of the audio system.

1. Tune the receiver to a low noise, unused channel.
2. Connect AM signal generator to picture tube cathode lead (yellow) thru a 5000 mmf capacitor. Connect ground lead to chassis.
3. Set generator to $\mathbf{4 . 5} \mathbf{~ M c}$.
4. Move VTVM to positive terminal of C-54capacitor, with ground lead to chassis.
5. Adjust 4.5 Mc trap (L-17) for minimum VTVM reading. (Generator output should be adjusted for 5 volts at VTVM.)


TUBE LOCATIONS \& IF ALIGNMENT DETAIL


#### Abstract

These models are nineteen tube direct viewing television receivers differing only in type of cabinet, size of speaker and their use in conjunction with a radio receiver and automatic record changer in the combination models. A $17^{\prime \prime}$ electrostatically focused rectangular tube ( 17 HP 4 ) is used in the $17^{\prime \prime}$ models and a $21^{\prime \prime}$ magnetically focused and rectangular tube $\left\{\begin{array}{l}2 I Z P 4 B \\ 2 I Z P 4 A\end{array}\right\}$ is used in the $21^{\prime \prime}$ models. Replacement, in all cases, must be of the identical size and type.


## DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask. Loosen the deflection yoke adjustment screw and rotate the deflection yoke until this condition is obtained, and retighten the yoke adjustment screw. If neck shadow is evident or the corners of the raster are dark, the deflection yoke must be moved forward as far as possible and the wing screw retightened.


## CENTERING MAGNET ADJUSTMENT

(17"-'"R" ONLY)

The 21 " receivers are electromagnetically focused and centering is accomplished by adjusting an arm which extends vertically from the front of the focus coil. This arm may be rotated, for a limited distance, around the neck of the tube and may also be moved up and down. The physical setting of the focus coil itself in relation to the neck of the tube will also affect picture position.

## IF ALIGNMENT PROCEDURE

## ORDER OF ALIGNMENT

When complete receiver alignment is necessary, it should be performed in the following sequence:
(1) Accompanying Sound Trap
(2) Adjacent Sound Trap
(3) Pix IF Coils
(4) 4.5 MC Trap
(5) 4.5 MC Sound IF and Ratio Detector

After removing chassis from cabinet re-connect power and speaker plugs.

If a local station is not operating on Channel 9 set the tuner to this channel, turn on power switch and proceed as follows: (If 9 is a local station, use Channel 8 or 10.$)$

CENTERING ADJUSTMENT (21" - S-U — ONLY)
The $21^{\prime \prime}$ receivers are magnetically focused and centering is accomplished by adjusting an arm which extends vertically from the front of the focus magnet. This arm may be rotated for a limited distance, around the neck of the tube and may also be moved up and down. The physical setting of the focus coil itself in relation to the neck of the tube will also affect picture position. Before the adjustment arm is used, it should be ascertained that (1) the focus magnet is at right angles to the neck of the tube (by setting the two nuts which tighten the tube support rods) and (2) that the neck of the tube is directly centered in the focus magnet (by loosening the two mounting screws on either side of the focus coil and sliding up or down).

## HORIZONTAL WIDTH \& DRIVE ADJUSTMENT

The Horizontal Drive Trimmer should be screwed tight (clockwise) and then backed off (counter-clockwise) until Horizontal Drive bars appear. Then turn Drive Trimmer in again (clockwise) until drive bars, just disappear. (Note: In some sets no horizontal drive bars will appear regardless of Drive Trimmer adjustment. In these sets the trimmer should be set for proper width.

Important: The horizontal oscillator frequency must be checked for proper range of horizontal control after any adjustment of horizontal drive (C67). Any adjustment of C67 will usually require resetting of the horizontal frequency adjustment coil (L-16).

## (Continued on page 92)

## ACCOMPANYING AND ADJACENT SOUND TRAPS

Insert a 100,000 ohm $1 / 2$ watt resistor in series with the "Hot Lead" of the electronic voltmeter and connect to the junction of LI2 and C25. Meter switch should be set to the lowest negative scale. Ground lead of meter should be connected to chassis.

Remove the shield of the RF Oscillator and Mixer tube (V2) from ground clips leaving shield resting on tube and connect hot lead of the RF Signal Generator to it. This will couple generator output to mixer plate.

Set the generator frequency accurately to 21.75 MC , and adjust (L9) sound trap (See Fig. 6 Tube and Trimmer Layout) for minimum reading on voltmeter.

Set the generator frequency accurately to 27.75 MC and adjust (L6) Adjacent Sound Trap for minimum reading on voltmeter.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## ADJUSTMENT OF HORIZONTAL OSCILLATOR

(I) Allow set to warm up to operating temperature Select station operating normally.
(2) Short out horizontal Phasing Coil (L. 17) Terminals C and D.
(3) Set horizontal hold control at maximum clock-wise rotation.
(4) Adjust horizontal frequency screw ( L (6) until picture falls into sync. Turning the horizontal frequincy screw (L 16) clockwise lowers the frequency, (bars sloping downward to left). Turning the screw counter-clockwise increases frequency (bars sloping downward to right).
(5) Connect vertical input lead of oscilloscope with 5 MMF isolating condenser in series to terminal " C " of horizontal oscillator transformer and ground oscilloscope to chassis. Set frequency of scope to approximately 5 KC .
(6) Remove short from terminals of the horizontal phasing coil (L 17) and adjust screw (L 17) until wave shape as observed on scope is like that shown in sketch. (See Fig. 3.)
(7) Some further adjustment of horizontal frequency screw (L 16) may be necessary to keep picture in sync after adjusting L 17 for proper wave shape.
(8) Remove scope from terminal " C " and retouch L 16, as per " 9 " below.
(9) Turn horizontal hold control through entire range. Picture should fall out of sync at either end of rotation. At full clockwise rotation blanking bar or jitter should be evident. At full counter-clockwise position picture should fall out to $41 / 2$ to 5 bars sloping downward to the left. (If picture stays in sync the tuner switch should be rotated to interrupt signal momentarily)

## ADJUST FOR EQUAL PEAKS <br>  <br> (II)


(지)


Tenno mom. os c. tame

 (RESSTTORS) RII Wm 10 KO, R30 was 47 K
 RIB WAS 22 KO Rm. FUSE ms $1 / 4$ AMP.
 COIL AND R29 RESISTOR. (CONDENSERS) CS E
 (RESISTORS) RTE WAS $82 K \Omega \neq 5 \%$ IN;
R79 WAS $47 K \Omega$ WW.; +450 V LIE IN HORT
CSC WAS +380 V .


Notes:

1. A4






ONLY

## OLYMPIC CHASSIS <br> 






## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## OLYMPIC RADIO \& TELEVISION

Chassis R, S, and U

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## VOLTMETER AND CRYSTAL DIODE CONNECTIONS

Olympic Chassis R, S, and U (Continued)


STANDARD RESPONSE CURVE
FIG. 4

## PIX IF COIL ADJUSTMENT

Adjust the following slugs for maximum output at frequencies and sequence indicated with meter and generator connected as above: (See Sound Traps above).


Note: After setting L5 DO NOT readjust to improve wave shape.

If oscillation occurs during alignment, temporarily raise frequency of L8 by turning screw counter-clockwise until screw projects approximately $3 / 4^{\prime \prime}$. Oscillation is evidenced by high reading on voltmeter ( -5 V to -20 V ) with signal generator OFF and no signal coming in through the antenna terminals. After properly adjusting L301, L5 and L7 reset L8 to proper frequency, if it had been necessary to detune.

Connect hot lead of sweep generator through a 330 uuf condenser to test.point on tuner and connect ground lead to chassis.

Connect vertical input terminal of oscilloscope to junction of peaking coil LI2 and C25 and connect ground lead of scope to chassis.

Connect I.5 V flashlight battery with positive terminal to chassis and negative terminal to junction of R13 and C21. This point is AGC bias voltage. Set tuner to Channel 9 unless local station is operating on this frequency, in which case an adjacent channel should be used.

Set Sweep Generator trequency to IF sweep on the 20 to 30 MC range.

Adjust sweep generator output to produce a curve on the scope which is approximately $2 / 3$ of the screen diameter.

Loosely couple output of RF signal generator by using shield on V2 and set frequency of RF signal generator to 26.25 MC (marker).

Curve shown on scope should be similar to the response curve shown in Figure 4. For proper setting of the pix carrier the 26.25 MC marker should appear on the curve at a point approximately $50 \%$ of the vertical height of the curve.

To obtain this setting retouch L8.

Reset RF signal generator frequency to 23.0 MC and retouch L301 and L7 for correct positioning of marker on curve.

Recheck setting of 26.25 MC marker to make sure that position has not shifted on curve.

Disconnect bias battery.
Note: If the curve cannot be made to appear as above due to a local station or other interference, or if multiple markers appear, remove (VI - 6BZ7 or $6 B Q 7$ ) RF tube from tuner.

## TRAP ALIGNMENT

Connect voltmeter lead to Diode crystal rectifier as shown in Fig. 5. Connect Diode crystal rectifier between C.R. Tube Cathode lead (yellow wire) and chassis ground. Signal generator is connected at junction of L12 and C33. Set contrast control at maximum and voltmeter to 3 volt scale (negative). Remove 6CB6 (V9) from socket. Use maximum output of generator at 4.5 MC. Adjust LI, top of TR-3386 for minimum reading on meter.

When it is necessary to retouch this trap in the field, proper adjustment can be made by using the local station signal and turning the Fine Tuning Control to bring fine herringbone sound beat into the picture. The 4.5 MC trap (LI) should then be adjusted to minimize this beat interference.

## SOUND IF TRANSFORMER, ( 4.5 MC ) AND RATIO DETECTOR ADJUSTMENT

In view of the fact that the transmitted sound signal from a TV station is probably the most accurate available, as far as frequency is concerned, it is recommended that a working signal be used for sound alignment. The set should be connected to an antenna. turned on, allowed to warm up for about 5 to 10 minutes and then tuned for the best picture. A vacuum tube voltmeter should be connected to Pin 2-V4 and the meter set to the minus 30 volt scale. The bottom of the 4.5 MC Sound IF Transformer (L2) and the primary of the Ratio Detector (L4 - bottom of the chassis) should be tuned for maximum deflection of the meter. The vacuum tube voltmeter should then be connected to the junction of R7 and Cb and one side of the volume control and the secondary of the Ratio Detector (L3 - top adjustment/ should be adjusted for a zero reading with the meter set to the 3 volt scale. The secondary can also be adjusted by ear tuning L3 for the elimination of buzz in the sound.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## Pachard-Bell

The Packard-Bell television receivers described in this manual incorporate either chassis type 2740 or $2940-1$. The television portion is identical on each, but the 2940-1 chassis includes a two tube standard broadcast tuner. All models use a 21 insh rectangular electrostatic focus picture tube.

The following table indicates the type chassis and TV tuner used in the respective models.

|  | VHF <br> Tuner <br> $(10534 A)$ | VHF/UHF <br> Tuner <br> $(10535 \mathrm{C})$ | Chassis <br> Type |
| :--- | :---: | :---: | :---: |
| Model | 2742 | 2842 | 2740 |
| Model | 2743 | 2843 | 2740 |
| Model | 2744 | 2844 | 2740 |
| Model | 2941 | 3041 | $2940-1$ |

## PRODUCTION MODIFICATIONS:

The following modifications were made after production of the receiver had begun and are listed to point out variations in production from the schematics shown in this manual. The reason for the change is shown in capital letters.
A. INCREASE TONE CONTROL RANGE. In early production of chassis 2740 , capacitor $\mathrm{C}-11$ was .005 mfd . Its value was changed to .01 mfd . This is the series capacitor in the tone control section.
B. INCREASE AUDIO OUTPUT. Ratio detector transformer 29068 was replaced by ratio detector transformer 29054. In connec-ion with this change, R-7 was changed from 82 to 47 C ohms, and a resistor R-97 (22,000 ohms, $1 / 2$ watt, $10 \%$ ) was added between the screen of V-2 and the low- B bus.
C. PREVENT REGENERATION IN MODELS USING VHF/ UHF TUNER 10535C. (See Fig. 12).

1. Capacitor, ceramic, 5000 mmf , (23931) added as bypass from R-F tuner filament terminal (C) to ground.
2. Capacitor, ceramic, $10,000 \mathrm{mmf}$, (23939) added as by-pass from 135 volt bus at power transformer to ground. The ground lug of terminal strip must be soldered to chassis.
3. Capacitor, ceramic, $\mathbf{5 0 0 0} \mathbf{m m f}$, (23931) added as bypass from pin 4 to pin 7 of V-9, 4th Pix I-F.
4. Radio irequency choke (2955I) added between pin 4 of V-8 and pin 4 of V-9. These points were formerly connectied directly together.
5. Resistor, 100 ohm, $1 / 2$ watt, ( 73013 ) inserted between pin 6 of V-9 and tie point previously connected to it.
6. R-21, E+ dropping resistor to R-F tuner ( 4700 ohm 2 watt; replaced by 5000 ohm 5 watt $10 \%$ resistor.
D. IMPROVE SOUND I-F SENSITIVITY. Resistor R-1, 10,000 ohms, $1 / 2$ watt, was removed from the receiver. This formerly was connected across the sound I-F input coil L-I.

## MODELS WITH 2740 CHASSIS: IMPROVED PERFORMANCE IN FRINGE AND HIGH SIGNAL AREAS.

The addition of delayed AGC circuitry has been incorporated in the production of these models. Improved performance will be noted in fringe areas, as evidenced by an increase in signal-to-noise ratio due to the RF amplifier bias beingtheld near zero for low signal input.

High signal areas will benefit because of the much greater input signal now required to produce overload or cross-modulation effects.

Chassis incorporating this delay circuit can be identified by the AGC control located on the chassis rear apron near the horizontal drive control.


If the delayed AGC circuit is added to a 2740 chassis containing a VHF/UHF (all-channel) tuner, the following additional changes must be made:

1. Add ground wire directly to chassis from pin 3 (ground side of heater) on 2 nd and 4 th I-F tubes, V-7 and V-9.
2. Add ceramic capacitor, 5000 mmf , part number 23931, between pins 3 and 4 of 2 nd I-F tube, V-7.
3. Also add a 5000 mmf capacitor, part number 23931, between pin 6 of pix detector, V-10, and tuner side of 1 megohm isolation resistor in delayed AGC circuit.
COMPLETE REALIGNMENT IS NECESSARY UPON INSTALLATION OF DELAYED AGC.
(Circuit diagram on page 94, over.)

NOTE: TUBE LOCATIONS, TEST POINTS, AND ADJUSTMENTS ON THE 2740 AND 2940-1 CHASSIS ARE IDENTICAL EXCEPT THAT THE 2740 DOES NOT HAVE THE STANDARD BROADCAST (AM) TUNER.

## NOTES:

R-1 not used.
R-19 used on 2740, not used on 2940-1
R-89 not used on 2740, used on 2940-1
R-90 not used on 2740 , used on $2940-1$.

C- 15 is .01 mfd on $2740, .005 \mathrm{mfd}$ on $2940-1$ C. 29 not used. $C .29$
not used.
$C$.
n not used.
C. 34 not used
$C .49$ not used
C. 67 not used on 2740, used on 2940.1
Packard-Bell Schematic Diagram Chassis 2740 (see bottom of preceding page for notes)


## ALIGNMENT PROCEDURE

## GENERAL:

It is important that the service technician read ard adhere to the alignment instructions in this section. This is especially important in the case of the picture l-F.

Some service technicians may be accustomed to aligning the picture I-F response curve on the oscilloscope alone. This procedure is not recommended because it is actually quite possible to get what appears to be an acceptable curve and still be lacking in horizontal resolution.
Instead, the spot frequency alignment outlined below should be followed.
In this procedure the sweep generator is fed in through the antenna terminals. The output impedance of the generator must match the 300 ohm input impedance of the set. A matching network may be devised to accomplish this. Fig. 7 shows a network for a generator with 75 ohms impedance. If the generator impedance is 50 ohms change the values to 56 onms for the shunt resistor and 130 ohms for each of the series resistors.

Loose-coupling the signal generator to mixer tube (after step 10) is accomplished by disconnecting the tube shield from ground and connecting the generator between the shield and ground.
Test point locations are shown on the schematics, Figs. 17 and 18, and on the chassis illustration, Figs. 9.


Fig. 7. Matching Network

## PICTURE I-F ALIGNMENT:

1. Remove ANI tube, 6AV6 (V-20).
2. Connect a 3 volt battery between point " $A$ " and ground, with the negative lead to point " $A$ ".
3. Connect a vacuum tube voltmeter between points "B" and " $C$ ", with the negative lead to point " C ".
4. Remove I-F output plug from top of R-F tuner. Connect signal generator to plug between eenter pin and shield, using a .001 mfd isolating capacitor. Connect generator ground to shield. Keep leads as short as possible to prevent regeneration. Set generator output at maximum.

|  | Sig. Gen. <br> Frequency | Adjust | For |
| ---: | :---: | :---: | :---: |
| Step | 47.25 Mc. | $\mathrm{S}-6$ and S-13 | Minimum |
| 5. | 39.75 Mc. | $\mathrm{S}-8$ and S-10 | Minimum |

Adjust generator output for 2.5 to 3 volt VTVM reading for steps 7 through 12.

| 7. | 41.25 Mc. | $\mathrm{S}-12$ | Minimum |
| ---: | :--- | :--- | :--- |
| 8. | 42.50 Mc. | $\mathrm{S}-11$ and S-15 | MAXIMUM |
| 9. | 45.35 Mc | $\mathrm{S}-14$ | MAXIMUM |
| 10. | 45.00 Mc. | $\mathrm{S}-9$ | MAXIMUM |

REPEAT STEPS 5 THROUGH 10. Disconnect signal generator and replace I-F plug in tuner. Loosely couple generator to mixer tube (6J6) in R-F tuner*, keeping leads short. (See general instructions, above.)
11.
12.
42.10 Mc .

S-7
MAXIMUM
$45.75 \mathrm{Mc} \quad \mathrm{S}$. 20
( $\mathrm{S}-20$ is the I-F adjustment on R-F tuner)
13. Disconnect VTVM and 3 volt battery.
14. Connect oscilloscope to point " B ", using a 22,000 ohms isolating resistor in series with the scope probe. Connect an electrolytic capacitor, 5 mfd , 50 volt, between point " $J$ " and ground, the negative lead going to point " J ".
15. Connect sweep generator to antenna terminals through an impedance matching network. (See general instructions, above.)
16. Rotate tuner to channel 3 , and set sweep generator to center frequency. With a sweep width of 10 Mc ., adjust generator output to develop approximately 4 volts of A. G. C.
17. With signal generator loosely coupled to converter tube, adjust output to provide the markers shown on the response curve, Fig. 8. Check the position of the markers one at a time.
18. Observe the waveform obtained on the oscilloscope, and compare it with the waveform shown in Fig. 8. If the spot frequency alignment has been carefully done, the comparison will be favorable. However, slight retouching of the I-F adjustments may be required. It should not be necessary to change any adjustment appreciably. The markers should be located as follows:

The 47.25 Mc ., the 39.75 Mc ., and the 41.25 Mc . markers at minimum response.
The 45.75 Mc . marker at $50 \%$ response.
The 42.25 Mc . marker at a minimum of $50 \%$ response.
The 45.00 Mc . marker at $97 \%$ response.
The 45.00 Mc . marker must not exceed $97 \%$ response or picture may smear on higher channels.

[^6]
## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

PACKARD-BELL COMPANY

## ALIGNMENT OF 4.5 Mc. TRAP:

1. Remove Pix Detector tube 6AL5, (V-10).
2. Connect signal generator between point " $B$ " and ground through a .001 mfd isolating capacitor.
3. Turn contrast control to maximum.
4. Connect an R-F vacuum tube voltmeter to point " $D$ ". If an R-F VTVM is not available, connect a germanium diode crystal in series with the positive probe of a conventional VTVM.
5. Set signal generator to 4.50 Mc ., exactly, with the output at one volt or more.
6. Adjust trap, S-16, for minimum VTVM reading.

NOTE: If signal generator is not capable of one volt output, it will be necessary to adjust the trap visually. To do this, observe the picture and adjust the trap to eliminate the 4.5 Mc. beat.


MODELS 2742, 2743, 2744 \& 2941 MODELS 2842, 2843, 2844, \& 3041

## SOUND I-F AND DETECTOR ALIGNMENT:

1. Connect signal generator between point " $B$ " and ground through a .001 mfd isolating capacitor.
2. Connect VTVM between points " $E$ " and " $F$ ".
3. With generator frequency at 4.5 Mc ., and an FM deviation of 7.5 Kc ., adjust $\mathrm{S}-1, \mathrm{~S}-2$, and S-3 for MAXIMUM output.
4. Connect AC voltmeter across speaker voice coil, and advance volume control to obtain indication on meter.
5. Adjust Ratio Detector primary, S-4, for MAXIMUM output.
6. Connect VTVM between points " G " and " H ".
7. Adjust Ratio Detector secondary, S-5, for zero between positive and negative peaks.


