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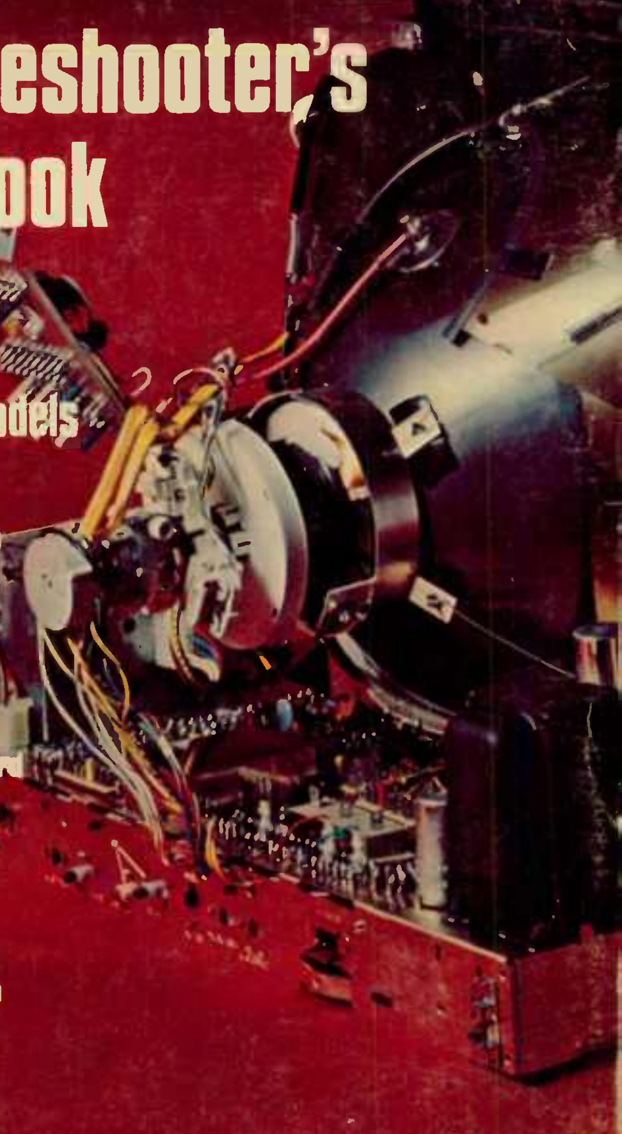
TV Troubleshooter's Handbook

NEW 3rd EDITION



- B&W TV
- Color TV
- Console Models

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By the Editors of Electronic Technician / Dealer

TV Troubleshooter's Handbook

THIRD EDITION

APRIL 5, 1983

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TAB BOOKS
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THIRD EDITION

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About This Book

This reference guide is based on material originally published in the "Technical Digest" section of the *Electronic Technician/Dealer* magazine. How in its third edition, TV Troubleshooter's Handbook has steadily grown—now 70% larger than the first edition—to include the technical data on an increasing number of television and console chassis. Receivers covered in this edition include models introduced by 17 manufacturers between 1966 and 1974.

This edition has been organized somewhat differently from it predecessors. There are now three sections—Black and White, Color, and Console—within the space allocated for each manufacturer. A thumb index which permits the reader to locate each of the three sections under any of the manufacturers has been included for the first time. This index sharply decreases the time usually required to zero in on exactly the information needed. The index will almost instantly get you to within a page or two of where you need to be for the information you want.

As always, this handbook contains a large collection of service hints, circuit schematics and descriptions, production changes, field service notes, and other technical data on the major makes and models of monochrome and color TV receivers and console subchassis.

The Editors

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ADMIRAL
B&W TV

TV Chassis Stamped Run 11, C21A1-1A, -1E and C21A10-1C — AGC Control Adjustment

The AGC control is an AGC threshold control which is used solely to adjust the receiver for optimum operation under all signal conditions. Note: This control is set at the factory and will not normally require field readjustment. Improper AGC control adjustment can result in picture bending, tearing (overloading) or buzz in the sound. However, these same conditions can also be caused by other troubles in the set.

If adjustment is required, it should be made exactly as instructed.

1. Turn set on and allow 15 minutes to warm up.
2. Turn channel selector to strongest station in the area.
3. Turn contrast and brightness controls fully to the right.
4. Very slowly turn AGC control to the left, just to the point where picture is weak (loses contrast).
5. Adjust horizontal lock (at rear of set) and vertical hold control (at side of set) for steady picture, without bending of vertical lines at top of picture.
6. Very slowly turn AGC control to the right, until picture just begins to bend, shift, or buzz is heard in sound. Then very slowly turn the AGC control to the left, to the point at which picture bending, tearing, shifting and buzz is removed.
7. Make final adjustment by turning AGC control an approximate additional 10 deg to the left.

8. Recheck at maximum contrast on all channels. Picture should not overload and should reappear immediately after changing channels.

IMPORTANT: AGC adjustment should always be made on the strongest TV station received. If adjustment is made only on a weak station, AGC overload may occur when a strong TV station is tuned in.

TV Chassis C21A1-1A, -1E and C21A10-1C Stamped Run 11—Improving Focus

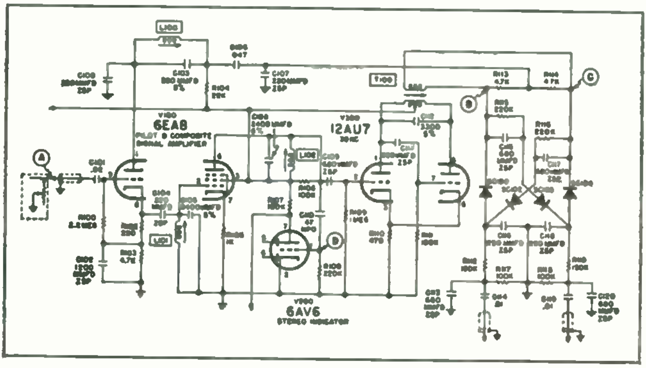
The CRT in these receivers uses electrostatic focus—with a 3-position focus adjustment consisting of a small plug-in type patch-cord and three receptacle pins shown as "A," "B" and "C" on the manufacturer's schematic. This is located at the bottom of the chassis near the horizontal range, vertical linearity and vertical height control mounting strip. To make the proper focus adjustment, connect plug-in focus lead to the receptacle pin that provides best focus at the center area of the CRT. Contrast and brightness controls should be set for a normal picture. Caution: *High B+ is present at the focus terminals. Use care and avoid accidental contact with these terminals to prevent electric shock.*

TV Chassis Stamped Run 11, Models C21A1-1A, -1E, C21A10-1C—Changes

The following schematic corrections should be indicated on TV installation, alignment and service data, form number 41D9-351-002 or St988-2. In run change column of schematic, disregard run 11 information, relating to change in value of several resistors and capacitors. Run 10 and 11 sets are identical. Proposed changes were cancelled, since it was not feasible to make changes at that time. Indicate correct value for following components in the schematic: Resistor R413 should be 470-kΩ, instead of 680-kΩ. Vertical hold control should be 750-kΩ, instead of 1.2 MΩ. Resistor R436 should be 150-kΩ, instead of 47-kΩ. Capacitor C405 should be 470 pf, instead of 220 pf. Capacitor C408 should be 560 pf, instead of 1200 pf. Also on schematic, indicate correct pin numbering for V405 (1X2B tube). Filament pins should be 2 and 9, instead of 4 and 8.

Schematics for TV Chassis C21A1-1A, C21A1-1E and C21A10-1C Stamped Run and Run 11—Component Listing Corrections

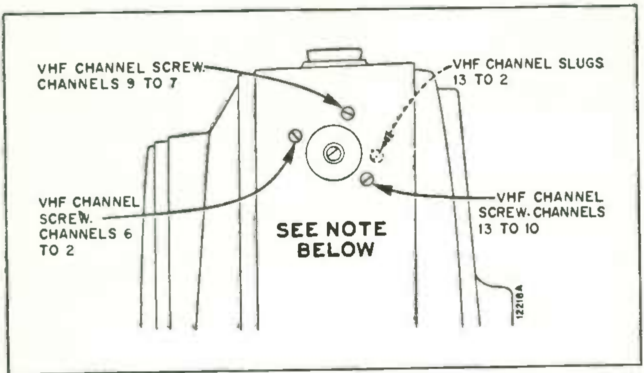
Run 10 and 11 are identical. Resistor R413 should be listed as 470,000 Ω, instead of 680,000 Ω. Vertical hold control should be 750,000 Ω, instead of



1.2 M Ω. Resistor R436 should be 150,000 Ω, instead of 47,000 Ω. Capacitor C405 should be 470 pf, instead of 20 pf. Capacitor C408 should be 560 pf, instead of 1200 pf. Pin numbering for V405 (1X2B tube) is incorrect. Should be 2 and 9 instead of 4 and 8.

TV Chassis Stamped Run 11 With Suffix "E"—VHF Channel Adjustment

All sets with suffix letter "E" after chassis and model number are provided with three channel adjustment screws. A channel screw covering channels 13 through 10, one covering 9 through 7 and one covering channels 6 through 2 are located as shown in the drawing. Since adjustment on a higher channel affects all lower channels, make adjustment starting with the highest operating channel, then on each lower chan-



Side view of Admiral cabinet, channel selector and fine tuning knobs removed. Use adjustments in solid lines for sets with suffix "E" after chassis and model number. Use adjustment in dashed lines for sets with suffix letter "A" or "C" after chassis and model number.

nel. Screws should be adjusted under the following conditions:

1. Turn receiver on and allow 15 min warm up.

2. Set channel selector at highest channel to be adjusted. Set fine tuning control at center of tuning range, by setting knob at mid-point between stops at extreme ends of rotation. Set other tuning controls for normal picture and sound.

3. Remove channel selector and fine tuning knobs.

4. Use a non-metallic adjustment screw-driver with metal tip blade, and carefully adjust channel screw for best picture. Note: *Sound may not be loudest at this point.*

5. Check adjustment on lower channels to be sure that good picture and sound can be tuned within range of the fine tuning control. If good picture and sound are not tunable on a lower channel, touch-up adjustment of the corresponding channel screw should be made on the lower channel, as a compromise adjustment to favor other channels.

TV Chassis G2 and 1G3—Service Hint

You may encounter a condition of vertical instability on the G2 chassis used in the 15 in. portable TV Models (PG1530 and PG1540 series), or on the 1G3 chassis used in the 17 in. Models (PG7030 and PG7040 series). This is usually caused by overscan or poor linearity and can usually be corrected by adjusting the size so that it just overscans at the bottom of the picture, and the vertical linearity so that it just overscans the top of the picture.

Should the above adjustments not correct the condition, and if you are certain that the vertical output tube is operating normally, it may then be necessary to replace the vertical output transformer. Any one of the following parts may be used: 79D100-8, -10 or -12.

TV Chassis H5/1H5—New Hybrid Chassis

The H5 and 1H5 chassis employ both tubes and transistors. Nine transistors and five tubes (plus CRT) are used. Tubes are used in the audio output, vertical output and horizontal sections; the rest of the circuitry, including both VHF and UHF tuners, use semiconductors.

Four new receiving tubes and two new CRTs are used in the following chassis: 11LT8, 24BF11, 24JZ8, 53HK7, 19HAP4 and 21GTP4.

TV Model TKE-3011—Audio Output Tube Replacement

The new educational TV receiver TKE3011 will use a 6BY11 audio output tube to obtain the specified 3w (EIA standard) audio output. At present the tube is only available from Admiral distributors.

Emergency replacements can be made with the 6BF11 tube used in current entertainment type sets. The output will be sharply reduced, to about 1w, which could be unsatisfactory for classroom use.

If you are called on to service any of these educational TV sets, be sure you have this tube on hand.

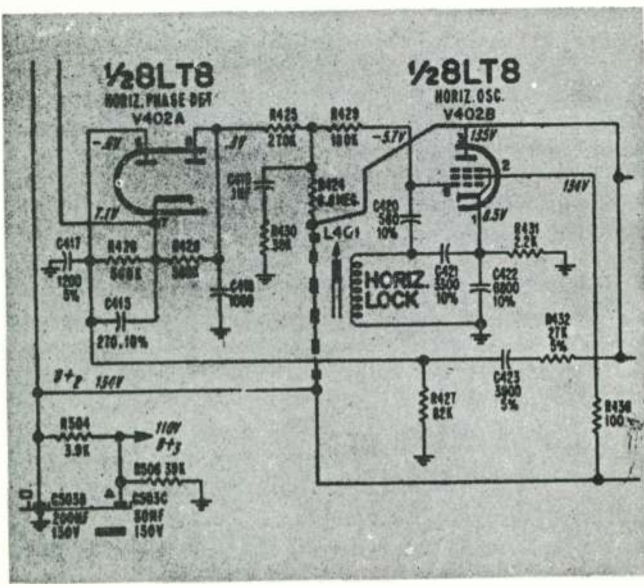
Instant Play Feature

The "instant play" feature on current ac-dc portable television receivers can be added to older ac-dc television receivers by adding a diode, 93B52-1, across the ac switch.

This feature cannot be added to ac-dc sets that use a filament transformer, a full-wave power supply or that have the remote control feature. The added diode must be connected so that it is of the opposite polarity to the one in the power supply. Our current portable B/W schematics show how the diode is connected. This feature will allow the tube filaments to operate at half their normal drain while everything else is shut off. The slight added cost of operation is usually offset by fewer service calls.

TV Chassis H2, H3, H4,—Slow Starting Horizontal Oscillators

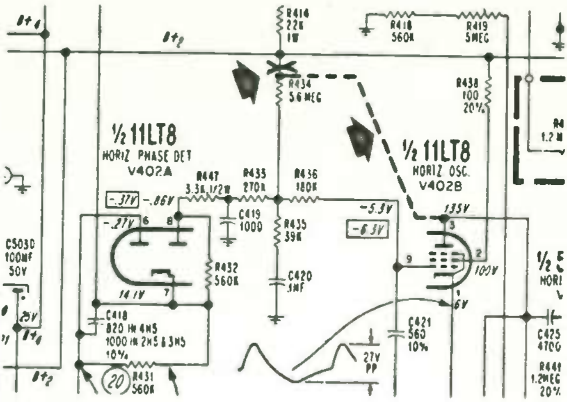
A number of 94D17-19 horizontal oscillator coils which have been returned as defective actually tested good. Investigation disclosed that these coils had been replaced in H1, H2, H3 and H4 chassis to cure slow-starting or intermittent horizontal oscillators. We suggest that you merely move the



end of R424, which is now connected to B+ 2, to the plate of V402B, the oscillator. This modification will provide more starting current. This revision has been made in production.

This same condition has been noted in the H5 and

MH5 series chassis and is corrected in the same manner.



Disconnect R434 from B+2 and connect it to the plate of V402B as shown in the diagram. Please note this change in your S1070, S1078 and S1090 series service manuals.

H2-1A Chassis Portable TV-Tube Substitution

Current 15in. portable TV models with H2-1A chassis use a 17BF11A sound detector/output tube. The new electron tube is electrically identical to the 17BF11, but is housed in a smaller glass envelope.

Although the old 17BF11 can be used for replacement in the 13in. set using the H1-1A chassis and in earlier sets, it would sit too close to the picture tube in the current 15in. models.

Since the 17BF11A can be used for replacement in all current and previous models, the manufacturer will stock only the new tubes and will substitute it on all orders for the 17BF11.

Current UHF Tuners—New Mixer Diode

The part number for this tuner diode is incorrectly identified in the parts list of many recent TV manuals. If your schematic shows a 1N82AG, change the part number in your parts list to 93A59-1. This diode is used in place of the common 1N82A (57D1-65).

Although both diodes perform the same function, the 1N82AG is smaller and is soldered in place. The following precautions should be observed when replacing this part:

• Replace the diode with the same type originally used.

• Use a heat sink on the lead between the body of the diode and the soldering iron. The iron should have a small tip and be rated at 35 to 50w.

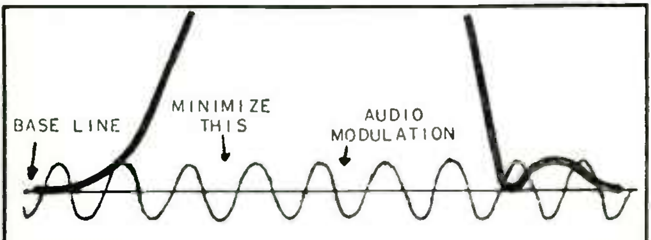
• The new part must be soldered in place and have the same lead length, lead shape and physical location as the original. Note: Some diodes have a loop in one lead that acts as an oscillator injection loop. Be sure to duplicate this loop in the replacement diode's lead.

• The replacement diode must be wired for the same polarity as the original for best results.

• The tuner shields must be replaced exactly as they had been before.

TV Trap Alignment

Admiral has included a more accurate method of TV IF trap alignment in its recent television alignment procedures. It amounts to using the alignment generator set at



OBSERVATION OF BASELINE AUDIO MODULATION WHILE NULLING TRAPS (DO NOT CONFUSE WITH CALIBRATING BEAT).

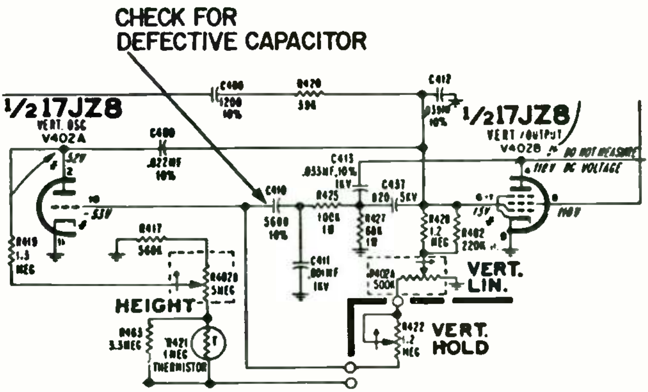
the trap frequency in the usual way and then adding a small amount of audio modulation, usually available from the generator. In theory, we are using the generator set at the trap frequency for carrier, while the modulation forms sidebands which appear on the baseline as sine waves.

To adjust the trap, observe the trace on the scope and vary the trap adjustments to minimize (null) the audio on the base line, giving more usable indication.

Be sure to keep the audio modulation at a low level as shown in the drawing.

TV Chassis TG2-2/9in. TV—Vertical Hold Problem

If the picture in a 9in. TV set will not roll down with the vertical hold control and it acts like a linearity control, check for a defective C410, a 5600pf capacitor in late



production models, connected to the vertical oscillator grid.

The part number of this capacitor is incorrectly listed in S1044E as 65C80-56; please change it to 65C80-78. We are temporarily substituting the previously used capacitor, 65C80-25 (4700pf).

Polyester Film Capacitor Identification

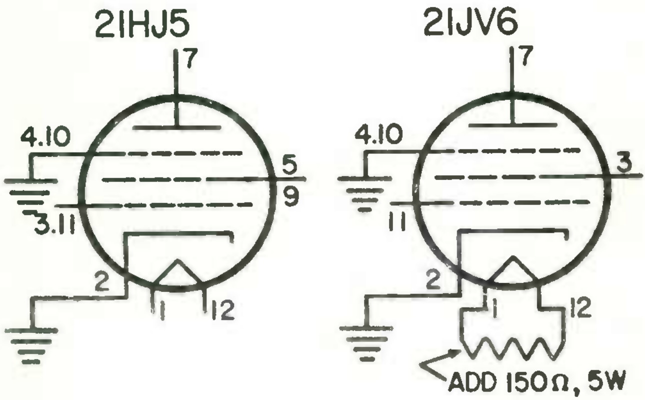
Many current Admiral electronic products use a rectangular green plastic capacitor with both leads at the bottom. Polyester film such as Du Pont's Mylar is used as the dielectric.

Some capacitors of this type have the value printed on the case (.01, 0.02, etc.); others have the value printed in code. The code consists of the first two digits of the picofarad value plus a digit indicating the number of zeros that follow. For instance: 223 is 22000pf or .022μf, 103 is 10000pf or .01μf, etc.

The letter M or K indicates tolerance: M is 20 percent, K is 10 percent. The working voltage and vendor code also appear on many. Most of this type that we have seen have this information arranged on four separate lines.

21HJ5 Horizontal Output Tube Replaced by 21JV6

The 21HJ5 tube used for horizontal output in the monochrome TV chassis covered by service manuals S924, S955, S956, S957 and S971 is no longer available. The



13GB5 tube, which replaced the 21HJ5 in later runs of these chassis, has been suggested as a substitute. However, this substitution required changing the tube socket and other components. We can now supply the 21JV6 which will replace the 21HJ5 with only slight rewiring of the original socket and the addition of a resistor across the heater.

To replace the 21HJ5 with a 21JV6: (1) Remove leads from pin 3 and connect to pin 11. (2) Remove leads from pins 5 and 9 and connect to pin 3. (3) Add a 61C20-44 (150Ω, 5w) resistor between pins 1 and 12. In areas with low line voltage, this resistance may be increased to 180Ω (do not exceed 180Ω).

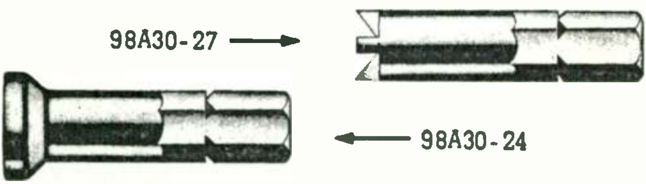
The following chassis may have used the 21HJ5: 16L3B,C; 16UK3B,C; 16UA4C,D; 16UE4C,D; 16UL3B,-

C; 16M3B,C; 16B4C; 16F4U; 16P3B; 16UM3B,C; 16UB4C; 16G4U; 16K3B,C; 16A4C,D; 16E4C,D.

The 21JV6 tube is available through an Admiral distributor.

Special Tools for Commercial TV

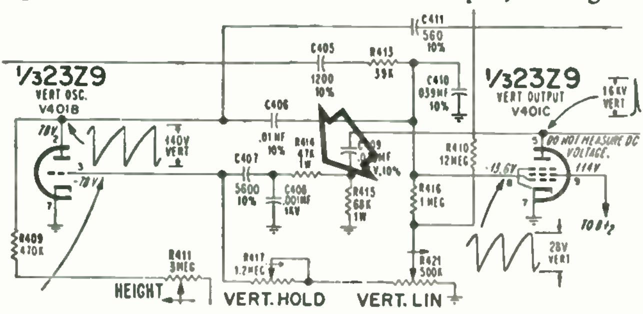
Special tamper-proof screws are used to secure the cabinet backs on commercial (hotel-motel, ETV) TV sets. The screwdriver bits illustrated will fit standard ¼in. hex nut drivers or power tools. You will need a 98A30-27 male



bit for plastic backs where screwheads are recessed. However, the screwheads are exposed on most sets, so the 98A30-24 female bit will give you a better grip and guard against slipping. Order from your Admiral distributor.

TV Chassis TK-3—No Vertical Sweep

The probable cause of a no vertical sweep complaint is resistor R414, 47K, 1w being open. There have been several reports that this resistor has been found open, although it

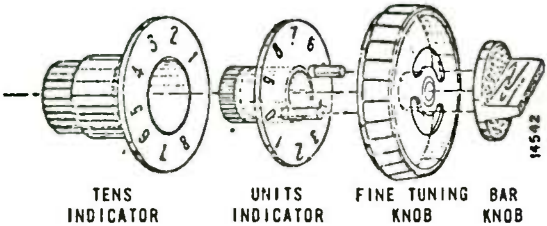


may not show any external evidence of failure. Replace it with the same type and value, Admiral Part No. 60A14-473.

On some of the other monochrome chassis, the equivalent value of the resistor was 100K, 1w, Admiral Part No. 60A107-104.

Current TV Models—70 Detent UHF Tuner Selector Knobs

In the parts lists for models using the 70-detent UHF tuners, all four parts of the UHF selector are listed as knobs. Actually, as shown in the illustration, there are two knobs and two indicators. Notice that the *tens indicator*



has numbers 1-8 for the tens digit of channel numbers 14-83, while the *units indicator* has numbers 0-9 for the *units digit* of the UHF channel numbers.

The UHF channel selector knob should never be forced past the ends of the band (14 and 83). It is possible not only to break off the posts on the units indicator, but also to break the tuner stops.

Three Function Remote Control

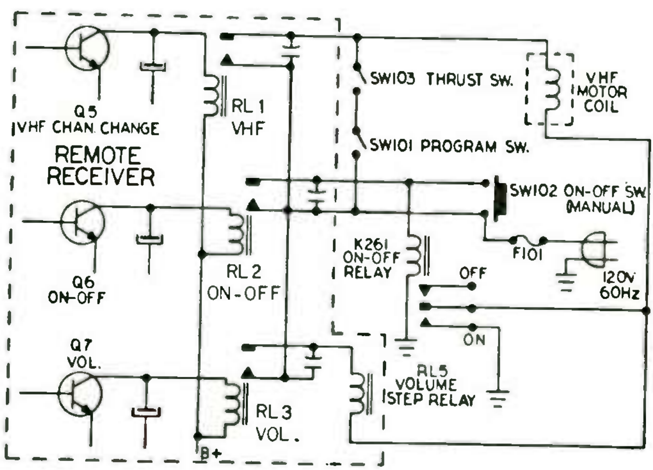
Models 19TS121C, 19TS129C and 21TS711C are equipped with a three function remote control for operation of the VHF CHANNEL CHANGE, ON/OFF and VOLUME control (Low, Medium, High) functions. The tuner can be programmed to bypass unused VHF channels.

The sets may be controlled either with the usual front mounted controls or the hand-held electronic transmitter, Model R300TA. Pressing the VHF button on the transmitter transmits a 41.5kHz CW signal, the ON/OFF button a 38.5kHz CW signal and the VOLUME button a 35.5kHz CW signal.

The Model R300R amplifier receives the signals with a small microphone and selects and amplifies each signal for relay control of the TV-set circuits, as shown in the simplified diagram.

The TV set can be turned ON or OFF by using the remote transmitter or the manual switch, SW102, on the control panel. When switch SW102 is closed, ac current flows from the 120v ac source through fuse F101, switch SW102 and relay coil K261. This closes the contacts of K261, applying power to the TV set.

When an ON/OFF signal is picked up by the remote receiver, transistor Q6 is forward biased so that current will flow through the transistor and RL2 dc relay coil. This closes the relay contacts and applies power to K261, turning the TV set ON. Relay K261 is a bi-stable type; thus, the TV set will remain ON until power is again applied to the K261 coil through SW102 or RL2. A set of contacts on K261 also supplies a ground return path for the VHF motor coil and RL5 volume step relay at any time that K261 is in the ON position.



When a channel change signal is picked up by the remote receiver, transistor Q5 is forward biased so that current will flow through the transistor and RL1 dc relay coil, thus closing the RL1 contacts and applying power to the VHF motor coil. The SW103 thrust switch closes when power is applied to the VHF motor coil—this switch prevents power from being applied to the motor through switch SW101 when the VHF is manually tuned.

If the tuner is turned to an unused channel, the SW101 program switch will be closed by a preset program screw on the channel strip. When SW101 is closed, power will continue to be applied to the motor coil through F101, SW101 and SW103. When SW101 senses an operable channel, it will open and stop the tuner on that channel.

When a volume change signal is picked up by the remote receiver, transistor Q7 is forward biased so that current will flow through the transistor and the RL3 dc relay coil. This causes the RL3 contacts to close and apply power to the RL5 volume-step relay coil, which will step the set volume to the next level.

TV Chassis H3/H4/K2/K3/K4—Weaving or Pulling in the Picture

Weaving or pulling in the picture can possibly be caused by heater-to-cathode leakage in the horizontal oscillator tube, 8LT8. This condition will appear as if the electrolytic capacitor in the low voltage power supply is defective. Confirm this possibility by substituting another horizontal-oscillator tube.

Servicing Solid-State TV Receivers

Most electronic technicians are pretty well aware by now of the special precautions that must be taken when servicing solid-state devices, but it is so easy to forget and take certain shortcuts that were considered perfectly acceptable before the advent of solid-state that we feel a reminder is in order.

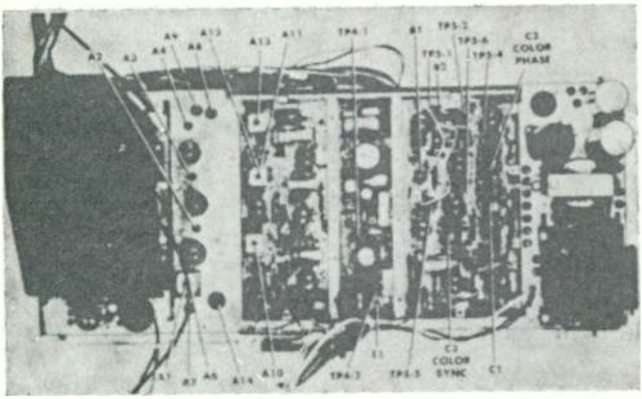
Take, for instance, the formerly accepted practice of using a screwdriver to draw an arc to test for the presence of electrical potential, or to bleed off the charge from a picture tube or electrolytic capacitor. This practice is absolutely forbidden in solid-state servicing. It will almost invariably damage solid-state components, even if there is no immediately apparent damage, the life of one or more components may have been seriously shortened, thus resulting in subsequent failures.

Troubleshooting in solid-state TV chassis consists primarily of voltage and resistance measurements. Such procedures, using the appropriate instruments, should disclose most defects in any circuit.

ADMIRAL
Color TV

Color TV Chassis D11 — Field Adjustment of Sync and Phase

To make color sync adjustment in the field, tune in color bar generator or color program. Short test point TP5-6 to ground. Adjust C3 (reactance coil



Test point and adjustment locations on Admiral color chassis D-11.

L507) for least amount of "barber-poling" or color-drift in picture. Remove ground from TP5-6, check color sync action.

To make color phase (tint) adjustment, tune in color bar generator or color program. Set tint control to approximate mid-rotation, and set color fidelity control at neutral position. Adjust C2 (burst transformer T502) for correct registration of color bar or most natual flesh tones. With tint control at extreme clockwise position, flesh tones should appear green. Natural flesh tones should be at mid-rotation.

Color TV Chassis G11 Series—Vertical Jitters

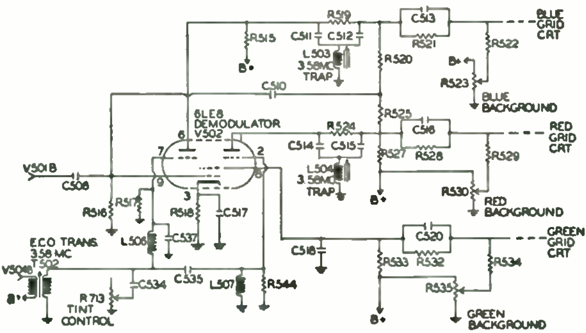
A condition of vertical, or interlace, jitter can be encountered on the G11, IG11, 2G11 and 3G11 chassis in areas with bad power line conditions. The following circuit change will minimize this condition. The vertical jitter is reduced by decoupling the B+ supply to the deflection board, PWS400, and the red lead of the vertical output transformer. This is accomplished by adding a 270Ω, 3w resistor from the input side of the filter choke to the B+ foil pattern on PWS400 and bypassing this point with an 80μf electrolytic. This will supply approximately 265v to PWS400. To maintain the original B+ to the IF and chroma sections, the jumper wires connecting B+ from PWS400 are removed and connected directly to the 280v supply. To make the change follow these instructions:

1. Locate the red lead supplying 280v B+ to PWS400 and unsolder it from the board. Connect one end of a 270Ω, 3w resistor to this point on the board. Mount an 80μf, 350v axial lead electrolytic under the chassis near the damper tube and connect the negative to chassis ground; connect positive lead to the 270Ω resistor.
2. Connect the other end of 270Ω resistor to "CC" on PWS400 (junction of CR405 and CR406).
3. Disconnect red lead of vertical outout transformer (T702) from B+. Splice in a length of 22AWG wire and connect to junction of 80μf capacitor and 270Ω resistor.
4. Remove red jumper wires connecting B+ from PWS400 to "E" on PWS300 and "D" on PWS500.
5. Connect B+ lead removed in step 1 to "E" on PWS300. Install a wire from "E" on PWS300 to "D" on PWS500.
6. If R442 (screen resistor of 6LU8) is 27K connect a 15K, lw resistor in parallel with it.

Color TV Chassis G11 — Color Demodulator — Circuit Description

Demodulation of the chrominance information is accomplished by one tube (6LE8) and its associated circuitry. The output signals, namely, the R-Y, G-Y and B-Y are applied directly to the respective control grid of the picture tube. The 6LE8 provides amplification of all three signals.

To better understand the operation of this multi-function stage, let's first examine the 6LE8 tube. We must consider the two plates as being two separate tubes, each having a separate suppressor grid. The control grid and cathode are common to both tubes as indicated by the drawing. The left-hand section of the tube is the B-Y demodulator while the right-hand section is the R-Y demodulator. G-Y signal is developed at the screen grid (Pin No. 8). We, in effect, then have a third plate, this plate of course being Pin No. 8.



Chrominance and high frequency information from the bandpass amplifier is applied to the control grid (Pin No. 9). The 3.58 Mc reference signal is applied to the suppressor grids (Pin No. 7 and No. 2). The phase shift network provides approximately 90 deg phase shift between the two reference signals. During color this 90 deg phase difference in the signals at Pin No. 7 and Pin No. 2 allows only one-half of the tube to conduct at a time. This action results in the reproduction of the B-Y signal at Pin No. 6 and the R-Y signal at Pin No. 1.

The G-Y signal which is developed at Pin No. 8 is a result of several things. First of all, we must realize that the signal when developed at Pin No. 8 will be a result of a change in the amount of current flow to the screen. This change in current will change the screen voltage and a varying signal will result. Current flows from cathode to Pin No. 8 because of the positive voltage on Pin No. 8. When the plates (Pin No. 1 and No. 6) are alternately attracting electrons from the cathode, less will go to the screen. This decrease in screen current raises the screen voltage. During the period that Pin No. 6 stops attracting electrons and Pin No. 1 is not yet attracting them, the electrons will be attracted to the screen grid. This increase in screen current will lower the screen voltage.

An additional factor is also important in the reproduction of the G-Y signal. This is feedback from the B-Y and R-Y demodulator plates to the control grid (Pin No. 9). This feedback network is made up of R520, R525, and C510. Matrixing takes place between the B-Y and R-Y which is the equivalent of -(G-Y) being applied back to the grid. All of these things combined result in the full G-Y signals redeveloping at Pin No. 8. Adjustable traps are provided in the 6LE8 plate circuits to remove the 3.58 Mc component.

Color TV Chassis G11—3.58 Mc Reference Oscillator—Circuit Description

The 3.58 Mc reference oscillator is an injection lock type. The circuit utilizes a quartz crystal as used in the past, and the oscillator continues to operate whether or not a color transmission is being received.

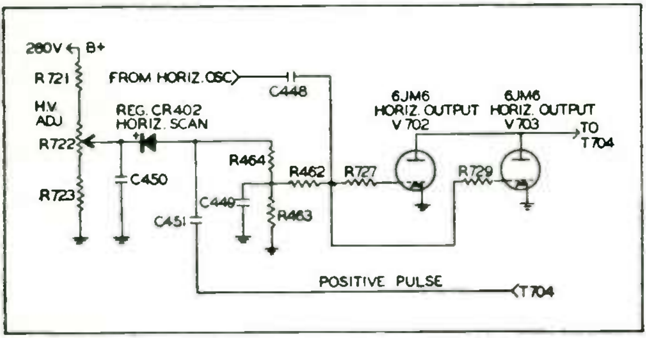
The burst is coupled to the oscillator by the burst transformer and by this means the reference oscillator is synchronized with the 3.58 sub-carrier at the transmitter.

The color killer cut-off bias and the ACC (Automatic Color Control) voltage is developed by CR501 (ACC Det.) and its associated circuit. CR501 is connected in the 3.58 Mc reference oscillator circuit and rectifies the oscillator frequency. When burst is present, the rectified voltage (—dc) increases and is sufficient to bias off the color killer. This voltage is also used to control the conduction of the 1st bandpass amplifier (V501A). The amplitude of the burst signal received determines the amount of −dc voltage produced; therefore, variations in burst levels are utilized to maintain a constant chroma level (ACC).

Color TV Chassis G11 — Circuit Descriptions

HV Regulator

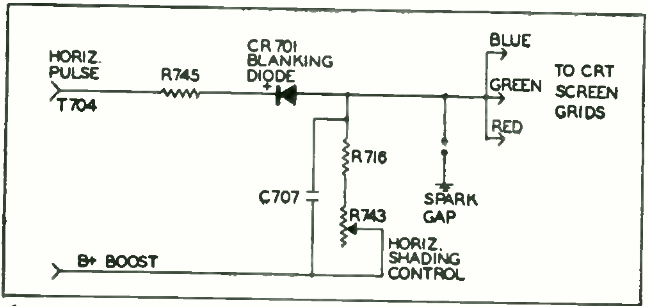
The purpose of the high voltage regulator (CR402) is to provide current regulation of the horizontal output circuit. CR402 and its associated components produce a negative voltage which biases the horizontal output tube grids proportionally to the load on the horizontal output transformer. This bias supplements the normal bias produced by the output stages. A positive pulse from the



horizontal output transformer (T704) determines the amount of regulating bias produced. The amplitude of the feed back pulse varies with the load on the transformer and in turn regulates the bias for V702 and V703. The high voltage adjustment (R722) varies the amount of reverse bias at CR402 and, therefore, the amount of conduction. The high voltage is proportional to the current through the horizontal output transformer.

Horizontal Blanking

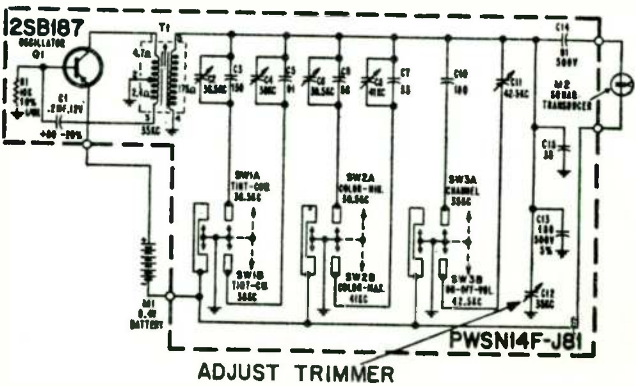
Horizontal blanking is accomplished by applying a pulse from the horizontal output transformer (T704) to the Red, Green, and Blue screen grids of the picture tube. The diode, CR701, is reverse-biased during horizontal scan time and the screen grids have B+ boost applied through R743 and R716. During horizontal retrace time, a negative pulse is applied to the cathode of the diode which causes it to conduct. This negative pulse reduces



the screen voltage sufficiently to blank the picture tube off. A HORIZONTAL SHADING Control, R743, is provided to adjust the blanking time to eliminate shading at the left-hand side of the picture tube. This adjustment will not normally require adjustment.

Color Remote Control S366AN—Hand Transmitter Oscillator Adjustment

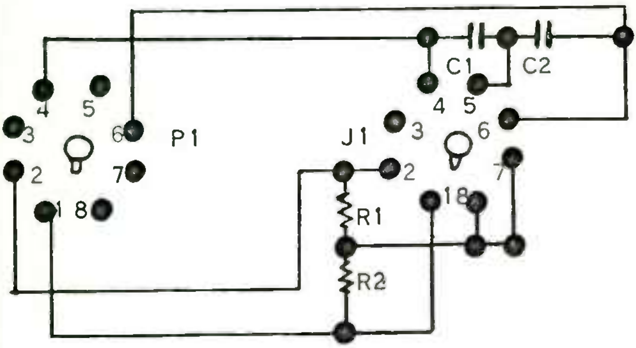
Reports have been received of the ON/OFF function being triggered when the color INCREASE function is activated. This trouble is caused by gradual drift of the S366AN hand transmitter oscillator circuit which can be corrected by a simple adjustment. Adjust only the over-



all trimmer, C12, (as shown in the schematic here) in the S366AN unit (next to transducer). This adjustment will correct all functions.

Deflection Yoke Adapter

The adapter shown will enable you to use a bench test jig employing a 7-lead yoke to test current color chassis



C1,2	65D10-77	100pf, 3KV
R1,2	60B14-271	270ohm, 10%, 1W

P1	88A23-6	Plug
J1	87A84-2	Socket

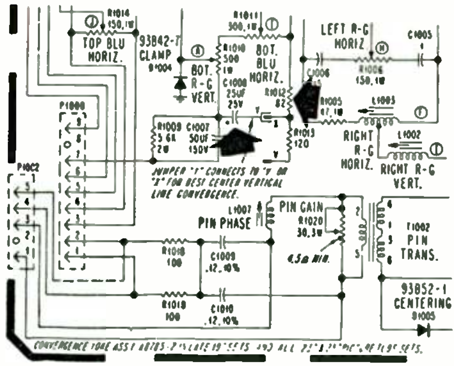
with 4-lead yokes. Plug P1 fits 3H10, 4H10, 5H10, 6H10, and 9H10 chassis. Socket J1 fits 94D304-1, -2, -3, -4; 94D275-1 and 94D306-1 yokes.

Color TV Chassis 3K19—Service Hint

If you encounter a symptom of insufficient or no vertica sweep, resistor R1012 overheated, and capacitor C1008 with the end blown out, the possible cause is as follows:

You will likely find filament-to-cathode leakage in the 10GF7A vertical-output tube. (Output section; pin 3 to pins 4 and 5).

With filament-to-cathode leakage in this tube, AC volt-



SECTION OF 3K19 CONVERGENCE BOARD SCHEMATIC

age is connected into the convergence assembly.

Replace the 10GF7A tube, resistor R1012 (82 ohm, ½ w) and capacitor C1008 (25 mfd, 25 v). The replacement should be made with Part No. 67A200-250-7.

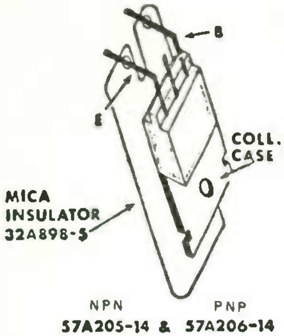
Color TV Chassis M24/M25/M30—Vertical-Output Transistors

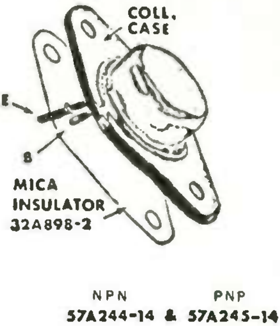
Vertical-output transistors with two different case styles were used interchangeably in production of the M24, M25 and M30 chassis. There is no electrical difference between the case styles; either may be used to replace the other.

The mica insulator packed with the replacement must be used when replacing one case style with the other. Be sure to apply silicone grease to both sides of the new insulator to insure maximum heat transfer to the sink. Make sure that the insulator is undamaged and that there are no burrs or foreign particles on any of the mating surfaces that might damage the insulator or prevent proper seating of the transistor.

It is also important that the mounting screw(s) be tightened sufficiently to position the transistor in firm contact with the insulator and, in turn, with the heat sink.

The above precautions apply to all power transistors which are mounted on heat sinks.





Color TV Chassis M10—Brightness and Contrast Control Adjustment

The type of brightness control circuitry employed in this chassis includes a black level clamp circuit. This circuit provides DC restoration, and the clamp level adjustment sets the peak limit of black video information. This, in turn, sets the minimum limit of picture tube beam current. It operates in conjunction with the brightness limiter circuit, which provides regulation of high-level picture tube beam current. The result is a stabilized brightness-to-contrast ratio during variations of scene intensity.

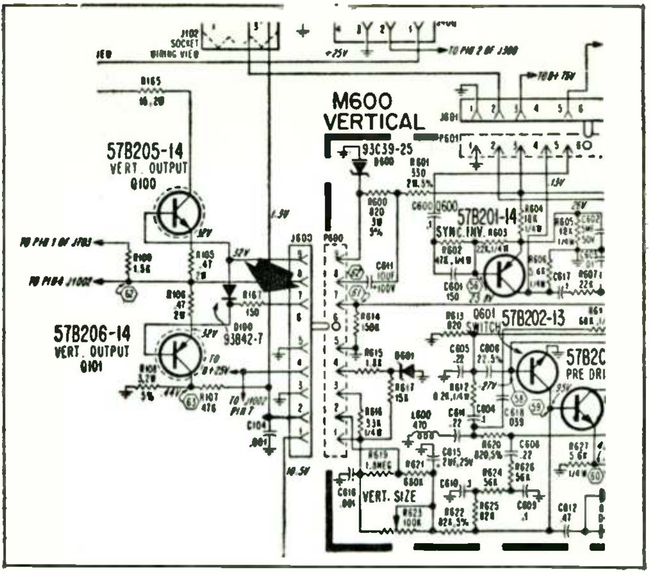
Correct operation of the clamp and brightness limit circuitry depends on proper adjustment of the black-and-white tracking controls.

Although the BRIGHTNESS control affects the overall picture tube brightness, it also sets the black clamp level. The CONTRAST control not only affects the amount of video drive, but also sets the brightness level of white information that is contained in the picture.

The complete procedure, including the clamp level brightness and contrast adjustments, is as follows:

1) Apply power to the TV set and allow it to warm up for 15 minutes.

2) Perform the black-and-white tracking procedure, if needed.



3) Switch *off* the COLOR MASTER control, if used.

4) Tune the TV receiver to a strong local station.

5) Rotate the COLOR control fully counterclockwise, to remove all color information from the TV screen.

6) Rotate the CONTRAST control fully counterclockwise to its *minimum* position.

7) Rotate the BRIGHTNESS control fully clockwise to its *maximum* position.

8) While observing the darkest areas in the picture, rotate the BRIGHTNESS control counterclockwise until the darkest areas just turn black. (Note: This adjusts the operating point of the black clamp level circuit.)

9) Rotate the CONTRAST control clockwise for the desired brightness-to-contrast ratio and the most desirable black-and-white picture.

10) This same procedure should be followed to adjust both the main and the PRESET BRIGHTNESS and CONTRAST controls.

11) Repeat for PRESET control adjustment with COLOR MASTER switch on, if used.

Color TV Chassis M24, M25, M30—Vertical-Output Transistors

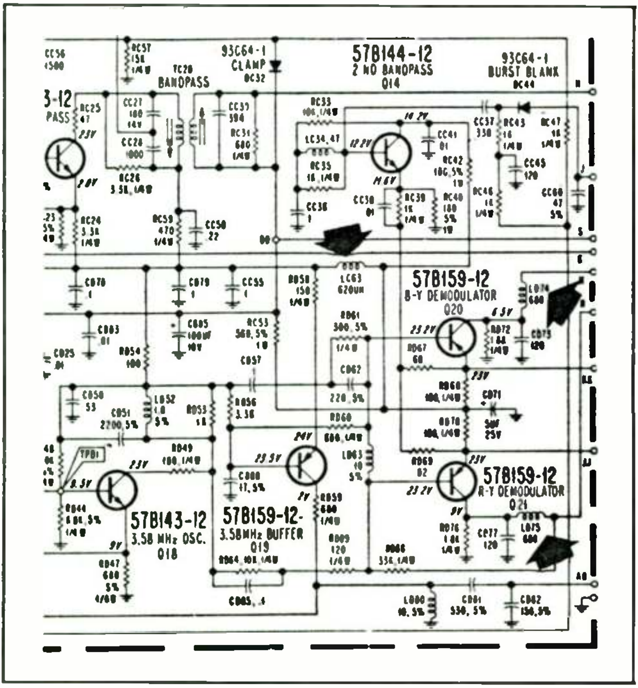
Whenever you replace vertical-output transistors 57A-205-14 and 57A206-14 in an M24, M25 or M30 color TV chassis, a 150-ohm, 10%, ½ w resistor should be added between pin 7 of J600 and the base of transistor Q101, as shown in the accompanying partial schematic.

It is imperative that a silicon heat transfer compound be used when mounting these transistors.

Color TV Chassis K10—No Color

A problem of no color can possibly be caused by an open coil, LC63 (620 mh). If this coil is open, we will not have voltage at the collector of the 2nd Bandpass transistor, Q14. Replace the defective coil with Part No. 73A55-48.

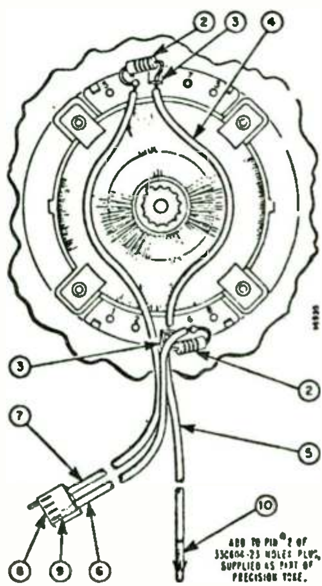
If we lack some colors in the TV picture, it possibly



can be caused by an open coil LD74 or LD75 (680 mh). With LD74 open, blue will be missing; with LD75 open, red will be missing. Replace the open coil with Part No. 73A55-17.

Color TV Chassis M10—Picture Tube/Deflection Yoke Replacement

The picture tube used in color TV receivers employing the M10 chassis have a precision yoke permanently bonded to the CRT. Replacement of the picture tube or deflection yoke requires changing the complete assembly. The



YOKE WIRING DIAGRAM
(Viewed from rear of set)

replacement picture tube, as supplied by the manufacturer, comes complete with the deflection yoke and wiring harness, except for the parts shown in the accompanying illustration.

When you replace the CRT assembly, remove the parts shown in the illustration and reinstall them on the replacement CRT after it has been mounted in the cabinet.

The CRT you return for warranty adjustment must be complete with exactly the same items that come with the replacement CRT you install in its place.

NOTE: Use a Molex pin extractor to remove the pin (Item 10) from the 12-pin Molex connector.

Do not attempt to reposition or remove the deflection yoke from the CRT, because it is permanently bonded to it and serious damage can occur.

The replacement CRT is supplied completely readjusted (purity and convergence) by the tube manufacturer and does not require these adjustments when installed.

ADMIRAL
Console Models

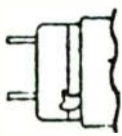
Solid-State Stereo—Revised Alignment Data

After extensive tests on Admiral solid-state stereo-radio chassis, it has been found that more consistant curves can be obtained by using the weakest possible sweep RF signal, rather than the more conventional curve level set at the –3db limiting threshold. Please note this revision in service data manuals S1018, S1020, S1033, S1034 & S1047.

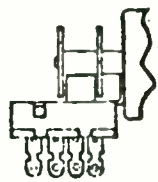
Also, when aligning late run 24A3 chassis, you will find that the alignment of Tl is satisfactory with both slugs at their outermost peaks.

Using the sweep levels above and data supplied in News Letters EDL6605 and EDL6607, all tuners (including the 24A3) may be aligned with the IF sample taken off at the discriminator electrolytic through the

Type I
75C119-1



Type II
75C119-11



standard decoupling network (be sure that the discriminator secondary slug is turned out while you observe the IF curve).

Much alignment information for other solid-state chassis appears in alignment procedures for the 22D5 chassis (service manual S1047).

REPLACEMENT CONTROL: Because of an error in specifications, the 75C119-1 control was purchased from two suppliers with two different types of switches. We have assigned a different dash number for the second type to permit proper field replacement.

Type I with SPST switch remains -1 but type II with DPDT switch is now 75C119-11. Orders for 75C119-11 can be filled without question, but 75C119-1 should be ordered with description "Control, SPST Switch," so we can be sure you are aware of the difference!

This control has been used on tuner clusters GC2155-1, -2 & -4 and is in parts lists in manuals S1022A, S1022B, S1025A and S1043.

Record Changers Stalling in Cycle

Slippage of the idler wheel on the turntable rim, which takes place under change-cycle load, may cause a slower-than-normal turntable speed and, under some circumstances, complete stalling.

An investigation has led to improved specifications which will eliminate the problem on new changers. However, the study also disclosed that thorough cleaning will cure the condition in the field.

1. Firmly wipe the entire inside flange of the turntable with a clean white cloth wet with trichlorethane. Do not use any other solvent!

2. With idler wheel lightly loaded against the rotating motor shaft, clean the circumference with 400 grit sandpaper until the working surface is uniformly black and all glazed surface removed.

3. Using a clean white cloth wet with trichlorethane wipe all surfaces of the motor shaft that contact the idler wheel (in any function).

4. Carefully replace the turntable, rotating it clockwise to ease installation.

Stereo Console — Chassis Removal

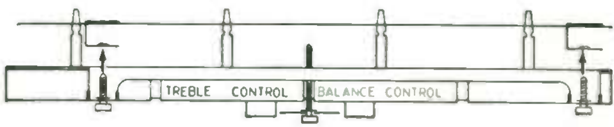
Most of Admiral's current console stereo models use a chassis design of two boards placed back-to-back. Removal of the chassis is often not easy; however, as on most jobs, the right tools and know-how make the job a lot easier.

A ¼in. hex nut driver 9in. long, or longer (XceLite No. A8) does the trick. Some chassis are held by a metal cup and a 9/16in. nut on the control shafts; use a driver similar to XceLite HS18 for these and remove the chassis in the following manner: (1) Pull knobs off; (2) disconnect chassis connectors; (3) while supporting chassis, remove one screw in each corner of chassis that screws into the escutcheon; (4) When reinstalling chassis, reverse the procedure using beeswax, permagum or masking tape in the nut driver to hold the nut.

Modular Stereo Models STC731/STC741/STC751—Disassembly Instructions

To remove the changer and chassis from these models, the cabinet bottom must be removed by removing the screws in the cover. On Models STC741 and STC751, turn the two changer hold down clamps to the vertical position (accessible through holes in the bottom of the chassis). Do not pull the record changer out by its centerpost, but lift the changer part way out with your hands on each side of the base plate. Then disconnect the changer audio cable and power connector. The changer can then be lifted out and most service can be performed without removing the chassis.

If it is necessary to remove the chassis, start by pulling off all knobs. Remove the mounting nut and washer securing the stereo phone jack, the four screws holding the chassis to the cabinet and the screws holding the rear jack panel to the cabinet. Loosen the Phillips screws below the stereo phone jack supporting the control bracket. Loosen the Phillips screw under the power switch, freeing the control bracket, and then loosen the Phillips screw between the Balance and Treble controls—lowering the control bracket as shown in the illustration.

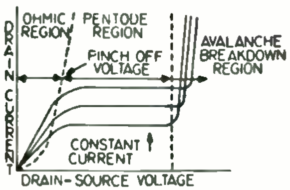


On Model STC751, the cassette recorder can be removed by taking out the four screws securing it to the chassis. Be certain to mark the audio cables as you unplug them. Carefully lift the chassis out.

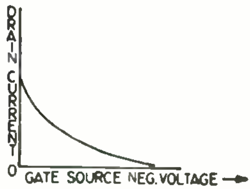
Reassemble the unit in reverse order, tightening the end screws after pushing controls up into position with the center screw.

bias voltage. The stable base bias voltage prevents thermal problems from occurring. Because of the negative temperature characteristic of the N channel FET, any chassis temperature increase will automatically reduce the forward bias of the output transistors, stabilizing the amplifier by reducing the base and collector currents.

Another advantage of the new circuit design is that the drain current of the FET is essentially constant for all practical variations of line and power-supply voltages. Therefore, little dc filtering is required for the B+ supply. With the correct bias setting, noise and hum components in the power source are not readily noticeable in the speaker output.



TYPICAL DEPLETION FET OUTPUT CURVE



TYPICAL DEPLETION DRAIN CURRENT-GATE VOLTAGE CURVE

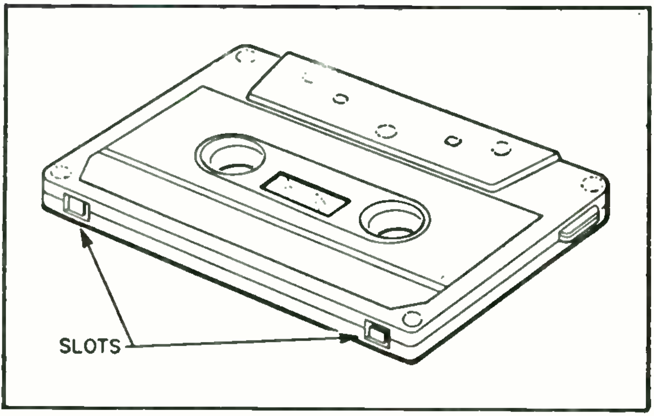
Besides regulating the applied current, the FET matches the circuit's impedance with the high impedance of the phonograph's low-capacity cartridge.

Tape Cassette—Service Hint

Tape cassettes have tabs in small slots (see drawing) that can be removed by the user to prevent accidental erasure or re-recording of the tape.

Some tape recorders are brought to service shops with a complaint of "will not erase or record" because the user removed the tabs.

If you get a tape recorder to service, first look for the tabs on the user's cassettes! If the tabs are removed try a known good cassette before looking for further troubles.



Tape Player Chassis 8Y6—Motor Failure

Admiral console stereo Models KS821, KS823, KS828, KS833 and KS843M were produced with alternate 8-track tape player chassis 8Y6 instead of the specified 8G6A. The chassis number is stamped on the player chassis.

If you encounter any 8Y6 tape players with motor failure caused by the motor fan rubbing or stalling on the bottom motor bracket, replace the motor with the 700A858-516 motor, which has been modified to prevent this type of failure.

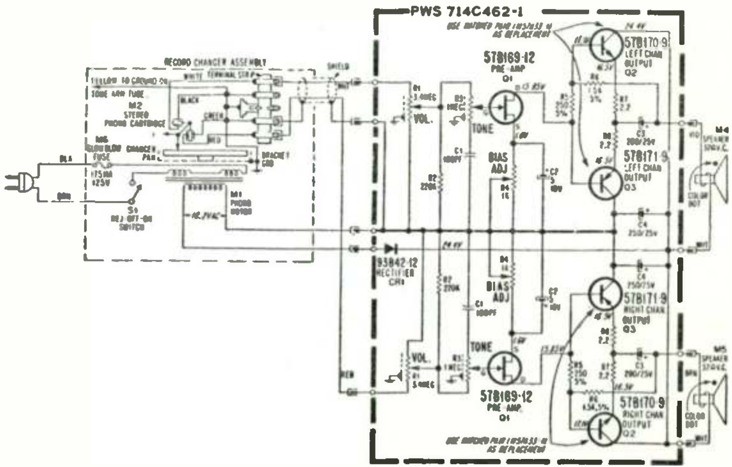
Console Cabinets—Lid Supports

If you need a replacement lid support for a console TV or stereo cabinet, please specify not only the part number shown in the parts list, but also give the type of mechanism and the color of the spring.

There are two basic types of mechanisms: Tension (spring stretches when lid is lifted) and Compression (spring is compressed as lid is lifted). The paint color on the spring is a code for its strength.

Because both of the above factors can vary within a model run, both of the above factors are needed to provide a suitable replacement support.

No stabilizing diodes or thermistors are said to be required to protect the complimentary symmetry output transistors incorporated in this phonograph amplifier. It is said to be protected by the characteristic constant-current circuit design of the FET bias-resistor R4, the bias adjustment for the FET source, is correctly set for a 5ma idling current through the FET and resistor R5. The same current, plus a few microamps of base current, flows through resistor R6 and the 32Ω speaker back to B+. Resistors R5 and R6 and the speaker also form the forward biasing divider network for output transistors Q2 and Q3.



The 5ma current from the FET through the biasing network is much greater than the base current of the output transistors and even if the output transistors heat up with a resulting decrease in their base current, there would not be any appreciable change in the output transistor base

DUMONT-EMERSON

B&W TV

TV Chassis 120677-A, -678B, -679A, -684A, -689A—Field Modification Note

These chassis are equipped with IF input coil which has been designed to allow for the addition of a second adjacent channel sound trap without removing the chassis from the cabinet. This input coil, which is housed in a two-piece shield can with removable top, has been wound around a coil from which extends beyond the windings sufficiently to allow the added adjacent channel sound trap (part No. 720396) to be cemented in place around it. An additional tuning slug (part No. 404052) is then inserted into the open end of the coil form and tuned for minimum adjacent channel sound interference, and the removable metal top section of the coil shield replaced. Parts necessary for this modification may be ordered from the manufacturer's distributors in areas where the need for these items may exist.

TV Chassis 120677-A, 120678-B, 120679-A, 120684-A, 120689-A, —UHF Channel Strips

Individual channel UHF strips may be installed within VHF tuner 471332 (used in 23-in. receivers) if desired. As many as four different UHF strips may be utilized after the VHF tuner has first been modified by the addition of a UHF antenna input adapter plate, Standard Kollsman part number 31T3898-01. Part numbers for the various UHF channel strips may be derived by stating the part number of the desired UHF channel, followed by the designation "P4". For example, the part numbers for the correct UHF strips for use with tuner 471332 would be 31P4 (channel 31), 54P4 (channel 54), etc. The UHF antenna input adapter plate required, as well as the individual channel strips for receivable channels in any particular area, may be obtained from your local DuMont distributor.

EMERSON
B&W TV

TV Chassis 120692A — Control Adjustment

Improper adjustment of the DuMonitor, RF AGC Delay or Trans-Lok Controls may result in one or more of the following adverse conditions:

1. Receiver overload on strong signals (sync instability, sound buzz or loss of interlace).
2. Insufficient picture contrast on suburban and weak signals.
3. Excessive picture snow on weak signals.

If any of these conditions are observed, readjust the controls as follows with the ABC switch in the OFF position and the Trans-Lok turned fully CCW.

1. Switch to the strongest station and turn the RF AGC Delay control fully clockwise, (position of maximum noise in the picture).
2. Rotate the DuMonitor fully counter-clockwise and then slowly clockwise until the receiver begins to overload (sync instability, sound buzz or loss of interlace), then back the control off slightly and leave it in this position. If the receiver does not overload when the control has been rotated fully, leave it in this position.
3. Switch to a medium-weak signal and turn the RF AGC Delay control slowly counter-clockwise until the noise in the picture just minimizes. This

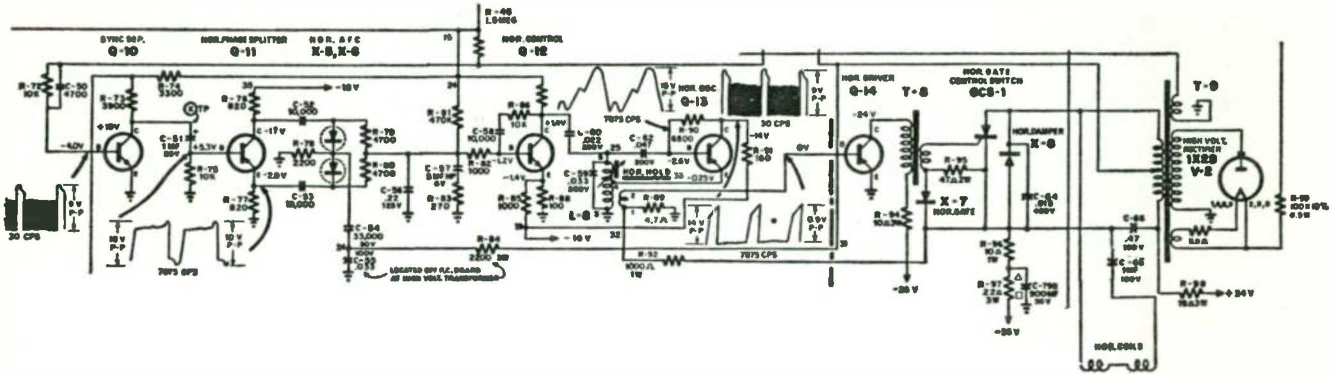
adjustment must be carefully made, otherwise strong signal performance will suffer due to overload or loss of picture contrast.

4. Switch back to the strongest station and, if there is evidence of overload, repeat step 2.
5. With the receiver still turned to strongest channel, rotate the Trans-Lok control slowly clockwise until the picture begins to overload (sync instability, sound buzz, kinks in picture), then back off slightly to eliminate this condition. With controls properly set, switch channels to verify setting for strongest signals. This optimizes operation of the Trans-Lok for mixed signal conditions (strong and weak). However, in extreme fringe areas it is possible to improve the picture stability by further clockwise adjustment of the control. In areas where all signals are strong, the Trans-Lok control can be left in extreme counter-clockwise position.

TV Chassis 120771—Circuit Descriptions Sync Separator, AFC, Horizontal Oscillator and Horizontal Sweep.

The basic function of the sync separator circuit is to remove the video from the composite signal while retaining the sync pulses necessary for proper operation of the vertical and horizontal oscillator circuits.

The sync-positive signal which drives the base of the sync separator transistor is taken from a tap on the video amplifier collector load to obtain the correct amplitude for driving the sync separator and to avoid excessive loading of the video amplifier. The video information of this signal charges C43, and holds the sync separator transistor in an almost off state until such time as a positive sync pulse appears at C43. This slight forward biasing helps to provide clean sync on weak signals. The transistor is turned on only for the duration of the positive pulse at its base, at which time the collector voltage drops, resulting in negative sync pulses at the collector for application to the vertical integrator and horizontal phase detector circuits. The vertical sync is taken from a tap on the collector load resistance to provide the proper amplitude



Sync Separator and Horizontal Circuits, Emerson 120771 Chassis.

for the vertical oscillator. Horizontal sync is taken directly from the collector of the sync separator.

Horizontal sync is applied, through C51, to the base of the horizontal phase splitter, Q1. At the collector of Q1 an amplified positive pulse exists and at the emittor a negative version of the same pulse appears. These two opposite pulses are fed to the phase detector diodes X5 and X6. A reference pulse taken from the primary of the high voltage transformer is applied to the other side of these diodes and compared to the sync pulses. Any difference in phase between the sync pulses and the reference pulse will appear as a dc level on the base of the horizontal control transistor, Q12, resulting in variations of collector current proportional to the phase difference. A change in the collector current of this transistor will change the effective capacitance of the circuit consisting of C60, C59 and L8. This capacitive change will result in a shift of phase, so as to correct for possible variations in horizontal output phase.

The frequency-controlled horizontal oscillator is a sine wave Hartley type and is tunable by varying the impedance of L8 (horizontal hold control). A low impedance winding on L8 couples the oscillator to the base of the horizontal driver (Q14). This stage reduces loading on the oscillator, thus improving stability.

The horizontal yoke current is supplied by a gate-controlled switch (GCS1). This is a fairly recent development in the solid state field. The action of this diode is similar to a grid-controlled thyratron tube except that the anode current can also be shut off by a negative pulse on the gate. Conduction does not occur in the GCS until a substantial amount of forward voltage is present at the anode. The anode voltage required for conduction can be varied, however, by the application of a positive voltage to the gate lead. In this circuit the anode voltage is constant and conduction is obtained by the application of a positive pulse at the gate. Conduction ceases when the pulse goes negative.

Conduction of the GCS permits current to flow through C65 and the yoke. The rise of this current is limited by the inductance of the yoke and its duration is limited by the length of the positive pulse applied to the gate. The relatively short duration of the GCS gate pulse causes the yoke current to rise in a linear manner until the GCS is turned off by the negative-going side of the gate pulse. At this time the yoke current falls rapidly toward its previous level. The damper diode (X8) across the yoke inhibits further oscillations after retrace, and conducts only after retrace when its cathode swings negative.

The GCS is turned on again slightly before the yoke current reaches zero, so as to provide a smooth transition of current from the damper diode to the GCS.

The high voltage transformer (T9) supplies the CRT voltage of 12 kv through the high voltage rectifier (V2).

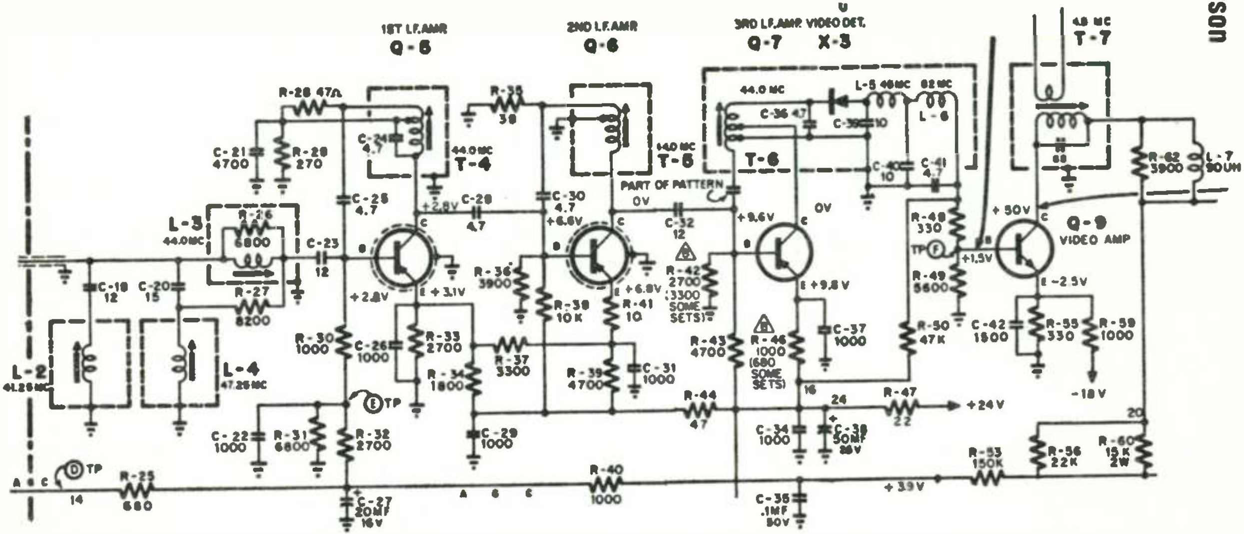
TV Chassis 12077 — Circuit Descriptions and Operations

Video Amplifiers: The video amplifier Q9 is an NPN silicon transistor operating from a collector supply voltage of +160v. This voltage is obtained by rectifying the pulse tapped off the primary of the high voltage transformer. In the absence of a signal from the video detector, the video amplifier is biased to conduction so that its collector voltage is approximately +20v. This bias is applied to the emitter from the voltage division of resistors R55 and R59. The resulting negative base voltage is partially counterbalanced by the flow of current through R50 so that the voltage across the video detector diode remains practically at zero. This biasing arrangement, in the absence of signal, reduces the video amplifier gain and no snow appears on the CRT. If the voltage is too high, the maximum available video drive is reduced.

As the negative going signal is applied to the base of the video amplifier, the sync tips drive the video amplifier toward cutoff and appear at the collector as a positive going signal, which is then applied to the cathode of the CRT through C44.

The collector of the video amplifier supplies 4.5 Mc to the audio IF amplifier through transformer T7. This transformer also acts as a trap to reduce the amount of 4.5 Mc beat interference visible in the picture. The video amplifier also supplies a sync positive signal to the AGC amplifier and the sync separator.

4.5 Mc Sound IF: The 4.5 Mc audio is amplified and



Video IF strip of Emerson transistorized TV.

limited by two stages, with the limiting done principally by the second stage.

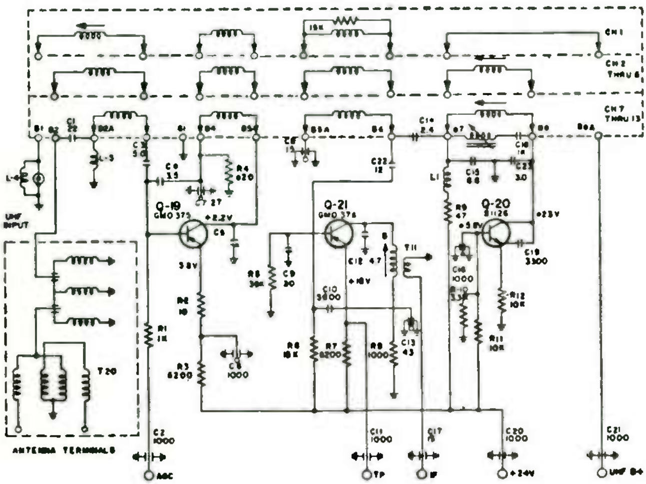
The FM audio detector is of the conventional discriminator type and except for the impedance of the circuit, it looks very much like the types used in tube receivers.