Fig. 8. I-F Response Curve

Fig. 9. Chassis 2940-1, Top View


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## PHILCO

The various models of Philco " B " and " C " line receivers (released to date of fublication) use several different chassis as listed below.

| MODEL | CODE | CHASSIS | TUNER <br> PART NO. | $\underset{\text { TUBE }}{\text { PICTURE }}$ | MODEL | CODE | CHASSIS | TUNER <br> PART NO. | $\begin{aligned} & \text { PICTURE } \\ & \text { TUBE } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $22 \mathrm{C4010}$ | 130 | R181, D181, D182 | 76-7664-2 | $21 \mathrm{WP4}$ | 22C4124 | $\left\{\begin{array}{l} 300 \\ 350 \end{array}\right.$ | $\begin{aligned} & 300 \\ & 350 \end{aligned}$ | $\begin{aligned} & 76-8946-1 \\ & 76-8946-1 \end{aligned}$ | ${ }_{21 \mathrm{ZP} 4 \mathrm{~B}}^{21 \mathrm{AP}}$ |
| $22 \mathrm{C4010}$ | 131 | R181, D182 | 76.7664-2 | $21 \times \mathrm{P} 4$ | 22C4124L | $\left\{\begin{array}{l} 350 \\ 300 \end{array}\right.$ | $\begin{aligned} & 350 \\ & 300 \end{aligned}$ | 76-8946-1 | ${ }_{21 \mathrm{ZP}}^{2 \mathrm{BD}}$ |
| $22 \mathrm{C4010L}$ | 130 | R181, D181, D182 | 76.7664-2 | $21 \mathrm{WP4}$ | 22C4126 | 350 | 350 | 76896 |  |
| 22C4010L | 131 | R181, D182 | 76-7664-2 | $21 \times \mathrm{P} 4$ | 22C4126L | 350 | 350 | 76-8946.2 | 21ZP4B |
| 22C4012 | 130 | R181, D181 | 76-7664-2 | $21 \mathrm{WP4}$ |  |  |  | 76-8946-2 | 21ZP4B |
| $22 \mathrm{C4012}$ | 131 | R181, D181, D182 | 76-7664-2 | 21 XP 4 | 22 C 4310. | 300 | 300 | 76-8946-1 | $21 \mathrm{YP4A}$ |
|  |  |  |  |  | 22C4310L | 300 | 300 | 70-8946-1 | 21YP4A |
| 22C4014 | 1130 | R181, D181, D182 | 76-7664-2 | ${ }_{21 W P 4}$ | $22 \mathrm{C4312}$ | 350 | 350 | 76-8946-2 | 21XP4A |
| 22 C 4016 | 350 | 350 | 76.8946-2 | 21ZP4B | 22C4312L | 350 | 350 | 76-8946-2 | 21ZP4B |
| 22C4016L | 350 | 350 | 76-8946-2 | 21ZP4B | $24 \mathrm{C6010}$ | 354 | 354 | 76-8946.2 | 24VP4A |
| 22 C 4119 | 300 | 300 | 76.8946-1 | $21 \times 84$ | 24 C 6109 | 354 | 354 | 76-8946-2 | 24VP4A |
| $22 \mathrm{C4} 120$ | 300 | 300 | 76.8946-1 | 21YP4A | 24C6109L | 354 | 354 | 76-8946-2 | 24VP4A |
| 22C4120L | 300 | 300 | 76-8946-1 | 21YP $\mathrm{A}_{\text {A }}$ | $24 \mathrm{C6110}$ | 354 | 354 | 70-8946-2 | 24VP4A |
| 22C4122 | $\left\{\begin{array}{l} 130 \\ 131 \end{array}\right.$ | $\begin{aligned} & \text { R181, D181, D182 } \\ & \text { R181, D182 } \end{aligned}$ | $\begin{aligned} & 7 ¢-7664-2 \\ & 76-7664-2 \end{aligned}$ | $\begin{aligned} & 212 \mathrm{ZP4B} \\ & 21 \mathrm{PP} 4 \mathrm{~A} \end{aligned}$ | 24C6110L | 354 | 354 | 76-8946-2 | 24VP4A |
| 22 C 4123 | 300 | 300 | 76-8946-1 | 2IYpas |  |  | 354 | 76-8946-2 | 24VP4A |
|  |  |  |  | 21YP4A | 24 C 5310 | 354 | 354 | 76-8946-2 | 24VP4A |

Material on R-181 and D-181 is published in SUPREME " 1954 Television Servicing Information" manual, pages 87 to 97 . The differences between D-181 and D-182 deflection chassis are explained below. Information on Chassis 300 (and 301) is on pages 98 to 106, in this manual; while information on Chassis 350 and 354 is on pages 107 to 114 . Look up the model you are servicing and refer to the correct chassis.


## DEFLECTION CHASSIS D-182

Philco "B" line, code 131 television receivers employ two chassis, RF chassis R-181, and deflection chassis D-182. These chassis are the same as the code 130 chassis ( $\mathrm{R}-181$ with D-181), with the exception that an electrostatic focus type cathode ray tube and a different horizontal output transformer are employed. See Figure No. 1.
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FIGURE I-HORIZONTAL OUTPUT TRANSFORMER CIRCUIT

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

# PHILCO TELEVISION TV-300 AND TV-301 CHASSIS 

## THE TV-300 AND TV-301 DIFFERENCE

The TV-301 is similar to the TV-300, the difference being in the picture tube used and the shorting out of one resistor in the TV-300 to make the TV-301 chassis.

The TV- 300 chassis uses a 21 XP4A picture tube which is an electrostatic focus tube. When this tube is used the 27 ohm resistor in the high voltage transformer is necessary for proper electrical centering of the picture.

The TV-301 chassis uses a 21 WP4A picture tube which is an electromagnetic focus picture tube. When this picture tube is used the 27 ohm resistor is shorted out and the chassis is called the 301.

The TV-300 receiver contains a 13 position incremental type VHF tuner, covering VHF channels 2 through 13 with a UHF position. Power and filament voltage for the UHF tuneradapter are supplied through a switch built into the rear of the VHF tuner. The output of the VHF tuner is a 40 Mc ., IF signal which is inductively coupled to three stagger tuned IF stages. A 1N64 crystal serves as the diode detector for the output of the IF stages.

The output of the video detector, a negative phase, compositevideo detected signal, is fed through a single video amplifier to the cathode ray tube.

## TELEVISION ALIGNMENT

## General

The alignment procedure follows the general pattern of first checking the tuner response with an FM sweep generator and oscilloscope, comparing the response curve with that given in the manual, and aligning the tuner if necessary. After it is established that the tuner is in correct alignment, the video I-F channel is aligned by tuning each coil to its assigned pole frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and retouching the I-F adjustments to obtain the desired pass band. Finally, the sound channel is aligned, using an AM signal, by tuning the sound take-off coil and the 1-F and ratio-detector transformers.
The over-all response curve (r-f, i-f) of the circuits fom the antenna terminals to the video detector, after the I-F stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 45.75 mc ., and the sound intermediate (intercarrier) frequency is 4.5 mc . Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chassis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.
2. Do not disconnect the picture tube yoke, or speaker while the receiver is turned on.

HORIZONTAL OSCILLATOR ADJUSTMENT

1. Center horizontal hold control.
2. Adjust T-1 until the picture comes into sync.

TUNER OSCILLATOR ALIGNMENT
TABLE 1

AM GENERATOR: Connect to the receiver antenna-input terminals. (No matching network is required.) Use in modulated R-F output.

OSCILLOSCOPE: Connect the vertical-input lead, in series with a 1000 -ohm resistor, to the mixer plate test point,

TP-2. Connect the scope ground lead to the chassis, near TP-4.
RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner AGC (white) lead from main chassis, and connect a 1.5 -volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis.

| STEP | AM GENERATOR dial setting | RECEIVER TUNING | ADJUST | REMARKS |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 257 mc . | channel 13 | TC-506 for zero beat on scope. | a. If regeneration occurs, increase bias; bias may be increased up to 4 or 5 volts, if necessary. <br> b. Preset fine tuaing control to center of its range. |
| 2 | 251 mc. | channel 12 | TC-507 for zero beat on scope. |  |
| 3 | 245 mc . | channel 11 | TC-508 for zero beat on scope. |  |
| 4 | 239 mc . | channel 10 | TC-509 for zero beat on scope. |  |
| 5 | 233 mc . | channel 9 | TC-510 for zero beat on scope. | a. To adjust channel 8 use channel 9 tuning core, then recheck channel 9. |
| 6 | 221 mc . | channel 7 | TC-511 for zero beat on scope. | a. Repeat steps 1 thru 6 and readjust if necessary until channels are within 500 kc . of proper frequency. |
| 7 | 129 mc . | channel 6 | TC-512 for zero beat on scope. |  |
| 8 | 113 mc . | channel 4 | TC-513 for zero beat on scope. |  |
| 9 | 101 mc . | channel 2 | TC-514 for zero beat on scope. |  |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## VIDEO I-F ALIGNMENT <br> TABLE 2

A.M. GENERATOR: Connect to mixer test point, TP.2, through a mixer jig, and adjust the generator for approximately $30 \%$ modulation at 400 cycles. Adjust the output of the generator during alignment to keep the output at the CRT cathode below 40 volts peak to peak.
SWEEP (FM) GENERATOR: After step 5 connect to antennainput circuit through antenna-input matching network (see figure ?)

OSCILLOSCOPE: Connect vertical-input lead to pin No. 11 at the cathode ray tube.
PRESET: Contrast control full on. Channel selector to channel position No. 1.
BIAS: Apply 5.0 volts of negative bias into TP-1 (AGC system).

NOTE: I-F shield must be in place.

| STEP | AM GENERATOR dIAL SETTING | SWEEP (FM) GENERATOR |  | ADJUST | REMARKS |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | SWEEP DIAL SETTING | MARKER DIAL SETtING |  |  |
| 1 | 45.5 mc . |  |  | TT for maximum indication on scope. | The scope level must not be permitted to exceed 40 volts peak to peak or overloading will occur. |
| 2 | 43.1 mc. |  |  | VC-1 for maximum indication on scope. |  |
| 3 | 42.7 mc . |  |  | T-2-IF for maximum indication on scope. |  |
| 4 | 45.0 mc . |  |  | TG-IF for maximum indication on scope. |  |
| 5 | 44.4 mc . |  |  | T3-IF for maximum indication on scope. |  |
| 6 |  | Channel 4 ( 69 mc . with 6 mc . sweep width). | Run marker along curve checking against curve limits given in figure 6. | If necessary retouch TT, VC1, T2-IF, T6-IF, T3-IF. | Adjust carrier level with TT and T6 level curve with T-3. Position 42.5 mc . slope with $\mathrm{VC}-1$ and T.2. CAUTION: Retouch only slightly. |

TUNER BANDPASS ALIGNMENT - See Table 3


Fig. 2. Teievision tuner response curve, sbowing bandpass limits.


Fig. 3. Television tuner response curve, showing tracking compensation.

## TUNER BANDPASS ALIGNMENT <br> TABLE 3

SWEEP (FM) GENERATOR: Connect to receiver antennainput circuit through antenna-input matching network (see figure 1).
OSCILLOSCOPE: Same as in Chart 1.

RECEIVER CIRCUIT ALTERATIONS: Bias same as Chart 1. Disconnect the tuner coupling link leads and connect a 40- to 70 -ohm carbon resistor across the open end of the lead from the tuner.

| STEP | SWEEP (FM) GEMERATOR |  | $\begin{aligned} & \text { RECEIVER } \\ & \text { TUNINE } \end{aligned}$ | ADJUST | remaris |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { SWEEP } \\ & \text { DIARL } \\ & \text { SETINE } \end{aligned}$ | $\begin{aligned} & \text { MARKER } \\ & \text { sifit } \end{aligned}$ |  |  |  |
| 1 | Channel 13 ( 213 mc ., with $10-\mathrm{mc}$. sweep width.) | Set first to 210 mc . and not position of marker on response curve. Then set to 216 mc . and note position of marker on response curve. | Channel 13 |  | Use oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve. Response curve should be flat between limits (see figure 2). If not, proceed with step 2. |
| 2 | Channel 13 | 213 mc . | Channel 13 | T-8 - WS2 counterclockwise until single peak appears. | CAUTION: Care must be taken not to un screw core far enough to make it drop out of the coil. |
| 3 | Channel 13 | 213 mc . | Channel 13 | T-15-WS3 until peak falls on 213 -mc. marker. | It may be necessary to increase sweepgenerator output. |
| 4 | Channel 7 ( 177 mc ., with 10-mc. sweep width.) | Set first to 174 mc . and note position of marker on response curve. Set to 180 mc . and note position of marker on response curve. | Channel 7 |  | Note curve with respect to tilt and center frequency. Curve should be centered in pass band and symmetrical. If not, proceed with step 5 . |
| 5 | Channel 7 | 174 mc \& 180 mc . | Channel 7 | VC-3 and VC-2 to obtain correct tilt on top of curve. | VC3 and VC2 compensate for the tuning effect of Channel 13 adjustment upon Channel 7. (See figure 3.) |
| 6 | Channel 13 | 213 mc . | Channel 13 | Retouch T-15 of WS3 and T-8 - WS2 for symmetrical response, centered about $213-\mathrm{mc}$. marker. | To retouch, only turn cores slighty. |
| 7 | Channel 7 | 117 mc . | Channel 7 | Repeat step 5. | Check response curve for correct center frequency and symmetry. |
| 8 |  |  |  | Repeat steps 6 and 7. | Repeat Channel 13 and Channel 7 adjustments, alternately, until favorable curves are obtained on both. |
| 9 | Channel 6 ( 85 mc ., with $10-\mathrm{mc}$. sweep width.) | Set first to 82 mc . and note position of marker on response curve. Then set to 88 mc . and note position of marker on response curve. | Channel 6 |  | Curve should be symmetrical and centered in pass band. If not, proceed with step 10. |
| 10 | Channel 6 | 85 mc . | Channel 6 | T-14 of WS2 counterclockwise until single peak appears. | CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil. |
| 11 | Channel 6 | 85 mc . | Channel 6 | T-21-WS3 until peak falls on $85-\mathrm{mc}$. marker. | It may be necessary to increase sweepgenerator output. |
| 12 | Channel 6 | 85 mc . | Channel 6 | T-27 - WS5 for maximum curve height and symmetry of single peak. | After adjusting TC501, recheck as in step 9. If necessary, reduce sweep-generator output to avoid overloading. |
| 13 | Channel 6 | 85 mc . | Channel 6 | Retouch T-21 - WS3 and T-14 - WS2 for symmetrical response, centered about $85-\mathrm{mc}$. marker. | To retouch, only turn cores slightly. |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICRNG INFORMATION

## PHILCO

TV-300 \& TV-301 CHASSIS

## JIGS AND ADAPTERS REQUIRED

## Mlxer Jly

Connectioas to the grid of the mixer tube may be made through the alignment jack provided for this purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68 -ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

## Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna input terminals of the receiver is shown in figure 1.


Fig. 1. Antenna-Input Matching Network.



TOP VIEW


SIDE VIEW

Fig. 4. Titner layout showing locations of adiustments.


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING RNFORMATION

PHILCO

## SOUND ALIGNMENT <br> TABLE 4

A.M. GENERATOR: Connect the "hot" lead through a 2200 ohm resistor to the junction of $\mathrm{C}-24, \mathrm{X} 3$ and the xtal det. Adjust generator for $\mathbf{4 0 0 v}$. modulation at approximately $30 \%$ modulation.


VOLTMETER: Use V.T.V.M. on 20,000 -ohms-per-volt woltmeter. Connect through a crystal probe to pin No. 11 of the picture tube in step 1 and to pin No. 3 of the 6W6 audio output tube in the remainder of the steps

| STEP | $\begin{aligned} & \text { AMM } \\ & \text { GENERATOR } \\ & \text { SEIAL } \\ & \text { SETING } \end{aligned}$ | ADJUST | REMARKS |
| :---: | :---: | :---: | :---: |
| 1 | $\begin{gathered} 4.5 \mathrm{mc} \text {. } \\ \text { modulated } \end{gathered}$ | T7-IF for minimum indication. | Voltmeter through xtal probe. Plate of video amplifier. |
| 2 | $\begin{gathered} 4.5 \mathrm{mc} . \\ \text { modulated } \end{gathered}$ | T's top for maximum indication. | a. Volume control full on. <br> b. Voltmeter thru |
| 3 | 4.5 mc . modulated | Ts bottom for maximum indica. tion. | c. Keep generator level low to prevent overload. |
| 4 | 4.5 mc . modulated | T4-IF for maximum indication. |  |

Fig. 6. Over-all R-F, I-F response curve, sbowing tolerance limits.


Fig. 7. Base Layout - Top View - TV-300 Cbassis.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



Fig. 8. Composite Signal, Pin 2 of 12BY7, 6 volts, 60 c.p.s.


Fig. 9. Composite Signal, Pin 2 of 12BY7, 6 vclts, 15,750 c.p.s.


Fig. 12. Sync Separator Plate, Pin 1, 30 volts, 15,750 c.p.s.


Fig. 15. Vertical-Output Plate, Pin 9, 900 volts, 60 c.p.s.


Fig. 18. Horizontal-Oscillator Cathode, Pins 3 and 8, 18 volts, 15,750 c.p.s.

## OSCILLOSCOPE WAVEFORM PATTERN - TV. 300

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 6 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms - not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.


Fig. 10. Video Amplifier Plate, 83 tolts, 60 c.p.s.


Fig. 13. Vertical-Oscillator Grid, Pin 7, 140 volts, 60 c.p.s.


Fig. 16. Phase Comparer, Pin 6, 7 volts, 15,750 c.p.s.


Fig. 19. Horizontal-Oscillator Grid, Pin 2, 40 volts, 15,750 c.p.s.


Fig. 11. Sync Separator Grid, Pin 2, 90 volts, 60 c.p.s.


Fig. 14. Vertical-Output Grid, Pin 2, 72 volts, 60 c.p.s.


Fig. 17. Horizontal Oscillator, junction of L800 and R806, 43 volts, 15,750 c.p.s.


Fig. 20. Horizontal-Output Grid, Pin S, 120 volts, 15,750 c.p.s.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION




## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



Fig. 22. Wiring Diagram, Bottom View - TV-300.


Fig. 23. Dial Cord Stringing Arrangement.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## PHILCO TELEVISION TV-350 AND TV-354 CHASSIS

## CIRCUIT DESCRIPTION OF TV-354

The TV- 354 is the same as the TV- 350 with the following exceptions. The vertical output tube has been changed from a 654 to a 6CM6. The horizontal output tube from a 6BQ6 to a 6CD6. The damper tube in the TV-350 is a GAX4, while the
damper tube in the TV-354 is a 6AU4GT. The power supply in the TV-354 contains two 5U4G rectifiers. These changes have been made in the TV-354 to accommodate the larger picture tube.

## HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture until approximately 1 inch of blank screen appears at the right-hand and left-hand sides of the picture.
2. Increase the BRIGHTNESS control setting until the blanking becomes visible. This will appear as a dark vertical bat on each side of the picture.
3. Connect a .1 mf condenser from the test point to ground. (The plate side of the horizontal ringing coil, $T 1$, is connected to the test point.)
4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.
5. Adjust the HORIZONTAL HOLD CENTERING control until equal portions of the blanking bar appear on both sides of the picture.
6. Remove the .1 mf condenser from the test point.
7. Adjust the horizontal ringing coil, T 1 , until equal portions of the blanking bar again appear on both sides of the picture.
8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync


Fig. 5. Television tuner response curve, showing tracking compensation.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

PHILCO

## TUNER OSCILLATOR ALIGNMENT

TABLE NO. I

AM GENERATOR: Connect to receiver antenna-input terminals. (No matching network is required.) Use unmodulated r-f output.

OSCILLOSCOPE: Connect the vertical-input lead, in series with a 1000 -ohm resistor, to the mixer grid test point.

Connect the scope ground lead to the chassis, near the test point.
RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (white) lead from main chassis, and connect a 1.5 volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis.

| STEP | AM GENERATOR dIAL SETTING | $\begin{aligned} & \hline \text { RECEIVER } \\ & \text { TUNING } \end{aligned}$ | ADJUST | REMARKS |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 257 mc . | channel 13 | VC4 for zero beat on scope. | a. If regeneration occurs, inject bias; bias may be ir.-anced up to 3 volts, if necessary at pin 1 video test jack - TSI. <br> b. Preset fine tuning adjustment so that it is in the middle of its range. |
| 2 | 251 mc . | channel 12 | VC5 for zero beat on scope. |  |
| 3 | 245 mc . | channel 11 | VC6 for zero beat on scope. |  |
| 4 | 239 mc . | channel 10 | VC7 for zero beat on scope. |  |
| 5 | 233 mc . | channel 9 | VC8 for zero beat on scope. |  |
| 6 | 227 mc . | channel 8 | VC9 for zero beat on scope. |  |
| 7 | 221 mc . | channel 7 | VC10 for zero beat on scope. |  |
| 8 | 64.5 mc . | channel 6 | VCil for zero beat on scope. | 2nd harmonic gives 129 mc . |
| 9 | 113 mc . | channel 4 | VC12 for zero beat on scope. |  |
| 10 | 101 mc . | channel 2 | VC13 for zero beat on scope. |  |



Fig. I. Antenna-Input matching network.


TOP VIEW


SIDE VIEW

Fig. 6. Tuner Layout.
Fig. 4. Television tuner response curre, showing bandpass limits.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## TUNER BANDPASS ALIGNMENT tABLE NO. 2

SWEEP (FM) GENERATOR: Connect to antenna-input circuit through antenna-input matching network (See figure 1). OSCILLOSCOPE: Connect the vettical-input lead, in series with a 1000 -ohm resistor, to the mixer plate test point, TP4. Connect scope ground lead to the chassis, near TP4.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (white) lead from main chassis, and connect a 1.5 volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis. Disconnect tuner link from terminal board, B-9, and connect a 40 to $\mathbf{7 0}$-ohm carbon resistor across the link.

| STEP | SWEEP (FM) GENERATOR |  | PRECE!VER TUMING | ADJUST | REMARKS |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | SWEEP DIAL SETTING | $\begin{aligned} & \text { MARKER DIAL } \\ & \text { SETTING } \end{aligned}$ |  |  |  |
| 1 | channel 13 ( 213 mc . with 10-mc. sweep width.) | Set first to 210 mc . and note position of marker on response curve. Then set to 216 mc . and note position of marker on response curve. | channel 13 |  | Use oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve. Response curve should be flat between limits (see fig. 5). If not, proceed with step 2. |
| 2 | channel 13 | 213 mc . | channel 13 | TC502 counterclockwise until single peak appears. | CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil. |
| 3 | channel 13 | 213 mc . | channel 13 | TC504 until peak falls on 213 mc . marker. | It may be necessary to increase sweep-generator output. |
| 4 | channel 6 ( 85 mc . with $10-\mathrm{mc}$. sweep width.) | Set first to 82 mc . and note position of marker on response curve. Then set to 88 mc . and note position of marker on response curve. | channel 6 |  | Curve should be symmetrical and centered in pass band. If not, proceed with step 5. |
| 5 | channel 6 | 85 mc . | channel 6 | TC503 counterclockwise until single peak appears. | CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil. |
| 6 | chanucl 6 | 85 mc . | channel 6 | TC505 until peak falls on 85 mc . marker. | It may be necessary to increase sweep-generator output. |
| 7 | channel 6 | 85 mc . | channel 6 | TC503 for maximum curve height and symmetry of single peak. | After adjusting TC503, recheck as in step 4 . If necessary, reduce sweep-generator output to avoid overloading. |
| 8 | channel 6 | 85 mc . | channel 6 | Retouch TC503 and TC505 for symmetrical response, centered about 85 mc . marker. | To retouch, only turn cores slightly. |
| 9 | $\begin{gathered} \text { channel } 1 \\ \text { (UHF) } \end{gathered}$ | 44 mc . | $\begin{aligned} & \text { channel } 1 \\ & \text { (UHF) } \end{aligned}$ | Retouch TC503 and TC505 for symmetrical response centered about 44 mc . | After this adjustment recheck channel 6 and be sure it is within limits. |

NOTE: On channel 7, observe the tilt and center frequency of the response curve. The curve should be centered on the pass band and should be symmetrical. If it is not symmetrical, and appears unbalanced, as in figure 6, adjust C507 and C512 (figure 5) to obtain 2 response curve which is in the mirror image
(tilt in the opposite direction) of the original: for example, if channel 7 response curve appears as in figure 6A, adjust C507 and C512 until the curve appears as in figure 7B. This adjustment over-compensates to make allowance for the effect of channel 13 adjustments upon channel 7 response.

## VIDEO I-F ALIGNMENT

AM GENERATOR: Connect to mixer test point, TP2, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during alignment, to keep the output at the second detector below 4 volt, peak to peak.
SWEEP (FM) GENERATOR: After step 7, connect to antennainput circuit through antenna input matching network. (See figure 1.)
OSCILLOSCOPE: Connect the vertical-input lead to the $15 K$ resistor of the video i-f alignment jig. Connect scope
ground lead to the ground lead of the jig. Plug jig into TSI.
PRESET: Contrast and Brightness controls fully counterclockwise, and channel selector to channel 4. Adjust AGC switch to normal position.
BIAS: Apply - 14 volts of negative bias to pin 1 of video i-f alignment jig; ground positive side of bias supply to pin 3 of jig. (See figure 2.)
NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

## MOST-OFTEN-NEEDED 1955 THLEVISION SERVICING INTORMATION

PHILCO

VIDEO I-F ALIGNMENT (Continued)
TABLE NO. 3

| STEP | am generator DIAL SETTING | SWEEP (FM) GENERATOR |  | ADJUST | REMARKS |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | SWEEP DIAL SETIING | MARKER DIAL SETTING |  |  |
| 1 2 | 47.25 41.25 | not used not used | not used not used | VC1 for minimum indication on scope. <br> VC2 for minimum indication on scope. | It is necessary to keep the generator output sufficiently bigh that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal. |
| 3 | 45.4 | not used | not used | TT for maximum indication on scope. | Adjust the output of the AM generator, to keep the output at the second de- |
| 4 | 45.4 | not used | not used | T2 for maximum indication on scope. | tector below 4 volt, peak to peak. (For convenience, the oscilloscope may be calibrated for this purpose before- |
| 5 | 43.0 | not used | not used | VC3 for maximum indication on scope. | hand.) |
| 6 | 42.7 | not used | not used | T3 for maximum indication on scope. |  |
| 7 | 44.4 | not used | not used | T4 for maximum indication on scope. |  |
| 8 | not used | channel 4 ( 69 mc ., with (-mc. sweep width) | Run marker along curve, checking against the curve limits given in fig. 7. | If necessary, retouch $\mathrm{T} 1, \mathrm{~T} 2, \mathrm{~T} 3$, \& T4 as directed in REMARKS column. <br> CAUTION: Do not touch settings of VC1 and VC2. | Set Fine Tuning Cam to reference point previously made in step 1 of Table 1. If response curve does not fall within limits shown in fig. 7, retouch T1 \& T2 for proper level of curve at video carrier frequency; adjust T4 to level top of curve and T3 for proper slope of low-frequency side of curve. CAUTION: To retouch, only turn the adjustments slightly, particularly T2. |

## SOUND IF ALIGNMENT

AM GENERATOR: Connect "bot" lead through a 2200 ohm resistor to pin 2 of TS1, using the video i-f alignment jig. Connect ground lead of generator to ground lead of jig.

Fig. 7. Over-all R-F, I-F response curve, showing tolerance limits.

VOLTMETER: Use v.t.v.m. or $\mathbf{2 0 , 0 0 0}$ ohms-per-volt voltmeter. Connect to sound test paint.
OSCILLOSCOPE: Connect through crystal probe to cathode (pin 11) of picture tube.

| STEP | $\begin{aligned} & \text { AM } \\ & \text { GENERATOR } \\ & \text { DEIAL } \\ & \text { SEIING } \end{aligned}$ | ADJust | REmARKS |
| :---: | :---: | :---: | :---: |
| 1 | 4.5 mc . | T7 for maximum indication on voltmeter. | Remove 1st video i-f tube, and adjust the volume control for moderate speaker output. |
| 2 | 4.5 mc . | Ts primary (bottom of T5) for maximum indication on voltmeter. |  |
| 3 | 4.5 mc . | Ts secondary (top of T5) for maximum indication on voltmeter and minimum speaker output. | The point of maximum meter indication for TC5 should also be the point of minimum speaker output. |
| 4 | 4.5 mc . | T8 for minimum indication as view on the oscilloscope. |  |
| 5 | use station signal | Ts primary (bottom of T5) for minimum AM (noise or buzz), using speaker output for indication. | Replace 1st video i-f tube, and tune in a station, setting fine tuning control to obtain a crisp picture, with a small amount of beat. |



Fig. 8. Video Detector Output, Pin 2 of TS1, 3.5 volts, 60 c.p.s.


Fig. 9. Video Detector Output, Pin 2 of TS1, 3.5 volts, 15,750 c.p.s.


Fig. 12. Sync Separator Plate, Pin 5, 41 volts, 15,750 c.p.s.


Fig. 15. Vertical Output Plate, Pin 9, 1100 volis, 60 c.p.s.


Fig: 18. Horizontal-Oscillator Casbode, Pins 3 and 8,18 volts, 15,750 c.p.s.

## OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 3.5 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms - not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.


Fig. 10. Video Amplifier Plate, Pin 7, 83 volts, 60 c.p.s.


Fig. 13. Vertical-Oscillator Grid, Pin 2, .34 volts, 60 c.p.s.


Fig. 16. Pbase Comparer, Pin 2, 11 volts, 15,750 c.p.s.


Fig. 19. Horizontal-Oscillator Grid, Pin 2, 65 volts, 15,750 c.p.s.


Fig. 11. Sync Separator Grid, Pin 7, 38 volts, 60 c.p.s.


Fig. 14. Vertical-Output Grid, Pin 6, 80 volts, 60 c.p.s.


Fig. 17. Horizontal Oscillator, 43 volts, 15,750 c.p.s. test point.


Fig. 20. Horizontal-Output Grid, Pin S, 160 volts, 15,750 c.p.s.


Voltage readings taken with a Philco Model No. 7001: VTVM. All capacity values in mieromicrofarads unless otherwise noted. Direction of arrow though control arms indicates clockwise rotation. - All capacitors so marked are of ceramic disc type. Capacitors marked GMV have tolerance $-0 \%+100 \%$. Letters on tuner awitch wafers read from front back of tuner. All resistors are. $4 / 2$ watt $10 \%$ unless otherwise noted. Resistance values noted for coil and trans. former windings are D.C. readings. Mica and ceramic capacitors are $\pm 10 \%$ unless otherwise noted.

## MOST-OFTEN-NEEDED 1955 TBLEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

PHILCO
TV-350 \& TV-354 CHASSIS


Fig. 24. Dial cord stringing arrangement (TV-350 \& TV.354).

## Models <br> 24-S-529, 24-S-529U 24-S-531, 24-S-531U 24-S-532, 24-S-532U

Chassis Nos. KCS84F, KCS84H, KCS84J or KCS84K

## Models

## 24-T-420, 24-T-420U <br> 24-T-435, 24-T-435U

Chassis No. KCS84C or KCS84E

Models 24S529, 24S531, and 24S532, use Chassis KCS84F or KCS84J which employ VHF tuner KRK-22D. The exact circuit for these sets is published in this manual. Chassis KCS84H and KCS84K are identical to other chassis except that a combination VHF-UHF (KRK-30D/E) tuner is used. These chassis are used in Models $24 \mathrm{~S} 529 \mathrm{U}, 24 \mathrm{~S} 531 \mathrm{U}$, and 24 S 532 U .

Models 24 T 420 and 24 T 435 use Chassis KCS84C which is practically identical to KCS84F. Models 24 T 420 U and 24 T 435 U use Chassis KCS84E which is practically identical to KCS84H.

## PICTURE I-F TRANSFORMER ADJUSTMENTS.-

Connect the i-f signal generator across the link circuit on terminals A and B of T104.
Conneat the "VoltOhmyst" to the junction of R123 and Cl42. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm poientiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R123 and C142.
Set the bias to produce approximately - 5.0 volt of bias at the junction of R123 and C142.
Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with - 5.0 volts of i-f bias at the junction of R123 and Cl42.


Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R135, L102. $47.25 \mathrm{mc} . \ldots . . . . . . . . . . . . .1118$
SWEEP ALIGNMENT OF PICTURE I-F.-
To align Tl and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf . ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner. Set the channel selector switch to channel 4.
Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset Cl 22 -to minimum capacity.
Adjust the bias box potentiometer to obtain - 5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and Cl42. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of Tl06. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjus: Tl (top) and Tl04 (top) for maximum gain and with 45.75 mc . at $75 \%$ of maximvm response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

[^7]
## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## (1git RCA Victor



COLOR CODES MOULDED PAPER CAPACITORS


RMA COLOR CODE, FIXED MICA CAPACITORS


The schematic is shown in the latest condition at the time of printing
Alf resistance values in ohms. $K$ $=1000$.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

CIRCUIT SCHEMATIC DIAGRAM KCS84F OR KCS84J

(For voltage information see the next three pages)

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within $\pm 20 \%$ with 117 v. a-c supply.

## Schematic Diagram <br> KCS84F or KCS84J

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

RCA Victor (continued)
24-S-529, 24-S-529U, 24-S-531 24-S-531U, 24-S-532, 24-S-532U


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

24-S-529, 24-S-529U, 24-S-531 24-S-531U, 24-S-532, 24-S-532U

VOLTAGE CHART
RCA Victor (continued)

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver the picture synced and the AGC control properly adjusted The second condition was obtained by removing the antenna leads and short circuitIng the recelver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol $<$ means less than

Balance of voltage chart on the next page, over.

| Tube No. | Tube Type | Function | Operating Condition | E. Plate |  | E. Screen |  | E. Cathode |  | E. Grid |  | Notes on Measurements |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | $\begin{aligned} & \text { Pin } \\ & \text { No. } \end{aligned}$ | Volts | $\begin{aligned} & \text { Pin } \\ & \text { No. } \end{aligned}$ | Volts | $\begin{aligned} & \text { Pin } \\ & \text { No. } \end{aligned}$ | Volts | Pin <br> No. | Volts |  |
| V1 (V2) <br> KRK22D <br> or <br> KRK30D <br> (or E) | 6BQ7A | R-F <br> Amplifier | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 6 | 170 | - | - | 8 | 0.1 | 7 |  |  |
|  |  |  | No Signal | 6 | 133 | -- | - | 8 | 1.1 | 7 | 0 |  |
|  |  | R-F <br> Amplifier | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \end{gathered}$ | 1 | 270 | - | -- | 3 | 170 | 2 | - |  |
|  |  |  | No Signal | 1 | 260 | - | $\cdots$ | 3 | 133 | 2 | - |  |
| V2 (V1) <br> KRK22D <br> or <br> KRK30D <br> (or E) | 6X8 | Mixer | 15000 Mu . V. Signal | 9 | 160 | 8 | 160 | 6 | 0 | 7 | $\begin{gathered} -2.4 \text { to } \\ -3.0 \end{gathered}$ |  |
|  |  |  | No Signal | 9 | 145 | 8 | 145 | 6 | 0 | 7 | $\begin{gathered} -2.8 \text { to } \\ -3.5 \end{gathered}$ |  |
|  |  | R-F Oscillator | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 3 | 95 | -- | - | 6 | 0 | 2 | $\begin{gathered} -3.8 \text { to } \\ -5.5 \end{gathered}$ |  |
|  |  |  | No Signal | 3 | 90 | - | -- | 6 | 0 | 2 | $\begin{gathered} -3.0 \text { to } \\ -5.1 \end{gathered}$ |  |
| V101 | 6AU6 | 1st Sound I-F Amp. | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 5 | 122 | 6 | 138 | 7 | 1.01 | 1 | 0 |  |
|  |  |  | No Signal | 5 | 113 | 6 | 126 | 7 | 95 | 1 | 0 |  |
| V102 | 6AU6 | 2nd Sound <br> I-F Amp. | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 5 | 210 | 6 | 130 | 7 | 0 | 1 | -2.05 | *Unreliable measuring point. Voltage depends |
|  |  |  | No Signal | 5 | 205 | 6 | 122 | 7 | 0 | 1 | *--1.12 | on noise. |
| V103 | 6AL5 | Ratio Detector | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 7 | 1.7 | - | - | 1 | 21 | -- | -- | 7.5 kc deviation at 1000 cycles |
|  |  |  | No Signal | 7 | 4.1 | - | -- | 1 | 11.8 | -- | - |  |
|  |  | Ratio <br> Detector | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \end{gathered}$ | 2 | 1.7 | - | - | 5 | 21 | - | --- |  |
|  |  |  | No Signal | 2 | 4.1 | - | - | 5 | 11.8 | - | - |  |
| V104 | 6AV6 | 1st Audio Amplifier | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \end{gathered}$ | 7 | 78 | - | - | 2 | 0 | 1 | $-.7$ | At min. volume |
|  |  |  | No Signal | 7 | 76 | - | $\cdots$ | 2 | 0 | 1 | $-.65$ | At min. volume |
| V105 | 6AQ5 | Audio Output | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \end{gathered}$ | 5 | 205 | 6 | 220 | 2 | 15.2 | 1.7 | 0 | At min. volume |
|  |  |  | No Signal | 5 | 198 | 6 | 207 | 2 | 14.5 | 1-7 | 0 | At min. volume |
| V106 | 6CF6 | lst Pix. I-F <br> Amplifier | $15000 \mathrm{Mu} . \mathrm{V} \text {. }$ <br> Signal | 5 | 218 | 6 | 240 | 2 | 132 | 1 | -8.2 | *Unreliable measuring point. |
|  |  |  | No Signal | 5 | 95.5 | 6 | 105 | 2 | 1.18 | 1 | * < 0.1 | at T104-8. |
| V107 | 6CF6 | 2nd Pix. I-F Amplifier | $15000 \mathrm{Mu} . \mathrm{V} .$ <br> Signal | 5 | 222 | 6 | 243 | 2 | $<0.1$ | 1 | -8.45 |  |
|  |  |  | No Signal | 5 | 95.5 | 6 | 105 | 2 | 0.53 | 1 | <0.1 |  |
| V108 | 6CB6 | 3rd Pix. I-F Amplifier | $15000 \mathrm{Mu} . \mathrm{V}$ Signal | 5 | 138 | 6 | 150 | 2 | 2.3 | 1 | 0 |  |
|  |  |  | No Signal | 5 | 130 | 6 | 143 | 2 | 2.2 | 1 | <0.1 |  |
| V109A | 12AU7 | Picture <br> 2nd Det. | 15000 Mu . V. Signal | 1 | -25.8 | - | -- | 3 | 0 | 2 | $-1.85$ |  |
|  |  |  | No Signal | 1 | -14 | - | - | 3 | 0 | 2 | $-.6$ |  |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING ENFORMATION

RCA Victor (continued)
24-S-529, 24-S-529U, 24-S-531
24-S-531U, 24-S-532, 24-S-532U

| Tube No. | Tube <br> Type | Function | Operating <br> Condition | E. Plate |  | E. Screen |  | E. Cathode |  | E. Grid |  | Notes on Measurements |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Pin <br> No. | Volts | $\begin{aligned} & \text { Pin } \\ & \text { No. } \end{aligned}$ | Volts | Pin <br> No. | Volts | Pin <br> No. | Volts |  |
| V109B | 12AU7 | Horiz. Sync Separator | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 6 | 260 | - | - | 8 | 160 | 7 | 122 |  |
|  |  |  | No Signal | 6 | 253 | - | - | 8 | 105 | 7 | 94.5 |  |
| V110A | 6X8 | Video Amplifier | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 9 | 120 | 8 | 147 | 6 | . 9 | 7 | -1.85 | AGC control set for normal operation |
|  |  |  | No Signal | 9 | 95 | 8 | 138 | 6 | 1.35 | 7 | $-.6$ | AGC control set for normal operation |
| V110B | 6X8 | Vert. Sync Separator | $15000 \mathrm{Mu} . \mathrm{V}$. Signal | 3 | 79 | - | - | 6 | . 90 | 2 | -26.8 |  |
|  |  |  | No Signal | 3 | 46.5 | - | - | 6 | 1.35 | 2 | -2.1 |  |
| V111A | 12AU7 | Video Output | 15000 Mu . V. Signal | 6 | 231 | - | - | 8 | 13 | 7 | 0 |  |
|  |  |  | No Signal | 6 | 225 | - | - | 8 | 12.5 | 7 | 0 |  |
| V111B | 12AU7 | AGC Amplifier | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \\ \hline \end{gathered}$ | 1 | -55 | - | - | 3 | 135 | 2 | 125 |  |
|  |  |  | No Signal | 1 | 0.3 | - | - | 3 | 132 | 2 | 68 |  |
| V112A | 12AU7 | SyncOutput | $15000 \mathrm{Mu} . \mathrm{V}$. Signal | 1 | 83 | - | - | 3 | 0 | 2 | -3.28 |  |
|  |  |  | No Signal | 1 | 84 | - | - | 3 | 0 | 2 | -1.3 |  |
| V112B | 12AU7 | Vertical Oscillator \& Discharge | $15000 \mathrm{Mu} . \mathrm{V}$. Signal | 6 | 80 | - | - | 8 | 0 | 7 | -63.5 | Depends on setting of Vert. hold control |
|  |  |  | No Signal | 6 | 182 | - | - | 8 | 0 | 7 | -60 | Voltages shown are synced pix adjustment |
| V113 | 6AQ5 | Vertical Output | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \end{gathered}$ | 5 | 253 | 6 | 262 | 2 | 0 | 1.7 | -28.8 |  |
|  |  |  | No Signal | 5 | 245 | 6 | 253 | 2 | 0 | 1.7 | -27.5 |  |
| V114 | 6SN7GT | Horizontal Osc. Control | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \end{gathered}$ | 2 | 175 | - | - | 3 | -3.5 | 1 | -21 |  |
|  |  |  | No Signal | 2 | 170 | - | - | 3 | -5.5 | 1 | -17.5 |  |
|  | 6SN7GT | Horizontal Oscillator | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | 5 | 183 | - | - | 6 | 0 | 4 | -67 |  |
|  |  |  | No Signal | 5 | 179 | - | - | 6 | 0 | 4 | -65 |  |
| V115 | 6CD6G | Horizontal Output | $15000 \mathrm{Mu} . \mathrm{V}$. Signal | Cap | * | 8 | 193 | 3 | 22 | 5 | -14 | *High Voltage Pulse Present |
|  |  |  | No Signal | Cap | * | 8 | 185 | 3 | 20.5 | 5 | -13.5 | *High Voltage <br> Pulse Present |
| V116 | $\begin{aligned} & \text { 1B3GT } \\ & / 8016 \end{aligned}$ | H. V. Rectifier | $15000 \mathrm{Mu} . \mathrm{V} .$ <br> Signal | Cap | * | - | - | 2 \& 7 | 18,700 | - | - | *High Voltage Pulse Present |
|  |  |  | No Signal | Cap | * | - | - | 2\& 7 | 18,350 | - | - | *High Voltage <br> Pulse Present |
| V117 | 6AU4GT | Damper | $15000 \mathrm{Mu} . \mathrm{V} .$ <br> Signal | 5 | 261 | - | - | 3 | * | - | - | ${ }^{*}$ High Voltage <br> Pulse Present |
|  |  |  | No Signal | 5 | 253 | - | - | 3 | * | - | - | ${ }^{*}$ High Voltage <br> Pulse Prement |
| V118 | 24CP4A | Kinescope | $\begin{gathered} 15000 \mathrm{Mu} . \mathrm{V} . \\ \text { Signal } \end{gathered}$ | Cap | 18,700 | 10 | 428 | 11 | 44.5 | 2 | 0 | At average Brightness |
|  |  |  | No Signal | Cap | 18,350 | 10 | 425 | 11 | 39.5 | 2 | 0 | At average Brightness |
| $\begin{aligned} & \text { V119 } \\ & \text { V120 } \end{aligned}$ | $\begin{aligned} & \text { 5U4G } \\ & \text { 5Y3GT } \end{aligned}$ | Rectifiers | $15000 \mathrm{Mu} . \mathrm{V} .$ Signal | $4 \& 6$ | - | - | - | 2\&8 | 277 | - | - |  |
|  |  |  | No Signal | 486 | - | - | - | $2 \& 8$ | 271 | - | - |  |

## rca Victor

## television receivers-Models

21-S-501(U), 21-S-502(U), 21-S-503(U), 21-S-504(U), 21-S-505(U), 21-S-506(U), 21-S-517(U), 21-S-518(U), 21-S-519(U), 21-S-521(U), 21-S-522(U), 21-S-523(U), 21-S-525(U), 21-S-526(U), 21-S-537(U), 21-S-5251(U), 21-S-5252(U)

Chassis Nos. KCs888, KCs88C, KCS88D, KCS88E, KCS88J, KCS88K, KCS88L, KCS88M, KCS88V, or KC588VA

> 21-S-348K, 21-S-348KU, 21-S-355K, 21-S-355KU, 21-S-357K, 21-S-357KU, 21-S-362K, 21-S-362KU, 21-S-367K, 21-S-367KU, 21-S-369K, 21-S-369KU
(Continued below and on the next 7 pages)

The models listed at left without the suffix "U" are for VHF reception. These models use Chassis KCS88B, KCS88C, KCS88D, KCS88E, KCS88V, with tuner unit KRK-22D. The models with the suffix " U " use Chassis KCS88J, KCS88K, KCS88L, KCS88M, or KCS88VA, with VHF-UHF tuner unit KRK-30, and the circuit for these sets is included.