Audio: This receiver utilizes a class "A" audio system consisting of a driver and an output stage capable of delivering 500 mw of undistorted output. The input stage operates between B− and chassis ground. The collector of this stage is directly coupled to the base of the output transistor which operates between B− and B+ with B− applied to the emitter through R21 and B+ applied to the collector through the primary of the output transformer. B+, in this circuit, is +24v and B− is −32v. This difference of potential of approximately 50v is across the collector-emitter junction, with the collector positively biased with respect to the emitter. This arrangement improves the efficiency of the audio system and keeps the total current drain down to a minimum.

AGC Amplifier: The sync positive signal from the collector of the video amplifier is divided down towards the −18-v bus, by the combined resistance of R56, R57A and R58, resulting in a voltage only slightly higher than chassis potential. The signal is then taken off the variable arm of R57A and applied to the base of the AGC amplifier. The emitter of this NPN transistor is connected to a secondary winding of the high voltage transformer, at which point there exists a 7-v negative pulse. This pulse is attenuated by R54 before application to the emitter of the AGC amplifier. With relatively low levels of sync positive (low antenna signal) applied to the base, this transistor will be cut off. In this off state resistors R53, R40, R32 and R31 divide the +150 v to +5 v for the tuner AGC and +3 v for IF AGC, resulting in maximum gain for these sections. If a stronger signal is received, resulting in higher levels of sync positive at the base of the AGC amplifier, the transistor will turn on, but only if these positive sync tips coincide with the negative horizontal pulse at the emitter. With the transistor conducting, the 150 v will be divided down to a lower level than previously, resulting in lesser voltages for both tuner and IF AGC. These lower AGC voltages will decrease the gain of both the tuner and the first two IF stages. R57A controls the amplitude of the positive sync tips applied to the base of the AGC amplifier and is adjusted for maximum video drive without overload. Buzz is usually the first sign of overload.

TV Chassis 120771—Tuner and Video IF Circuit Description

Tuner: The VHF tuner uses two germanium (RF and Mixer) and one silicon (oscillator) transistor. The UHF tuner utilizes a silicon diode (mixer) and a silicon transistor (oscillator). Tuning shafts are concentric with the inner shaft as the VHF selector and the UHF and VHF fine tuning as well as the UHF coarse tuning. The outermost shaft is for the UHF dial. The UHF is switched-on in the channel "1" position, in which case the VHF tuner acts as the first stage of IF amplification. The oscillators of both the VHF and UHF tuners are carefully designed to minimize drift. Tuner B+ is 22 v and normal AGC is +5 v with stronger signals resulting in lesser AGC voltages. This decreased voltage is applied to the base of the VHF RF amplifier (Q-19) and results in an increase of collector current, thereby reducing both



Schematic of VHF tuner used in Emerson TV Chassis 120771.

collector voltage and gain as the transistor approaches saturation. A LOCAL/DISTANCE switch (SW2) at the antenna input to the tuner places a 330 Ω resistor in series with each side of the 300 Ω balanced line, when switched to the LOCAL position.

Video IF: The video IF section consists of three synchronously tuned (44 Mc) transistor stages and one diode detector. The first two stages are gain controlled by the AGC amplifier. Normal AGC is 3 v which decreases as signal increases, resulting in forward gain control for the first stage. This action is similar to that in the VHF RF stage, ie: the resultant increased collector current reduces both the collector voltage and the gain of the stage. This stage is initially biased by the emitter bleeder resistors R32 and R31.

The second video IF stage is gain controlled by reverse AGC applied by the first stage. As the collector current in the 1st stage increases, the voltage developed across emitter resistor R33 is applied to the emitter of the 2nd stage through R37. This acts to decrease collector current resulting in the reduction of gain. There is no AGC applied to the 3rd IF stage.

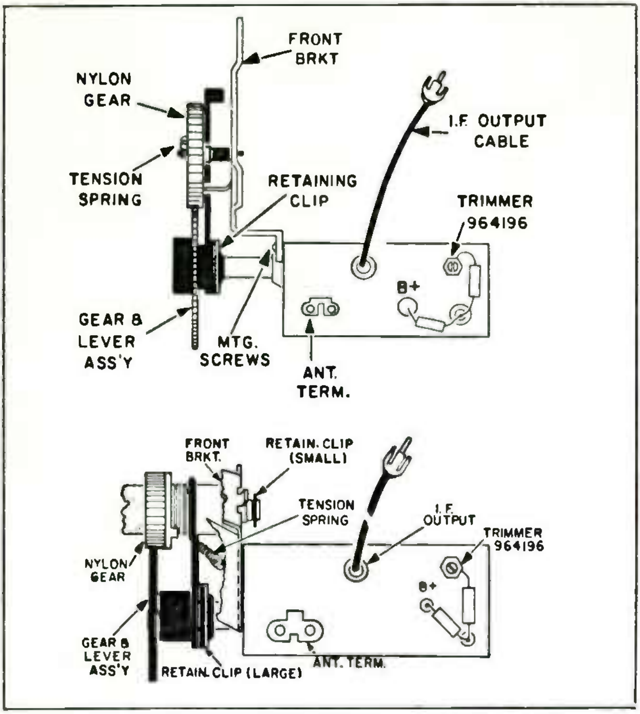
The reason for using forward AGC in the 1st stage and reverse AGC in the 2nd stage is to achieve greater bandpass stability with changes in AGC voltage. The 3rd IF stage is not gain controlled and is biased by the bleeder resistors R43 and R42.

Each of the video IF stages is tuned by a single resonant circuit in the collector of each of the three transistors. The tuned coils are tapped to permit the application of neutralization. T4, T5 and T6 are all tuned to the center of the IF band (44 Mc). The tuner output coil (T11) and L3 form an overcoupled system and together with the traps (L2 and L4 shape the IF curve). L2 and L4 supply the proper amount of attenuation at the 41.25 and 47.25 Mc sound carrier frequencies.

The video detector produces a sync negative signal which is directly coupled to the base of the video amplifier.

TV Chassis 120744G/753J—UHF Tuner Field Alignment

UHF Tuner alignment is factory pre-set and should not require any additional adjustments. Should



it become necessary to change the oscillator transistor try several, choosing the one which most closely resembles the original with regard to sensitivity and calibration.

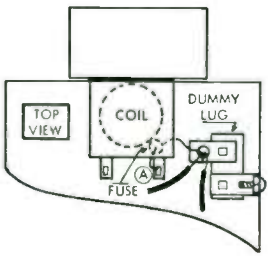
UHF tuner 471532 is supplied with gear and lever assembly, nylon gear and front bracket. UHF tuner 471541 is supplied with gear and lever assembly, tuning shaft assembly and front bracket. Therefore, if returning one of these units for service or replacement, it should be shipped complete with IF output cable and all of the aforementioned items. Only the antenna lead-in wire should be removed.

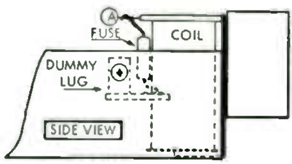
Remote Control Receiver Chassis 471917—Addition of Thermal Fuse

The Model 19P86 receiver uses remote control receiver chassis 471917, which hereafter will include the addition of a thermal fuse—Emerson Part No. 808028. The purpose of this fuse is to provide protection for the stepping relay. It is wired in series with the relay coil and is dressed snugly against the coil body so as to react to any extreme temperature rise of the coil.

Whenever servicing a Model 19P86 receiver, it is recommended that this simple modification be made in the remote receiver. Fix-kit Part No. 966529, consisting of the fuse, a 1-pt. dummy lug, nut and screw, is available from the factory at no charge.

The sketches show top and side views of the relay end of the remote chassis. Install the dummy lug as shown. Remove the two wires from Terminal A of the relay coil and

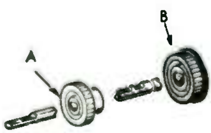


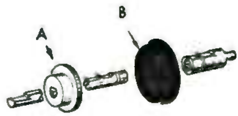


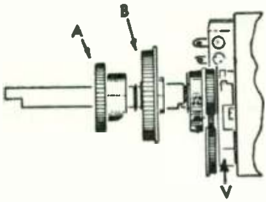
connect them to the dummy lug. Then connect the fuse from the dummy lug to Terminal A. Dress the fuse against the body of the coil to provide maximum sensitivity to coil temperature.

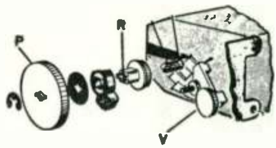
Tuner Gear Identification

Certain tuner gears are incorrectly identified on some service notes. Please use this as your guide when ordering









the gears shown. Several configurations are illustrated.

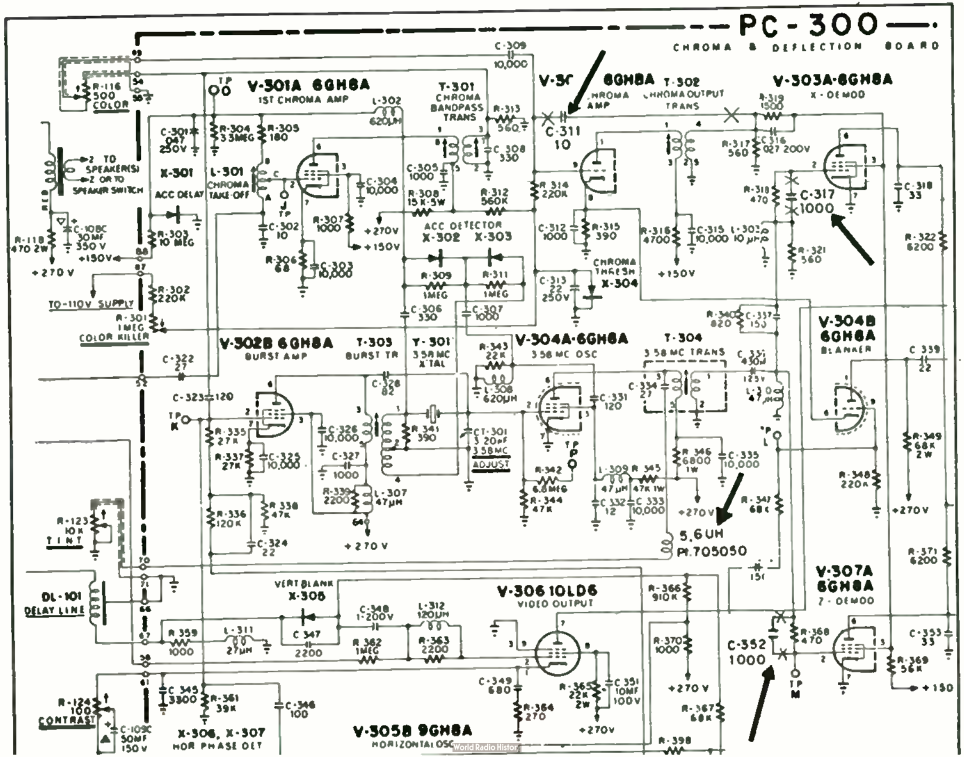
A—Drive Gear	965862	P—FT Gear (Solid)	964699
B—FT Gear	965927	R—FT Intermediate Gear	964700
		V—FT Assembly	964704

EMERSON
Color TV

Color TV Chassis--Channel Four Interference

It is possible for a harmonic of the 3.58MHz oscillator to radiate and be picked up by the tuner, resulting in picture interference on channel four. In the majority of cases of this type, the antenna system from which the set is operated from a properly balanced 300 Ω antenna system, the interference disappears. An antenna pad will improve the balanced input to the receiver's antenna systems. It again should be realized that there will be approximately a 6db loss of signal and as a result the pad cannot be used effectively in weak signal areas. In a few cases involving the color chassis with series filaments, the removal of the components C317, C352 and C311 shown in the partial schematic will effectively reduce picture interference on channel four which stems from a harmonic radiation of the 3.58MHz oscillator circuit. In some cases, disconnecting the ground lead between the shielded 300 Ω input antenna lead and the tuner is effective.

If interference is still present, disconnect the center conductor of the shielded lead from the tint control, at the bottom of the chroma board. Connect choke coil (5.6μh), part number 705050 in series with this lead connecting the tint control at the chroma board end.


PC-300
CHROMA & DEFLECTION BOARD
V-301A 6GH8A
1ST CHROMA AMP
T-301
CHROMA BANDPASS TRANS
6GH8A
CHROMA AMP
T-302
CHROMA OUTPUT TRANS
V-303A 6GH8A
X-DEMOD
R-116 500 COLOR
2 TO SPEAKER(S)
2 OR TO SPEAKER SWITCH
X-301 ACC DELAY
L-301 CHROMA TAKE-OFF
ACC DETECTOR
X-302 X-303
C-311 10
C-317 1000
CHROMA THRESH X-304
TO 110V SUPPLY
R-301 1MEG COLOR KILLER
V-302B 6GH8A
BURST AMP
T-303 BURST TR
Y-301 3.58 MC X'TAL
V-304A 6GH8A
3.58 MC OSC
T-304 3.58 MC TRANS
V-304B 6GH8A
BLANKER
CT-301 3-20PF 3.58MC ADJUST
5.6UH
Pt.705050
R-123 10K TINT
DL-101 DELAY LINE
VERT BLANK X-305
V-306 10LD6
VIDEO OUTPUT
V-307A 6GH8A
Z-DEMOD
C-352 1000
R-124 100 CONTRAST
X-306, X-307
HOR PHASE DET
V-305B 9GH8A
HORIZONTAL OSC
+270 V
+150 V

GAMBLE-SKOGMO
B&W TV

TV Chassis TV2-9542A—Centering 23 in. Receivers

Receivers using the 92 deg tubes are more subject to pin cushion and linearity problems when not properly centered than are the 90 deg type sets. Should you experience any difficulty with either of these problems, a careful check of centering should be made. Exact centering and adjustment of the height and linearity controls will result in an improved picture in nearly all cases.

TV Chassis TV2-9542A—Poor Vertical Linearity

If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause: 1) Check variable resistors R310, 315 and 316. 2) Vertical output transformer defective 3) V7B or V8 defective, check voltages. 4) Excessive leakage or incorrect value of capacitors C306C, 307, 308, 309, 310 or open or incorrect value of resistors R312, 313, 314 or 318. 5) Low plate voltages. Check power supply. 6) Vertical deflection coils defective.

GENERAL ELECTRIC B&W TV

All Sets—Shorted Yokes

Although some chassis must be removed and taken to the service shop, most technicians prefer to repair a TV set in the customers home whenever possible. One service technique which works well without removing the chassis is determining whether the horizontal windings of the deflection yoke are defective.

Quite often a TV set will be encountered which has little or no high voltage. Through routine checks it is discovered that the set has no B+ boost voltage. Through experience you know that this can be caused by a shorted horizontal winding in the deflection yoke. Now if you could only determine in the customer's home that the yoke is the culprit, you wouldn't have to pull the chassis.

There *is* a way to tell if the yoke is defective. Remove the yoke from the neck of the CRT and with it still electrically connected to the set, lay it down beside the chassis where it will not accidentally short against the chassis or component. Plug the power cord into the chassis and let it warm up for two or three minutes. Now remove the power plug and feel around on the inside of the yoke windings. If a definnite hot spot is found, the yoke has internal shorted turns and needs to be replaced.

CAUTION! Never touch the yoke or any high voltage component with power applied to the chassis.

Now you may wish to go one step further to definitely prove that the yoke is defective. Disconnect one of the wires going to the horizontal yoke windings to remove these windings from the circuit. Measure the B+ boost voltage and you will find that it has returned to normal or possibly higher since the deflection yoke has been removed from the circuit and normally is a load on the high voltage transformer.

This is just another simple method of performing service in the customer's home with the least inconvenience to the customer and a minimum of work for you.

All TV Sets — Deflection Yoke Tests

When you are faced with a service problem which appears to be caused by a yoke failure, check the yoke before condemning it. A little extra checking will frequently save you the time and expense of replacement. The most obvious test is to check for correct winding resistance. Usually, individual resistances will be shown in the service notes. Any wide deviation from the published values should be investigated, although shorted turns can rarely be determined in this manner. Of course, the most common type of yoke failure is found in the horizontal portion. The symptoms may be loss of brightness, horizontal keystoning, or complete loss of high voltage. In yokes using series connected coils, an open circuit may occur because of wire breakage at any of the terminal lugs. This is easily determined by a resistance check or visual inspection. If the lead is broken short, it should be spliced before attempting to resolder to the lug. You should also check for internal shorts between horizontal and vertical windings, although in some cases the breakdown occurs only under high pulse voltages. Failure of the small capacitor located across one section of the horizontal winding is frequently mistaken for a shorted winding, since it also causes loss of brightness and keystoning. In some cases the capacitor will also exhibit a burned spot. Be sure to replace only with the exact part specified in the service manual. These capacitors are critical in value, usually having about a 2KV rating and an N2200 temperature coefficient. Parallel connected windings may become broken at the lugs, thus opening one or both coils. Again, a resistance check will determine this problem and the repair is simple. Vertical windings rarely cause problems. When a vertical problem does exist, the windings should be checked for resistance and damage at the lugs. In saddle wound yokes, resistors of about 1000Ω are located across the coils preventing an open coil from showing as a complete open circuit.

When you are handling or repairing any yoke you should always observe the following precautions:

1. Do not change the dress of windings or permit any leads to cross over others.

2. Handle yokes with care to prevent movement or misplacement of turns when passing over the tube base and neck.

3. Be sure that leads to the yoke are kept away from tubes, hot resistors, or any points likely to induce corona from the yoke leads.

ET86X229 Transistorized Tuner

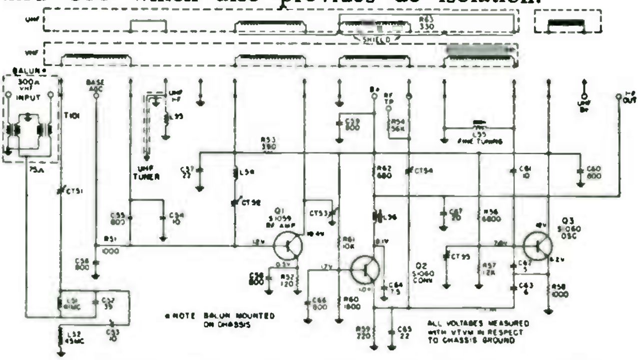
The G-E Transistorized VHF Tuner ET86X229 uses three silicon NPN transistors, one S1059 as RF amplifier and two S1060's as mixer and oscillator.

Thirteen channel strips contain the RF, interstage and oscillator coils for each of the 12 VHF channels and one for the UHF40-50 Mc IF channel. These strips are mounted in a turret type configuration and continuity of circuitry is maintained by the strips contacting nickel alloy stator blades. The stator blades are returned to the appropriate points on an etched circuit board. All other components with the exception of the fine tuning coil are mounted on this etched board which is rigidly held in place by the tuner body. A removable shield which clips to the tuner body completes the shielding of the unit and provides access to the turret and circuit board.

Input impedance is 75Ω connected through a balun to the antenna. The power supply input is + 12 at about 15 ma maximum.

The RF signal from the antenna is fed directly to the highpass filter consisting of L51, C52, L52, and C53. L51 and L52 are mutually coupled and tuned to 41 Mc and 45 Mc, respectively. This filter provides attenuation of frequencies in the IF band.

The (ch 2-13) RF coil is tuned by trimmer CT51 and the resonant circuit completed by C54 and Q1 base. The RF signal is coupled to the base of Q1 thru C55 which also provides dc isolation.



An AGC voltage of positive polarity is supplied to the base of Q1 through the isolation resistor R51 and filtered by C56. R53 is the collector load resistor.

Stabilization of Q1 is maintained by the bias derived from the voltage drop across R52. C58 provides the RF by-pass. Neutralization of Q1 is accomplished by feeding back the signal present at the junction of C57 and R53 to the base through L54 and trimmer CT52.

The primary of the interstage coil (ch 2-13) in the collector circuit of Q1 is tuned by trimmer CT53 and inductively coupled to the secondary coil (ch 2-13) in the emitter circuit of the mixer transistor, Q2.

The secondary coil is tuned by trimmer CT54 and fed to the emitter of Q2. Stabilization of Q2 is maintained by the bias developed across R59. C65 provides the RF by-pass and is also a portion of the capacitor divider required for the oscillator injection voltage. R60 and R61 constitute a voltage divider to provide base bias to Q2 with C66 as the RF by-pass at this point. R62 is the collector load resistor and C59 the RF by-pass capacitor. L56 and C64 in the collector circuit of Q2 and C67 constitute the resonant circuit to provide the 40-50 Mc IF output.

Transistor Q3 is used in a modified colpitts circuit to provide oscillator injection voltage to the mixer stage. The oscillator tank coil (ch 2-13) is tuned by trimmer CT55 and shunted by L55 which contains an adjustable core to provide fine tuning. Each of the 12 VHF channels can be coarse-tuned by the brass screws mounted on the individual coil strips.

The tank coil is shunted by C61, C62, C63, and C65. The base of Q3 is connected to the junction of C61 and C62. The emitter is connected to the junction of C62 and C63 and returned to ground through the stabilizer resistor R58. The AC return for the collector is provided by C60, C65, and C63.

The oscillator injection voltage is fed to the mixer from the junction of the capacitor divider C63 and C65. Q3 base bias is supplied from the junction point of divider R56 and R57.

The channel one or UHF strip, when switched to its operating position, converts the RF and mixer transistors to a two stage 40-50 Mc amplifier. The output (40-50) Mc) of a separately mounted UHF tuner is applied across L53 and coupled to Q1 base through C55. L53 provides the dc return path for the UHF tuner.

The two coils on the UHF strip are mutually coupled and tuned to provide maximum bandpass from 41.25 Mc to 45.75 Mc. The circuit of Q3 becomes non-oscillatory because of the damping resistor R63. A shorting bar which is mounted on the turret provides the switching mechanism for supplying B+ to the UHF tuner. The grounded shield mounted on the channel one strip prevents interaction between the low channels and channels 12 and 13.

TV Chassis AA—Horizontal Weave or Hum

Some AA receivers have exhibited a horizontal weaving, hum or streaking in the picture. These symptoms may result from a poor 6GE5 pin 12 filament ground at the circuit board mounting screw. The filament return circuit for the 6GE5 depends entirely on this board mounting screw being tight. Even a tight ground screw may at times develop a poor connection and result in voltage drop.

It is suggested that an additional wire be added between lug 12 of the 6GE5 socket and lug 12 of the 6B10 socket. This may be done from the copper side of the board. An alternate method is to run a wire from lug 12 of the 6GE5 socket to the filament ground at the transformer. Be sure and tighten all of the sweep and power supply board mounting screws, as an additional precaution.

TV Chassis AA and AB—Horizontal Hold

The horizontal pull-in range of the AB chassis is normally 3 to 5 bars from either side. On some receivers this range may be less, due to accumulated tolerances of components. This may create a problem of frequent hold control re-adjustment in critical reception areas. Basically proper pull-in range is dependent upon proper adjustment of the horizontal frequency circuit and proper balance of the phase detector. The horizontal frequency adjustment should be performed according to the service manual. If the receiver has insufficient pull-in range after completing the frequency adjustment, the following is recommended.

Change capacitor C252 from 47 to 68pf to correct the balance of the phase detector. This capacitor is available from the top of the chassis and it will usually be more convenient to add an extra capacitor of from 18-24pf across the existing C252.

If a soldering iron and extra capacitor are not available, the following, slightly less effective cure (which will probably prove adequate in the majority of cases), may be used. As an additional step to the routine set-up of horizontal frequency, short the clipper grid to ground and adjust the horizontal hold R257 until the picture floats across the screen. Remove the short and check performance.

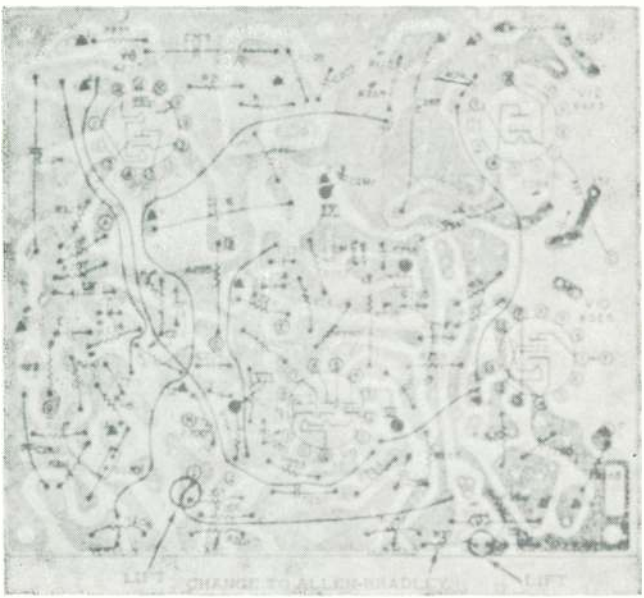
This information is not only applicable to the AA and AB chassis but may be used in troubleshooting the horizontal circuits of other chassis employing this type of phase detector and multivibrator horizontal oscillator.

TV Chassis — AA, AY — Open CRT Filaments

A percentage of the 23DYP4 or 23FVP4 picture tubes which fail in the above chassis have been found to have open filaments. Investigation has shown the following cause. As in the case with any type of electrostatic focus tube, occasional arcing occurs, mainly during the early life or breakin period. This arcing is normally discharged across the spark gap from G2 to ground and no harm results. On the sweep board, there are a couple of locations in the copper pattern where the islands connected to G1 and G2 are spaced close to a B+ island. If a slight misregistration of the copper pattern occurs, the reduced spacing may allow an arc over to occur simultaneously with a discharge across the spark gap. If this

should occur a heavy B+ current flows into G1 or G2 and follows the HV arc to the filament causing burnout. This type of failure may be prevented by increasing the spacing of critical conductor points according to the following instructions. We suggest you make these changes whenever an "open filament" picture tube failure has occurred in an AA or AY Chassis, to prevent a repetition of the failure. Chassis passing through your shop for other service should also be inspected for this condition. AA receivers built after Chassis Date Code 504 have the circuit corrections incorporated.

AA Chassis — (See Illustration) (Both early and late production boards)



1. The junction of R216 and the yellow wire to terminal 5 of the yoke should be lifted from the copper island and reconnected in open space.

2. Increase the clearance between the following two copper islands.

   a. Junction of spark gap and lead to pin 3 of CRT.
   b. Junction C213 and lead to R268.

3. Increase clearance between these two islands:
   a. B+ end of R266.
   b. Junction R268 and C272.

4. Change R272, 330K to an Allen-Bradley. The Allen-Bradley will have a smooth body surface.

AY Chassis — (See illustration)

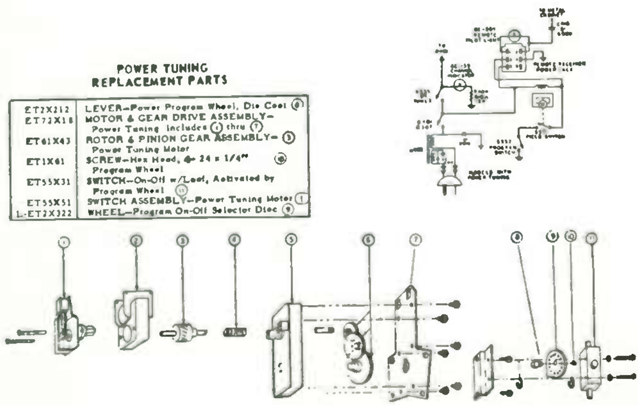
1. Lift the junction of R203 and B+ lead from the island and reconnect. This clears the island of all connections.

2. Lift R272 and lead connecting to R268 above island and reconnect. This clears island of all connections.

3. Change R272, 47OK to Allen-Bradley. The Allen-Bradley has a smooth body surface.

TV Chassis DA—RW365 Power Tuning Function

The power tuning motor and drive mechanism is mounted on the rear of the VHF tuner and when activated by the remote receiver, drives the shaft of the VHF tuner. Also mounted to the rear of the tuner is a microswitch (S555) for the TV receiver ON/OFF function. The microswitch is in series with the main receiver switch and is activated by a cam fastened to the tune



POWER TUNING
REPLACEMENT PARTS

ET2X212	LEVER—Power Program Wheel, Die Cast (8)
ET72X18	MOTOR & GEAR DRIVE ASSEMBLY—Power Tuning Includes (1) thru (7)
ET61X43	ROTOR & PINION GEAR ASSEMBLY—Power Tuning Motor (3)
ET1X61	SCREW—Hex Head, 4-24 x 1/4" Program Wheel (10)
ET55X31	SWITCH—On-Off w/Leaf, Activated by Program Wheel (11)
ET55X51	SWITCH ASSEMBLY—Power Tuning Motor (1)
L-ET2X322	WHEEL—Program On-Off Selector Disc (9)

Exploded view and schematic of drive and control mechanism for G-E power tuning DA Chassis.

selector shaft. A program switch (S552) is mounted at the front of the VHF tuner. This switch is activated by the fine tuning slugs. To program a channel IN, merely select the channel, then properly fine tune. To program a channel OUT, turn the fine tuning counterclockwise several tunes.

The ON/OFF program wheel and micro-switch (S-555) assembly allows one channel position to be selected as the automatic ON/OFF position for the main chassis. The program wheel is a flat metal cam with a hole in the center for the tuner shaft and has 13 small holes in a circle around the center hole (9 in exploded view). A channel number is located adjacent to each small hole and a 3/16 in. hex head screw is assembled through a selected channel hole in the cam and is then mated with the threaded hole in a lever mounted directly behind the cam. To change position of the OFF/ON program wheel, remove the 3/16 in. hex head screw, and rotate the wheel until the hole with the desired channel number aligns with the threaded hole in the lever, then replace the screw.

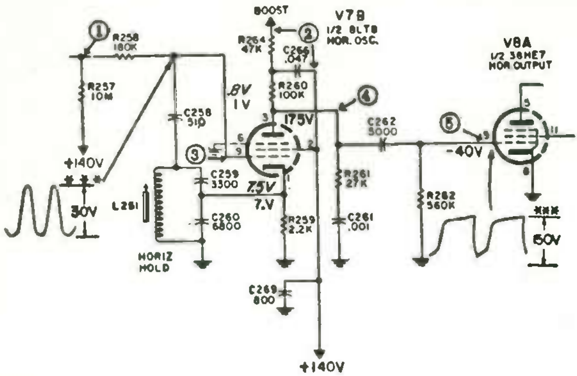
TV Chassis DB—Horizontal Oscillator Troubleshooting Procedures

The following procedure may be used by service technicians to check the sine-wave horizontal oscillator of the DB chassis while troubleshooting the horizontal-high voltage system. It may also be applied to other G-E chassis incorporating the same type horizontal circuitry.

The partial schematic shows the oscillator circuitry with numbers identifying areas referred to in the step-by-step procedure. In actual troubleshooting, the DB (or other chassis) main-chassis schematic should be used, and common-sense troubleshooting practices followed; for example, in the event of a failure in the horizontal or high-voltage area, a preliminary visual inspection and a check of circuit voltages may furnish immediate clues to the trouble source.

1. Connect a jumper between chassis ground and the junction of R257 R258. If high voltage becomes operative as shown by the raster, it can be assumed that the diffi-

culty is in the phase detector or another stage on that side of the oscillator. In this case, normal troubleshooting prac-



tices should be applied beginning with the phase detector output and working back.

2. If the oscillator remains suspect after Step 1, check dc voltages at the 8LT8 screen (pin 2) and the boost end of R264. Potential at both points should be approximately 140v without boost. If voltages are in this range, proceed to step 3. (No voltage at the end of R264 indicates failure in the damper or flyback circuitry.)

3. Using a scope, check at the control grid (pin 9) for a horizontal-frequency sine-wave indicating that the oscillator is functioning. If the waveform does not appear, or appears at considerably smaller amplitude than indicated on the schematic, troubleshoot the oscillator stage for possible tube or component failure. If the waveform appears normal, proceed to Step 4.

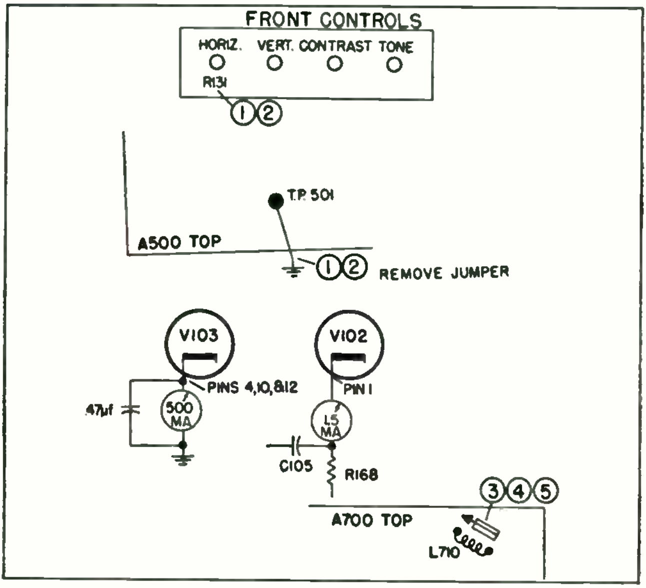
4. Connect the scope to the 8LT8 plate (pin 3). If the scope does not show a trapezoidal waveform of approximately 100v amplitude, check for a short or open in the plate circuitry. Otherwise, go on to Step 5.

5. Connect the scope to the driver control grid (pin 9 of the 38HE7). The display and voltage reading should conform to that obtained at the plate of the 8LT8 in Step. 4. If not, the coupling capacitor C262 may be at fault.

If the oscillator is operating and properly driving the horizontal output stage, a high-voltage failure indicates trouble — probably a tube or component failure — in the high voltage area itself.

TV FY Chassis—Horizontal Deflection Alignment

Tune the receiver to a signal and synchronize the picture; open jumper (see diagrams) and insert a 0-500 ma meter between tube socket terminals 4,



10, 12 (cathode) of V103 (horizontal output) and ground. Bypass meter with a 0.47 μf capacitor; connect a 0-1.5 ma meter in series with cathode lead of V102 shunt regulator by opening jumper between the cathode of V102 and the junction of C105 and R168; connect a VTVM through a high voltage anode lead with high voltage probe at CRT.

1. Short jumper from TP501 to ground. Adjust horizontal hold control, R131, to center of its range.

2. Adjust L501 slug until picture drifts very

slowly and sides are vertical. Remove TP501 jumper. Check R131 at both ends of its range.

3. Adjust L710 (horizontal efficiency coil) for current of 210 ma. (Current should not exceed 220 ma.)

4. Adjust R105 for 24.5 kv. Check current on milliammeter. Current must not be less than 1.5 ma with minimum brightness. Try to attain as close to 1.5 ma as possible while turning L710 core no more than ½ turn clockwise and checking to see that horizontal output tube current does not exceed 220 ma.

5. If foldover occurs after adjusting R105, readjust L710 (horizontal efficiency coil) clockwise to eliminate the foldover. Be sure that current milliammeter does not exceed 220 ma. Adjust focus, height, and vertical linearity controls for proper focus and vertical size. Don't forget to replace jumpers when milliammeters are removed.

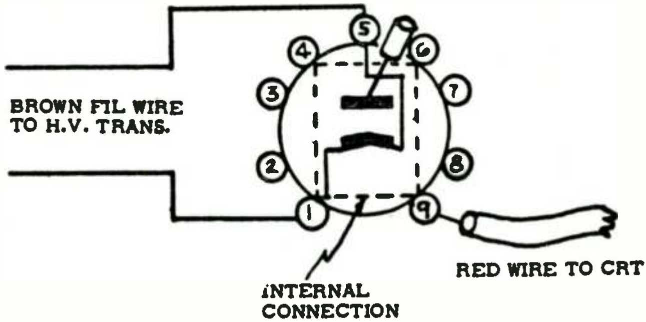
TV Chassis "MW"—Production Changes

To improve circuity, capacitor C170 and C171, in the video amplifier circuit, were deleted in all chassis bearing code 133MW and above. . . . To improve circuitry in chassis bearing code 134MW and above, the value of capacitors C305 and C308 in the 6DT6, audio detector circuits, are changed from 10,000 pf to 5,000 pf. . . . To decrease UHF radiation, the UHF B+ dropping resistor (R2) was changed from 10,000 to 15,000Ω. Although this change was made effective on chassis coded 125 MW and above, if replacement becomes necessary of the previous 10,000Ω units, replace with ET 14X-145, 15,000Ω. . . . To increase the audio output for models M780 and M781 coded 137MW and above, the divider resistor (R316) in the plate circuit of V8 (6DT6) was changed from 10,000Ω to 15,000Ω.

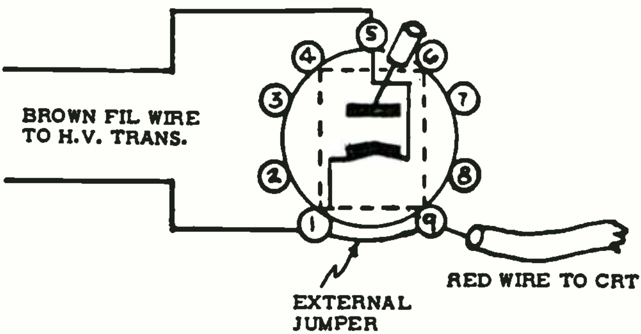
SB Chassis—High Voltage Rectifier Failures

A few cases of 1BC2 rectifier failure are attributable to the socket connections used in early production receivers. The internal construction of the 1BC2 includes

EARLY PRODUCTION



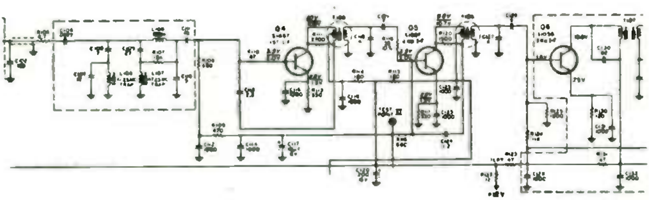
LATE PRODUCTION



a corona shield which is supported by welding to the inner ends of pins 1, 4, 6 and 9. For convenience in assembly, early production sets were connected as shown in Fig. 1. It is apparent that the HV connections must pass through the internal connections in the tube and may not be opened in the event of a weld failure in the tube. Late production receivers are connected as in Fig. 2, which provides a positive HV connection to the tube filament and increases reliability. If you encounter any 1BC2 failures, you should install a jumper between lugs 1 and 9 of the tube socket. If the tube has failed because of an open weld, it may then operate without replacement. This jumper will also eliminate any possibility of subsequent tube failure from this cause.

TV Chassis TA, Video IF Strip—Circuit Description

The tuner IF output signal is coupled to the base of Q4, the 1st video IF amplifier, through L108, C111 and R110. L106, C107 and C108 form a series parallel 41.25 Mc tunable trap. L107, along with C109, forms a series tunable 47.25 Mc adjacent channel sound carrier trap. Any 47.25 Mc signal that might appear across L108 will have a lagging 90 deg shift and it will be cancelled at this point by a similar 47.25 Mc signal which is leading by 90 deg and coupled from the top end of L107 by R107. L108 and C111 along with the input capacity of Q4 form a series resonant circuit which is tuned to 45 Mc.



The signal that was fed into the base of Q4 is amplified by the transistor and appears across the primary winding of T105. Q4 is a silicon NPN transistor. The dc ground path for the emitter of Q4 is through R113 while the ac ground path is furnished by C116. The primary of T105 is tuned to 44.15 Mc and is loaded by R111, a 2700 Ω resistor. The collector voltage is supplied from the +12 v supply through R122, R114 and through the tapped primary winding of T105. The neutralizing capacitor C113 couples a small amount of the output voltage that appears across the primary of T105, back to the base of Q4. The feedback voltage is of the opposite polarity in respect to the voltage at the collector of Q4.

The AGC voltage which is developed in the AGC circuitry controls the gain of the video amplifier by increasing the amount of forward bias voltage applied to the emitter-base junction of Q4 through R108.

The IF signal which is present across the primary winding of T105 is inductively coupled to the secondary of T105 and then through C121 and R118 to the base of Q5, the 2nd video IF amplifier. The signal is amplified by Q5 and appears across the primary winding of T106. The AGC voltage which controls the gain of Q5 is supplied to the base through R116.

The signal that appears across the primary of T106 is inductively coupled to the secondary of T106, then through C128 to the base of Q6, the 3rd video IF amplifier. The signal is amplified by the transistor and appears in the collector circuit across the primary of T107.

Q6, an NPN silicon transistor, has its emitter-base junction forward biased. The proper value of base voltage is developed through the voltage dividing action of R124 and R125. It should be noted that there is no AGC control voltage applied to the base circuit of Q6. The collector voltage is supplied through the series connection of R123, R131 and the primary winding of T107. The necessary ac ground path for any signal that might appear at the junction of R131, R133 and the primary winding of T107 is furnished by C132. The resistor R130 furnishes the dc ground return path for the emitter while C131 supplies the necessary ac ground path. The primary and secondary of T107 are tuned to 45 Mc.

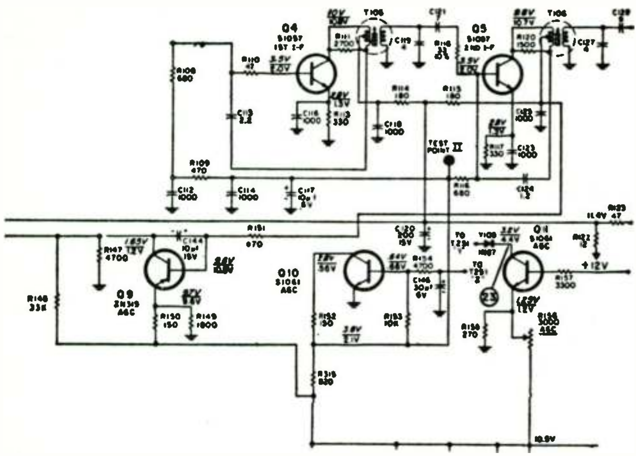
TV Chassis TA, AGC Stages — Circuit Operation

The tuner RF transistor and the 1st and 2nd IF amplifier transistors, Q4 and Q5, are biased to operate such that an increase in emitter current reduces the gain.

Since these three transistors are NPN types, current is increased by making the base voltage more positive and gain is thereby decreased.

Q11 has a pulse from the horizontal output transformer impressed on its collector and a positive-going composite video signal on its base. Q11 will therefore conduct during the sync pulse interval and its conduction will change in relation to the sync pulse level which is proportional to the signal strength.

For an increase in signal, Q11 will conduct heavier causing the voltage across R153 and R154 to increase.



This decreases the voltage on the base of Q10 causing its conduction to decrease. A reduction in the collector current of Q10 raises the positive voltage at the junction of R152 and R315 which is the AGC voltage impressed, through RC filters, on the bases of Q4 and Q5, the 1st and 2nd video IF amplifier transistors. Since this is a rise in the forward bias of those two stages, the gains will decrease.

In addition to reducing the IF gain, the RF gain will also be reduced through the action of Q9.

Q9, a PNP transistor, will conduct heavier when its base becomes less positive, producing a higher positive voltage across R147. The voltage across R147 is set for low signal levels by its divider action with R148. This sets the level of I_E.

As Q5 conduction is increased to lower its gain, the voltage across C125 decreases. Since this voltage is impressed on the base of Q9 through R151, Q9 will increase its conduction, drawing more current through R147 and thereby raising the RF AGC voltage. Since the RF transistor, like those in the IF, is biased to go down in gain with an increase in conduction, the increased AGC voltage on its base will increase conduction and reduce its gain.

TV Chassis TA—Video Detector, 1st and 2nd Video Amplifiers Circuit Operation

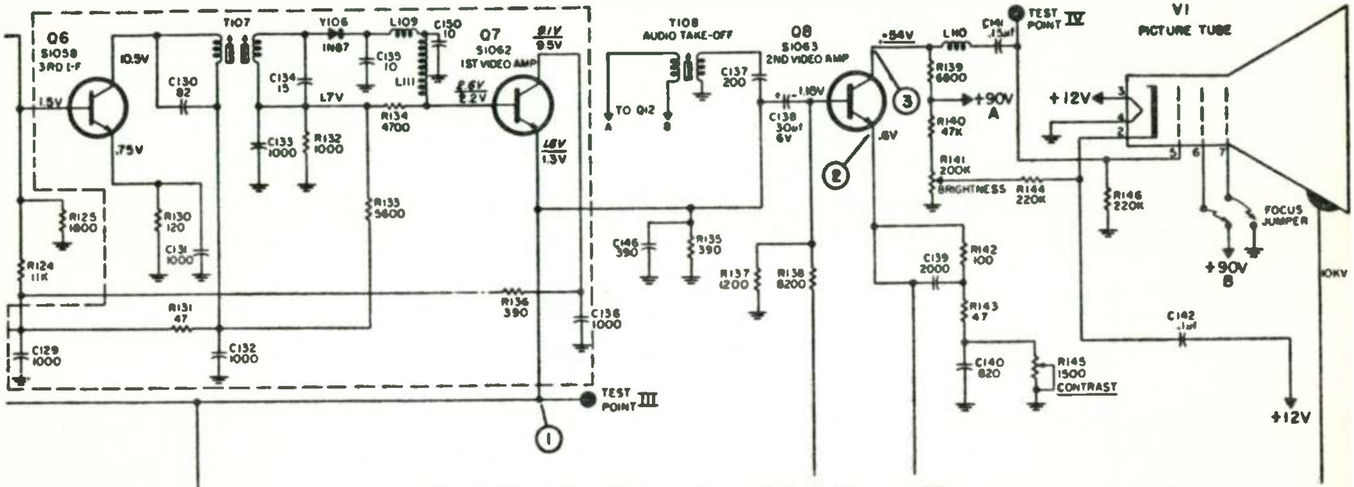
The IF signal which is present across the primary of T107 is inductively coupled to the secondary winding and is detected by the germanium diode Y106. The detected composite signal which contains positive going sync and video information is dc coupled to the base of Q7, the 1st video amplifier, through L109.

The entire detector circuit is above chassis ground by approximately 1 v through the voltage dividing action of R132 and R133 to establish the base bias on Q7. The ac ground return path is supplied by C133 which is in shunt with R132. The diode load resistor is R134 which is in series with L109 across the secondary winding of T107. L109 presents a series impedance to any 45 Mc information that might be present across the diode Y106. C135 provides a low impedance path for this 45 Mc signal to chassis ground while it has little if any effect on the video signal that is present at this point in the circuit.

Q7, the 1st video amplifier, is a silicon NPN transsistor. With its associated circuitry it serves as an emitter-follower. It has a relatively high input impedance while it is capable of supplying a low output impedance to furnish the necessary power at a low impedance source to drive the 2nd video amplifier, clipper and AGC circuits.

Since there is no phase reversal through an emitter-follower, the positive signal at the base of Q7 is also present at the emitter. Also, the dc component of the signal, which was preserved by virtue of the dc coupling between the detector and the base of Q7, is present at the emitter.

The composite signal which is present at the emitter of Q7, the 1st video IF amplifier, contains the 4.5 Mc



G-E Chassis TA, Video detector, 1st and 2nd video amplifiers.

FM sound signal as well as the video and sync information. This signal is coupled to the primary winding of T108, the audio take off transformer, by C137.

The primary winding of T108 is a series 4.5 Mc trap. It presents a low impedance path for the 4.5 Mc FM sound signal. The function of this trap is to remove the 4.5 Mc FM signal from the video information at this point, so that it does not reach the grid of the CRT. The 4.5 Mc FM signal which is across the primary winding of T108 is inductively coupled to the secondary winding to drive the audio circuits which will be discussed later.

A composite video signal from the emitter of Q7 is coupled to the base of Q8, the 2nd video amplifier, by C138. This signal is amplified by the transistor and appears in the collector circuit across R139. The negative vertical blanking pulse, which is supplied through R213 to the emitter of Q8, will also be amplified by the transistor and will appear in its collector circuit across R139.

The collector voltage for Q8 is supplied from the +90 v source through R139. The proper amount of voltage for the base of Q8 is taken from the junction of the voltage divider R137 and R138. C138 serves as a video coupling capacitor and is also a dc blocking capacitor. The series parallel connection of R142, R143, and C139 supplies emitter peaking for the 2nd video amplifier. R142 and R143 along with R145, the contrast control, provide the emitter dc path to ground. The gain of Q8 is controlled by changing the effective emitter-base bias voltage. This is accomplished by adjusting the contrast control R145.

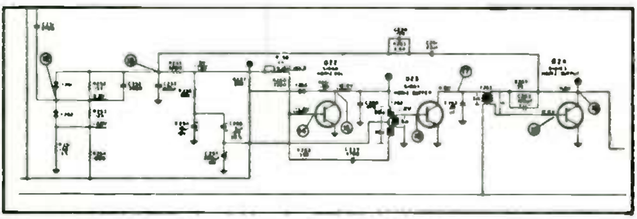
The video signal which is present across the collector load resistor, R139, is coupled to the control grid of the CRT through L110 and C141. Positive horizontal blanking pulses are coupled from the top of the primary winding of T251 through R265 and C142 to the cathode of the CRT.

L110, in the collector circuit of Q8, functions as a series peaking choke while C141 serves as a coupling and dc blocking capacitor. The cathode voltage for the CRT is taken from R141, the brightness control, which is connected in series with the +90 v source to ground. R146 is the ground return for the control grid of the

CRT. Grid number three, the focusing anode, may be connected to either +90 v or ground. The screen grid is connected to the +90 v supply. The 10 kv high voltage for the anode of the CRT is supplied by the high voltage supply.

TV Chassis TA—Horizontal Phase Detector and Horizontal Circuit Operation

The negative sync pulse from the clipper, Q17, is applied through C251 to the common cathode connection of Y251 and Y252. The horizontal reference pulse is coupled from the collector circuit of Q24 to Y251, Y252 and integrated by R263 and C253 to shape the horizontal pulse into a sawtooth waveform. When either the sync pulse or the reference pulse is present, zero voltage will be developed from the phase detector. Also, no correction voltage is developed when the sync pulse and the reference pulse are both present and in phase. The only time any correction voltage is developed is when the sync pulse and the reference pulse are out of phase by some amount. The amplitude and polarity of the correction voltage are determined by the phase difference between the sync pulses and the reference pulses.



The correction voltage from the phase detector is fed through R255, R259 and R260 to the base of Q22 to control its frequency.

The horizontal oscillator circuit uses an NPN silicon transistor, Q22, in a blocking oscillator. When voltage is applied to the circuit, the transistor will conduct and current will flow from the emitter to the collector. The current through the upper primary winding of T252 induces a positive pulse into the auto-transformer-connected lower primary winding. This pulse is coupled to the base of Q22 by C259 and R262. This increases the forward bias on Q22 and it conducts heavily — driving the transistor into saturation. As the collector current increases, so does the emitter current. The emitter-base electron flow charges the base end of C259 negative. This cuts down the amount of forward bias at the emitter-base junction to a value which will cut off Q22. The transistor will remain cut off until the negative charge on C259 has been discharged through R260, R259 and R257 and the base is again forward biased. When this has happened, Q22 will conduct and repeat the cycle.

Y253 and R261 damp the flyback pulse generated in the upper primary winding when Q22 cuts off. C260 minimizes radiation from the flyback pulse.

C257 filters horizontal information from B+. R256, C254 and C256 form the anti-hunt circuit. C256 serves to charge C254 quickly, when power is first applied to the receiver, to immediately stablize the control voltage at the base of Q22. If C256 were not present, C254 would be charged slowly through R257 and R256, resulting in a slow initial horizontal pull-in.

TV Chassis TA, Horizontal Buffer Amplifier, Horizontal Output and High Voltage Circuits — Circuit Operation

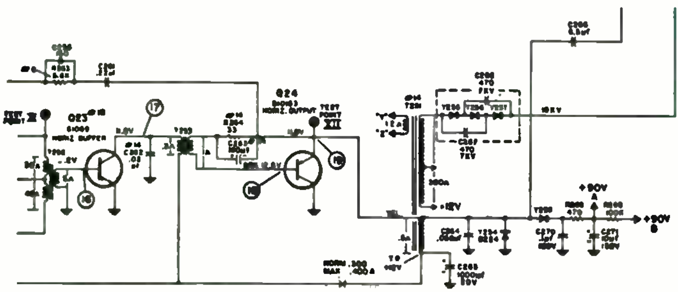
The negative horizontal oscillator signal which is present across the primary windings of T252 is inductively coupled to the secondary. The secondary winding of T252 is phased so that the signal which is fed to the base of Q23, the horizontal buffer amplifier, is a positive-going pulse. The signal is amplified by the transistor and appears in its collector circuit across the primary winding of T253.

Q23 is an NPN silicon transistor. The collector voltage is supplied from the 12 v supply through the primary winding of T253. The presence of C262 from the collector to ground will damp the oscillations that are present across the primary of T253 during flyback time. The effective capacity of C262 across the primary of T253 will lower the frequency and amplitude of these oscillations.

The horizontal output transistor, Q24, is a germanium PNP type which is connected as an emitter-follower. For simplicity, this transistor can be considered to function as a switch. The transistor conducts during trace time and is cut off during retrace time by the positive horizontal pulse which is applied to its base from the secondary of T253.

When power is first applied to the horizontal circuit, C266 will charge to the polarity shown in the main schematic diagram. During the time Q24 is conducting it presents a low impedance current path to chassis ground and C266 will discharge. Since the yoke horizontal windings are in series with C266, current will flow through the yoke when the capacitor is discharging through Q24. This current will rise linearly to produce the sawtooth waveform which is needed to deflect the picture tube electron beam, thus creating horizontal sweep.

The positive horizontal pulse arriving at the base of Q24 cuts off the transistor at the end of trace. The timing of this pulse initiates the horizontal retrace period. While this pulse is present it reverse biases the emitter-base junction of Q24 to the point that it causes the junction to break down, and through zener diode action, reverse current will flow through the junction, charging C263 with



base end negative. This is in such a direction as to help to keep the transistor on during the entire trace period.

When the positive pulse at the base of Q24 cuts the transistor off, the energy which is stored in the magnetic field of the yoke collapses. This action will shock the resonant circuit, which consists of L251A, L251B, C266, C264 and the primary winding of T251; into oscillation at a frequency of approximately 50 kc. The resonant frequency of this circuit dictates the horizontal flyback time which is equal to 10μs. This circuit would continue to oscillate if it were not for the damper diode Y254. The damper diode will conduct during the first negative half-cycle of this oscillation, thus damping the circuit to a point where it cannot oscillate. While the damper diode is conducting, current will flow through the yoke which will charge C266 and start the horizontal trace period again. The diode will furnish most of the current for the first one-half of the trace time; however, some current will flow through Q24 during this time. The entire current will flow through Q24 during the latter one-half of the trace period.

When the magnetic yoke field collapses there is a positive pulse generated across the primary winding of T251 which is caused by the oscillatory action of the resonant circuit. This pulse is inductively coupled to the secondary windings of T251 through its autotransformer action. The positive pulse that appears across the lower end of the secondary winding is rectified by Y259, the high B+ rectifier. The rectified voltage will appear at the junction of R268 and C271 at a potential of 90 v. The combination of C270, R268 and C271 represents a pi filter network to smooth the ripple out of the 90 v supply.

The positive pulse which appears at the top of the secondary winding of T251 is coupled to a voltage doubler circuit consisting of Y255, Y256, Y257, C267 and C268. The output of this circuit is approximately 10KV which supplies the anode voltage for the picture tube.

TV Chassis TA — Sound IF, Ratio Detector and Audio Stages — Circuit Operation

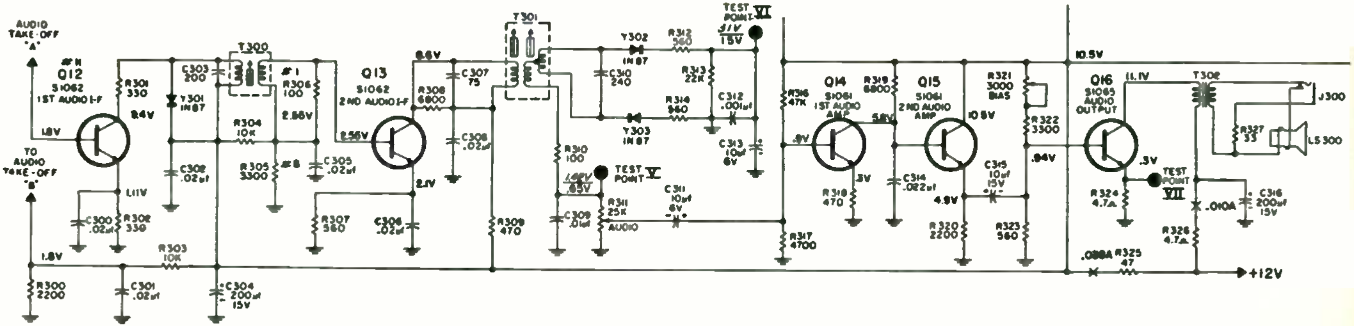
First Sound IF Amplifier: Q12, an NPN silicon transistor, is the first sound 4.5 Mc IF amplifier. The signal from the secondary of T108 is connected to the emitter-base junction which is forward biased by the voltage obtained from the dividing action of R300 and R303. The collector-base junction is reverse biased through the series connection of R301 and the primary winding of T300. The amplified 4.5 Mc FM sound signal appears in the collector circuit of Q12 across the primary winding of T300. This same signal is inductively coupled to the secondary winding of T300 which is connected across the emitter base junction of Q13. The germanium diode Y-301 limits the amount of 4.5 Mc signal that can be developed across the primary of T300. It also tends to suppress any ac variations that might be present in the form of spikes or noise. The purpose of R302 is to stabilize the 4.5 Mc amplifier, thus preventing it from oscillating. C302 filters high-frequency ripple from the B+ line which may be present because of Y301 conduction. C300 is the emitter bypass.

Second Sound IF Amplifier and Ratio Detector: Q13 along with its associated circuitry serves as the second sound IF amplifier. The emitter-base junction is forward biased by the voltage obtained from the dividing action of R304 and R305. The collector-base junction is reverse biased through the series connection of R309 and the primary of T301. The primary of T301 is tuned to 4.5 Mc, the center frequency of the second FM signal. The amplified 4.5 Mc FM sound signal is inductively coupled to the secondary winding of T301.

The ratio detector, Y302 and Y303, is similar to and functions in the same way as the ratio detectors used in previous receivers. Signal from the secondary of T301 is applied to the two germanium diodes Y302, Y303. The detected audio signal is developed across C309 which also provides some de-emphasis of the high frequencies.

First and Second Audio Amplifiers: The audio signal developed across C309 is fed through the volume control R311 and coupling capacitor C311 to the base of Q14, the first audio amplifier. Base bias is developed from the voltage divider R316, R317. The emitter resistor R318 maintains a constant input impedance between the base and ground. If the emitter were grounded, differences in parameters of replacement transistors would change the base-to-ground input impedance.

The collector of Q14 is directly coupled to the base of Q15, the second audio amplifier. This is possible since Q15 is connected in an emitter-follower configuration with a high input impedance at the base which matches the output impedance of Q14. R319 is the common load resistor for Q14 collector and Q15 base. C314, like C309, de-emphasizes the high frequencies. R320 is the emitter resistor. Since Q15 is an emitter-follower, it has a voltage



Audio stages of General Electric TA chassis

gain of less than one. Q15 is a power amplifier supplying power to the audio output stage.

Audio Output Stage: The audio output stage uses a NPN silicon transistor, Q16, as a power amplifier. Its emitter-base junction is forward biased through the voltage dividing action of R323, R322 and the bias potentiometer R321.

It is important that this stage operate as a class A amplifier. It should be noticed that test point VII provides a convenient check point for emitter current. The voltage drop across the 4.7Ω emitter resistor, R324, is measured and current calculated. Without signal, the stage is adjusted for class A operation by rotating the bias potentiometer until +0.3 v can be measured across the resistor. The +0.3 volt across R324 indicates approximately 65 ma of emitter idling current.

The P-P audio current through T302 and Q16 is quite high. Therefore, the RC filter circuit consisting of R326 and C316 is used to prevent these peak audio currents from modulating the +12v supply.

R327 limits the power supplied to the accessory earphone which may be plugged into J300.

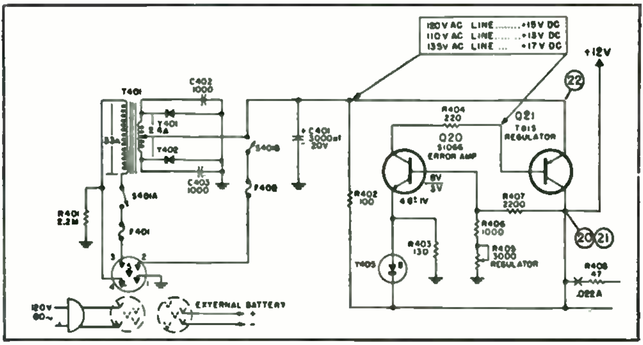
LS 300 is a 2¼ x 4 in. loudspeaker with a voice coil impedance of 8Ω. It is mounted on the left chassis side panel.

TV Chassis TA — Low Voltage Power Supply — Circuit Operation

The low voltage power supply is a transistorized, adjustable, voltage regulated type which uses two transistors, two silicon diodes, and one zener diode. The silicon diodes Y401 and Y402 are connected to form a full wave rectifier circuit, with the output filtered by C401. The dc output voltage is connected to the emitter of Q21, a PNP germanium transistor, which serves as a series voltage regulator.

For simplicity, consider the transistor Q21 to function as a variable resistor. The internal resistance of the transistor can be varied by changing the amount of forward bias voltage that is applied to the emitter-base junction.

Q20 is an NPN silicon transistor which functions as an error amplifier. It will respond to voltage variations which appear at the collector of Q21 and adjusts the base bias on Q21 to keep the output voltage at a constant amplitude. The base voltage for Q20 is supplied from the series voltage divider which consists of R407, R406, and R405, the regulator potentiometer. The cathode of the zener diode, Y403, is connected to the collector of Q21, which is the output of the dc supply. Its anode is connected in series with R403 to chassis ground. The emitter of Q20 is connected at the junction of R403 and Y403. A constant reference voltage equal to 6.3 vdc is developed across Y401 through its zener diode action. The emitter voltage for Q20 will always be equal to the differencc between 6.3 v and the collector voltage of Q21.



Assume for a moment the ac line voltage rises; the output voltage from Y401 and Y402 will rise and the collector voltage of Q21 will also rise. This will cause the base voltage of Q20 to go more positive, but by a smaller amount, in comparison to its emitter rise, effectively decreasing the amount of forward bias applied across its emitter base junction. This is in the direction to lower the emitter-collector current of Q20 which is flowing through the emitter-base junction of Q21. The effect of this current change will decrease the amount of forward bias applied to the emitter-base junction of Q21 and the transistor will not conduct as heavily. The internal resistance of Q21 will rise and the voltage drop across it will be higher. This change in resistance will lower the output voltage to its original 12 v.

R402 assures that the regulator circuit starts to function when power is applied to the receiver by supplying an initial voltage to the base of the error amplifier Q20. Since R402 is connected between the emitter and collector of Q21, its resistance has no effect when Q21 is functioning because the resistance of Q21 is less than 8 ohms while it is conducting.

R405 is the regulator bias control which is adjusted to produce an output of 12 v at the collector of Q21 to power the receiver.

Chassis "MW"—Production Changes

1. To increase picture tube beam current the value of resistor R176 in the picture tube cathode circuit was changed from 180,000 to 150,000 Ω in all 23 in. receivers coded 117MW and above.

2. In chassis bearing code 125MW and above, the high voltage rectifier tube was changed from a 1J3 to a 3A3. This change necessitated the use of an additional two turns of filament winding on the horizontal sweep transformer and an additional series resistor in the filament circuit. The resistor (R268) value is 3.6 Ω, ½ w, wire wound. This change provided controlled warm-up of the high voltage.

3. To reduce picture top bend, a 100 pf, capacitor (C266) was added from Pin 7 of the horizontal output transformer to the junction of R263-R264 in the 6DQ6B grid circuit. The 6DQ6B was mounted on the sweep circuit board. This change was incorporated in 23 in. chassis bearing code 125MW and above and in 19 in. chassis bearing code 127MW and above.

4. In chassis bearing code 128MW and above, the value of resistor R263 was changed from 820,000 Ω to 560,000 Ω. This change was made to avoid over dissipation of the 6DQ6 (V13) grid.

Chassis M579—Production Changes

"W" Code: Separate schematics drawn for 23 in. and 19 in. models. Minor circuit value changes. Refer to "W" Code chassis diagram for 19 in. or 23 in. as required. **"V" Code:** Rectifier Y251A, Y251B changed from dual selenium type (Cat. # R3057) to a single silicon type Cat. # R5931—2 used. This change also requires a change of capacitor C252 from 68 pf (Cat. # R4090). Otherwise refer to "W" Code chassis diagram for 19 or 23 in. as required. **"U" Code:** On 23 in. models only the tuner was changed to a cascode type Cat. # R5963. This change also required deletion of R180 and R181 was changed to 4.7K 4 w. On 19 in models no change was made and "U" code 19 in. chassis are the same as "V" Code 18 in. chassis. **"T" Code:** On 19 in. models the tuner was changed to a cascode type Cat. # R5963. This change also required deletion of R180 and R181 was changed to 4.7K 4 w.

Chassis M579—Production Changes

"Y" Code: A ceramic capacitor C266 100 pf 10% 1000 v N1500 (Cat. # R743) is added between terminal 7 of the Horizontal Output Transformer T251 and the junction of C259/R263 and R264 (grid circuit of V13). **"X" Code:** R402 (in series with the pilot light) is deleted. The pilot light now connects directly to pin 3 of V5.

TV Models M500X QX Chassis — Horizontal Pull or Weave

A few cases have been reported of a horizontal pulling or weaving which is not caused by a defective component or tube.

This complaint concerns the left side of the picture, and is characteristic of 60-cps hum in the horizontal sync circuits. The pulling is in the picture area with the raster edge remaining straight. A scope test on pin 10 of V8A will show a 60-cps hum. Pin 3 of V8B may read as low as 500 K to ground (caused by leakage). This is caused by a leakage path from pin 3 of V8B to the adjacent filament circuit copper pattern. This leakage is caused by a resin build-up, and should be corrected by scraping if necessary, then cleaning with alcohol. Be sure the entire area between the filament copper pattern and the pins of V8 is cleaned of excess resin.

Tuners ETX111, 2, 3, 4, and 5 — Production Changes

In tuners with an odd number in the last digit of their model number have been modified to reduce radiation. C120 was changed from 1.5 pf to 6 pf. Tuners which are already changed are coded with a red dot.

To improve the performance in even numbered tuners, C104 was changed from a trimmer to a 313 ff capacitor. These tuners are also coded with a red dot.

MXT TV Chassis — Production Changes

The MXT receiver uses either of the two divider circuits, depending on the type of VHF tuner used. Tuners ET86X139, ET86X140, ET86X141, ET86X-142, ET86X143, ET86X152 and ET86X153 require the "low B+" dividers R403-R404 and the +135V connection. Tuners ET86X172, ET86X173,, ET86X-176, ET86X179 and ET86X180 use the "high B+" circuitry and have no +135 v connection.

The blocking capacitor C177 was added to the receiver IF board in chassis bearing code stamp 228MXT and higher code numbers. Prior to this change the blocking capacitor was part of the tuner circuit.

In some receivers with chassis code stamps 233MXT and lower code numbers, a capacitor (C174) was connected between the AGC keyer plate and ground and a choke (L257) appeared in the B+ line feeding C265, L256 and R266.

R270 was added to the receiver circuitry beginning with the 233MXT code stamp. At about the same time, R187 and C178 were added to the V5A cathode circuit; and trap L155 and its parallel-connected capacitor, C157 were deleted from the T151 assembly.

R258 was 62K ohms, 5%, carbon, prior to chassis code MXT249.

A 6GE5 compactron was used instead of the 6DQ6 horizontal output tube in some receivers coded MXT251 through MXT302.

Beginning with chassis code MXT302, the 6BE3 damper tube was replaced by a 6AX3 type; R251 changed from 680K to 560K ohms, R261 from 43K to 47K ohms, R262 from 33K to 27K ohms, and the horizontal stabilizer coil, L251, was changed from ET36X436 to ET36X650.

The integrator network RC217 was replaced by individual components beginning with chassis code MXT304. Resistors R225 and R226, respectively, replaced R217A and R217B; capacitors C205, C209 and C210, respectively, replaced C217A, C217B and C217C.

TV Chassis QX Models M500X—Horizontal Pulling

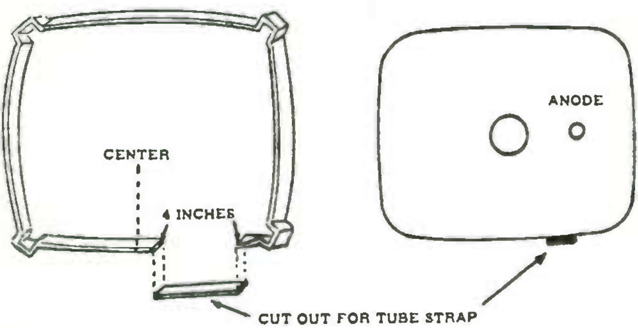
This may not be caused by a defective tube or component. The left side of the picture is affected and is characteristic of 60 cps hum in the horizontal sync circuits. The raster edge remains straight. Make a test with the scope on Pin 10 of V8A. If 60 cps hum is observed, check pin 3 of V8B with a VTVM to ground. A reading of 500K indicates leakage. This symptom is caused by a leakage path from pin 3 of V8B to the adjacent filament circuit copper pattern. This leakage is caused by a resin build-up, and should be corrected by scraping if necessary, then cleaning with alcohol. Be sure the entire area between the filament copper pattern and the pins of V8 is cleaned of excess resin.

QX Chassis — Flashing Picture Correction

If you should encounter a problem of picture flashing in any QX Chassis model, it is probably due to poor contact between the aluminum foil strip, located on the left side of the cabinet back, and some of the grounding clips which press against it. In servicing, care should be taken to be sure that all three clips press firmly against the foil when the cabinet back is installed.

TV Chassis QX, QY and Early EA — CRT Replacement

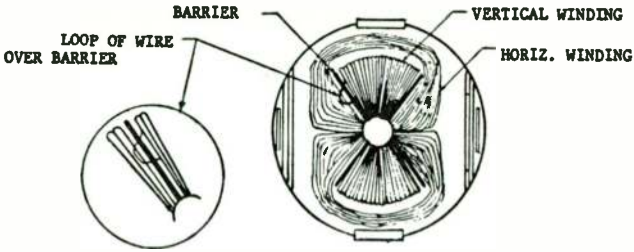
The following 16 in. CRTs, with bonded plastic implosion plates, will not be manufactured when current stocks are exhausted: 16ATP4 A11 QX, 16AZP4 A11 QY, 16BUP4 Early EA models M501A, M505A. Replace these tubes with type 16BYP4. This tube is equipped with tension band implosion protection. This tube requires a minor alteration to the plastic cabinet. To alter the cabinet, remove approximately 4 in. of the plastic rib which sur-



rounds the picture tube. This allows the clamp on the tension band to fit properly into the cabinet. The illustration shows the area to be cut out and the dimension. The plastic can be easily snipped out with side cutters.

TV Chassis SB—Yoke Failure

Evaluation of several yokes returned from the field indicate that most SB yoke failures occur because of a turn of the vertical winding looped over the barrier and touching a horizontal winding. This may show up as a loss of high voltage or a trapezoidal raster. A visual



inspection of the inside of the yoke may reveal a loop of wire from a vertical winding looped over the barrier and touching the horizontal winding. Redressing the wire to the correct side of the barrier will restore normal operation. Any SB yokes which appear to be defective, should be inspected and redressed rather than replaced.

SB—SC Chassis—Sound Distortion

Buzz in sound, distortion, or a narrow sound fine tuning range can be caused by a poor crimp on the seams of the shield cans surrounding L-302 quadrature coil or L-301 interstage coil. The poor crimp can cause detuning of the stage involved and may vary with heat, age and the looseness of the crimp.

It is recommended that prior to sound alignment and in all cases of sound problems outlined above, a bead of solder should be run up the seam of the quadrature and interstage shield cans.