The models listed at left without the suffix "U" use Chassis KCS88, KCS88A, which are very similar to Chassis KCS -88B. The models with the suffix " $U$ " use Chassis KCS88F or KCS88H which are similar KCS88J, but use tuner KRK-31 for combined VHF and UHF reception. In general, this service material is applicable to all models. Models 21S548 (Chassis KCS88N) and 21 S 548 U (Chassis KCS88P) are combinations with the television sections very similar to the sets described on these pages.
Models 17S450, 17S451, and 17S453, use Chassis KCS87 with tuner KRK-32. These same numbered models with a suffix "U" use Chassis KCS87A with tuner KRK-30A. These are similar sets to the ones covered in these pages, but use 17 HP 4 picture tubes.


Receiver Operating Controls (UHF.VHF Models).

ION TRAP MAGNET ADJUSTMENT.-Set the ion trap magnet approximately in the position shown in Figure 3. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Turn the focus control (shown in Figure 3) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.


Figure 3-Yoke and Focus Magnet Adjustments

DO NOT INSTALL, REMOVE OR HANDLE THE KINESCOPE IN ANY MANNER UNLESS SHATTERPROOF GOGGLES ARE WORN. PEOPLE NOT SO EQUIPPED SHOULD BE KEPT AWAY WHILE HANDIING KINESCOPES. KEEP THE KINESCOPE AWAY FROM THE BODY WHILE HANDLING.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICLNG INFORMATION

RCA Victor (continued)
INSTALLATION INSTRUCTIONS
21-S-501 to 21-S-537 incl.
21-S-501U to 21-S-537U incl.

DEFLECTION YOKE ADJUSTMENT.-If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the knurled yoke adjustment nuts.

PICTURE ADJUSTMENTS.-It will now be necessary to obtain a test pattern or picture in order to make further adjusiments.
When the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R149 on the rear apron (see Figure 4) counter-clockwise until the set operates normally and the picture can be synced.
CHECK OF HORIZONTAL OSCILLATOR ADJUSTMENT.Turn the horizontal hold control to the extreme clockwise position. The picture should be out of sync, with approximately twelve bars slanting downward to the right. Turn the control counter-clockwise slowly. The number of diagonal black bars will be gradually reduced and when only $11 / 2$ to 3 bars sloping downward to the right are obtained, the picture will pull into sync upon slight additional counter-clockwise rotation of the control. The picture should remain in sync for approximately two full turns of additional counter-clockwise rotation of the control. Continue counter-clockwise rotation until the picture falls out of sync. Rotation beyond fallout position should produce between 2 and 5 bars before interrupted oscillation (motorboat occurs). Interrupted oscillation (motorboat) should be reached before full counterclockwise rotation.

When the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Adjustment of Horizontal Oscillator" and proceed with "Focus Magnet Adjustment."


Figure 4-Rear Chassis Adiustments

ADJUSTMENT OF HORIZONTAL OSCILLATOR.-If in the above check the receiver failed to hold sync over two full turns of counter-clcckwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.
Turn the horizontal drive trimmer Cl 71 fully clockwise, then counter-clockwise one full turn. Set the width coil Llll with the stud flush with the inside edge of the chassis. Set the sine wave coil L121 fully counter-clockwise.

Adjustment of the horizontal frequency control in the coun-ter-clockwise direction will show a multiple number of bars before "motorboat" occurs. Adjust the sine ware coil Ll2l until 3 or 4 bars are present before "motorboat" occurs, when the horizontal frequency control is rotated counterclockwise from the fall out point.
If it is impossible to sync the picture and the AGC system is in proper adjustment it will be necessary to align the Horizontal Oscillator by the method outlined in the alignment procedure on page

FOCUS MAGNET ADJUSTMENT. - The focus magnet should be adjusted so that there is approximately threeeighths inch of space between the rear plate of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.
The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck centered in the opening.

CENTERING ADJUSTMENT.-Centering is accomplished by means of a separate plate on the focus magnet. The centering plate includes a nut which must be loosened before centering. Up and down adjustment of the plate moves the picture up and down and sidewise adjustment moves the picture from side to side.
If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH AND DRIVE ADJUSTMENTS.-Set the horizontal control at the "pull-in" point. Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage bence the brightest and best focused picture, adjust horizontal drive trimmer counter-clockwise until a bright vertical line appears in the middle of the picture then clockwise until the bright

NOTE: Chassis designations with an "X" as the final letter (such as KCS88CX) use plate assembly Z102, instead of printed circuit PC102, for picture IF section and are connected as shown below.


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICLNG INFORMATION

21-S-501 to $21-\mathrm{S}-537$ incl. 21-S-501U to 21-S-537U incl.

INSTALLATION INSTRUCTIONS
line just disappears.
At maximum brightness adjust the width control Llll to obtain correct picture width.
Return the brightness to normal level and readjust the drive trimmer Cl7l as before.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS. Adjust the height control (R165 behind front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R174 behind front control panel), until the test paftern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.-Adjust the focus control for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.
Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the knurled nuts of the yoke and focus magnet and the focus magnet mounting nuts are tight.


Figure 5-KRK22D R-F Oscillator Adjustments
KRK22D, OR KRK30 VHF R-F OSCILLATOR ADJUST-MENTS.-Tune in all available stations to see if the receiver $r-f$ oscillator is adjusted to the proper frequency on all channels. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 5 or 6. Adjustment for channel 13 is on top of the chassis. The oscillator for the UHF tuner section of the KRK30 tuner should be adjusted by the method outlined on page 14 under Alignment Procedure.

AGC THRESHOLD CONTROL.-The AGC threshold control R149 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the pic-


Figure 6-KRK30 VHF R-F Oscillator Adjustment
ture reappears immediately, the receiver is not overloading due to improper setting of R149. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R149 should be readjusted.

Turn R149 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R149 clockwise until there is 'a very, very slight bend or change of bend in the picture. Then turn R149 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R149 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADIUSTMENT.-In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is L53 on KRK22D or L5 or KRK30 tuners and is located on the antenna matching transformer.

CAUTION.-In some receivers, the FM trap L5 or L53 will tune down into channel 6 or even into chamnel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L5 or L53 to make sure that adjustment does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding the back are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

KINESCOPE AND SAFETY GLASS CLEANING.-The front safety glass may be removed to allow for cleaning of the kinescope faceplate and the salety glass if required.

To do this, remove the rear panel of the receiver. There are several flat springs holding the front metal trim of the cabinet to the plastic kinescope mask.
Reach in from the rear of the receiver and press in on each spring at the open end. Slide the spring out of the slot provided. The front trim and safety glass should be held in position by another person to prevent its falling outward when removing the springs.

Remove the metal trim and the safety glass.
The kinescope faceplate and the satety glass should only be cleaned with a soft cloth and "Windex" or similar cleaninq agent.

Replace the metal trim, the cabinet rear panel and the safety glass.

## PICTURE I-F TRANSFORMER_ADJUSTMENTS.-

Connect the i-f signal generator, in series with a 1500 mmf . ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R118, R146 and Cl 20 and to ground. Turn the AGC control fully clockwise. Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R118, R146 and Cl20. The second battery will be used later.
Set the bias to produce approximately -4.0 volt of bias at the junction of R118, R146 and Cl20.

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." (Note: These transformers should be peaked with their cores at the ends of the coils nearest the chassis.) During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L.103 with - -4.0 volts of $\mathrm{i}-\mathrm{f}$ bias at the junction of R118, R146 and Cl20.

T105

## RCA Victor (continued)

## ALIGNMENT PROCEDURE

## 21-S-501 to 21-S-537 incl. 21-S-501U to 21-S-537U incl

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R129, L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made. 47.25 mc .

## L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

## SWEEP ALIGNMENT OF PICTURE I-F.-

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf . ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.
Clip a 330 ohm resistor between pin 1 of V107 and ground Preset Cll 16 to minimum capacity.
Adjust the bias box potentiometer to obtain - 4.0 volts of bias as measured by a "VoltOhmyst" at the junction of Rll8, R146 and Cl20.

Connect a 180 ohm composition resistor from pin 5 of V10S to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

## For Models Without Suffix 'U"

Adjust Tl (top) and Tl04 (top) for maximum gain and with 45.75 mc . at $75 \%$ of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust Cl 16 until 42.5 mc . is at $70 \%$ response with respect to the low frequency shoulder of the curve as shown in Figure 9. Maximum allowable tilt is $20 \%$

Disconnect the diode probe, the 180 ohm and the 330 ohm resistors.

Connect the oscilloscope to the junction of Rl29 and Ll03. Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.


Figure 9-
KRK22D
Tl and T104
Response

Figure 10-
Overall I-F
Response
with KRK22D

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc . Adjust Tl0S and Tl07 to set 41.25 me. between 25 and 35 times down with curve as shown in Figure 10.

Move the sweep generator to the antenna terminals. Connect -3.0 volts bias to pin 5 of V103. Adjust T106 and T107. slightly to correct for any overall tilt while switching from channel to channel.

## Instructions Applicable to "U" Models

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc . at $75 \%$ of maximum response.
Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust Cll 16 until 42.5 me. is at $70 \%$ response with respect to the low frequency shoulder of the curve as shown in Figure 11. Maximum allowable tilt is $20 \%$.

Disconnect the diode probe, the 180 ohm and the 330 ohm resistors.


Figure 11KRK 30
T2 and T104 Response

Figure 12-
Overall
I-F Response with KRK30

Figure 13KRK30
$L 9$ and C308 I-F Response

Connect the oscilloscope to the junction of R129 and Ll03.
Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.
Adjust the output of the sweep generator to obtain 3.0 to 0.5 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T105, T106 and T107 to obtain the response shown in Figure 12.
Increase sweep output ten times and check attenuation at 41.25 me. Adjust Tl 05 and T107 to set 41.25 me. between 30 and 40 times down with curve as shown in Figure 12.
To align the I-F amplifier circuit of the KRK30, connect the VHF sweep generator to the front terminal of the 1 N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf . ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.
To do this, remove the crystal cover and connect the resistor, after insulating the lead with tubing, to the crystal front terminal.
Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING between channels 68 and 69 at 800 mc .

Connect a 180 ohm composition resistor and a 1500 mmf . capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground.
Connect the oscilloscope diode probe to the junction between the resistor and capacitor.

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.
Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potenti"ometer to produce - 3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.
Set the sweep generator to produce 0.5 volt or less peak-topeak on the oscilloscope.
Adjust C308, on the UHF section, and L9, on the VHF section, of the tuner for maximum gain with 45.75 mc . and 42.5 me. markers as shown in figure 13 .

If necessary adjust $L 27$ to place the 45.75 mc. marker at the peak of the curve. Adjust L 43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to the junction of R129 and L103. Use 3.0 v peak-to-peak on the oscilloscope.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at -3.0 V and the I-F bias at -4.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 12. Retouch T106 and T107 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 12, re-

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## ALIGNMENT PROCEDURE

RCA Victor (continued)

touching C308 and L9 if necessary to correct any overall tilt. Do not retouch T2, T104, T105, T106 or T107.
Remove the sweep and marker generators and the bias supplies.
RATIO DETECTOR ALIGNMENT.-Set the signal generator at 4.5 mc . and connect it to the first video amplifier grid, pin 7 of V108A, in series with a .01 mfd capacitor.

As an alternate source of signal. the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin l of V107.
Set the frequency of the calibrator to 45.75 mc . (pix carrier) and modulate with 4.5 mc . crystal. The 4.5 mc . signal will be picked off at pin 9 of V108A and amplified through the sound $i-f$ amplifier.
Connect the "VoltOhmyst" to pin 7 of V102.
Tune the ratio detector primary, Tl02 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.
Connect the "VoltOhmyst" to the junction of R104 and C107.
Tune the ratio detector secondary Tl02 bottom core for zero d-c on the "VoltOhmyst." (Adjust with core at chassis end of coil.)
Repeat adjustments of Tl02 top for maximum d-c at pin 7 of V102 and T102 bottom for zero d-c at the junction of R104 and C107. Make the final adjustments with the signal input level adjusted to produce 5 volts $d-c$ on the "VoltOhmyst" at pin 7 of V102
SOUND TAKE-OFF ALIGNMENT.-Connect the signal generator to the first video amplifier grid, pin 7 of V108A.
As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 7 of V102.
Tune the Tl01 top core for maximum $\mathrm{d}-\mathrm{c}$ on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.
(Alternate Method for Ratio Detector and Sound I-F Alignment)
Set the signal generator at 4.5 mc . and connect it to the first video amplifier grid, pin 7 of V108A in series with a . 01 mid. capacitor
Connect the "VoltOhmyst" to pin 7 of V102.
Tune the ratio detector secondary T102 bottom core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)
Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked, when making the above adjustments.
Tune the Tl0l (top) core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)
The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the Tl0l adjustment are made.

Connect the "VoltOhmyst" to the junction of R104 and Cl07.
Tune Tl02 bottom for zero d-c at the junction of R104 and Cl07. (Make adjustment with core at chassis end of coil.)
4.5 MC. TRAP ADJUSTMENT.-Connect the signal generator in series with a 1500 mmf . capacitor to pin 7 of V108A. Set the generator to 4.5 mc . and modulate it $30 \%$ with 400 cycles. Set the output to approximately 0.5 volt.
Short the third pix i-f grid to ground, pin 1, V107, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video output, pin 6 of V109A.
Adjust the core of Ll09 for minimum output on the oscilloscope. (Make adjustment with core at chassis end of coil.) Remove the short from pin l. V107 to ground.
As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the aligament is completed.
If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc . beat is present in the picture. when the fine tuning control is set for proper oscillator-fre-
quency, then L 109 requires no adjustment. If a 4.5 mc . beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L109 for minimum beat.

AGC CONTROL ADJUSTMENT.-Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V109A.
Connect an antenna to the receiver antenna terminals.
Turn the AGC control fully counter-clockwise.
Tune in a strong signal and adjust the oscilloscope to see the video wavelorm.

Turn the AGC confro! clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained

## HORIZONTAL OSCILLATOR AND OUTPUT ALIGNMENT.

-Normally the alignment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned.

Turn the horizontal drive trimmer Cl71 fully clockwise then counter-clockwise one full turn. Set the stud of the width coil Llll flush with the inside rear edge of the chassis.

Place a jumper across the terminals of the sine wave coil L121 and adjust the horizontal (frequency) control until the picture pulls into sync. Remove the short across the sine wave coil.

Connect the low capacity probe of an oscilloscope to the junction of L120, L121 and R189. Turn the horizontal (frequency) control clockwise until the picture falls out of sync, then counter-clockwise until the picture just pulls into sync. The pattern on the oscilloscope should be as shown in Figure 23. Adjust the sine wave adjustment core L121 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the herizontal (frequency) control if necessary


Figure 23-Horizontal Oscillator Waveforms
This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator may occur. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak ean cause double triggering of the oscillator when the hold control approaches the clockwise position.
Remove the oscilloscope upon completion of this adjustment.

Horizontal Drive Adjustment (for correct locking range) Turn the horizontal (frequency) control until the picture falls out of sync with the diagonal lines sloping down to the right. Slowiy turn the iorizontal control counter-clockwise and note the number of diagonal bars obtained just before the picture pulls into sync.

Pull-in should occur with one and one-hall to three bars present.

With the horizontal control set at the pull-in point, adjust the horizontal drive trimmer Cl71 counter-clockwise for a bright vertical line in the center of the picture. Turn the trimmer clockwise until the line just disappears.

Set the brightness control to maximum and adjust the width control so the picture fills the mask. Return the brightness control to normal and readjust the horizontal drive trimmer as above.
The picture should pull into sync with one und one-half to three bars present reman in sync for approximately two full turns founter-clockwise from pull-in, and fall out of sync with between 2 and 5 bars present before interrupted oscillation (motorboating) occurs.

RCA Victor
CIRCUIT SCHEMATIC DIAGRAM KCS88J, KCS88K, KCS88L, KCS88M or KCS88VA


The schematic is shown in the latest condition at the time of printing
All resistance value in ohms. $\mathrm{K}=1000$.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

21-S-501U to 21-S-537U incl.

(See next page for chassis top view)

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within $\pm 20 \%$ with 117 v. a-c supply

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICLNG INFORMATION

RCA Victor (continued)

21-S-501 to $21-\mathrm{S}-537$ incl. 21-S-501U to 21-S-537U incl.


Chassis Top View (shown wish KRK22D Tuner)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

RAYTHEON MANUFACTURING COMPANY

## 17 T 18 and 21 T 19 CHASSIS

(See list of models on next page, over.)


MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## RAYTHEON 17 Iו8, 21 Iti9 TELEVISION SCHEMATIC DIAGRAM

| MODEL | CHASSIS |
| :---: | :---: |
| M-1750A | $17 T 18$ |
| $\mathrm{M}-1750 \mathrm{C}$ | 17 T 18 |
| $\mathrm{M}-1750 \mathrm{G}$ | 17 T 18 |
| $\mathrm{M}-1750 \mathrm{~K}$ | 17 T 18 |
| $\mathrm{M}-1751 \mathrm{D}$ | 17 T 18 |
| $\mathrm{M}-1751 \mathrm{~F}$ | 17 T 18 |
| $\mathrm{M}-1752 \mathrm{E}$ | 17 T 18 |
| $\mathrm{M}-1752 \mathrm{~L}$ | 17 T 18 |
| $\mathrm{M}-2160 \mathrm{~A}$ | 21 T 19 |
| $\mathrm{M}-2160 \mathrm{C}$ | 21 T 19 |
| $\mathrm{M}-2160 \mathrm{G}$ | 21 T 19 |
| $\mathrm{M}-2160 \mathrm{~K}$ | 21 T 19 |
| $\mathrm{M}-2161 \mathrm{D}$ | 21 T 19 |
| $\mathrm{M}-2161 \mathrm{~F}$ | 21 T 19 |
| $\mathrm{M}-2162 \mathrm{E}$ | 21 T 19 |
| $\mathrm{M}-2162 \mathrm{~L}$ | 21 T 19 |

1) Poof


NOTE:
CAPACITOR VALUES IN MMFD UNLESS OTHERWISE MARKED.
RESISTOR WATTAGE SHOWN IN


H HOLD BRIGHTNESS

TTAGE SHOWN IN MARKED
VSS OTHERWISE MAR

1/26AN8

$\mathrm{B}_{1}$
$\qquad$

FINE TUNING


STATION SELECTOR
Top Controls


Service Controls

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## Raytheon Manufacturing Company Chassis 17T18 and 21T19 (continued)

## PRE-ALIGNMENT PRECAUTIDNS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a $1000 \mathbf{m m f}$ capacitor across scope terminals and a 10 K ohm resistor in series with hot lead
as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. When aligning the IF Amplifier be sure tuner is set to channel 10.

VIDED IF ALIGNMENT

| Step <br> No. | Signal <br> Generator <br> Freq. (mc.) | Sweep <br> Generator <br> Freq (mc.) | Signal <br> Input <br> Point | Output <br> Point | Remarks | Adjust | Response |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{2 n . 9}$ | 25 | Pin 8 <br> of V-5A | Scope at IF <br> detector <br> output | Connect short <br> between pin <br> 5 and 6 of V-4 | T200 pri. (top) <br> T200 sec. (bot.) <br> Coupling rod |  |  |

Markers should fall $10 \%$ down. If response curve is not as shown, readjust coupling rod (bottom T200) for proper bandwidth and T200 primary and secondary for flat response and maximum gain.

| 8 | 21.3 | - | Converter grid | VTVM at Pin 8 of V-6A | Remove short. Adjust generator for output of approx. 2 volts DC on VTVM | L202B (bottom core) | Maximum reading |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4 | 26.5 | - | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L202A (top core) | Maximum reading |
| 5 | 21.3 | - | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L202B (bottom core) | Maximum reading |
| 6 | 24.0 | - | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L200 | Maximum reading |
| 7 | 25.0 | - | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L11 | Maximum reading |
| 8 | - | 25 | Converter grid | Scope at Pin 8 of V-6A | - | L11 | Rock for flat response |
| 9 | $\begin{gathered} 23.8 \\ 26.65 \end{gathered}$ | 25 | Converter grid | Scope at Pin 8 of V-6A | Markers should be $50 \%$ down and response curve should be as shown. If not, repeat alignment | Check point only |  |

Picture IF frequency $\mathbf{2 6 . 7 5} \mathrm{MC}$ - Sound IF frequency 22.25 MC .
NOTE: A very short lead from the generator must be used to prevent regeneration.

## SOUND IF ALIGNMENT

Sound Alignment can be performed without test equipment and without removing the picture tube from the chassis.

1. Tune in a TV station and adjust fine tuning until sound bars just appear.
2. Turn T201 primary (furthest from chassis pan) slug all the way out (counter-clockwise).
3. Turn same T201 slug in (clockwise) until the horizontal scanning lines are smooth and continuous.
4. Readjust fine tuning for best picture with adequate sound.
5. Reduce signal strength at antenna terminals by use of an attenuator or similar device until a "hiss" accompanies the sound.
6. Adjust sound pick-off transformer (T201 secondary), interstage transformer (T100), quadrature coil (L100) and buzz control (R102) for maximum clear sound and minimum buzz.
7. If "hiss" disappears during step 3, further reduce signal strength.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



Sears, Roebuck \& Co. Chassis 528.271, $528.292,528.300$, and 528.303

| Chassis | 528. - |  | Chassi | 528.- |
| :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} 271,-1,-2, \\ 271-3,-4 \end{gathered}$ | $\begin{gathered} 292,-1, \\ 292-2,-3 \end{gathered}$ | Television Receiver Cabinet | $\begin{gathered} 300,-1, \\ 300-2-3 \end{gathered}$ | 303, -1 |
| Catalog Number |  | Description | Catalog Number |  |
| 4125 | $\begin{aligned} & 4133 \\ & 4135 \\ & 4127 C \\ & 4129 A \\ & 4135 B \\ & 4118 B \end{aligned}$ | Console, Mahogany with Doors | 14150 E |  |
|  |  | Console, Maple with Doors | 4155 E |  |
|  |  | Console, Limed Oak with Doors | 4153E |  |
|  |  | Console, Mahogany, Open Face | 4140E |  |
|  |  | Console, Limed Oak, Open Face |  |  |
|  |  | Console, Maroon Leatherette |  | 41270 |
|  |  | Console, Marlite Mahogany |  | 4129B |
|  |  | Console, Masonite, Limed Oak |  |  |
|  |  | Table Model, Mahogany |  | 4118C |
| 4108A |  | Table Model, Limed Oak |  | 4119A |
|  | 4113A | Table Model, Maroon Leath. |  | 4113B |
|  |  | Table Model, Red Leath. |  |  |
| 3104A3102 X |  | Table Model, Black Leath. |  | 4112 |
|  | 3112X | Table Model, Brown Leath. |  |  |
| 4108 |  | Table Model, Marlite Mahog. |  |  |
|  |  | Table Model, Masonite Mahog. |  | 5113 |

Circuit diagram on the next two pages; alignment on the page following the circuit.

All chassis except $528.271,271-1,271-2,271-3,271-4,303$ and $303-1$ contain a $212 P 4,21$ " glass picrure tube. Chassis 528.271, 271-1, 271-2, 271-3 and 271-4 contain a 17BP4, 17" glass tube, whie chassis 528.303 and $303-1$ contain a 21 Wh4, $20.5 / 8^{\prime \prime}$ glass picture tube.


Fig. 2. Top View - All chassis except $528.300,300-1,300-2$ and $300-3$

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Sears, Roebuck \& Co. Chassis 528.271, 528.292, 528.300, 528.303


Sears, Roebuck \& Co. Chassis $528,271,528.292,528.300,528.303$


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Sears, Roebuck \& Co. Chassis $528.271,528.292,528.300,528.303$, continued.

## TELEVISION ALIGNMENT PROCEDURE

## PRELIMINARY

Alignment is an exacting procedure and should be undertaken only when necessary. The following equipment is required for alignment work.

1. Signal generator, with an output of at least 1 volt maximum. Crystal controlled or calibrated markers for the sound (41.25 Mc) and picture ( 45.75 Mc ) IF carriers are required in addition to the following variable frequencies.
4.5 Mc

Intercarrier Sound IF
41.25 Mc Sound IF Trap (T-3, top)
$42.9 \mathrm{M}_{\mathrm{C}} \quad$ 1st \& 3rd I.F. (T-3, bottom; T. 5 bottom)
44.1 Mc Converter and I.F. input (L-2 bottom; L204 Top)
45.2 Mc 2nd \& 4th I.F. (T-4 bottom; T-6 bottom)
$47.25 \mathrm{Mc} \quad$ Adjacent Sound Trap (T-4 Top)
2. Electronic voltmeter (VTVM)
3. R.F. sweep generator with a frequency range of 40 to 220 Mc with a sweep width of at least 10 Mc, having an adjustable output of at least 0.1 volts.
4. Cathode ray oscilloscope, preferably with a wide band vertical amplifier and an input calibrating source.

VIDEO IF ALIGNMENT

| Stop | Signal Generator |  | Output Indicator | Connect to | Adjust | Remarks |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Freauency | Connect to |  |  |  |  |
| 1 | 42.9 Mc | Floating shield on mixer tube, V-21 | VTVM | Junction of R32 and L7 | T3 Bottom for maximum reading | Apply - 4.5 volt bias to AGC line, - side to C.42, + side to chassis. Short antenna terminals, |
| 2 | 42.9 Mc | Same | Same | Same | Ts Bottom for maximum reading |  |
| 3 | 45.2 Mc | Same | Same | Same | T4 Bottom for maximum reading | chassis. Short antenna terminals, set channel selector to unused |
| 4 | 45.2 Mc | Same | Same | Same | T6 Bottom for maximum reading | channel free of harmonics or other interference. Adjust signal penerator to give reading of ap- |
| 5 | 41.25 Mc | Same | Same | Same | T3 Top for minimum reading | proximately 2.5 volts on VTVM. On all "maximum" adjustments |
| 6 | 47.25 Mc | Same | Same | Same | T4 Top for minimum reading | reduce generator output so that <br> VTVM reading does not exceed |
| 7 | 42.9 Mc | Same | Same | Same | T3 Bottom for maximum reading | 2.5 volts. On minimum adjustments increase generator output |
| 8 | 45.2 Mc | Same | Same | Same | T4 Bottom for maximum reading | to provide definite dip on meter. |
| 9 | 44.1 Mc | Same | Same | Same | L2 Bottom for maximum reading |  |
| 10 | 44.1 Mc | Same | Same | Same | L204 Top for maximum reading |  |
| 11 | Sweep 44 Mc , 10 Mc Sweep, Marker to freqs. in Fig. 6 | See Fig. 7 | Oscilloscope | Vertical terminals to junction of R32 and 17 . Horizontal terminals to sweep Gen. | T6 for 45.75 Mc $50 \%$ position. L2 for correct tilt. See Fig. 4 for correct wave form | When sweeping overall pattern do not exceed 2 volts P-P (or approximately 3 volts D.C. at detector load resistor) to avoid overload and distortion of response curve. |

SOUND ALIGNMENT

| Step | Signal Generator |  | Oufput | Connect to | Indicotor | Connect to |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |

NOTE 1. Connect two 100 K ohm matched resistors in series between Pin 2 of V2 ( 6 T 8 ) and ground. Connect negative lead of VTVM to the junction of the two resistors and the positive lead to junction of R4 and $\mathbf{C 7}$.

NOTE 2. As a field adjustment, the 4.5 Mc trap (L5) may be set on a signal by adjusting L5 for a minimum amount of graininess in the picture. This interference can be described as a moving, shadowy, bead-like appearance in the picture which is caused by a breakup at extremely close intervals of the horizontal lines. This is most easily seen in the neutral grey shades in the raster.


## SENTINEL RADIO CORPORATION

(Material below and continued on the next five pages)

## MODELS

WHEN REPLACING PICTURE TUBE ALWAYS HAVE FACE OF TUBE TIGHT AGAINST RUBBER STOPS
ADJUSTMENT PROCEDURE FOR DEFLECTION YOKE, ION TRAP, HORIZONTAL AND VERTICAL CENTERING, CORNER SHADOW, AND PICTURE TUBE ALIGNMENT.


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICLIG HNFORNATION

Sentinel Models $1 \mathrm{U}-701,1 \mathrm{U}-711$, etc. (Continued)

## RATIO DETECTOR AND SOUND I-F ALIGNMENT

In most cases only the secondary of the ratio detector coil will require adjustment. This can be done simply by adjusting the top adjustment screw of the ratio detector for minimum buzz with the sound carrier of a TV station. For complete alignment use steps 1,2 , and 3 in the alignment table.


FIG. 4

VHF ALIGNMENT TABLE
RATIO DETECTOR AND SOUND ALIGNMENT

| Step No. | Connect Signal Generator to | Sig. Gen. Freq. | Connect Voltmeter to | Miscellaneaus Instructions | Adjust |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | In series with . 001 Mfd. Cond. to junction of L-15 and L-16. See fig. 6 | 4.5 MC. | In series with 47,000 ohm res. across C-66 a 10 Mfd cond. See fig. 6 | Maintain reading on 10 volt scale contrast at maximum. <br> Remove 3rd video IF tube 6CB6. | T-15 (top) and T16 (bottom) for max. reading. See fig. $5 \& 6$ |
| 2 | In series with .001 Mfd. Cord. to junction of L-15 and L-16. See fig. 6 | 4.5 MC. | In sories with 47,000 ohm res. to junction of R-60 and C-69 See fig. 6 | Maintain reading on 10 volt scale contrast at maximum. <br> Remove 3rd video IF tube 6CB6. | T-16 (top) for zero reading. See fig. 5 |
| 3 | In series with .001 Mfd . Cond. to cathode of picture tube yellow lead. See fig. 6 | 4.5 MC. | In series with 47,000 ohm res. across C-66 a 10 Mfd . cond. See fig. 6 | Maintain reading on low volt scale. <br> Remove 3rd video IF tube 6CB6. | T. 14 (top) for minimum reading. See fig. 5 |

NOTE 1: For minimum buzz always adjust $T$ - 16 (top) with the sound carrier of a TV station.
NOTE 2: Alternate 4.5 MC. trap alignment: Adjust T-14 (top) for minimum 4.5 MC. beat on picture with a strong station signal.
PICTURE I-F ALIGNMENT

| Step No. | Connect Signal Generator to | Sig. Gen. Freq. | Connect Voltmeter to | Miscellaneous Instructions | Adjust |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 4 | Ungrounded converter tube (6U8) shield | 44.0 MC. | In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6 | Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 | T-13 (top) for maximum reading. See fig. 5 |
| 5 | Ungrounded converter tube (6U8) shield | 43.2 MC. | In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6 | Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 | T-12 (top) for maximum reading. See fig. 5 |
| 6 | Ungrounded converter tube (6U8) shield | 41.25 MC. | In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6 | Tuner on channal 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 Repeat Steps 5 \& 6 | T-12 (bottom) for minimum reading. See fig. 6 |
| 7 | Ungrounded converter tube (6U8) shield | 45.4 MC. | In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6 | Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. Sse fig. 6 | T-II (top) for maximum reading. See fig. 5 |
| 8 | Ungrounded converter tube (6U8) shield | 47.25 MC. | In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6 | Tuner on channel 3,3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 Repeat Steps 7 \& 8 | T-II (bottom) for minimum reading. See fig. 6 |
| 9 | Ungrounded converter tube (6U8) shield | 44.5 MC. | In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6 | Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 NOTE: Detune T-IO by turning slug out as far as possible. | T. 1 (top) for maximum reading. See fig. 5 |
| 10 | Ungrounded converter tube (6U8) shield | 45.75 MC. | In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6 | Tuner on channel 3, 3 volts bias across C-49 positive side to position. See fig. 6 | T-10 (top) for maximum reading. See fig. 5 |

NOTE 3: For visual check of IF response curve (see fig. 3) connect signal and sweep generator to ungrounded converter tube shield (6J6). Connect oscilloscope in series with 47,000 ohm resistor to junction of R-46 and L-16.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Sentinel Models $1 \mathrm{U}-701,1 \mathrm{U}-711,1 \mathrm{U}-714,1 \mathrm{U}-721,1 \mathrm{U}-724,1 \mathrm{U}-752$, etc. (Continued)




## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## Sentinel TRIMMER LOCATION AND ALIGNMENT CONNECTION POINTS (Continued)



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

MODELS

See pages 146-147 for circuit diagram, and page 148 for alignment.


FRONT VIEW OF CHASSIS


REAR VIEW OF CHASSIS
(Tube \& Alignment Locations \& Tube Filament Wiring)

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

SENTINEL RADIO CORP.

## REMOVING CABINET FROM CABINET BASE (TABLE MODELS ONLY)

1. Remove all control knobs and cabinet back.
2. Remove antenna terminal plate from cabinet and disconnect speaker leads.
3. Place cabinet face down on a soft clean cloth.
4. Remove ONLY the cabinet mounting screws located under and on the outer edges of cabinet base. DO NOT REMOVE CHASSIS MOUNTING SCREWS. Remove the 2 wood screws from the lower rear corner support braces of cabinet.
5. Carefully guide cabinet and cabinet base to its normal upright position. Remove cabinet by lifting straight up.

MODELS
1 U-901 1 U-921
1U-911 1U-924
1 U-914 1U-991


THE PROPER ADJ. SCREW FOR THE CHANNEL TUNED TO WILL APPEAR HERE.

Provide markers as shown on curve.


NOMINAL OVERALL I-F RESPONSE CURVE


## REMOVING CHASSIS BASE FROM CONSOLE CABINETS

1. Remove all knobs and cabinet back.
2. Remove antenna terminal plate from cabinet and disconnect speaker leads.
3. Remove the screws under guide rails of chassis base and the one screw under center support


MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Sentinel Radio Corp.
ALIGNMENT DATA Models 1U-901, etc. (Continued)
CAUTION: One side of the chassis is connected to the power line. Therefore, fest equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.
The front side of the chassis as referred to below means the side opposite the tubes.
SOUND ALIGNMENT

| Step No. | Connect Signal Generator Through a . 01 Capacitor | Signal Gen. Freq. MC. | Connect VTVM | Miscellaneous Connections and Instructions | Adjust |
| :---: | :---: | :---: | :---: | :---: | :---: |
| I | Cathode of Picture Tube | 4.5 mc . | Across secondary of output trans. Tlo5. | Use a high input level on signal generator. | Adjust L109 (rear slug) for minimum reading. |
| 2 | Pin 8 of V104. | 4.5 mc . FM modulated 400 c.p.s., 25 kc . deviation | Across secondary of output trans. TIO5. | Set Buzz Control (RI32) to approximately $90^{\circ}$ from clockwise stop. Set the Volume Control (R135) at a low level. | Ll06 for maximum reading. |
| 3 | Pin 8 of V104. | 4.5 mc . FM modulated 400 c.p.s., 25 kc . deviation | Across secondary of output trans. TIO5. | Set Buzz Control (RI32) to approximately $90^{\circ}$ from clockwise stop. Set the Volume Control (RI35) at a low level. | LIII for maximum reading keeping input signal at a low level (below limiting). |
| 4 | Pin 8 of V104. | 4.5 mc . <br> FM modulated <br> 400 c.p.s.. <br> 25 kc . <br> deviation | Across secondary of output trans. TlO5. | Set Buzz Control (R132) to approximately $90^{\circ}$ from clockwise stop. Set the Volume Control (RI35) at a low level. | L109 (front slug) for maximum reading keeping input signal at a low level. |
| 5 | Pin 8 of V104. | 4.5 mc . AM modulated 400 c.p.s. | Across secondary of output trans. 1105. | Use a high input level on signal generator. | Buzz Control (R132) for null (minimum reading). |
| 6 | Pin 8 of V104. | 4.5 mc . FM modulated 400 c.p.s., 25 kc . deviation | Across secondary of output trans. TIO5. | Set the Volume Control (R135) at a low level. | Re-peak Ll06 for maximum reading. |

## I.F. ALIGNMENT



## Sparton CHASSIS TYPE 23 U214 <br> THE SPARKS-WITHINGTON COMPANY-JACKSON, MICHIGAN

SPARTON Models 11T210, 12A204, 12A210, and 14A204
(Circuit diagram on pages 148-149; see page 150 for data on Standard
Tuner used in these sets.)


Ion Trap and Focus

1. With brightness control set for low brilliance, move trap forward or backward and at the same time rotate until maximum brightness of raster is obtained.
2. Readjust raster brilliance to normal.
3. Adjust focus control until best picture detail is observed over entire face of picture tube.
4. Readjust ion trap once more for maximum brilliance.

THERE MAY BE TWO LOCATIONS WHERE ION TRAP WILL PRODUCE BRILLIANCE ON CRT; USE ONLY THE POSITION NEAR THE CRT BASE SOCKET; NEVER USE THE FORWARD POSITION
Deflection Yoke

1. The yoke must be held firmly against the flare of CRT.
2. To level picture, loosen and adjust wing nut on yoke.

## Centering Raster

1. Center with magnet control tab on focus unit.
2. Readjust ion trap for maximum brilliance.

Picture Symmetry
Sornetimes linearity and corresponding size controls may have to be re-adjusted. A test pattern is
most practical for these adjustments which consist of HEIGHT, VERT LIN., WIDTH, and HOR LIN.
Peak Performance Control

1. With receiver operating, set the peak performance control to extreme counter-clockwise position (fringe area).
2. Tune in strongest signal in your area.
3. Set contrast to maximum (extreme clockwise position).
4. If picture appears normal leave control set in fringe position.
5. If picture shows any signs ov overload, rotate control clockwise towards local position until picture becomes normal.
6. Do not turn control toward local position any more than necessary.

Horizontal Oscillator (Make only when necessary)

1. Pull 6AL5 (phase detector).
2. Set hor. hold to center of range.
3. Shunt L47 with . 1 MFD 400 V condenser from test point on high voltage transformer to ground.
4. Adjust R133 until picture floats in horizontal sync.
5. Remove .1 condenser and adjust L 47 until picture floats in horizontal sync.
6. Replace 6AL5.
7. Pull-in should occur when 2 or 3 diagonal bars are observed as hor. hold is rotated towards center of range.
FOCUS ADJUSTMENTS:
Under certain conditions the focus may be improved by adjusting focus unit mounting brackets to locate the focus unit approximately $4-1 / 4$ to $4-3 / 8$ inches from the base of the picture tube (measured from the end of center locating key of duodecal base). With the ion trap set as previously described, adjust the focus control for best overall picture detail.

CAUTION: READJUST ION TRAP AFTER ALL ADJUSTMENTS OF FOCUS.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



SPARTON TELEVISION SCHEMATIC DIAGRAM

CHASSIS TYPE $23 U 214$ MODELS $11 T 210,12 A 204,12 A 210,14 A 204$




## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Standard Tuner used in Sparton Chassis 23U214, continued.

R. F. Tuner.

Figure 1 shows an exploded view of the composite Standard Coil tuner. It can readily be seen that separate UHF and VHF assemblies have been combined mechanically and electrically to form the complete unit. Three concentric shafts are used to drive all of the UHF/VHF switching and tuning elements. Of these, the inside shaft rotates a 12 position VHF turret assembly and, ganged to this same shaft, three cam shape dielectric sections that tune the UHF decade coils through the UHF digit positions. The center shaft rotates the UHF decade turret and with an attached double action cam tilts the 45 MC I. F. rocker bar into position for UHF operation. The third or outside shaft drives the ganged VHF and UHF fine tuning capacitors.
Block diagrams $A$ and $B$ show how the tuner circuits are arranged in the VHF and UHF positions.
The antenna circuit of the VHF portion contains resonant circuits L2-C8 and L3-C7 which are fixed tuned for maximum rejection of interference in the I.F. band. Circuit C9-L10 can be variably tuned to provide additional attenuation of any specific interfering signal in the 35 to 48 MC region. Remaining circuitry in the VHF section of the tuner is similar to that found in the straight VHF version, except that a pentode triode (6U8) is used as the VHF oscillator mixer. The coupling circuit between the mixer plate and 1st video I.F. stage is described in the video I.F. section.
A separate UHF antenna input is provided on the tuner. This is connected to capacitors C30 and C31, which together with coils L20 and L21 form a high pass filter with a cutoff frequency just below the UHF band. This system attenuates I.F., VHF and other interfering signals before they can enter the IN82 crystal mixer circuit.
The remainder of the antenna circuit consists of a portion of the UHF decade coil assembly (D on the schematic diagram) plus trimmers C33 and C34, choke L6 and capacitor C164. Tuning coils L22 and L23 are connected to capacitor blades which are imbedded in the coil board assembly proper (see item 64 to 71 , figure 1). UHF channels within the range of a particular decade coil are tuned by movement of cam shaped dielectric sections which mechanically fit between these capacitor blades. To cover the entire UHF band eight separate decade coil board assemblies are switched in and out of the circuit by rotation of the UHF turret assembly (item 57, 58, shown in figure 1).