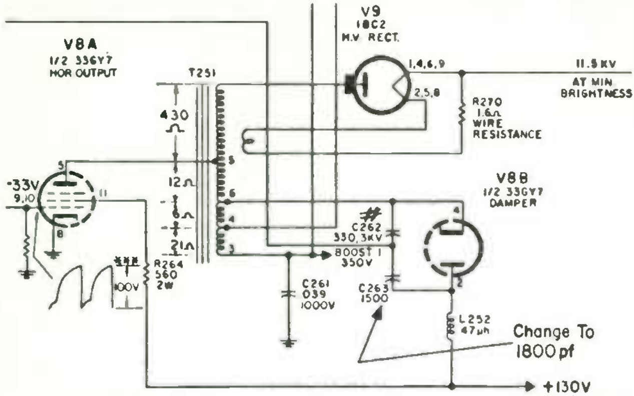
The shield can seams are now being soldered.

TV Chassis SC/S-1—Low Sensitivity on Weak Signals

Occasional complaints of poor sensitivity on the SC/S-1 chassis line of receivers have been reported in the field.

In most cases, this is caused by an excessive AGC keying pulse being applied to the plate of AGC keyer V4B (14BR11).

The pulse is obtained across a capacitive voltage divider consisting of C262 and C263 in the damper circuit. If the pulse exceeds 360v P-P, a negative IF AGC voltage can be developed on weak signals. Negative



AGC applied to the grid of the 1st IF amplifier V3A (11BQ11) will result in a loss of sensitivity, especially if the IF circuits are slightly out of alignment.

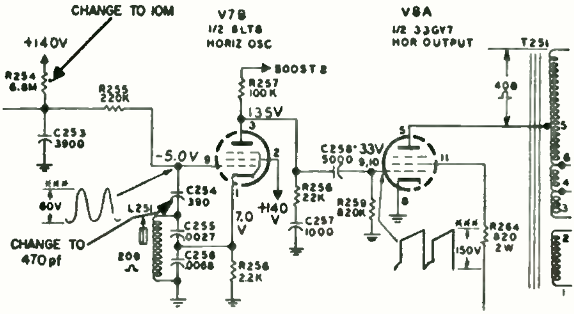
Changing the value of capacitor C263 from 1500pf to 1800pf, 500v (GE Catalog No. ET22X195) will usually correct the problem.

This modification should not be made on all SC/S-1 chassis receivers. Use only as required to correct individual low sensitivity complaints.

TV Chassis S/V—Intermittent Horizontal Oscillator Startup

Occasional field reports indicate horizontal oscillator startup problems on monochrome "S" and "V" chassis receivers. These chassis both employ an 8LT8 tube in the same basic oscillator circuit.

The problem appears as a "no raster" symptom when the receiver is switched on. Sometimes switching the set off and on will cause the oscillator to start. Then the receiver may operate normally for some period of time, only to have the problem occur again a few days or weeks later. Because the problem is random and intermittent in nature, it is very difficult to pin down. Normal troubleshooting procedures do not seem to provide any answers.



First, the receiver should be checked thoroughly. Change the 8LT8 (horiz osc) tube and check all associated circuitry to determine that components are the proper value and not defective. Reduce the ac line voltage by means of a variac to 100v and check for oscillator operation. Sometimes a borderline no-start will show up under reduced line voltage.

If a chronic startup problem exists, resistor R254 should be increased in value to 10M. Original values found in "S" and "V" chassis receivers will be 4.7, 5.6 and 6.8M.

Increasing R254 resistance will reduce grid current under startup conditions raising the grid input impedance. With the circuit noise working into the higher impedance, lower energy noise is sufficient to start the oscillator.

An increase in the value of capacitor, C254, from 390pf to 470pf will also aid oscillator startup. However, changing this capacitor value can be extremely critical because C254 controls part of the temperature compensation of the horizontal oscillator. The replacement part used must be a ceramic 470pf, N750, 5%, 500v unit (G.E. Catalog No. EU18X542 or equivalent).

After changing capacitors, check the receiver for horizontal drift and hold-in range. Using a strong channel signal (preferably Channel 6) set the fine tuning for best picture and all other controls in their normal operating position.

Turn the horizontal hold control two full turns counterclockwise. Switch to the next highest channel and then return to the original channel. Slowly turn the horizontal hold control clockwise until the picture just barely "hangs on" out of sync. You should count three or four bars just before the picture snaps into sync. Repeat this same procedure in the opposite direction.

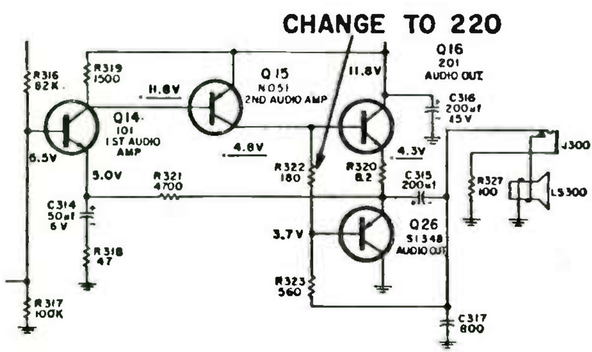
After completing this test, the control has to be returned to its proper setting. This can be approximated by fine tuning into audio and adjusting the horizontal hold for a floating picture. Exact horizontal frequency adjustment procedure can be found in the specific chassis service manual.

These field fixes are applicable only to individual chronic horizontal oscillator startup problems which will not respond to normal troubleshooting and repair procedures and should not be indiscriminately applied.

The change in R254 value is very much preferred over the capacitance change when dealing with this "no start" condition.

TB Chassis—Audio Distortion

Audio distortion, resembling a "raspy" speaker, has been reported from some areas. This has been traced to crossover distortion occurring in Q15 and Q16 because of component tolerance buildup.



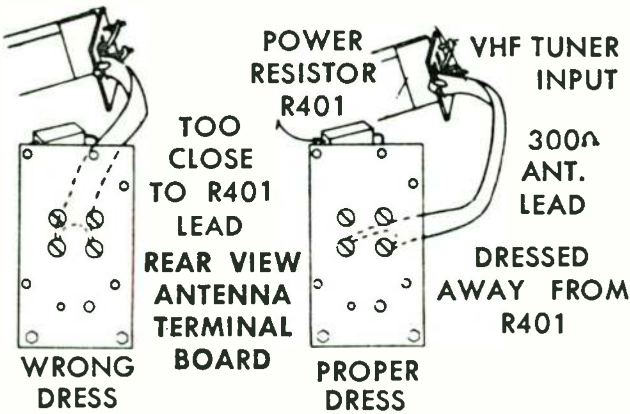
The correction is to replace R322 180Ω±10% with a 220Ω±10% ½w resistor. If a 10% tolerance resistor is not readily available, select the proper value using an accurate ohmmeter.

Do not increase the value of R322 over 240Ω or the ratings of the output transistors will be exceeded.

TV Chassis V—VHF Tuner 300Ω lead dress

The 300Ω twin lead which connects the VHF tuner input terminals to the antenna input terminal board can contact power resistor R401 if not properly dressed.

Heat from the resistor could melt the insulation on the 300Ω lead, causing a short from 120vac to the monopole antenna assembly.

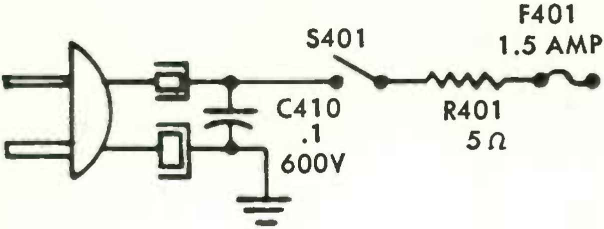


Refer to the drawing and dress the 300Ω lead well away from R401, as shown, before the back of the receiver is reassembled.

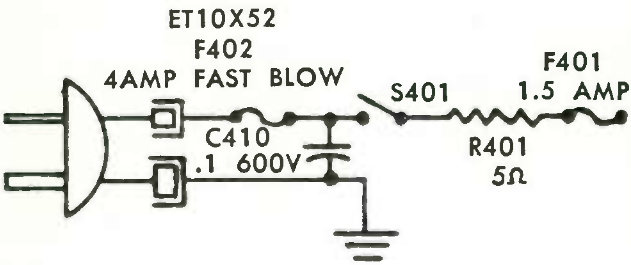
Check this lead dress whenever a "V" chassis receiver is serviced. Models included in this chassis line are M106, M107, M108, M138 and M140, containing VC chassis, V-1 chassis or V-2 chassis.

TV Chassis SB/SC—Lightning Protection

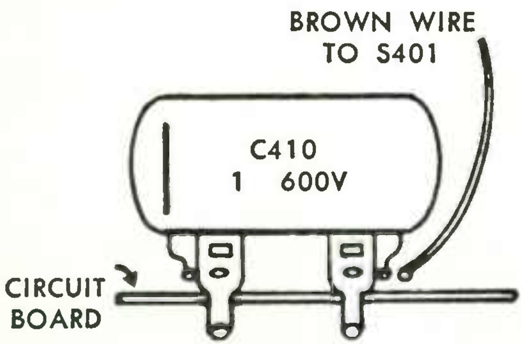
Starting with chassis stamped EN75, the SC chassis will incorporate a 4a fast blow fuse (ET10X52) in series with the ac line ahead of C410. This provides lightning protection for C410 even when the set is off. (This is in addition to F401 1.5a fuse already in the set.)



Schematic for SB and SC Prior to EN75



SC Schematic—EN75 and later

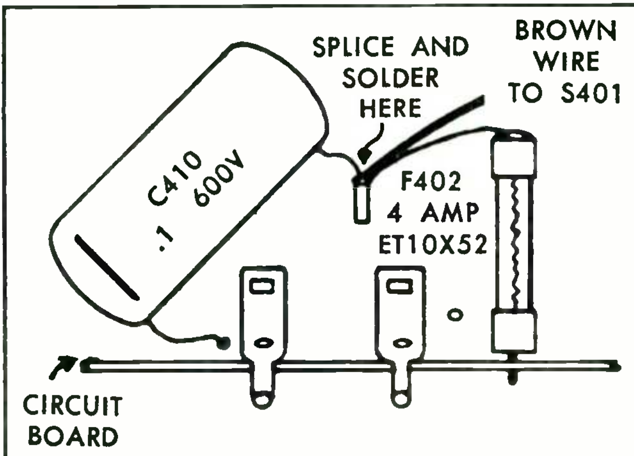


Configuration before Modification

This feature should be added to every SB and SC chassis stamped below EN75 that comes in for service. The modification is simple and takes only a few minutes, since only the cabinet back needs to be removed. Your customers will appreciate this added protection.

Modification Procedure:

Unsolder end of C410 from circuit board beside small interlock pin. Unsolder brown wire to S401 from circuit board beside small interlock pin. Clip pigtail on one end of 5a fuse ET10X52 to 3/16in. long and install as shown in hole where brown wire was removed. Solder in place. Clip pigtail at top end of R402 to ½in. length. Splice the brown



Configuration after Modification

wire, C401 pigtail and F402 pigtail together as shown and solder. Clip off any excess wire at joint and dress the splice outward to make sure that there is no possibility of splice touching vertical output transformer.

Portable TV—Quadrature Coil Tuning Capacitor

The quadrature coil tuning capacitor used in all current General Electric portable television receivers has a negative temperature coefficient to compensate for temperature-produced drift in associated components. The schematic designations, by chassis, for this capacitor are:

S-2 Chassis—C308 H-2 Chassis—C307
P-2 Chassis—C308 G-1 Chassis—C307
V-2 Chassis—C308

Should this capacitor not track properly with temperature, the audio may distort with temperature changes.

The audio may be good initially and become distorted in a few hours or it could be poor initially and gradually get better as the receiver reaches normal operating temperature.

When making repairs in any receiver using a quadrature grid audio detection system, it is good practice to check the audio quality at two temperature extremes—when the receiver is cold, and after it has reached normal operating temperature. If the audio is distorted at either of these points, it is possible that the capacitor is not tracking correctly and it should be replaced.

Replacement capacitors must have the proper temperature coefficient to insure reliable receiver operation. In the case of the chassis listed, the capacitor should be 18pf, 10%, *N470* (Cat. No. ET18X399).

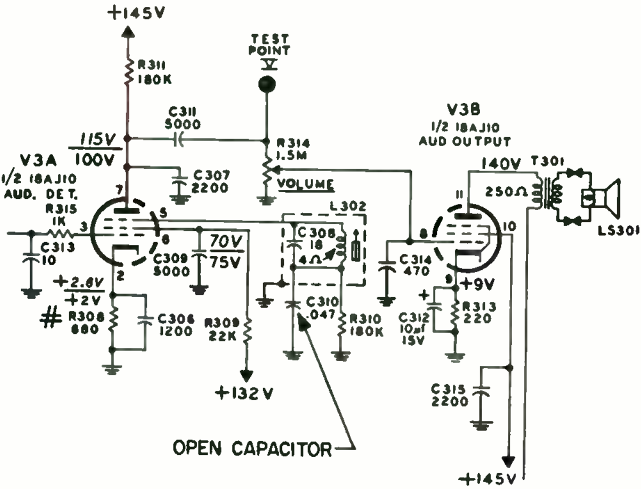
After replacing the capacitor, the quad coil should be realigned and the receiver rechecked at both temperature extremes.

TV Chassis S-2, P-1 and P-2—Intermittent Audio

The small, green, .047μf capacitors used in the audio circuits of S-2, P-1 and P-2 chassis receivers may cause complaints of intermittent audio. In S-2 chassis receivers, these capacitors are designated C309, and in P-1 and P-2 chassis receivers, they are designated C304 and C310.

If C309 (S-2 chassis) or C310 (P-1 and P-2 chassis) opens, audio is lost, sync buzz becomes pronounced and off channel white noise is normal. There is very little effect on the audio quality when these capacitors are shorted.

In P-1 and P-2 chassis receivers an open C304 causes reduced audio, sync buzz and no white noise when the tun-



er is switched to an unused channel. A shorted C304 upsets the bias of Q301 and causes loss of audio.

TV Chassis AY through AD — B+ Fuse

Some service technicians are replacing the B+ fuse in the "A" line chassis (AY through AD) with a slow-blow type. This type of fuse will not protect the set from damage in the event of a B+ short.

Whenever an "A" chassis ("AY" through "AD") is serviced for any reason, the B+ fuse should be checked to be sure that it is a 2a, fast-blow type, catalog No. ET10X41.

AC Chassis—Tube Type Change

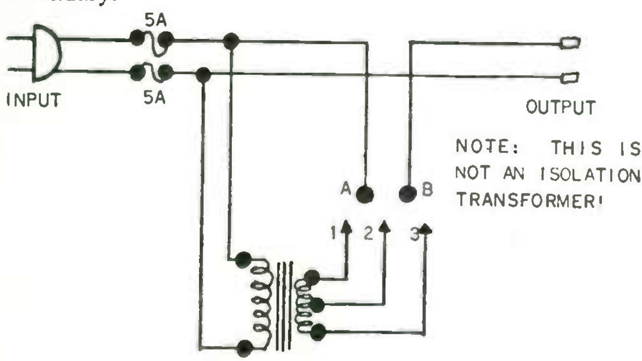
The vertical multivibrator V8 has been changed in the AC chassis from a 6FY7 to a 6FM7. To accommodate this change, the copper pattern that grounds pin 8 of the vertical compactron socket had to be removed, allowing pin 8 to "float." This change was necessary since pin 8 and 3 of the 6FM7 are internally connected to the control grid of the amplifier triode, while there had been so internal connection to pin 8 in the 6FY7 tube.

No other circuit modifications are necessary for the change-over from a 6FY7 to a 6FM7. Therefore, on receivers that are originally equipped with a 6FM7, a 6FY7 may be used as a substitute replacement. A 6FM7 tube may not be used as a substitute replacement, however, in a receiver that was originally equipped to function with a 6FY7 tube — unless the pin 8 ground return is removed.

Adjustable Line Voltage Transformer

Occasionally there is a desire to boost or cut the line voltage for a TV set or appliance. This can easily be done with a small filament transformer placed in series with the appliance power cord. A switch could also be added in the secondary to provide a step-variable shop supply for cooking out' stubborn intermittents.

The 5a unit shown has enough capacity for a color TV set (about 350w). For other requirements you can roughly calculate the transformer needed by adding 30 percent to the wattage of the appliance and dividing it by 120v. This will give you the current requirement for the transformer secondary.



FILAMENT TRANSFORMER
117V/12.6V, CT, 5AMP

1. Purchase locally, a filament transformer with a 12.6v, center tapped, 5a secondary.
2. Construct unit in small metal box large enough to

hold transformer (and switch, if desired). Use adequate gromment and strain reliefs where wires enter box. Cut a number of small holes in the box for ventilation. Remove all burrs!

3. Attach VTVM to output — set on 150vac scale. Connect secondary leads to A and B, two at a time, until you get the desired voltage reading on VTVM. In diagram, connecting 1 to A and 3 to B would add 12v; 3 to A and 1 to B would subtract 12v.

4. Tape up unused secondary lead. Label box with input and output voltages and wattage limit.

TV Chassis P2/S2—Intermittent High Voltage

To correct this high voltage problem, the high voltage rectifier tube quite often is replaced. However, the real source of trouble may be a poor solder connection at the high voltage rectifier socket. Always check the solder connections before replacing the high voltage rectifier tube. The connections should have rounded edges.

All Chassis Using Printed Circuit Board Mounted Audio Output Transformers—Intermittent—No Audio

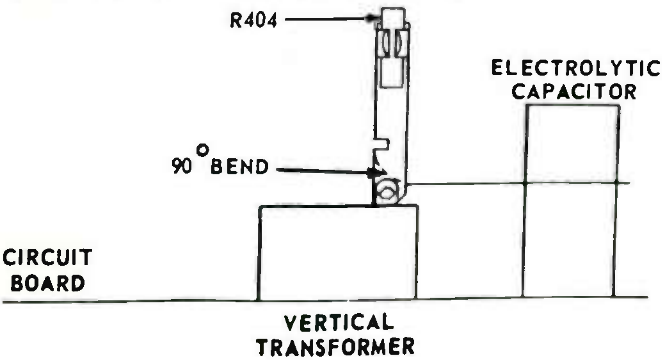
Symptom: Audio intermits at intervals during warm-up. Cause: Intermittent solder connections at circuit board where transformer leads pass through board. Correction: De-solder leads, one at a time, and use a knife to scrape the transformer lead clean to insure a good solder flow when the lead is resoldered to the board. Resolder. Caution: Visual inspection of the solder connection can be misleading. The solder fillet may look perfectly good and still be making a poor electrical connection.

TV Chassis SF—Vertical Buzz

Vertical buzz can be caused by the heat from resistor R404, causing the temperature of the vertical output transformer to rise sufficiently to soften the transformer wax. This allows the transformer laminations to vibrate, causing buzz.

To correct the problem remove resistor R404 from its bracket. Remove one screw and disassemble the bracket from the transformer and electrolytic capacitor. Then bend bracket 90° as shown in illustration and reassemble bracket and resistor. Allow transformer about one hour to cool off before applying power. This allows the wax to harden.

Maintain the following dimensions for the indicated receiver: In the SF1600 Series receivers, slide resistor R404 down in the clip to create at least a ½-in. space between it and the bottom of the VHF tuner cover. In the SF2200 Series receivers, maintain at least a 1-in. space between the resistor and the antenna terminal assembly.



TV Chassis SF—Circuit-Board Modification

The SF chassis circuit board has been modified by deleting the audio module and placing the former module components on the printed-circuit board. Operation of the circuitry remains the same and circuit boards made before and after the modification are interchangeable.

In troubleshooting the new circuit board, one important caution should be observed. Disconnect power from the receiver before the audio integrated circuit, IC301, is removed from its socket and leave power disconnected while IC301 is out of its socket. Damage to IC301 and the horizontal oscillator transistor, Q251, is very probable if this caution is not observed.

Both IC301 and transistor Q251 receive their B+ supply voltages from a common +12v source, but IC301 draws much more current than transistor Q251. Therefore, removing IC301 will cause the +12v source to rise to a much higher voltage with probable damage to transistor Q251. The higher voltage would also damage IC301 when reinserted.

The new modification is in receivers beginning with Serial Number 5L2P-----.

TV Chassis SF—Symptoms Caused by Shorted IC301

Symptoms such as no raster, no horizontal sync, intermittent raster, intermittent horizontal sync and sound, which might or might not be affected, can be caused by low +12v source voltage.

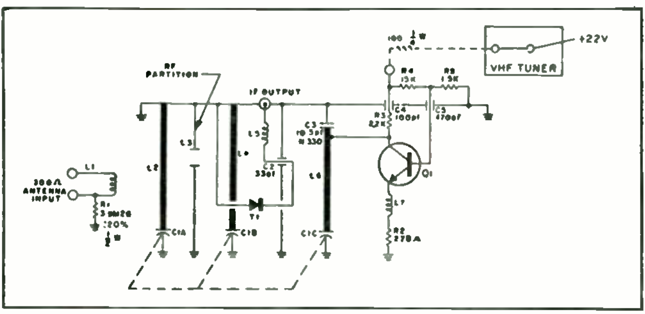
The above symptoms all can be caused by decreased B+ (12v) to the horizontal oscillator, caused by a short circuit in IC301.

Short circuit conditions in the internal zener diode regulator will cause the regulator to draw more current, thus dropping the 12v B+ to a lower voltage. When troubleshooting the above symptoms, measure the DC voltage present at the Drain of the horizontal oscillator, Q251. Normally this voltage will be +10.5v DC. If it is lower, replace IC301 (replace complete audio module in early-production receivers).

Be sure the receiver is unplugged when replacing IC301 (or audio module in early production), and do not operate the receiver with IC301 removed.

TV Chassis U1/UA—UHF Tuner

These tuners are customarily used in television receivers in which the chassis is connected to one side of the AC



power line. To prevent possible hazards to the user, the tuning shafts are molded from nonconductive plastic and the antenna circuit is isolated from chassis ground by a 3.9M, ½w resistor, R1. For continued protection, these items should be checked, and any defects corrected, each time the tuner is serviced. Both the value and wattage rating of R1 are important. Replace only with a 3.9M, ½w resistor. Replacement tuners must provide similar isolation.

Before condemning the tuner, be sure to check the supply and control voltages and the UHF input of the VHF tuner. A known good tuner can be quickly "patched in" to confirm or contradict your initial diagnosis.

Extensive repairs and/or alignments are difficult to perform without special equipment. If such repairs are necessary, replace the entire tuner or send it to an agency specializing in tuner repair.

TV Chassis C-1—Arcing in Corona Seal on High Voltage Rectifier Socket

Some problems associated with the high voltage rectifier socket in this receivers chassis have been traced to the corona seal around the socket terminals.

Excessive leakage currents in some corona seals have caused any or all of the following failures: (1) Arcing in the corona seal. (2) Deterioration of the rectifier socket. (3) Deterioration of the 2 ohm filament series resistor.

The correction is to remove all the old corona seal, replace all damaged components and install new corona seal (Cat. No. ET90X24) in any receiver which has a failure in this area.

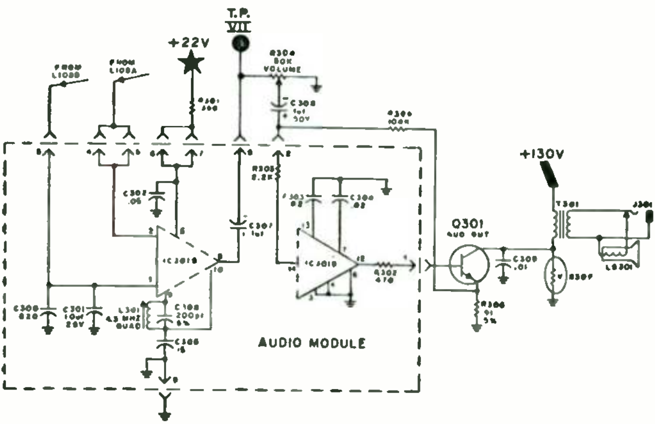
TV Chassis U-1—Audio Circuit

With the exception of the input coil, VOLUME control, and the output stage, the entire audio circuit is assembled to a plug-in type module, shown in the illustration. The module is a circuit board measuring about 2.25 by 1.75 in., and containing an integrated circuit (IC) and a few other components.

The IC contains a detector section and an audio amplifier section. The detector circuit operates much the same as the quadrature detector used in tube-type receivers. The quad coil, L301, is the only tuning adjustment on the module, and it should be tuned for maximum audio.

The sound take-off coil, L108, couples the 4.5MHz signal to the module and it also couples a bias voltage from Terminal 3 of the module to Terminal 4. If the secondary of L108 opens, there will be no bias voltage at Terminal 4 and the module will not function.

Audio signals from the detector circuit are coupled through capacitor C307 to Terminal 8 of the module. From this point, they are coupled to the VOLUME control and



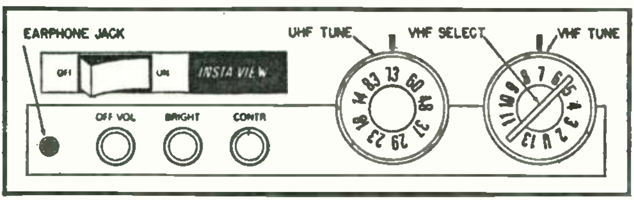
then back to the audio section of the IC through capacitor C308 and resistor R303.

The audio output transistor, Q301, is biased for Class A operation. Base bias is obtained through the audio section of the IC. The bias level is controlled by a voltage which is fed from the emitter of Q301 through resistor R305 to the IC. To prevent thermal runaway, this bias circuit is connected in a negative feedback configuration—an increase in emitter voltage causing a decrease in base voltage and vice versa. The collector circuit is protected from transient pulses by the voltage dependent resistor, R307.

Insta-View Circuitry — Circuit Description

The Insta-View circuitry featured in several G-E "C" Line TV models keeps the electron tube filaments in a pre-heated standby condition when the receiver is not being used. This provides instant viewing when the set is turned on instead of having to wait for the usual warm up period.

A special Insta-View switch is located on the front control panel. For normal receiver operation, this switch



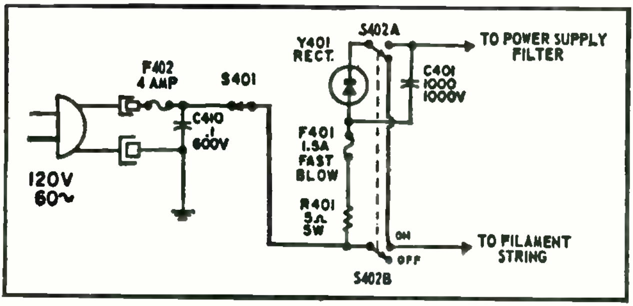
is left in the ON position and the receiver is turned ON and OFF with the main ac switch on the volume control.

For Insta-View operation, the ac power switch on the volume control is left in the ON position, and the receiver is then turned ON and OFF with the Insta-View switch.

From the schematic diagram we see that a DPDT switch (S402) is used to provide the standby condition. When the ac power switch (S401) is in an ON position, switch S402 provides a means of switching both the filament string and the rectifier output.

When in the OFF position, S402B removes the normal ac line voltage from the tube filaments while at the same time, S402A removes the rectifier output from the B+ power supply filter circuit and connects it directly to the filament string, supplying a pulsating dc voltage to the tube filaments. The average voltage will then be much lower than the normal filament string voltage, but it is sufficient to maintain the tubes in a partially heated condition.

When the Insta-View switch on the front control panel (S402) is pushed to the ON position, the rectifier output is connected to the power supply filter circuit, supplying



B+ voltage to the chassis, and the full ac line voltage is applied to the filament string.

The manufacturer recommends that the receiver be turned completely off if it is to be left unattended for an extended period of time. To turn the receiver off completely, rotate the OFF-VOL. knob fully counter-clockwise to the stop.

GENERAL ELECTRIC
Color TV

Color Chassis CW, CX and CY—Adjusting Horizontal Efficiency Coil

The horizontal efficiency coil is adjusted to obtain a specific horizontal amplifier cathode current. The cathode current is specified in the service manual and is measured on a milliammeter inserted in series with the cathode to ground connection.

Some service technicians are substituting a pilot lamp as an indicating device—placing it between the plate cap and connector on top of the horizontal amplifier tube. They adjust the horizontal efficiency coil for minimum lamp brilliance to indicate minimum plate current.

The lamp method is not recommended for the following reasons:

1. Minimum plate current does not necessarily mean maximum output from a screen grid tube. Maximum horizontal amplifier tube output can be obtained only by adjusting the horizontal efficiency coil for the horizontal amplifier cathode current specified in the service manual. Of course, maximum output should be produced to obtain maximum efficiency from the horizontal system (boost, brightness, focus, sweep).

2. The eye cannot see small changes in a pilot lamp's brightness which represent current variations of a few milliamperes. Therefore critical adjustments which can be observed on a milliammeter cannot be

seen with a pilot lamp.

3. If the pilot lamp represents significant capacity, it could result in flyback transformer detuning when removed from the circuit.

"FY" Color Chassis—Horizontal Interference During Alignment

Interference from the horizontal sweep circuits of the receiver may appear on the scope responses during alignment procedures, making it difficult to observe a clearly defined trace. To avoid such interference, it is important that the horizontal circuits be disabled during alignment of the IF, RF and Video sections of the receiver.

The horizontal circuits in these receivers should be disabled in the following manner: Open the jumper grounding the cathode of the horizontal output tube V105. Connect a 2000Ω 100-w resistor from the +405-v buss to ground, to load the B+ supply by an amount equivalent to the horizontal circuit load.

If interference is encountered from the vertical deflection circuits during alignment, switch the "Normal/Service" switch on the rear of the chassis to the "Service" position.

Color TV Chassis KC—Changing HV Regulator Tube Type

Regardless of the type of service being done on the KC chassis color TV, the high voltage regulator tube V17, with white printed code (white branding) is to be changed to a new type, as shown. Tubes having a yellow code and branding are not to be changed. Chassis stamped EN378 or higher do not require this change.

This tube type change should be performed regardless of whether the TV is in or out of warranty. The old tube removed from the chassis is to be tagged with customer's name and address, along with the model and serial number of the TV set. Return the tagged tube to the nearest G-E TV distributor for credit or exchange.

For 6EA4 ....use 6EH6
For 6EF4 ....use 6EJ4
For 6LC6 ....use 6LH6

After installing the tube, attach one of the new tube type labels (packed with the tube) to the rear wall of the HV compartment and the other label to the outside of the cabinet back near the top. The information on the label will then indicate to anyone subsequently servicing receiver that the new type tube has been installed.

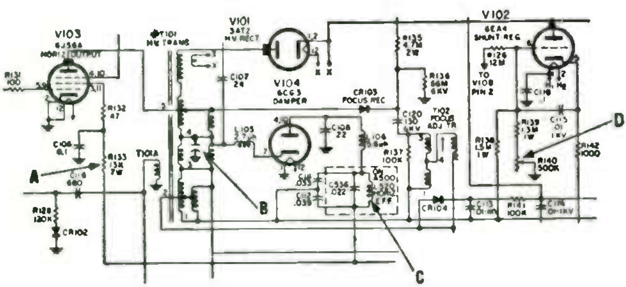
Operate receiver and adjust the HV as instructed in the KC manual. The marking (or lack of marking) on the HV shield determines if the HV requires adjustment.

CB Chassis—Horizontal Output Circuit

A new procedure has been developed for replacing the horizontal output transformer T101 and for making efficiency coil and high voltage adjustments in the CB chassis. These new procedures and adjustments are to supersede service manual instructions.

A coat of No. 641 silicone heat compound should be spread between the chassis and the base of the replacement transformer. This compound will soon be available from G-E distributors under catalog No. ET90X23.

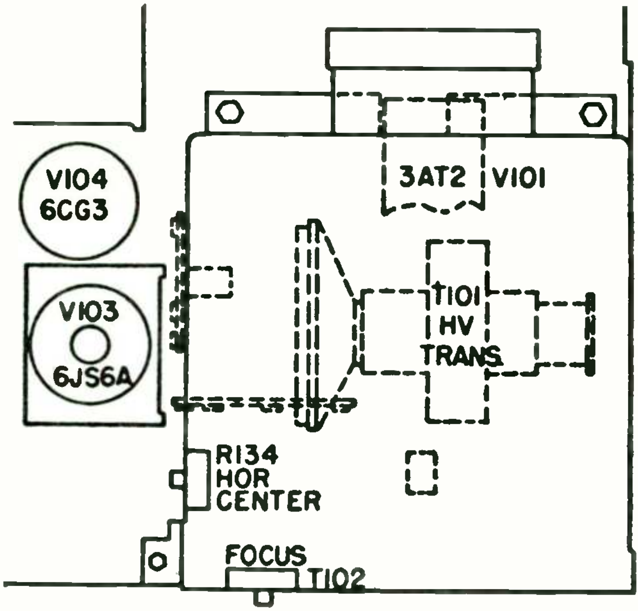
The replacement transformer must be securely mounted to the chassis, thoroughly tightening all screws.



Defective or doubtful horizontal output, damper, high voltage rectifier or high voltage regulator tubes should be checked or replaced.

The 6JS6A horizontal output tube screen resistor, R133 (A), a 13k resistor, should be replaced with a 17K resistor.

On 23- and 25-in. chassis, an 82pf, 6kv capacitor, ET18X579 (B), should be connected from terminal 4



of the horizontal output transformer to the chassis ground. This 82pf capacitor will effectively increase picture width.

After adjusting the line to 117v, the horizontal efficiency coil, L520 (C), should be adjusted for minimum cathode current dip in the 6JS6A horizontal output tube. It is not necessary to adjust for any particular current reading, but make sure that resonance occurs at a maximum dip point.

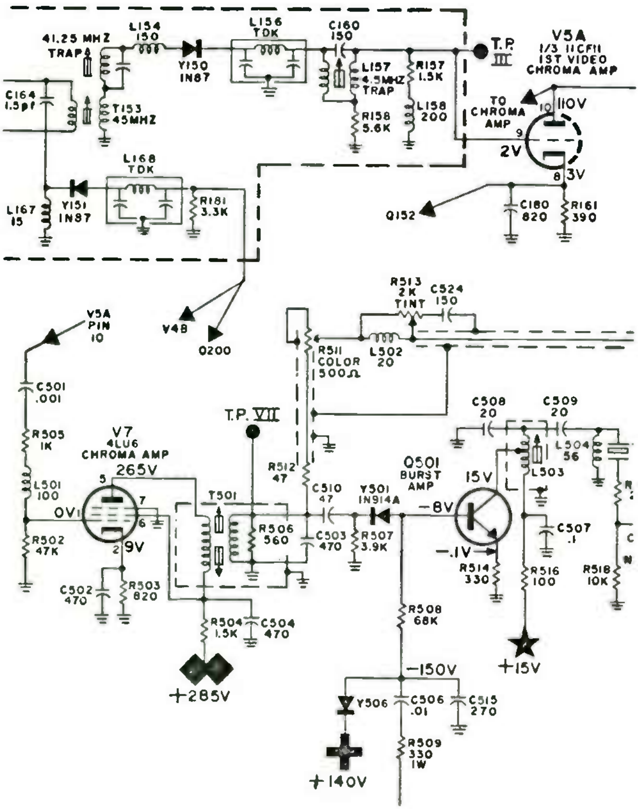
The high voltage should be set by adjusting the 500K pot, R140 (D), to obtain 25kv. Use an accurate VTVM with HV probe. This pot should not be adjusted for any specific regulator current.

The regulator circuit may be checked for proper operation by observing the meter reading as the brightness is adjusted from minimum to normal. The HV should not vary more than 300 to 400v over this range under any circumstances.

TV Receivers—Schematics with a New Look

With recent designs stressing serviceability, it is becoming easier for technicians to find their way around TV receivers. It is only logical then that schematics also be easier to read.

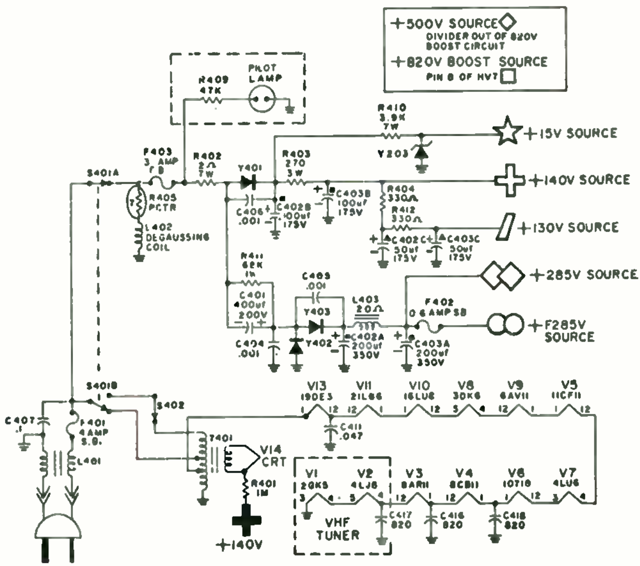
Circuits can be difficult enough without further confusion from cluttered schematics. Especially difficult to trace are interrupted lines connecting one section of a schematic to another separated section.



Typical interrupted lines are: interstage coupling, feedback, and B+.

More convenient point-to-point schematic reading might be possible if there were no interrupted lines at all. But this then would result in many crisscrossing lines, and would still be confusing. So another solution must be found.

When the purpose of interrupted lines is considered, an obvious answer to the problem becomes evident. Since these lines show a signal going from one point to another point, the direction of the interconnection could be shown. In this way, one can "visualize" the point-to-point connection between interrupted lines.



The partial schematic shown illustrates this idea. There are two specific things about these interrupted lines:

- different slopes, and
- arrowheads.

A line going from a point is at the same slope as a line going to another point being connected. Also, an arrowhead shows the from-to direction of signal flow. Then, to complete the line identification, reference points are given.

Notice in the illustration, for example, how easy it is to trace the line from V5A, pin 10, to C501.

Also to be noticed are the different symbols used for various B+ lines. Such eye-catching symbols help in quickly identifying power distribution throughout a schematic. To further aid in recognizing B+ distribution, each power source symbol is white, and each load is black. And as shown in the illustration, all the different symbols and their voltage level are conveniently referenced in the power supply section of the schematic.

Schematics for General Electric portable TV receivers are taking on this new look—using these features of interconnection lines and B+ symbols. The first one is with General Electric's new 16-in., N-1 color chassis.

Color TV Chassis "C"—High Voltage "Ticking/Sizzling" Sounds

The "ticking/sizzling" sounds that are sometimes heard in the high voltage cage area of the "C" chassis are caused by static build-ups and discharges. The condition is not detrimental or an indication of a fault existing in the TV set. There have, however, been some customer complaints about these sounds. The following recommended procedure should be used to reduce and, in most cases, eliminate the noise.

Step 1—Measure the high voltage at minimum brightness and contrast. If it is high, adjust to correct level (with minimum illumination of screen) as follows: Sets with a focus rectifier should be set to maximum 26.0 kv. Sets with a focus divider resistor should be set to maximum 25.0 kv. If the high voltage cannot be adjusted as described, check the high voltage circuitry for a component failure (possibly the hold down diode). If this step does not correct the "ticking" problem, continue to the next step.

Step 2—Reduce the high voltage to the minimum setting (i.e., turn the *high voltage adjust* pot completely counterclockwise). Turn the brightness and contrast controls through their complete range from minimum to maximum to insure that there is no picture deterioration caused by lowering the high voltage. If picture deterioration exists, increase the high voltage until it is eliminated and a customer acceptable picture exists.

Step 3—With the *brightness* and *contrast* controls both set at maximum, increase the *brightness limit* control (i.e., clockwise direction) until picture tube spot blooming is seen. Reduce the brightness limit setting until the blooming is no longer evident.

Step 4—Remove and discard the strap that holds the 3DS3 tube in place during shipment.

If these steps fail to eliminate the problem in stubborn cases, the following items should be checked and/or corrected as indicated.

Disconnect the anode cap from the picture tube and inspect for corona/arcing damage. If the anode cap shows damage or deterioration, replace with a new cap. This may occur especially on sets that have been in use for a long time.

Wipe lightly around the anode connection of the picture tube with a soft cloth and distilled water to remove any contaminants. Clean the anode cap in the same manner. Allow sufficient time for complete drying of the anode cap and anode connection area on the picture tube before reconnecting the anode and applying power to the set.

Replace the high voltage rectifier with a brand new 3DS3 insuring that the tube is clean and has not been previously used.

Before installing the plate cap on the 3DS3, fill the plate cap with "Insulgrease" (EP90X9).

Remove and discard the duct seal (gray putty material) from the pins of the high voltage rectifier socket.

Replace the black cap on the high voltage cup with the new clear cap (EP60X16). Some sets produced in the last quarter of 1973 already have the new cap and it is not necessary to complete this step.

Inspect the 3DS3 socket connections insuring that no pigtails exist and that all connections are smooth and round. Inspect the cup area to insure no foreign material (such as solder balls or splashes, etc.) are in the cup.

Install new duct seal (EP90X24) in the high voltage cup so that the duct seal covers all of the pins in the cup completely and does not come in contact with the cover.

On sets that have focus dividers, excessive spark gap lead length protruding through the terminal board may cause arcing. Cut the leads on the backside of the board so that they are flush with the board. Resolder the connections to produce a smooth round solder joint.

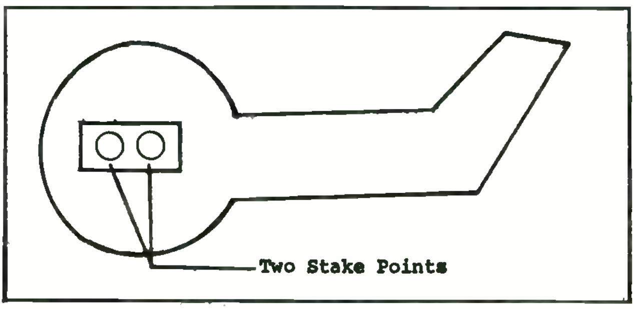
On sets with a focus divider, clean the spark gap with a clean, soft cloth to remove any dust or oil built up in the gap (Note: Do not use sandpaper, files or other abrasives since they will leave sharp edges which will encourage spark gap breakdown).

GENERAL ELECTRIC
Console Models

Record Changer Balance Arm Shaft — Replacement

The balance arm shaft is now being supplied in two separate parts to eliminate the necessity of tearing the charger down for its replacement. This two piece balance arm shaft may be installed by using the following procedure.

1. Remove the balance arm.
2. Remove the defective balance arm shaft.
   a. The damaged lever on the balance arm shaft may be removed with a pair of long nose pliers.
   b. The balance arm shaft may then be pulled out from the top of the changer.
3. Install the new balance arm shaft in the same location that old one was removed from.



4. Turn the changer upside down and place a metal block or other hard object under the balance arm shaft. (The metal block will serve as an anvil.) A small block may be used to balance the changer in this position.
5. Place the balance arm foot on the balance arm shaft. With the end of the balance arm lever in its slot, the shaft must be oriented with its flat end facing

the corner occupied by the tone arm island.

6. Remove the rubber bumper. Item no. 135.
7. A small center punch may now be inserted into the hole vacated by the rubber bumper, and the end of the balance arm shaft may be staked with the center punch and a hammer. A most effective stake may be accomplished by staking the end of the balance arm shaft in at least two spots as shown in the diagram.
8. Replace the rubber bumper and balance arm to complete the repair.

Replacement parts have reportedly been changed, and the balance arm shaft, part no. EA80X133, now supplied in two parts will bear the same part number as the previously cataloged one piece balance arm shaft.

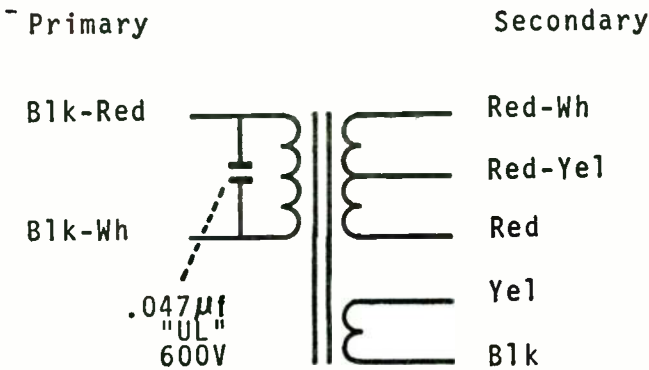
Record Changers—Binding Turntables

The following information gives possible causes and cures for binding turntables. 1. **Cause:** Spindle and bearing are improperly lubricated. **Cure:** The spindle and bearing area must be lubricated in accordance with appropriate changer service manual. (If the turntable hub is cast zinc, use vaseline to lubricate the spindle and hub.) 2. **Cause:** Foreign material in the area of the turntable hub, the spindle or bearing. **Cure:** Clean hub, spindle or bearing area. (Lubricate Ref. Cure #1.) 3. **Cause:** Spindle bent. **Cure:** Replace spindle. (Lubricate Ref. Cure #1.) 4. **Cause:** Nicks or burred edges on the spindle. **Cure:** Remove burred edges and nicks with fine emery cloth. (Caution: Emery dust must be cleaned out of the bearing area.) (Lubricate Ref. Cure #1.) 5. **Cause:** Turntable hub frozen to the spindle because of shrinkage of the zinc hub. **Cure:** Replace turntable. (If zinc material from the hub has adhered to the spindle, it will be necessary to clean bearing surface of the spindle with fine emery cloth.) (Clean and lubricate Ref. Cure #1.)

Amplifier Models T20/30 and T60/112—On/Off 'Pop' Noise

If there is a "pop" in the speaker when the amplifier is switched on or off, the noise can be eliminated as follows:

Place a 0.047μf 600v capacitor (Cat. No. EA26X10 or



equivalent) across the primary winding of the amplifier power transformer.

The addition of this 0.047 capacitor will greatly reduce the amplitude of the "pop." Late production amplifiers had this capacitor installed at the factory.

AM, FM, FM Stereo Tuner Model M671 — Change in T12

The inductance of coil T12 on the M671 chassis has been changed from 58mh to 61mh. The 58mh version is identified with a white dot, the 61mh with a yellow dot. This dot is located on the coil form between pin 1 and 5.

To compensate for this revision, the shunting capacitor, C65, has been changed from 1200pf to 1000pf.

Renewal parts is stocking only the "white dot" at this time. Therefore, if a "yellow dot" is replaced with the "white dot" (Cat.ER7878), C65 must be changed.

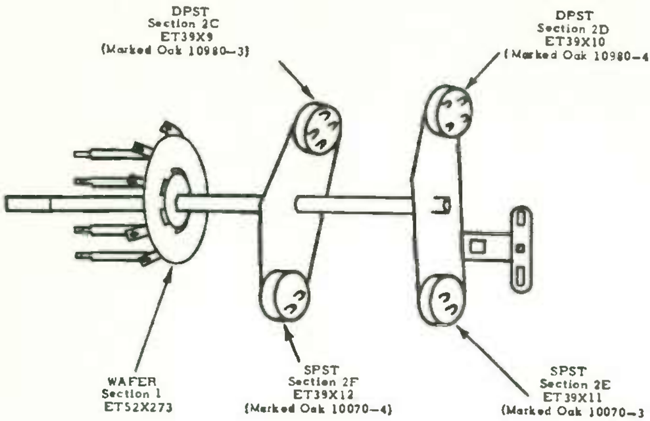
TV/Phono Chassis M6/MW — Function Switch Availability

Replacement function switch assemblies, used in M6 and MW chassis TV/Phono combination models, will soon become "no longer available." The switch assembly catalog numbers are ET55X35 for the M6 chassis models and ET55X41 for the MW chassis models.

Each switch assembly includes one wafer switch, two SPST switches and two DPST switches.

Nearly all defective switch assemblies can be repaired by replacing the faulty switch section or sections.

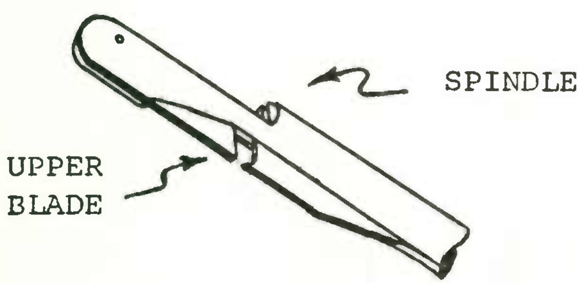
The illustration identifies the various individual switch sections.



Record Changer R0400/R0500 Series—Multiple Record Drop

Reports from the field indicate that an occasional complaint of multiple record drop exists on RD400 and RD500 series changers.

This problem occurs when the small blade in top of spindle does not move freely to select a single record. The blade movement may be restricted by the presence of small particles of solidified rust inhibitor remaining on the spindle.



To dissolve the rust inhibitor particles, wipe the spindle with a soft cloth soaked in alcohol. Check the movement of blade for correct vertical travel; it must fall freely of its own weight. See illustration.

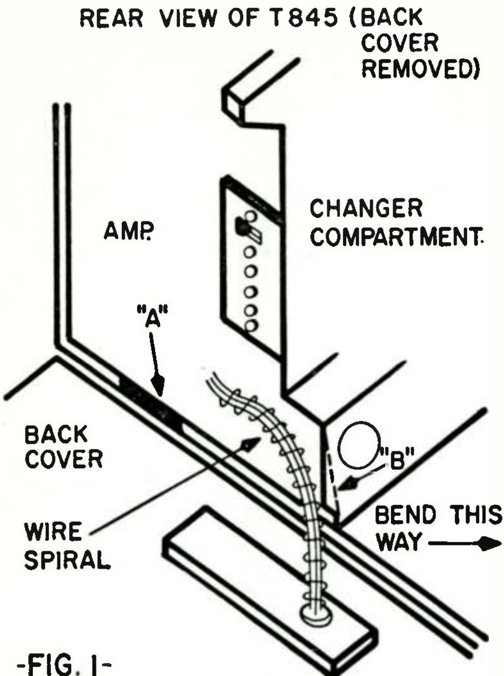
Radio/Phono Model T845—Safety Modification

A safety modification must be applied to all Model T845's received for service previous to serial number 1250043. Because of the proximity of the ac line cord and the metal edge of the jack pack bulkhead, there is a possible safety problem.

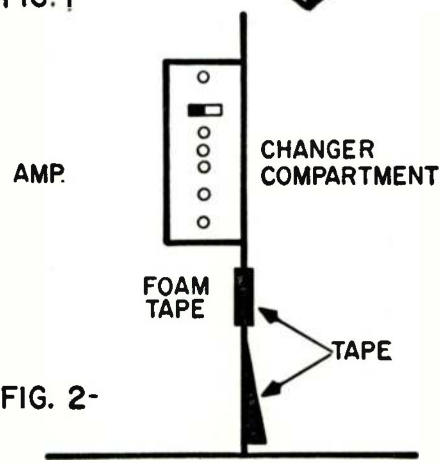
The corrective modification is as follows: Remove back cover by removing 10 cover screws and two jack pack screws. Lay back cover flat on work bench. Do not remove ac line cord from strain relief. Tape (electrical) lip of cabinet frame at point A as shown in Fig. 1. Bend bottom edge of jack pack bulkhead in toward changer compartment until frame edge is parallel with back cover. Bend should be made at point B as shown. Tape (electrical) frame edge as shown in Fig. 2. Install foam tape as shown. Install a piece of (plastic) wire spiral around the ac line cord between ac line cord strain relief and wire bundle. Insure sufficient spiral is used to cover cord. Note: Insure wire tie holding wire bundle is secure (See Fig. 1). Reinstall back cover observing ac lead dress to make sure that ac cord is dressed by taped area. Perform this normal safety check as follows:

a. Inspect lead dress. Wires should not be pinched by chassis, and leads should be dressed and secured to prevent any possibility of being pinched by the changer or becoming entrapped in the changer mechanism.
b. Temporarily connect a jumper between the two blades of the line cord plug.
c. Measure the resistance (with unit completely assembled) from the two shorted blades of the power plug to exposed metal portions of the set. Must indicate an open circuit when using the R X 10,000 scale of VOM.
d. Should a reading other than an open circuit be obtained, locate and correct the cause and re-perform safety check.

General Electric Audio Products Dept. is shipping adhesive-backed tape and spiral material to make the above-


REAR VIEW OF T845 (BACK COVER REMOVED)
AMP.
CHANGER COMPARTMENT
"A"
BACK COVER
WIRE SPIRAL
"B"
BEND THIS WAY

-FIG. 1-


AMP.
CHANGER COMPARTMENT
FOAM TAPE
TAPE

-FIG. 2-

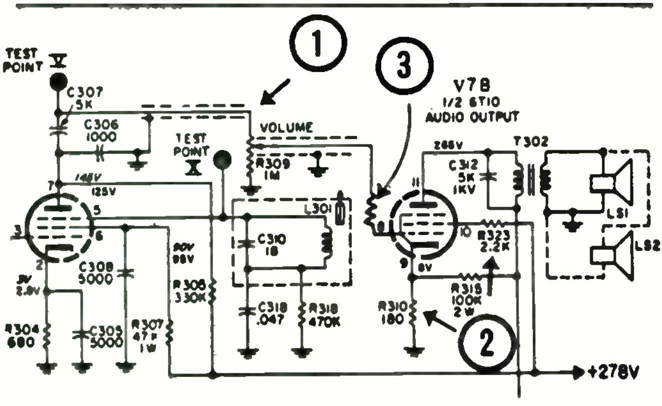
mentioned safety modification. If you need additional material for performing these safety modifications, call or wire Fred Furnish 8-322-6313.

If you receive units for safety check and modification that are still in the unopened factory carton, it is not necessary to remove set from the carton. Turn carton upside down and open carton from the bottom—back cover of unit is now exposed—and perform corrective steps described above.

CANADIAN
GENERAL ELECTRIC
B&W TV

TV Chassis M664 — Volume Control Damage

There have been a few cases where a 6T10 audio output tube has developed a grid to screen grid short, resulting in high B+ current through the volume control and damaging the element. This happens when the volume control is set for a medium to low volume when such a short occurs.



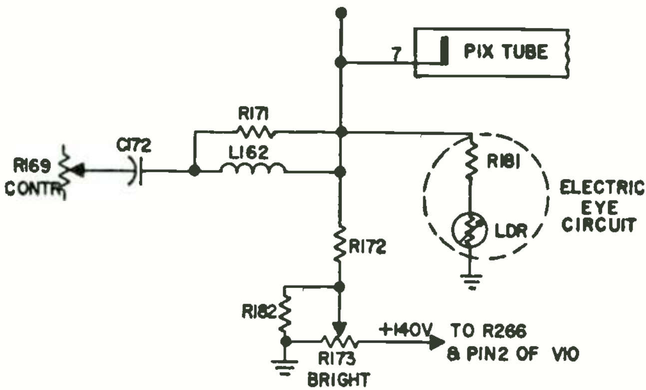
Whenever a M664 chassis is serviced for a defective volume control or 6T10 audio output tube, the following items should be checked for possible damage and a 22K resistor added to prevent future damage. 1. Volume control checked for noisy or intermittent spots. 2. Measure the screen grid resistor R323 and cathode resistor R310 for correct values. 3. Add a 22K, ½w resistor between pin 8 of 6T10 and the center arm of the volume control.

TV Chassis M664/M687 — Operation of 'Electric Eye'

Some 1968 models using the M664 and M687 chassis, employ an "electric eye" feature. The purpose of this feature is to adjust picture brightness automatically in proportion to room brightness.

For proper operation of the light dependent resistor (LDR) unit, it should not be blocked off, nor should a lamp be placed near or in front of the unit. To check the operation of the electric eye, switch the set on and adjust brightness and contrast for normal operation under normal viewing conditions. Cover the LDR window and note if the picture brightness decreases. If it does, the LDR is functioning correctly. If not, check the resistance of the LDR unit and check to see if the unit is properly connected to the circuit.

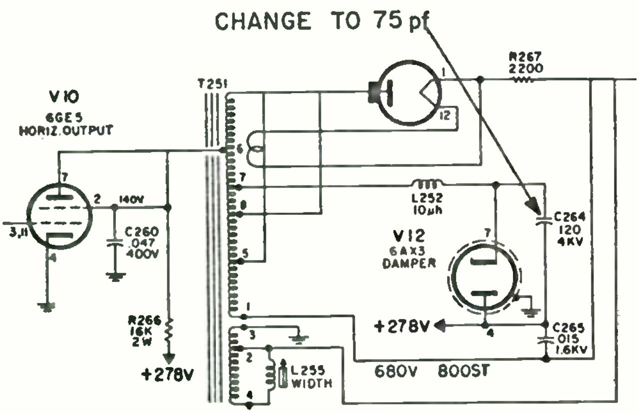
In chassis employing the LDR, a 400 Ω brightness potentiometer is used instead of the usual 300 Ω pot. The LDR is connected in parallel with a portion of the brightness control through a tap on the pot. When the amount of illumination striking the LDR decreases (as the room darkens), the resistance of the LDR increases. The increased resistance raises the CRT cathode voltage with respect to ground, thereby increasing the potential difference between cathode and control grid of the CRT. The grid becomes more negative since it is connected to ground through the horizontal blanking winding of T251. Thus current flow is decreased, with lower brightness on CRT.



In the M664 chassis, the LDR is effectively placed in parallel with the brightness control. Again, when the amount of illumination striking the LDR decreases, the resistance of the LDR increases. The increased resistance raises the CRT cathode voltage and reduces brightness.

TV Chassis M664—Reducing Width

The plate to cathode capacitor, C264, on the damper tube, V12, has been changed to reduce scan width. Change

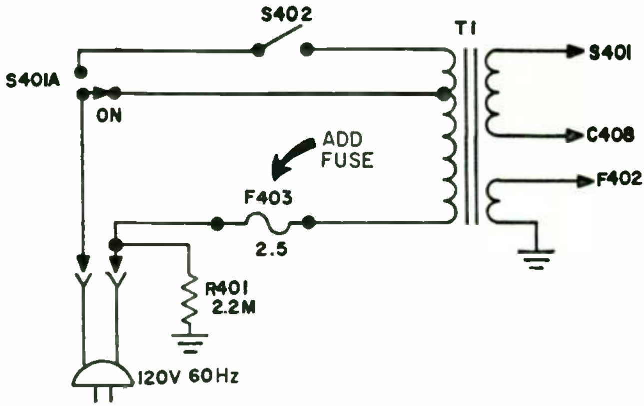


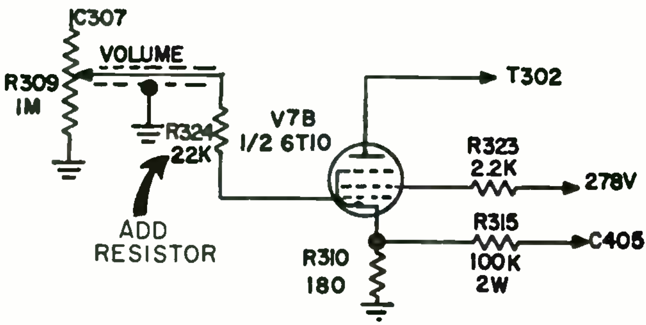
C264 on your schematic from 120pf to 75pf 4kv. The part is a standard value and will not be stocked.

TV Chassis M664 Codes 'X' and 'W' — Production Changes

During production, fuse F403 was added in the primary circuit of T401 as shown.

In latest production, resistor R324 has been added between pin 8 of 6T10 V7B tube and the volume control R309 to prevent damage to R309.





TV Chassis M657 Code "Z"—Substitution of CRTs and Schematic Corrections

In the plate circuit of the horizontal oscillator, V7B, resistor R257 should read 150k.

The schematic shows 180k and only 150k resistors have been used in production.

When removing and connecting sockets to the base of 12BMP4 and 16CFP4 CRTs, to minimize glass breakage, the tubes have been substituted by a 12CDP4 and 16CQP4.

Electrically, these two types are identical to their predecessor. Physically, a moulded base has been added to the 12CDP4 and 16CQP4. The socket used for connecting the 12BMP4 and the 16CFP4 will not fit the new tubes. This means that the two types are not interchangeable with the original types.

The tube department will continue to make the 12BMP4 and 16CFP4 available for replacement purposes.

CANADIAN

GENERAL ELECTRIC

Color TV

Color TV Chassis 19 and 25in. — HV Transformer Replacement

The renewal parts department is supplying R8511 as a replacement for the 19 and 25in. color sets. To use this transformer as a replacement on earlier versions of the 25in. sets, terminals 5 and 6 have to be tied together, otherwise very poor linearity and loss of width will result. Terminals 5 and 6 of this transformer, when used on the later production sets, are connected to the horizontal centering control.

Terminals 1, 2, 6, 8 and 9 on the old transformer are blank. The new transformer has no connections on terminals 1, 2 and 9.

Color TV 25in. Models — New CRT Type

Presently there are two types of 25in. color tubes used; the only differences are as follows:

Characteristics	25AP22A	25SP22
Heater current	.8a	1.3a
G1 cut off at 440 G2	−95 to −190	−75 to −167v
Over-all length	20.924 ± .375	21.123 ± .375

Both tubes are interchangeable with only one small modification — R124 .08 Ω 3w resistor should be bypassed by a piece of buss wire when you use the 25SP22. The buss wire is removed if you replace a 25SP22 with a 25AP22A. The resistor is located under the chassis near the power transformer.

Color Chassis CTC21/25 — Audio Hum

Field reports include complaints of audio hum in some chassis and mentions one chassis may have more or less hum than another.

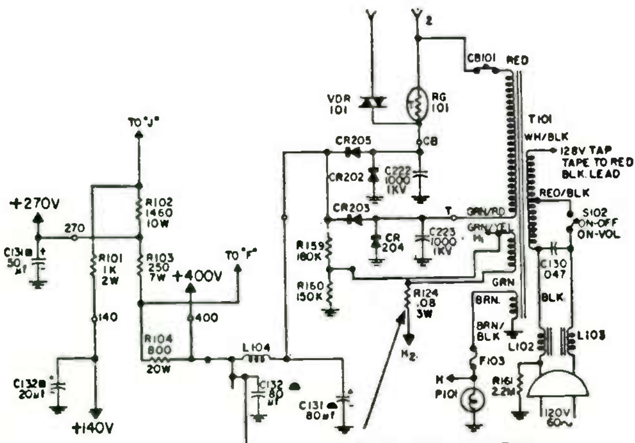
Investigation reveals this hum level is emphasized by the "Beta" of the output transistor, Q202. Corrective action is to add enough degeneration in the emitter circuit to reduce this hum to a minimum level, yet maintain good audio output. To provide this degeneration a 33 to 68Ω½w resistor is needed in this circuit. In most instances this resistor can be installed without removing the chassis from the cabinet.

Color TV—New Picture Tube Type

At present there are two types of 25in. color tubes used in Canadian G-E sets. The only differences are as follows:

Characteristics	25AP22A	25SP22
Heater current	0.8a	1.3a
G1 cutoff at 440v G2	−95 to −190	−75 to −167v
Over-all length	20.924 ±0.375	21.123 ±0.375

It can be seen that both tubes are interchangeable. There is one small modification — R124, the 0.08Ω,



BYPASS WHEN USING 25SP22

3W resistor should be bypassed by a piece of buss wire when you use the 25SP22, the buss wire is removed if you replace a 25SP22 with a 25AP22A. The resistor is located under the chassis near the power transformer.

Color TV Model M663—Audio Trouble

There have been reports of audio problems that can be caused by bad lead dress in the audio circuit.

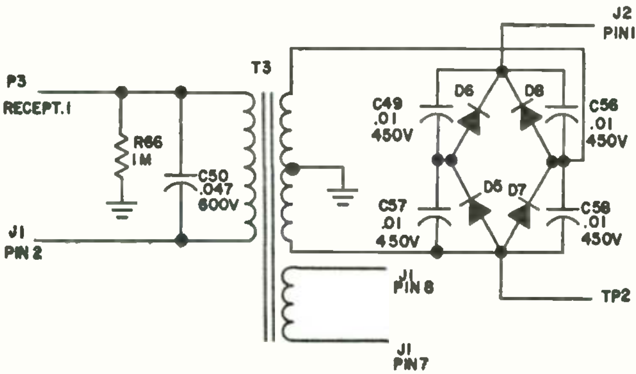
The leads of C313 and C306 have been found to be in contact with the envelope of the 12BF11 audio output tube. The transfer of heat will cause distortion.

The solution, of course, is to bend the capacitors away from the envelope so they are no longer in contact.

CANADIAN
GENERAL ELECTRIC
Console Models

Amplifier Chassis M683—Pulse-Noise Radiation from the Power Supply

Tests showed that the power diodes were radiating an excessive amount of RF. Because of cabinet limitations, the AM loops had been placed close enough to the power

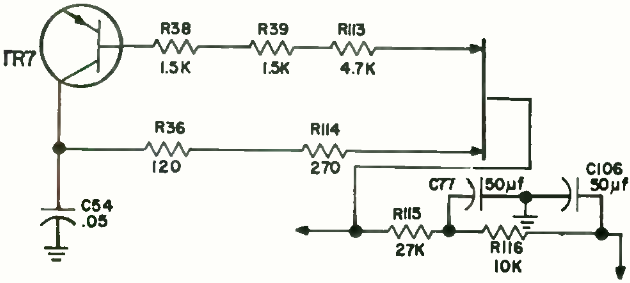


supply to pick up this radiation. The intent of C49 was to suppress residual radiation, but it could not handle this excess amount satisfactorily.

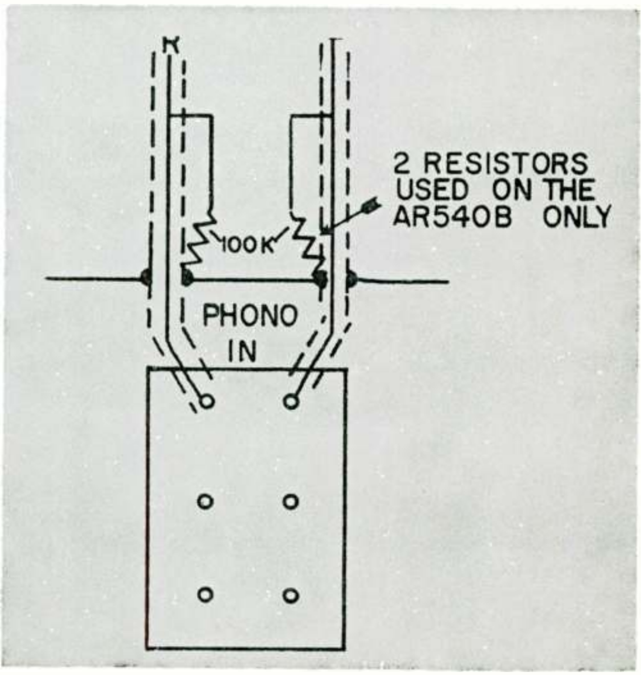
In future runs of the M683 chassis, bypass capacitors will be added across each power diode. These chassis will then be coded: "Chassis Code Z."

Phono Chassis M686 — Audio Circuit Alterations

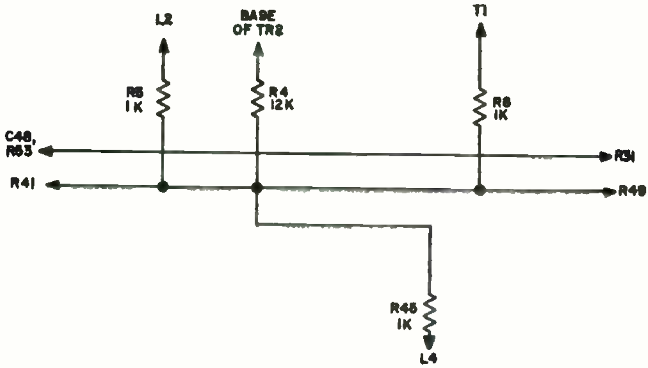
Since the initial version of the M686 service note, there have been a few minor alterations to the schematic as shown: 1. Resistors R113 and R114 were used on the de-



luxe 12 push-button version of the M686 chassis only. They were used to lower the amount of supply voltage being fed to the tuner's regulator circuit consisting of TR7 and D5. 2. Capacitors C86 and C87 have been changed from



.01 µf to .005 µf to smooth out the bass response which initially proved to be too critical. 3. Transistors TR17 and TR18 should be shown as NPN not PNP. 4. On the AR540B chassis only — two 100K resistors have been add-



ed in the phono input circuit to decrease the amount of bass response as shown in diagram. 5. There should be a ground connection between C77 and C106 as shown on the diagram. 6. There is no connection between R4 and R53 as previously shown. There is, however, a connection to R3 as shown on the diagram.

Amplifier Chassis M683 — Poor Bass Response — Earphone Hum and Hiss

There have been a few complaints of (1) insufficient bass response and (2) hum while the set is operated with earphones connected.

To effectively overcome the complaints of insufficient bass response, a signal divider network may be added to each channel.

To reduce the amount of earphone hum and hiss a 100 Ω resistor should be added to one lead of each earphone per channel.

This is not intended as an instruction to rework sets, but is given as information only.

MAGNAVOX
B&W TV

Combination, Model 1MV/U381 — AM radio Interference In TV Sound

Some comments have been received from the field indicating that the AM radio is not being completely disabled when the function switch is set to TV on this model. Technical service bulletin No. 63.11, November 1963 called attention to a production change made in the 75-09 radio chassis (used in the 381, Run 2) to insure cut-off of the B+ supply to the AM oscillator with the bandswitch in the TV position. Evidently a small quantity of these instruments were shipped prior to the change. This change in the 75-09 radio chassis can be made by transposing two leads at the bandswitch as follows: 1) The yellow lead coming from P609 on the FM stereo board must be removed from terminal 9 on section 2 of the bandswitch and connected instead to the terminal between 9 and 8. 2) The +135 v lead must be removed from the terminal between 9 and 8 on section 2 and connected instead to terminal 9.

TV Chassis 48 Series — Circuit Description

The 48 Series TV chassis are series filament types designed for portable television instruments. The majority of the components used are contained on a single printed board. Major components are located elsewhere on the main chassis assembly.

These chassis have a video bandpass of approximately

3.0 Mc at the 6 db level. The video IF circuit employs a 4EH7 tube and a 4EJ7 tube. The first IF stage is AGC controlled. Traps are provided in the input which are tuned to 41.25 Mc and 47.25 Mc. A IN60 diode is used as the video detector and this diode is mounted on the coil form.

The pentode section of a 10JY8 tube is used as the video amplifier. Contrast variation is obtained by a variable control which functions as part of the plate load thus controlling the gain of this stage. A double-tuned 4.5 Mc trap, located in the plate circuit of this video amplifier, serves two functions. First it is used to keep the 4.5 Mc from the video signal being coupled to the picture tube and second it is used as the sound take-off coil.

The audio section employs the triode section of the 10JY8 as the sound IF amplifier and a 17BF11 which functions as a gated beam detector and audio output.

An 8B10 type tube containing three triodes function as the AGC amplifier, sync separator and horizontal AFC.

The triode which functions as the AGC Amplifier has its control grid connected to the +145 v source through the AGC control and also to the plate of the Video amplifier. The cathode, although containing a cathode resistor to ground is also returned to the boost source. Under normal conditions, the positive potential at the cathode, being greater than that at the grid will bias the tube well below cut-off. The signal appearing at the grid is a sync positive composite video signal. Components are chosen so only the sync pulses will drive the grid out of cut-off. The instant the sync pulse appears on the grid, the plate which is capacitively coupled to a tap on the HV transformer, is driven positive by the pulse obtained from the HV transformer thus allowing the tube to conduct. Since the tube will only conduct when its plate is positive, any noise pulses which may occur between sync pulses cannot cause the tube to conduct, therefore, the noise pulses will have no effect on the AGC voltage.

The second triode section of the 8B10 tube functions as the sync separator. The sync-positive composite signal coupled in at the grid strips the video from the signal allowing only the sync pulses to appear at the plate. The vertical pulses are coupled to the vertical circuit through the 560 pf. capacitor (C167). The horizontal pulses are coupled to the horizontal AFC circuit through the 100 pf. capacitor (C183).

The third triode section of the 8B10 tube functions in an unbalanced horizontal AFC circuit. This circuit compares the phase difference between the sync pulses from the sync separator and the horizontal retrace pulse supplied from the horizontal output transformer. Circuit design and components are chosen to provide a zero dc reference level at the grid of the horizontal oscillator.