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## STEWART-WARNER MODELS 17T-9620A, 17T-9620B, 21C-9630C, 21C-9630CB, 21C-9630D, 21T-9630A, 21T-9630AB

Circuit diagram and other service information is printed on pages 152-153.

|  | PRODUCTION CHANGES |
| :---: | :---: |
| The following tabulation furnishes complete details on changes which occurred during rocesiver production. The chassis circuitry can be estabtished by referring to the serial number label <br>  numbers of a hioh urder will contain changes listed under lower order numbers. |  |
| A letter following the component circuit diagram number thus-201A. indicates that this item was offected by a circuit change and is used only for circuit diagram reference. |  |
| SERIAL NUMBER | DESCRIPTION OF CHANGE |
| 104,601 | Initial Production |
| 106,601 | The following change was incarporated ta reduce drive bar and affected components have circuit diagram reference $A$. <br> 1. Resistar 169 was added between the center top of the power transformer 63 and chassis ground. <br> 2. Resistor 106 in grid circuit of tube V10, Horizontal Scanning Output, was changed from 470,000 Ohms to 330,000 Ohms. |
| 106,701 | The companents offected by the following changes have circuit reference $B$. <br> The following change was incorporated to provide a longer antenna lead. in. <br> 1. R.F. Tuner part number was changed from 522514 to 522931 . There are na electrical differences between these two units. <br> The following change was incorporated to reduce radiation of harmonic frecuencies being fedback through antenna lead. in. <br> 1. Tube shields were added to the three I.F. Amplifier tubes V3, V4, and vs. <br> 2. Antenna lead-in was dressed against side of chassis and antenna terminals were lowered to lower part of cabinet. <br> 3. Resistor 168 ( 15,000 Ohms) was added across primary of 3rd I.F. transiormer. <br> 4. Peaking Coil 187 was added between defector 40 and condenser 44 . The following change was incorporated to facilitate production. <br> 1. Power Tronsformer 63 part number was changed from 522577 to s22973. When ortier transtormer is <br> 2. Ion trap, 60 part number was changed from 521183 to 523001 . <br> The following change was incorporated to improve the taper of the Picture control. <br> 1. Volume ond Picture potentiometers, 46-A,B,C part number was shanged from 522515 to 522744 . When the latter control is used, resistor 47 is no longer required, therefore, it wos omitted. |





## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

VOLTAGE MEASUREMENTS
All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to
a 117 volt 60 cycle power supply.
Tuner set to an inactive channel with antenno terminals shoried and connected to ground.
Controls set for normal reception-Picture control completely counterclockwise. Voltages marked with an asterisk (*) will vary widely with confrol settings.
All voltages shown, except R.F. Tuner socket measurements, were taken under the above conditions.
R. F. tuner socket voltage measurements were taken with tubes removed from sockets.

STEWART - WARNER
Models $17 \mathrm{~T}-9620 \mathrm{~A},-\mathrm{B}, 21 \mathrm{C}-9630 \mathrm{C}$, $21 \mathrm{C}-9630 \mathrm{CB},-\mathrm{D},-\mathrm{A},-\mathrm{AB}$.


# STEWART-WARNER MODELS <br> 21C-9700W, 21C-9700WB, 21C-9700X 21C-9700XB, 21T-9700R, 21T-9700RB 

 IOENTIFICA

3rd
i.F. Coil
520979 IOENTIFICA

3rd
i.F. Coil
520979 IOENTIFICA

3rd
i.F. Coil
520979

WHite

 '̀" 28

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.
Tuner set to an inactive channel with antenna terminals shorted and connected to ground.
Controls set for normal reception-Power Booster control completely counterclockwise.
Voltages marked with an asterisk (*) will vary widely with control settings.
All voltages shown, except R.F. Tuner socket measurements, were taken under the above conditions.
$\ddagger$ R. F. tuner socket voltage measurements were taken with tubes removed from sockets. No voltage reading at a tube element indicates zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.

## OSCILLOGRAMS

All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Power Booster control adjusted to give 40 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within $20 \%$ at 2 MC .
Number appearing ta the left of ascillogram specifies setting of horizontal sweep frequency control on Scope.

MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION
STEWART-WARNER Models 21T-9700R, 21T-9700RB, $21 \mathrm{~T}-9700 \mathrm{~W}$,
21T-9700WB, $21 \mathrm{~T}-9700 \mathrm{X}, 21 \mathrm{~T}-9700 \mathrm{XB}$.


## MOST-OFTEN-NEEDED 1955 THLEVISION SERVICING INFORMATION

STEWART - WARNER Models 21T-9700R, -RB, -W, -WB, -X, -XB, Continued



521068 R.F. TUNER UNT (SHOWN WITH SIDE SHELD REMOVED)


TUBE AND CONTROL LOCATIONS


$\rightarrow\left\{\begin{array}{l}\text { (INCLUDES SLUG \& CLIP) } \\ \frac{509062 ~ S L U G ~ C O R E-C O N V E R T E R ~ P L A T E ~ C O I L ~}{520518 ~ C O T L-C H O K E ~}\end{array}\right.$
$434 \frac{509062 \text { SLUG CORE }}{520518 \text { COIL-CHOKE }}$


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## STROMBERG-CARLSON 2IT-22T SERIES TELEVISION RECEIVER

## UHF Conversion Model 21 T.

In these models the receiver is equipped with a funing unit that is capable of receiving UHF stations by making a slight modification on the tuner.
(Caution: U type UHF and VHF strips must be used in the 21 T chassis).

To accomplish Customized Tuning on either UHF or VHF, it may be necessary to center the range of the fine tuning control. Set the selector knob to the desired channel and adjust the fine tuning control for the midpoint of its rotation. Remove the control knobs and insert a thin non-metallic screwdriver through the cabinet adjustment hole, and adjust oscillator slug for best picture and sound. Note that each channel is to be adjusted individually, both on UHF and VHF.

## AGC Adjustment.

The AGC control is located on back of the chassis (See tube location chartl. The purpose of this control is to eliminate an interference beat which may be produced in strong channel 6 areas. The normal position of this control is fully counterclockwise when beat interference is not present.

If this beat occurs, the control should be turned slockwise from a completely counter-clockwise position until the beat disappears.

T-11 has been changed in production (effective as follows):

1. Remove white lead from bottom terminal of trap coil to cathode of fube.
2. Disconnect ground end of cathode resistor (330 ohmy and by-pass ( 330 MMF ) and connect to cathode of fube.
3. Connect jumper, between the ground point of which the cathode resistor-condenser combination was connected, and the bottom terminal on the same side of the coil.

Keep in mind on the 21-22 series TV receivers that the current to the IF strip is drawn through $V-19$ ( 6 W 6 audio output tube). Failure of this tube, of course, would remove $B$ plus from the IF slrip, causing no picture and no audio.

The following changes have been made in production

1. Delete C.131.0047 MF capacitor
2. Delete C-133 100 MMF capacitor.
3. Delete C-191.1 MF capacitor.
4. Delete R-191 560K resistor.
5. Delete R-185 120 K ohm resistor.
6. Change R-184 from 270 K ohm to 560 K ohm resistor. (S-C Part $\$ 28188$ ).
7. Add $1680 \mathrm{~K} 1 / 2$ watt resistor R-108 (S.C Pari $\$ 28189$ ) from pin 5 of V-19 ( 6 W 6 audio output) to junction of R-193 and C-193.
8. Add 470 K ohms $1 / 2$ watt resistor R-197 (S-C Part $\# 28187$ ) from R-190 270K ohm resistor to ground.
9. Add 26.8 K 2 watt resistors R-185 (S-C Part \#149053) in series from 8 plus 150 volts to ground.
10. Remove R-243 3.9 K ohm resistor from junction of R-204 and R-215 and connect to B plus 150 volts.
11. Remove B plus 150 volts from 1 st IF V-9 ( 6 CB 6 ) at junction of R-94, R-93, C-94 and connect to B plus 110 volts.

A change in the circuit of the 21-22 series TV receivers to prevent pulling at the fop of the picture, has been put in production. A 2.2 meg. $1 / 2 \mathrm{w}$. resistor R-249 (S.C Port $\# 149121$ ) has been added from B plus 310 volts to pin 1 of $V-20$ ( 6 AU6) keyed AGC tube. A $47 \mathrm{~K} 1 / 2 \mathrm{w}$ resistor $\mathrm{R}-216$ (S-C Part $\$ 149111$ ) is added across L-28 horizontal frequency coil. (Code date 54-211).


ALTERNATE TRAP ALIGNMENT
If THIS METHOD IS USED, IT SHOULD BE PERFORMED BEFORE THE IF CURVE ALIGNMENT

| SIGNAL GENERATOR CONNECTION | OSCILLOSCOPE OR VTVM CONNECTION | ADJUSTMENTS |
| :---: | :---: | :---: |
| 1. Connect a modulated (400 cycle) 39.75 MC signal to the grid of lst IF tube, pin 1 of V-9, 6CB6. | Same as Step \$1. (above). | 1. Adjust top slug of T-6 for minimum response on scope. |
| 2. Connect a modulated (400 cycle) 47.25 MC signal to the grid of 1 st IF tube, pin 1 of V-9, 6CB6. | Same as Step \# 1. | 2. Adjust top slug of $\mathrm{T}-8$ for minimum response on scope. |
| 3. Connect a modulated $(400$ cycle) 41.25 MC signal to the grid, pin 1 of V-9, 6CB6. | Same as Step \# 1. | 3. Adjust top slug of T-7 and T-ll for minimum response on scope. |

Complete alignment on the page after next. Circuit diagram on the next page, over.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Stromberg-Carlson 21T-22T Series Television Receivers Circuit Diagram


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Stromberg-Carlson 21T-22T Series Television Receivers (Continued)

## ALIGNMENT PROCEDURE

Apply AGC bias of opproximately 3 volts to AGC line (across C-160).
Maintain the output Jevel of the sweep generator to obtain a second detector outpul of 2 volts peak-topeak. Oscilloscope should be calibroted to read 1 -VOLT per inch vertical deflection.

| SIGNAL GENERATOR CONNECTION | OSCILLOSCOPE OR VTVM CONNECTION | ADJUSTMENTS |
| :---: | :---: | :---: |
| 1. Output of 40 MC . sweep generator to grid of lst IF tube, pin 1 of V9, 6CB6 thru 100 MMF isolating capacitor. | Input of scope to grid of Video Amp., pin 1 of V-13, 6AU6 thre 47KOhm isolating resistor. | 1. Adjust the bottom slug of T-7 1st If iransformer for low intermediate frequency (43.2 MC approx.). <br> 2. Adjust the boltom slug of T-9 3rd If transformer for low frequency. (42.0 MC approx.). <br> 3. Adjust the bottom slug of $\mathbf{T}-8$ 2nd IF transformer for high frequency. (45.0 MC approx.). <br> 4. Adjust the bottom siug of T-10 4th If transformer for high infermediate frequency. (44.5 MC approx.). <br> 5. Maintaining the above relative frequency positions of the individual stages, adjust the slugs to produce a curve as shown with the 41.9 and 45.75 MC markers at $50 \%$ response Fig. \# 1. |
| 2. Output of 40 MC sweep generator to junction of $\mathrm{T}-6$ and L-18. Using 39.75 MC marker. <br> 3. Same os Step \# 2. Using 41.25MC marker. | Same as Step \# 1. Same as Step \# 1. | 1. Adiust the top slug of T-6 for response 39.75 MC as shown on curve Fig. 2. <br> 1. Adiust the top slug of T-7 and T. 11 for response as shown on curve Fig. 2. |
| 4. Same as Step $\# 1$ using 47.25 MC marker. | Same as Step \$ 1. | 1. Adjust the top slug of T-8 for response curve as shown on Fig. 3. <br> 2. Repeat Step \# 1 (IF response) to reproduce the curve as shown in Fig. 1. |
| 5. Raise converter tube shield from ground and connect output of 40 MC sweep generator to the shield. | Same as Step \$ 1. | 1. Adjust the bottom slug of T-6 and T. 5 tuner assembly to produce a curve as shown in Fig. 4. |

6. Connect a 400 cycle modulated 4.5 MC signal to the junction of Video Detector $M-13$ and C-126. Adjust generator output to a level to indicate 1.5 volts VTVM.

Connect 2-100K resistors in series from the plate of rotio detector, pin 2 of V-18, 6T8 to ground, connect VTVM from junction of the resistors to ground.

## Connect VTVM ground

 lead to the junction of the 2-100K resistors (see step $\$ 6$ above). Connect VTVM D.C. leod to the junction of C-181 and R-1811. Adjust L-21, T-15, and the bottom slug of $\mathrm{T}-16$ for maximum indication.

Tube and trimmer location diagram on the next page.

Adjust the top slug of T. 8 for response curve as shown on Fig. 3.

Repeat Step $\% 1$ (if response) to reproduce the curve as hown in Fig. 1.

FIG. 4

Adjust the bottom slug of T-6 Tuner assembly to produce a curve as shown in fig. 4.

Stromberg-Carlson Tube and Trimmer Location Diagram

## 21T-22T Series Television Receiver



NOTE: 1 N105 Diode Detector is Located Under Removable Shield Cover of T-10 4th Video IF Trans.

# SYLVANIA ELECTRIC PRODUCTS INC. <br> CHASSIS 1-522-1, -2 <br> <br> MODELS 596 SERIES 

 <br> <br> MODELS 596 SERIES}

picture tube installation

## HORIZONTAL AFC CIRCUIT ADJUSTMENT

1. Tune in a normal air signal and adjust L71 Horizontal Size control for approximately normal scan using a locked-in picture.
2. Turn receiver power "off" and connect shorting jumpers as follows:
a. From junction of R212 (330 ohm) and T 60 sync phase splitting coil to chassis.
b. Across terminals of L68 Horizontal Frequency coil.
3. Turn receiver power "on" and tune in a normal air signal.

## SERVICE INSTRUCTIONS

REMOVAL AND CALIBRATION OF CHANNEL SELECTOR KNOB:
a. To remove Channel Selector knob, loosen (do not remove completely) knob retaining clamp screw. Knob may then be pulled off tuner shaft.
b. To calibrate Channel Selector knob, rotate Channel Indicator Dial in cabinet front until channel number that tuner is set to appears behind picture window glass. Install Channel Selector knob meshing its gears with those of the dial. Make any minor adjustments required to insure that dial number corresponds to tuner setting.
4. Rotate R259 Horizontal Hold control to center position.
5. Adjust R260 Horizontal Range control until picture moves back and forth across screen with blanking bar vertical
6. Remove shorting jumper from L68 Horizontal Frequency conl.
7. Adjust $L 68$ Horizontal Frequency coil until picture moves back and forth across screen with blanking barverticol.
8. Remove shorting jumper from junction of R212 (330 ohm) and T60 sync phase splitting coil to chassis.


Service material on Chassis 1-522-1, -2, continued on the next five pages.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

## PREALIGNMENT INSTRUCTIONS <br> READ CAREFULLY

1. Stand chassis on side with high voltage shield down for under chassis adjustments.
2. Ground all test equipment unless otherwise stated.
3. Keep detector circuit leads as short as possible.
4. Allow test equipment and receiver chassis to warm up for 15 min utes after the intial equipment and ACC battery setup.
5. Deflection yoke should be connected during alignment.
6. Use non-metallic allgnment tools for powdered iron cores. Metallic screwdriver may be used for brass screw adjustments.
7. Wrap a short length of insulated wire around pin 7 prong of V2 (6X8) tube in VHF tuner to facilitate test equipment connections.

Sylvania Electric Products
Chassis 1-522-1, -2
Models 596 Series
(Continued)

## VIDEO IF ALIGNMENT

| STEP | ALIGNMENT SETUP NOTES | TEST EQUIPMENT HOOKUP | ADJUST |
| :---: | :---: | :---: | :---: |
| 1. | Connect 20V. battery (-) terminal to junction of C129 (. 047 mfd .) and R 128 (120K) and connect ( + ) terminal to chassis. <br> Set VHF tuner to signal-free channel with minimum interference. | SIGNAL GENERATOR - to ungrounded tube shield on Osc. /Mixer tube on VHF tuner. <br> VTVM - D.C. Probe to junction of L58 peaking coil and R151 (2.7K). | L54 (top core) for MIN. at 39.75 MC . T55 (top core) for MIN. at 41.25 MC . L55 for MIN. at 41.25 MC . T56 (top core) for MIN. at 47. 25 MC . <br> Use sufficient signal generator output for satisfactory VTVM reading. |
| 2. | Same as 1. | Same as 1. | T58 for MAX. at 44. 0 MC . <br> T57 for MAX. at 42.0 MC . <br> T56 (bottom core) for MAX. at 45.2 MC. <br> T55 (bottom core) for MAX. at 43.2 MC. <br> Adjust signal generator output to keep VTVM reading between 1 and 2 volts. |
| 3. | Repeat step 1 trap adjustments. |  |  |
| 4. | Remove 20V. AGC battery. <br> Disconnect T55 lead from pin 5 of V3 (6CB6). Connect 330 ohm resistor across T55 primary from R132 (1K) to pin 5 of V3. <br> Set VHF tuner to signal-free channel with minimum interference. | SWEEP GENERATOR - to pin 7 of V2 (6X8). Set to 43. 5 MC with 10 MC sweep. <br> SIGNAL GENERATOR - loosely couple to sweep generator lead. <br> OSCILLOSCOPE - through detector circuit to pin 5 of V3 (6CB6). | L54 (bottom core), L16(VHF tuner) and L53 for response curve shown: |
| 5. | Repeat step 4 adjustments until response curve is flat with $\mathbf{4 2 . 1} \mathrm{MC}$ and $\mathbf{4 5 . 7 5} \mathrm{MC}$ markers |  |  |
| 6. | Connect 20V. battery (-) terminal to junction of C129 (. 047 mfd .) and R 128 (120K) and connect ( + ) terminal to chassis. <br> REMOVE 330 OHM RESISTOR AND RECONNECT T55. <br> Set VHF tuner to signal-free channel with minimum interference. | SWEEP GENERATOR - to ungrounded tube shield on Osc. /Mixer tube on VHF tuner. Set to 43. 5 MC with 10 MC sweep. <br> SIGNAL GENERATOR - loosely couple to sweep generator lead. <br> OSCILLOSCOPE - through 33 K resistor to junction of L58 peaking coil and R151 (2.7K). | Retouch T58, T57, T56 (bottom core) and T55 (bottom core) if necessary to obtain response curve shown: |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Sylvania Electric Chassis 1-522-1, -2, Alignment Information, Continued

### 4.5MC TRAP ALIGNMENT

| STEP | ALIGNMENT SETUP NOTES | TEST EQUIPMENT HOOKUP | ADJUST |
| :---: | :---: | :---: | :---: |
| 1. | Short pin 2 of V6 (6AM8) to chassis. | SIGHAL GENERATOR - to pin 2 of V8 (12BY7). Set to 4.5 MC. <br> VTVM - R.F. Probe to pin 11 of V24 (Picture Tube); Ground Lead to chassis. | L61 for MINIMUM. |
| SOUND ALIGNMENT |  |  |  |
| STEP | ALIGNMENT SETUP NOTES | TEST EQUIPMENT HOOKUP | ADJUST |
| 1. | Short pin 1 of V5 (6CB6) to chassis. DO NOT GROUND VTVM. | SIGNAL GENERATOR \#1 - through 1 K resistor to pin 2 of V6 (6AM8). Set to 45.0 MC . <br> SIGNAL GENERATOR \#2 - through 1 K resistor to pin 2 of V6 (6AM8). Set to 4.5 MC . <br> OR <br> SIGNAL GENERATOR - through 1K resistor to pin 2 of V6 (6AM8). Set to 45.0 MC with a crystal controlled 4.5 MC marker. <br> ALSO <br> VTVM - D. C. Probe to pin 5 of V10 (6AL5); Ground Lead to pin 7 of V10 (6A L5). | T52 (both cores) for MAXIMUM. T59 (both cores) for MAXIMUM. <br> Use peak resulting in greatest separation of cores. <br> Repeat adjustments until maximum reading is reached. |
| 2. | Same as 1. | USE SAME SIGNAL GENERATOR HOOKUP AS IN STEP 1. <br> VTVM - D. C. Probe through 100K resistor to term inal "1 of de-emphasis plate; Ground Lead to junction of two matched 100 K resistors connected in series across R106 (68K). | T52 (top core) for ZERO. <br> Use lowest VTVM scale set to zero center. At correct core setting, a slight turn of core will give either a positive or negative reading. |
| 3. | Remove test equipment and resistors; then, tune in a weak station and adjust T52 (top core) for optimum signal-to-noise ratio. |  |  |

## ALTERNATE SOUND ALIGNMENT

| STEP | ALUGNMENT SETUP NOTES | TEST EQUIPMENT HOOKUP | ADJUST |
| :---: | :---: | :---: | :---: |
| 1. | Connect a good antenna installation to receiver. <br> Set VHF tuner to a strong station. <br> DO NOT GROUND VTVM. | VTVM - D. C. Probe to pin 5 of V10 (6AL5); Ground Lead to pin 7 of V10 (6AL5). | T52 (both cores) for MAXIMUM. <br> T59 (both cores) for MAXIMUM. <br> Use peak resulting in greatest separation of cores. <br> Repeat adjustments until maximum reading is reached. |
| 2. | Same as 1. | VTVM - D. C. Probe through 100K resistor to terminal \#1 of de-emphasis plate; Ground Lead to junction of two matched 100 K resistors connected in series across R106 (68K). | T52 (top core) for ZERO. <br> Use lowest VTVM scale set to zero center. At correct core setting, a slight turn of core will give either a positive or negative reading. |
| 3. | Remove test equipment and resistors; then, tune in a weak station and adjust $\mathbf{T} 52$ (top core) for optimumsignal-to-noise ratio. |  |  |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## TRAV-LER RADII CURPIRATIIN Chassis Nos. 48A3 and 48A4

The material on pages 167 through 170 is exact for chassis listed above. Chassis 47A3 is the same except a different tuner is used.
Chassis 48 C 4 is very similar to these models.
Chassis 49A4 is almost the same, but uses still another type tuner.
The alignment information applies to all these chassis.
FRONT PANEL CONTROLS


The 40 Mc IF amplifier strip can be aligned by following the procedure listed below. These instructions are to be used in conjunction with schematic diagram

These IF transformers use a threaded coil form with a powdered iron core having a $3 / 16^{\prime \prime}$ hex center and is to be adjusted with a non-metallic alignment tool with a $3 / 16^{\prime \prime}$ hex stud. One such item is the Walsco 2526 molded-nylon tool.