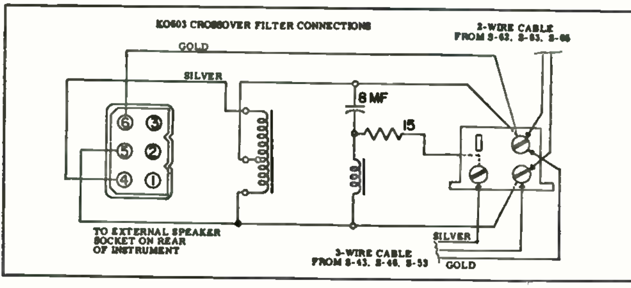
The vertical output stage consists of a 17JZ8 tube connected in a conventional multivibrator-output circuit. The vertical linearity controls the bias on the grid of the output stage. The height control, connected in the plate circuit of the triode section controls the gain of the oscillator stage. The vertical hold determines the bias on the grid of the oscillator stage.

The horizontal oscillator circuit consists of a single 8FQ7 connected in a common cathode multivibrator circuit. The L C network in the plate circuit of the first section is used to set the horizontal frequency. The range control (VR105) is used as a coarse frequency adjust and the horizontal hold control (VR104) acts as a fine-frequency adjustment.

The modified sawtooth appearing at the output of the multivibrator is coupled to the grid of the pentode section of a 33GY7 tube which functions as the horizontal output tube. The diode section of this same tube is used as the damper tube A B+ boost voltage of approximately 350 v is obtained.

Companion Speaker Systems Models S-62, S-63 & S-65—Connections

All of these speaker units incorporate 1,000 cps horns in conjunction with either a 12 or 15 in. bass speaker. The frequency crossover network is included in the speaker unit. This means that these speaker units can be connected directly to the external speaker terminals of any Magnavox instrument except Astro-Sonic models using the A590 (100 watt) Amplifier. With earlier speaker units, similar to the S-43, S-46 and S-53, using high frequency horns it is necessary to install the KO602 crossover filter kit when used with



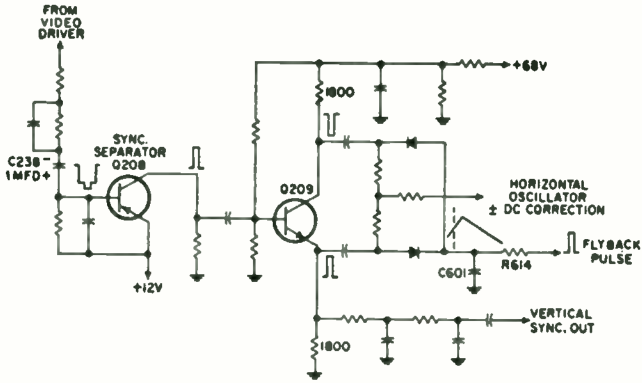
Magnavox connections for two types of speaker units when used with KO603 kit in conjunction with Astro-Sonic 100-w models.

models other than the 100-w Astro-Sonic. The KO603 kit must still be used with the Astro-Sonic models incorporating the 100-w amplifier regardless of which companion speaker system is used. In the case of the S-62, S-63 and S-65, however, only the impedance matching section of the network is used. The diagram shows the different connections required for the two types of speaker units when used with the KO603 kit in conjunction with the 100-w Astro-Sonic Models.

TV Chassis T908—Sync Stages—Circuit Description

The video signal from the video driver stage is coupled to the base of the sync separator. With no signal present, Q208 is cut off since there are no provisions for forward biasing the base-emitter junction. However, when a signal is received, the negative-going sync tips forward bias the PNP transistor into conduction. Base current flows and charges C238 as shown. The capacitor charge tends to reverse bias the base-emitter junction so that only sync tips are able to turn on the transistor. Strong signals would charge the capacitor still more, further increasing reverse bias, and allow only the sync tips to be amplified. The operation of this circuit is exactly the same as the grid leak bias method used in tube circuits.

The amplified sync pulses are inverted in the collector circuit and coupled to the base of Q209. Q209 is a sync splitter stage. Equal amplitude but opposite polarity pulses are developed at the collector and the emitter. This occurs due to the equal value load resistors in the collector and emitter (1800Ω). The positive emitter signal is integrated in a dual section filter network into a 60Hz or vertical sync pulse which then controls the frequency of the vertical oscillator. Both the emitter and collector sync pulses are coupled to the AFC diodes to develop

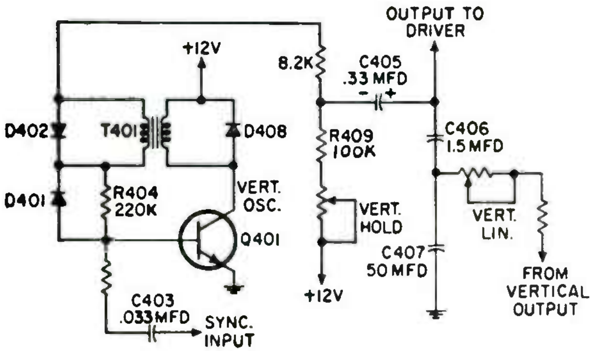


a dc control voltage for the horizontal oscillator. These two signals are compared to a third signal supplied by a winding on the flyback transformer. The flyback pulse is integrated into a sawtooth waveform by R614 and C601. When the oscillator is exactly on frequency the accumulated charge on the two sync coupling capacitors are equal but opposite in polarity. The two charges just cancel each other at the junction of the three resistors so that zero correction voltage is produced.

Should the oscillator shift frequency slightly, the sawtooth waveform at the diodes will advance or retard in phase. This allows one diode to conduct more while the other diode conducts less. The diode that conducts more, charges its coupling capacitor to a higher level while the other diode develops a smaller charge on its coupling capacitor. The net voltage at the junction of the three resistors will no longer be zero but will take on the polarity of the capacitor having the most charge. This resultant voltage, which may be positive or negative, is then used to correct the frequency of the horizontal oscillator.

TV Chassis T908 Vertical Sweep Circuits—Circuit Description

A blocking oscillator is used to generate the 60Hz vertical sweep voltage. Forward bias voltage is supplied through the vertical hold control, the 100K and 8.2K resistors, D402 and D401 to the base. When the receiver is turned on Q401 is forward biased and collector current increases. This increasing current flows through the transformer and induces a voltage into the secondary winding, minus at the top and plus at the bottom. The positive voltage is applied through D401 to the base and, since this



is an NPN transistor, further increases the bias so that more collector current flows. This action is very rapid and the transistor almost immediately goes into saturation.

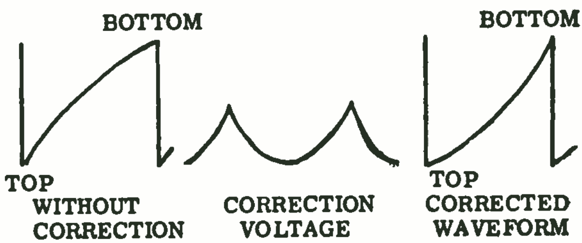
While this is occurring, the negative pulse at the top of the transformer charges C405 minus to plus as shown. As soon as the transistor becomes saturated, collector current ceases to change and the field in the transformer winding collapses. This produces a reversal of polarity across the windings which forward biases D402 and D403. These diodes act as a short circuit and dissipate the energy stored in the transformer.

C405, however, is still charged. The negative voltage on the capacitor reverse biases the transistor through R404 and Q401 remains cut off. The only other discharge path is through the 100K resistor and the vertical hold control. The capacitor then discharges toward the supply voltage and starts to take on a positive charge. When the positive charge becomes great enough to forward bias the transistor, Q401 again goes into saturation and the cycle is repeated.

The oscillating frequency is dependent on the time constant formed by C405, R409 and the hold control. The larger the amount of resistance in series with the capacitor the longer it takes for the capacitor to discharge and take on a positive charge. This represents a lower oscillator frequency. The vertical hold control varies the RC time constant and, therefore, the oscillating frequency.

The oscillator is free-running at a nominal frequency of 60Hz and must be synchronized to the received signal. The positive-going sync pulse formed by the integrating network is coupled to the base of the oscillator through C403. The pulse forward biases the base-emitter junction to start a new cycle. D401 acts as a high impedance to the sync pulse so that the full amplitude of the pulse is applied to the base. The free-running frequency of the oscillator must be slightly lower than the repetition rate of the vertical sync pulses; otherwise, the oscillator cannot be synchronized.

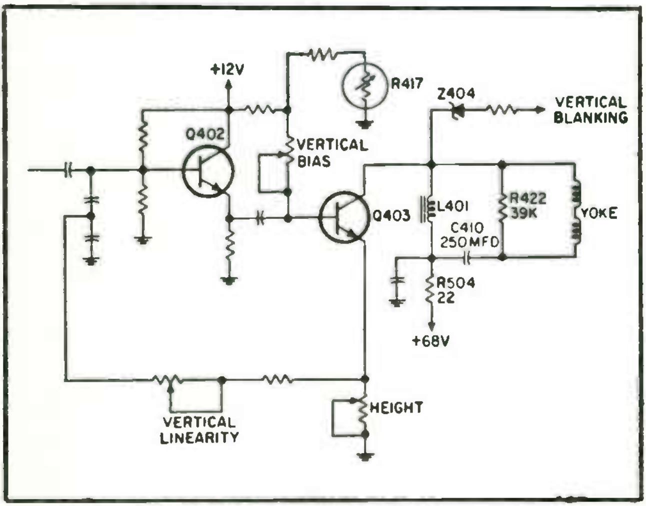
The output waveform from the blocking oscillator is not suitable, as yet, to produce a satisfactory vertical



sweep. Such a waveform would produce severe stretching at the top of the picture and compression at the bottom. C406 and C407 are used to modify the output waveform to produce satisfactory linearity. A sawtooth waveform from the vertical output stage is coupled through the linearity control to C407. This capacitor forms the sawtooth voltage into a parabolic waveform. The linearity adjustment controls the amplitude and the phase of the parabola. The parabolic waveform is then added to the oscillator waveform and changes the slope of the curve as shown.

The rate of vertical scan during the portion of the slope corresponding to the top of the screen is reduced to compensate for stretching. The rate of scan during the portion of the slope associated with the bottom of the scan is increased to correct for compression. This corrected waveform is then coupled to the base of the vertical driver.

The driver stage is connected as an emitter-follower. Its purpose is to present a high impedance to the oscillator signal and a low impedance output to the base of the output stage. This arrangement helps to isolate the output stage from the oscillator. The vertical output stage uses a power type transistor which operates as a class A amplifier. No output transformer is required since the low output impedance of the transistor permits connecting the yoke directly to the collector. C410 is a dc blocking capacitor which allows only ac voltages to produce yoke current. L401 is a relatively high impedance compared to the yoke induc-



tance. During retrace time, a large positive pulse is developed by L401 which reverses the current through the yoke and moves the beam from the bottom of the screen to the top.

The picture height is controlled by a potentiometer in the emitter. The more resistance in series with the emitter the greater the amount of degeneration which takes place and the smaller the vertical size of the raster. The sawtooth voltage drop across the height control is the signal applied to the waveshaping capacitors discussed earlier.

For good linearity and output power, it is important that Q403 be biased correctly. Beta characteristics can vary from one transistor to another. So that each individual transistor may operate correctly, a vertical bias control is used. This adjustment is made by placing a milliammeter across R504 and setting the bias control for 120ma collector current.

R417 is a thermistor which is used to compensate for temperature changes within the output transistor. As collector current increases, the temperature of the transistor also increases which allows more collector current to flow and so on. This is referred to as thermal run-away and can destroy the transistor. The emitter resistance, however, prevents run-away from occurring. In addition, R417 compensates for small changes in collector current by sensing temperature changes. The ground end of the thermistor is soldered to the chassis close to the transistor. Since the chassis acts as a heat sink for this stage, changes in chassis temperature are conducted to the thermistor through its ground lead. The resistance of the thermistor becomes less which lowers the forward bias applied to the base of the output stage, thereby, stabilizing collector current.

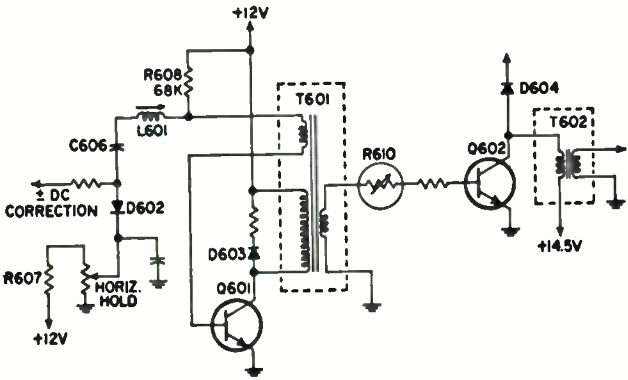
Vertical blanking for the picture tube is provided by coupling a portion of the positive retrace pulse through Z404 and R419 to the emitter of the video output stage. The zener diode is cut off until the positive pulse on its cathode reaches approximately 100v. At that point, the zener conducts and couples the pulse to the video output stage.

The retrace pulse tends to shock the deflection yoke into oscillation which would produce horizontal ringing bars across the screen. To prevent these ringing bars from developing, R422 is connected directly across the vertical yoke windings. The resistor reduces the "Q" of the deflection coils just enough so that the ringing voltage is damped out.

TV Chassis T908 Horizontal Sweep Circuits—Circuit Description

The horizontal oscillator uses the blocking oscillator configuration. The initial forward bias to start oscillation is provided by R608 through the feedback winding of the transformer. As the transistor conducts, the increasing collector current through the primary winding induces a voltage into the feedback winding which applies a positive voltage to the base of the NPN transistor. The rise in forward bias is very fast and the transistor becomes a closed switch almost instantly. The negative side of the feedback winding pulses the 15.750Hz resonant circuit formed by L601, C606, and a diode, D602 which acts as a variable capacitor.

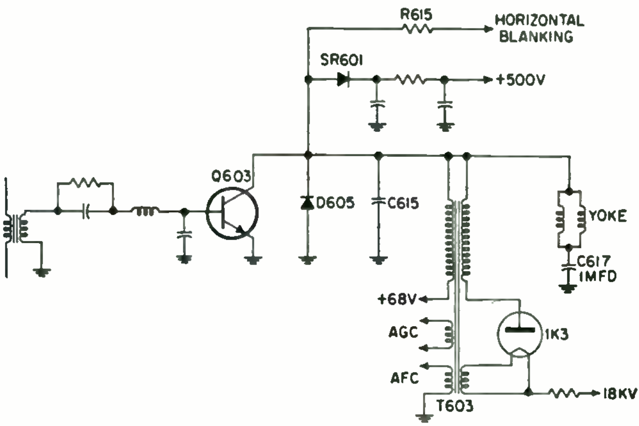
When collector current ceases to change, the field in the transformer collapses and reverses the polarity across



the feedback winding which immediately cuts off the transistor. The transistor remains cut off until the sinewave voltage produced by the resonant circuit goes into its positive half cycle of oscillation. At this time the base-emitter junction becomes forward biased and the cycle is repeated. D603 and its series resistor damp the high positive voltage spike which occurs when the transistor is switched off.

The frequency of the oscillator is controlled by the pulse or minus dc correction voltage from the AFC circuit. This correction voltage is applied to diode D602. D602 serves as a variable capacitor in series with the other frequency determining components. To act as a capacitor, the diode must be reverse biased. A positive voltage is placed on the cathode through a voltage divider network, R607 and the horizontal hold control. As the hold control is changed in resistance, the reverse voltage across the diode increases or decreases which changes the diode capacitance and the frequency of the oscillator. Any correction voltage from the AFC circuits also changes the capacitance of the diode and corrects for frequency errors.

L601 is the main frequency-determining component in the circuit. To adjust this coil, the horizontal hold control should first be set to mid-range and the AFC correction voltage shorted to ground at the junction of R601, R602 and R603. With a station tuned in, L601 is adjusted until the picture is steady or slowly drifting horizontally. When the AFC short is removed the picture will lock in.



The oscillator signal is coupled through another winding of T601 to the base of the horizontal driver. A thermistor, R610, is placed in series with the base to compensate for temperature changes within the oscillator transistor. As the temperature of Q601 changes, the collector current and the frequency of oscillation will change. The collector current increase is coupled to R610 which causes the thermistor resistance to decrease. This produces a heavier load across the secondary winding and causes a small change in the inductance of T601. The inductance change is such as to correct the frequency drift of the oscillator and to stabilize the collector current.

The driver stage is either cut off or driven into saturation by the base signal. The output signal appears as a rectangular waveform and is transformer coupled to the base of the horizontal output stage. When the driver is cut off by the base signal, T602 tends to ring as a result of the collapsing field in its windings. This can produce voltages which may exceed the ratings of the transistor and destroy it. D604 serves to limit the positive peaks of the ringing voltage to a safe value. The diode serves a second purpose: the rectified peaks are filtered and added to the supply voltages used with the phase splitter stage.

The horizontal output stage has three main functions: it supplies the yoke with the correct horizontal scanning currents, it develops the high voltage for the anode of the CRT and develops a +500v supply voltage for the CRT. In addition, auxiliary windings on the high voltage transformer supply pulses to the AGC and AFC circuits. Blanking pulses are also coupled out of this stage.

Q603 acts as a switch which is turned "on" or "off" by the rectangular waveform on the base. When the transistor is turned on, yoke current increases in a linear manner and moves the beam from near the center of the screen to the right side and C617 becomes charged. At this time the transistor is turned off by a negative voltage on its base which causes the transformer to oscillate. A high reactive voltage in the form of a positive pulse is developed by T603 which quickly reverses the current through the yoke and moves the beam to the left side of the screen. This pulse is stepped up by the high voltage secondary winding, rectified and filtered to produce the 18kv supply to the CRT anode.

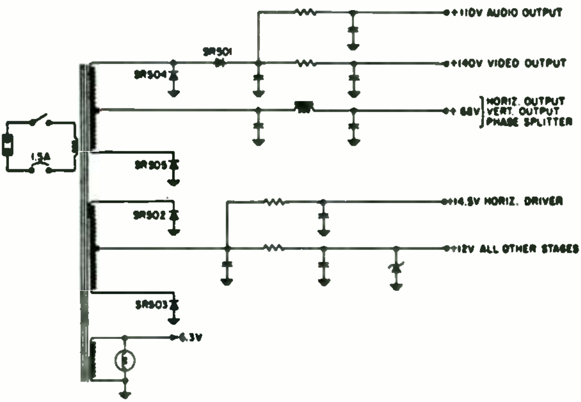
During the negative half-cycle of oscillation, the damper diode, D605, becomes forward biased. Capacitor C617 can now discharge through the yoke and damper diode to ground. The discharge rate is linear and the beam is moved from the left side of the screen to the center. The transistor then becomes forward biased by the base signal and the beam is moved on to the right side as before.

C617, in series with the yoke, also serves to block dc currents through the yoke and to provide "S" shaping of the current waveform. "S" shaping compensates for stretching at the left and right sides of the picture because of the curvature of the CRT face and the deflected beam do not describe the same arc.

The positive pulse developed during retrace time is rectified by SR601 and filtered. This produces +500vdc which is used by the focus control, the LDR Range adjustment, and the brightness control. A portion of this positive pulse is coupled through R615 to the emitter of the video output stage to provide horizontal blanking of the CRT.

TV Chassis T908—Power Supply and Tuner—Circuit Descriptions

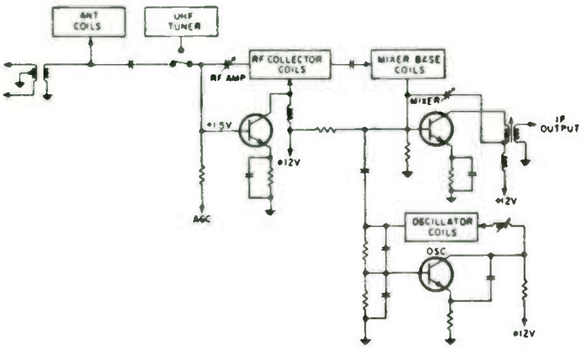
Power Supply. The dc supply voltages in the T908 chassis are developed by two secondary windings on the power transformer. Five separate dc voltages are developed. A low voltage winding connected in a full wave rectifier circuit develops the +12v and +14.5v supplies. The +12v supply is regulated by a zener diode and operates most of the small signal type transistors. The



+14.5v supply is used only with the horizontal driver stage and is separated from the +12v supply to provide better decoupling of the horizontal sweep pulses.

The second winding is also connected as a full wave rectifier to provide a +68v output. This supply is used to power the horizontal and vertical output stages along with the phase splitter. SR501 operates as a half wave rectifier to produce two higher dc voltages. The +140v supply is used by the video output stage and the +110v supply is used by the audio output stage. A 6.93vac winding supplies the pilot lamps and the filament of the CRT.

Tuners. An incremental inductance VHF tuner is used with the T908. In this type of tuner, small amounts of inductance are switched in or out as the channel selector is rotated from one station to another. The tuner in-

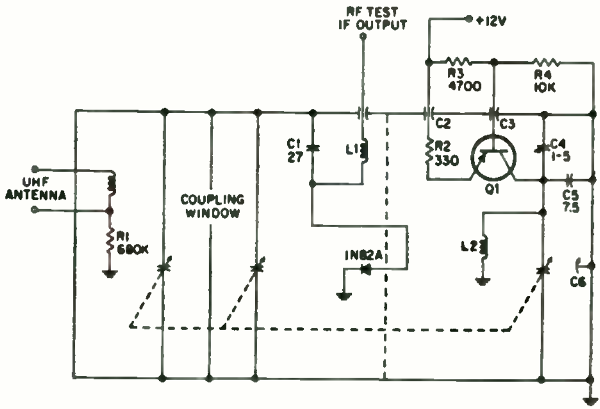


corporates NPN silicon transistors in the RF, mixer and oscillator stages. The RF amplifier is neutralized for stability and is controlled by a delayed RF AGC voltage. A nominal +1.5v is applied to the base of the amplifier so that the stage operates at maximum gain. When the received signal becomes strong enough an RF AGC voltage is developed which reduces the gain of this stage. The RF amplifier also functions as a 40 MHz IF amplifier when the tuner is set to the UHF position.

Signals from the collector of the RF stage are coupled to the base of the mixer stage where they combine with the oscillator signal. The mixer output signal is then developed across the IF transformer in the collector circuit and link-coupled through coaxial cable to the first IF amplifier. The mixer is neutralized by coupling a portion of the output signal back to the base.

The oscillator uses the modified colpitts configuration. Feedback voltage for maintaining oscillation is developed across a capacitance voltage divider network in the base circuit. The resistors across the capacitors connect back through the oscillator coils to the 12v supply and provide the initial forward bias on the base to start oscillation.

The tuner features pre-set fine tuning. This is accomplished by switching in individual oscillator coils for each TV channel. When the fine-tuning control is pushed in, a gear train engages a gear on the oscillator coil slug. The gear-train disengages when the fine-tuning control is released. This pre-set tuning arrangement is the same as used on tube-type tuners.



The UHF tuner is quite similar to the ones used with our tube-type models. It incorporates two passive RF preselector circuits, a PNP UHF local oscillator, and a 1N82A diode mixer. The tuner box is divided into three compartments: the RF preselector circuit, the mixer preselector stage and the mixer diode, and the third contains the oscillator circuit.

The antenna is terminated by two turns of wire which inductively couple the signal to the RF preselector circuit. This section consists of a solid metal bar with a variable capacitor attached to one end to form a resonant circuit tuned to the incoming frequency. The signal is next coupled to a similar resonant circuit in the mixer compartment. Coupling is achieved through an opening in the partition which separates the two.

The signal is then coupled from the mixer preselector circuit to one end of the mixer diode by a short length of wire. The opposite end of the diode extends through a partition into the oscillator compartment. The oscillator signal is coupled into the mixer lead to combine with the received signal. The difference frequencies produced by beating the oscillator signal with the received signal are coupled through a low pass filter. This filter allows the 40MHz IF to pass through without attenuation but filters out the high frequency oscillator signal and the RF signal from the antenna. The output signal is cabled to the input of the RF amplifier in the VHF tuner. You will recall that this amplifier converts to a 40MHz stage when the tuner is switched to the UHF position.

A PNP transistor is used in the grounded-base oscillator circuit. Another tuned line is used to control the frequency of oscillation. Positive feedback from collector to emitter through the transistor's internal capacitance sustains oscillation. Forward bias is obtained from the voltage divider resistors in the base circuit.

TV Chassis T908 and T915 — Service Information

Buzz in sound—on station. A condition of buzz, apparently only when a station is tuned-in, has been reported on some T908 and T915 chassis. This buzz can be eliminated by adding a 0.01μf capacitor from point 3A on the printed circuit board to chassis ground. This capacitor has been incorporated in later production. Also in some instances it has been reported that R312 on T908 chassis using a tone control was 470K instead of 470Ω. This will distort the frequency response of the amplifier and aggravate the buzz condition so check the value of this resistor when making the change. **Hum In Audio.** If excessive hum is noticed on T908 or T915 chassis, the following circuit change is suggested: Remove R308, 33K resistor, in the audio driver circuit, and replace it with a series combination of a 5.6K and 27K resistor. Be sure that the 27K resistor connects to the audio driver base and the 5.6K resistor to the 12v+ source (point VC). Then connect a 5μf., 20v electrolytic capacitor between the junction of the two resistors and chassis ground.

TV Chassis T908/T915—Production Changes

Intermittent Sound: Some reports have been received of intermittent sound accompanied by a "popping" sound in the audio. The sound IF stage uses a 2.2pf capacitor (C303) as a neutralizing capacitor and under certain circumstances this stage may tend to oscillate at a frequency around 20MHz. If this is the case, removing C303 will eliminate the "popping" and intermittent sound, however, it may be necessary to re-tune the sound input transformer, L301, as outlined in the service manual. In later production C303 will be a 1.5pf capacitor and R304 will be changed from 1K to 1.2K.

Horizontal Hold Range: If improvement in the horizontal hold range is desired, this can be achieved by shorting R603 (with a jumper wire) and removing the 390pf capacitor connected across the varicap, D602. On the T908 chassis this capacitor is C614 and on the T915 chassis it is C606. In later productions R603 will be changed from 47K to 1K and the 390pf capacitor is omitted.

Addition of AGC Control: R236 in the AGC circuit was changed from a fixed resistor (680Ω) to a variable pot to provide adjustment of AGC to compensate for variables in VHF tuner and IF characteristics. This control is mounted on the printed board in the same location as the fixed resistor. This is a 1500Ω pot, part No. 220182-2. In some chassis a 10K pot was used, but it was shunted with a fixed resistor to provide an equivalent value of approximately 1500Ω. This control is accurately set at the factory to provide 1.7v AGC voltage at the RF AGC point with a 2000μv signal at the antenna input. The control will not normally require adjustment in the field unless it is suspected that the factory setting has been changed or in the event that the VHF tuner or the 1st or 2nd video IF transistors are replaced. If adjustment is required: (1) Connect an ohm meter from ground to the junction of the control (R236) and D204 and adjust the control to provide a resistance of approximately 550Ω. (2) Turn the receiver on and check reception on all available channels. The control may be adjusted very slightly from this pre-set position to minimize snow on channels you normally receive snow free or to eliminate overloading on very strong signals. In most cases, however, the correct setting will be at the pre-set resistance as in step 1.

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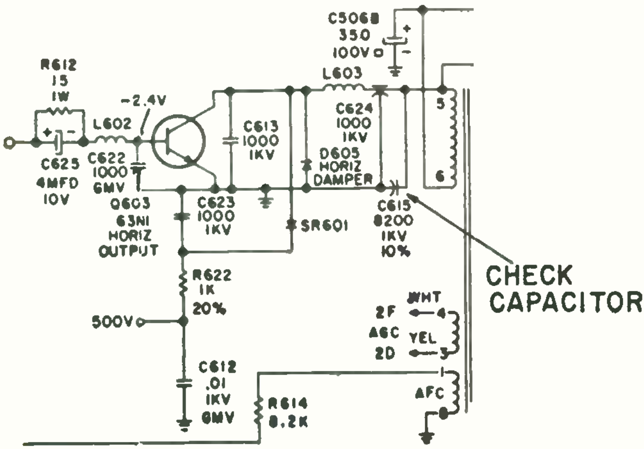
TV Chassis T908/T915 — Failure of Capacitor C615

Some reports have been received of capacitor C615 (8200pf) opening. This results in a sharp increase in resonant frequency of the horizontal output transformer with an



attendant increase in pulse voltage during retrace. This voltage can be sufficient to damage the output transistor. It is suggested that in all cases of horizontal output transistor failure, C615 should be checked and replaced as necessary before installing the new transistor. C615 has been changed in later production to a 2kv capacitor part No. 250290-17. Stock and use this capacitor as a replacement.

TV Chassis T937 – Failure of Vertical Driver

Failure of the vertical driver transistor may be caused by arcing from the dag coating on the CRT to chassis components. Capacitor C405 in some chassis was a .33μf, 400v unit which is larger than the originally specified .33μf, 75v unit. It is possible for this larger capacitor to touch the dag coating resulting in an "arc-through" damaging the transistor. When replacing the vertical driver always use the exact replacement transistor Part No. 610070-2 and if the larger capacitor is used, replace it with Part No. 250555-94.

Distorted Audio in TV Sets

You may encounter a few cases of distorted audio because of audio drift in television chassis using a 360847-2 quadrature coil with the polypropylene coil form. This coil can be readily identified since the form is a translucent colorless material.

To eliminate drift, production is now using as a replacement a new coil which can be identified by an opaque-white coil form. Also used in production are some 360847-2 coils having a shorter, blue colored form which is also an acceptable replacement for the earlier type.

All replacement 360847-2 coils shipped from Magna-Par will be of the improved type.

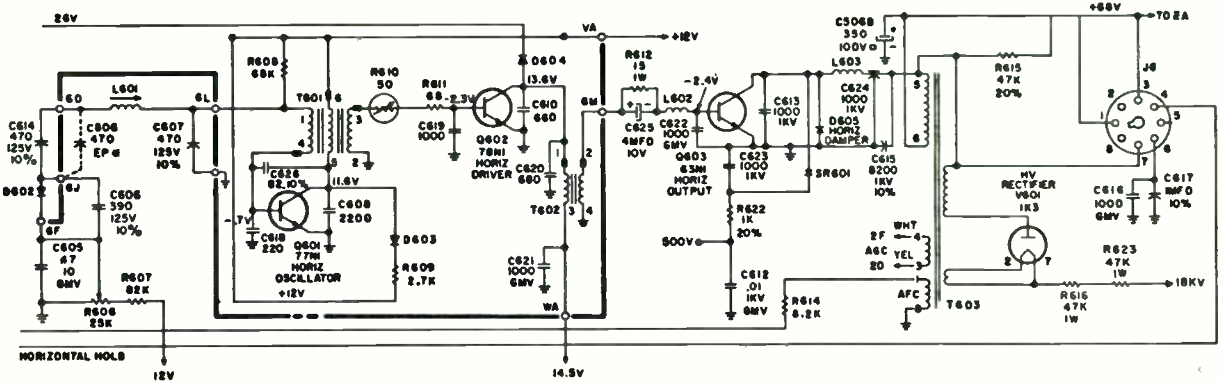
Transistor TV Chassis T908 — Troubleshooting the Horizontal Circuits

Horizontal circuit defects can often be analyzed by observing the pattern on the screen. As an example, suppose the set had sound but no raster. The first step would be to check for high voltage. If there is no high voltage, check for presence of ac at the cap of the high voltage rectifier. If the ac component is missing, any one of the three horizontal stages could be at fault. Voltage measurements, starting with the horizontal output and working back toward the oscillator, should be the next step.

Unlike its tube counterpart, the horizontal output circuit in the solid-state receiver does not draw excessive current when signal drive is lost, but instead becomes cut off. This is also true of the horizontal driver stage (Q602). There are, however, several unique symptoms which may be obtained on this receiver due primarily to the design of the horizontal output circuit.

For example, high voltage can be developed with the horizontal yoke windings open. This condition produces a straight vertical line on the CRT.

Another condition unique to the output circuit is that in most cases the circuit will continue to function with the damper diode (D605) open. This is because the horizontal


26V
VA
+12V
+68V
TO 2A
C506B 350 100V
R612 15 1W
L603
R615 47K 20%
J6
R608 68K
D604
13.6V
L601
6D
6L
6M
T601
R610 50
R611 68
-2.3V
C610 680
L602
-2.4V
C613 1000 1KV
C624 1000 1KV
D605 HORIZ DAMPER
C614 470 125V 10%
C608 470 EP
C607 470 125V 10%
C619 1000
Q602 78N1 HORIZ DRIVER
C625 4MFD 10V
C622 1000 6MV
Q603 63N1 HORIZ OUTPUT
C623 1000 1KV
SR601
C615 8200 1KV 10%
HV RECTIFIER V601 1K3
C616 1000 6MV
C617 1MFD 10%
D602
6J
C626 82 10%
11.6V
C620 680
T602
C606 390 125V 10%
C609 2200
6F
-.7V
C618 220
Q601 77N1 HORIZ OSCILLATOR
D603
R609 2.7K
C621 1000 6MV
R622 1K 20%
500V
WHT
2F
AGC
YEL
2D
R623 47K 1W
18KV
C605 47 10 6MV
R607 82K
+12V
C612 .01 1KV 6MV
R614 8.2K
AFC
T603
R616 47K 1W
R606 25K
WA
HORIZONTAL HOLD
12V
14.5V

output transistor has the ability to function as the damper should D605 become open. An open damper diode, however, usually causes poor horizontal linearity having its greatest effect on the left side of the screen.

In addition, the 500v "boost" supply is not a rectified voltage because of damper diode action, as is the case in most tube type receivers. Instead a separate boost diode, SR601, rectifies the horizontal pulses from the collector of the output to supply the boost voltage.

The boost voltage connects to only three points. These are the focus control, brightness control and the LDR range control.

The horizontal AFC circuitry is very similar to that used in tube type receivers. However, the dc correction voltage developed by the AFC diodes is not directly applied to the horizontal oscillator. Instead, this voltage is applied to a varicap (D602) which forms part of the horizontal oscillator resonant frequency. The AFC voltage applied to D602 varies its effective capacitance and maintains the oscillator "on frequency."

Should loss of horizontal sync occur, while vertical sync remains normal, the AFC diodes and their associated circuitry, as well as the varicap, should be checked. Normally, if the horizontal hold control varies the oscillator frequency around its correct point, the varicap can be discounted.

A good indication of the condition of the AFC diodes is to measure the dc voltages at the high side of the 47K resistors R601, R602, connected to these diodes (these voltages should be measured with no signal).

If this voltage measures low, check the amplitude of the flyback pulse applied to the cathode-anode side of these diodes (normal 15v P-P).

Another good checkpoint would be the sync signals applied to the AFC diodes through capacitors C602 and C603 (these should measure 12 to 15v P-P).

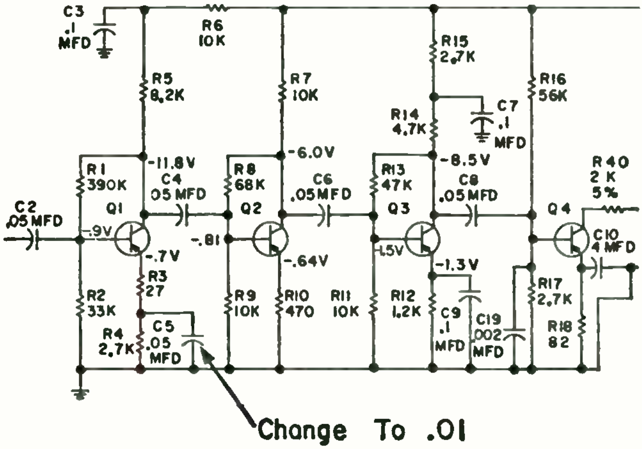
TV Chassis T915 — A Description of Production Changes

Most of the production changes in this series do not contain a code. They consist of the following: Better sync separation has resulted when R239 was changed from 820Ω to 330Ω. Vertical sync has been improved by changing R403 from 82K to 47K. By removing capacitor C606, the horizontal hold range is increased. A decoupling network has been added to prevent horizontal pulses from getting into the video. The network consists of resistor, R251, (33Ω 20%) inserted between R220 and the vertical hold and bias controls, plus electrolytic capacitor C244 (10μf + 100% −10%) between R220 and R251 connected to ground. By changing R308 from 33K to 27K and adding another decoupling network the hum in the sound was reduced. This decoupling network consists of resistor R314 (5.6K 10%) inserted between R308 and the collector of the audio driver transistor, Q203 (70N1), plus electrolytic capacitor C138 (4μf 15v +100% −10%) between R308 and R314 connected to ground. By changing C303 from 2.2pf to 1.5pf and R304 from 1K to 1.2K, "popping" and intermittent sound is eliminated. Variations in characteristics of the VHF tuner and IF are compensated by substituting a 1500Ω pot for the 680Ω resistor (R236) and by changing R212 to 4.3K. The vertical linearity is improved by changing C405 from 0.33μf to 0.22μf and C406 from 1.5μf to 1.0μf.

A BA production code suffix was used to identify the following production changes: A diode is connected between the high-voltage horizontal transformer (T603) and the collector of the AGC keyer transistor Q206 (79PI). This transistor is given additional protection against failure by inserting resistor, R252 (100Ω10%), between the diode and the transformer. The capacitor C235 was removed from the junction of D204 and R235 to ground. Noise immunity was improved by changing C238 from 1μf to 0.33μf and C604 from 1μf to 0.47μf, plus inserting resistor R624 (1K 10%) between the emitter of the phase splitter transistor Q209 (76N1) and capacitor C602. Resistor R212 was changed from 10Ω to 470Ω for the new VHF tuner. The driver stage was decoupled from the output stage by adding capacitor C412 (0.01μf 20%) between the base of the vertical output transistor Q403 (64N1) and ground. The "blocking" of sound was eliminated by adding capacitor C322 (2.2pf±.25) between the collector of the sound IF transistor, Q301 (69N1) and ground.

Remote Control Receiver 704028—Sensitivity

Some comments have been received indicating that the sensitivity of the receiver may be such that extraneous signals will trigger the relays. In some cases the 28kHz relay (Channel Change) was being triggered by the second har-



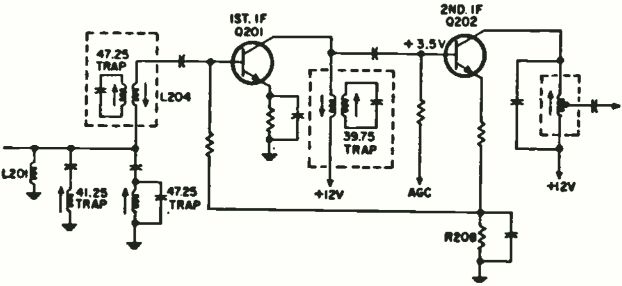
monic of the horizontal oscillator as this stage warms up during initial turn on of the receiver. In these cases the receiver sentivity can be reduced, without materially effecting the normal operating range of the hand transmitter, by changing the emitter bypass capacitor in the 1st stage of the receiver from .05μf to .01μf.

TV Chassis T908 and T915, Video IF and Output—Circuit Description

IF Circuits

The low impedance link coupling from the VHF tuner is terminated by L201 on the IF board. Three trap circuits are located in the base circuit of Q201. Two of them provide trappage for adjacent channel sound and the third provides 28db reduction of the desired sound carrier.

L204 is the input coil for Q201 and helps to shape the over-all IF response curve. Base bias voltage for Q201 is taken from R208. Emitter current flow through Q202 develops a positive voltage across R208 which is used to forward bias Q201. The IF transformer in the collector circuit is broadly tuned. An absorption trap tuned to the adjacent channel picture carrier frequency is wound on the same coil form.



The IF signal is next capacitively coupled to the base of the second IF stage. Q202 also has a broadly tuned transformer in its collector circuit. This stage is particularly important since its base is directly controlled by the AGC voltage. A nominal +3.5v is presented on the base to provide forward bias. At this voltage, the stage operates at maximum gain. Also, as stated earlier, the voltage drop across R208 supplies forward bias to the first IF stage.

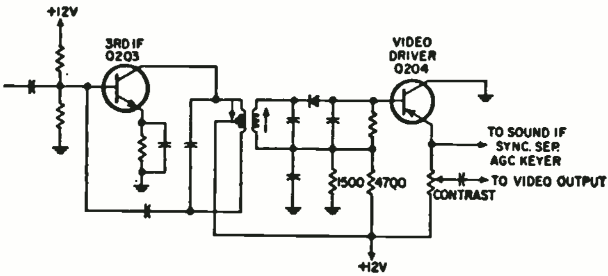
When AGC voltage is developed, the base of Q202 becomes more positive and increases collector current. The voltage drop across the emitter resistor becomes more positive and increases the collector current of the first IF stage. With these particular transistors, as collector current increases, gain decreases. This method of reducing gain is referred to as forward AGC.

The third IF stage is forward biased in the conventional manner with the voltage dividing resistors in the base circuit. The IF transformer in the collector circuit is sharply tuned to shape the IF response curve. The transformer is tapped so that an out-of-phase voltage can be coupled back to the base to neutralize this stage.

The IF signal is coupled through the transformer to the detector diode. The diode rectifies the IF signal and the remaining IF frequency components are filtered to ground. The polarity of the diode produces a video signal with negative-going sync pulses. This signal is then dc coupled to the base of the video driver stage.

Video Circuits

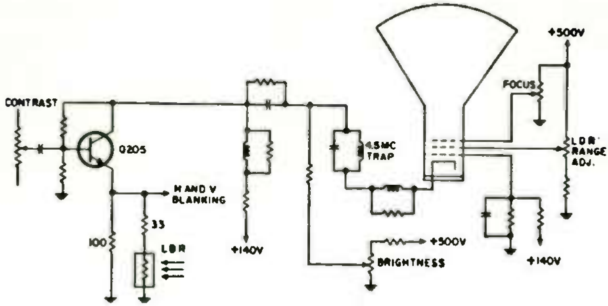
The video driver uses a PNP silicon transistor in an emitter-follower circuit. With this arrangement, all of the signal voltage is developed across the emitter resistance which, in this case, is the contrast control. The signal at the emitter has the same polarity and approximately the same amplitude as the signal on the base. The video signal at this point is of special importance since it is coupled to four different circuits: the video output stage (through the contrast control), the sound IF amplifier, the AGC circuits and the sync separator.



The video output stage is biased for class "A," linear operation. The base biasing resistors are connected directly to the collector. This is a negative feedback circuit for both ac and dc which stabilizes the amplifier and improves frequency response. The emitter resistor is unbypassed which results in some loss of gain. However, this is done to accommodate the LDR used in the automatic brightness and contrast circuit.

The transistor used in this stage is a silicon type NPN which is capable of handling relatively high collector voltages; the collector returns to a +140v supply. The picture tube requires a nominal P-P video signal of 50v at normal contrast. Because of variations from one picture tube to another the output stage must be able to supply ample drive beyond what is normally needed. At maximum contrast, the video signal has a P-P value of around 100v. A heat sink is attached to the transistor case to provide heat dissipation.

The video signal is amplified and inverted in the collector circuit so that sync tips are positive. This is the correct polarity for blanking the picture tube when the cathode is the driven element. Peaking networks are also included to optimize high frequency response. A 4.5MHz trap is inserted in series with the cathode to attenuate any sound carrier that may be present.



The brightness control affects the brightness of the picture tube by varying the CRT cathode voltage. Increasing the positive voltage on the cathode has the same effect as increasing the negative voltage on the control grid; that is, brightness will be reduced. In this case, the control grid is supplied with a fixed positive voltage through a voltage divider network. A more positive voltage is applied to the cathode so that the control grid is effectively negative with respect to the cathode.

Focusing of the beam spot is accomplished by adjusting the grid 3 voltage on the CRT from zero to 500v. This grid acts as a lens to converge the electrons making up the beam into a small spot at the time the beam strikes the faceplate.

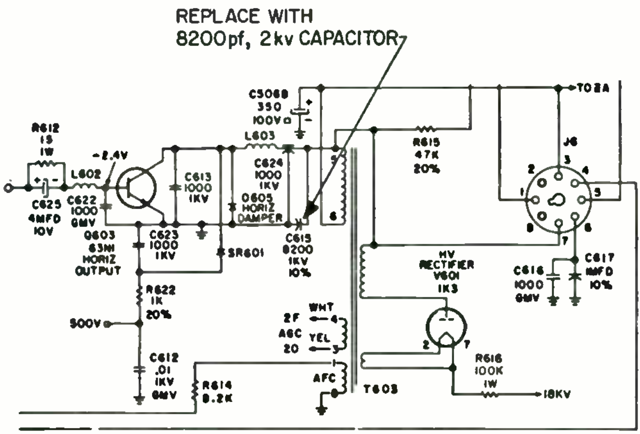
Blanking of the picture tube is also provided in the video output stage. Horizontal and vertical blanking pulses are coupled from the sweep circuits to the emitter of Q205. These pulses are positive-going and, therefore, reduce the forward bias voltage on the base-emitter junction. The sync and blanking pulses contained in the composite video signal on the base are negative and also reduce forward bias. The combination of negative sync on the base and positive blanking on the emitter results in amplified, positive-going blanking pulses in the collector circuit which cut off the CRT during retrace time.

The LDR circuit provides an automatic means for adjusting brightness and contrast under varying room lighting conditions. The circuit accomplishes this control by varying the emitter resistance in the video output stage with a light dependent resistor. The LDR forms a part of the unbypassed emitter resistance of the video output stage. As room lighting increases, the LDR resistance becomes less which results in less total emitter resistance. The stage produces more gain, since there is less degeneration, and drives the CRT with a higher amplitude video signal to produce more contrast. As the stage conducts harder under these conditions, the average dc collector voltage decreases. Since the collector is dc coupled to the CRT cathode, this results in a decrease in cathode voltage and a higher brightness level on the picture tube.

As room lighting decreases, the LDR increases in resistance, produces more degeneration and less gain to reduce contrast. The output stage conducts less which allows the collector dc voltage to become more positive and reduce picture tube brightness. A 33Ω resistor is inserted in series with the LDR to limit the variations of resistance in the circuit so that over-correction of brightness and contrast does not occur.

TV Chassis T908/T915—Horizontal Output Transistor Failure

Capacitor C615 (8200pf,1kv) forms part of a resonant circuit in the horizontal output circuit. Should this capacitor open, voltage pulses of sufficient amplitude to damage the horizontal output transistor will be developed in the output circuit. Ultimate destruction of the transistor may not occur for a period of weeks after the capacitor has



opened and again after a replacement transistor has been installed.

It is suggested that C615 be checked for open prior to installing a replacement horizontal output transistor. In the event a positive check of the condition of the capacitor cannot be made, the capacitor should be replaced. Use Magna-Par Part No. 250290-17, which is a 8200pf capacitor rated at 2kv, for replacement purposes.

Remote Control Model 704054-3—Relay K-106 Slow to Release

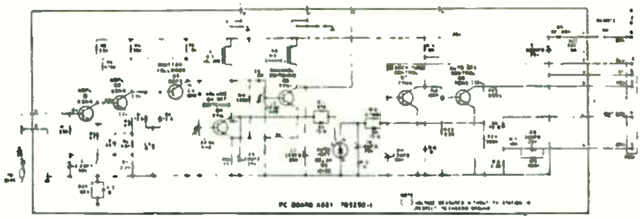
There is a small piece of clear tape attached to the armature (movable assembly) of Relay K-106 to provide a gap between armature and core when the relay is closed. The gap is required to prevent the relay from remaining closed because of residual magnetism. The contacts of the relay should open, removing ac to the TV chassis, when the TV Off function has been activated. It is possible, however, for adhesive to be squeezed out around the outer edges of the tape, come in contact with the relay core and hold the contacts in a closed position for as long as five minutes after the TV Off function has been activated. This condition can be corrected by removing the clear tape, cleaning all adhesive from the armature and core and replacing the tape with a similar size piece of masking tape. The armature can be removed from the relay for replacement of the tape by removing the armature return spring and spacer board and lifting the armature free.

Remote Receiver Model 704053—Bench Service

The remote receiver can be powered and checked, with the receiver disconnected from the TV instrument, as follows:

Note: Referring to the schematic diagram, terminal "G" is the common connection and the connections to terminal "G" are indicated as connection to the chassis. This is correct as far as the TV chassis is concerned, however, terminal "G" is not connected to the remote chassis. Terminal "G" connections are isolated from the remote receiver chassis by the network R25/C13.

(1) Connect 120vac between terminals six and eight of P401. Turn remote switch on. Use isolation transformer between receiver and ac line or connect a 26vdc supply between terminal "G" and the cathode of D5, with the nega-



tive side of the supply to terminal "G". (2) Press the LOUDNESS ON-OFF function button on the transmitter while watching K1 for momentary operation. (3) Press STATION SELECT button on the transmitter while watching K2 for momentary operation. (4) A. Connect a jumper between terminals "H" and "C". This connects transistor Q7 collector to the collector of transistor, Q5 as though a VHF search tune function was in progress. B. Forward bias places transistor Q7 into conduction by applying about +.6v to the base. This can be accomplished by connecting a low voltage bias supply between terminals "G" and "E", with the negative side of the supply to terminal "G". Check K2 for operation as transistor Q7 is biased into conduction.

Solid-State TV Chassis T908 and T915

An earlier newsletter reported that failure of the horizontal output transistor (Q603) may be caused by failure of capacitor C615. Recent field reports indicate a need for re-emphasizing the importance of checking this capacitor. Whenever it is necessary to replace the horizontal output transistor, capacitor C615 should be replaced at the same time using Magnavox Part No. 250290-17, which is an 8200pf capacitor rated at 2kv.

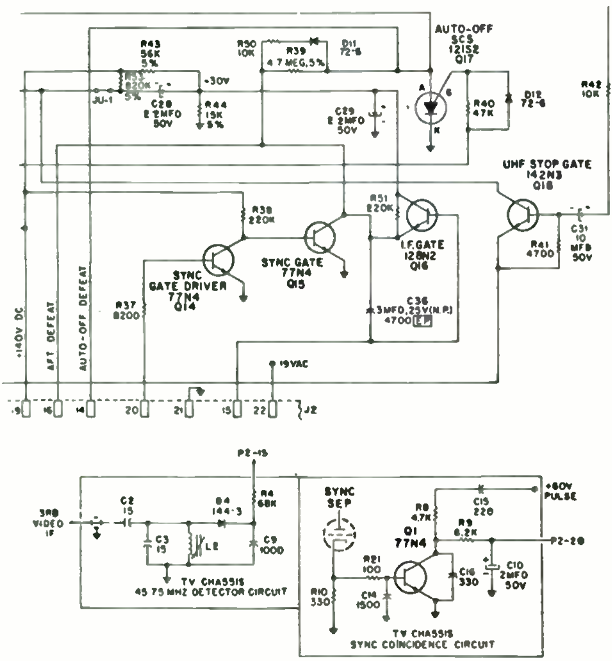
Some receivers may have 60Hz hum bars on the screen when the VHF tuner is set to the VHF position. This symptom can be caused by 60Hz radiation from the UHF neon indicator lamp circuit. The problem can be corrected by moving the UHF indicator lamp ground lead from its present grounding point on the control unit and reconnecting it at a grounding point on the main chassis. A convenient grounding point is the grounded terminal pin (AC-2) located adjacent to the Vertical Hold Control (R73).

Amplifier Models A595/A596—Resistor Identification

The Model A595 and A596 amplifiers use 1w carbon and 2w wire-wound resistors that have the same body size and configuration as typical 1w resistors. The 2w wire-wound resistors can be identified by the first color band, which is approximately twice the width of the other value coding bands. The 2w resistors, which must not be replaced with any lower wattage rating, are identified in the replacement parts list of their respective service manuals.

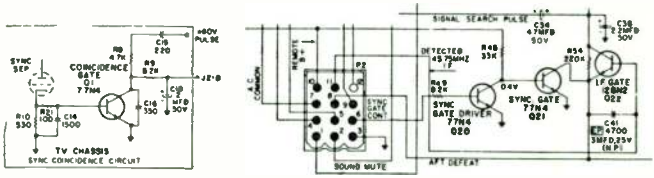
Remote Control Receiver Models 704064/704065—Erratic Stopping During UHF Search Operation

The correct adjustment of the REMOTE SENSITIVITY control is important for proper stopping action during UHF



704065

search, but under most signal conditions this adjustment is not critical. Under adverse signal conditions, such as weak signal or strong images, the SENSITIVITY control may require critical adjustment to reduce erratic operation on



704064-1

UHF stations. The following circuit modifications will make the adjustment of the SENSITIVITY control less critical and make the UHF search operation more positive under adverse signal conditions.

Remote Control Receiver Model 704064

- Change the value of capacitor C41 from .0047μf to 3μf, 25v non-polarized, Part No. 270070-603.
- Change the value of capacitor C15, located on the AFT board, from 150pf to 220pf.

Remote Control Receiver Model 704065

- Change the value of capacitor C36 from .0047μf to 3μf, 25v non-polarized Part No. 270070-603.
- Change the value of capacitor C-15, located on the AFT board, from 150pf to 220pf.

TV Model 1S117/2S117—12DEP4 Picture Tube Replacement

Those models using the T917-02 TV chassis employ a type 12DEP4 picture tube. When a replacement picture tube is needed, it is said to be important that you use only a Magnavox replacement 12DEP4. Physical dimensions for the 12DEP4 will vary between the different picture tube manufacturers to the extent that the cabinet back cannot be fitted into place if some general replacement types are used.

TV Chassis T925—Selection of Correct Replacement Horizontal Output Transformer T501

Before ordering a replacement horizontal output transformer (T501), inspect the original transformer. If its terminals are arranged in two rows as in Fig. 1, replace it with Magnavox Part No. 361048-4. If its terminals are arranged in a semicircle as in Fig. 2, replace it with Magnavox Part No. 36A039-3.

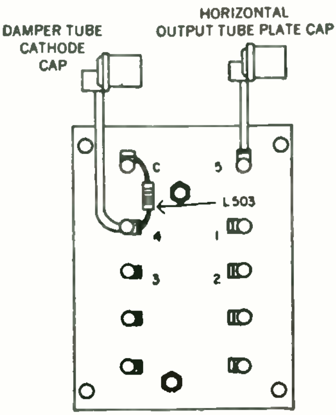


Fig. 1—Replace with Part No. 361048-4.

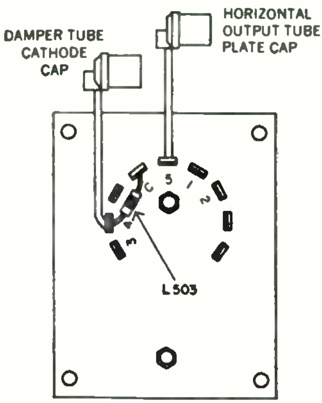


Fig. 2—Replace with Part No. 36A039-3.

TV Chassis T925—Selection of Correct Replacement Volume ON/OFF Control VR1

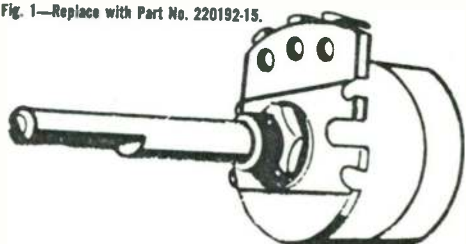
Before ordering a replacement volume ON/OFF control (VR1) inspect the original control. If the control has a flat shaft as in Fig. 1, replace it with Magnavox Part No. 220192-15. If the control shaft is knurled and slotted as in Fig. 2, replace it with Magnavox Part No. 22A009-3 (on T925-03 chassis) or Magnavox Part No. 22A010-17 (on T925-04 and later chassis).

All replacement 340129-2 tuners from Magna-Par will be the current versions, with resistor R4 mounted in place between the AFT terminal and the terminal strip. When replacing either of the two earlier versions with the current version, the AFT lead must be connected directly to the terminal strip end of resistor R4 on the tuner.

Color TV Chassis T940—Elimination of Channel 2-6 Beat Interference

Kit No. 171026-1 is now available from Magna-Par Branches. This kit includes all necessary parts and instructions for modification of T940 chassis to eliminate the beat interference pattern reported in low-channel VHF signal areas. This modification includes the following: (1) Changes in the QA1 (3.58MHz switch) circuit on the ATC Board. (a) 1μh Choke (Part No. 360522-9) added, Emitter to ground. (b) 3.9K resistor (Part No. 230104-69) added in base circuit. (c) 15pf capacitor (Part No. 250546-1509) added, base to ground. (2) Eliminate ground lead between the ATC switch and ATC board, ground the ATC switch at the Tuner/Control Assembly and point G1 on the ATC board in the ATC chassis.

Fig. 1—Replace with Part No. 220192-15.



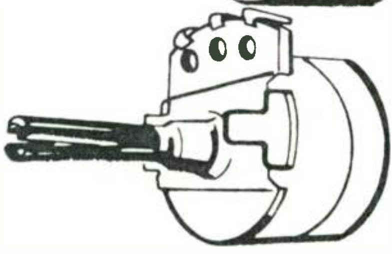


Fig. 2—Replace with Part No. 22A009-3 (T925-03 chassis) and Part No. 22A010-17 (T925-04 and later chassis).

MAGNAVOX
Color TV

Color TV Chassis, 45 Series — Color Temperature Adjustment

Some confusion exists in the field concerning the procedure for color temperature adjustment. Circuits associated with these adjustments are not the same in the 45 Series chassis as in previous color TV chassis and the adjustment procedure is *not* the same. Adjustment instructions in Manual 7274 (45 Series) did not point out these differences. Also, in late models incorporating the Chroma-Tone (Sepia) switch feature, the switch must be in the OFF position while setting color temperature. To clarify this situation the entire procedure is outlined here:

1. Set BRIGHTNESS, RED, BLUE and GREEN and CRT BIAS controls fully counter-clockwise. Set CONTRAST at mid-range and BLUE and GREEN DRIVE controls to maximum (full clockwise).
2. Set the CHROMA-TONE switch to OFF and the NORMAL/SERVICE switch to SERVICE.
3. Advance each of the three SCREEN controls until each produces a horizontal line on the picture tube. If any of the controls fails to produce a line, advance the BRIGHTNESS control slightly until the line appears. The objective here is to obtain equal brightness level of all three lines with the *lowest* possible setting of the BRIGHTNESS control and with the CRT BIAS control fully CCW!
4. Return the NORMAL/SERVICE switch to NORMAL set the BRIGHTNESS control to maximum and then

advance the CRT BIAS control until the picture just starts to "bloom."

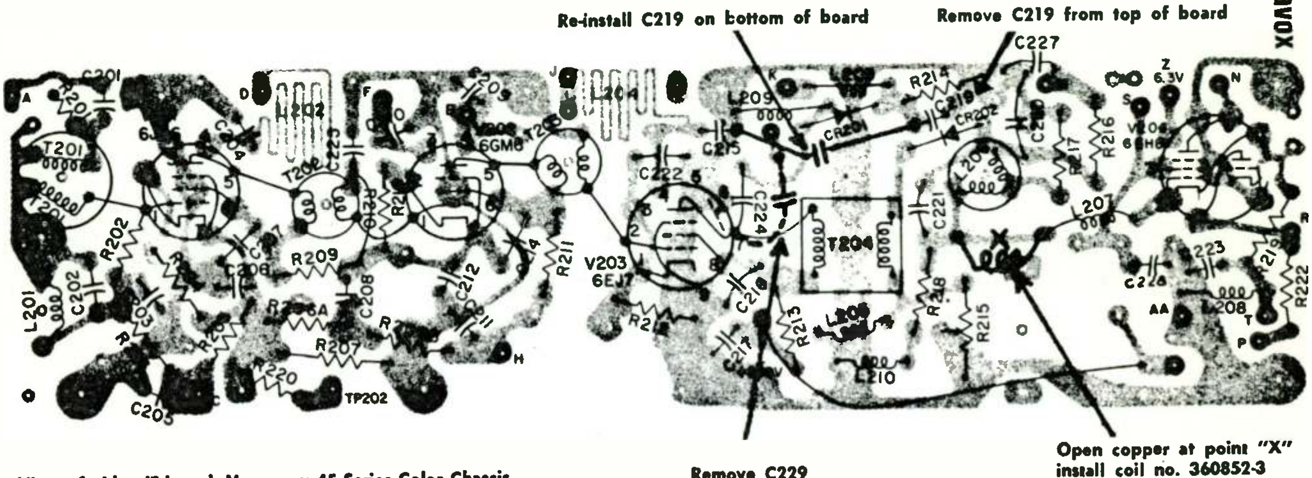
5. Return the BRIGHTNESS control to normal and adjust the BLUE and GREEN DRIVE controls to produce a normal black and white picture. Check the picture at all brightness control levels for proper tracking of the three guns. If the screen controls (step 3) have been accurately adjusted, the color temperature of the picture tube should remain the same at all brightness levels. If not, repeat the adjustments.

Color TV Chassis 45 Series — Circuit Modification

In some channel 8 areas reports have been received of an unusual interference pattern on the screen of the 45 Series Color TV Chassis incorporating the AFC feature. This was found to be caused by the 4th harmonic of the picture IF signal (which falls within the channel 8 passband) being fed back to the front end and resulting in the development of a beat signal. Since the resulting signal is modulated, the pattern on the screen will vary and has at times been described "loosely" as a herringbone pattern and at other times as being similar to diathermy interference. This type of interference can be readily identified, however, if removing the 6BZ6 tube in the AFC circuit materially reduces the interference.

Changes have been incorporated in production to eliminate this interference.

Modification instructions for earlier chassis are as follows: 1. Remove the IF board top shield and remove C229 — 0.47 μf. capacitator from the IF board. This capacitor is not marked on the board, but can be located rather easily. It is positioned on the top side of the board between C224 and the 3rd IF shield. (See illustration). Note: C229 is not replaced by another capacitor since the space coupling is satisfactory for feeding the IF signal to the AFC board. Removal of this capacitor will tilt the IF curve. This will not be noticeable in the picture, but may cause a significant reduction in chroma under weak signal conditions. Adjustment of the 3rd IF will be necessary and *this adjustment is critical.* Working from the top side of the board, this is the second (or



View of video IF board, Magnavox 45 Series Color Chassis.

lower) core in the can. Using a hex tuning wand, insert it through the first core into the second. *Do not turn the top core.* Turn the lower slug ¾ of a turn *counter-clockwise.*

2. Change the 6BZ6, AFC amplifier tube to a 6BA6, readjust the secondary of the AFC discriminator. This can be done rather easily by tuning in the channel 8 signal, with the AFC in operation, and retune the secondary for the proper tuning point.

Now observe the picture on channel 8. This modification should normally reduce the interference to an acceptable level. In more persistent cases, however, it may be necessary to make the following additional changes.

1. Remove the chassis and then the shield under the IF board. Remove capacitator C219, 10 pf from the top of the board and reinstall on the bottom side. Solder one lead to the point to which it was originally connected. Add a 1 inch wire to the other capacitor lead and solder to the ground connection at the same point where C215 is connected. This simply places the ground connection of C219 at a new point. (See illustration.)

2. Open the circuit between L206 and L207 by cutting a ⅛ in. section of the copper land from the board and install choke #360852-3 across this open circuit.

3. Top and bottom IF shield should then be replaced, being certain to resolder the bottom shield at all six points.

4. Insert a 5600 Ω resistor at point C on the AFC board, in series with the AFC voltage line to the tuner.

5. Re-install the chassis in the cabinet and check reception, particularly on channel 8.

45 Series Color TV Chassis—Audio Problems

Some models using the 45 series chassis have an objectionable 60 cps hum in the sound. It has been found that this hum can be caused by a ground loop resulting from grounding the shields of the audio leads at the loudness control to the tuner and control mounting plate. This hum can be removed by cutting the jumper wire which connects from the low end of the loudness control to the ground lug on the mounting plate.

Production changes have been incorporated to improve the audio high frequency response in 45 series color chassis which utilize the AP92-01-00 external audio amplifier. Earlier production chassis may be modified in the field as follows: parallel R315-100K resistor with a 1500 pf capacitor, replace C26, 1000 pf, with a 3300 pf capacitor. On 45 series chassis with internal audio systems, replace C126, 1000 pf, with a 3300 pf capacitor.

In self-contained audio versions of the 45 series chassis, an occasional unit may have higher than normal minimum volume hum because of component stacking tolerances to the low side. To correct this condition, add a 100 μf 200v electrolytic across C130B. This change has been made in production.

A small quantity of the initial production of the 3RT540K may have a noticeable audio buzz when the remote control audio step relay is in No. 3 or No. 4 position. To eliminate the buzz, install a .01 μf 1000v capacitor to ground from the ac connection on the terminal strip, located on the remote receiver. A blue ac lead from the TV chassis is connected to this terminal.

Color TV Chassis 45 Series and 904 Series — HV Arcing or Corona

The following checks are suggested as preventive maintenance for high voltage arcing or corona:

1. Check the lead dress of capacitor C118 and be sure that the leads are dressed as far as possible away from the focus coil.

2. Check the focus coil and if there is any evidence of arcing on the coil, replace it.

3. Check the HV Transformer "tire" and if there are any cracks or breaks in the "tire," replace the transformer.

4. Check the spacing between the 6BK4 shunt regulator tube and the HV transformer tire. Spacing should be at least ⅝ in., if not, bend the tube mounting bracket to provide proper space.

5. Check the 3A3 HV rectifier filament leads and be

sure that they are dressed away from the 3A3 tube and the HV transformer. If not, tape the leads to the 3A3 socket metal support to hold them away.

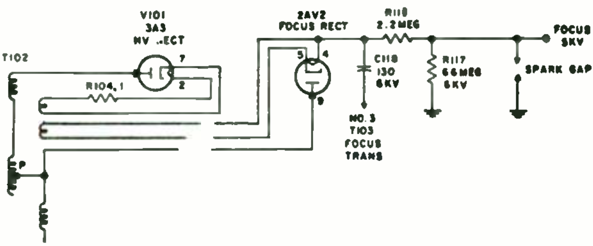
6. Check resistor R118 (4.7 M) dress it away from the ground point on the terminal board.

7. Check the spark gap terminal, which is a part of the focus lead terminal on the HV transformer board, and if necessary adjust it to provide a 3/16 in. gap between the terminal and the transformer core. To do this bend the end of the terminal away from the board and toward the transformer core.

Color TV Chassis 45 and 904 Series — Production Change

A production change has been made in both the 45 (21 in.) and T904 (25 in.) series color TV chassis which incorporates a tube-type focus rectifier. A partial shematic diagram illustrating this circuit is shown. Your attention is called to the fact that the high voltage transformer used in

ALTERNATE FOCUS RECTIFIER CIRCUIT



chassis with the 2AV2 focus rectifier has been changed, to provide the additional filament winding needed. Part No. for the new HV transformer used in the 45 series chassis is 361084-2. For the T904 chassis the part No. is 361138-3. These transformers can be used as service replacements in the earlier versions, if desired. Your attention is also called to the fact that some type 12HG7 tubes have been used in production on these chassis in place of the 12GN7 video output tube. These two tube types are directly inter-changeable.

T918/T919/T920 Chassis—Improved Horizontal Range

The horizontal hold control is being changed from 35K (part No. 220146-48) to 45K (part No. 220146-69) to provide improved hold control operation.

A 10K resistor has been added in series between R533 (180K) and point D (top of the hold control) on the deflection board, in conjunction with the 35K pot.

In replacing the hold control, the 45K pot (220146-69) should be used. The 10K resistor should be removed and R533 returned to point D.

T911/T918/T919/T920 Color Chassis—Production Changes

It was noted in service literature that some color sync problems arose in the T911/T918/T919/T920 chassis that could be caused by a defective diode in either the color killer detector or color phase detector circuits. Further checks have shown that arcing in the picture tube may be an indirect cause of the diode failure. Spark gaps are provided on the chroma board for the CRT grid leads. In the case of the blue grid, the spark gap ground was connected at the ground lead for the V706. The spark gap is now being relocated in production to return more directly to chassis ground—from the ground lug on the terminal strip used to mount R147 and R146 in current production. In earlier production, the ground lead could be extended and connected to the same ground point as the spark gap for the red grid.

It is suggested that this change be made when replacing a defective killer phase detector diode. It should be remembered that these diodes are matched and should only be replaced in matched pairs.

When the focus rectifier on the T911 chassis was changed in production from a 2AV2 to a 1V2, a 3.6Ω resistor was connected in series with the 1V2 filament. Some cases were reported indicating that the CRT screens on these sets could not be extinguished, during the white balance adjustment, by setting the brightness control. This problem was corrected by adding an 18Ω resistor across the 3.6Ω resistor in the 1V2 filament circuit. In future production this resistor will be changed to 3Ω.

Color TV Chassis T911/T918/T919/T920—Color Sync Problems

Either the color killer detector diodes, CR701A & CR701B or the color phase detector diodes, CR702A & CR702B, can be the cause of intermittent loss of color sync, poor color sync or in some cases, even loss of color. These diodes are specified as matched pairs, which means that they have identical characteristics. If one of the diodes should suffer a change in characteristics, operation of the circuit will be impaired. The usual resistance checks will not be satisfactory in determining if the suspected diode has changed characteristics. If you suspect that either the killer detector or phase detector are at fault, the following check is suggested:

Connect a color bar generator to the receiver and set it for a normal color bar display. Remove the 3.58MHz oscillator tube, V708, and ground the junction of R756A and R756B in the color killer detector circuit. Under these conditions measure the dc voltages developed across each diode to ground with a VTVM. Check the phase detector diode first and compare the voltage readings. On a typical receiver the cathode of CR702A measured +53v and the anode of CR702B measured −56v. The polarity of the voltages are opposite, but we are concerned with the difference in amplitude which in this case is 3v. Voltages on CR701A and CR701B measured +55 and −55v respectively. These readings are satisfactory since as much as a 10 percent difference is within allowable tolerance. In other words anything more than a 5v difference in this case would indicate that the diodes should be replaced.

The value of the voltages measured at these points will vary from set to set and will also depend on the level of the burst signal as supplied by the signal source. If the burst level is low the voltage readings will also be lower. The important point is the difference (if any) between the voltages measured across each of the diodes. Under ideal conditions there should be no difference.

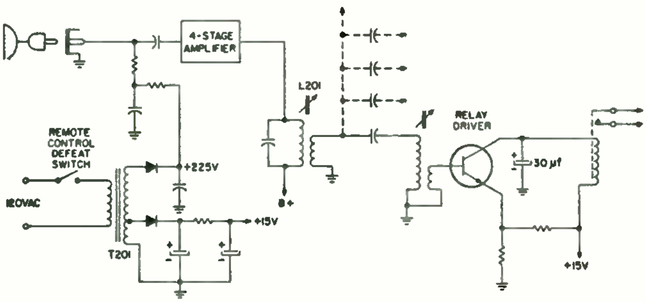
If either the killer or phase detector causes poor color sync, replace the matched pair of diodes. Do not replace just one diode. These are stocked as matched pairs under Part No. 170733-1.

Instant Automatic Remote Control—Receiver Circuit Description

The remote receiver chassis is constructed in two sections. The circuits which amplify the transmitted signal and actuate each of the eight functions are located on a circuit board inside the metal enclosure. Additional relays, terminal strips and the search board are mounted on the top cover of the receiver enclosure.

The receiver circuit board contains a power supply, four amplifier stages, eight tuned circuits, eight driver transistors and eight relays. Molex connectors are used to connect the receiver to the TV chassis, tuner and the radio chassis.

The receiver microphone (transducer) is identical to the one used in the transmitter. It is mounted on an opening in the front of the cabinet and plugs into the receiver chassis. The purpose of the transducer is to change the received sound signal to an electrical signal. This is accomplished by applying a dc bias voltage to the mike. As the plates are moved by the sound signal, the capacity is changed and



causes the dc voltage to become modulated. The signal is then amplified by four broad-band amplifier stages.