1. Tune receiver to channel 12.
2. Set PICTURE control fully counter-clockwise (minimum).
3. Connect negative lead of 3 -volt battery at point (B) shown on schematic diagram; connect positive lead to chassis.
4. Connect vertical input of oscilloscope at point (A); connect ground lead to chassis.
5. Connect sweep generator ( 40 to 48 Nic ) to loosely coupled shield of 6 J 6 or 6 U 8 oscillator-mixer tube making certain that shield is not grounded. Connect ground lead to chassis.
6. Connect synchronized sweep voltage from sweep signal generator to horizontal input of oscilloscope for horizontal deflection.
7. Marker generator frequencies are 41.25 Nc for sound carrier and 45.75 Mc for video carrier.
8. Adjust IF coils and transformers L-6, L-47, L-49, L-48, and L-50 for response curve similar to figure below with markers as shown,
9. L-6 Mixer plate coil of tuner tuned near center of pass band at approximately 43.5 Mc . Detuning affects dip at bottom of response curve.
10. L-47 IF input coil tuned near center of passband at approximately 44.5 Mc. Detuning affects dip at bottom of response curve.
11. L-49 (bottom) lst IF transformer tuned to low side of pass band at approximately 42.5 Kc . Detuning affects low side of response curve. Sound carrier trap coil (top) tuned to 41.25 Mc .
12. L-48 (bottom) 2nd IF transformer tuned to high side of passband at approximately 45.5 Mc . Detuning affects high side of response curve. Adjacent channel sound carrier trap (top) tuned to 47.25 Nc .
13. L-50 3rd IF transformer tuned to center of passband at approximately 44 Mc. Detuning tilts bottom of response curve.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION


I. LINE VOLTAGE IITV.AC. ALL VOLTAGES D.C.
2. ALL VOLTAGES MEASURED TO CHASSIS AND ARE POSITIVE UNLESS OTAERWISE SPECIFIED.
V VOLTAGE READIRGS TAKEM WITH ZERO SIGMAL INPUT AND PICTURE CONTROL SET MAX. CLOCKWISE
ALL OTKER CONTROLS SET FOR NOMMAL
OPERATION.
4. VOLTABE READIHGS TAXEN WITH AN
E.ECTIOAIC YOLTMETEA

heater choke detall

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



REAR PANEL CONTROLS


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

TRAV-LER ALIGNMENT INFORMATION (Continued)



FIG. 4. Dummy Antenna Detail


FIG. 5. Diode Defector Detail

SOUND IF AMP ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

| DUMMY ANTENNA | SIGNAL GENERATOR COUPLING | SIGNAL GENERATOR FREQUENCY | CHANNEL | CONNECT VTVM | ADJUST | REMARKS |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Direct | High side to point (A). Low side to chassis. | 4.5 Mc (Unmod.) | Any channel unused locally. | De probe to point (C). <br> Common to chassis. | L-16A and bottom adjustment of L-17. | Adjust for max. voltage at VTVM. |
| " | " | " | 11 | DC probe to point (E). <br> Common to chassis. | Adjust top slug of L-17. | Adjust for zero voltage. A positive and negative reading will be obtained on either side of the correct setting. |

CHECK ON SOUND IF AMP ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

| Connect the synchronized sweep voltage from the signal generator to the horizontal input of the oscilloscope for horicuntal deflection. |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { DUMMY } \\ & \text { ANTENNA } \\ & \hline \end{aligned}$ | SWEEP <br> GENERATOR <br> COUPLING | SWEEP GENERATOR FREQUENCY | $\begin{aligned} & \text { MAI } \\ & \text { GENE } \\ & \text { FREQI } \end{aligned}$ |  | CHANNEL | $\begin{array}{r} \mathrm{CONI} \\ \mathrm{SCO} \\ \hline \end{array}$ |  | ADJUST | REMARKS |
| Direct | High side to point (A). Low side to chassis. | $\begin{aligned} & 4.5 \mathrm{Mc} \\ & \text { (s00 Kc } \\ & \text { sweep) } \end{aligned}$ | 4.45 4.5 4.55 | $\begin{aligned} & 45 \mathrm{Mc} \\ & 5 \mathrm{Mc} \\ & 55 \mathrm{Mc} \end{aligned}$ | Any channel unused locally. |  |  | L-17 | Touch up the adjustments of L-17 ma:n taining max. amplitude while adjusting for max. stee; eress and straightness of the slope. See Fig. 7. Note that the 4.5 Mc marker pip tends to disappear as the correct setting of the top adjustment of $\mathrm{L}-17$ is reached. |
| 4.5 MC TRAP ADJUSTMENT |  |  |  |  |  |  |  |  |  |
| DUMMY ANTENNA | $\qquad$ | $\begin{aligned} & \text { SIGNAL } \\ & \text { GENERATOR } \\ & \text { FREQUENCY } \end{aligned}$ |  | CHANNEL | CONNECT VIVM |  |  | JUST | REMARKS |
| Direct | High side to point (A). <br> Low side to chassis. | $\begin{gathered} 4.5 \mathrm{Mc} \\ \text { (Unmod.) } \end{gathered}$ |  | Any ch unus local | (1) $\begin{gathered}\text { AC Pr } \\ \text { cath } \\ \text { fictu } \\ \text { Test poin } \\ \text { Com } \\ \text { ch }\end{gathered}$ | be to e of tube. (D) n to s. |  | $16 B$ | Adjust for minimum voltage. A crystal detector shown in Fig. 5 may be used with the VTVM in place of a commertial AC probe if desired. |

## MOST-OFTEN-NEEDED 1955 TELEVISION SFRVICING RNFORMATION

## Westinghouse CHASSIS ASSEMBLY V-2313 AND V-2323

CHASSIS ASSEMBLIES V-2313-15, V-2313-25, and V-2313-35

Several different variations of the $\mathrm{V}-2313$ chassis are used in current production. The differences will be found in the type of CRT used and the mounting bracket of the off-on-volume control.

CHASSIS ASSEMBLIES V-2323-101, V-2323-201, and V-2323-301
When the letter " $U$ "appears in the model number, it indicates that the recejver contains a type $V-2323$ chassis. The $V-2323$ chassis is identical to the $V-2313$ chassis with the exception that an all-channel VHF-UHF combination tuner has been factory installed to provide UHF reception of the UHF television channels ( 14 through 83) in addition to the VHF channels (2 through 13).

Several different variations of the V-2323 chassis are used in curtent production. The differences will be found in the VHF-UHF tuner combioations, the type of CRT used and the mounting bracket of the offonvolume control. The dash numbers following the basic chassis number identifies these vatiations.
Models H-838K21B, H-841T21, H-842T21, H-843K21, H-844K21, H-847K21, H-848K21, H-861T21, H-862T21, H-863T21, H-864T21, H-865T21, H-866T21, $\mathrm{H}-867 \mathrm{~T} 21, \mathrm{H}-868 \mathrm{~T} 21, \mathrm{H}-871 \mathrm{~T} 21$, and $\mathrm{H}-872 \mathrm{~T} 21$.
Models with same numbers having letters KU in place of K and TU in place of T, contain a built-in all channel VHF-UHF combination RF tuner.

## CHASSIS ASSEMBLY V-2314 OR V-2324

## CHASSIS ASSEMBLIES V-2314-15 AND V-2314-25

Several different variations of the V-2314 chassis are used in current production. The differences will be found in the type of RF tuner and CRT used.

Models H-853K24, H-854K24, H-869K24, H-870K24, H-875T24, -A, H-876T24, $\mathrm{H}-877 \mathrm{~T} 24, \mathrm{H}-878 \mathrm{~K} 24$, and $\mathrm{H}-881 \mathrm{~K} 24$.
Models with same numbers having letters KU in place of K, and TU in place of T, contain a built-in all channel VHF-UHF combination RF tuner.

All the sets listed on this page are similar in most respects. The alignment information on pages 172 and 173 is applicable to all sets. Since there are a number of important circuit differences between the two groups of chassis, the circuit diagram for Chassis $\mathrm{V}-2313$ (and $\mathrm{V}-2323$ ) is printed on pages 174175, while the circuit for Chassis V-2314 (and V-2324) is on pages 176-177. Figure 6, top view of each type of chassis, is printed on page 178, and will aid you in locating tubes and alignment adjustments.

## CRITICAL LEAD DRESS

[^8]
## MOST-OFTEN-NEEDED 1955 THLEVISION SERVICING INFORMATION

## WESTINGHOUSE Chassis V-2313, V-2314, V-2323, V-2324, (Continued)

## ION TRAP MAGNET

It is extremely important that the ion trap magnet be correctly adjusted immediately after the sef is first turned on during installation. This is true even through the set appears to be operating satisfactorily. When the magnet is not correctly oriented, the electron beam strikes the edge of the aperture in the anode top disc instead of moving cleanly through the hole. The resultant heat vaporizes the metal of the disc, thus releasing gas which has a harmful effect on the cube. Some of the vaporized material may be deposited on the screen of the tube and be apparent as darkened area. An excessively high setting of the brightness control will aggravate this condition. From this it is apparent that the brightness control should never be turned up to compensate for an incorrectly adjusted ion trap magnet. The tube can be ruined in a very short time under this condition.

To adjust the ion trap magnet, position the magnet approximately as shown in Fig. 1. with the color code mark facing upward, than rotate the magne: and move it forward and backward until the position is found where the picture is brightest. If the brightness peaks at two positions of the magnet, the position nearer the base of the tube is the correct one. Never more the ion trap magnet to remove a shadow from the raster if the brightness is decreased by so doing. Shadows should be removed by adjusting the position of the deflection yoke. The ion trap magnet must always be adiusted for maximum picture brightness.

## wIDTH AND HORIZONTAL LINEARITY

The width adjustment on the back of the chassis controls the overall width of the picture, and the horizontal linearity adjustment controls the relationship hetween the horizontal dimensions of the left and the right sections of the picture. A balance between the two controls is necessary to make the picture symmetrical with correct horizontal dimensions. These controls are sliding type adjustments.


Fig. 1 CRT Adiustments

## HEIGHT AND VERTICAL LINEARITY

The height adjustment on the back of the chassis controls the overall height of the picture, and the vertical linearity adjustment controls the relationship between the vertical dimensions of the upper and the lower sections of the picture. A balance between the two controls is necessary to make the picture symmetrical and fill the mask vertically.

## VERTICAL HOLD

The vertical synchronization is controlled by the vertical hold adjustment. To adjust, rotate the control clockwise or counterclockwise until the picture is stabilized vertically. The adjustment should preferably be made on the weakest signal that is available, and a check should be made to see that the receiver pulls into sync on all channels.

## HORIZONTAL RINGING COIL

The horizontal ringing coil (L400) should be adjusted as follows:

1. Short out the ringing coil with a short jumper wire.
2. Set the horizontal hold control to the middle of its range, and leave it in this position during the steps that follow.
3. Connect a VTVM to the pin $\# 2$ grid circuit of the horizontal multivibrator, so as to measure the DC voltage between this point and ground.
4. With the receiver tuned to a TV station, adjust C421 (located on the rear of the chassis) for zero voltage on the meter. If zero voltage can be approached but not quite reached at one extreme of the C421 adjustment, it may be necessary to set the horizontal hold control slightly to one side of midposition to obtain zero voltage.
5. Remove the jumper from across the ringing coil.
6. Adjust the ringing coil for zero voltage on the meter, and check the adjustment by switching to another channel and then back again. The receiver should pull into horizontal synchronization on all channels.


Fig. 2. Oscilloscope Connections

## MOST-OFTEN-NEEDED 1955 TELEVISION SFRVICING INFORMATION

Westinghouse Chassis V-2313, 2314, etc. Alignment Charts, (Continued)

GENERAL INFORMATION
The chassis and test equipment should bebonded together by short lengths of heavy braided copper ribbon, and all interconnecting leads should be shielded and should be as short as possible consistent with ease in making connections.

## COMMON I-F SECTION

Rotate the channal selector to channel 13.
Connect the oscilloscope to the video test terminal, point "B" (V-2314 schematic diagram) through the decoupling network shown in Fig. 2.

Connect a 9 volt bias battery to the AGC line, point "A" on (V-2314 schematic diagram).

Couple the marker generator output to the sweep generator output. In the steps that follow, use the marker to check the response curve at the frequencies indicated on Fig. 4.

| Step | Alignment <br> Signal | Remarks | Adjustments |
| :--- | :--- | :--- | :--- |
| 1. | Remove the RF omplifier tube. |  |  |

## ALIGNMENT TOOL

To adjust the slugs in the common I-F transformers a special tool is required. This tool must fit into the $.035^{\prime \prime} \times .093^{\prime \prime}$ slot in the slug. An incorrectly designed tool will cause chipping of the slug. A suitable tool is stocked under Westinghouse part number V-8345.


Fig. 4. Response Curves at Various Stages of Alignment

SOUND I.F SECTION AND 4.5 MC. TRAP
Connect the signal generator to the video test terminal (point "B") through a .001 mfd . capacitor.

| Step | Signal Generator Frequency | VTVM Connections | Remarks | Adiustments |
| :---: | :---: | :---: | :---: | :---: |
| 1. | 4.5 mc . unmoduloted | RF probe to point "C" (see V-2314 schematic diogrom) ond common lood to chossis. | Use strong signol from genorotor | L303 for minimum voltoge |
| 2. | $4.5 \mathrm{mc} \text {. FM }$ | Across volume control | Use strong signal from gen-- sotor | L202 for moximum output |
| 3. | Same os step 2 | Some as stop 2 | Use weakest signol from generotor. | L200, L201 ond L202 for maximum output |
| 4. | $4.5 \mathrm{mc} . \mathrm{AM}$ $30 \%$ Mod. | Some as stop 2 | Stort with weak signol increose as adjustment is mode. | Quieting control for dip to zero. |

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

WESTINGHOUSE Chassis V-2313 and V-2323 Circuit Diagram


## MOST-OFTEN-NEEDED 1955 TBLEVISION SERVICLNG INFORMATION

## Westinghouse

Chassis V-2313 and V-2323 Circuit Diagram

In later production of the V-2213 or V-2323 chassis the horizontal output tube has been replaced by a 6BQ6GA or 6CU6 tube. Both tubes are directly interchangeable.


MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION
Westinghouse Chassis V-2314 and V-2324 Circuit Diagram


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Westinghouse Chassis V-2314 and V-2324 Circuit Diagram


WESTINGHOUSE Chassis V-2313, V2314, V-2323, V-2324, (Continued)
 Chassis V-2313, V-2323.


Fig. 6. Top View of Chassis V-2314 and V-2324.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

CHASSIS I9M2O - I9M2OZ - I9M2I - I9M2IZ

## 1955 RECEIVERS

20M2O - 20M2OZ - 20M2I - 20M2IZ

CHASSIS I9R20-19R21 - I9R22
22R20-22R21

The various Zenith 1955 Chassis listed above are used in models tabulated below. All these sets are similar in design. Alignment and adjustment procedures given apply to all chassis. Suffix " U " indicates that a continuous tuner is used. Circuit on pages $184-185$ is for the 19 M series of sets. The 20 M series covered by a separate circuit on pages 186-187 is similar to the basic 19 M series except for horizontal output tube, and additional 5 U 4 G rectifier to provide 18 KV high voltage.

The circuit on pages $188-189$ is exact for 19 R series, 19 R 20 and 19 R 21 chassis. The 19R22 chassis is similar except that the tuner and volume control assemblies are externally mounted with plug-in cables as they are also in the 22 R 20 chassis. In general, the 22 R series ( 22 R 20 and 22 R 21 ) is similar to the basic 19 R series except for the horizontal output tube, an additional 5 U 4 G rectifier, higher second anode voltage, and high fidelity sound. In addition, the receivers using the 22 R chassis are equipped with phono connector, push pull audio, and different knob positions. The waveforms and peak-to-peak voltages shown in the circuit on pages 188-189 are representative for all chassis.

| MODEL | TV CHASSIS | MODEL CH | HASSIS | M ODEL | CHASSIS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| M1800E or R | 19M20 | M2252EZ 1 | 19M21Z | R2253M | 19R21 |
| M1800EZ | 19 M 20 Z | M2252RZ 1 | 19M21Z | R2257 E \& R | 19R22 |
| M1800RZ | 19M20Z | M2258RZ1 1 | 19L28 | R2258E \& R | 19R21 |
| M1800RZ1 | 19L34 | M2260R 2 | 20M20 | R2258EZ \& RZ | 19M21 |
| M2228E or R | 19M21 | M2260RZ 2 | 20M20Z | R2337E \& R | 22R20 |
| M2228RZ | 19M21Z | $\mathrm{M} 2261 \mathrm{E} \quad 2$ | 20M20 | R2359E \& R | 22R20 |
| M2229E or R | 19M21 | M2261EZ 2 | 20 M 20 Z | R2360R | 22R20 |
| M2229EZ | 19M21Z | M2267Y | 20M20 | R2368R | 22R20 |
| M2229RZ | 19M21Z | M2267YZ | 20 M 20 Z | R2367E \& Y | 22R20 |
| M2230E or R | 19M21 | M 2570 R | 20 M 21 | R2367R \& P | 22R20 |
| M2230RZ | 19M21Z | M2570RZ 20 | 20 M 21 Z | R2387R | 22R20 |
| M2230RZ2 | 19M21 | R1800E \& R | 19R20 | R2391E ${ }_{\text {R2671E }}$ \& $R$ | 22R20 |
| M2237EZ | 20 M 20 Z | R1800EZ \& RZ | 19M20 | R2671E \& R R2975R | 22R21 |
| M 2237 R M 2237 RZ | 20 M 20 | R1812E \& R | 19R20 | R2975R | 22R21 |
| M2237RZ ${ }^{\text {M2249E or }} \mathrm{R}$ | 20M20Z | R1812EZ \& RZ | 19M20 | R2976E | 22R21 |
| M2249RZ | 19M21Z | R2229E \& R | 19R21 | R2994EU | 22R21 |
| M2250E or R | 19M21 | R2229EZ \& RZ | 19M21 | R2994HU | 22R21 |
| M2250EZ | 19M21Z | R2230E \& R | 19R21 |  |  |
| M2250RZ | 19M21Z | R2230EZ \& RZ | 19M21 | E - Blond |  |
| M2251EZ1 | 19L28 | R2249E \& R | 19R21 | H - Cherry |  |
| M2251RZ1 | 19L28 | R2249EZ \& RZ | 19M21 | M - Maple |  |
| M2251Z1 | 19L28 | R2250E \& R | 19R21 | R - Mahogany |  |
| M2252E or R | 19M21 | R2250EZ \& RZ | 19M21 | Y - Ebony |  |

[^9]
## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



Fig. 4 Tube And Trimmer Layout 19M20, 19M20Z, 19M20U, 19M20UZ, 19M21, $19 \mathrm{M} 21 \mathrm{Z}, 19 \mathrm{M} 21 \mathrm{U}, 19 \mathrm{M} 21 \mathrm{UZ}$ \& 19M22UZ.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

Zenith 1955 Chassis (Continued)

## FRINGE LOCK ADJUSTMENT

1. Turn the fringe lock control fully clockwise and then back it off approximately $1 / 4$ turn. Adjust the vertical and horizontal hold controls and check operation of the receiver to see that it syncs normally when the tur ret is switched from channel to channel.
2. If the picture jitters or shows evidence of delay, tearing, split phase, etc., back down the fringe lock control further, a few degrees at a time, each time re-adjusting the hold controls and switching from channel to channel until normal sync action is obtained. It will be found that under normal signal conditions, the correct adjustment will be near the counter-clockwise position of the control.
3. In fringe and noisy areas, the best adjustment will be found at or near the maximum clockwise position of the control, however, do not automatically turn the fringe lock fully clockwise in fringe areas as has been done on previous models. Always follow the procedure outlined.

## BULLS EYE TUNER ADJUSTMENTS

To adjust the receiver for bulls-eye tuning, set the fine tuning control to its approximate center position as shown in Fig. 1 . Without further adjustment of the fine tuning control insert a 68-21 alignment wrench into the tuner (See Fig. 11) and adjust each operating channel to resonance. It will be noted that tuning to one side of resonance results in a faded, washed-out picture with the spacing between the wedge lines fogged and tuning in the opposite direction causes the spaces between the lines to clear up. However, going beyond this point causes the picture to take on a "wormy" appearance from sound getting into the picture. Correct adjustment is obtained by tuning to the "wormy" picture and then backing the control off slightly until the picture clears up.


Fig. 11 Bulls-eye Tuning Adjustment

## AGC ADJUSTMENTS

IMPORTANT: THE AGC CONTROL CANNOT BE USED IN ANY WAY TO IMPROVE THE RECEIVER SENSITIVITY. The sole function of this control is to set the level applied to the video amplifier (12BY7) tube so that the output of this tube is approximately 100 volts peak ( $100 \%$ modulated video signal) for application to the picture tube cathode.
The adjustment can also be made by connecting a calibrated oscilloscope through a 10 K isolation resistor, to test point " $D$ ', and, while receiving the strongest TV signal adjust the AGC delay control for 2.75 volts peak output.

Satisfactory adjustment can also be made by observing the picture and slowly turning the AGC delay control from its maximum clockwise position, counterclockwise until a point is reached where the picture distorts and buzz is heard in the sound. The control should then be turned slowly clockwise and set at a point comfortably below this level of intercarrier buzz, picture distortion and improper sync.

## REMOVING CHANNEL STRIPS

1. Rotate the turret drum until the strip to be removed is readily accessible.
2. Insert a small screwdriver in the slot (See Fig. 13). Push in the direction of arrow until the channel strip clears the drum slot then lift straight out in direction of screwdriver shaft. Some strips have a round hole instead of a slot and a pointed tool is used in place of the screwdriver.

CAUTION: TO AVOID DAMAGE TO CHANNEL STRIPS, DO NOT USE PRYING ACTION IN REMOVING STRIPS.


Fig. 13 Removing Channel Strips.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

ZENITH 1955 Chassis (Continued)

## ALIGNMENT



Fig. 14 IF-RF Alignment Fixtures
A suitable VHF and UHF sweep generator in conjunction with an accurate marker must be used for alignment work. It is very important to have the sweep generator output cable properly terminated and to check whether or not its attenuator is reactive. If the attenuator is reactive or if the output cable is improperly terminated, correct alignment cannot be made since the degree of attenuation then may change the shape as well as the amplitude of the response curve. The position of the attenuator should only vary the amplitude and not the shape of the response curve.

## SOUND ALIGNMENT

Proper alignment of the 4.5 Mc intercarrier sound channel can only be obtained if the signal to the receiver antenna terminals is reduced to a level below the limiting point of the 6BN6 Gated Beam Detector. This level can be easily identified by the "hiss" which then accompanies the sound.

Various methods may be used to reduce the signal level, however, it is recommended that a step attenuator similar to the S-17203 unit be used for most satisfactory results.

1. Connect the step attenuator between the antenna and the receiver antenna terminals.
2. Tune in a tone modulated TV signal and adjust the step attenuator until the signal is reduced to a level where 'hiss'' is heard with the sound.
3. Adjust the sound take-off coil L17 (top and bottom slugs), intercarrier coil L19, quadrature coil L20 and buzz control R32 for the cleanest sound and minimum buzz. It must be remembered that any of these adjustments may cause the "hiss' to disappear and further reduction of the signal will be necessary so that the "hiss'" does not disappear during alignment.

If intercarrier buzz is in evidence, after all normal sound adjustments have been made, the cause may be attributed to one or more of the following:

1. Improper adjustment of the AGC delay control.
2. Defective 6AU6 sound limiter.
3. Extremely high signal levels which require attenuation in the antenna circuit.
4. Transmitter over modulation.

## VIDEO IF ALIGNMENT

1. Slowly turn the channel selector until the turret is made to rest between two channels. Connect the negative lead of a 2 volt battery supply to terminal " $E$ " (Fig. 27) and the positive lead to chassis. The bias supply should be made variable so that it can be varied from negative 3 volts to positive 3 volts. Keep the supply leads short.
2. Connect the calibrated oscilloscope through a 10,000 ohm isolation resistor between terminal ' $D$ '" and chassis. The sweep generator input to the receiver should be adjusted for 3 volts peak to peak detector output. Do not exceed this output level during any of the adjustments.
3. Feed the output from the sweep generator through the special termination unit shown in Fig. 14 to point " C " (Pin 1 of 6CB6, 3rd IF). Adjust the generator until a pattern similar to Fig. 16 is obtained.


Fig. 16 4th IF Response.
4. Set the Marker Generator to 45.75 Mc and alternately adjust the top and bottom slugs of the 4th IF transformer for maximum gain and symmetry with the 45.75 Mc markers positioned as shown in Fig. 16 The 39.75 Mc marker can be within 50.5 Mc of the specified frequency. If the correct response curve cannot be obtained in this step, check the position of the two slugs to see that they are entering their respective coils from the opposite ends of the coil form. The position of the slugs near the center of the coils may change the coefficient of coupling, making correct alignment difficult if not impossible.

Zenith Chassis 19M20, 19M20Z, 19M21, 19M21Z, 20M20, 20M20Z, 20M21, 20M21Z, 19R20, 19R21, 19R22, 22R20, 22R21.
5. Connect the sweep generator cable to terminal "A" (Mixer Grid). In this step it may be necessary to temporarily reduce the bias to zero or even to go to a slightly positive voltage in order to see the highly attenuated trap slots with the oscilloscope vertical gain near maximum.
6. Adjust the $47.25 \mathrm{Mc}, 41.25 \mathrm{Mc}$ (Top slug of Ist IF transformer) and 39.75 Mc traps for minimum marker amplitude, See Fig. 17. It can be seen that maximum oscilloscope gain has been used and as a result the top of the response curve has been 'run off" the oscilloscope screen in order to see a "blowup'' of the trap slots.


Fig. 17 Exploded View of Traps.
7. Readjust the bias to - 2 volts and set the oscilloscope vertical gain to the calibrated position. Adjust the sweep generator for a 3 volt peak to peak output from the video detector.
8. With the test equipment set up as in Step 7, alternately adjust the 2nd IF, 3rd IF, lst IF and the converter plate coil until an overall response curve similar to Fig. 18 is obtained. Do not adjust the 4th IF in this step. It will be found that the 2nd IF affects the low side ( 42.75 Mc ) and the 3 rd IF the high side of the response curve.


Fig. 18 Overall IF Response.

## TURRET TUNER ALIGNMENT

The RF chassis adjustments have been made at the factory and normally do not require readjustment in the field unless tampered with. If adjustment becomes necessary check the overall IF response and proceed as follows:

1. Temporarily ground the turret AGC by connecting a jumper between the AGC bus (yellow lead) and chassis. (If sufficient output from the signal generator is available moderately better results may be obtained with 2 volts of bias.)
2. Connect the calibrated oscilloscope to the feed through terminal " H " (Fig. 4 ) through a 10 K isolation resistor. This terminal is the screen of the 6 U 8 mixer.
3. Use a 50 to 300 ohm matching transformer (Fig. 14) and feed the output from the sweep generator to the antenna terminals of the receiver.
4. Turn the channel selector to Channel 4 and adjust the sweep generator until a response curve somewhat similar to Fig. 19 is obtained.


Fig. 19 Channel 4 RF Response.
5. Study Fig. 4 and adjust the converter grid capacitor (C9), the RF plate capacitor (C8) and the RF grid capacitor ( C 5 ) until a response curve similar to Fig. 19 is obtained.
6. Turn the channel selector to Channel ll and adjust the sweep generator until a response somewhat similar to Fig. 20 is obtained. Adjust L5 and L6 to obtain symmetry. If the band pass is too great or too narrow also adjust L7.


Fig. 20 Channel 11 RF Response.
7. Repeat steps 5 and 6 until the best overall symmetry is obtained. REMOVE AGC JUMPER.

## MASTER OSCILLATOR ALIGNMENT

The master oscillator adjustment is to be made only if resonance cannot be obtained with the strip oscillator adjustment wrench with the fine tuning control in its center position, and after it has been determined that the channel strip itself is not at fault.

If channels 2 through 6 can be made to resonate with the bull's-eye adjustment at the rear of the turret and the high channels do not resonate, a slight readjustment of the oscillator inductance Ll0 (See Fig. 4 ) may be necessary to affect resonance on the high channels.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## CENTERING ADJUSTMENT

In the 19 M series, the centering assembly is built into the yoke housing. This assembly is made up of two magnetic rings which can be rotated by means of tabs. Centering is accomplished by gradually rotating the tabs with respect to each other then rotating both tabs simultaneously until the picture is centered.

FOCUS CONTROL: In the 19M Series, a 7.5 Megohm potentiometer is provided for focusing the picture tube.

## UHF-VHF CHANGEOVER SWITCH

The low loss 85-546 UHF-VHF changeover switch is part of the S-21001 UHF-VHF tuner package. The switch performs 3 functions.

1. Is used to switch the antenna between tuners.
2. Switches the oscillator B+ between tuners.
3. Actuates the UHF pilot light.

The switch is actuated by a lever which is mounted on the turret tuner shaft. When the VHF tuner is in the UHF position, the lever, if properly aligned, will actuate the changeover switch.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

ZENITH Chassis 19M20, 19M20U, 19M21, and 19M21U.
Chassis 19M20Z, 19M20UZ, 19M21Z, and 19M21UZ, are similar but have a socket for UHF tuner connection.


## REMOVING TURRET TUNER FROM THE CHASSIS

1. Pull out the VHF power connector, UHF IF connector, VHF oscillator B+ connector, VHF IF connector and disconnect the antenna transmission line.
2. To insure proper indexing, note the channel to which the receiver is tuned so that the tuner drum can be rotated back to this channel before the unit is reassembled.
3. Loosen (do not remove) the hex head set screw in the VHF tuner drive pulley and slide pulley off the fine tuning shaft. Remove screws and hex nuts.
4. Gently pull the tuner out of its case

If, after the tuner is reinstalled, the fine tuning knob does not have normal mechanical travel (from stop to stop of the lower pulley) and can be turned to hit only one stop, the dial cord can be made to slip towards the other stop by applying sufficient pressure to the fine tuning knob.

## METAL WRAPPED RESISTORS

In servicing the TV receiver, the serviceman will find several circuits in which metal wrapped resistors are used. The metal wrapping dissipates much of the resistor heat and doubles the wattage rating. In replacing a resistor care should be used to mount it as the original. If the metal mounting clamp is discarded, the resistor wattage must be doubled.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## CENTERING ADJUSTMENT

In the 20 M series, PM focusing and centering is utilized. The top screwdriver adjustment on the centering assembly is used to move the picture up or down and the bottom adjustment for side to side movement. The center adjustment is for focusing.

In some 20 M 21 receivers, a single centering lever is used for both vertical and horizontal centering. The up-down movement of this lever moves the picture horizontally while a left-right movement moves the picture vertically. A screwdriver adjustment is provided for focusing.

## AFC ADJUSTMENT

The AFC adjustment can effectively be made by setting the horizontal hold control L2l to a position where it is virtually impossible to 'throw' the receiver out of horizontal sync when switching from channel to channel.


Adjustments on Neck of Picture Tube 20M21 Chassis

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

ZENITH Diagram for Chassis 20 M 20 and 20M20U. Chassis 20M21, 20M21U, and 20 M 21 Z are similar in most respects; some of the differences are the use of 24CP4 or $27 E P 4$ picture tube, and 6 AU5GT or $6 A V 5 G T$ vertical output tube.


## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION



## CENTERING ADJUSTMENT

In the 19R series, the centering assembly is built into the yoke housing. This assembly is made up of two magnetic rings which can be rotated by means of tabs. Centering is accomplished by gradually rotating the tabs with respect to each other then rotating both tabs simultaneously until the picture is centered.

In the 22R series, PM focusing and centering is utilized. The top screwdriver adjustment on the centering assembly is used to move the picture up or down and the bottom adjustment for side to side movement. The center adjustment is for focusing.

In some 22R20 and 22R21 receivers, a single centering lever is used for both vertical and horizontal centering. The up-down movement of this lever moves the picture horizontally while a left-right movement moves the picture vertically. A screwdriver adjustment is provided for focusing.

## AFC ADJUSTMENT

The AFC is adjusted by setting the horizontal hold control L2l to a position where it is virtually impossible to "throw" the receiver out of horizontal sync when switching from channel to channel.

## MOST-OFTEN-NEEDED 1955 TELEVISION SERVICING INFORMATION

ZENITH Diagram for Chassis 19R20, 19R21, and 19R22. Chassis 22R20 and 22R21 are similar except for the horizontal output tube, an additional 5 U4G, higher second anode voltage, and high fidelity sound. Knob positions also differ.


## CORRECTOR MAGNET ADJUSTMENT

Two corrector magnets are used (not required in the 19R series) to obtain straight, sharply focused sweep lines across the face of the picture tube. In the 22R21 chassis, the corrector magnets are mounted top and bottom. The magnets are mounted on the deflection coil mounting brackets and can be moved in and out or up and down by bending the flexible arms which support them. Adjustment has been made at the factory and should not require re-adjustment unless accidentally bent out of position. If this occurs, proceed as follows:

1. With the vertical and horizontal size controls, reduce the size of the picture to a point where the
four corners and sides of the picture are visible. (In some receivers it may not be possible to reduce the picture size sufficiently to see all the sides and in this case it may be necessary to shift the picture with the centering control to view one side at a time.)
2. Bend the corrector magnet arms until the corners become right angles and the top of the raster is parallel with the bottom and the left side is parallel with the right side. After adjustment, the picture should be restored to normal size.

NOTE: Mis-adjustment of the corrector magnets may cause pincushioning, barreling, keystoning, poor linearity, etc.

This signal path chart will help you diagnose faults that may develop in the 1955 Zenith television models.


## MOST－OFTEN－NEEDED 1955 TELEVISION SERVICING INFORMATION

|  |  | D． | Under each manu and models in numer number at right of ea tion dealing with such | acturer＇s name ical order，at le $h$ listing refers material． | are listed <br> ft．The to the firs | hat make chas rresponding $p$ page of each se |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Admiral Cor |  | Armiral，cont | CBS，continued | Emerson， | cont． | Majestic |  |
| 19L2，19L2Z | 11 | ＂224天3Z 10 | 921－13 31 | 798 B | 47 | $88$ | $73$ |
| 1912 | 11 | TA2242 11 | 921－14 31 | 120179B | 47 | 123 | 73 |
| 19 NZZ | 11 | CA2246 11 | 021－14 31 | 120203 B | 47 | 124 | 73 |
| 19R2 | 11 | C2256 10 | Crosley Corp． | 120204 B | 47 | 124－2 | 73 |
| 19S2 | 11 | K2256 10 | G－17TOB 35 | $120205 B$ | 47 |  |  |
| 19T1，－C | 11 | K2257 10 | G－17TOBK 35 |  |  | Montgome | Ward |
| 19W1，－A | 11 | CA2526 11 | G－17TOBU 35 | General－E | ctric | WG－3071E | F 77 |
| 19W1B，－C | 11 |  | G－17TOMH 35 | F | 57 | WG－3073E | －F 77 |
| 19Y1A | 11 | Arvin | G－17TOMU 35 | G，J，K | 63 | WG－3075D | －E 77 |
| 20A2，20A2Z | 5 | 21－550 25 | G－17TOWEH 35 | $17 \mathrm{Cl} 2^{7}$ | 57 | WG－3077D | －E 77 |
| 20D2 | 5 | 21－551 25 | G－17TOWH 35 | $17 T 14$ | 63 | WG－3079D | －E 77 |
| 20L2 | 11 | 21－552 25 | G－17TOWU 35 | 17 Tl 5 | 63 |  |  |
| 20X5 | 10 | 21－553 25 | $\mathrm{H}-17 \mathrm{TOBH} 35$ | 17 Tl 6 | 63 | Motorola | Inc． |
| 20X5A，－B | 10 | 21－554 23 | H－17TOBU 35 | 17 T 20 | 63 | 17T20 | 85 |
| 20X5C | 10 | 21－555 23 | $\mathrm{H}-17 \mathrm{TOMH} \quad 35$ | 17 Tl 15 | 57 | Y17T20 | 85 |
| 20XP5A | 10 | 21－557 23 | H－17TOMU 35 | 17 Tl 17 | 57 | $21 \mathrm{C3}$ | 79 |
| TA1811 | 11 | D－379 25 | H－17TOWH 35 | 21 Cl 03 | 63 | 21 Kl 9 | 85 |
| TA1812 | 11 | D－382 25 | H－17TOWU 35 | 210104 | 63 | 21 K 20 | 79 |
| TA1822 | 11 | E－383 23 | G－21TOBH 35 | 21 cll 4 | 57 | 21K21 | 79 |
| T1831 | 10 |  | G－21 TOMH 35 | 210115 | 57 | 21 K 22 | 79 |
| T1832 | 10 | Capehart－ | G－21TOWH 35 | 210116 | 57 | 21 K 23 | 79 |
| T1842 | 10 | Farnsworth | $\mathrm{H}-21 \mathrm{COBH} 35$ | 210117 | 57 | 21K24 | 79 |
| TA2211 | 11 | 1T174＋ 27 | H－21COBU 35 | 216119 | 57 | 21 Tl 5 | 85 |
| TA2212 | 11 | 2T214＋ 27 | $\mathrm{H}-21 \mathrm{COMH} 35$ | 210120 | 57 | 21 Tl 6 | 85 |
| T2212B | 10 | $4 \mathrm{Cl74+} 27$ | H－21COMU 35 | $21 \mathrm{cl21}$ | 57 | 21 Tl 7 | 85 |
| CA2215Z | 11 | $5 \mathrm{C} 214+\quad 27$ | H－21COSBH 35 | 21.350 | 63 | 21 Tl 8 | 79 |
| LA2215Z | 11 | $9 \mathrm{~F} 214+27$ | H－21COSH 35 | 210351 | 63 | $21 T 19$ | 79 |
| 「A2215 | 11 | 15W214＋ 27 | H－21COWH 35 | 21 Tl 0 | 57 | Y21c3 | 79 |
| C2216A2 | 5 | $16 \mathrm{~T} 244+\quad 27$ | H－21COWU 35 | 21 Tl 1 | 57 | Y21K19 | 85 |
| CA22162 | 11 | $18 W 214$ | $\mathrm{H}-21 \mathrm{HCBH} 35$ | 21112 | 57 | Y21K20 | 79 |
| HA2216Z | 11 | CX－37 27 | H－21HCBU 35 | 21 Tl 4 | 57 | Y21K21 | 79 |
| K2216A | 5 | CX－37－1 27 | H－21HCMU 35 | $21 T 15$ | 57 | Y21K22 | 79 |
| KA2216 | 11 | CT－89 27 | H－21HCWH 35 | 21 Tl 7 | 63 | Y21K23 | 79 |
| LA22162 | 11 | CT－90 27 | H－21H PBHa，d 35 | 21 Tl | 63 | Y21K24 | 79 |
| T2216A | 5 | CT－95 27 | H－21HPWHa，d 35 | $21 T 19$ | 57 | Y21T15 | 85 |
| TA2216，－ | 11 | CT－108 27 | 426 | 21 122 | 63 | Y21Tl6 | 85 |
| CA2217Z | 11 | CT－110 27 | 431 | 21 T 23 | 63 | Y21T17 | 85 |
| HA2217Z | 11 | CT－112 27 | 431－2 35 | 21 124 | 63 | Y21T18 | 79 |
| K2217A | 5 | CT－115 27 | 432 | 21 T25 | 63 | Y21T19 | 79 |
| KA2217 | 11 | CT－116 27 | 443 | 21 T30 | 63 | 24K4 | 79 |
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## Another

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[^0]:    * If ratio detector transformer (T201) has hollow hexagonal core slugs, bottom slug adjustment A8 can be made from top of chassis, if you use alignment tool (part number 98A30-12; available at Admiral distributor). Bottom slug (A8) can be reached through the hole in the core of the upper slug (A6).

[^1]:    If separate VHF and UHF external antennas are used, connect the VHF antenna lead-in to the lower antenna terminals and the UHF antenna lead-in to the upper antenna terminals.

[^2]:    * Ratio detector transformer (T201) has hollow hexagonal core slugs, bottom slug adjustment AlU can be made from top of chassis, if you use alignment tool (part number 98A30-12; available at Admiral distributor). Bottom slug (Al0) can be reached through the hole in the core of the upper slug (A8).

[^3]:    - Sound Corrier Marker
    * *Picture Corrier Marker

[^4]:    *Sound Carrier Marker
    **Picture Carrier Marker

[^5]:    *Some receivers use only one core.

[^6]:    *In 82-channel tuner, mixer tube is a 648 .

[^7]:    Adjust Cl22 until 42.5 mc . is at $70 \%$ response with respect to the low frequency shoulder of the curve as shown in Figure 23. Maximum allowable tilt is $20 \%$.

    Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.
    Connect the oscilloscope to the junction of R135 and L 102 .
    Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.
    Adjust the output of the sweep generctor to obtain 3.0 volts peak-to-peak on the oscilloscope.

    Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.
    Retouch T106, T107 and T108 to obtain the response shown in Fiqure 24.
    RATIO DETECTOR ALIGNMENT.-Set the signal generator at 4.5 mc . and connect it to the first sound i-f grid, pin 1 of V101.

    Connect the "VoltOhmyst" to pin 2 of Vl03.
    Tune the ratio detector primary, T102 top core for maximum $\mathrm{d}-\mathrm{c}$ output on the "VoltOhmyst." Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.
    Connect the "VoltOhmyst" to the junction of R108 and C109.
    Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst."
    Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R108 and Cl09. Make the final adjustments with the signal input level adjusted to produce 6 volts $d-c$ on the "VoltOhmyst" at pin 2 of V103.
    SOUND I-F ALIGNMENT.-Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

    Connect the "VoltOhmyst" to pin 2 of V103.
    Tune the T101 top core for maximum $\mathrm{d}-\mathrm{c}$ on the "VoltOhmyst."
    The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.
    4.5 MC. TRAP ADJUSTMENT.-Connect the signal generator in series with a 100 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc . and modulate it $30 \%$ with 400 cycles. Set the output to approximately 0.5 volt.
    Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

    Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 9 of V110.

    Adjust the core of L104 for minimum output on the oscilloscope.

    Remove the short from pin 1, V108 to ground.

[^8]:    All leads that can result in interaction between stages due to RF pick-up must be dressed close to the chassis. Leads in this category include the heater, AGC and B $\not \subset$ leads, these leads must be long enough to permit dressing close to the chassis.

    All leads located near the horizoncal multivibrator trimmer capacitor, C421, must be dressed away from the capacitor and close to the chassis.

    Video peaking coils should be dressed away from the chassis and clear of adjacent parts.
    The lead-in from the antena terminals to the tuner must be dressed away from the IF strip to prevent "RF" tweet from interfering with the picture.

[^9]:    SUFFIX " $U$ " FOLLOWING ANY MODEL NUMBER INDICATES A RECEIVER EQUIPPED WITH THE ZENITH CONTINUOUS TUNER