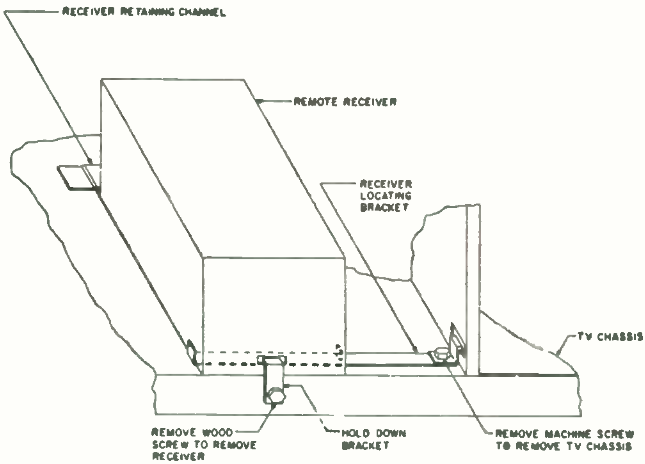
L201 resonates at the center of the pass-band, approximately 40kHz from a signal which is link-coupled to eight series-resonant circuits. Each resonant circuit is highly selective and will respond only to the frequency to which it is tuned while rejecting all other frequencies. The highest frequency to which a resonant circuit is tuned is 46.0kHz and the lowest frequency is 35.5kHz. The remaining six circuits are resonant to frequencies within this range and are spaced at 1.5kHz intervals.

The signal is passed through one of the resonant circuits and coupled to the base of an NPN driver transistor. The driver is normally cutoff by placing a small positive voltage on the emitter to reverse-bias the base-emitter junction. This arrangement reduces the possibility of random noise pulses turning on the driver. With a signal applied to the base, the transistor is switched on during the positive half-cycle and switched off during the negative half-cycle. During conduction time, the transistor acts as a closed switch and allows current to flow through the relay coil. Also during conduction time, the 30μf capacitor discharges through the transistor. When the transistor is cutoff by the negative half-cycle of the applied signal, current continues to flow through the relay coil as the capacitor charges toward the supply voltage. The relay contacts will be held closed as long as a signal is received from the transmitter. The contacts connect 120vac to a motor or relay coil depending upon the function selected.

The power supply contains two half-wave rectifier circuits. A $\pm$15vdc output operates the transistor stages while the 225vdc supply is used to bias the microphone through a voltage divider. A switch is included in the primary winding of the power transformer so the remote control system can be switched off.

TV Remote Control Receiver Model 704044 — Locating Bracket

A remote receiver locating bracket is now being used in instruments which employ the eight-function remote system. The bracket maintains correct spacing between the remote receiver and the television chassis. The remote receiver may be removed, as before, by detaching the hold-down



bracket and pulling the receiver toward the rear of the in strument until it clears the retaining channel. The remote receiver and the locating bracket need not be removed when the television chassis is removed from the cabinet.

New "CE" Color TV Models—Modifications

Last year, the 10-digit, alpha-numeric model numbering system was put into effect. Models introduced in 1973 were identified by the letter "D" in the model number, such as the color TV model C*D*4730WA11. Since the first of this year, several models have been shipped with the second letter updated to "E," such as C*E*4731WA11, to indicate 1974 model introductions. Certain color TV models which use the T989 chassis and carry the "E" designation have been modified in the following ways:

First, the wiring for the AFT switch has been altered to enhance the benefits provided by the Videomatic feature. Formerly, the AFT circuit could be switched on or off only when the VIDEOMATIC button was in the on position. With Videomatic off, the AFT circuit was inoperative. This switching action has been reversed in the "CE" models so that AFT is always on when Videomatic is on, regardless of the AFT switch position. When Videomatic is off, the AFT circuit may be turned on or off as desired. The AFT switch is located on the front panel of "E" models and on the secondary control (rear) panel of "D" models.

A second change concerns the HIGH BRIGHTNESS ADJUST (on the rear apron of the chassis), which has been deleted in the "CE" models. One PRESET BRIGHTNESS control has been retained for Videomatic set up, and is positioned behind the customer-operated BRIGHTNESS control. This preset control should be adjusted for the desired brightness level with the VIDEOMATIC switch in the on position and with the customer BRIGHTNESS control set at the 12 o'clock position.

Also, a PRESET CONTRAST control has been mounted behind the main CONTRAST control. Similar to the other preset adjustments, the PRESET CONTRAST control is adjusted through the hollow shaft of the customer-operated CONTRAST control, and it is set for the desired contrast level with the VIDEOMATIC switch in the on position and the customer CONTRAST control set at the 12 o'clock position. Stereo theatre models which use the 704078 remote control do *not* have the PRESET CONTRAST control, because the PRESET COLOR control occupies this position.

Color TV Chassis T989—Digital Channel-Indicator Dimmer Circuit

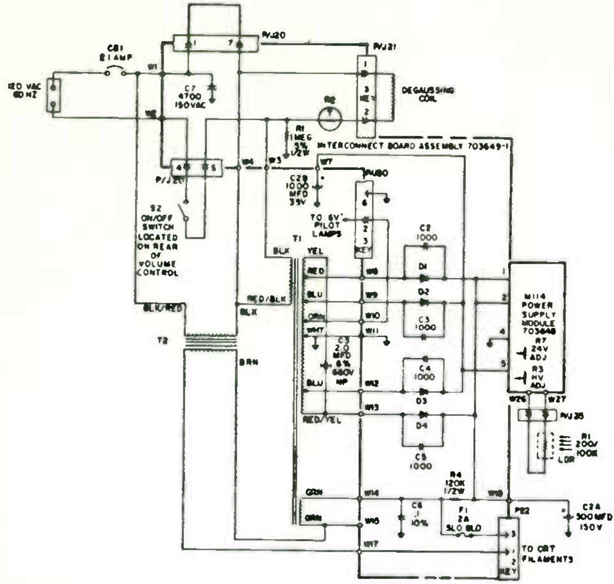
Color TV models which use the T989 chassis and the 704084-1 Six-Function Remote Control system have a dimming circuit to control the brilliance of the channel-indicator lamps. In normal operation, the proper combination of lamps is switched in for each position of the channel-selector knob to indicate the channel number. When a channel is first switched in, the selected channel-indicator lamps glow at maximum brilliance for several seconds. At the end of this time, a dimmer circuit switches the lamps to a half-power condition so that the channel number becomes less noticeable during normal viewing.

There have been cases reported where the lamps remain at full brilliance all of the time. In each instance, the problem was traced to a shorted or leaky diode, D20, on the Remote Receiver module. The diode is made of germanium, rather than silicon, and this fact is important to the correct operation of the remote system. Should diode D20 require replacement, be sure to use the correct replacement—Part No. 530092-1001.

Color TV Chassis T995—Quick-On Wiring

Most TV receivers in this year's product line do not have the Quick-On feature. The T995 color TV chassis was originally designed with the Quick-On feature and contains a Quick-On transformer. The function of this transformer is defeated as shown in the illustration. The jumper wire from pin 1 to 7 on P/J 20 of the Interconnect board shorts out the primary winding of the Quick-On transformer, T2, and disables the Quick-On option. The filament voltage to the picture tube is provided by the bottom winding on the power transformer, T1 (Part No. 300316-1). However, the Quick-On transformer must remain in the circuit because its secondary winding serves as a load in series with the picture tube filaments.

In the near future, transformer T1 will be changed to part number 300316-2. At that time, the filament wind-



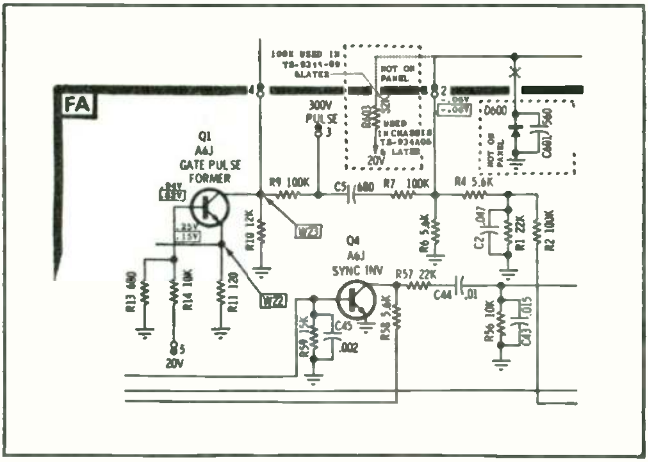
ing of T1 will be 6.3 v AC and will be connected to terminals W14 and W17 of the Interconnect board. Transformer T2 will be eliminated.

Color TV Chassis T995—Vertical Shading Bars

Vertical shading bars beginning at the left side of the raster and attenuating in density toward the center of the screen are caused by inadequate ground contact between the vertical and horizontal members of the chassis. This ground contact is made by a U-shaped clip on the vertical chassis member. When the chassis is placed in the upright position, this clip makes ground contact with the horizontal chassis near the flyback transformer. The problem may be corrected by simply bending the ground clip downward slightly to ensure its contact with the horizontal member when the chassis is in the upright position. In the future, production will use two ground clips, one on each chassis member. These clips will contact each other when the vertical member is placed in the upright position.

Color TV Chassis TS-934—Vertical Black Line at Top and Sometimes at the Bottom of the Screen

Remove resistor R603 (82K or 100K), connected at pin 2 of the FA panel. If the vertical line is still present on the

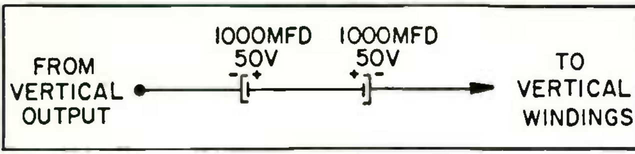


screen, add diode D600 (Part No. 48-67120A01), with 560-pf, disc capacitor in parallel, as shown in the accompanying illustration.

Color TV Chassis T989—Hookup to Test Fixtures

The two vertical windings of the deflection yoke used in the T989 chassis are normally connected in parallel. The parallel arrangement is maintained with T989 Adapter Cable, Part No. 171323-1, when the chassis is connected to the yoke in the Magnavox S973 Test Fixture. The vertical output stages in the T989 chassis are DC coupled to the yoke windings, and a 1-amp, fast-blow fuse is connected in series with each output stage, to protect against component damage should one of the output transistors become shorted.

If the chassis is connected to a test fixture which has the vertical yoke windings connected in series, a shorted vertical-output stage could cause a high DC current to flow through the windings, but not sufficiently high enough to open the 1-amp fuse. As a result, the electron beam might strike and eventually cut through the neck of the picture tube. (The CRT in the S973 fixture cannot be damaged by this problem as long as the correct fuses are in use and if

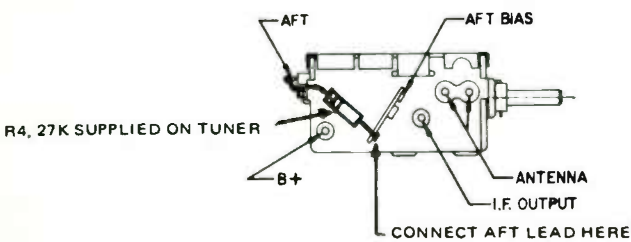


the fuses are not defeated by jumper wires.)

To prevent the possibility of damage to fixtures other than the S973, two 1000-Mfd., 50-v capacitors should be connected back-to-back and placed in series with the vertical-output lead between the chassis and the yoke. The capacitors prevent DC current from passing through the windings, so that the amount of deflection is determined only by the amplitude of the AC vertical sweep voltage.

Color TV Chassis T933/T939/T940 Employing 340129-2 UHF Tuner—Change in Location and Value of Resistor R4

This tuner has been produced with three possible locations for resistor R4, a resistor connected to the automatic fine tuning terminal. On the initial version, the resistor is

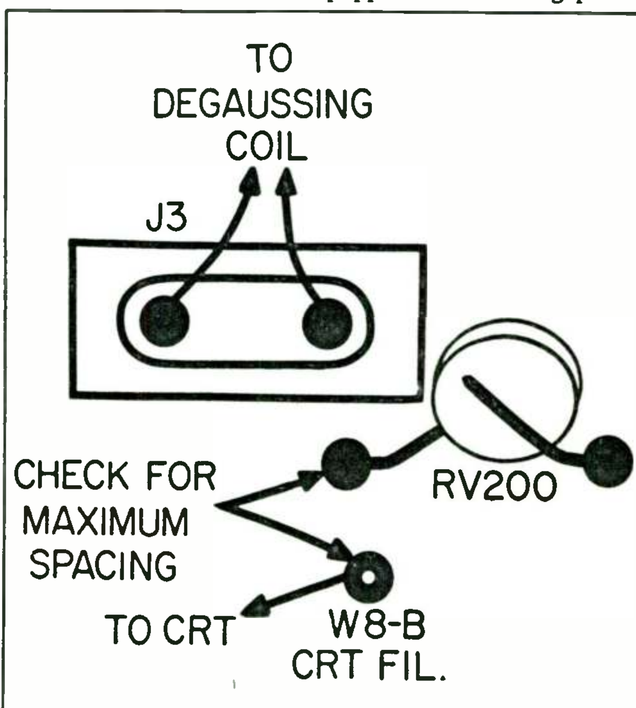


located inside the tuner and has a value of 150K. On later versions the resistor was moved to the outside of the tuner and changed in value to 27K. In this version, the resistor is connected directly between the AFT lead from the main chassis and the AFT terminal on the tuner. Current versions of the tuner have the 27K resistor (R4) connected between the AFT terminal of the tuner and a terminal strip mounted on the top of the tuner.

Color TV Chassis T981/T982/T987—Power Supply Diode Failures

Failure of one or more power supply diodes, and possibly the CRT filament, might occur in the T981, T982, and T987 color TV chassis as a result of arcing in the picture tube. The voltage pulse produced by the arc travels down one of the CRT filament leads to point W8B on the Scan board. If this lead is positioned too close to thermistor RV200, the pulse will be transferred to the thermistor and to the power supply diodes. Should any of these diodes have to be replaced, check the position of the filament lead to be sure it is dressed as far away from RV200 as possible. An inspection of the filament lead dress should be made on all T981, T982, and T987 chassis during routine service.

The power supply diodes might also be destroyed if the T981 or T982 chassis is connected directly to earth ground. Neither of these chassis is equipped with isolating power



transformer. The AC line voltage is connected directly to a bridge rectifier, and the circuit arrangement causes the chassis to measure approximately 70 v AC above earth ground, regardless of the polarity of the AC plug. If the chassis is connected to earth ground (such as through the ground lead of a VTVM using a three-wire AC cord), one or more of the diodes in the bridge circuit will be destroyed instantly. This problem can occur in any radio or TV set which has one side of the AC line connected to the chassis. Therefore, an isolation transformer should always be used when servicing this type chassis.

Color TV Chassis T995—Module Removal

The Horizontal module and the Retrace/Screen module are each held in place by a nylon mounting post fastened to the module with a ¼ inch hex screw.

The nylon post snaps into a hole in the chassis to secure the module. The modules should be removed by pushing the post out of the chassis hole, not by removing the screw on the module. Replacement modules are supplied with nylon mounting posts attached to the module.

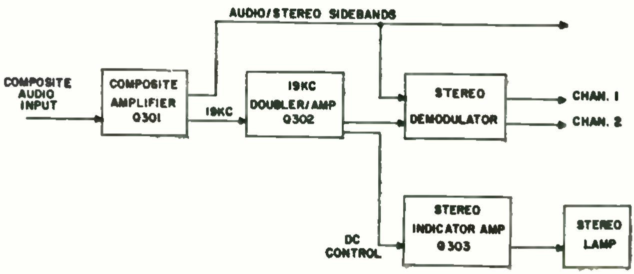
MAGNAVOX
Console Models

Radio Chassis R212—FM Stereo Translator Circuit

A new stereo translator circuit was introduced last year in the R211 radio and it has been incorporated in all new radio chassis developed since that time. Three transistors are used in translators which include a stereo indicator lamp circuit—otherwise, only two transistors are needed. In most radio chassis the translator components are contained on a single printed circuit board; but in some chassis, such as the R212, the translator components share the same board with most of the other receiver components.

The stereo signal at the output of the FM detector contains three parts—an audio signal, a 19kHz CW signal and stereo sidebands. The audio signal, or monophonic signal, contains frequencies up to 15kHz. The 19kHz CW signal, called the pilot signal, is present when a stereo signal is transmitted. The stereo sidebands contain still higher frequencies which are positioned above and below a 38kHz center frequency. All three of these signal components combine to form the composite stereo signal.

THE MAGNAVOX FM STEREO TRANSLATOR

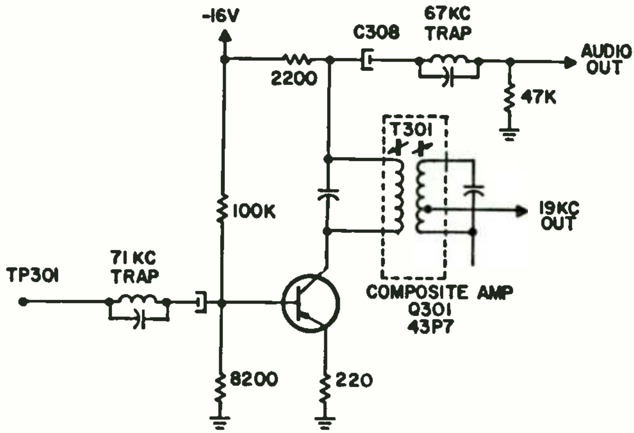


A block diagram of the stereo translator circuits is shown here. The composite signal from the FM detector is amplified by Q301. Q301. is a broadband stage which amplified all frequencies from the lowest audio frequency to the highest stereo sideband frequency at 53kHz. At the collector of the composite amplifier the 19kHz pilot signal is separated from the audio signal and the stereo sidebands. This is accomplished by a transformer tuned to 19kHz which acts as a high impedance trap at 19kHz and also couples the pilot signal through the secondary winding to the 19kHz amplifier and doubler, Q302. The pilot signal, when doubled in frequency, serves to reproduce the 38kHz carrier which was suppressed at the transmitter. This carrier must be regenerated in the receiver to demodulate the high frequency stereo sidebands. Doubling the pilot signal takes place at the output of Q302 and results from a transformer tuned to 38kHz. The 38kHz CW signal is then combined with the audio signal and stereo sidebands in the demodulator circuit to produce right and left channel audio output signals.

A separate monophonic audio output is provided in cases where extremely weak stereo signals may produce excessive noise. Better audio quality and improved signal-to-noise ratio may be obtained by operating the receiver in the monophonic position of the bandswitch.

A transistor, Q303, acts as a switch to turn on a stereo indicator lamp in those chassis which have this feature. The switch is turned on when the 19kHz amplifier conducts. The 19kHz amplifier conducts when a pilot signal is applied to its base.

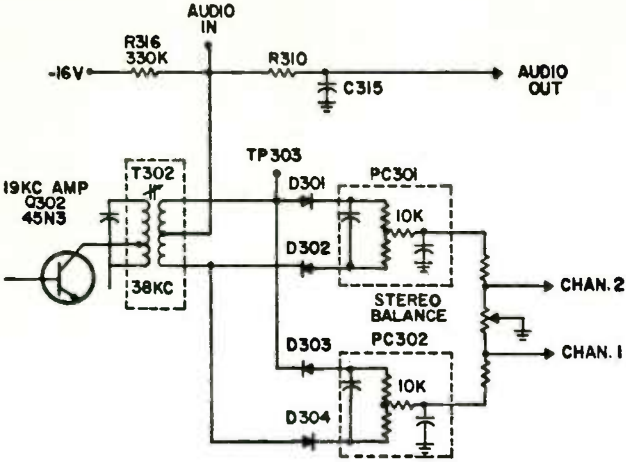
A schematic of the composite amplifier is shown here. A lowpass filter is located in the base circuit of this stage which effectively removes extraneous noise that may be present in the detected signal above 71kHz. The amplifier is a conventional RC coupled stage and all three components of the composite signal appear amplified at the collector. Here, at the collector, the pilot signal is separated from the composite signal. The transformer, T301, is tuned to 19kHz and couples the pilot signal through the secondary winding to the frequency-doubler stage. At the same time, the transformer acts as a 19kHz trap and prevents the pilot signal from appearing across the 2.2k collector load resistor. The low frequency audio com-



ponent and the high frequency stereo sidebands see the primary winding as a low impedance and are coupled through C308 and a second trap circuit.

Some FM stations are authorized to transmit background music service for hotels, offices, retail stores, etc. Such broadcasts are referred to as SCA (Subsidiary Communications Authorization). These special transmissions use a 67kHz subcarrier frequency to convey the music information. It is possible for the SCA signal to mix with the stereo sidebands and produce beats and whistles in the demodulated audio output. For this reason, a 67kHz trap is used to attenuate the SCA signal so that interference is avoided.

The stereo demodulator circuits are shown here. The 19kHz pilot signal is amplified by Q302 and the frequency is doubled by T302 which is resonant at 38kHz. The 38kHz signal is always separated 180deg across the ends of the secondary winding. The audio signal and the high-frequency stereo sidebands from the composite amplifier are connected to the center-tap of the secondary winding. The combined signal is then applied to the four demodulator diodes. The waveform at TP303 is a 38kHz envelope with left channel audio variations along the positive peaks and right channel audio variations along the negative peaks. At the opposite end of the secondary winding the



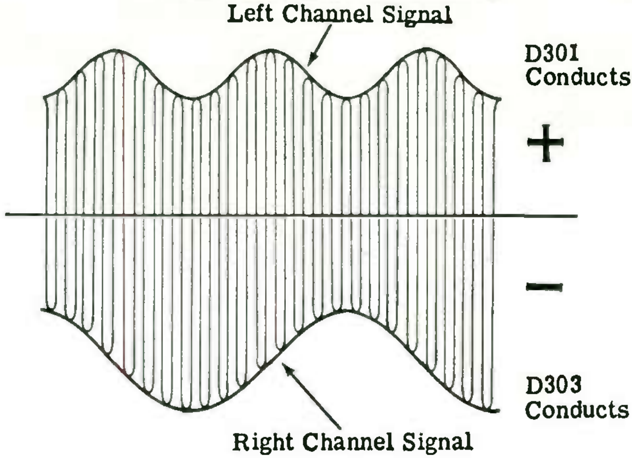
waveform is inverted and the right and left channel audio variations reverse their positions on the envelope.

Audio variations in the postive peaks of the 38kHz envelope at TP303 forward bias D301 in the left channel demodulator. At the same instant the audio variations in the negative peaks of the bottom envelope forward bias D302 which is also on the left channel. The 38kHz subcarrier is filtered out by the capacitor connected between the diodes and the detected audio signal passes through a de-emphasis network to the audio preamp.

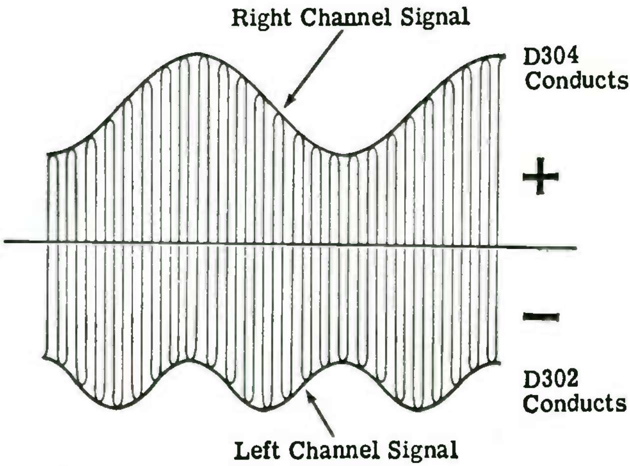
In like manner, the right channel audio variations on the 38kHz envelope are detected by D303 and D304. D303 conducts on negative variations of the envelope at the top of the secondary winding and D304 conducts on positive variations of the envelope at the bottom of the winding. The 38kHz filter and de-emphasis network at the output of the diodes is the same for both channels.

The stereo indicator lamp circuit is also shown here. The operation of the lamp is dependent upon the conduction of the 19kHz amplifier. During no-signal conditions or when a monophonic program is received, Q302 is forward biased by a very small amount so that collector current barely flows. The low forward bias voltage is obtained by using a large value resistance, 330K, in the

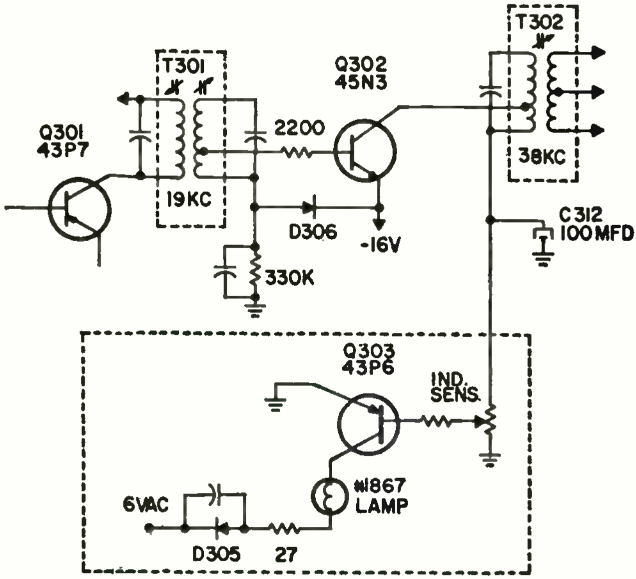
38KC WAVEFORM AT TP303



38KC WAVEFORM AT OPPOSITE END OF T302 SECONDARY WINDING



base circuit to ground. To stabilize the base-emitter voltage for variations in power supply voltages and temperature changes, diode D306 is effectively connected across the base-emitter junction.



When a stereo signal is received the 19kHz pulses on the base of Q302 cause full collector current to flow. After passing through the primary winding of the 38kHz transformer, the pulses are filtered by C312 and a negative dc voltage is developed across the indicator sensitivity control. A portion of this voltage is applied to the base of Q303 and causes it to conduct. Q303 acts as a switch which effectively grounds one side of the indicator lamp. Power for the lamp is obtained from the 6vac winding on the power transformer. The ac voltage is rectified by D305 which drives the lamp with negative-going pulses. A 27Ω resistor is connected in series with the lamp to limit current flow.

Under no-signal conditions, or when a monophonic program is received, Q302 is biased to near cutoff. Since very little collector current flows, there is practically no voltage drop across the indicator sensitivity control and Q303 is zero biased. Under these conditions Q303 acts as an open switch so the indicator does not light.

The stereo indicator sensitivity control should be adjusted while receiving a stereo program. A VTVM is connected to the collector of the indicator amplifier (Q303) and the sensitivity control is adjusted for a reading of −1v. Operation of the lamp should then be checked on all stereo stations normally received in the area. If the lamp fails to light on a particular station, and that station is *known* to be transmitting a stereo program and is received with almost full quieting, alter the setting of the control slightly until the indicator just lights. Sensitivity is increased by turning the control in the CCW direction.

During monophonic reception the audio signal passes through the demodulator diodes and is amplified equally in each channel. To prevent the diodes from partially rectifying the audio signal and producing distortion, a dc voltage is applied to the diodes. R316 couples a small amount of negative voltage through the center tap of the 38kHz transformer to all four diodes. Diodes D302 and D303 become forward biased so that a direct signal path into each channel is established and distortion is avoided.

The stereo translator used in the new R216 and R217 radio tuners contains the same circuits as those described here. A variation does exist to the extent that the AM audio signal also passes through the composite amplifier This point should be remembered when servicing the AM circuits of these tuners.

Stereo Theatres — Remote Shut-Off Delay

Stereo theatre models equipped with remote control display a delay of approximately 2s in TV remote shut-off. When the TV picture does not disappear immediately after the set is switched off by the remote transmitter, some customers question the operation of the set. It should be explained that this delay is normal and intended to avoid unnecessary switching on and off of the TV chassis as the volume is adjusted by remote.

The delay results because the ac to the TV chassis is controlled by a relay which is actuated by the B+ supply in the radio chassis. The stepper relay is triggered by the remote signal and when it reaches the OFF position, it interrupts the ac supply to the radio chassis. Because the radio chassis B+ decays gradually there is resultant delay of about 2s before the TV is switched off.

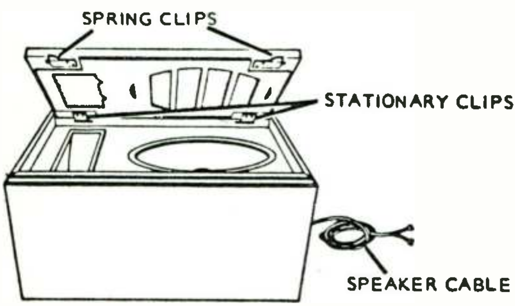
Stereo Theatre Models T933/R220—Raspy Sound

In reported cases of too much high frequency response causing raspy sound, check the value of C713 in the TV sound de-emphasis circuit. If it is 680pf, change it to 1000pf. Also check the TV audio input circuit on the radio-chassis to see if capacitor C232 (1500pf) is used. If it is, remove it.

Remote Speaker System Model 1S8716—Access to Speakers and Crossover Network

This speaker system uses a completely sealed acoustical enclosure. Access to the speakers and crossover network is provided through a removable front grill panel held in place by two nylon spring clips. The panel is released by depressing the clips.

With the speaker cabinet on its back as illustrated, insert a strip of stiff cardboard between the grill panel and the cabinet molding, about 3in. in from the top and bottom of the cabinet. Sliding this strip along the opening will release the spring clip and allow this side of the panel to be opened.



A dull-edged knife blade can also be used, but use care to avoid scratching the cabinet. The speakers are mounted from the front of the baffle board and sealed with caulking compound. The crossover network is mounted inside the cabinet. Therefore, the bass speaker must be removed to gain access to the network.

In some cases, the speaker leads had been reversed at the crossover network resulting in a loss of high frequencies. Proper connection is achieved with the green wire from the bass speaker going to the crossover capacitor, the gray wire from the horn going to the resistor, and the black (or common) lead going to the inductance.

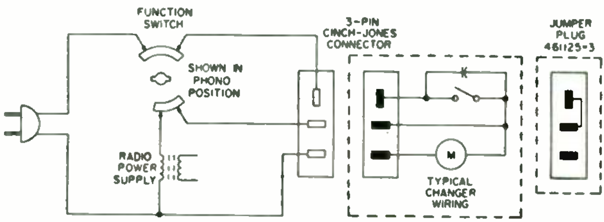
Be sure to re-seal the speaker properly when it is replaced. Use ribbon caulking compound – Part No. 800313-1 or equivalent.

Amplifier A577—Motorboating

Models such as the 1K8851 component tuner, which utilize the A577 Amplifier, may exhibit a motorboating condition when headphones are used and the speakers are cut off. This condition can be corrected by removing capacitors C1 and C51 from the amplifier chassis. Later versions have had this change made in production.

Jumper Plug for Operating Component-Type Radio Tuner with Non-Compatible Record Changer

As indicated in the diagram, the primary power circuit of most Magnavox radio tuners is designed to provide power to the motor of a compatible record changer, and also to allow the ON/OFF and automatic shut-off functions of the record changer to control the application of power to the radio unit when the PHONO function is selected. The power and control functions are routed between the radio and record changer through a 3-pin Cinch-Jones connector mounted to the rear of the radio unit.



If a non-compatible changer is to be used with a Magnavox component radio unit, it must be powered from a source other than through the radio function switch. Under this condition, ac power cannot be controlled by the changer switch; and a direct connection must be made between two pins of the 3-pin connector on the radio to allow power to be applied to the radio power supply when the function switch is in the PHONO position. A jumper plug with an internal short between the appropriate two pins, Part No. 461125-3, is available from your Magna-Par Branch.

Record Changers—Slow Turntable Speed

Slow turntable speed can be caused by the incorrect location sequence of the turntable bearing and washers on the turntable spigot housing assembly. It is not uncommon for the bearing and washers to adhere to the turntable hub during turntable removal, and fall off as the turntable clears the record spindle. Therefore, for all complaints of "slow turntable speed," consider the possibility that the turntable may have previously been removed and then reinstalled with the bearing/washer group in an incorrect sequence. It is imperative that the bearing/washer group be installed in the sequence shown in the service manual for the changer involved. If the bearing/washer group is assembled in an incorrect sequence, the speed of turntable rotation can be reduced by as much as 10 percent.

Tape Recorder Model 1K8879—Replacing 60Hz Capstan Sleeves

The dual capstan drive of this tape recorder requires that both 60Hz capstan sleeves have precisely identical outside diameters. A small difference in outside diameters of the two sleeves, which could result when replacing only one sleeve, can cause the tape to bunch in one direction. Because of this requirement, replacement sleeves are supplied in matched pairs under Part No. 11C028-5. It is imperative that the sleeves be replaced in pairs, using only matched pair replacements.

Radio Chassis R231—Noise On AM Band Only

On early versions of the R231 chassis, noise on the AM band only can be caused by the pilot light. These chassis used a GE No. 1847 (Magnavox Part No. 180161-17), which had an aluminum base. It has been discovered that over a period of time the aluminum may oxidize creating an intermittent connection between the pilot light base and socket. The static created by this intermittent connection can then be picked up by the AM receiver. To correct the problem, remove this bulb type, clean the socket of any corrosive material and replace with a bulb of the same part number but with a brass base.

Stereo Console Four Channel Speakers

Some cases have been reported of low VOLUME level from the rear speakers when playing four channel mode. This can occur when the front (console speakers) are higher in efficiency than the rear speakers.

A new series of open back extension speakers, with higher efficiency, are now available for use with console stereo models as either extension speakers or rear four channel speakers.

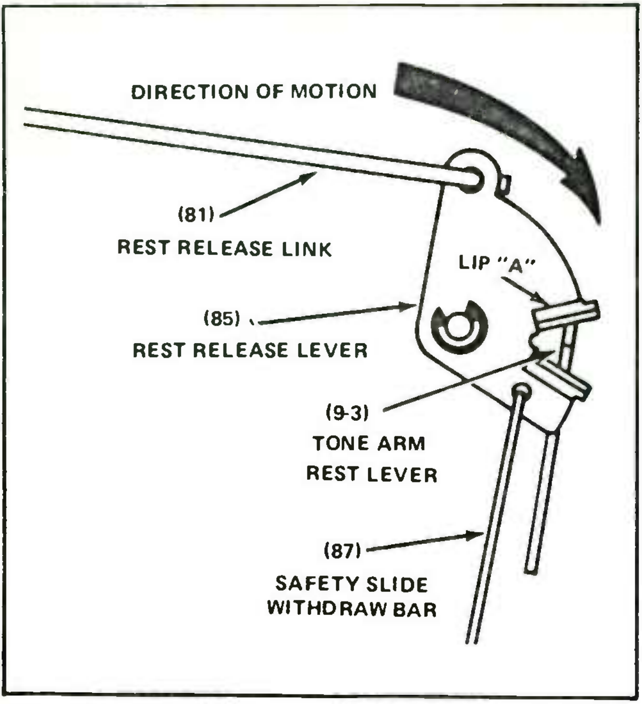
Model 1S8440 speakers should be used with the 1P3440, 3470, 3680, 3780 and 3790 series console stereos; and Model 1S8450 speakers should be used with the 1P3840 and 3960 series console stereos.

Speaker System Models 1S8757 through 1S8759, and 1S8762 through 1S8766—Fusible Resistors

Speaker systems such as the Models 1S8757 through 1S8759 and 1S8762 through 1S8766, employ a fusible resistor in series with the positive lead to the speakers. This device is intended to protect against excessive current flow in the event of a shorted speaker voice coil. This fusible resistor is rated a .225Ω, 2w and is identified by Part No. 240104-3. Because of the protective characteristics of this resistor, you are cautioned to use only the exact replacement. When replacing one of these fusible resistors, use the full length of the resistor leads and heat sink the leads while soldering them in place.

Record Changer Model W832—Binding When Turned ON

Reports have been encountered on several Model W832 Record changers that bound when an attempt was made to turn them ON. The binding was caused by the Rest Release Lever, item 85 in the accompanying sketch, binding against the Tone Arm Rest Lever, Item 9-3. When the



FUNCTION selector is turned to the ON position, the Rest Release Link (81) moves in the direction shown, pivoting the Rest Release Lever. Additional lubricant was first applied to the under side of Lip "A" in an effort to reduce the friction between the two parts. When this failed, the lip angle was increased slightly, i.e., bent away from the baseplate. A very slight bending was all that was required to reduce the friction and correct the problem.

Combination Radio/TV Models 1C8017, 1C8019, 1C8021—Continuous VHF Search, Radio Search or Record Reject

A Model 1C8017, 1C8019 or 1C8021 vertical three-way TV console may, depending upon the position of the function selector switch, search continuously on VHF TV or radio or reject records repeatedly. The fault lies in a .1μf capacitor soldered across the record reject solenoid beneath the record changer baseplate.

The problem can be eliminated by removing the capacitor, without replacement. After the capacitor has been removed, a reed relay K1 on the remote receiver may have to be gently tapped to free its contacts.

Record Changers Model W624-W800—Intermediate Gear Alignment

Reports from the field indicate that the intermediate gear (Part No. 76130310), which is part of the immediate gear and striker assembly Part No. 76130389 is being replaced unnecessarily in attempts to correct changer cycling problems. The gear is assumed to be at fault because of the two shaved teeth adjacent to the end of the striker level which are a·part of the normal design. Some confusion results from the early design of this gear that had only one tooth shaved. The additional shaved tooth was incorporated later to prevent a condition of continuous cycling.

The general cause of improper cycling has been found to be a mis-aligned intermediate gear center post. Two symptoms can result if the post, which is part of the intermediate gear lever assembly, is incorrectly aligned. If the post is bent away from the turntable gear, the intermediate gear and turntable gear can lose mesh at the shaved intermediate gear teeth. This will cause failure to complete the change cycle and is generally accompanied by a chattering sound as the turntable gear slips against the shaved teeth of the intermediate gear.

The second symptom is caused if the post is bent away from the axis of the main cam gear. This condition can cause the intermediate gear to "climb" the main cam gear and lose mesh with the main cam gear. When the out of cycle condition exist, the intermediate gear is not allowed to retract when the main cam gear reaches the neutral position. Symptoms may include failure to reject and chattering.

Either of these symptoms may be corrected by removing the intermediate gear and re-forming the intermediate gear center post so it is perpendicular to the changer baseplate. After this adjustment has been made, replace the intermediate gear and run the changer through cycle several times to be certain there is positive mesh between the intermediate and turntable gears, particularly at the point where the teeth are shaved. Also check to be certain the teeth of the intermediate gear have some clearance from the lower lip of the main cam gear. In the neutral position there should also be approximately 1/32in. clearance between the intermediate gear and the turntable gear.

Tuner/Amplifier Chassis R243/244/245—Distorted or No Audio on One Channel Only (Early Version)

There have been reported cases of "distorted audio" or "no audio" (usually affecting only one channel) in the early version of the R243, R244 and R245 chassis. For no apparent reason the fuses open in the output section of the affected channel. For such symptoms, check fuses F401 and F403, or F402 and F404 before making any further troubleshooting checks. If a fuse is open, replace it with one of the exact value and type called for in the service manual for that particular chassis. Then, with the speakers disconnected, check the dc voltage between the two speaker terminals of the affected channel mentioned in the following steps under servicing precautions. If the dc voltage at the speaker terminals is within the indicated limits, there is probably no circuit malfunction and the chassis can be returned to service.

Servicing Precautions

In some cases, damage to the amplifier section circuit components and speakers has resulted from improper service procedures. Because of the relatively heavy currents in the amplifier sections of these units, the following service procedures must be strictly observed.

Never replace an amplifier section fuse with a slow blow type or one of a higher ampere rating than called for in the service manual. The correct replacement fuses are as follows:

Chassis Model	Ampere Rating	Magnavox Part No.
R243	2.5a	181021-1250
R244	3a	181021-1300
R245	4a	181021-1400

Never, substitute a higher ampere rated fuse or bridging device, such as a clip lead, for a fuse in the amplifier section. Such procedures can result in almost instantaneous damage to speakers and/or components of the amplifier section.

Always, before connecting speakers to the amplifier, measure the dc voltage at the output of each channel. This measurement can be made at the speaker terminals, between the ground terminal and the hot terminal, but the front panel mounted speaker switches must first be closed to connect the speaker terminals to the amplifier section. The voltage between the terminals for each channel should be 0v ±0.2v. If the voltage is not within these limits, there is a malfunction in the amplifier section and this malfunction must be corrected before the speakers are connected.

Always, immediately upon connecting speakers to the amplifier and before power is applied, check the connections at the speaker terminals to insure that the speaker leads are not shorted together or shorted to the amplifier case.

Later Version Production Change

Beginning with the "C" version, i.e., R243-01-CA, of these chassis, fuses F401, F402, F403 and F404 will not be used in the output circuits of the amplifier section. The function of the fuses will be performed by special type 0.47Ω resistors (similar to fusible resistors) used for the R437, R438, R439 and R440 chassis. In the R243 and R244 chassis these special resistors are 0.47Ω, 2w components, Part No. 240104-1. In the R245 chassis these special resistors are 0.47Ω, 3w components, Part No. 240104-2. Because of the protective characteristics of these special resistors and their importance in these applications, only the specified Magnavox replacement part should be used if replacement is required.

Power Amplifier Bias Adjustment

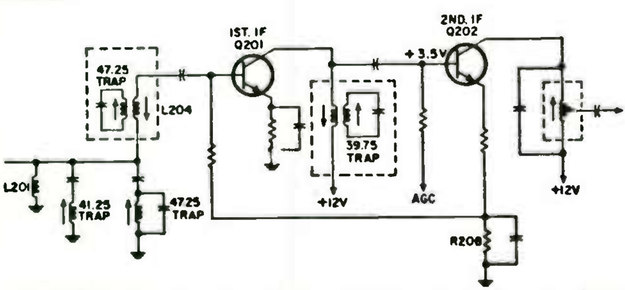
To provide a more accurate adjustment of the idling current through the audio output stages and prevent the possibility of cross-over distortion, instructions under the heading "Power-Amplifier Bias Adjust" should be changed to the following:

(1) Place the speaker switches to the OFF position and the VOLUME control fully CCW. (2) Connect a milliammeter in series with transistor Q415 and Q417 (if the instrument has fuses in the output circuit, remove a fuse from the appropriate channel and connect the milliammeter across the fuse holder) and set the BIAS ADJUST pot, R419, for a reading of between 20ma and 40ma. Or this adjustment can be made with the following step: Connect a VTVM or other high-impedance voltmeter between the emitter of Q415 and the collector of Q417 and set the BIAS ADJUST pot (R419) for a reading of between 20mv and 40mv. (3) Repeat steps for Q416 and Q418 and adjust R420 for the same readings. Add these notations to service manuals 1478, 1479, and 1480.

TV Chassis T908 and T915, Video IF and Output—Circuit Description

IF Circuits

The low impedance link coupling from the VHF tuner is terminated by L201 on the IF board. Three trap circuits are located in the base circuit of Q201. Two of them provide trappage for adjacent channel sound and the third provides 28db reduction of the desired sound carrier.



L204 is the input coil for Q201 and helps to shape the over-all IF response curve. Base bias voltage for Q201 is taken from R208. Emitter current flow through Q202 develops a positive voltage across R208 which is used to forward bias Q201. The IF transformer in the collector circuit is broadly tuned. An absorption trap tuned to the adjacent channel picture carrier frequency is wound on the same coil form.

The IF signal is next capacitively coupled to the base of the second IF stage. Q202 also has a broadly tuned transformer in its collector circuit. This stage is particularly important since its base is directly controlled by the AGC voltage. A nominal +3.5v is presented on the base to provide forward bias. At this voltage, the stage operates at maximum gain. Also, as stated earlier, the voltage drop across R208 supplies forward bias to the first IF stage.

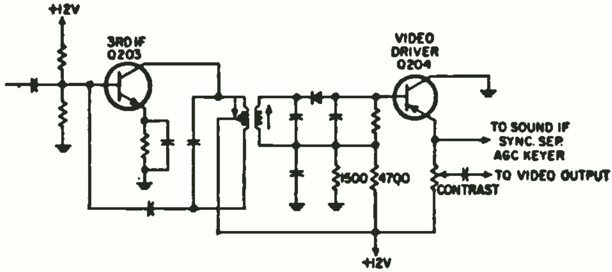
When AGC voltage is developed, the base of Q202 becomes more positive and increases collector current. The voltage drop across the emitter resistor becomes more positive and increases the collector current of the first IF stage. With these particular transistors, as collector current increases, gain decreases. This method of reducing gain is referred to as forward AGC.

The third IF stage is forward biased in the conventional manner with the voltage dividing resistors in the base circuit. The IF transformer in the collector circuit is sharply tuned to shape the IF response curve. The transformer is tapped so that an out-of-phase voltage can be coupled back to the base to neutralize this stage.

The IF signal is coupled through the transformer to the detector diode. The diode rectifies the IF signal and the remaining IF frequency components are filtered to ground. The polarity of the diode produces a video signal with negative-going sync pulses. This signal is then dc coupled to the base of the video driver stage.

Video Circuits

The video driver uses a PNP silicon transistor in an emitter-follower circuit. With this arrangement, all of the signal voltage is developed across the emitter resistance which, in this case, is the contrast control. The signal at the emitter has the same polarity and approximately the same amplitude as the signal on the base. The video signal at this point is of special importance since it is coupled to four different circuits: the video output stage (through the contrast control), the sound IF amplifier, the AGC circuits and the sync separator.



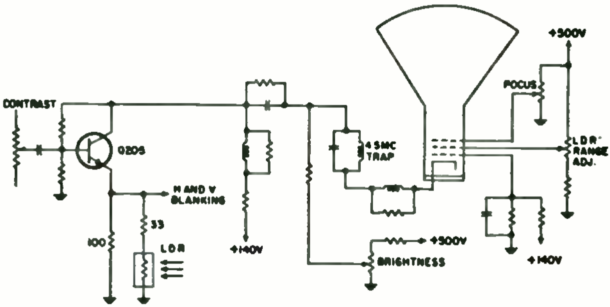
The video output stage is biased for class "A," linear operation. The base biasing resistors are connected directly to the collector. This is a negative feedback circuit for both ac and dc which stabilizes the amplifier and improves frequency response. The emitter resistor is unbypassed which results in some loss of gain. However, this is done to accommodate the LDR used in the automatic brightness and contrast circuit.

The transistor used in this stage is a silicon type NPN which is capable of handling relatively high collector voltages; the collector returns to a +140v supply. The picture tube requires a nominal P-P video signal of 50v at normal contrast. Because of variations from one picture tube to another the output stage must be able to supply ample drive beyond what is normally needed. At maximum contrast, the video signal has a P-P value of around 100v. A heat sink is attached to the transistor case to provide heat dissipation.

The video signal is amplified and inverted in the collector circuit so that sync tips are positive. This is the correct polarity for blanking the picture tube when the cathode is the driven element. Peaking networks are also included to optimize high frequency response. A 4.5MHz trap is inserted in series with the cathode to attenuate any sound carrier that may be present.

The brightness control affects the brightness of the picture tube by varying the CRT cathode voltage. Increasing the positive voltage on the cathode has the same effect as increasing the negative voltage on the control grid; that is, brightness will be reduced. In this case, the control grid is supplied with a fixed positive voltage through a voltage divider network. A more positive voltage is applied to the cathode so that the control grid is effectively negative with respect to the cathode.

Focusing of the beam spot is accomplished by adjusting the grid 3 voltage on the CRT from zero to 500v. This grid acts as a lens to converge the electrons making up the beam into a small spot at the time the beam strikes the faceplate.



Blanking of the picture tube is also provided in the video output stage. Horizontal and vertical blanking pulses are coupled from the sweep circuits to the emitter of Q205. These pulses are positive-going and, therefore, reduce the forward bias voltage on the base-emitter junction. The sync and blanking pulses contained in the composite video signal on the base are negative and also reduce forward bias. The combination of negative sync on the base and positive blanking on the emitter results in amplified, positive-going blanking pulses in the collector circuit which cut off the CRT during retrace time.

The LDR circuit provides an automatic means for adjusting brightness and contrast under varying room lighting conditions. The circuit accomplishes this control by varying the emitter resistance in the video output stage with a light dependent resistor. The LDR forms a part of the unbypassed emitter resistance of the video output stage. As room lighting increases, the LDR resistance becomes less which results in less total emitter resistance. The stage produces more gain, since there is less degeneration, and drives the CRT with a higher amplitude video signal to produce more contrast. As the stage conducts harder under these conditions, the average dc collector voltage decreases. Since the collector is dc coupled to the CRT cathode, this results in a decrease in cathode voltage and a higher brightness level on the picture tube.

As room lighting decreases, the LDR increases in resistance, produces more degeneration and less gain to reduce contrast. The output stage conducts less which allows the collector dc voltage to become more positive and reduce picture tube brightness. A 33Ω resistor is inserted in series with the LDR to limit the variations of resistance in the circuit so that over-correction of brightness and contrast does not occur.

MONTGOMERY WARD
B&W TV

TV/FM/AM/Phono Combinations, WG5914A, 5944A, 5974A, 6914A 6944A, 6974A—Poor Resolution

If the picture resolution is not up to standard, it may be caused by any of the following: 1) Defective pix IF tubes V3 or V5. 2) Defective pix detector crystal (part of T-202). 3) V6 defective. 4) Defective CRT. 5) Open video peaking coil. Check all peaking coils L202, L203, L205 and L206 for continuity. Note that L203 and L206 have shunting resistors. 6) Leakage in V6 grid capacitor C212. If the capacitor is not found to be defective, check the following: (A). This trouble can also originate at the transmitter. Check reception from another station. (B). Check all potentials in video circuits. (C). Check CRT grid circuit for poor or dirty contact. (D). Check and realign, if necessary, the picture IF and RF circuits. 7) Incorrect setting of fine tuning control.

MOTOROLA

B&W TV

TV Chassis TS-454A — Production Changes

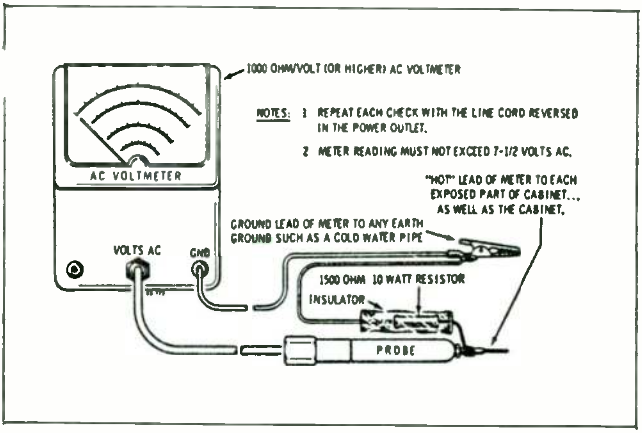
To reduce barkhausen oscillation: The 0.005μf capacitor, C512, removed from screen circuit of horizontal output tube. **To eliminate silicon diode radiation:** The gray ac lead feeding power rectifier diode, E801, was removed from wiring harness and re-dressed. **To increase brightness range:** The 180K resistor, R201, in brightness control circuit changed to 150K. **To improve reliability of electrolytic filter capacitor, C802:** Filter capacitor, C802, relocated beneath VHF tuner. It is recommended that if the filter capacitor is being replaced and is located under the top chassis, that it be re-located. The Motorola replacement capacitor Part No. 23P65133A22, includes the mounting bracket. Add approximately 5 in. of lead to the filter choke leads to facilitate possible future servicing of upper chassis. **To increase 47.25Mc attenuation:** The 16K resistor, R101, changed to 10K, 5%. **To improve reliability of 4BZ6, 1st IF amplifier, V-3:** The 220Ω resistor, R104, in plate circuit changed to 1000Ω. **Design change:** The main chassis board (etched panel) has been revised slightly to improve insulation area adjacent to horizontal output tube, to provide filtered B+ voltage to plate of audio output tube and to provide space for an RC (R620-C610) filter network located in the feed-back network between the grid of horizontal output tube and vertical linearity control.

All TV Chassis — Safety Tests

As a matter of personal safety and protection of receiver circuitry, service technicians should always use an isolation transformer when working on chassis which are connected to one side of the power mains. Remember, depending on which way the line plug is polarized to the wall outlet, full line voltage may appear between the chassis and "earth" ground.

Make it a positive safety rule also, to protect the consumer from electrical shock, by testing every set serviced before it is returned to its owner. Test each chassis with the shunted ac voltmeter illustrated here.

The safety test is made by contacting one meter



Voltmeter hook-up for making safety checks on all TV sets.

probe to any portion of the receiver exposed to the consumer or operator such as the cabinet trim, hardware, control knobs, etc., while the other probe is held in contact with a good "earth" ground—a cold water pipe. Voltage indicated by the meter should not exceed 7.5 v. More voltage would indicate a potentially dangerous leakage path existing between the exposed portion of the receiver and "earth" ground. *Do not use a line isolation transformer when making this test and do not return a receiver to the customer which does not pass the safety test until the fault has been located and corrected.*

Make a double test of the exposed cabinet parts. The second test is made with the power plug reversed in the outlet. Remember, exposed cabinet parts include metal legs, mounting hardware under the cabinet, and metal base or stand that the cabinet rests on.

When making the safety test on receivers with external connections (remote controls and motorized tuners or any special accessories including indoor antennas), be sure all units are operating and functioning at the time of the test.

The safety test should be applied to all receivers, whether or not the design incorporates a power transformer with line isolating windings.

Receivers damaged by lightning, floods, accidents or other causes require careful examination of all the isolating components and circuitry to insure that they are in good condition.

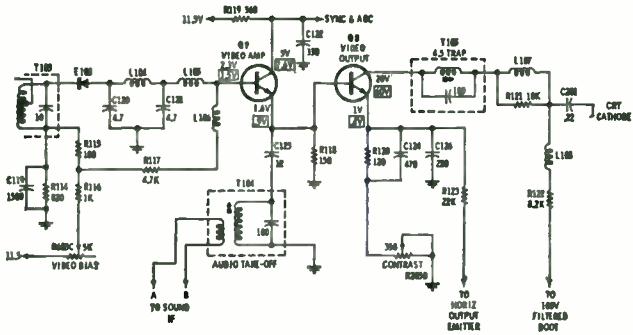
Protect the meter movement by originating the test on the 150 v scale—then switch to a lower range.

TV Chassis TS460 Video Amplifier and Output Circuits—Circuit Description

A two-stage video amplifier is used in the TS460. The first stage is used to provide a relatively high impedance load to the 2nd detector and a low impedance to the video output. Since audio, sync and AGC information are taken from the output of the video amplifier, the video output can be designed to take advantage of this to obtain a 25 percent increase in video output over what could be obtained if sync, sound and AGC information had to be retained.

Forward bias for the video amplifier, Q7, (shown in schematic) is provided by a voltage divider consisting of R114, R115, R116, R117 and R603C. The video bias control, R603C, is adjustable and is used to vary the bias of the video amplifier, Q7. Since the video output, Q8, base circuit is connected back to the emitter of the video amplifier, any change in bias setting of R603C will also change the conduction of Q8. Bias for Q8 is derived by the current flowing through the emitter resistor R118 of the video amplifier, Q7.

When the IF is amplifying, noise or signal is applied to the 2nd detector diode. The diode conducts on the negative peaks or negative portions of the signal and



electrons flow through L104, L105, L106, R117, R115 and T103. The electron flow in R117 causes a voltage drop, because of signal or noise which is in opposition to the bias voltage, thus reducing the forward bias on this stage. Because of this, the receiver should be tuned to a low noise vacant channel, preferably channel 13, or set between channels, when adjusting the bias control, R603C.

To adjust the bias control:

1. Set receiver to vacant channel, preferably channel 13 (or set between channels).
2. Set contrast control to maximum.
3. Adjust video bias control counter-clockwise (CCW) until snow disappears.
4. Rotate control clockwise (CW) until snow appears normal, plus about ⅛ turn.
5. Check receiver on all channels to determine if they are snow free.

At this setting, the collector voltage of the video output, Q8, should be approximately 10-12v (with the IF disabled by shorting the emitter-to-base of the 3rd IF amplifier, Q6, and with the tuner set on a vacant channel).

The video amplifier, Q7, operates as an emitter-follower for video and audio information and as a common-emitter for sync and AGC information. The 2nd detector output controls the base/emitter voltage of Q18 and in turn determines emitter/collector current. T104, in the emitter circuit of the video amplifier, Q7, is a sound take-off transformer, tuned to 4.5MHz. Composite video appearing across the emitter resistor, R118, is directly coupled to the base of the video output, Q8. Video is also taken from the collector of Q7 and fed to the AGC gate and sync separator.

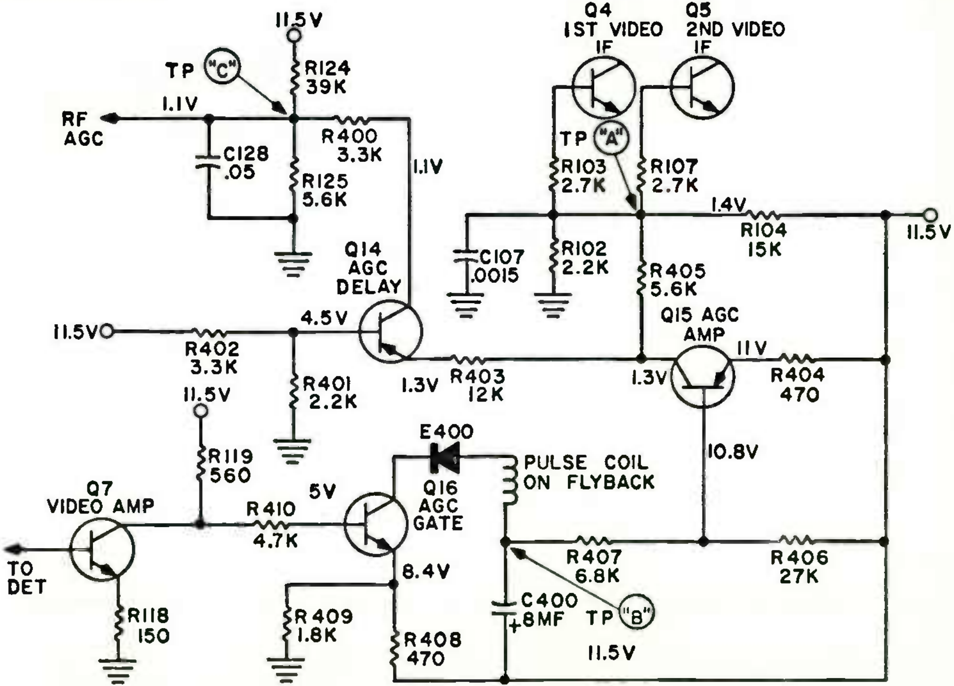
The emitter resistance of Q8 is near 250Ω. The contrast control, R203B, introduces degeneration in the emitter circuit when set toward minimum contrast (maximum resistance). C124 and C126 provides some bypassing of the higher frequencies to improve high frequency response.

The collector load of Q8 consists of L107, L108 and R122. The video information is ac-coupled from the Q8 collector circuit, to the CRT cathode by C201. T105 is a sound trap tuned to 4.5MHz and is adjusted for minimum 4.5MHz interference on the CRT. L107 and L108 provide high frequency peaking. Collector voltage is supplied by the boot strap circuit of the horizontal output stage.

Horizontal retrace blanking is provided by introducing a positive horizontal pulse from the emitter circuit of the horizontal output, Q23, through R123 to the emitter of the video output. This positive pulse turns off the video output, Q8. The collector voltage of Q8 will then rise—biasing off the CRT during the horizontal retrace interval.

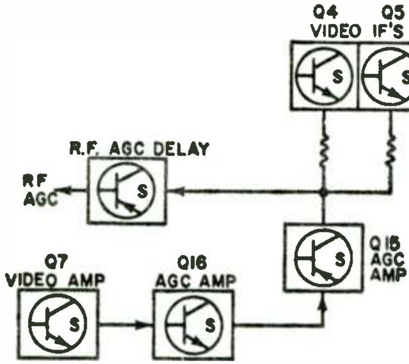
TV Chassis TS460—AGC Circuit Description

As we know, the RF and IF gain in a TV receiver must be varied in accordance with the relative strength of the received signal. A strong signal requires a gain reduction in both RF and IF amplifiers to prevent overloading. When a medium strength (snow-free) signal is received, only a reduction in IF gain is necessary, thus, allowing the RF amplifier to operate with maximum gain. If a weak signal (snowy picture) is received, no AGC is applied to either RF or IF stages. In short, the output of the system must be kept fairly constant regardless of the strength of the received signal. By not applying AGC to the RF amplifier during the reception of weak and medium strength signals, excellent signal-to-noise characteristics can be obtained in the tuner by virtue of the high RF-mixer-noise ratio. In essence, when a large RF signal is applied to the mixer, it overrides


11.5V
TP "C"
R124
39K
1.1V
RF
AGC
R400
3.3K
C128
.05
R125
5.6K
1.1V
Q4
1ST VIDEO
IF
Q5
2ND VIDEO
IF
TP "A"
R103
2.7K
R107
2.7K
1.4V
R104
15K
11.5V
C107
.0015
R102
2.2K
R405
5.6K
Q14
AGC
DELAY
4.5V
11.5V
R402
3.3K
R401
2.2K
1.3V
R403
12K
Q15 AGC
AMP
11V
1.3V
R404
470
11.5V
10.8V
E400
PULSE COIL
ON FLYBACK
Q7
VIDEO AMP
R119
560
5V
R410
4.7K
Q16
AGC
GATE
TO
DET
8.4V
R407
6.8K
R406
27K
R118
150
R409
1.8K
R408
470
C400
8MF
TP "B"
11.5V

Motorola

the noise generated within the mixer. The IF output signal from the mixer is now relatively noise-free and produces a noise-free picture on the TV screen. Hence, AGC applied to the tuner is delayed until the received signal is of such magnitude that any further increase in signal would cause



the tuner to overload. The delayed RF AGC stage will then come on and allow a reduction in RF amplifier gain for any further increase in the received signal.

The AGC system in the TS460 is keyed (gated) and consists of three stages: AGC gate (Q16), AGC amplifier (Q15) and RF AGC delay (Q14 shown in block diagram). When tuned between channels, Q16 is reverse biased by low collector voltage of the video amplifier (Q7). Q7 produces a large voltage drop across R119 (see schematic). This voltage drop is sufficient to cause the base of Q16 to be negative with respect to its emitter, thus reverse biasing its emitter/base junction which prevents conduction.

When tuned to a channel, the video amplifier, Q7, will be driven toward cutoff by the negative sync pulses and dc voltage introduced to its base from the 2nd detector, E100. As a result, the collector current of Q7 decreases, the voltage drop across R119 will then reduce. This, in turn, will elevate the base of Q16 to a higher positive voltage with respect to its emitter which will forward bias it and allow collector current to flow — if a positive voltage is applied to its collector that is higher than the emitter voltage.

A pulse coil wound on the flyback transformer will supply a 20v P-P positive pulse to the anode of E400. This pulse will forward bias E400 switching it on. The pulse will then appear on the collector of Q16. Q16 will now conduct, charging C400. The horizontal sync pulse on the base of Q16 and the horizontal gate pulse on the collector of Q16 occur simultaneously (with sync pulse varying in amplitude as a function of received signal strength). The magnitude of negative voltage (with respect to the 12.5v supply) developed at TP "B" is directly proportional to the amplitude of the received signal. This negative-going (less positive) voltage is applied to the base of Q15 increasing its forward bias. Its impedance lowers, causing a larger voltage drop across voltage divider resistor R104. This additional voltage supplements the existing 1.4v at TP "A" (IF AGC). Thus, the voltage at the IF AGC point will now increase to a more positive value and positive voltage is then coupled to the base of Q4 and Q5 through base current limiting resistors R103 and R107. The positive voltage on the base of the NPN IF transistors forward biases their emitter/base junction and causes a gain reduction by forward AGC.

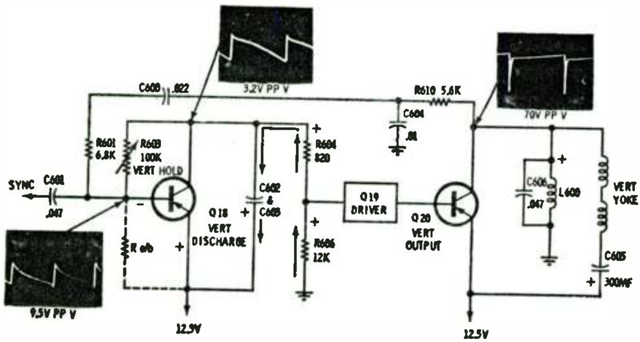
The function of the AGC delay, Q14, is to apply AGC to the RF amplifier just prior to signal overload in the tuner. This gives us the necessary RF AGC delay as previously explained.

The RF AGC delay (Q14) is a PNP transistor and is held at cuttoff by its emitter voltage divider network, R401 and R402. If the received signal is strong enough to cause approximately 2.1v to be developed at the IF AGC (TP "A"), Q14 will then be forward biased by this voltage and switch on. Collector current of Q14 will flow through R125 and R400 and cause TP "C" to become more positive. This positive voltage will be applied to the RF amplifier to cause a gain reduction. Any further increase in signal strength will result in RF amplifier gain reduction providing the necessary RF AGC.

TV Chassis TS460 — Vertical Sweep Circuit Description

The purpose of the vertical sweep section is to supply the proper voltage and current to the vertical deflection coils, causing the CRT beam to trace from top to bottom in synchronization with the TV studio camera.

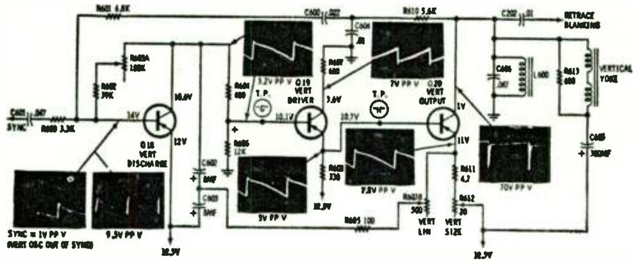
A simplified diagram of the vertical sweep section is shown here. The oscillator is a multivibrator, similar to that used in tube-type receivers, which provides feedback from the output to the discharge stage, maintaining oscillation. Capacitors C602 and C603 make up the sawtooth-forming network. (These capacitors are directly across the



discharge transistor, Q18.) At the beginning of trace, these capacitors are completely discharged. The collector and base of Q18 are at the same potential as its emitter, therefore, Q18 will not conduct. As the capacitors charge, the forward bias on the driver and output stages increases causing the beam to be deflected from top to bottom.

During this time, the voltage across the vertical discharge transistor, Q18, is also increasing. This voltage is divided by the vertical hold control, R603, and the emitter-to-base resistance of Q18, and it is used to forward bias this stage.

When Q18 begins to conduct, its collector voltage becomes more positive, reducing the forward bias on the driver and output stage. (The driver is an emitter-follower and can be considered a direct connection as far as the oscillator action is concerned.) The magnetic field that has been built around the vertical deflection coils, L600, now begins to collapse, causing retrace, inducing a voltage across the deflection coils and L600 which causes the collector of the output stage to go negative. This negative pulse is coupled by R610, C600 and R601 back to the base of the discharge transistor, Q18, driving it into



saturation, discharging the sawtooth forming capacitors quickly. When the magnetic field around the yoke has collapsed, no more negative voltage is induced across the deflection yoke and the collector voltage of Q20 now goes back toward zero. This positive-going voltage now cuts off Q18 and the sawtooth capacitors begin to charge, repeating the sequence of events.

Negative going sync pulses are applied through C601 to the base of Q18 which turns Q18 on to begin trace. This synchronizes the receiver with the transmitted signal.

A complete schematic of the vertical sweep section is shown.

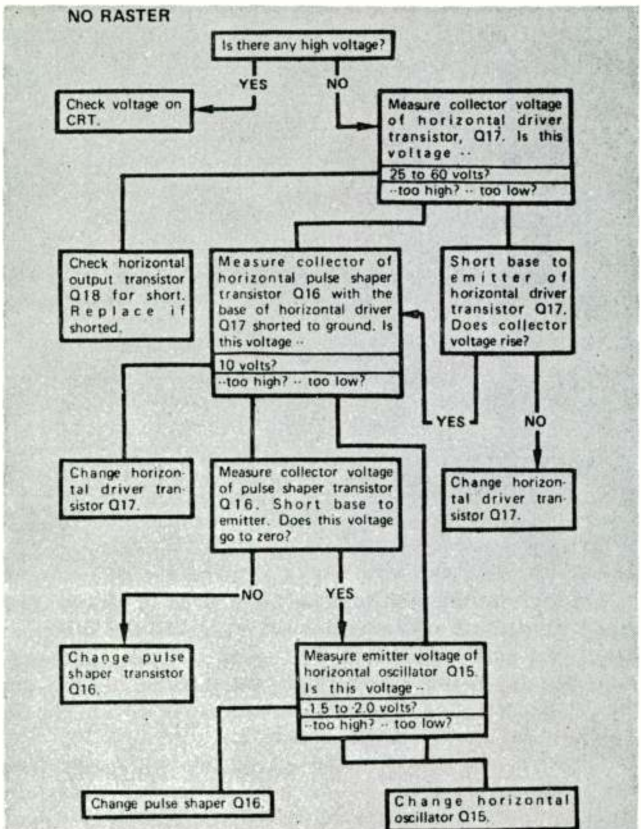
The vertical discharge transistor, Q18, receives forward bias from its collector and R604. Q19 provides an impedance match between the high impedance of Q18 collector circuit and the low impedance base circuit of the output transistor, Q20. The vertical size control, R612, determines the amount of bias and degeneration in the emitter circuit of the output stage. A sawtooth is taken from the emitter circuit of Q20, shaped into a parabolic waveform by C603 and fed back into the base of the driver, Q19. The amplitude and shape of the parabola is controlled by the vertical linearity control, R603B. As in the horizontal output stage, a germanium device is used for the vertical output circuit. C604, in the feedback circuit, filters out the horizontal pulses picked up by the vertical yoke, to prevent vertical jitter.

C605, in series with the vertical deflection coils, blocks dc current through the coils to prevent decentering of the raster.

R613 and C606 prevent the negative pulse, induced during retrace, from exceeding the breakdown voltage of Q20. C606 presents a relatively low reactance to this short-time duration pulse. R613 lowers the "Q" of the yoke to help limit this pulse.

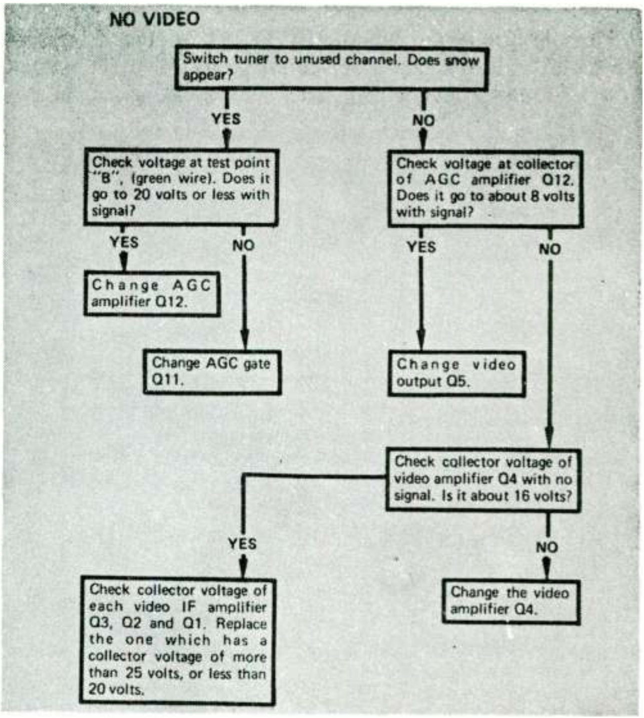
TV Chassis TS592/TS612 — Troubleshooting by Transistor Isolation

To help determine whether a TS592 or TS612 chassis can be fixed in the home or should go to the shop, several troubleshooting charts have been written as an aid in iso-



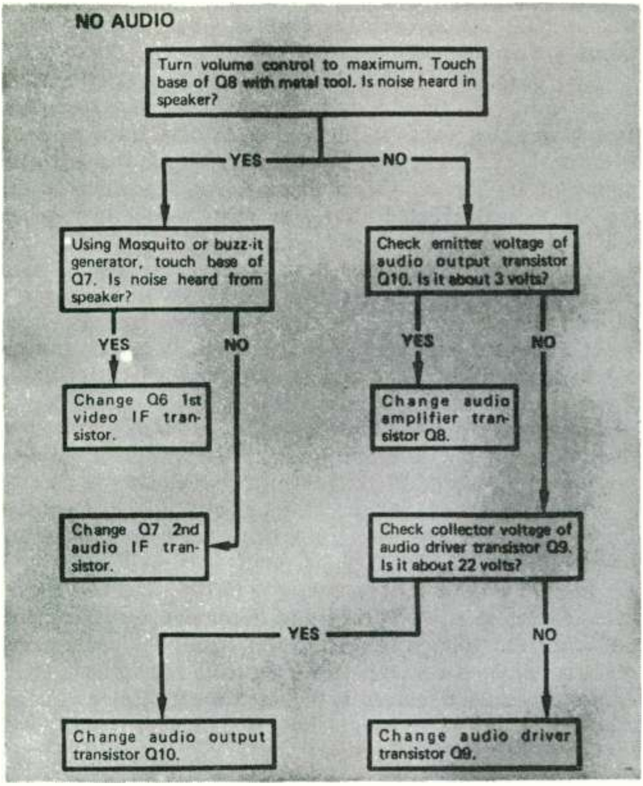
lating a defective transistor stage. The same procedure can be used in the shop.

The primary function of the charts is to direct you to the defective stage by a "process of elimination." An important prerequisite in using these charts is to define the receiver's symptom accurately.



On each troubleshooting chart is a series of blocks. Each block contains a suggested action related to the symptoms described and a question. The question asks the results obtained from the action. You are directed to the next block by answering the question with a yes or no. The last block on the chart gives the conclusion.

These charts can be used effectively with very little knowledge of the receiver's circuitry. Also, the only equipment required is an accurate VTVM or 20,000 ohm/volt VOM.



TV Chassis TS592 — Service Tips

Symptom: Critical horizontal sync. Set will perform as if horizontal phase diode E501 is defective. **Cause:** R505 (100K) resistor open. Check C510 (.005 horizontal pulse coupling) for short or leaky condition. **Solution:** Replace R505 (100K) and check horizontal frequency. Re-phase if required.

TV Chassis TS594 Video IF Circuits — Circuit Description

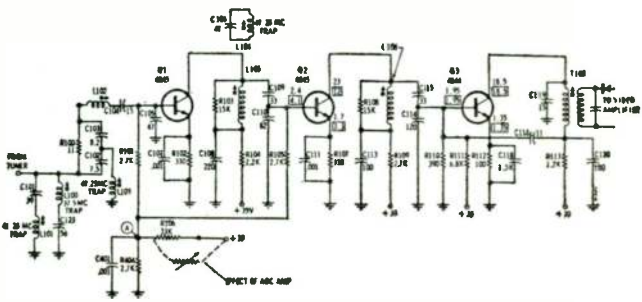
The transistor video IF system consists of three stages — each stage being basically a common emitter circuit with the input signal applied to the base and the output signal obtained from the collector. Since the transistors used are silicon NPN types, both the base and collector are more positive than the emitter.

The coupling circuit between the tuner and IF system is very similar to those used in conventional tube receivers. It contains the usual 41.25 and 47.25MHz traps plus an additional 37.5MHz trap used for rejecting the adjacent upper video channel. This additional trap is secured to the top of the 41.25MHz trap for easy accessibility when touching up the coil for signal conditions in the field.

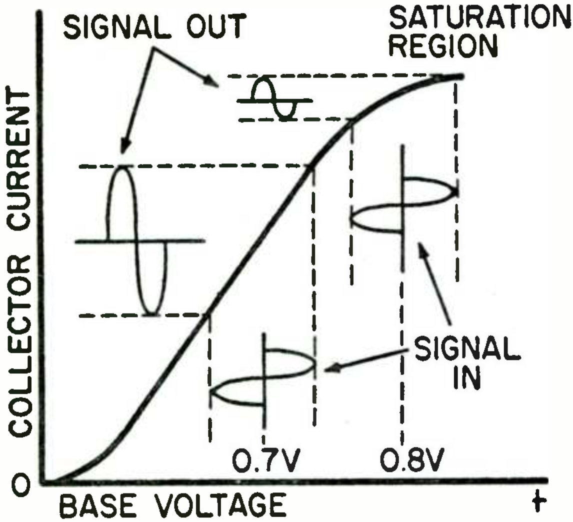
The input signal applied to the base of the first IF transistor is tuned by L101, C104 and C105 which form a series resonate circuit. Capacitor C104 isolates the transistor's base from dc present in the tuner. With this capacitor, in conjunction with C105, the input impedance matches the impedance of the transistor.

An emitter resistor (R102, R107, or R112) is used in each stage for the dc stabilization of the transistor. The ac portion of the signal passing through the emitter is shorted to ground by a capacitor (C107, C111 or C118) to eliminate the signal loss which would otherwise occur in the emitter resistor.

In each stage a collector resistor (R104, R109 or R113) is connected to a +33v buss and decouples the signal output from the voltage source. When stronger signals cause the transistor to conduct more current, the voltage drop across the resistor increases, reducing the collector voltage.



This reduction in the collector-to-emitter voltage, as a result of the stronger signal, reduces the gain of the amplifier. By increasing the forward biasing of the transistors in the first two stages, the AGC system causes them to conduct more



Transistor's forward bias characteristics graph

current — further reducing the collector-to-emitter voltage and the gain of the amplifier.

A capacitor (C108, C113 or C120) bypasses the collector resistor in all three stages. The voltage drop across this resistor is the result of only the dc portion of the collector current. This degenerates or reduces the gain of these two stages and neutralizes or eliminates their tendency to oscillate. An additional capacitor (C116) couples a small portion of the output of the third stage back to the base of that stage. The resulting negative feedback provides that stage with additional stabilization.

The signal output in the collector circuitry of the first two stages is tuned to approximately 44MHz — the center of the over-all passband. The coil used (L105 or L106) is very broad and contributes little to the overall selectivity of the system. In series with the coil are two capacitors (C109 and C110 or C115 and C114) which like the capacitors (C104 and C105) in the first stage, isolate the base of the transistor from the dc of the previous stage and make the input impedance of the circuit match the impedance of the transistor.

The output circuit in the first stage also contains a 47.25MHz trap designed to further attenuate the lower adjacent channel sound to the desired level.

Selectivity of the IF system is accomplished by taps incorporated in the input circuitry and by the band width of the 3rd IF transformer (T100).

As previously indicated, the forward bias of the first two stages is controlled by the AGC system. Under "no signal" conditions about +2.5v is developed by the AGC system at point "A" in the circuit. This 2.5v bias source develops a 0.7v emitter-to-base voltage in the first two IF stages — causing these stages to function with maximum gain. When a signal is received, the voltage at point "A" in the circuit increases in proportion to the strength of the signal. For a moderately strong signal, 4.4v is developed by the AGC system at point "A" — resulting in a 0.8v emitter-to-base voltage. As a result of the larger forward bias, the transistors conduct more current — reducing the gain of the circuits. This reduction in gain is shown on the transistor's forward biasing characteristics graph.

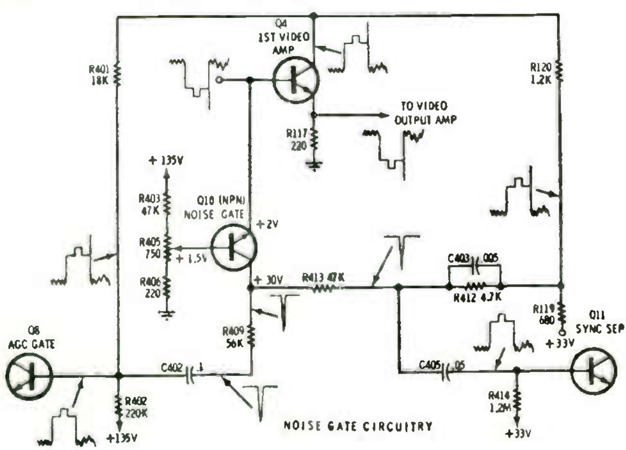
TV Chassis TS594 — Noise Gate Circuit Description

The AGC system samples the signal strength only during horizontal sync time, immune to noise interference at all other times. A properly adjusted noise gate circuit will help make the AGC system immune to noise even during horizontal sync time and will remove noise signals from the sync separator stage as well.

Basically, the noise gate (sometimes called a noise inverter) is a transistor stage that is reverse biased so that normal amplitude video signals do not switch it on. When a noise pulse is received larger in amplitude than the video signal, the stage conducts and makes an amplified negative going pulse from the noise. This negative pulse is fed to both the sync separator and the AGC stage and cancels the noise burst.

The Q10 emitter is connected directly to the 1st video amplifier stage base and has the same potential or approximately 2v when a signal is being received. The Q10 base is connected to an adjustable voltage source which is adjusted to provide approximately 1.5v to the base for normal operation. With these conditions, the stage is reverse biased or cut off. The negative going video signal from the 1st video stage will, switch the noise gate stage on if the amplitude becomes large enough.

The noise gate control is adjusted so that the stage is reverse biased and the negative going horizontal sync pulses fed to the emitted do not have sufficient amplitude to switch the stage on. Any noise present on the sync pulse larger in amplitude than the pulse will drive the transistor on. The noise pulse will be amplified only in the collector circuit. The circuit configuration is common base, hence no phase inversion occurs and the noise pulse in the collector circuit is negative going also.



NOISE GATE CIRCUITRY

The negative noise pulse is coupled through C402, 1 μf to the base of the AGC gate where it cancels the positive noise pulse in the signal from the 1st video amplifier collector.

A reduced value of the negative noise pulse is developed at the junction of R413 and R412 which cancels the positive noise pulse in the signal from the 1st video amplifier collector circuit.

Canceling out noise pulses provides a measure of noise immunity for the AGC and sync separator stages.

Adjustment of this circuit is very simple. The receiver should be correctly tuned to the strongest channel to be received. Starting with the noise gate control maximum counter-clockwise (off), slowly rotate it clockwise until the picture starts to bend or fall out of sync. Then back up until the picture is stable.

Malfunctions in this circuit can cause picture tearing or bending that can easily be confused with AGC or sync trouble. Also a defect in the noise gate circuit can prevent proper setting of 1st video amplifier bias.

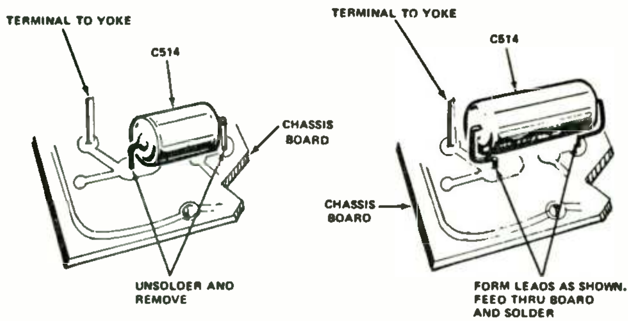
To eliminate the noise gate transistor as the source of a problem, it can be removed from the circuit by cutting the wire test loop in its emitter circuit. If the problem clears up, the noise gate circuitry (and adjustment) should be checked. If the problem persists after the test loop has been cut, other circuits should be analyzed and checked.

If the problem is in the noise gate circuitry, it can be checked as follows. After reconnecting the wire test loop, the noise gate transistor can be checked for its ability to turn on and off as forward bias is increased or removed. Shorting the base and emitter together should provide a slight increase in collector voltage indicating the transistor is not shorted and capable of being turned off.

The forward bias can be increased by bridging a resistor (approximately 27K) from 135v to the arm of the noise gate control and noting a decrease in collector voltage indicating that the transistor is not open and is capable of being turned on. However, this check is generally unnecessary since an open noise gate transistor will not generally be apparent in the picture performance on most signals and the only effect will be impaired noise immunity on noisy fringe signals.

TV Chassis TS597 — Service Tips

Symptom: No high voltage. **Cause:** C514 shorted. **Solution:** When replacing C514 (.027μf in some sets, .033μf in others), it should always be replaced with a molded type



ORIGINAL INSTALLATION — INSTALLATION USING MOLDED TYPE

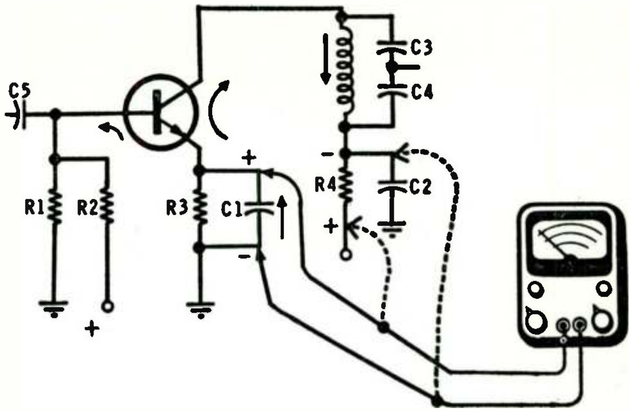
rather than original metalized style. The molded type is usually longer. However, it can be installed in position as shown here. Use a .056μf and 600v dc capacitor in all replacements.

Checking a Transistor Stage with the Transistor in Place

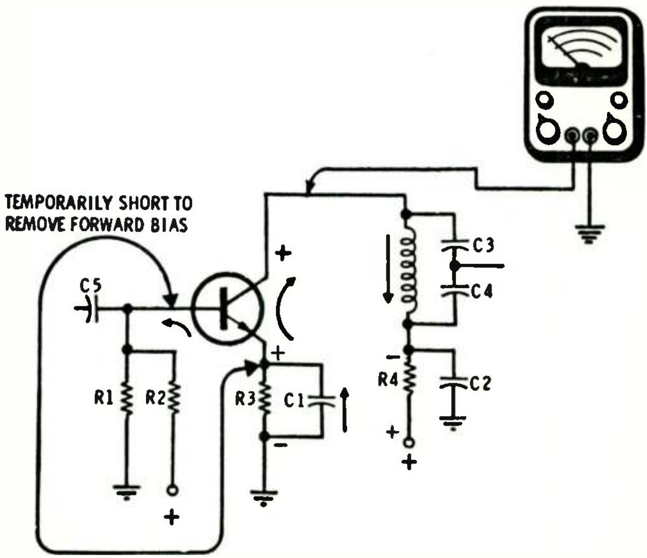
In transistor circuits, many defects can be localized by measuring the voltage on the transistor elements since the defective component in the majority of cases will upset the current drawn by the stage. This change from normal current will cause a different voltage to develop across the resistive components in the circuit.

The illustration shows a typical transistor circuit with the necessary meter connections for measuring voltage drops as a result of transistor current. Electronic flow is in the direction indicated by the arrows and causes the polarity of voltage drop across the resistors as shown.

The emitter resistor is common to both the input and output circuits. The voltage drop across R3 is the sum of the total transistor base and collector currents. The voltage drop across R3, therefore, indicates the total transistor current. Collector current can be determined separately, if desired, by metering the voltage drop across R4.



If a circuit irregularity is indicated by an incorrect voltage across the emitter resistor R3, as compared to the serv-



ice manual, it then becomes desirable to know if the transistor is capable of controlling its current. If we can determine that the transistor base is not capable of controlling current, we would suspect that the transistor is defective. If we find that the base is capable of controlling current, we would then suspect that the stage is biased incorrectly indicating a defective bias resistor or other component such as a shorted coupling capacitor.

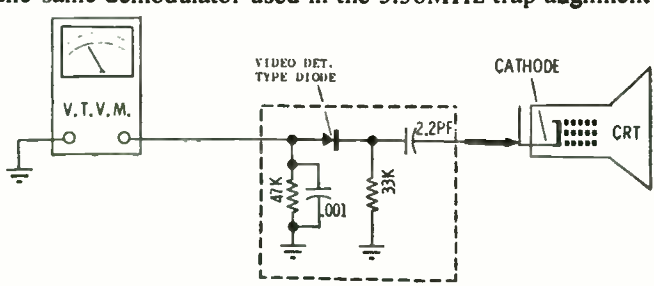
In servicing NPN transistor circuits, we can determine if the transistor base is capable of controlling the current by temporarily subtracting from the bias voltage and noting if there is a corresponding change in voltage at the collector element (see illustration).

By using a short piece of jumper wire connected from base element to emitter, we can eliminate the forward bias. If after removing the forward bias there is no change in voltage at the collector element, you can assume that the base element is not able to control the current and probably indicates a defective transistor. However, should the voltage change, it indicates that the base is capable of controlling current, that the transistor is probably good and the defect likely to be a biasing component, such as R1, R2, or C5.

Alternate Method of 4.5MHz Trap Alignment in Solid-State B/W Receivers

In some chassis the visual MHz trap alignment may be critical because of its sharp attenuation characteristics.

The following method of alignment may be used by employing a VTVM and a 3.58MHz demodulator. This is the same demodulator used in the 3.58MHz trap alignment



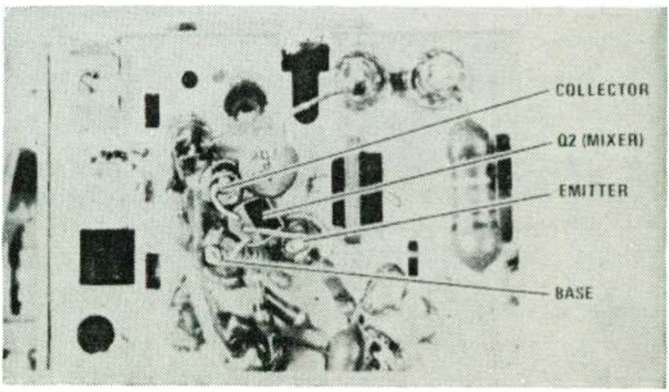
on TS914, 918 and 921 tube type color chassis. If a demodulator is not available, one should be constructed as shown. Alignment Procedure: (1) Connect the VTVM and demodulator. (2) Tune receiver to snow-free picture. Fine tune to near burble. Set optimizer or video peaking control to maximum (optimum high frequency response). (3) Start with 4.5MHz trap core at top of coil. Tune for maximum attenuation (minimum reading) at first dip on meter.

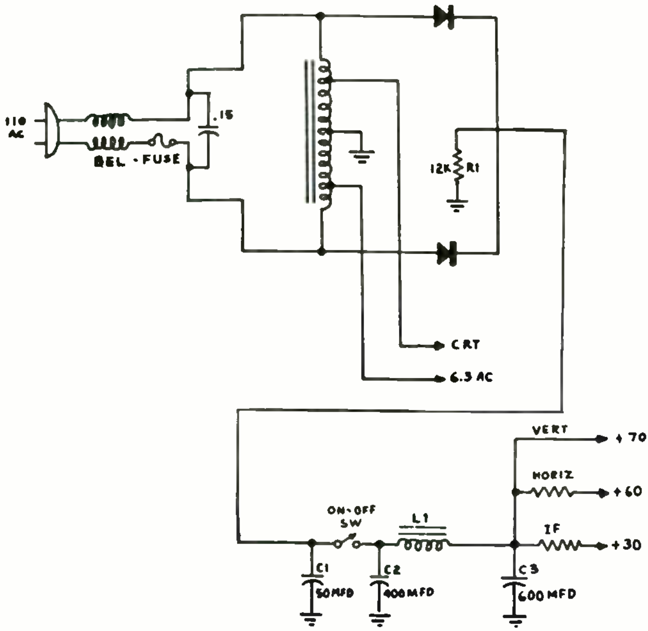
TV Chassis TS592/612 VHF Tuner TT409 – Transistor Replacement

Symptom: Raster, no video, no sound (noise only). Raster good with slight snow. *Cause:* Open Q2 (A2H) mixer transistor in tuner. Shorted Q2 (A2H) mixer transistor in tuner. *Solution:* Replace transistor with Motorola Part No. 48S134950. Mixer transistor replacement on VHF tuner TT-409 may be made on the top of the tuner. Unsolder and remove shield from top of tuner. Position replacement transistor bottom side up between feed through terminals as shown in photo. Observe correct polarity and keep leads as short as possible. Wrap leads around feedthrough terminals and solder. Replace shield and solder. If it has been ascertained that the original transistor is defective, it may be removed without unsoldering. Grasp transistor leads adjacent to terminal with long nosed pliers and twist off.

TV Chassis TS-599—Circuit Descriptions
Power Supply

A single-winding auto transformer provides the voltages





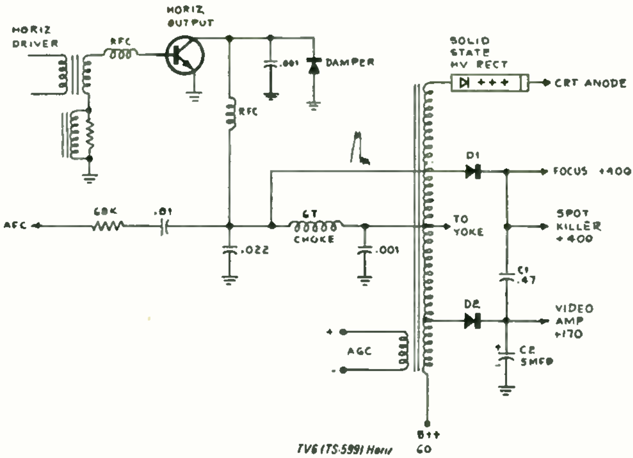
to operate this receiver. The winding is center-tapped to chassis ground and taps on each side of center provide 6.3v necessary for the cathode ray tube employed on this new chassis.

Full-wave recitation and filtering provides a 70vdc output from the filter to the vertical circuit. The 70v line is further filtered through two separate RC filters and provides 60v to the horizontal output and 30v for the remaining circuits.

Horizontal Sweep Circuit

The horizontal sweep circuit of the TS599 chassis is similar to several other Motorola transistorized horizontal output circuits. However, several modifications and additions are incorporated.

The positive going pulses generated during retrace are applied to two diodes, D1 and D2. Filter capacitors C1 and



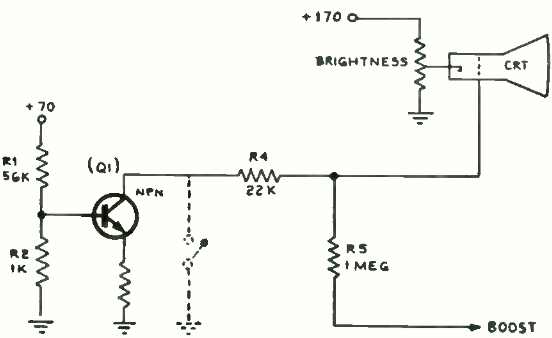
C2 provide the 170 and 400vdc outputs. The 170 line is used for the video amplifier and the 400v line supplies both the focus and spot killer circuits.

The horizontal coils of the yoke are tapped on the transformer primary, but dc decoupled by a capacitor so they are at ground dc. High voltage for the CRT is provided through a solid-state HV rectifier.

Spot Killer Circuit

The purpose of the spot killer is to eliminate the lingering spot on the CRT when the set is turned off.

With the receiver on, the diagram illustrates the spot



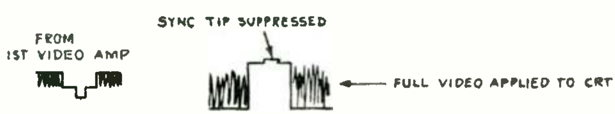
killer transistor Q1 is essentially a switch. The collector voltage of Q1 is derived from the boost voltage and in the base circuit, R1 and R2 form a voltage divider from a +70vdc supply and serve to bias Q1 into saturation. The Q1 collector impedance is a very low value (essentially a short) as represented by the switch. R4, R5 and Q1 now act as a voltage divider and apply the correct grid bias to the CRT.

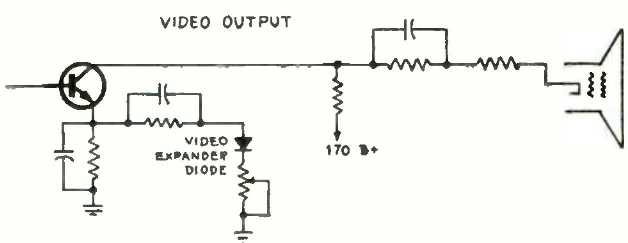
When the receiver is turned off, the voltage applied to the Q1 transistor base circuit decays faster than the boost voltage. As a result, Q1 is no longer forward biased and is essentially an open circuit. The "switch" is now open and there is no longer a voltage divider.

The boost voltage is applied through R5, to the control grid of the CRT. Control grid, G1 is now highly positive, at the same time the cathode voltage is near ground potential. As a result, the CRT conducts heavily and discharges any remaining charge at the anode and the spot is "killed."

Video Expander Diode

The video expander diode allows greater contrast on the picture tube. This is achieved by eliminating the sync pulses of the incoming composite video signal from the





linear conduction range of the transistor.

The diode is in series with the contrast control and an RC circuit in the emitter return. The diode acts to bias the transistor just at the point of conduction for the pedestal level of the incoming signal, with the negative-going sync pulses below conduction. Sync pulses are 20 percent of the composite signal, which means that without this diode only 80 percent of the input swing can be for "black and white" information.

MOTOROLA
Color TV

Color TV Models 23CK37, 38, 39, 40, 42, 44 & 46—General Convergence Procedure

The following eight steps outline, in general, the complete step-by-step convergence procedure detailed in the service manual:

1. Demagnetize shadow mask with degaussing coil.
2. Adjust purity ring for center screen area red, adjust yoke position for outer area red.
3. Set black and white brightness tracking.
4. Properly center and size picture.
5. Converge all three colors in center area of screen.
6. Dynamically converge all three.
7. Recheck steps #2 and #5.
8. Repeat step #3.

Complete details of each step appear in manual 68P65110A79.

Color TV Chassis WTS-907 or TS-908—Service Experience Information

Symptom: Set overloads when tuned to strong signals. **Solution:** Replace 0.02 μf capacitor, C124.

Symptom: Color indicator light will not stay lit during entire hue control rotation. **Solution:** COLOR KILLER control incorrectly adjusted and should be readjusted.

Symptom: Insufficient brightness. The customer brightness control does not have sufficient range to cause the

HV to go off the regulator even when the master GI control is full clockwise. **Solution:** This could result from a loss of blanker pulse on the color difference amp's or from a contrast control that has increased in value. One case of blanker malfunction has been traced to an open R920.

Symptom: Severe vertical fold-over. **Solution:** Replace 0.0033 μf capacitor, C602.

Symptom: Vertical buzz in sound, frequency varies with vertical hold control. **Solution:** Dress all leads away from the audio leads at the point they enter the 12 pin plug underneath the chassis. The audio cable is the one with two leads inside one shield.

Color TV Chassis TS-908—Service Experience Information

Symptom: Color indicator light burns all the time. No color. **Solution:** capacitor C912, .01 in T902 shorted.

Symptom: Overheating or burn up of resistor R802 in 275 v B+ line. **Solution:** Shorted capacitor C920 plate circuit of V21A, the blue demodulator.

Symptom: Picture smeared - low brightness. **Solution:** Green drive control R137A open.

Symptom: Left side of raster turns purple. Set appears out of convergence. **Solution:** C924, .1μf in plate circuit of V27B. G-Y amp open.

Symptom: No R-G vertical amplitude dynamic control action. **Solution:** Lead to red convergene coil broken off.

Symptom: On color, can get only magenta. Hue control has little or no effect. **Solution:** Defective crystal oscillator tube or crystal.

Symptom: No channel 5. Other channels OK. **Solution:** Tuning slug not engaging drive gear because retaining spring on channel 5 strip missing.

Symptom: Poor blue horizontal dynamic convergence. **Solution:** Open or poor connection in plug P3 which supplies pulse.

Symptom: No color. **Solution:** Lead from color intensity control to main chassis not plugged in at chassis or making poor connection.

Symptom: Poor focus, brightness, lack of width. **Solution:** Capacitor, C522, .015 μf in regulator circuit shorted.

Symptom: Uncontrollable, excess brightness. **Solution:** V10 — 6BH6 tube shorted.

Symptom: Insufficient range of blue lateral control. **Solution:** Be sure the blue lateral assembly is properly seated and positioned on CRT neck. Remove and discard the small metal clip from around blue lateral magnet if set has one.

Color TV Chassis TS908 — High Voltage Regulator Adjustment

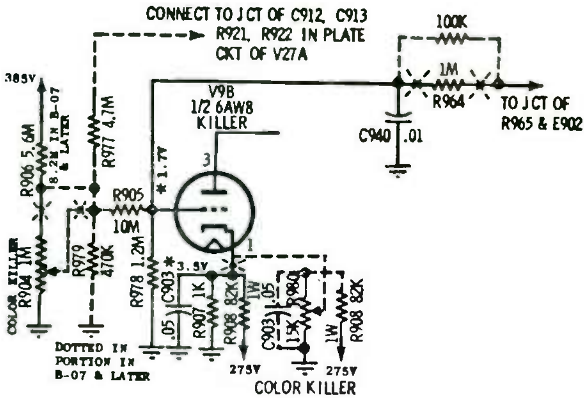
Measure the high voltage at the 2nd anode with an accurately calibrated voltmeter equipped with a high voltage probe capable of measuring 30 kv. Adjust R532 located on the left of chassis for a 2nd anode voltage of 24 kv. If a 30 kv probe is not available, adjust regulator as follows: Connect a VTVM across the high voltage regulator cathode resistor, R533. Set the brightness control to full counterclockwise position to extinguish raster. With raster extinguished, adjust control R532 to produce 1.2 vdc ±5% on the VTVM. Meter must be accurate to within ±5%.

Color TV Chassis TS-908—Circuit Guard

The circuit guard is a thermal cutout type of overload relay. It is in series with the B+ power into the receiver for protection against shorts. The circuit guard will remain in the "closed circuit" state when the current requirements are normal. In the event of a continuous high current overload, the bi-metallic elements of the unit will become overheated to the extent of "opening" the contacts and disconnecting the B+ power. After the bi-metallic elements have cooled, the circuit guard may be re-set by depressing the plastic re-set button. The circuit guard is designed to remain "closed" on the higher-than-normal instantaneous surge currents encountered during the initial charge of the filter capacitors. When a short exists in the associated circuitry, power will not be reapplied when the re-set button is held depressed.

Color TV Chassis TS-908B—Production Changes, Revisions and Additions to Motorola Service Manual Part No. 68P65110A80.

To improve color killer control action: The dotted in portion of the partial schematic diagram shown indicates the changes made in the color killer circuit. In addition,



R922 (27K, 2 w) in plate circuit of V27A is changed to a 4 w metalized film resistor, Part No. 17S10130A16. Part number of color killer control R980 is 18D66836A42. All other components used in this equipment are standard types.

To reduce the effect of barkhausen oscillations on the UHF channels:

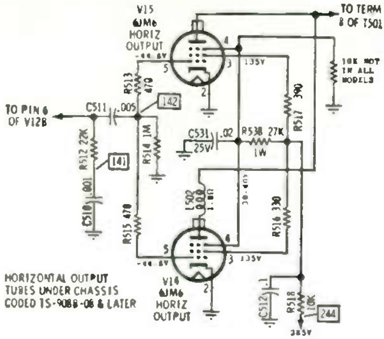
Horizontal output tubes (6DQ6) replaced with 6JM6 types and additional circuitry added to suppressor grids. See partial schematic.

To reduce 920 kc beat produced by sound carrier and chroma carrier:

A 10k resistor was added across the 39.75Mc trap coil, L103.

To stabilize the horizontal output suppressor grid voltage: A 10K, 10%, ½w resistor has been added to the suppressor grid of the horizontal output tubes and to chassis ground.

To increase focus voltage: The white and blue wires formerly connected to junction of T502 and R529 (100K) were removed from T502 and connected together. L510,



3600 μh choke, (Part No. 24D67324A30) added to junction of T502, R529 and solder well terminal 241, the -500VP-P pulse source.

To further minimize 920 kc beat: C134, a 2.2 pf, NPO, 1 kv capacitor was added across primary of T103.

Color TV Chassis TS-908B — Production Changes, Revisions and Additions to Motorola TV Service Manual Part No. 68P65110A80

To increase range of BLUE HORIZONTAL PHASE control, L-216: Capacitor C215 (0.022μf) changed to 0.025μf, 10%, 200 v mylar, part No. 8R10072A14.

An additional BLUE VERTICAL TILT adjustment has been added to the convergence panel. The center arm of the blue VERTICAL AMP control, R220, and the center arm of the blue VERTICAL TILT control, R217, are now connected to a terminal strip "P5" on the panel. Reversing these wires reverses the blue dynamic convergence coil. If blue cannot be satisfactorily converged vertically, reverse the wires on the terminal strip, P5.

To improve audio AM rejection: Capacitor C314 (0.0015) in grid circuit of V8A, is replaced with a 0.01 μf.

Design change: R116 (10K) connected across secondary of T102 changed to 3.3K Ω resistor.

To eliminate radiation from damper circuit into channel 2: Chokes, L505 and L509, in cathode circuit of damper V23 replaced with part No. 24C66772A06.

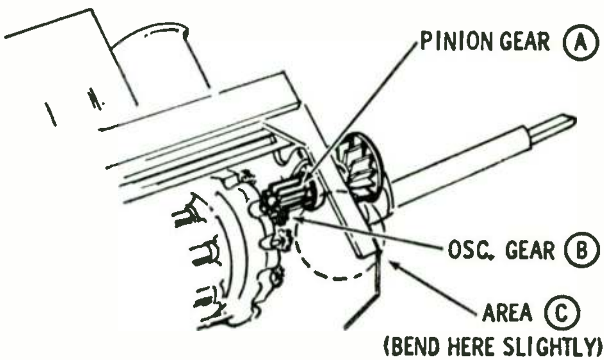
To reduce left side yoke ringing: the 260 pf, 3kv capacitor, C701, formerly tied between terminals number 3 and number 14 on yoke is now re-located to a terminal strip on bottom of chassis. One side of C701 is now connected to the unfiltered boost source, the electrical junction of C514, R521 and terminal number 2 of horizontal output transformer. The other side of C701 is returned to terminal number 14 on yoke.

Color TV Chassis TS-912 — Service Experience Information

Symptom: No focus at low brightness. *Solution:* Focus diode lead broken off but touching lug.

Symptom: No color. *Solution:* Resistor R113, 3.9K in in plate circuit of V5A, 1st video amp open.

Symptom: Poor color sync. Oscillator coil L913, very critical to adjust. *Solution;* 3.58 Mc crystal had low activity. Should be replaced.



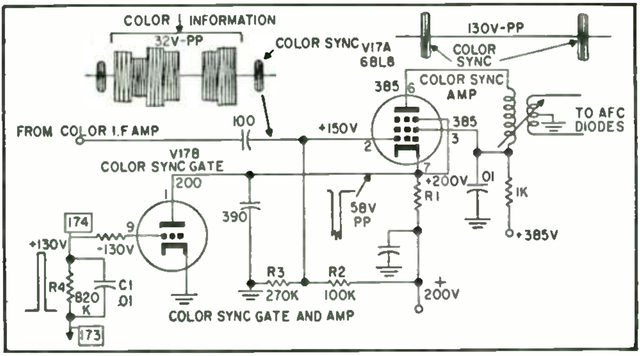
Symptom: Brightness slow to come up to normal. *Solution:* Video output tube, 15HB6, was slow to warm up. Replace tube.

Symptom: Series of vertical green bars on BW signals while color sync or color stripe is being transmitted. *Solution:* Defective 3.58 Mc crystal. Replace.

Symptom: Unable to fine tune any channel. *Solution:* (see drawing) Pinion gear (A) does not engage individual oscillator gears (B). To correct this condition, the front housing of the tuner can be slightly bent in the area (C) with pliers in the direction necessary to bring the pinion gear closer to the oscillator gear.

Color Sync, Gate and Amplifier — Operation

The gate and color sync amplifier circuitry passes and amplifies the color sync signal and rejects all other information. A composite color signal from the



Color sync and gate amplifier circuitry in Motorola set.

plate of the first color IF amplifier is fed to the gate-color sync amplifier circuitry. The gate tube is a switch to turn the color sync amplifier on when the color sync is present at its grid and allows the stage to be turned off at all other times. The basic circuitry is shown in the accompanying drawing.

The color sync amplifier plate is fed from a +385 v source and the cathode from a 200 v source. R2 and R3 form a voltage divider from the 200 v source to ground. This causes the V-17A grid to be +150 v. Since the cathode is +200 v, the tube has -50 v bias and is cut off.

The gate tube plate is connected directly to the color sync amplifier cathode. A positive pulse from the horizontal transformer is fed to the gate tube grid.

When the pulse is present, V-17B draws heavy plate current causing V-17A's cathode to become less positive and thus, turn the sync amplifier on. This same pulse causes V-19A to draw current which charges C1 providing bias for this tube.

The color sync signal and the pulse from the horizontal transformer both occur during horizontal retrace so that the color sync amplifier tube is turned on during the time the burst of color sync is present, and off during the remaining portion of each scan line.

If the sync amplifier and gate circuitry should become completely inoperative for some reason, there would be a complete loss of color sync if a color program was being viewed; color would be present on the screen but would be out of sync (scattered through the picture). A partially inoperative color amplifier-gate circuit may cause the color sync to be unstable or the hue range to be incorrect.

These circuits can best be checked for normal operation by removing the chassis and observing the waveforms with a wide band oscilloscope. The set should be connected to the color pattern generator or tuned to a color program. The color signal amplitude in the sync amplifier control grid will depend to a degree on the signal strength but the sync signal amplitude on the plate of the stage should be approximately 13 times greater than that on the grid. The area between the plate circuit color sync bursts should be clean. Any evidence of color information in this area would indicate that the amplifier stage is biased incorrectly. A dc voltage check on the tube elements should disclose this.

The gating pulse amplitude should be checked at V-17A's cathode to insure that the sync amplifier is turned on completely when sync is present. The sync signal should be centered in the gating pulse measured at V-17A's cathode when the horizontal hold control is adjusted at its most stable point. This insures correct timing for the gating pulse to turn the sync amplifier on at the instant the color sync is present on the control grid. If these two signals do not coincide, an undesired sync signal phase shift results, causing a hue change on the screen. Incorrect timing could be caused by incorrect R and C values in V-17A's grid circuit.

The gate tube, V-17B, is biased by grid current caused by a pulse from the horizontal transformer. In servicing this chassis, the set should not be operated with the horizontal sweep system inoperative for an appreciable period of time without removing V-17 or connecting sufficient negative voltage to its grid to prevent tube damage.

When servicing the color sync system, the defective stage must be located before the preceding checks can be applied. If color sync is poor or nonexistent, the AFC circuit should be checked first. Determine if color sync is received at the detector tube by measuring the dc voltage at pin #1 of the 6AL5 (color oscillator tube removed). This should be near +18 v. Determine if the AFC diode is receiving a local oscillator reference signal by measuring the dc voltage at pin #1 of the 6AL5 (color sync amplifier tube removed). This should be approximately +7.5 vdc.

If the AFC will pass these two tests, the defect is probably in the reactance or oscillator stages. If sync is not present at the AFC diode, the defect is likely in the sync gate-sync amplifier or color IF circuitry.

Color TV Chassis TS-914—Low Brightness

Check the value of R224 connected from arm to ground of master G1 control. If the value of this resistor is 47K, change it to 150K and readjust background and master G1 control.

Low brightness can also be caused by low emission of the 1st video amplifier tube V6 (6DX8) or the 2nd video amplifier tube V7 (6LY8). Conduction of these tubes affects the plate voltage of the video output tube and thus the voltage of the cathodes of the CRT.

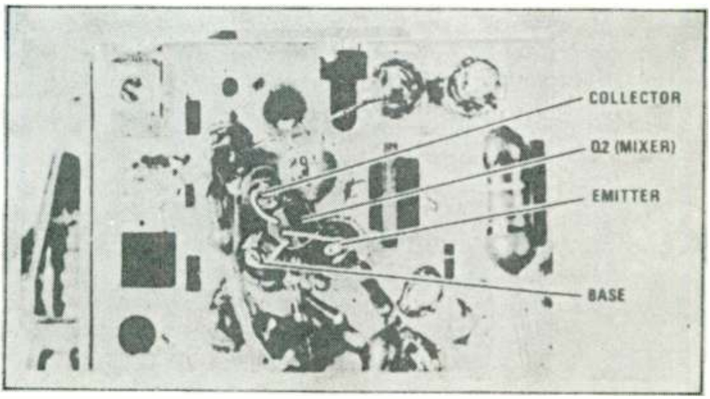
Check the value of the contrast control. It should be 200Ω. A higher resistance will also reduce brightness.

Color TV TS915/919 – Service Tip

Symptom: White vertical line on left side of raster appears to be a drive line. Generally not noticeable with picture. Usually can be seen at low video level – particularly on blank raster. *Cause:* Suppression in emitter circuit of horizontal output transistors Q6F and Q7F must be increased. *Solution:* Replace ferrite beads in emitter circuit of horizontal output transistors Q6F and Q7F. Order Part No. 76A544401 from your local distributor. Six ferrite beads are required. Remove heat sink from horizontal output panel "F" to gain access for replacement.

TV Chassis TS592/612 VHF Tuner TT409 – Transistor Replacement

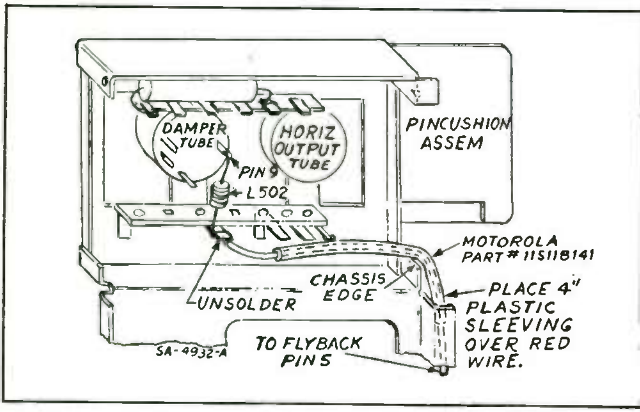
Symptom: Raster, no video, no sound (noise only). Raster good with slight snow. *Cause:* Open Q2 (A2H) mixer transistor in tuner. Shorted Q2 (A2H) mixer transistor in tuner. *Solution:* Replace transistor with Motorola Part No. 48S134950. Mixer transistor replacement on VHF tuner TT-409 may be made on the top of the tuner. Unsolder and



remove shield from top of tuner. Position replacement transistor bottom side up between feed through terminals as shown in photo. Observe correct polarity and keep leads as short as possible. Wrap leads around feedthrough terminals and solder. Replace shield and solder. If it has been ascertained that the original transistor is defective, it may be removed without unsoldering. Grasp transistor leads adjacent to terminal with long nosed pliers and twist off.

Color TV Chassis TS-934—Thin Vertical Line Near Left Edge of Screen

RF radiation may be caused by damaged insulation on the red wire between pin 5 of the high-voltage transformer



and pin 9 of the damper tube. Place plastic sleeving over the wire, to prevent leakage to the chassis edge, as shown in the accompanying illustration.

MOTOROLA

Console Models

Tape Player Models TM706S-1/TM707S/TM708S/TM709S — Failure To Index

This condition may be caused by two factors, the solenoid and/or cam adjustment incorrect or weak pawl spring (part No. 41A41328B01).

A solution to this problem is to make correct the solenoid plunger adjustment. Apply Molycote G (Part No. 11P40059A62) to pawls, ratchet and cam. Insert tape cartridge and adjust power supply for 11v. Use Allen wrench (or screwdriver) to turn adjustment screw clockwise while repeatedly depressing the track change switch. When pawls just fail to turn cam, back screw out ¼ turn beyond point where cam begins to turn consistently.

Then check pawl spring. Remove the bracket which encloses the ratchet cam shaft assembly (two ¼ in. screws).

Carefully manipulate the assembly until the solenoid plunger leaves the solenoid.

Examine assembly. If spring has enough tension to hold both pawls in contact with the ratchet, the spring is good. If the pawls actually spring out from the ratchet, replace spring (Part No. 41A41328B01). A good spring has a 45-deg angle.

Visible wear on the ratchet teeth does not interfere with normal operation.

Roll pin must be removed from the plunger to make correct spring replacement. If pawls are captive when a new spring is installed, spring will be damaged. Check the tension after a new spring is installed. Repeat above solenoid adjustment.

AM/FM Hi Fi Chassis IC350

The IC350 chassis with the AM/FM and amplifier is contained on a single chassis with no sub chassis.

The receiver employs the dual in-line packaged IC (integrated circuit) stereo FM decoder. This IC provides FM stereo demodulation, FM noise mute, stereo kill and stereo indicator.

This chassis contains nine diodes, one Zener, 21 bipolar transistors, five field-effect transistors and two IC solid-state devices.

Customer features include: slide-rule audio controls, flywheel tuning, push-button function selector, two stages of FM RF amplification, FM mute, J-FET (junction field effect) employed in the FM receiver, FM AGC, tuning eye for AM/FM tuning, stereo FM indicator light, FM stereo "IC" decoder, "J-FET" audio preamplifier and 350w instantaneous peak power output (EIA music power output rating 175w).

The complete unit lifts out from the top of the cabinet by simply removing back cover, connecting plugs, knob, earphone nut and screw under tuning knob, snap off escutcheon and four chassis bolts.

After the unit is removed, virtually everything is accessible for service and the side portion of the chassis swings out on hinges. The circuit boards are legended on both sides for circuit tracing. All leads on the AM/FM tuner are plug-in for easy removal. The chassis is transformer powered with a regulated 12v supply voltage.

AGC and Stereo Decoder

The AGC amplifier (Q5) and stereo decoder circuit are shown in the schematic.

FM AGC voltage for the 2nd FM RF amplifier is derived from the AGC amplifier (Q5) collector.

The 3rd FM IF signal is sampled through capacitor C11. Diode E2 converts the FM signal to a + dc voltage. The voltage varies with the received signal strength. This + dc biases the NPN AGC amplifier.

At the collector between resistor R29 and R30 a negative going AGC voltage is developed for the 2nd RF amplifier.

Since the AGC amplifier emitter voltage varies with signal strength, a customer tuning meter is connected here as a tuning aid.

A regulated +12v from the power supply is the IC source voltage at pins number 1 and 9. Pin number 8 receives a 4.7v bias derived from the same source through R33.

The signal flow to and from the IC is as follows:

Audio input: (pin number 3) Monaural audio (L-R) enters the IC input (pin 3) and is fed to the right and left audio channels from pins number 11 and 12.

Stereo information (pin number 3): L-R sidebands (23kHz to 53kHz) at the IC input (pin 3) are decoded into audio; added to the monaural signal (L+R) to reproduce the left (pin 11) and right (pin 12) stereo audio signals.

19kHz pilot (pin number 1): The 19kHz pilot transformer (L2) and 38kHz reinserted-stereo-carrier transformer (L1) are external to the IC. These are the only adjustments related to the IC.

Stereo light (pin number 6): During a stereo broadcast, pin number 6 is grounded through the IC switch action to turn on the stereo indicator light (E5).

Audio mute (pin number 5): To eliminate the normal "rushing" noise between FM stations, the mute switch is depressed.

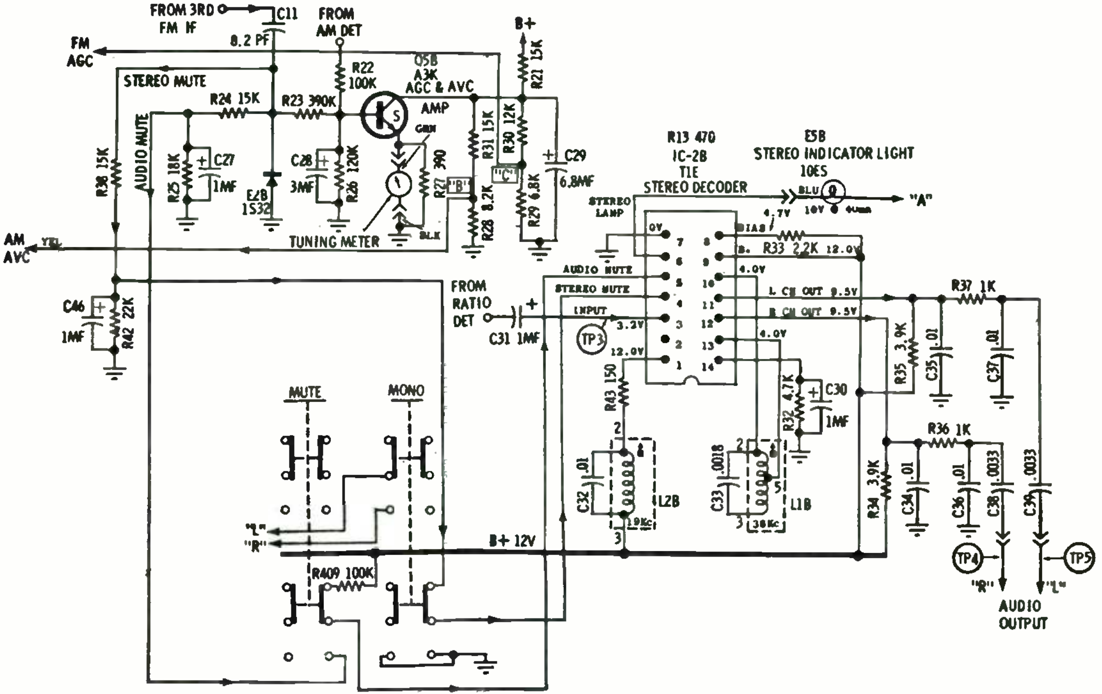
If the mute voltage at pin number 5 of the IC drops below a predetermined level (approximately + .9v), all signals are blocked from passing through the IC.

With the mute switch depressed (on), the IC pin number 5 is connected to the FM rectified signal (Junction C27, R25, R24). This rectified dc signal varies with signal strength. Between stations, the voltage drops below the mute threshold (+ .9v) and the IC is cut off and we have mute between stations and on undesirable weak stations. This action is similar to "squelch" used in two-way radio.

The mute feature is defeated when the mute switch is released (off). A fixed voltage (approximately +1.1v) is connected to the IC audio mute input (pin 5) through resistor R409.

Stereo Mute (pin number 4): The stereo information is blocked if the voltage at pin number 4 drops below .9v. Since this voltage is derived from the rectified FM signal through R38, this voltage will reduce with signal strength. On weak noisy stereo stations, the voltage drops below the .9v threshold point; all stereo information with the noise is blocked. The monaural signal is not affected.

Monaural switch: The monaural switch is depressed if


FROM 3RD FM IF
C11 8.2 PF
FROM AM DET
FM AGC
STEREO MUTE
R24 15K
R23 390K
R22 100K
Q5B A3K AGC & AVC AMP
B+
R21 15K
R31 15K
R30 12K
"C"
C29 6.8MF
R27 390
"B"
R28 8.2K
R29 6.8K
AUDIO MUTE
R38 15K
R25 18K
C27 1MF
E2B 1S32
C28 3MF
R26 120K
TUNING METER
BLK
AM AVC
YEL
C46 1MF
R42 22K
R13 470
IC-2B T1E STEREO DECODER
E5B STEREO INDICATOR LIGHT 10ES
BLU
"A"
STEREO LAMP
AUDIO MUTE
STEREO MUTE
INPUT
BIAS
R33 2.2K
L CH OUT 9.5V
R CH OUT 9.5V
FROM RATIO DET
C31 1MF
TP3
R37 1K
R35 3.9K
C35 .01
C37 .01
R43 150
R32 4.7K
C30 1MF
MUTE
MONO
R409 100K
B+ 12V
"L"
"R"
C32 .01
L2B
19Kc
C33 .0018
L1B
38Kc
R34 3.9K
C34 .01
R36 1K
C36 .01
C38 .0033
C39 .0033
TP4
TP5
AUDIO OUTPUT

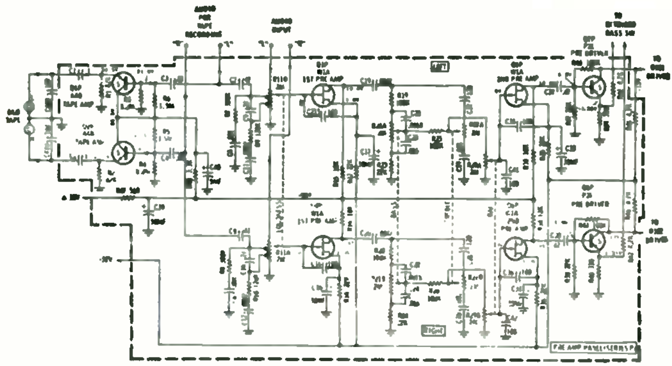
for some reason stereo is not desired. This grounds the 38kHz stereo carrier at the IC pin number 4.

Left and right output (pin numbers 11 and 12): Each output channel from the IC is bypassed to permit only audio to pass (30-15kHz). Frequencies above 15kHz are attenuated.

Audio Preamp

The complete preamp pre-driver and tape amplifiers are contained on the preamp panel (P) and are shown in the schematic. Since both audio channels are identical, only one channel will be explained.

Junction Field Effect transistors (J-FETs) are used for the 1st and 2nd preamplifiers to increase the signal-to-noise



ratio and improve reliability by using smaller valued coupling capacitors. The high supply voltage for the amplifiers, +25v for the source leads and −32v for the drains (57v total). This supplies a high degree of self-bias for each stage through the bias resistors R17 and R35. With such a large self-bias voltage, consistent class "A" operation is realized over a wide tolerance range of J-FETs.

Both preamp (Q3 and Q5) are connected as "common source" amplifiers (same as common cathode). The source leads are common to both input and output signals.

Audio from the selected function (phono, tape, AM or FM) is capacitive coupled to the LOUDNESS CONTROL input (R11). While there are no coupling capacitors shown from the phono and tape inputs, the cartridge or tape head acts like a coupling capacitor in that no dc voltage is generated.

Two taps and associated components on the LOUDNESS CONTROL compensate for a loss of bass and treble at low audio settings. Treble boost is provided by high frequency pass capacitors C7 and C9. The bias is boosted by high frequency-cut capacitors C5 and C11.

A full range of tone control is provided by completely separate bass and treble tone-control networks.

Making up the BASS CONTROL network are R19, R21, C21, C23 and R23. Capacitor C21 and C23 are effective short circuits for the high frequencies. Bass boost occurs when the BASS CONTROL (R21) slider are shorts across C21. Bypass capacitor C23 provides attenuation for the high frequencies but is an open circuit for lows. Therefore, the bass is said to be "boosted."

In the bass-cut position, the BASS CONTROL offers maximum resistance to the bass signal. Notice that in this position, the control slider arm short circuits capacitor C23. With the high frequency pass capacitor C21 now across the tone control, the high frequencies go around the control and receive less attenuation than the lows.

The TREBLE CONTROL network is made up of C27, R27 and C29 (see Fig. 16). In the treble-boost position, the TREBLE CONTROL connects high-frequency pass capacitor C27 directly to the control slider arm. High frequencies now bypass both tone controls for a direct path to the subsequent amplifiers.

Treble-cut occurs when the TREBLE CONTROL slider arm moves away from capacitor C27. This added resistance reduces the action of the capacitor thus cutting the high frequencies.

A BALANCE CONTROL (R29) acts as a reciprocal volume control between the left and right audio channels. From the BALANCE CONTROL the audio is presented to the 2nd preamp gate. Capacitor C37 couples the signal from the drain to the pre-driver base (Q7).

Audio leaves the preamp panel (P) at the pre-driver collector and is directly coupled to the NPN emitter-follower driver.

OLYMPIC B&W TV

TV Chassis NCP, NDP—Horizontal Oscillator Modification

The NCP and NDP chassis employ an 8FQ7 tube as a horizontal oscillator which has a wide range of dynamic operation.

When a replacement of this tube is required, the new tube may throw the horizontal frequency out of control range. This may also happen if the tube or components in the circuit age.

Compensation in the horizontal oscillator circuit was required in the past. Varying the value of R149 and R151 resistors, was good for the immediate tube change, but not a permanent cure.

Modification has been made on the horizontal circuit to employ an additional control, not available before. The control allows setting of the horizontal hold control to its mid-position under all conditions encountered with various 8FQ7 tubes, when the horizontal sweep circuit is adjusted as follows:

Allow a two minute warm-up, tune in a station.

Short out the horizontal frequency coil (L115), by jumping TP-105 tie point to the −140v terminal.

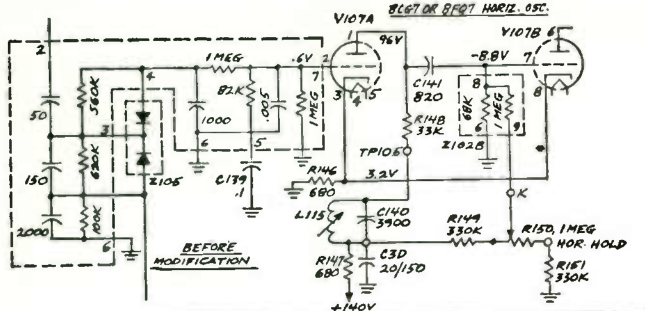
Connect a clip lead from TP-104 to ground, to disable the horizontal sync input.

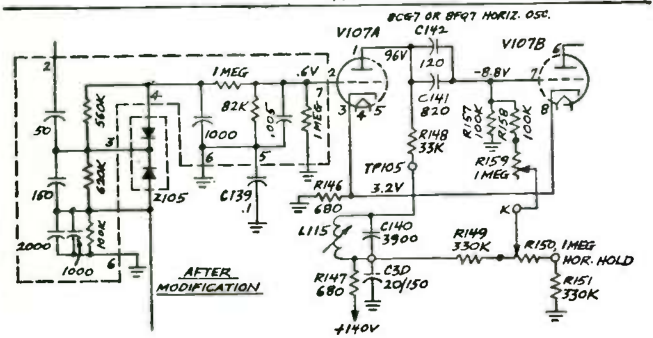
Adjust the horizontal hold control to mid-position, adjust the new control until the picture is near locked-in.

Remove jumper from L115 and adjust L115 until picture is in sync. Remove clip lead from TP-104 and ground allowing station sync signal to reach the horizontal circuits.

In production this control will be labeled "H. BAL." (horizontal balance), and will be located directly above and on the same plate as the horizontal hold control.

The control and its associated circuit can be added in the field, by installation of modification kit PP35557,





which has installation instructions enclosed.

The kit is available at $2.50 list, and consists of the following parts:

1	Potentiometer	1M ½w ±30%
2	Resistors	100K ½w
1	Capacitor	120pf N1500
1	Capacitor	1000pf 1kv ±20%
1	Terminal strip, double lug, stand-off	

TV Chassis NCP and NDP — To Eliminate Horizontal Drift

If horizontal drift is experienced in these chassis, proceed as follows: 1. Change S141 (820pf) to a 1000 pf temperature compensating capacitor. 2. Change R149 to 470K. 3. Short terminal 4 of the AFC couplate (Z102) to ground. 4. Shunt out the horizontal frequency coil (L115). 5. Check to see that the proper frequency range has been attained by varying the hold control. In some instances it may be necessary to increase R149 to 680K. 6. Remove the short

from terminal 4 and the jumper from the frequency coil.
7. Adjust the frequency coil until the picture is synchronized horizontally.

Snivets

Some reports have been received indicating trouble with snivets in fringe area reception on UHF and VHF. Most cases are cured by replacing the 21JZ6. In some instances it may be necessary to use a different tube type, a 21GY5 for example, in place of the 21JZ6. To make this change, place a jumper from pin 10 of the 21JZ6 to ground.

These changes have been made in production on the NDP chassis commencing with run 10. On the NCP chassis the changes started with run 16.

TV Chassis NDP—Horizontal Pulling and Bending under Certain Signal Conditions

This chassis, used in models 7C133, 7C134, 7C135 and in some "7K" series, has a pair of long yellow and orange wires connecting the front control panel to the CRT socket and connecting point "E" on the chassis board respectively. These wires should be gathered in a flat loop and taped together so that they run "direct," the shortest possible distance between connecting points. In some models they were stapled to the top of the cabinet, thereby running near the deflection yoke. This may cause an induction of the horizontal sweep frequency into the wire resulting in horizontal pull. When this happens, the two wires should be "hanked" and taped.

TV Models 5T100, 6C125, 6C126 — Parasitic Oscillation

To prevent the possibility of parasitic oscillations (inability to lock picture horizontally), particularly on channels 2, 3, 4, the front bottom control panel should only be grounded to the CRT grounding strap. If the control panel is grounded to the speaker and tuner mounting bracket, remove the ground between the control panel and speaker.

On units with monopole antennas, using the NCP or NDP chassis, lift the ground lead running from antenna to top of the HV cage, insert a 560Ω ½w resistor between terminal of cage and ground lead.

TV Model 9P56/9P65—Horizontal Oscillator Drift

Symptom: Horizontal oscillator drift during warm up.
Correction:

- Locate C261, a 471pf capacitor adjacent to the V10 tube socket. This component should be tilted outward to position it away from the hot tube envelope.
- Locate R258, usually a 1M ½w or possibly a 100K ½w resistor also adjacent to the V10 tube socket. Replace this resistor with a value of 470K ½w.
- Perform the following alignment tests with the chassis secured in its original cabinet mounted position. (Important: due to interactive coupling existing between deflection yoke fields and the stabilizer coil L208, chassis must be cabinet mounted.)
  1. With the set warmed up and tuned to a station, attach a jumper from the junction of C256 and R258 to ground and also add a second jumper across the leads of C260 to effectively short it out. The picture may now be out of sync.
  2. Adjust the hold control VR201C to bring picture into sync, although it may drift sideways due to the jumper at the sync input.
  3. If the hold control must be set at or near the end of its range to achieve the condition of zero beat, as described in previous step, check and/or replace C259, C261, R264 and R262 to obtain a zero beat at control near center position.
  4. Now remove jumper across C260 and adjust L208 to bring picture back to sync. Some of these coils have waxed cores which may require a few drops of cement thinner or tuner spray to dissolve wax before the slug can be moved.
  5. Remove jumper at sync input C256 and R258, and picture should now lock in.

Solid-State TV Model 9P59—Service Hints

Symptom: Loss of raster within first 30 min. of operation.

Correction: Replace resistor R514, a 1.5Ω, ½w base bias resistor in the horizontal output stage.

Symptom: Critical vertical sync lock and/or complete loss of vertical and horizontal sync.

Correction: Check sync transistors Tr-18 and 19. Also check by substitution capacitor C405, 10μf at 25v.

Symptom: Picture flagging at top of raster.

Correction: Replace capacitor C503, 3μf at 6v located in Anti-Hunt network of the Horizontal AFC circuit.

Symptom: Picture bending and distorted.

Correction: Replace capacitor C805, a dual section electrolytic in the power supply.

Symptom: Weak sound output.

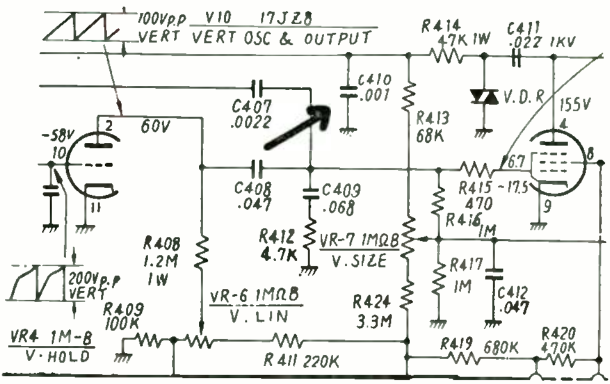
Correction: Check the following electrolytics capacitors by substitution: C323 and C320 located in the audio-amplifier circuitry.

Symptom: Fine grain appearance in video (4.5MHz beat).

Correction: Realign the L201-trap coil. Refer to service manual for alignment instructions.

TV Chassis NEC—Vertical Sweep Failure

Vertical sweep failure (white line) may be caused by shorted capacitor C410 located in the plate feedback net-



work of the vertical oscillator and output tube, V10, in the vertical output stage.

OLYMPIC
Color TV

Color TV Chassis—CTC17 and CTC18—Circuit Modification

If any models using these chassis have insufficient width, ringing bars at start of sweep on left side of raster and/or excessive blooming the following steps should be taken to correct the fault: (1) Connect 100 pf 5kv disc capacitor between pins no. 2 and no. 9 on 6DW4 damper tube. If this value is not available it is possible to substitute Olympic part no. CO-32092-27, 130pf 6kv disc capacitor. If width is increased too much connect 2-130pf capacitors in series (65pf total). (2) Replace 6JE6 and 3A3. (3) Turn brightness up to maximum and then reduce to normal viewing level. (4) Adjust high voltage control for minimum blooming and optimum brightness. (5) Adjust focus control for best focus in center of screen. (6) If the screen controls (red, blue, green) have been misadjusted, it will be necessary to repeat screen adjustments as indicated in service manual. (7) Bias switch should be checked for best operation when setting screen controls.

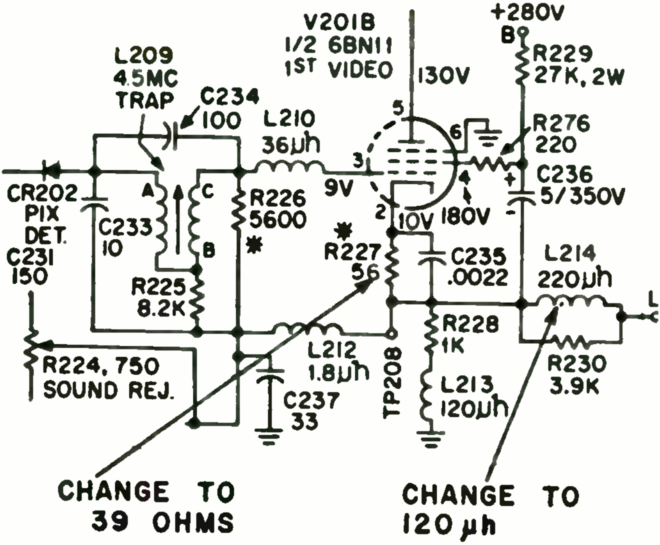
Color TV Chassis — Circuit Modifications

Chassis CTC19. **To improve picture quality, increase contrast and improve definition.**

Change resistor R227 from 56 Ω to 39 Ω 1½w and peaking coil L214 220μh to 120μh (part # C13244345). Both are located in front of the V201 6BN11 tube. Chassis which already have this change will have the number 7 or 8 stamped on the upper left hand corner of the HV cage.

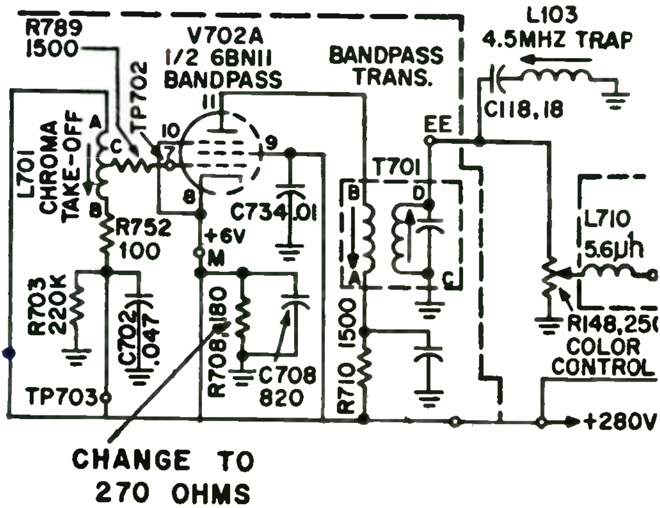
Chassis CTC20. **To improve picture quality and increase band width of video amplifier.**

Change resistor R117 from 10K to 5.6K 3w (part RE-32087-43). The resistor is located on rear control panel next to BLUE drive control. When making this change,



check resistor R729 which must be 47K (not 100K as in earlier production). Its location is adjacent to T701 band-pass transformer.

Chassis CTC19/21. **To remove a red vertical bar on left side of picture caused by the burst signal passing through chroma amplifier.**



Change R708, 180 Ω resistor to 270 Ω, ½w. This resistor is located adjacent to V702, 6BN11 tube. Chassis which already have this change will have the number 7 or 8 stamped on the upper left corner of the HV cage.

Chassis CTC19/21. **To remove retrace lines visible at top of picture during certain programs, also fold over at top of picture.**

Replace resistor R252 (10K) with a 2.75 ½w. This resistor is located adjacent to the 6LU8 tube socket. Also change R281 (560K) to a 330 K ½w — located under the PC board near the 6LU8 tube.

TV Chassis CTC-20 — Up Dating Chassis and Service Hints

The following circuit changes will bring the CTC20 Chassis up to date, through run 16:

To minimize background noise reduced by run 13: Install a second 4.5MHz trap (L118, part no. CL35311) with a new 18pf capacitor (C152, part no. CCD18051) in series with the trap, between the high side of the color control and ground. Adjust the trap for a minimum interference beat in color picture.

For improved ventilation obtained by run 14: Drill ventilating holes into the high-voltage cage cover.

Run 15 was changed to prevent shifting of yoke: Use Emery tape on each side of yoke ring, part no. PP35348.

To prevent shifting of convergence yoke: Add masking tape to the neck of the CRT under the convergence yoke.

To increase brightness on all CTC20 Chassis: Set the screen controls in proper relation to the bias switch: This is done by setting the bias switch at a minimum position and adjusting the screens to proper intensity. The bias switch then remains at the minimum position.

To improve picture quality: Add a 0.0022μf, 20% disc capacitor (C150, part no. CCD222M2) on the terminal strip adjacent to the contrast control ground lug.

To sharpen picture detail: Adjust the IF response, causing the picture carrier to fall at a 40 percent point on the IF alignment curve. This is done by realigning the second IF transformer (T206). Shops without alignment equipment can adjust the second IF transformer by turning the top slug counterclockwise ½ to ⅔ turns.

To improve picture quality by run 16: Put a jumper across C122 and R119 mounted on a terminal strip on the top center of the chassis, thereby shorting these two parts out of the circuit.

To improve picture stability: Brightness fluctuations that occur when the volume control is advanced beyond mid-position can be eliminated by connecting the screen grid of the 6AD10 tube to a +280v supply rather than the +140v supply. This is done by removing the yellow wire from points FF on the signal board and connecting a jumper wire from pin 10 of the 6AD10 tube (junction of C212 and FF points, which is the exposed lead going to the top side of the vertically mounted capacitor C122) located adjacent to the tube and the +280v terminal on the board. (This is a tall pin at the edge of the board that has a red lead attached to it.)

To increase the brightness control range: Bridge resistor R729 (a 100K ½w resistor) with another resistor of approximately the same value. R729 is in series with the brightness control.

A kit is now available for modfying the CTC20 chassis up through run 15. This kit (part no. PP35398) contains one 4.5MHz coil (L118), one 18 pf capacitor, two pieces of Emery tape and one holder for capacitor C216 (part no. 1N32586).

The manufacturer has suggested some service hints should certain symptoms occur in current or older models of the CTC20 chassis. These suggested corrections are not required in every chassis and are intended only as a guide in the event of a failure.

Should a black vertical line appear near the right side of the raster, particularly on low UHF channels, the problem is probably Barkhausen oscillation and can be corrected if the 6KD6 tube is replaced.

The relay circuit breaker may be open, possibly after the unit has been shipped. This will occur if the degaussing coil has become shorted to the CRT shield. To correct this problem, the chassis and shield should be removed. Once the short has been located and insulated with tape, care should be taken to make certain the shield does not cut into the coil again.

The memory tuning action may become inoperative if the HF channel indicator knob has been forced on the shaft. This will cause the gears to mesh incorrectly. The problem can be corrected by removing the VHF knob from the front. Then, using long-nose pliers, inside the cabinet, pull the indicator knob slightly forward. After reassembling, the fine tuning knob should have a light "spring action" indicating that the gears are now properly disengaging when switching channels.

Lack of detail, weak or smeared color and a 920kHz beat in the picture may appear if the IF and traps are out of alignment. Before commencing alignment, check the position of capacitor C215, which is part of the 47.25MHz trap (L201). If it is leaning toward the coil or at an angle in the other direction, the over-all alignment will be affected. After it has been straightened up, an alignment job may not be necessary.

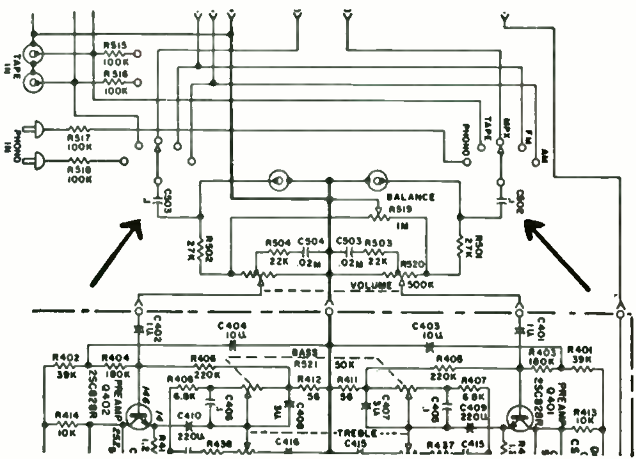
OLYMPIC
Console Models

Model 327 Stereo Chassis—Service Hint

Symptom: Whenever this chassis is separated from cabinet wiring harness, as during shop service, it will be necessary to install a jumper wire between pins 2 and 4 of the remote speaker socket to secure stereo speaker operation.

Radio Chassis 330-1, 330R—Noisy LOUDNESS Control Symptoms

Noisy LOUDNESS controls symptoms may be caused by leakage in coupling capacitors C502 and C503. Replace-



ment of these capacitors will eliminate the need to replace the dual LOUDNESS control.

Radio Chassis 329-1, I-329-1—Interchangeable Transistors

The circuit diagram and parts list for this chassis list audio output transistors as 2SD72's and 2SB405's. However, because of the variations in production runs, some chassis may contain different transistor types as listed, which are directly interchangeable.

2SD405 or 2SB370 Olympic TNJ 60612
2SD72 or 2SD170 Olympic TNJ 6167

Tape Deck TD20—Displaced Drive Belts

A problem of displaced drive belts is generally the result of the belt slipping on the motor pulley caused by a coating of oil found on the surface of the motor pulley and inner surface of the drive belt. This condition is attributed to an oil spray liberated from the upper motor bearing as the operating temperature rises. Therefore, a cold motor may not show signs of this condition until its temperature has sufficiently increased after the first hour of operation.

To correct the displaced belt problem in this model use the following procedure:

- Completely remove drive belt from mechanism.
- Operate motor continuously (without belt) for a period of four hours.
- Wipe motor pulley and capstan pulley clean of oil coating.
- Invert belt and reinstall so that the dry side becomes the inner surface.
- Replace chassis and secure. No further problems with this condition are anticipated.

PACKARD BELL

Color TV

Color TV Chassis 98C6 — Loss of Video and Sync

In several sets capacitor C-313, 560 pf broke down and shorted out. This capacitor is in the plate circuit of the third picture IF (½6AW8). Shorting resulted in loss of video and sync. The 470 ohm resistor R-317 burned out and in some cases resistor R-148, 5600 ohms, 5 w, also had to be replaced.

PHILCO
B&W TV

Chassis 12N51, 12N51A, 12N51X and 12N52—Production Changes

12N51 Run 9 — VOS Perma-Circuit Panel was changed to Run 6 (blue dot). Panel changes were as follows: Resistor R16, vertical oscillator plate circuit, was changed from 1.5 MΩ to 2.2 MΩ. Resistor R43, horizontal oscillator cathode was changed from 1200 ohms to 1100 ohms 5%. Reason To improve horizontal oscillator performance.

12N51A Run 7—was changed to Run 5 (green dot). Panel change involved resistor R43, horizontal oscillator cathode circuit, which was changed from 1200 ohms to 1100 ohms 5%. Reason: To improve horizontal performance.

12N51X Run 4—was changed from Run 3 to Run 4 (yellow dot), part no. 54-5794-15. Panel component changes were the same as Run 7 of the 12N51 chassis.

12N52 Run 4—was changed from Run 4 to Run 5 (green dot), part no. 54-5794-15. Panel component changes were the same as Run 7 of the 12N51 chassis.

TV Chassis 13L80 — Height-Linearity Control Adjustments

It is possible through vertical linearity and height control adjustment to cause this TV receiver to exhibit vertical sync conditions inferior to normal capabilities. This is possible because of vertical feedback and varistor compensating circuitry characteristics. The vertical height control affects scan at the top and bottom. The linearity control affects the bottom portion primarily. Preferred sequence of adjustment is:

1. Reduce height control setting to underscan vertically.
2. Adjust vertical linearity control for linear scan.
3. Re-adjust height control to fill screen vertically (normal scan).

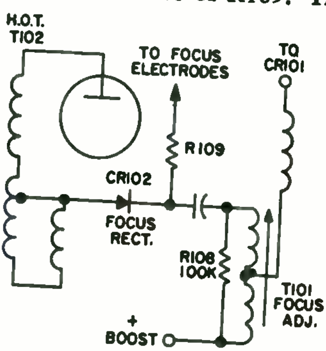
If the receiver still exhibits sub-standard or weak vertical sync after following this procedure, change the 6EM7 vertical oscillator/output tube.

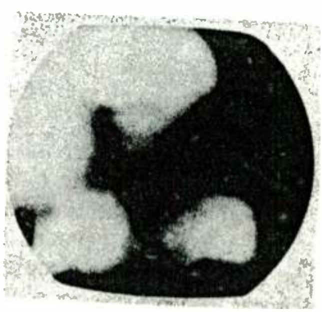
TV Chassis, All 1963 "L" Line — Checking Horizontal Phase Comparer Selenium Diode

When troubleshooting TV receivers where a defective dual selenium horizontal phase comparer diode is suspected, here's a fast and efficient method of checking them. A 20,000Ω/v meter is used. With the meter set on the 10K scale and with the probes matching the diode polarity, the forward diode resistance should be a maximum of 6000Ω. The ratio of the forward resistance of the diodes should be less than 2:1. With the meter set on the 100K scale and meter probes reversed to the diode, back resistance should be a minimum of 2MΩ. The phase comparer unit's diode center is common negative.

TV Chassis 14M91, Model M-52414MR—Picture Out of Focus

Shorted focus rectifier CR102 causes overheating and rise in resistance of R109. This condition results in insuf-

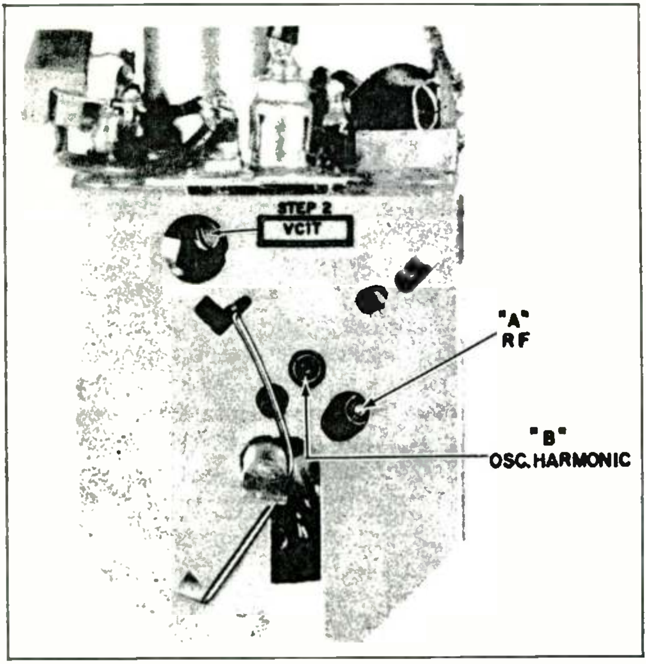




ficient brightness, blooming and poor focus. Color and sound are OK in this instance.

TV Tuners TT82, TT83, and TT84 Series—Installation and Adjustment of UHF Channel Strip

1. Before installing UHF strip the tuner must be modified for UHF operation by installing a UHF adapter kit, part no. 425-0052. Where tuner is already adapted for UHF disregard above.



Trimmer screw locations on Philco tuner.

2. Remove tuner cover.

3. Remove unused VHF channel strip and two adjacent VHF strips.

4. Install UHF strip in center portion and replace adjacent VHF strips.

5. Replace tuner cover.

6. Rotate tuner to bring in UHF station.

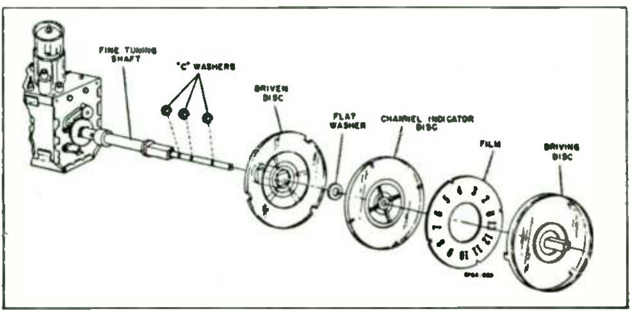
7. Adjustment of the UHF strip is usually not necessary. However, in the event the UHF strip, when installed in a fringe area, does not provide adequate reception, the RF and oscillator trimmer on the UHF strip may be touched up.

8. Make centain fine tuning control is correctly adjusted.

9. Using a non-metallic screwdriver, carefully adjust trimmer screws "A" (RF) and "B" (osc) in this order, for best picture with minimum snow.

TV Tuners VHF TT-165 and UHF TT-155A—Disc Removal

If it becomes necessary to remove tuner discs in servicing the "N" line chassis, this can be accomplished in the following steps: (1) Remove tape holding driving disc and driven disc together. (2) Remove "C" washer in front of driving disc and remove driving disc. (3) Remove "C" washer in front of channel indicator disc and remove indicator. (4) Remove "C" washer and flat washer in front of driven disc and remove disc. (5) To replace, reverse procedure. Caution: Be sure to replace tape that was removed in step one. Note: The film is mounted into the channel indicator disc, but is removable for replacement purposes. Should the film have to be replaced, proper posi-



Disc placement for Philco TT-165 and TT-155A tuners.

tioning must be observed. Be sure to note position of film before removal.

The drawing represents VHF tuner, follow same procedure in assembling the discs from UHF tuner.

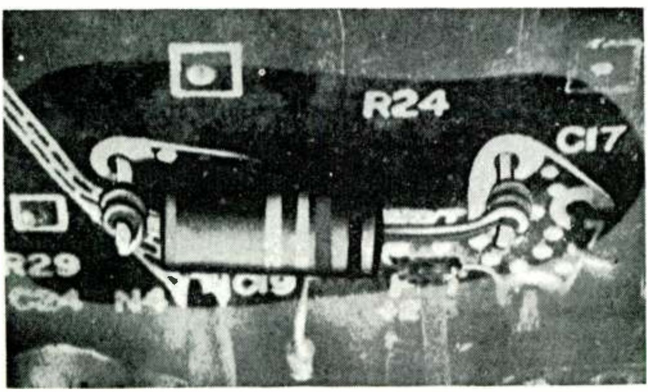
Model RC-21 Remote Control — Correcting Channel Changing at Turn-on

Some RC-21 remote control units change channels when the set is turned on and must be recycled to the correct channel. If this problem is encountered, R7, located across relay K1 should be changed from a 15 K to a 10 K resistor. This modification may also be accomplished by shunting R7 with a 27 K resistor.

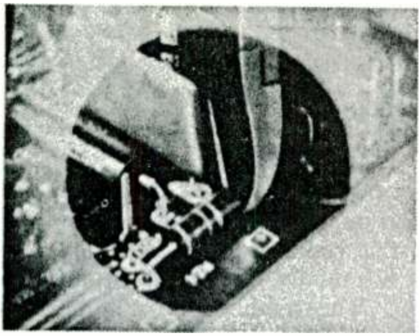
The range of the unit will be somewhat reduced when this modification is installed.

Perma-Circuits — Component Replacements

Replacement of most components of these panels is best done from the top, *component side,* for the following reasons: 1 — Prevention of excessive heating of the foil which may cause it to break free of the panel, 2 — damage to the protective coating sprayed on the foil side of the panel is prevented, 3 — the repair is made completely from the panel top — in many cases eliminating the need for chassis removal. As shown,



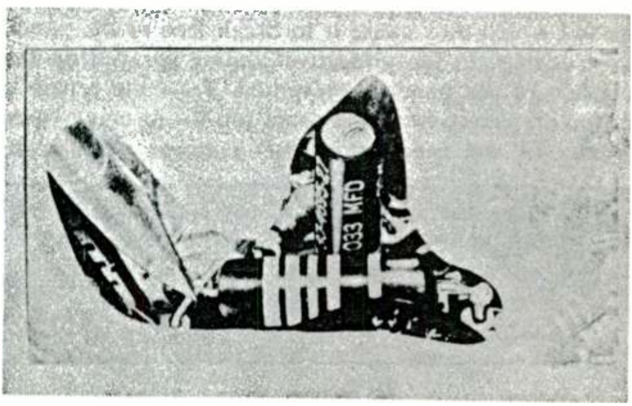
the defective component is clipped out leaving about



Method of replacing components in Philco's P e r m a-Circuit panels.

¼ in. of pigtail lead on either end. These leads, once straightened, serve as mounting points for the new replacement component.

Although replacement of horizontally mounted components on the perma-circuit panel top-side is comparatively straightforward, a question arises when vertically



Replacing vertically-mounted capacitor on Philco perma-circuit panel.

mounted capacitors need replacement since one lead is often inaccessible for cutting.

Naturally, the capacitor can be desoldered from the copper plate and replaced. A more timesaving method is to confine all action to the panel top-side.

Clip the component lead close at the defective part. The new unit is installed by using the former pigtail lead and a circuit-junction as mounting points. The new capacitor, for example, is soldered in leaving the old unit disconnected but still "standing" as shown here.

TV Chassis 16JT26 and 16JT26A, IF Sensitivity and AGC Overload — Servicing

The manufacturer has found that technicians are having difficulty servicing transistor circuits—particularly when low IF sensitivity and/or AGC overload is the apparent problem.

In servicing a TV receiver, it is helpful to know the normal range of voltages and wave shapes expected at different test points. In servicing any transistor equipment, it is well to review some precautions that should be taken:

- All transistors are voltage sensitive and in no case should voltages be applied to the transistor in excess of the voltage shown on the schematic.
- All voltages must be correctly polarized.
- The soldering iron should be electrically isolated from all circuits and care should be taken not to overheat semiconductors.
- Be sure that the ground side of all test instruments, including VTVM and scope, is firmly tied to the TV chassis before using the test probe.
- Any transistor's emitter-to-base junction is extremely sensitive to voltage. Use only the low ohm scale of the multimeter to measure the reverse resistance. The reading in all cases should be infinite resistance.

The tuner AGC bias at lug M32 will vary from approximately +1.2v in fringe areas to +4.0v in a very strong signal area. Zerovolts or grounding this point will cut the tuner off. If it becomes necessary to apply an external bias to this point, do not use a negative voltage or more than a +5.0v supply or damage to the transistor or diodes may occur.

The voltage at the IF bias lug H24 will vary from

TABLE I

Suspect Component	Fault	Picture Tube	Test Point M32	Test Point M24	2nd Detector P.P. Volts
C25 3μf AGC	Open	Oscillation	+6V	+5V	6 to 7V P.P.
TV 16	CE Short	White Raster	+1.2V	+3.3V	0
	CE Open	White Raster	+1.2V	+3.3V	0
TV 17	CE Short	White Raster	+5.0V	+6.0V	0
	CE Open	Dark Grey Raster	+1.2V	+3.3V	6 to 7V P.P.
TV 18	CE Short	White Raster	+6.0V	+6.3V	0
	CE Open	Dark Grey	+1.2V	+3.3V	6 to 7V P.P.

Input Signal	Picture	AGC RF	AGC IF	2nd Det. Output	Possible Causes
Strong or Weak	White No video	+5 to +6	+6V	0	TV 17 or 18 CE short, video tube cut off
Strong or Weak	White No video	low +1.2V	low +3.3V	0	TV 16 open or cut off
Strong	Grey, little or no video	low +1.2V	low +3.3V	Approx. 7.V	D1 open D2 open or shorted. TV 17 or 18 cut off. This type would appear normal under fringe conditions
Strong	Overloaded	Nearly normal		Over-loaded	TV 16 partly defective, 2nd Det. diode DS partly bad (low rev. R) last I.F. (L5) mistuned appreciably.
Strong	Excessive contrast or grey with little con-trast	Nearly normal		High	D2 low in rev. R

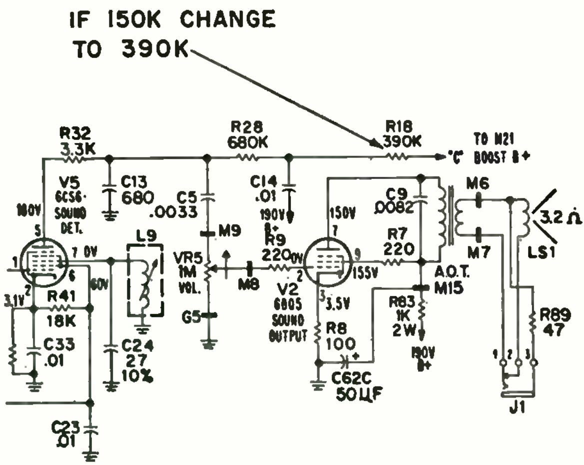
+2.5v in a fringe area to approximately +5.0v with a strong signal. If it is necessary to apply an external bias to this test point, care should be taken not to apply any negative voltage or a positive voltage of more than +5.0v.

The normal peak to peak signal at the second detector lug M14 should be from 2.0v to 2.5v with approximately 30 percent sync.

Table I can be used as a guide when it is suspected that one of the transistors, diodes or capacitors listed have failed.

TV Chassis 17JT41, 17LT43, 17NT45—Run Change Information

17NT45 Run #2 Panel and 17JT41, 17LT43 Run #7 Panel.



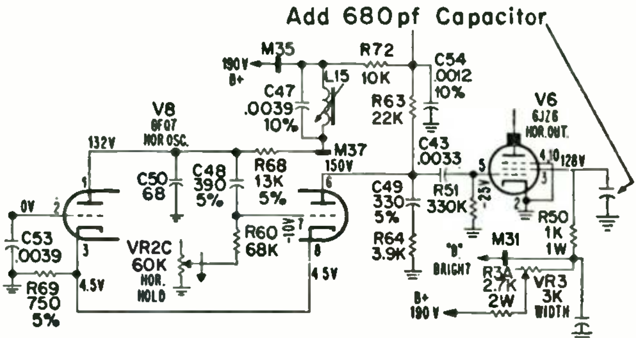
To improve hum rejection in the audio output stage, resistor R18 in the audio detector plate has been changed from 150K to 390K.

17NT45 Run #2 panel will be identified by a red dot on the panel.

17JT41 and 17LT43 run #7 panels will be identified by a violet dot on the panel.

TV Chassis 17LT43, 17JT41, 17NT45—Vertical Lines on Left of Screen

If one or more vertical lines are noticed on left of center screen, this condition may be caused by parasitic oscillation in the horizontal output tube. If this condition is en-



countered, the addition of a 680pf capacitor from screen grid pin 3 of the horizontal output tube (6JZ6) to ground will eliminate the oscillation.

Later production of the above chassis will incorporate the addition of the 680pf capacitor.

Monochrome TV 19-inch Models—Picture Tube Mounting Ring Removal

The front mounting ring or wire band which holds the 19-inch picture tube to the cabinet front is secured by a coil spring which maintains tension on the ring. This spring must be compressed to relieve the tension during picture tube replacement. However, standard pliers present a problem of slipping off the compressed spring.

Although "special" tools are available with which to compress the spring, such as the type of pliers used to compress automotive brake springs, the following method using readily available hardware can also be used:

Obtain a 3/16-inch nut and a bolt approximately 2½ inches long (hex or slotted head). (The type of bolt used to secure the mounting ring on small-screen sets can be used.) Insert the bolt through the spring from the bottom, mount the nut, and tighten until the spring compresses and the mounting ring is loose. This arrangement also will safely hold the spring compressed during remounting of the new picture tube.

Monochrome TV Chassis—Service Check of Filament Diode Rectifier 34-8054-23

A number of Philco-Ford monochrome receivers have a solid-state rectifier connected in series with the series-string filaments of the tubes and CRT. (The present part number of this rectifier is 34-8054-23. The part number previously was 34-8054-7.)

Because of the action of this half-wave rectifier, the total rectified voltage across the filament string should be considerably less than the 115-120 volt AC line voltage. If the filament diode should become shorted, full line voltage will be applied across the filament string, reducing tube filament life.

Philco-Ford recommends that the filament diode be checked whenever any tubes are replaced, particularly if a tube is being replaced because of filament failure. The diode can be checked by connecting an AC voltmeter between the output of the diode and ground (across the filament string). If the voltmeter reading is equal to or almost equal to the line voltage, the diode should be replaced. Because the rectified output of the half-wave filament rectifier is neither pure DC nor an RMS sine wave, a normal reading will be between 55 and 80 volts, depending on the type of meter used.

An alternative method of checking the filament diode is to turn off the power and measure the forward and reverse resistances of the diode.

PHILCO

Color TV

Color TV Chassis 14M91—No Color, Sound OK

If no color, insufficient brightness and adjustment of brightness control has practically no effect, trouble is probably in the chroma section. Check at the common color difference amplifier cathodes. If no signal is present, check at the blanker cathode. If a high dc voltage is found here, check for an open 820 Ω resistor (R708), connected from the bandpass amplifier and blanker cathodes to ground. An open resistor in the common blanker, bandpass amplifier circuit, not only cuts-off the bandpass amplifier but removes dc restoration by disabling the blanker stage. Replacement of the open resistor restores color and proper CRT grid bias.

Color TV Chassis 15M91 — Production Change and Part Omission

The 6BK4 high voltage regulator tube cap and lead assembly, used on the 15M91 color television chassis, has been changed in production to a larger type, part number 41-4367-1. This part number is now the recommended field replacement. The new cap and cable assembly is recommended for field replacement for M-line 14M90 and 14M91 chassis, L-line 13L80 and 13L80U and K-line 12L80 and 12L80U color television chassis.

It has been found that a 0.01 μf 500v disc isolating capacitor was omitted from early production 15M91 color television chassis. The omission of the disc capacitor does not affect set performance and was intended for circuit isolating purposes. As such it adds protection to the perma circuit panel should arcing occur in the high voltage section. When servicing any 15M91 chassis check to be sure that the capacitor has been installed. The capacitor is connected to pin 8 of socket J1, the convergence coil socket. It is in series with the purple lead which runs along the copper circuit side of the chroma panel to lug M36. If the capacitor is missing, unsolder the purple lead from pin 8 of the convergence socket and insert the capacitor in series with the lead and the socket pin 8. Tape the lead end of the capacitor for insulating purposes.

Color TV Chassis 15M91—Field Service Information

Sound IF Padding: In the event of sync buzz in the audio, check (L2) interstage transformer bottom core for maximum output. The bottom core of L2 can be peaked at two different settings. The proper setting should be with the bottom core closest to the circuit panel. The bottom core can be adjusted from the top of the transformer without the need to pull the chassis.

Proper Lead Dress, Sound Det. RFC (L40): RFC L40 located on the video IF panel between lugs M72 and M73 must be dressed up and away from the bottom of the circuit panel. If it is dressed against the panel, some evidence of sync buzz may occur when tuning toward smear.

Vertical Bands or Lines During Blank Raster: The purple lead running from lug M36 on the chroma panel to socket J1 pin 8 should be dressed away from the delay line (DL1) and copper on circuit panel where lug M33 connects to RL network N3. Proper dressing of this lead should remove the vertical bands from the raster during the absence of video.

Color TV Chassis 15M91 (See TEKFAX No. 898, January 1965) — Field Service Information

Sound IF Padding. In the event of sync buzz in the audio, check (L2) interstage transformer bottom core for maximum output. The bottom core of L2 can be peaked at two different settings. The proper setting should be with the bottom core closest to the PW board. The bottom core can be adjusted from the top of the transformer without pulling the chassis.

Proper Lead Dress, Sound Det. RFC (L40). RFC L40 located on the video IF panel between lugs M72 and M73 must be dressed up and away from the bottom of the PW board. If it is dressed against the panel, some sync buzz may occur when tuning toward smear.

Vertical Bands or Lines During Blank Raster. The purple lead running from lug M36 on the chroma panel to socket J1 pin 8 should be dressed away from the delay line and copper on the PW board where lug M33 connects to RL network N3. Proper dressing of this lead should remove the vertical bands from the raster during the absence of video.

Color Chassis 15M91 — Production Change Information

Run 1 — First Production. Run 2 — Focus rectifier (D8) changed from part no. 34-8053-2 to 34-8053-3. Reason: To improve focus quality. Run 3 — Horizontal hold and tone control (VR25) changed from part no. 33-5604-39 to 33-5618-2. Reason: To improve horizontal hold range. Run 4 — In the run 4 chassis a capacitor (C41) .01 μf has been removed from the chroma panel. The chroma panel will be identified by a red slash on the panel. This will be a run 2 chroma panel. In addition a .001 μf capacitor has been added between the tuner AGC feedthru and ground. The part number of the capacitor is 30-1238-13. Reason: To improve set radiation supression. Run 5 — A run 3 chroma panel is used which is identified by an orange dot on the panel. The run 3 panel has a slight copper change which will not affect servicing or parts replacement. The part number of the run 3 chroma panel is 27-11018-2. Reason: To improve spark gap protection should the CRT arc.

Color Chassis 15M91, Run 6—Production Change

Sound panel capacitor C14 changed from 750 to 820pf—part number 30-1293-35. Panel is identified by a red dot and is known as a run 2 panel. Reason: To improve sound IF performance and prevent IF oscillation.

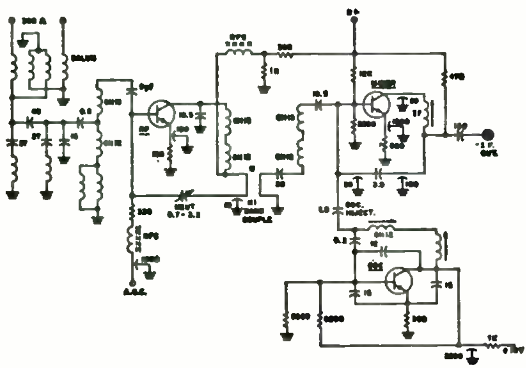
Color TV Chassis, 16QT85—Tuner Circuit Descriptions

RF Amplifier. The RF amplifier is a common emitter circuit. Both input (base circuit) and output (collector circuit) channel coils are incremental types. This, and the following tuner circuits, are shown without channel switching to simplify the circuit. There are several impedance transformations to properly match the traps, the tuned circuit and the base input. Base bias is determined by the tuner AGC line. The RF choke and 1000 pf capacitor in the AGC feed is to provide ac isolation by decoupling. Emitter stabilization is employed with emitter bypassed to prevent degeneration.

The output couples, through mutual inductance, to the mixer base coils. Highband coupling is accomplished by the hair-pin loops. As with any triode RF equipment, neutralization is necessary. This is done with a variable capacitor from the lower end of the coupling loop back to the base.

B+ is fed to the collector circuit through an RF choke to the junction of the channel coils with the coupling loop.

Mixer. The mixer stage is connected as a common emitter circuit. Base bias is provided by a voltage divider from the 18v B+ to ground. Emitter stabilization is used with the emitter bypassed by the 1000pf capacitor.



RF signal is coupled into the mixer coils by mutual inductance on the low bands and assisted by the coupling loops on the high channels. The mixer channel coils are incremental types. This RF signal is fed to the base. The oscillator signal is also injected to the base through the 1.8pf capacitor.

The collector circuit is a π type output coupling network which acts as a lowpass filter and impedance match between collector and IF link. This π network also provides the 180 deg phase shift necessary for neutralization. Neutralization is provided by the 3.9pf capacitor from the IF take-off point back to the base. The π network has provided the necessary phase shift.

The 150pf capacitor connects the shielded IF link to the main chassis circuits.

The 10.5pf coupling and 36pf bypass capacitors in the base circuit form an impedance transformation to match the high impedance tuned circuit to the lower base input impedance.

Oscillator. The oscillator used in the VHF tuner is connected as a common collector Colpitts. The common collector circuit was chosen as it gives the best frequency stability. This is because the collector circuit parameters exhibit the greatest variations with both voltage and temperature change. By placing the collector at signal ground, by the 1000pf bypass capacitor, these variables do not affect the frequency determining circuits as they would in either of the other two possible circuits.

Bias is established for the base through the voltage divider formed by the 8200 and 5600Ω resistors. Additional bias stabilization is obtained by dividing from the collector rather than from B+, what is called "self-bias." Also, the emitter resistor contributes to bias stability.

Further contributing to the stability of the oscillator frequency are the three capacitors shown between the transistor terminals. These capacitor values are at least ten times the transistor's capacitances. Therefore, small changes in transistor capacitance will have negligible effect on total circuit values. The 6.2pf capacitor is in series with the inductance and changes the tank impedance to match the base. It also allows larger values of tuning capacity to be used so the transistor's capacitance can be swamped.

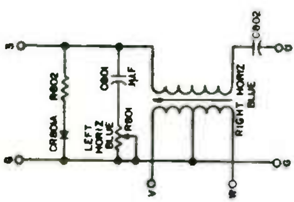
The 12pf capacitance is directly across the tank. The two 15pf capacitors are in series across the tank and form the Colpitts tap for feedback to the emitter.

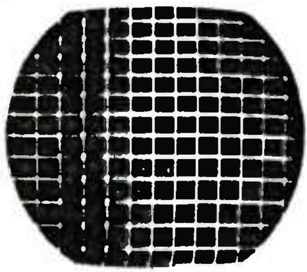
Channel coils are switched rather than adding increments for each successively lower channel. The tuner uses "pre-set" fine tuning. The coil indicated as "fine tuning" is an adjustment to set the range of the channel coils.

The oscillator signal take-off for mixer injection is through a 1.8pf capacitor from the junction of the 6.2pf capacitor and the channel coil.

Blue Left Horizontal Convergence Control

Open capacitor C801 will cause the blue left horizontal convergence control to be inoperative. The



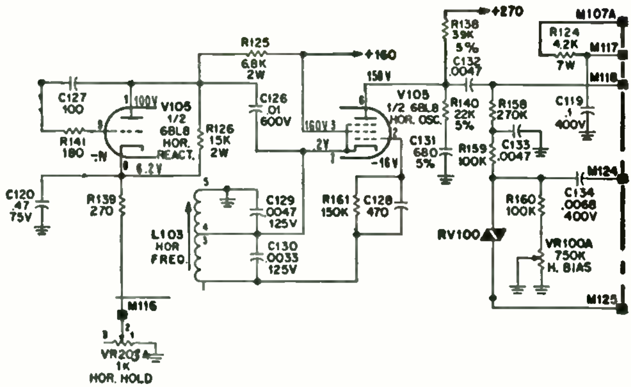


set cannot then be completely converged by the right blue horizontal control. Replacement of the defective capacitor corrects the fault.

Color TV 'Q' Line—Improving Vertical Linearity Performance

On the deflection sound panel, capacitor C133 was changed from a 0.0047μf 500v part #30-1294-13 to a 0.0015μf 500v part #30-1294-30. The capacitor is located in the plate circuit of the horizontal oscillator tube.

Also, capacitor C134 was changed from a 0.0068μf 20 percent part #30-4705-111 to a 0.001μf 20 percent part #30-4705-201. This capacitor is located between lug M124 and resistor R160 in the horizontal oscillator circuit. This panel will be identified by a red slash.



The above changes will help eliminate the low frequency oscillation in the horizontal output circuit.

In the event capacitor C120 (0.47μf 75v) in the cathode circuit of the horizontal reactance tube, V105, requires replacement, add a 1K ½w resistor between the center arm of the horizontal hold control, VR203A, and ground. This change will insure improved protection against intermittents which could cause voltage stress on C120.

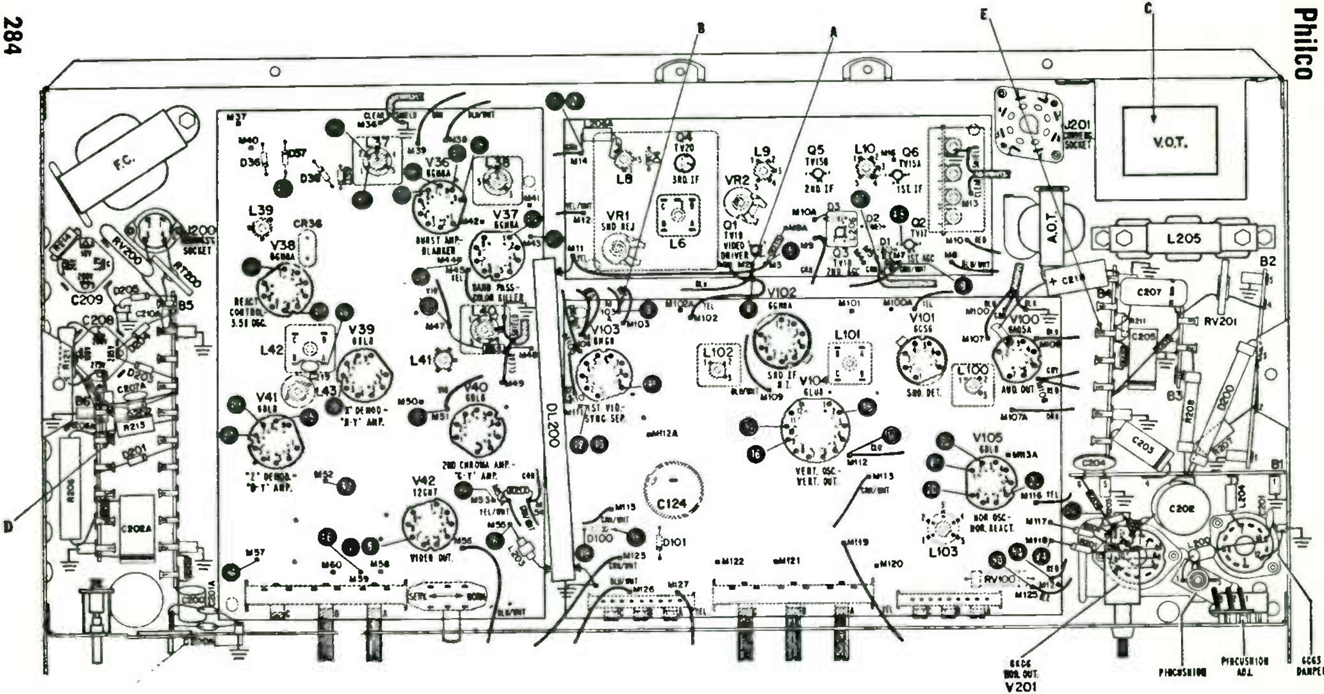
A touch up of L103 (horizontal frequency coil) may be necessary after adding the resistor to center the horizontal hold range.

Color Chassis Models 16NT82, 16QT85A and 17KT50—Intensify Ringing

The following lead dress procedure should be performed to minimize any vertical bars that may appear on the left side of the screen, so they are not objectionable at the normal viewing level.

The blue and white wires coming from the contrast control should be dressed and prevented from overlapping the IF panel. They should be squared to follow the sides of the panel. The blue wire goes to lug M2 (A) on the IF panel and the white wire goes to lug M103 (B) on the deflection-sound panel.

The series of leads coming from the secondary controls, running along the front apron of the chassis, should be


B
A
E
C
V.O.T.
J201
F.C.
L37
V36
L38
L39
CR36
V37
V38
L8
Q4
L9
Q5
L10
Q6
VR2
VR1
L6
Q1
Q3
Q2
A.O.T.
L205
B2
C209
C208
B5
B4
C207
V102
V101
V100
RV201
V103
L102
L101
L100
L42
V39
L41
V40
L43
V41
V104
V105
DL200
D
V42
C124
D100
D101
L103
RV100
C202
B1
V201
B3
PINCUSHION
PINCUSHION ADJ.
6CG3 DAMPER
6KG6 HOR. OUT.

secured to the front apron by using a tie lug mounted to the ¼-in. self-tapping screw next to the vertical output transformer (C), if it is not already secured.

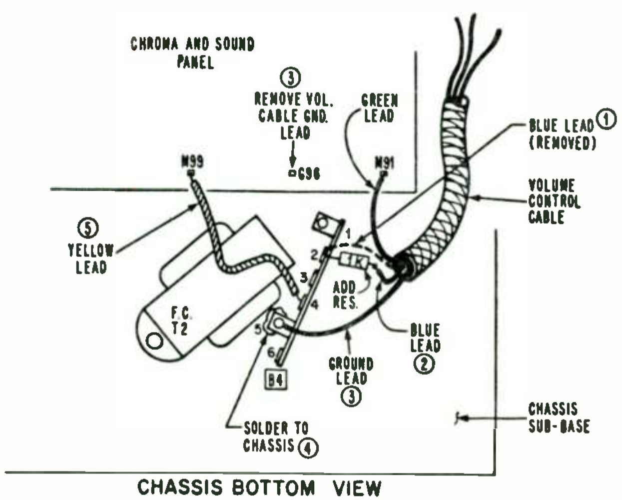
The proper dressing of the orange lead coming from terminal strip B6 lug 5 (D) and going past the IF panel along the front chassis apron, terminating on terminal strip B4 lug 5 (E), should be checked. This lead should be dressed away from the IF panel toward the front apron and down as close as possible to the chassis base and secured by the two tie lugs which are part of the front apron.

When the chassis is replaced in the cabinet, it should be securely bolted so the cabinet ground strip is properly grounded to the chassis.

Color TV Chassis 22QT80, 21KT40/41—Buzz or Hum at Low Setting of Volume Control

If hum or buzz is encountered at low levels of volume in any of these chassis, the following procedures should remove or reduce the hum or buzz to a point where it will no longer be objectionable:

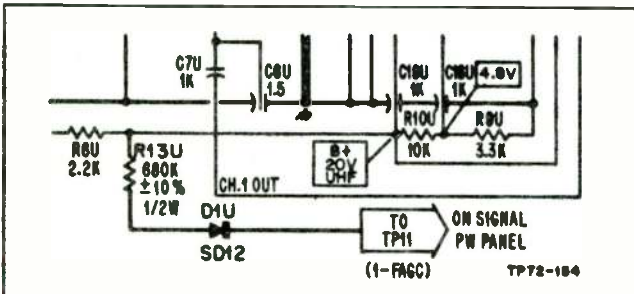
1) Remove the blue lead of the volume control cable

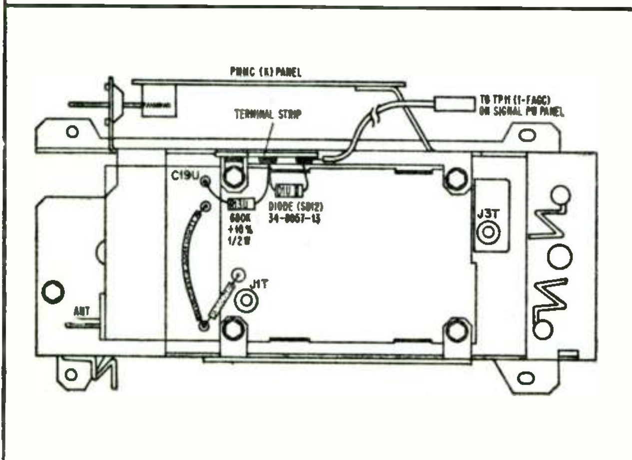


CHASSIS BOTTOM VIEW

from lug 2 on terminal B4.
2) Connect a 1K, ½w resistor between lug 2 and the blue lead.
3) Remove the ground lead of the volume cable from lug G96 on the PW panel and reconnect it to lug 5 (ground) on terminal B4.
4) Securely solder ground lug 5 on terminal B4 to the chassis, for improved mechanical grounding.
5) Dress the yellow lead connected between lug M99 (on PW panel) and B4-4 away from filter choke (T2) and at right angles to the choke core, as shown in the accompanying illustration. ■

Color TV Chassis 4CS73/4CY91—Medium Level Snow on UHF Channels Using VVC Tuner





A production change has been made on the VVC tuner to increase the receiver's gain and eliminate or reduce medium level snow on UHF channels.

The change involves mounting a three-lug terminal strip on the tuner frame and connecting a 680 K-ohm resistor (R13U) from capacitor C19U to the anode of diode SD12 (DIU) No. 34-8057-13, and then connecting the cathode of the diode to lug TP11 (1-FAGC) on the Signal PW Panel with an added wire. (Refer to attached illustration for layout of the new parts.)

This modification should be made on tuners not already modified if a snowy UHF picture is produced in an area where a nearly snow free picture is possible (assuming no other defect is causing the snowy UHF picture).

PHILCO

Console Models

High Fidelity Console Models N-P-Q Line—Noisy Loudness Controls

If static or noisy audio is heard through the speaker system on the mentioned models, when the metal control knob is touched, juggled, or rotated, use a compression spring over the control shaft between the knob and control bushing to provide an improved ground between the knob and control shaft.

To reduce or minimize the condition proceed as follows:

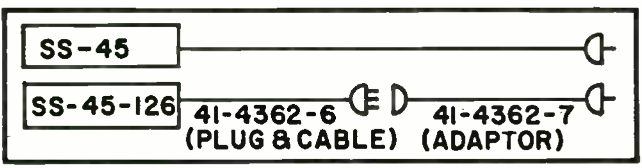
1. Remove metal loudness control knob.
2. Place spring over shaft.
3. Replace loudness control knob.

Suggested spring Part #28-14692-1 or equivalent.

SS-45 and SS-45, Code 126 Extension Speakers—Converting 3-Prong Plug to Common Phono Plug

The SS-45 extension speaker was early-production used with "P" line high fidelity merchandise. The connector on the end of the extension cable uses a regular single prong phono plug.

The SS-45 Code 126 extension speaker is later-production used with high power output "Q" line high fidelity merchandise. The connector on the end of the extension cable is a special 3-prong plug to match the associated



extension speaker socket on "Q" line 300w models which has sufficient power output to damage the smaller speaker assembly, SS-36.

When used with "P" line and lower power "Q" line models.

SS-45 is already equipped with proper single prong plug.

SS-45, Code 126 has an adaptor plug #41-4362-7 packed in shipping carton with speaker assembly (Converts 3-prong to common phono plug).

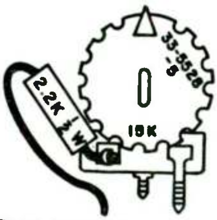
When used with high power "Q" line models (Q-1799, 1795 and 1793).

SS-45 needs a 3-prong plug instead of a single prong plug the assembly comes equipped with. There is no adapter available, so to use the early production SS45 you must do the following:

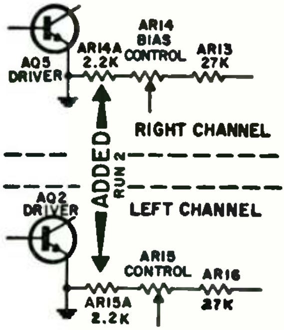
Install a 3-prong plug (#54-4878) on end of the extension cable, or, replace extension cable and plug assembly with #41-4362-6.

Hi Fi Amplifier Chassis R20—Production Run Change

Run Number 2—Resistors AR14A and AR15A have been inserted in series with the ground connected lug of the associated bias controls AR14 and AR15 as shown in the illus-



BIAS CONTROL
AR-14 AND AR-15
WITH 2.2K RESISTOR
ADDED



tration. Run Number 2A—An equivalent stop was added to body of pot as a 2.2K stop in place of the resistors.

This change prevents the possible danger of damage to the associated push-pull output transistors should extreme and rapid rocking of the control adjustment arm take place during bias adjustment.

If and when service is being rendered on the first production, Run #1, R20 amp chassis, it is strongly suggested that the two bias pots, AR14 and AR15, be removed and reinstalled with a 2.2K added so that this protective improvement will be incorporated. CAUTION: Use care in soldering resistors to bias control ground terminal to prevent solder flux from running up into the control.

Hi Fi Amplifier Chassis R20ST Tuner—Hum On Multiplex Operation

Should there be noticeable hum interference when the R20ST tuner is receiving FM stereo and the hum disappears when the Stereo/Monaural switch is placed in no aural position, the following change may be applied.

Disconnect the orange multiplex B+lead from terminal M3 on the amplifier PW panel and relocate to the opposite side of R4A (330Ω).

Stereo Component Models M4780BWA/M5780BWA—Hum Conditions Low Residual Hum on Minimum Volume—All Functions

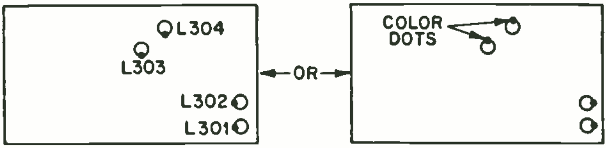
These models contain a chassis assembly of modular design composed of individual modular assemblies. Each modular assembly (tuner, preamps, amplifier, etc.) are linked together with inter-connecting wires and cables having plug connectors to form the complete tuner-amp chassis assembly, 2ACMT100354Q. To avoid danger of "ground loops" causing a residual hum at minimum volume, the chassis of all individual modular sub-assemblies are externally grounded together by ground cables and clips.

Should a condition of residual hum occur at minimum volume on all functions, look for a poor or open connection in the ground wires and clips electrically connecting the chassis of each module together. A "ground-loop" is caused when inter-modular grounding is made through the inter-connecting signal cables rather than externally through common-ground jumper wires and clips.

Background Hum on FM Reception

When replacing any of the choke coils (L301, L302, L303 and L304) on the tuner panel in the 2T204E tuner modular assembly, a condition of 60Hz hum can be created as background interference during FM/stereo operation if the coils are not polarized by their phasing dots as shown in the sketches.

The four color dots should be facing in, towards the center of the panel or facing out, towards the outer edge



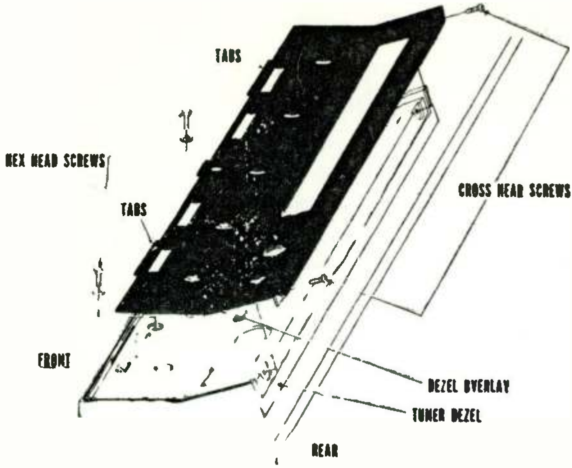
of the panel. In either of these two combinations, the coils are oriented so that stray 60Hz hum pickup is cancelled out.

With any other combination having some coil color dots facing out and others facing in, the hum pickup by these coils will pass through along with the FM monaural or stereo audio signals as the volume is increased, either on or off station—the hum level also increasing. Moving the BASS control to maximum will emphasize the background hum.

This hum results from the close proximity of the power transformer and its ac leads to the multiplex circuitry on the tuner panel. The power transformer leads should be dressed tight against the amplifier sub base to minimize coupling to the tuner.

Hi-Fi Tuner Chassis Models C8180UWA/C8182UPC—Removing Tuner Chassis

Before the Hi-Fi tuner can be removed for servicing, the bezel overlay and tuner bezel must first be removed. To remove these, use the following procedure while referring to the exploded view drawing: Remove all knobs and the two cross-head screws at the rear of the bezel overlay. Lift the rear of the bezel overlay gently and slide it towards the rear of the cabinet so that the bezel overlay tabs clear the tab holes in the tuner bezel. Remove the two hexhead screws which captivate the tuner bezel to the tuner bracket and remove one hex head screw (located on the bottom of



the wood panel) and clip which hold the tuner bezel, then remove the bezel.

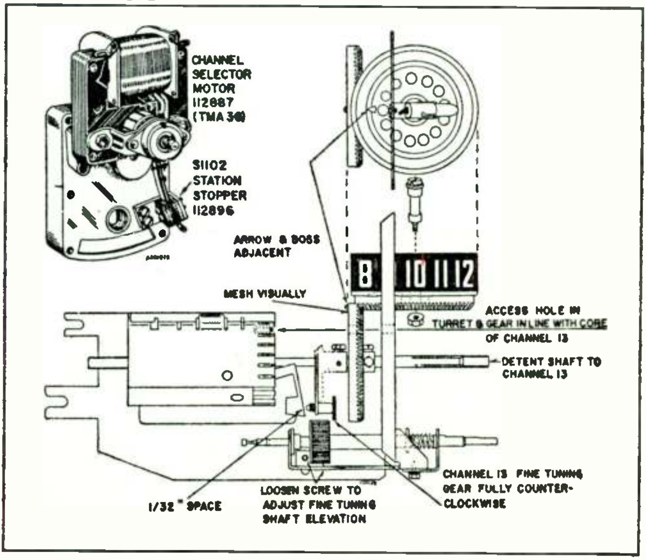
The chassis can now be removed as follows: Remove the two hex-head screws holding the front of the tuner bracket (screws located on the top side of the wood panel). Remove the two nuts holding the rear of the tuner bracket (nuts located at the bottom of tuner bracket), then remove the tuner from the cabinet.

RCA
B&W TV

VHF TV Chassis KRK 102-5, 107-8, 113 and UHF KRK 66, 112—Tuner Field Service

Preset fine tuning which employs a pull-out fine tune knob may develop one or more of the following problems:

1. Fine tune knob sticks in extended position.
2. Fine tuning ratchets or slips on one or more channels.
3. Fine tuning shaft resists momentarily while being pulled out.



RCA tuner field service adjustments.

The aforementioned problems may be corrected by following the illustration. The tuning assembly may remain in the cabinet. The fine tuning gear driver must be adjusted relative to the individual fine tuning turret gears by bending the fine tuning shaft bracket at the rear. Bend the bracket down for Problem 1 or 3 and bend up for Problem 2.

4. Channel selector motor labors.

Examine for broken or missing motor mounts (grommets). The detent shaft may be bent or rotor shaft dragging in bearings.

5. Electrical lead dress.

Because of the need to disturb interconnecting wires when making mechanical and electrical repairs, it is important to observe the original lead dress and the position of cable clamps before removing a tuner from the cabinet. It is imperative for UHF and color TV. The following procedure should be observed:

1. Dress all ac and AGC leads clear of the antenna transformer.
2. Dress UHF leads clear of VHF leads and separate the individual UHF leads somewhat (do not twist).
3. Replace the IF coupling link in its original position. If this is not known, position it experimentally and observe for possible interference patterns on the active channels. Late color instruments (CTC12 and CTC15) require that this link be suspended at the top left corner of the CRT shield.

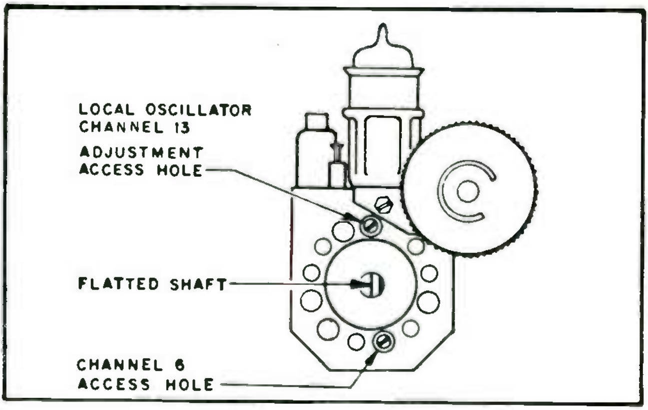
Observe safety requirements and restore all covers, fish papers and hoods.

A replacement fine tuning coil is supplied complete with the core and return spring. If the tuner under service requires the core and spring only, the assembly may be removed from the new coil and inserted in the original coil eliminating the need for soldering of new leads. The coil, which remains, may be retained for future needs.

The fine tuning lever should not be bent to compensate for incorrect positioning of the fine tuning turret. To do so many change the effect of the spring loading or cause the lever to be obstructed in advance of its full travel. Late detent shafts are provided with a dimple which locates the set screw providing automatic positioning of the turret. This provision should be used in place of the measured orientation shown in the illustration.

TV Chassis KCS 152—Local Oscillator Adjustment, KRK 123 Tuner

Only two adjustments are required to track the local oscillator of the KRK 123 tuner over the entire VHF range. The adjustment procedure is as follows:



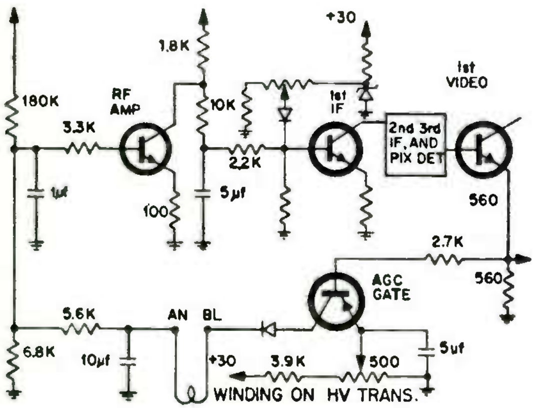
Set the fine tuning control to the approximate center of its range, switch tuner to the highest channel that can be received in the high VHF band, (Channels 7-13). Remove the VHF channel selector knob, and adjust channel 13 oscillator coil for best picture and sound. Without disturbing fine tuning, switch to the highest channel available locally in the low band (channels 2-6). Adjust channel 6 oscillator coil for best sound and picture. Because the thumbwheel fine tuning control is sufficiently broad, all available stations can then be tuned.

TV Chassis KCS153—AGC Circuit Description

The AGC system used in this chassis consists of a closed loop made up of the AGC gate, the RF amplifier, IF amplifiers, 1st video amplifier, and back to the AGC gate.

The system maintains a constant 1.2v at the emitter of the first video amplifier over a wide range of signal inputs. It is a "gated" or keyed AGC system in which an AGC voltage is developed at horizontal sync time and sustains for the duration of the horizontal scan time. Sync tips only are utilized to produce the control voltage; the system is noise immune, and not affected by scene variations.

Operation of the AGC circuits is as follows: As signal increases at the antenna, the output of the first video



amplifier tends to increase. The increased video level is applied as an input signal to the "AGC gate." The AGC gate is rendered operative at horizontal sync time by a 30 volt negative pulse from the HV transformer which is applied to the collector of the AGC gate. At that time AGC gate amplifies the sync signal which is simultaneously occurring at the base. A positive AGC voltage is then developed, and is retained during scan time by the long time-constant of the AGC bus. To prevent the collector to base junction of the AGC transistor from becoming forward biased by this developed AGC voltage, a diode is inserted between the AGC gate collector and the AGC bus. Such a condition would short out the AGC voltage. The positive AGC voltage so formed is then applied as forward bias on the RF amplifier transistor. This reduces the gain of the RF stage.

The RF amplifier then plays a "dual" role — in addition to its function as an RF amplifier, it amplifies and inverts the AGC signal delivering it to the base of the first IF amplifier as reverse bias. This reduces the gain of the first IF amplifier. In this manner both the RF amplifier and the first IF amplifier act to reduce the gain of the system.

The AGC output is filtered at the output of the AGC gate and additional filtering is provided at the IF AGC input.

The time constant of the system is slow enough to prevent "hang-up" of sync or AGC due to horizontal being out of sync; and still fast enough to permit AGC action on fast fluctuations.

To maintain optimum gain and signal to noise ratio and to prevent cross-modulation from occuring in the mixer, the RF amplifier is permitted to give nearly full gain on weak-to-medium input signals, most of the control being in the IF amplifier. As the signal gets increasingly stronger, the RF amplifier then assumes more control.

This is accomplished primarily by the characteristic of the RF amplifier. Further control over the "crossover" point is provided for the bias adjustment; this control sets the minimum gain of the first IF amplifier. This circuit is regulated by the use of a zener diode and isolated from the first IF amplifier by another diode.

TV Chassis KCS153—Video IF Stages Circuit Operation

The three picture IF amplifier stages of the KCS 153 employ NPN transistors in the common emitter circuit.

Standard 40 Mc frequencies are used with the picture carrier at 45.75 Mc and the sound carrier at 41.25 Mc; traps are provided at 47.25 and 41.25 Mc (adjacent sound and accompanying sound). The collector circuits are tuned and impedance-matched to the input of each succeeding stage. At the second detector approximately 1.5 v of video is developed for the video amplifiers.

A special input circuit is used in the KCS 153 which provides for coupling and matching of the tuner output to the first IF amplifier. Adjacent sound (47.25 Mc) is attenuated in this circuit by a "T" notch filter. A tuned circuit is used at the collector of the 1st IF to couple to the base of the 2nd IF transistor. This circuit is parallel resonant and matches the base of the next stage by a resistive "tap" — this transformer is referred to as an Rx transformer. A 10:1 stepdown is obtained in this transformer.

Coupling circuits between the 2nd and 3rd IFs is similar to that of the 1st and 2nd IFs. The output of the 3rd IF is tuned by a transformer with separate primary and secondary windings giving a 2:1 stepdown to match the 2nd detector to the 3rd picture IF collector.

The 2nd detector is "elevated" from ground to satisfy the base bias condition of the first video amplifier. An additional feed from the 30 v B+ supply insures that the 2nd detector is not forward biased by the "elevating" voltage.

AGC is applied to the first IF amplifier by way of the RF amplifier operating as a dc amplifier. This is *reverse* bias which uses the cut off characteristic of the first IF amplifier. Attenuation of about 35 db is possible from AGC action on the 1st IF and an additional 35 db is introduced on strong signals in the RF amplifier.

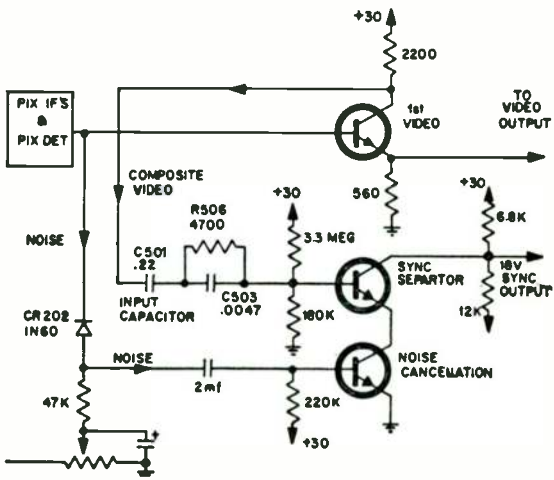
Basic alignment procedure is to first, set the 47.25 trap, then adjust the mixer output and IF input for correct response, then the 41.25 trap is adjusted. The interstage transformers are then peaked at 44.5 Mc. Over-all response is then checked with possible touch-up of the 2nd IF collector transformer T207. Bias on the first IF can be set for 3.25 v with no signal or for a condition which can be viewed on the picture tube by tuning in a medium strength signal, then adjust the bias for the appearance of noise, then back off until noise just disappears.

TV Chassis KCS153—Sync Separator and Noise Cancellation—Circuit Description

This circuit provides noise free sync pulses of large amplitude to synchronize the vertical oscillator and horizontal oscillator. The sync separator will operate (separation of sync from composite video) on incoming signals with a minimum sync level of 18 percent. Most transmissions have at least 20 to 25 percent sync.

Sync pulses are produced with sufficiently short duration to respond to equalizing pulses following vertical sync pulses.

The "dynamic input range" (the ability to operate over a wide range of input signal levels) is increased by operating the base of the sync separator at approximately 0.6v at no signal. This overcomes the forward bias of the base-emitter diode of the sync separator. This range is



approximately 0.5 to 5v of composite video; well above and below the expected output level of the video amplifier.

Composite video (with sync tips positive) is obtained from the ocllector of the 1st video amplifier and applied to the base of the sync separator.

This stage is a common emitter circuit set near zero bias. Base current will flow on sync tips when a signal is present; this current will cause conduction of the base-emitter junction which in turn saturates the collector-base junction of the sync separator.

Also, C501 (.22μf) charges which will then discharge during sweep time through resistors R507 and R510. The negative voltage thereby established will cut off the sync separator between sync pulses. The collector of the sync separator will swing between cutoff and saturation. This will provide a sync output having an amplitude of approximately 18v.

An RC network consisting of R506 (4.7K) and C503 (.0047μf) prevents C501 (.22μf), the input capacitor, from charging too heavily on the broad vertical sync pulses of the input signal.

Noise can cause erratic operation of deflection oscillators because their conduction, or initiation of each new cycle of operation, depends on the occurance of a distinct pulse occurring at the correct instant of time.

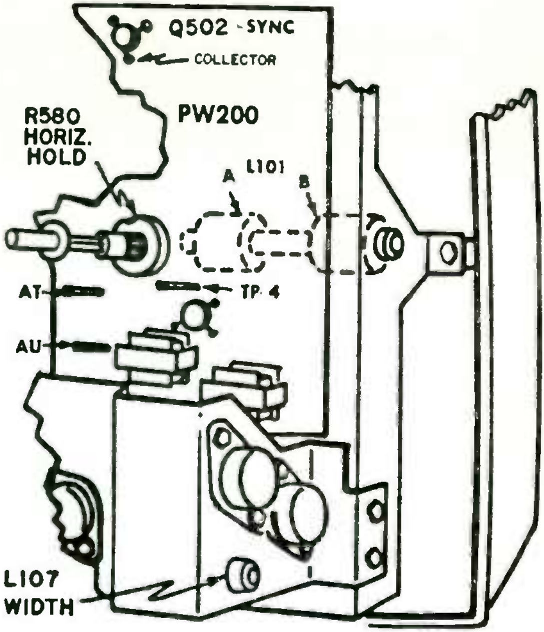
The KCS153 employs a noise cancellation circuit which removes noise from the sync output with the noise cancellation transistor, Q503.

A diode, CR202 (normally reverse biased) couples any noise signals to the base of the noise cancellation transistor, Q503. This transistor is normally conducting and serves as a ground return for the emitter of the sync separator. When noise pulses appear at Q503's base, the effect is a momentary "open circuiting" of the emitter return of the sync separator.

Noise is then prevented from charging the input capacitor, C501, and also prevents noise from appearing in the sync output.

TV Chassis KCS153—Horizontal Oscillator Adjustments

The horizontal oscillator originates the 15,750Hz waveform for use in developing a sweep waveform in the horizontal output stage. This stage uses an NPN transistor in the grounded emitter circuit; it is a blocking oscillator with refinements to obtain high operating stability. Within certain limits the frequency is automatically corrected by an AFC correction voltage. The output of the oscillator



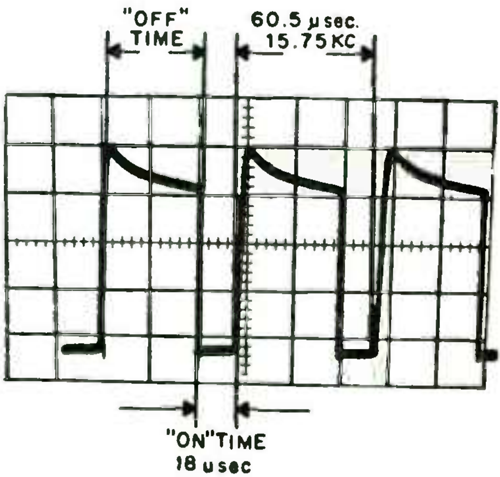


Figure 6—Waveform at TP4

is a squarewave which is applied to the horizontal driver for further processing.

Stability is achieved by using two stabilizing coils. One coil, L101A is the familiar "sinewave" coil which stabilizes the oscillator OFF time. The other coil, L101B, is used to introduce a higher frequency "ringing" (approximately 40kHz); this stabilizes the ON time of the oscillator.

Field Procedure: (1) Connect a jumper from Q502 (collector) to ground. (2) Connect a jumper from terminals AT to AU. (3) Adjust horiz hold (R580) for least sideway drift of picture. (4) Remove jumper from terminals at AT and AU. (5) Adjust L101A for least sideway drift of picture. (6) Remove jumper from Q502 (collector) to ground.

Adjustment of L101B is not a normal field service adjustment. The following "shop procedure" should be used when adjusting L101B.

Shop Procedure: (1) Perform steps 1 through 5 of field procedure. (2) Connect scope to TP4. (3) Adjust L101B so ON time is about ½ the width of the OFF time. (4) Remove scope from TP4. (5) Readjust L101A to lock picture. (6) Remove jumper from Q205 (collector) to ground.

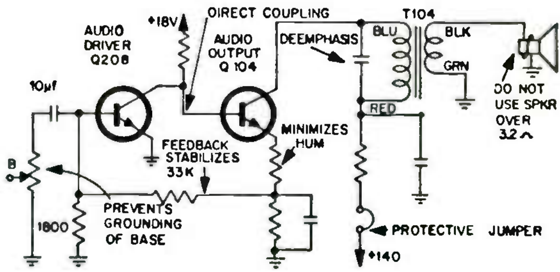
Width Coil Adjustment: At an ac input line voltage of 108v, adjust L107 (width coil) to fill screen with not more than ¼ in. overscan on both sides of the picture.

TV Chassis KCS153, Sound Stages—Circuit Descriptions

The sound portion of the KCS153 consists of two stages of 4.5Mc IF amplification, a ratio detector and two stages of audio amplification.

Provision is made in some models for earphone listening. A jumper connector on the speaker plug protects the audio output transistor from damage when the speaker is disconnected. The speaker is 3.2Ω; when operating the receiver on a test speaker for service purpose use a 3.2Ω or lower impedance speaker. A higher impedance speaker will cause damage to the audio output transistor because of inductive coupling of high audio peaks into the audio output transformer primary. The earphone jack permits a 10Ω earphone.

The sound IF take-off is at the emitter of the 1st video amplifier through a sharply tuned (100kc bw) series resonant circuit, T201 and C242 (39pf). A gain of approximately 2 to 3 is realized from the base of the 1st video to the base of the 1st sound IF. The 4.5Mc signal is amplified by Q206, then broadly tuned by the transformer T202 in the collector of the first sound IF and coupled to the base of the 2nd sound IF. A gain of 15 is obtained from the base of the 1st IF to the base of the 2nd IF.



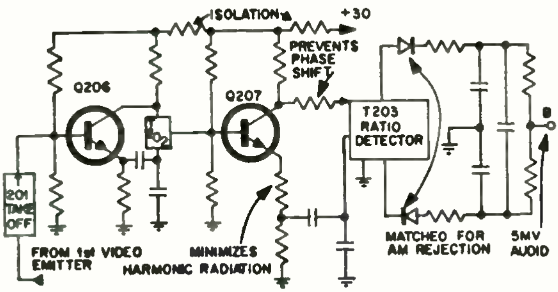
At the collector of the 2nd sound IF additional limiting takes place and the 4.5Mc IF is fed to the ratio detector transformer, T203. The emitter of the 2nd IF has some degeneration via R250 (15Ω). This improves linearity which minimizes the production of beats or harmonics.

The audio at terminal "B" is then fed to the wiper arm of the volume control. The high side of the volume control is coupled through C255 (10μf) to the base of the audio driver. The collector of the audio driver is directly coupled to the base of the audio output transistor, Q104.

Q104 operates in a common emitter circuit and the collector is fed from a +140v source. Approximately 90v appear at the collector, 13v at the base and 12.5v at the emitter. The emitter of this stage furnishes negative feedback to the base of Q208, the audio driver. T104, the auido output transformer, is the collector load for the audio output transistor, and provides an impedance match to the 3.2Ω speaker. A protective jumper disconnects the +140v source when the speaker is disconnected.

On models employing the earphone jack, speaker operation is unaffected when the jack is not used. A resistor, R269 (68K), is tied from the base of the audio driver

to ground (through the jack) under these conditions.
When an earphone plug is inserted, the earphone is connected across the output transformer secondary and



SIMPLIFIED CIRCUIT SOUND IF

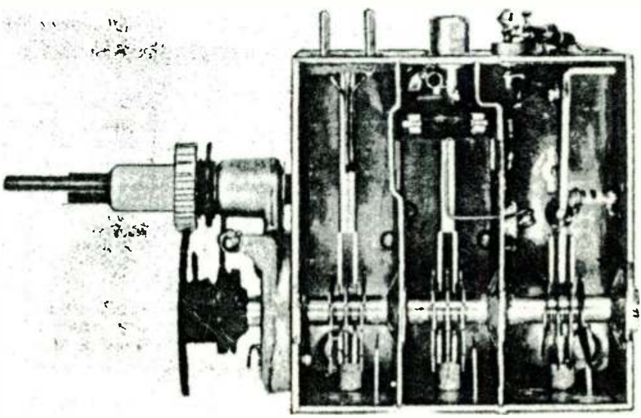
the ground connection is opened. This causes high level audio to be applied to the base of the driver which reduces the gain of the system considerably and permits higher impedance earphone units. Ground for the circuit with earphone inserted is made through the speaker voice coil; no appreciable sound is produced from the speaker when the earphone jack is used.

Some 1964 TV Models—UHF Tuner

Some models in the 1964 sets have a UHF tuner, KRK112. It uses either a 2DV4 or 6DV4 nuvistor oscillator tube. This tuner is very similar to the KRK 66, which is also used in 1964 sets. Since the alignment procedure and adjustments are so similar in each of these tuners, the service data including KRK 66 information may be used when a KRK 112 is found in a particular receiver. The low band tracking adjustment C58 (shown in service data drawings) and the B+ input terminal are relocated on the KRK 112. Also a more rigid oscillator inductor is used and the high band oscillator tracking tab, C62, is provided with a foam cushion to minimize microphonics. Both high band RF and mixer tracking adjustments are accomplished by air-gap capacitors C50 and C52 respectively. High band local oscillator adjustment is made by the placement of the tab, C62. Low band oscillator adjustment is made by C58 which is accessible from the outside of the tuner case. Because of its simple, sturdy construction and few components, this tuner is relatively service free. The tube, mixer crystal, and the comparatively straight-forward local oscillator circuitry should be checked carefully when servicing is required. Mechanical malfunctions can usually be found by simple visual inspection. The best method of checking oscillator action is by measuring crystal current or the injection voltage. This is measured across a 100Ω resistor connected from the center conductor of J50 to ground. Injection voltage should be between .07 and .30v.

UHF Tuners — General Description

The KRK 120 transistorized UHF tuner is used in current RCA TV sets. The tuner has three basic versions, the KRK 120J, K, and L. The KRK 120J



RCA KRK-120 UHF Tuner

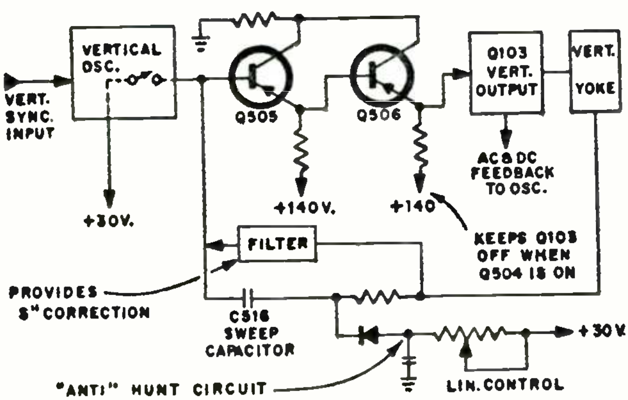
series uses an SE1037 transistor, the KRK 120K series a 35449 transistor, and the L series uses a GM-380 type transistor. The oscillator circuit of each tuner varies with the transistor used, but all use the same supply voltage connected to the same input terminal. As an assembly, the tuners are interchangeable. If a transistor fails the replacement must be the same type as the original. The transistors are easily identified. The KRK 120J version uses a transistor that has a black epoxy case with a plastic, button type, lead protector cemented to the case. Both the KRK 120K and KRK 120L transistors have a silver color metal case with the type number.

Supply voltage for each version is either 270 vdc through a 22K resistor, or 250 vdc through a 20K resistor. The tuner draws approximately 11.4 ma and the supply voltage at the input is plus 19 vdc.

The oscillator circuit is a modified Colpitts. The transistor is used in a common base configuration and the feedback signal is coupled from the collector terminal to the emitter by internal transistor capacitance.

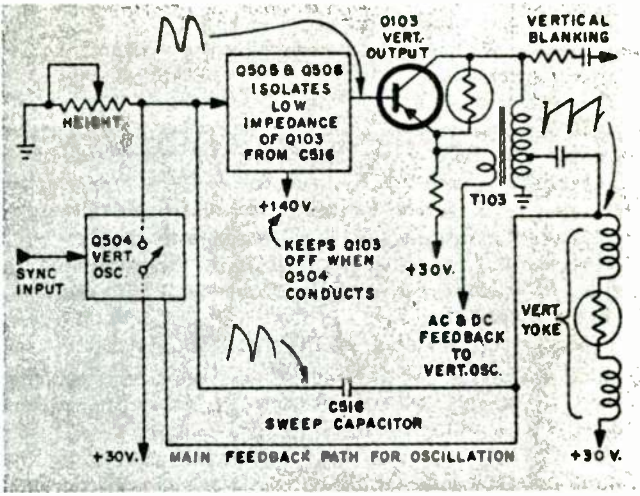
TV Chassis KCS153 — Vertical Deflection Circuit Descriptions

Transistors now perform all necessary functions of vertical deflection in a transistorized television set since the frequency of operation and the power required in this cir-



cuit are well within the capabilities of modern transistors. Most circuit refinements in a practical transistor television vertical circuit are concerned with obtaining a high degree of stability and good linearity.

The vertical circuits of the KCS153 chassis consist of a vertical oscillator (synchronized with incoming vertical



sync pulses), a "predriver" stage, a "driver" stage and a vertical-output stage.

The oscillator and output transistors work as a feedback system and are grounded-emitter circuits. The predriver stages are dc amplifiers which are "emitter-followers," or common-collector, circuits. A very linear rise in current through the vertical-deflection yoke windings is accomplished by this vertical-deflection system.

The vertical oscillator can be considered as a "switch" which is closed at retrace time and open during vertical scan time.

Oscillation is sustained by positive feedback from the yoke to the base circuit of the vertical oscillator.

Off-time, or that time during which the oscillator transistor is open, is controlled by the large time constant in the oscillator base circuit. This corresponds to sweep time. On-time of the oscillator occurs when the voltage on the vertical oscillator base becomes lower than the emitter. This happens quickly and lasts for a very short duration. This is vertical retrace time.

The switching action is employed at the vertical oscillator collector to connect the sweep capacitor quickly to 30v at retrace time and permit a linear decrease in voltage on this capacitor during scan time or while the oscillator transistor is off.

The predriver and driver stages perform the function of isolating the vertical-output stage from the sweep-capacitor charging circuit.

The sweep capacitor during retrace time is discharged rapidly because of the 130v flyback pulse. During scan time, the capacitor starts a gradual exponential buildup. This buildup, however, is "linearized" by the feedback from the output transistor, which tends to keep the charging current constant. This produces a very linear voltage rise.

The output transistor then drives an impedance-matching autotransformer to feed the deflection yoke through a dc blocking capacitor.

Other circuit features of the KCS153 vertical circuit include a VDR across the output transistor which protects it from the large flyback pulse. A VDR is also used to stabilize the bias voltage of the oscillator transistor.

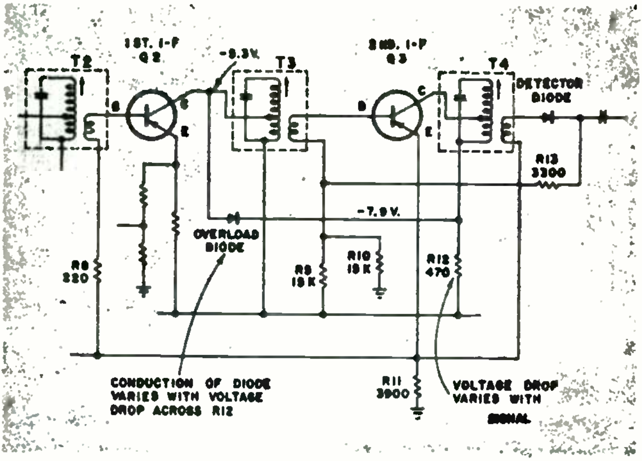
The over-all performance of the vertical circuits of this chassis delivers a linear, stable vertical scan. Circuit refinements insure good noise immunity, freedom from line-voltage variations, independence from varying transistor characteristics and full control of the vertical-sweep waveform with the usual height, linearity and hold controls.

Service can be performed on transistor vertical-deflection circuits by using signal injection. The circuit can be treated as a 60Hz amplifier, and when 6.3vac is fed through a blocking capacitor (5 μf to 10 μf) to various points, an isolation to a particular stage can be made. Voltage and resistance readings are then used to isolate a component.

TV Chassis KCS153 — Transistorized AGC Circuits

Since the strength of radio and TV signals vary greatly from station to station and from one locality to another, it is important that some provisions be made in the receiver circuits to "level off" these variations.

Automatic gain control (AGC) circuits are employed to accomplish this. In tube-type circuitry, the "remote cut-off" type tubes permit using a bias voltage (derived from the incoming signal) to vary the over-all gain of the receiver.



In solid-state circuitry, this becomes more difficult since the transistor is basically a "sharp cut-off" device. Many radio receivers use the overload diode to accomplish a measure of "AGC."

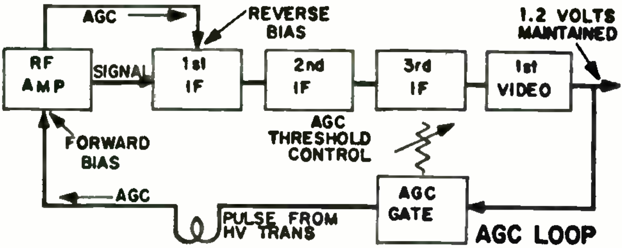
In this circuit, an increased incoming signal causes an increase in voltage drop on R12 (see illustration), which causes the overload diode to conduct. This produces a "shunting" effect on the primary of T3 which reduces the gain.

The transistorized TV chassis employs a special AGC circuit which controls the gain of the RF amplifier and 1st IF amplifier to achieve AGC action.

The system consists of a closed loop made up of the AGC gate, the RF amplifier, IF amplifier, 1st video amplifier and back to the AGC gate. The circuit maintains a constant voltage at the emitter of the 1st video amplifier over a wide range of signal inputs.

It is a "gated" or keyed AGC system in which an AGC voltage is developed at horizontal sync time and sustains for the duration of horizontal scan time. Sync tips only are employed to produce the control voltage; the system is noise immune and not affected by scene variations.

Operations of the AGC circuits are as follows: As signal increases at the antenna, the output of the 1st video amplifier tends to increase. The increased video level is applied

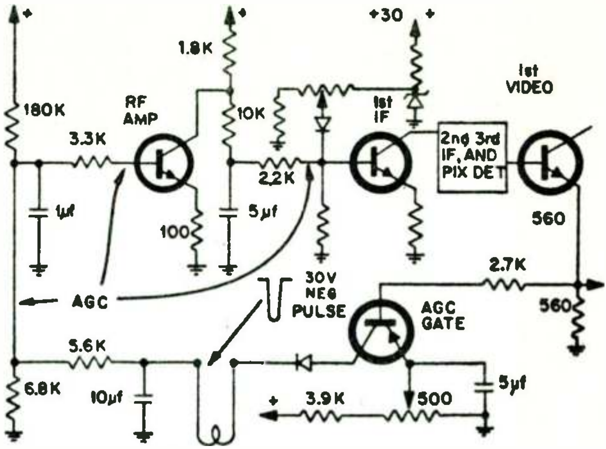


as an input signal to the "AGC gate." The AGC gate is rendered operative at horizontal sync time by a 30v negative pulse from the HV transformer which is applied to the collector of the AGC gate. At that time, the AGC gate amplifies the sync signal which is simultaneously occurring at the base. A positive AGC voltage is then developed, this is retained during scan time by the long-time constant of the AGC bus. To prevent the collector-to-base junction of the AGC transistor from becoming forward biased by this developed AGC voltage, a diode is inserted between the AGC gate collector and the AGC bus. The positive AGC voltage so formed is then applied as forward bias on the RF amplifier transistor. This reduces the gain of the RF stage.

The RF amplifier then serves a "dual" role. In addition to its function as an RF amplifier, it amplifies and inverts the AGC voltage variation, delivering it to the base of the 1st IF amplifier as reverse bias. This reduces the gain of the 1st IF amplifier.

It should be noted that either reverse bias or forward bias will cause a reduction of gain in a transistor amplifier. In one case, the cutoff characteristic of the transistor is employed and in the other the saturation characteristic is used.

In this manner both the RF amplifier and the 1st IF amplifier act to reduce the gain of the system.



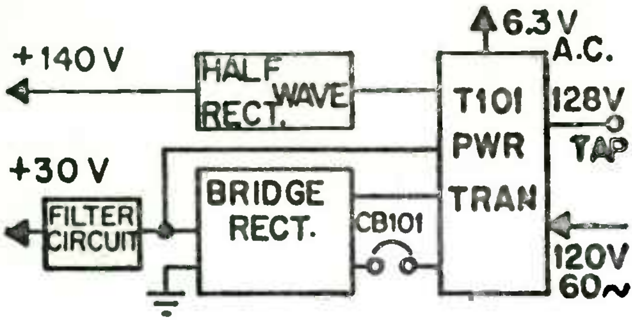
TV Chassis KCS153 Power Supply—Circuit Description

The KCS153 chassis is designed for 120v, 60Hz ac operation. A power transformer is used with provisions for high line voltage operation through an alternate 128v tap on the primary. The voltages furnished are; +30v for most of the circuit requirements, +140v for powering the audio output, video output, and biasing the vertical drivers and 6.3vac for the picture tube filament.

A circuit breaker is used which protects both the +140v and the +30v supplies. A power filter is used to produce an extremely smooth dc in the +30v source. This assures that hum will be minimized in all circuits which may be susceptible to amplifying ripple voltage.

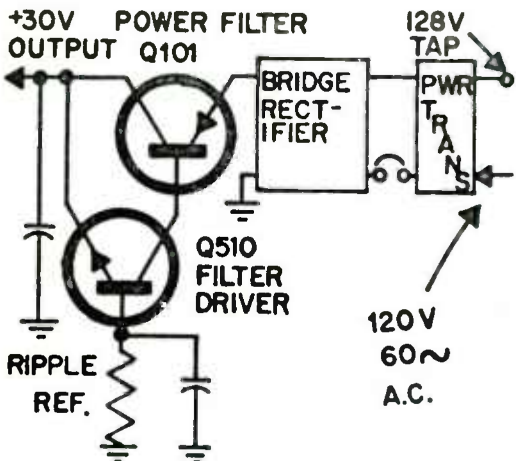
The power filter circuit enables a very low level of ripple to be obtained with a minimum of large (even prohibitive) size components. The "filter driver" senses any ripple voltage present and amplifies, inverts and feeds the ripple to the "power filter" which cancels the effect of such ripple in the output.

Since the base current of the power filter is the same as the collector current of the filter driver, the effect of the ripple cancellation can be seen. A ripple level of only



50mv results from this circuit. This filtering is effective at 120Hz (the ripple frequency) as well as at 15Hz (the frequency of the variations originating in the horizontal circuits). A current of approximately 900ma is drawn from the +30v supply.

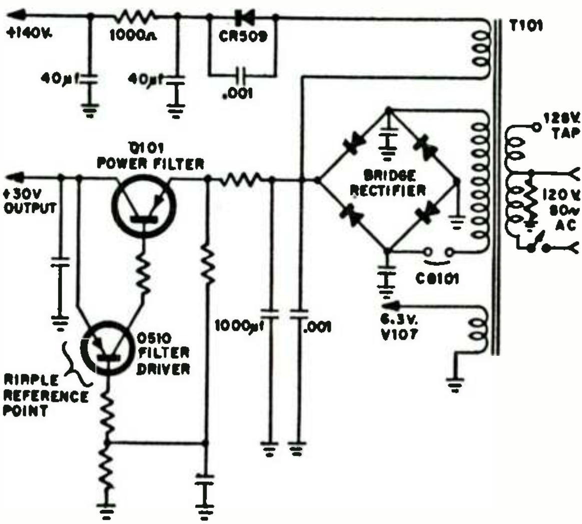
The +140v supply is a conventional half-wave rectifier



fed by a separate power transformer winding. The output is "stacked" on the +30v supply and smoothed by an RC filter. This circuit arrangement permits one circuit breaker to be common to both supplies. A circuit breaker, CB101. is in the common return of the power supply.

This breaker will normally carry about 1.8a and will trip at 2.7a. Although the circuit breaker is similar in appearance to the type used in tube type instruments, it has a different current carrying capacity and tripping current rating than the usual circuit breaker. Replacement should be made only with the exact type specified in the parts list. Current of approximately 50ma is drawn from the +140v supply. If the circuit breaker should trip, a quick check would be to read both the +140v and +30v outputs while resetting the circuit breaker; this will indicate which circuit may have caused the tripping.

If service is performed with the deflection yoke removed, a load of 20Ω @ 25w should be inserted from the

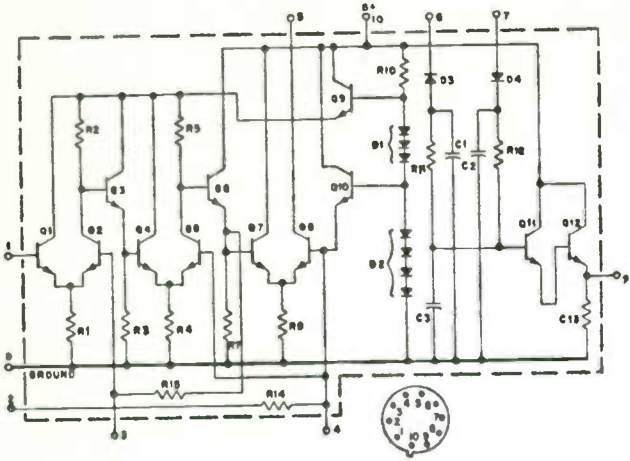


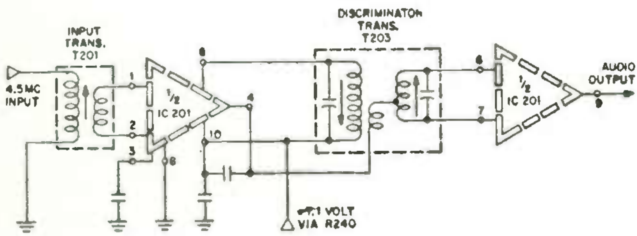
+30v supply. This will substitute for the current drain normally consumed in the deflection output circuits.

A wire fuse is used to protect the 6.3vac filament circuit of the picture tube. Power consumption from the ac line is approximately 60w in the KCS153.

TV Chassis KCS153X Integrated Audio Circuit — Servicing

If audio trouble develops in this model, the integrated circuit should be considered the component least likely to be at fault. The following procedure has been found

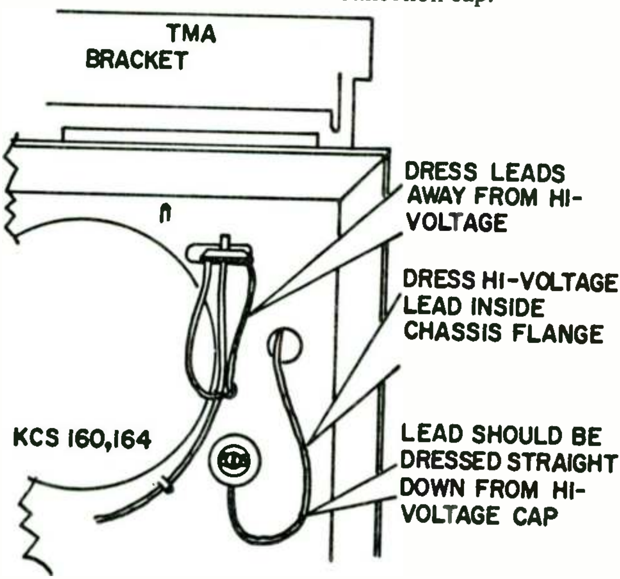




effective when checking the integrated circuit. A signal injector is used to determine whether or not the circuits following and preceding the integrated circuit are functioning. If trouble appears to be in the circuit that incorporates the integrated circuit, pass a signal through that circuit as well. Check the voltages on the pin connections of the integrated circuit device. These voltages are very significant. All external components associated with the integrated circuit should be checked before the "chip" is replaced. Should it be necessary to remove and install a new integrated circuit, great care should be exercised to prevent additional damage.

TV Chassis KCS160/164 — Critical Lead Dress

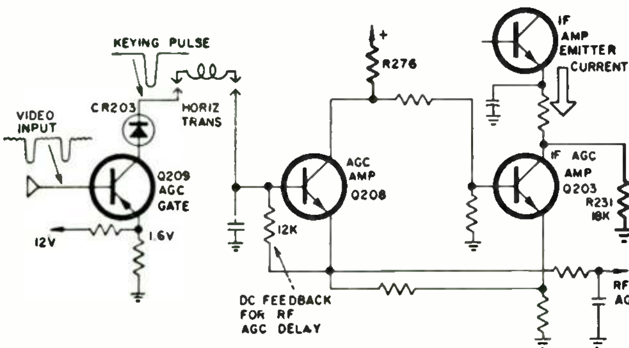
Recent field reports indicate "arcing" of the HV may occur in humid areas, from the 2nd anode to wiring close by or to ground. This arcing may cause a breakdown and deterioration of the 2nd anode connection cap.



When service is required on these chassis it is recommended that the wiring in the vicinity of the 2nd anode lead be dressed straight down as illustrated, when plugged into the CRT.

TV Chassis KCS169—Automatic Gain Control AGC Circuit Description

AGC is derived through the action of three transistors—an AGC gate, AGC amplifier, and IF AGC amplifier. The base of the AGC gate receives video information while the collector receives negative going pulses from a special winding on the horizontal output transformer. These pulses act to "turn on" the AGC gate coincidentally with the incoming horizontal sync pulses. The degree of conduction of the AGC gate (and therefore the developed AGC voltage) is proportional to the amplitude of the sync pulses contained in the video signal input. The blocking diode, CR203, in



series with the collector of this transistor prevents forward biasing of the transistor collector-base junction. A 1.7v reference voltage on the AGC gate emitter prevents this transistor from conducting until the sync tips applied to the base drive the transistor into conduction.

Under no-signal conditions, the AGC gate (receiving no video information) does not develop forward bias for the AGC amplifier, Q208; with Q208 in a cutoff condition the voltage drop across R276 is minimal, causing a forward bias condition of the IF AGC amplifier, Q203. As a result, Q203 conducts heavily, the 1st video IF draws maximum current (9.5ma), and its gain is at maximum.

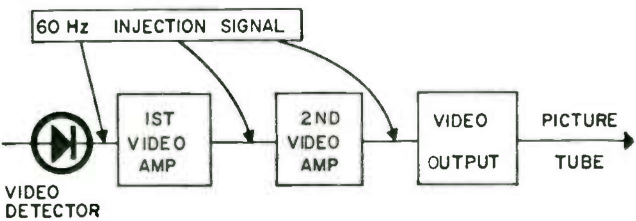
The RF AGC voltage is developed at the emitter of Q208. Under no-signal conditions (with Q208 not conducting) the emitter voltage is at a minimum value of 1.7v. This voltage applied to the RF stage acts to hold its gain at maximum.

When signal strength is increased, the AGC gate (and therefore the AGC amplifier) starts to conduct. This action reduces the forward bias on the IF AGC amplifier, reducing its conduction; reception of stronger signals will act to progressively reduce conduction until emitter current is determined only by the 18K emitter return resistor. At this time the gain of this stage is at minimum. When the IF AGC amplifier is cut off, the AGC amplifier, Q208, supplies bias voltage only to the RF stage. AGC delay is accomplished by a feedback network from the collector of Q208 to the base of Q203. Courtesy of RCA Sales Corp.

Troubleshooting Video Stages

Experienced radio technicians use a signal injection technique for troubleshooting audio amplifiers that can be readily adapted to servicing video stages. This technique is a simple and quick method for troubleshooting either transistor of tube type video amplifier circuits.

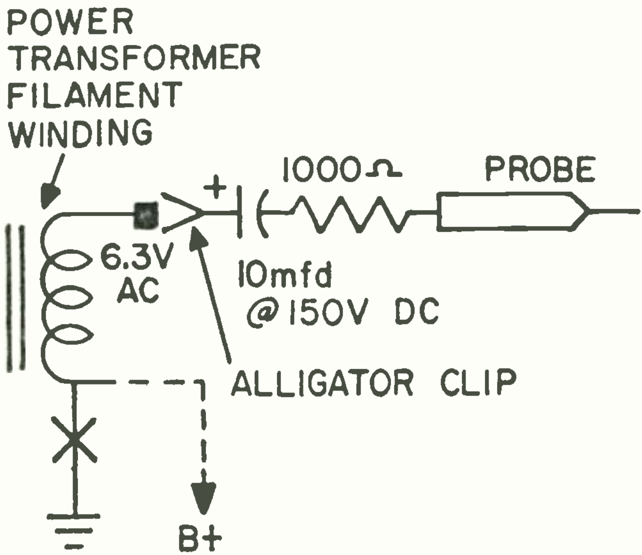
The troubleshooting procedure begins by injecting a 60Hz test signal at the input of the first video amplifier stage as illustrated. The absence of a hum-bar on the screen indicates a video amplifier problem. Next inject the signal



at the input of each following stage until a hum-bar is produced on the screen. Obtaining a hum-bar indicates that the stages following the injection point are passing signal and the problem is located in the stage preceding the injection point.

The filament winding of transformer-powered sets provides a handy point to obtain a 60Hz injection signal of the necessary amplitude. When servicing series filaments chassis, a 5-8v 60Hz signal can be obtained by selecting a point near the chassis common end of the filament line. (The tuner filament point is at this potential in many sets.)

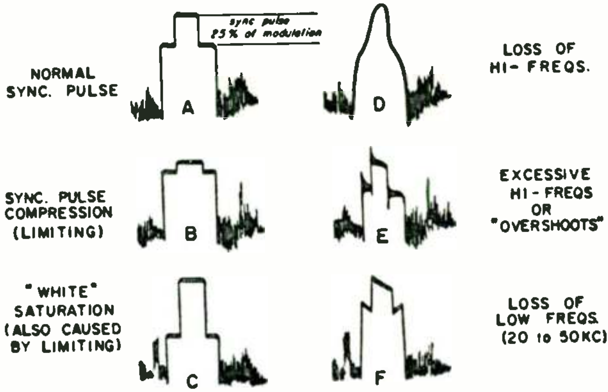
The test signal should be coupled to the chassis by using an electrolytic capacitor and a resistor as illustrated. The values of these components are not critical—a good combination is a 10μf capacitor and a 1000Ω resistor. A word of caution, however: The picture tube filament winding of many color sets operates at a relatively high dc potential, and since an electrolytic capacitor is used to couple the injection signal, polarity must be observed. Also the dc voltage rating of the capacitor should be at least 150v.



Video Waveforms

An oscilloscope can be of great value to a technician if he uses it to advantage in observing waveforms. The process of signal tracing by waveform is of great value in speeding up television receiver service; it provides a means of quickly determining the operating condition of the most complex circuitry.

Waveform D illustrates the rounding effect of the horizontal blanking and sync pulse, affecting the frequency response within the video section of a receiver.



The most informative waveform encountered in television service work is the composite video signal waveform consisting of the video information, the blanking pedestals and the sync pulses. If a technician learns to recognize discrepancies in this waveform, he can quickly check the performance of many of the circuits within the receiver.

The measurement of the peak-to-peak voltages of these waveforms further reveals the condition of the circuitry; this information is normally supplied in related service information.

To attain reliable information from the observations of composite video waveforms, always use a low-capacity probe and a good oscilloscope. This will assure observation of waveforms as they actually exist in the circuitry. Learn to analyze video waveforms; they can often reveal obscure troubles and save you a great deal of valuable time.

Observation of the horizontal blanking and sync pulse waveform alone contains a wealth of information:

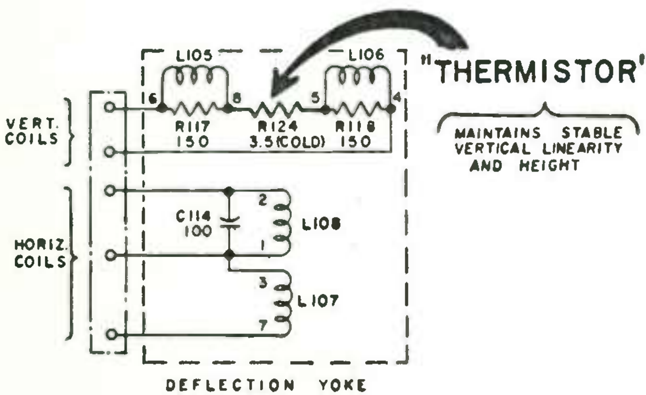
Clipping or limiting caused by malfunctioning circuitry can be detected at a glance, as illustrated in waveform B and C. Sync pulses should normally be approximately 25 percent of the over-all signal level.

In many instances, distortion of the horizontal blanking and sync pulse can reveal malfunctioning circuitry by a loss of high frequencies and indicates a loss of picture detail. Waveform E shows the effect of excessive high-frequency response on the horizontal blanking and sync pulse which results in fine vertical black-and-white striations following a sharp change in picture shading. The horizontal blanking and sync pulse takes the form shown in waveform F when subjected to a loss of low-frequencies. This would show up on the kinescope of the receiver as a change in shading of large picture areas and a general smear of picture detail. Courtesy of RCA Sales Corporation.

TV Receivers — Function of Yoke Thermistor

The resistance of the vertical windings in a deflection yoke increases as its temperature increases. Unless this condition is compensated for, the increase in resistance of the vertical windings will decrease the height of the raster and adversely affect the vertical linearity.

To compensate for this undesirable condition, RCA Victor TV receivers use a thermistor (temperature compensating resistor) in series with the vertical windings of



the deflection yoke. A thermistor serves to compensate for the resistance changes that take place in the vertical windings of the yoke because of variations in temperature, A thermistor decreases in resistance as the ambient temperature increases; placed in series with the vertical windings of the deflection yoke and positioned in proximity of the windings, it heats as the yoke windings heat. Since changes in the resistance of the "thermistor" and the yoke windings are opposite one another, the effective over-all resistance of the circuit remains constant.

Although few thermistors fail, keep in mind that an improperly functioning thermistor can affect picture vertical linearity and height.

Making TV and FM Absorption Traps

Television and FM receivers are specially designed to reject unwanted signals. Occasionally, however, in areas where undesirable signals are extremely strong, a problem may appear. For example, adjacent channel interference may occur in areas where a customer wishes to watch a distant station and there is a local station on an adjacent channel. Although correct antenna orientation and selective tuning will usually help, the unwanted signal may still cause interference. In such cases, a tuned trap will usually solve the problem.

RF interference is another problem that sometimes presents itself. This type interference usually occurs in areas where the set is located "next door" to a TV or FM transmitter. These particular circumstances can cause interference on several or all TV channels. On an FM receiver, spurious signals may be received at several spots on the dial, or in extreme cases, block out several or all FM stations.

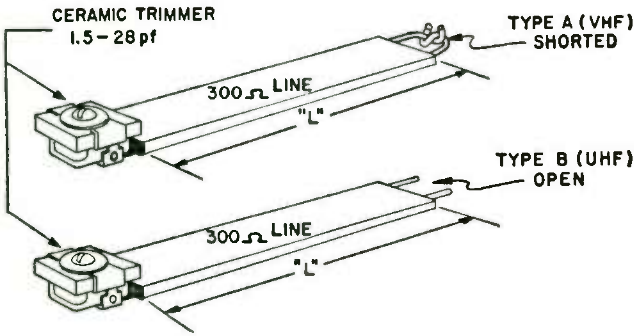
In solving problems of an interference nature, it is often desirable to attenuate (or reject) a specific frequency or band of frequencies. In most cases, this can be done by simply installing an absorption trap on the antenna lead-in. Such traps may be quickly constructed by using a section of 300—flat ribbon transmission line, terminated on one end by a small trimmer capacitor. The other end of the trap is short-circuited for trapping VHF signals; whereas for UHF, the other end is open-circuited as shown in the illustrations.

Lengths of 300Ω line for typical traps follow: (Tuning trimmer capacitance range in all cases is 1.5 to 28pf.)

Channels	Length "L"
Ch. 2—6 and FM	8in. VHF Type A
Ch. 7—13	3in. VHF Type A
Ch. 14—50	5in. UHF Type B
Ch. 51—83	3in. UHF Type B

These traps are installed by taping them to the 300Ω antenna lead-in. The effectiveness of the trap is controlled by several factors:

1. Position of the trap along the lead-in: The trap sets up a standing wave at the trapped frequency in the lead-in wire to the receiver. The trap should be moved along the lead-in until the optimum trap placement is found, remembering to retune the variable trimmer.
2. Physical length of the trap: The length (dimension "L") may be varied and the trimmer adjusted accordingly. A longer trap tends to be "broad band."
3. Coupling of the trap to the line: For effective operation it is necessary that the trap be installed against flat 300Ω lead-in. After final adjustment the trap can be held in place by paper or vinyl tape. A convenient initial adjustment technique is to hold the trap on the 300Ω line with spring-loaded plastic clothespins. The clothespins serve as convenient handles during the initial trimmer adjustment and allow positioning along the lead in for optimum attenuation.

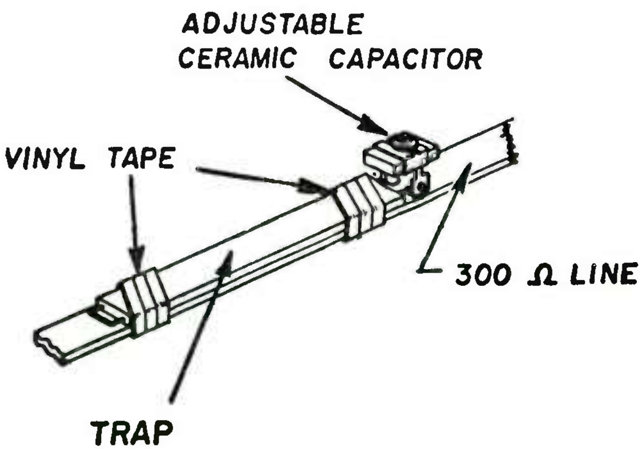


Practical use of the traps may fall into three categories:
1. A trap for narrow band interfering signals.
2. Trapping a broad band signal like a TV channel.
3. A method for identifying the frequency of an inter-

fering signal in the field.

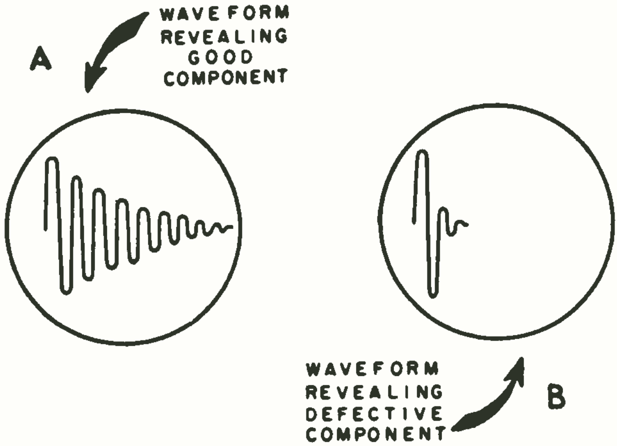
To reject a narrow band signal, the trap is coupled to the transmission line and adjusted to the interfering signal. The trap lengths given in the table will cover the range of frequencies from 50 to 890MHz. Remember to position the trap along the lead-in for optimum rejection.

Trap circuits can attenuate a broad band signal (a strong TV channel) that is interfering with a weaker channel. Because the trap will have a pronounced effect on the channel to which it is tuned it is very important to check the performance of the receiver on the "trapped" channel, with and without the trap in place. In particular, a color TV should be checked with a color program. If undue effect is noticed, it may be necessary to "broad band" the trap circuit. This may be done in one of two ways: by increasing the length "L" of the trap and readjusting the trimmer or alternatively, by loading the trap with a resistor, typically 10K.



Using the Scope for Horizontal Circuit Testing

A defective component in the horizontal deflection circuit of a television receiver can often be difficult to diagnose. (Sometimes substitution with a good component is



the only sure method.) An open winding is easy to check, but shorted turns can be evasive — resistance measurements are not always a conclusive test.

Test Procedure

The following test is based on the ability of a tuned circuit to "ring" when a pulse is applied; it provides a means of detecting even partially shorted turns in horizontal deflection coils. With this procedure it is not necessary to remove the components from the chassis. The test circuit employs a pulse which is picked up from the cathode of the sweep oscillator tube in the oscilloscope and applied to the suspected coil or transformer. The waveform developed on the screen of the oscilloscope will reveal the condition of the winding under test. If the coil is good, the waveform will appear as a wave-train — shown in illustration A. If the coil is defective, the waveform will be heavily damped as shown in illustration B.

The sweep rate of the oscilloscope should be adjusted to produce a single waveform, such as shown in illustration A. Table 1 lists the approximate sweep rate recommended for various components that may be readily tested in this manner.

Table 1

Component	Sweep Rate
Width coil	2500/5000 Hz
Horizontal linearity coil	2500/5000 Hz
Horizontal output transformer	500/1000 Hz
Deflection yoke*	2500/5000 Hz
Receiver deflection circuit with yoke connected	2500/5000 Hz
Receiver deflection circuit with yoke disconnected	500/1000 Hz

**Check auxiliary components before discarding yoke if test indicates a defect — internal capacitors, etc.*

System Check

The complete horizontal output system, including the transformer and yoke, may be checked with the "ringing pulse" by removing the plate cap of the horizontal output tube and connecting the oscilloscope probe and the "Sweep" lead to the plate cap lead of the transformer. Connect the ground lead of the probe to the receiver chassis. One shorted turn on the horizontal output transformer will produce the short, damped waveform characteristic of a defective component. The effect of shorted turns may be seen by shorting the filament winding of the horizontal output transformer while checking it with the oscilloscope.

How To Obtain The Test Pulse

To obtain the test pulse, simply connect one end of a 680pf, 600v capacitor to the cathode of the sweep oscillator in the oscillocope, and terminate the other end at an insulated binding post mounted on the front panel. Table 2 indicates the correct connection point for this capacitor in RCA scopes.

Table 2

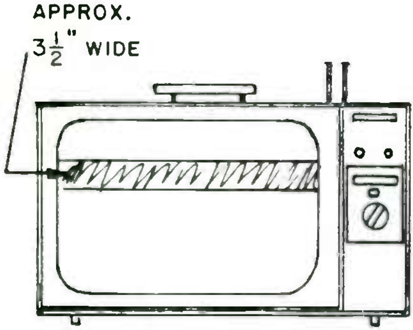
RCA Oscilloscope	Connect Capacitor to —
WO-91A, B	Pin 3 (or 8) of V9 12AX7
WO-88A	Pin 3 (or 8) of V8 12AU7
WO-78A, B	Pin 3 (or 8) of V14 6BQ7

WO-58A	Pin 3 (or 6) of V8 6SL7GT
WO-56A	Pin 3 (or 8) of V10 12AU7

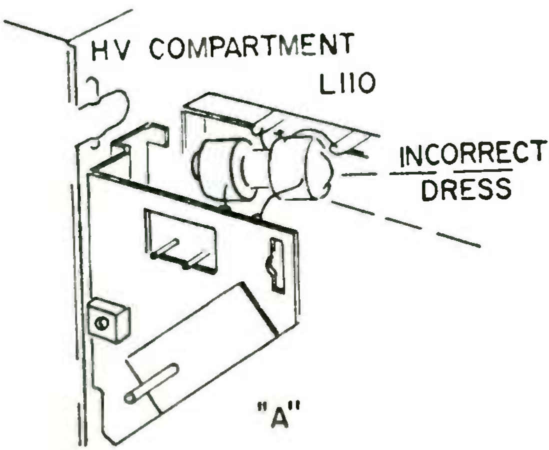
After installing this binding post be sure to label it "Sweep."

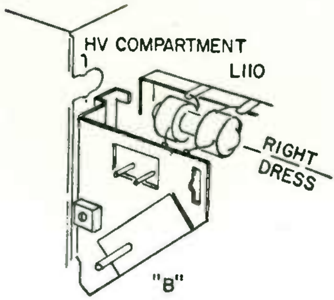
TV Chassis KCS158 Series—Apparent 'Hum bar'

Field reports mention an apparent "hum bar" on some KCS158 chassis. Investigation reveals that L110 positioning



can be critical with respect to the yoke position. Where this "hum bar" is evident, L110 should be redressed as illustrated in "B."

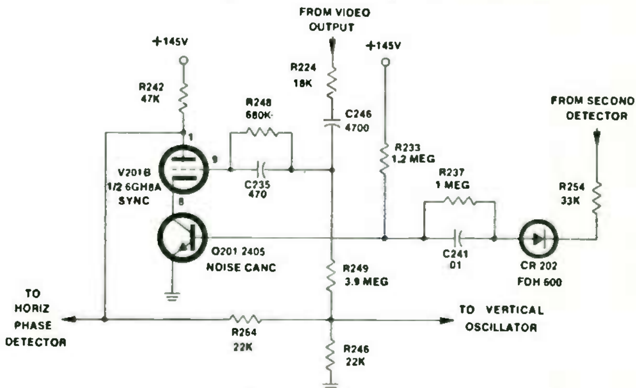




TV Chassis KCS179/KCS183—Sync and Noise Cancellation Circuit

This receiver's sync section consists of the sync-separator stage and the noise-cancellation stage. Under normal signal conditions, the sync-separator tube, V201B, and the noise-cancellation transistor, Q201, are conducting.

A positive-going signal from the video output stage is coupled through resistor R224 and capacitor C246 to the RC network made up of resistor R248 and capacitor C235.



The signal bias developed by this RC network sets the operating point of the tube, allowing the tube to conduct during sync-pulse time only.

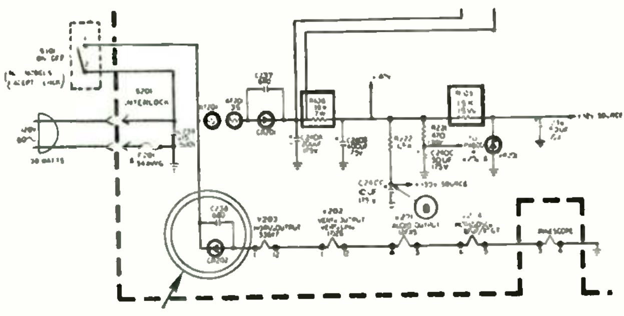
A negative-going video signal from the second detector is coupled through resistor R254 and diode CR202 to the RC network, consisting of resistor 237 and capacitor C241.

This RC network sets the cutoff point of the transistor at the sync-tip level.

Under normal signal conditions, both stages are conducting, providing sync pulses to the vertical and horizontal oscillators. Since transistor Q201 is operating just short of cutoff at the sync top level, any pulse, such as a noise spike, which drives the base of the transistor more negative then the sync tip will cut off the transistor. With transistor Q201 cut off during a noise spike, the conduction path of the sync amplifier tube V201B is open, deleting any output from the sync separator during the noise-pulse time; thus maintaining stable vertical and horizontal synchronization.

TV Chassis KCS169, "L," "M," "P" Line Models KCS176, 177, "M" Line Models—Hum Bar in Raster and/or Loss of Sync

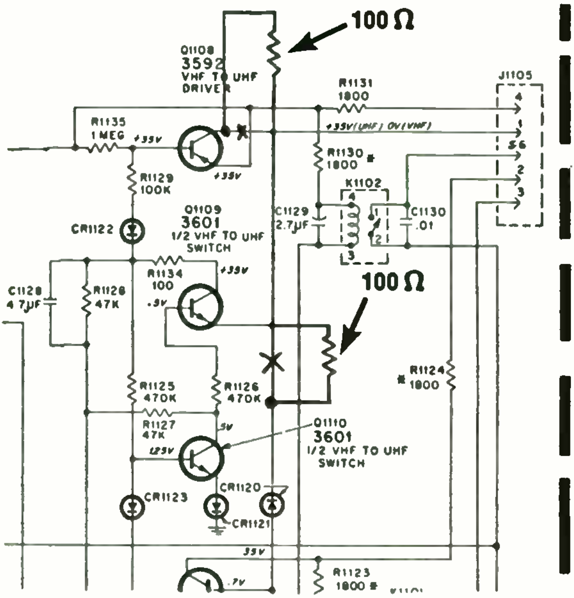
These chassis use a half-wave rectifier for filament power. Should the diode (or the capacitor across it) short, the filament string will be operating on full line voltage (120v ac) rather than the normal half-wave rectifier output.



The tube filaments will glow brighter than normal and may result in reduced tube life. In addition, a hum bar in the raster and/or poor vertical sync may be evident.

Remote Amplifier CTC44/CTP19A—Service Tips

If the VHF to UHF driver transistor Q1108 in the CTP19A remote amplifier fails (shorts), the instrument will go to the UHF function only. Should this failure occur in early-production versions of this chassis, the following circuit changes will improve reliability. Later-production chassis have these changes incorporated. • Add a 100Ω, ½w resistor (Stock No. 502110) in series with the collector lead when replacing transistor Q1108. • Unsolder diode CR1120 cathode lead and add a 100Ω, ½w resistor (Stock No. 502110) in series.



Mechanical buzz or hum in instruments utilizing the CTC44/CTP19A chassis may be from the remote power transformer mounting. The buzz will be evident any time the MASTER switch is ON. In those specific instruments exhibiting a buzz, tighten and then solder the remote power transformer T1102 mounting tabs.

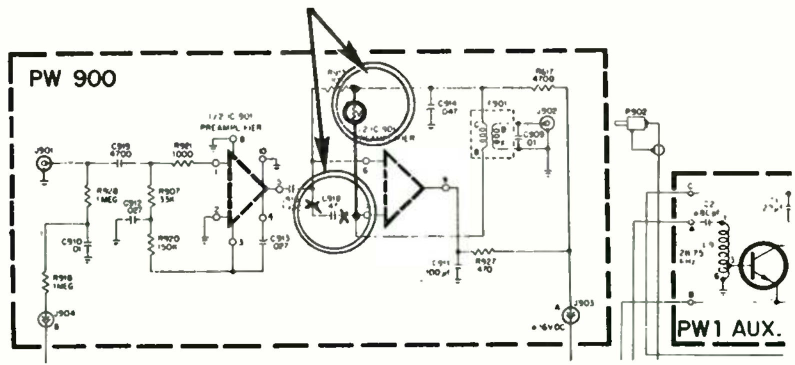
Remote Preamplifier Model CTP13A—Marginal Sensitivity

Some versions of the PW900 board utilized in the CTP 13A remote amplifiers may have a circuit modification. As shown in the schematic, capacitor C918 is deleted and a varistor (Stock No. 130042-7) is added in parallel with the primary of transistor T901.

Physically, the varistor replaces the capacitor. The printed circuit is modified slightly in order to make the proper connections.

Marginal remote sensitivity in amplifiers that have been modified may be improved by removing the varistor. It is not necessary to replace the capacitor unless high-frequency interference is evident in the picture during remote functions.

Capacitor replaced with varistor



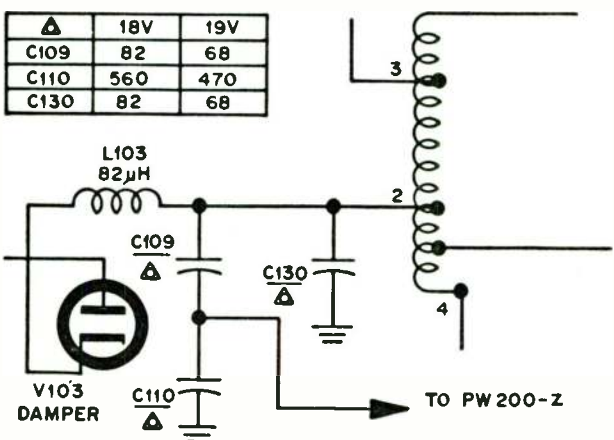
TV-Chassis KCS186—Video Output Transistor Q504 Failure

Video output transistor failure symptoms in this chassis may be similar to those associated with AGC problems—overloaded picture on strong signals, relatively normal on weak signals.

For continued protection of this transistor, make certain that there is a neon bulb mounted on the picture tube socket. The bulb, stock No. 130043, should be connected between the grid (green lead) and ground. The lead attached to the grid must be as short as possible.

TV Chassis KCS171—Circuit Modifications

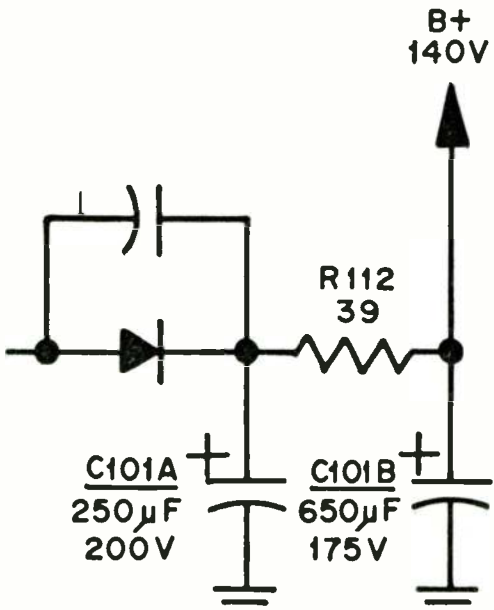
The vertical mounted tube-type KCS171 chassis has been continued in portable B/W-TV sets employing an 18-in. diagonal screen. A KRK148 tuner is used for VHF tuning and a KRK152 tuner is used for UHF tuning. Although the chassis continues with minimum changes, some horizontal sweep circuit modifications have been incorporated in this version of the KCS171AB chassis.



Δ	18V	19V
C109	82	68
C110	560	470
C130	82	68

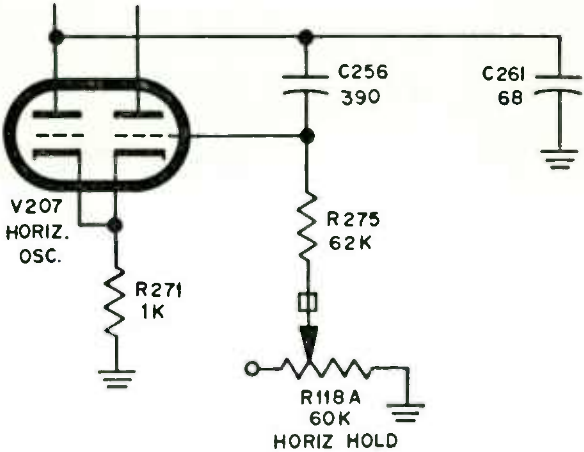
The capacitive voltage-divider network in the flyback circuit is changed by connecting a capacitor (C130) to the junction of C109 and Terminal No. 2 of the flyback transformer. With this capacitor arrangement, the high voltage cannot exceed the specified maximum voltage under a failure of an open capacitor in the voltage divider network. Early versions of this chassis had a capacitor connected to the junction of C109 and C110. With that arrangement, an open C109 capacitor could have caused the high voltage to exceed the maximum limits. The value of these capacitors vary for 18-in. to 19-in. diagonal screen. The appropriate value is given in the table accompanying the schematic diagram.

The low-voltage filter capacitor (C101) is a new high-reliability type specially designed to prevent internal shorting of the positive plates. As a further precaution against



shorting, heat shrinkable tubing is used on the capacitor terminals to prevent external wiring shorts.

Another significant circuit change is the connection of one end of the HORIZONTAL HOLD control to ground. In

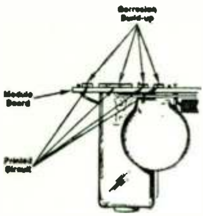


some earlier KCS171 chassis, this side of the hold control was connected to a horizontal oscillator disable circuit, which produced a non-viewable picture should a failure occur. Since these changes prevent the high voltage from increasing above the specified limits, the disable circuit is no longer required. Should the need arise to replace any of the specially designed components mentioned, do so with an exact replacement type.

Cleaning Module Edge Connectors

Intermittent symptoms in modular-equipped TV sets, whether associated with signal or deflection circuitry, may be the result of high-resistance module contact surfaces rather than a faulty component. High-resistance connections are particularly prone to development in atmospheres which contain corrosive substances, such as salt and/or various sulphur compounds.

In the event symptoms are encountered which may relate to high-resistance (corroded) contacts, the printed-circuit edge-connector area of the module should be cleaned with a cotton swab dipped in isopropyl alcohol—as shown in the illustration. Never use any type of spray chemicals to clean either the edge connectors or the module sockets.



Before replacing a module in its socket, inspect the socket for bent or broken contacts.

When replacing modules, always make sure they are completely seated in their sockets and that the spring-clip locks are in place.

"Triple-Branded" 6MJ6/6LQ6/6JE6C Horizontal Deflection Tube

The new RCA 6MJ6, which has been triple-branded to include 6LQ6 and 6JE6C, is a double-ended, high-perveance, beam power tube of the novar type with a T-12 envelope. This tube type is specifically designed to be an ultra-reliable field replacement for the older 6LQ6 and 6JE6C tubes in horizontal deflection amplifier service in color TV receivers.

This new horizontal-output tube has an integral envelope top-cap assembly which eliminates loose top-caps and minimizes glass dome failures.

The design also assures reduced microphonics and improves the ability to withstand shock and vibration. Other improvements allow this type to endure the excessive plate dissipation encountered during receiver fault conditions. Control testing assures that the tube can withstand a 200-w plate dissipation for a continuous or accumulated exposure time not exceeding 40 seconds, which should be sufficient time to permit conventional receiver protection devices to function.

The sharp high-voltage cutoff characteristic and the high transconductance (gm) of the tube assure low retrace conduction levels even in TV receivers with reduced drive voltage.

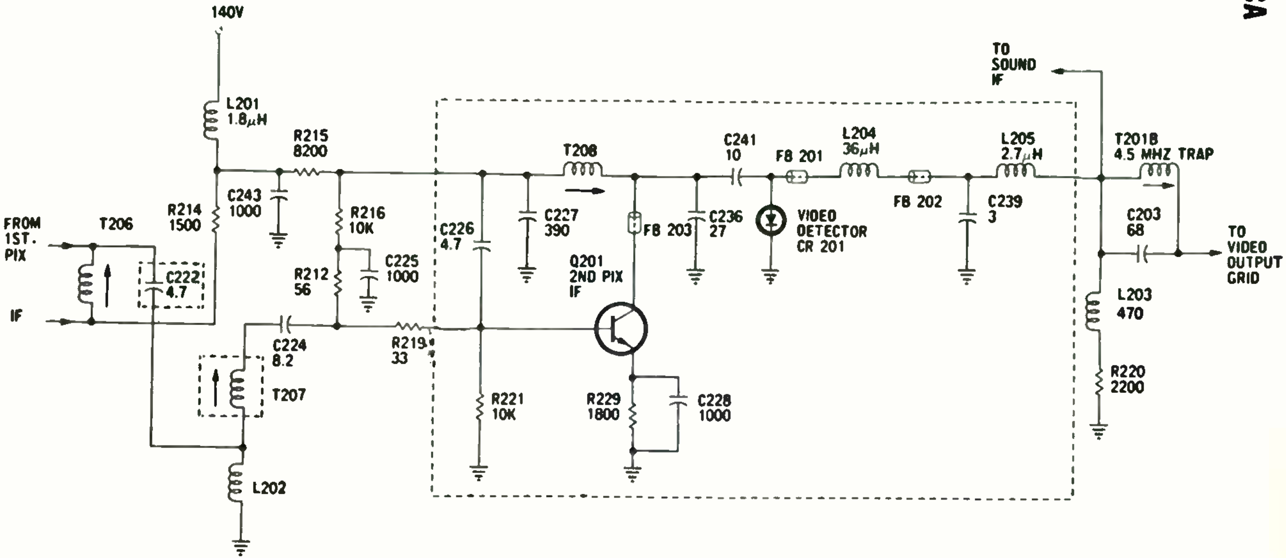
A plate connector cools the plate by conduction, resulting in lower plate operating temperatures and longer life. The special plate structure is designed to minimize secondary-electron emission from the plate and "knee" discontinuities in the zero-bias region of the E_b — I_b characteristic. A separate base-pin connection to grid No. 3 is provided so that positive voltage can be applied to grid No. 3 to minimize interference from "snivets" and to increase power output.

TV Chassis KCS192—Horizontal Retrace Blanking and Second Video IF Circuits

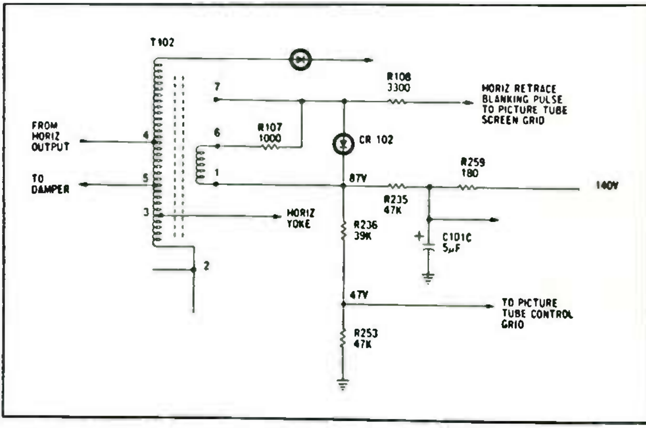
A new hybrid chassis, KCS192, is introduced this year in a 16-in. (measured diagonally) B/W portable TV receiver, Model AS164. This chassis is electrically similar to hybrid chassis KCS189, which was introduced last fall in the 9-in. (measured diagonally) models; and all-tube-type chassis KCS188, which was introduced previously in 12-in. (measured diagonally) models.

Like the KCS189, the KCS192 chassis is equipped with a solid-state second Video IF circuit, shown in the illustration. However, in the KCS192 chassis double-tuned interstage coupling (T206, C222 and T207) is used between the tube-equipped first Video IF instead of the untuned transformer coupling used in the KCS189. Ferrite beads FB201, FB203 and FB205 are included in the design to eliminate the possibility of "beat" interference on Channel 8.

Another significant difference between the KCS192 and the KCS189 is the addition of horizontal retrace blanking shown in the illustration. Diode CR102—connected across the winding of the horizontal-output transformer from which is developed the horizontal retrace blanking pulse—clamps the blanking pulse to a level below that at which ringing normally would occur. The approximate 87v developed at the junction of resistors R236 and R253 is applied to the screen grid on the picture tube through the retrace blanking winding and resistors R107 and R108. Diode CR102 remains reverse biased until the voltage on its anode exceeds 87v.


140V
L201
1.8μH
R215
8200
C243
1000
R214
1500
R216
10K
FROM
1ST.
PIX
IF
T206
C222
4.7
R212
56
C225
1000
C224
8.2
T207
L202
R219
33
C226
4.7
C227
390
T208
R221
10K
Q201
2ND PIX
IF
FB 203
R229
1800
C228
1000
C241
10
C236
27
FB 201
VIDEO
DETECTOR
CR 201
L204
36μH
FB 202
L205
2.7μH
C239
3
TO
SOUND
IF
T201B
4.5 MHZ TRAP
C203
68
TO
VIDEO
OUTPUT
GRID
L203
470
R220
2200

During the retrace interval, the high positive pulse developed across the primary of the horizontal-output transformer induces a negative-going pulse across the retrace blanking winding. Because this establishes a negative potential on pin 6 of the winding relative to pin 1, diode CR102 remains reverse biased and the negative-going pulse "opposes" the 87v from the junction of resistors R236 and R253, decreasing the voltage on the screen grid of the

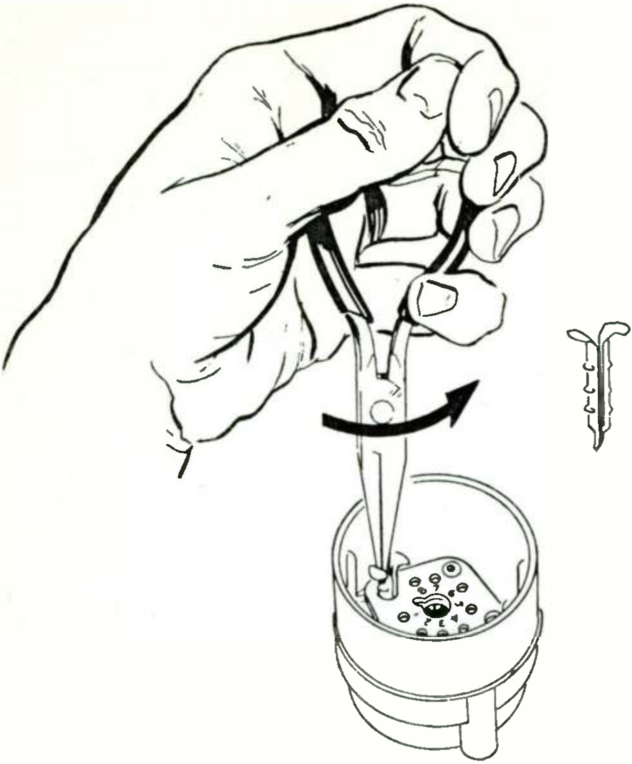


picture tube to about 30v, which, in turn, cuts OFF the picture tube.

When the negative-going pulse induced across the blanking winding ceases, the reactive components of the blanking circuit would normally cause it to "ring," producing a train of damped sine waves. However, because the amplitude of the ringing exceeds the 87v on the cathode of diode CR102, the diode conducts and damps it out, clamping the voltage on the screen grid of the picture tube to about 87v during the trace interval.

TV Chassis KCS172, 179, 183—High Voltage Tube Socket Removal

A new insert screw is utilized for attaching the high-voltage rectifier tube socket to the high-voltage cup in current production of the KCS172, 179, and 183 B/W-TV chassis. To remove the screws, simply turn counterclock-



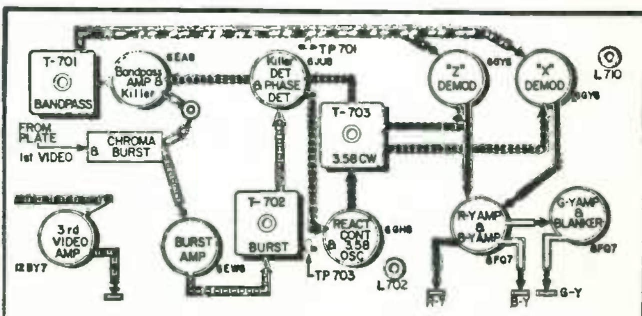
wise in the normal manner. Use small long-nose pliers, a screwdriver, or a cotter pin to turn the screw. To reinstall, either press in place or turn clockwise.

RCA
Color TV

Color Chassis CTC12—Chroma Board Layout

The new chroma board layout with signal paths for video, color, color control and killer control signals is illustrated here. The video signal from the delay line is fed through the third video amplifier stage to the cathodes of the kinescope.

Color and burst signals are taken from the plate of the first video amplifier and fed to the color take-off coil. The color signal as chroma is amplified in the bandpass amplifier and fed to the demodulator tubes. Output of the "X" and "Z" demodulators is fed to the color video amplifiers from which the color video information is fed to the kinescope grids. The burst signal is fed through the keyer tube to the phase and killer



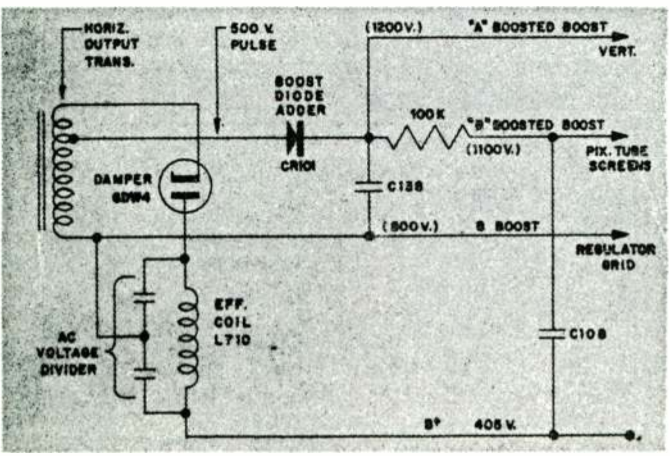
Chroma board layout of RCA CTC12 color chassis

detectors. The killer detector tube allows the bandpass amplifier to pass signals only when burst is present and the 3.58 cw oscillator is in correct sync with burst.

The phase detector compares the phase of the 3.58 MC cw signal with burst phase. If this is incorrect, a correction voltage is produced which is applied to the color oscillator control grid to correct phase. The 3.58 cw signal is also given the proper phase shift and applied to the suppressor grids of the "X" and "Z" demodulators.

Color TV Chassis CTC15—'Boosted' Boost

An adder circuit has been incorporated in the CTC15 to supply the higher voltages for the screens of the picture tube. This higher voltage is required to accomplish the smaller spot size feature. The 500 v pulse produced by the collapsing field of the horizontal output transformer during flyback time is applied to CR101, the "boost diode adder," and is effectively added to the normal B-boost of 800 v. The higher "boosted" boost voltage of 1,200 v is utilized as a source voltage for the vertical oscillator. A voltage

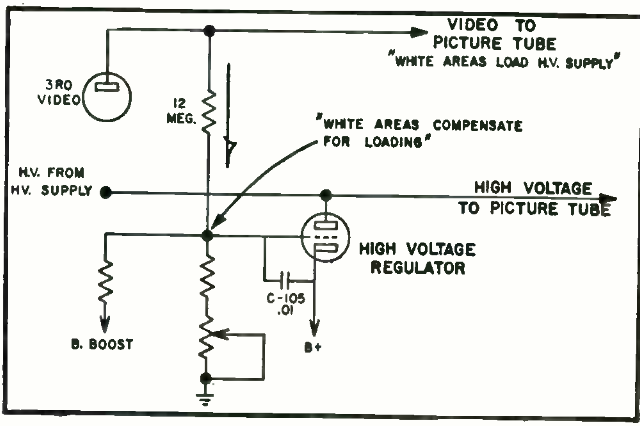


RCA 'boosted' boost circuit.

divider is used to derive the 1,100 v which is applied to the CRT screens.

Color TV CTC 15—High Voltage Regulation

The CTC 15 high voltage supply includes a regulating system which maintains a steady high voltage despite variations in picture tube loading. A feature consists of a connection between the third video amplifier plate circuit and the shunt regulator grid. Normally, white areas of the picture tend to load the



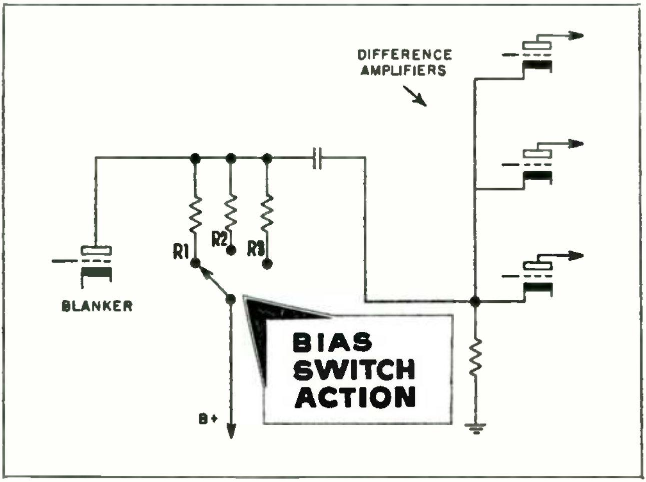
Schematic of RCA's CTC 15 high voltage regulation system

high voltage supply because of additional beam current drawn by the CRT. To compensate for this, video of the same polarity as that at the CRT cathodes is coupled to the shunt regulator grid through a 12 MΩ resistor. This causes the high voltage to remain at the same level when large white areas are being displayed on the CRT. The long time-constant formed by the 12MΩ resistor and the 0.01 μf capacitor in the regulator grid circuit insure that only long term video variations are coupled to the shunt regulator.

CTC15 Color Chassis — CRT Bias Switch

The CRT bias switch has been relocated in the circuitry and now affects the picture tube grids instead of the cathodes as in the previous CTC12. This maintains a more constant load to the third video amplifier at any setting of the CRT bias switch.

A three-position slide switch effectively selects three

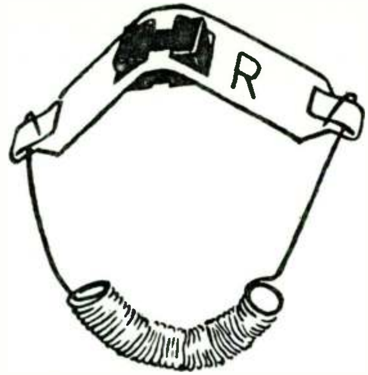


CRT bias switch on RCA CTC15 color chassis.

different plate load resistor values for the blanking amplifier when the CRT bias switch is operated. This changes the blanking pulse amplitude which is fed to the common cathodes of the R-Y, B-Y, and G-Y amplifiers. As a result, the average bias on these tubes will change with each postiion of the switch. A change in bias results in a plate voltage change, and since the CRT control grids are dc coupled this change appears at the CRT. With the three settings provided on the bias switch, it is possible to make adjustment for any variations in CRT characteristics.

TV Color Chassis CTC15—Blue Lateral Magnet

Adjustment of the three magnets on the convergence assembly causes the red and green dots to shift diagonally and the blue dot to shift vertically. To



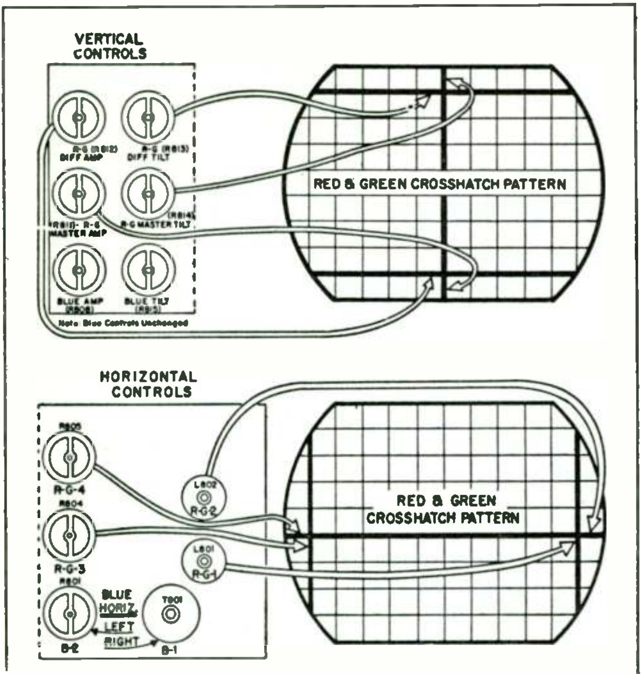
Blue lateral magnet used on RCA CTC15 color TV.

achieve center convergence, additional lateral motion must be imparted to the blue dot by means of another magnet. The configuration of the blue lateral magnet varies with the chassis series in which it is used. In some earlier color sets, this magnet influences all three dots in a lateral direction, hence giving rise to the term, "lateral" magnet. In the CTC15. this magnet affects only the blue dot and can be referred to as a blue lateral magnet.

This new blue lateral magnet is oriented directly above the blue pole section of the gun assembly. Its exclusive, tighter control of the blue dot helps the technician lighten his setup task.

Color TV Chassis CTC 15—Convergence

The CTC 15 convergence controls operate in a manner very similar to the previous CTC 12. Two improvements have been incorporated in this area, however. One is the addition of a clamp diode which gives better action to the vertical RG controls, and the other consists of a change in the placement of the

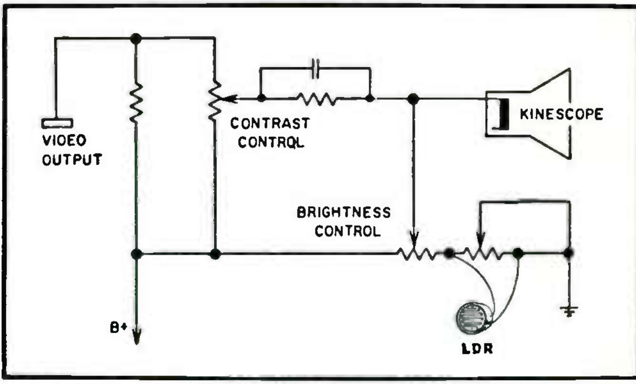


Convergence controls on RCA's CTC 15 color TV receiver and adjustment procedure with crosshatch pattern.

horizontal RG 3 and RG 4 controls. With this layout the entire top row of controls are adjusted on the basis of horizontal lines of a crosshatch pattern and the entire second row are adjusted on the basis of vertical lines on the crosshatch pattern. The effect of the other controls remain the same as in the previous CTC 12 color TV chassis.

Chassis 136Z — Automatic Brightness Control Circuit

The ABC circuit operates as follows: After optimum brightness has been set, any change in room lighting acts on the light dependent resistor. An increase in overall room light causes the LDR to decrease in value. This places the low side of the brightness control nearer to ground potential, decreasing B+ on the kinescope cathode. Lower potential at



Automatic brightness control using light dependent resistor in RCA receivers.

the cathode decreases grid-cathode bias and causes the kinescope to conduct more heavily thus increasing raster brightness. A decrease in room brightness has the opposite effect.

Kelvin Color Temperature

The color temperature of the raster on a color picture tube refers to the TINT of white or gray produced by the raster and not to its brightness level. To reproduce transmitted pictures properly on a color TV receiver during both black and white and color programing, it is necessary that the raster be set up to a specific color temperature. This provides the background upon which the picture can be reproduced.

The proper color temperature is described in degrees Kelvin (K).

Kelvin is a temperature scale used in reference to light, as a method of establishing certain characteristics in a light source, namely its hue. Most light is produced by thermal-radiation (matter being raised in temperature until it emits light). This temperature is a quality of light that can be readily measured.

The Kelvin scale simulates the centrigrade scale but provides for a greater range in the degree of represented temperature without going below zero. The Kelvin scale uses absolute zero as its starting point, while the centrigrade scale uses the freezing point of water as its zero — zero degrees contigrade being 273°K.

In using temperature to measure the color of light, black is the color that an absolute black body would emit at zero degrees K (absolute zero). As the black body temperature is increased, the color emitted from the body changes. When the body temperature reaches the range of 8000 to 9000 degrees K, the color of light emitted approaches the white that is seen in the raster of a CRT.

The light color emitted from several of the more common sources is shown in the color temperature Chart I.

Color using the 21CYP22 color CRT normally

Chart I

LIGHT SOURCE	KELVIN TEMPERATURE
Ordinary Candle	1900-1950
Common Household Lamp	2750-2850
Moonlight	4100
Sunlight	5300-5800
Daylight (Sun & Clear Sky)	5800-6500
Daylight (Overcast Sky)	6300-7200
Clear Blue Sky	14000-50000

calls for a color temperature of 8200°K. It sets incorporating the 21FJP22 and 21FBP22 color CRT, the color temperature is set up to 9300°K which gives the slightly bluer tint viewers seem to prefer.

Knowing the meaning and value of the Kelvin temperature scale, technicians will realize the importance of adjusting the color receiver to produce the proper white raster.

When a color TV receiver is adjusted to an excessively high color temperature a loss of red in the picture detail will result, and the over-all picture will take on a metallic appearance. Too low a color temperature results in the loss of blue, green, or cyan colors in the picture, giving objects a generally reddish-brown cast.

Color CRT 25AP22 — Description

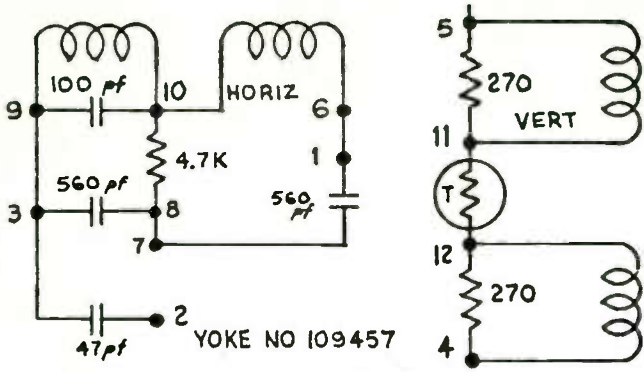
This 25-in. rectangular glass picture tube is a triple-gun shadowmask type. The screen has nearly straight sides with sharply rounded corners. A small neck diameter makes possible a high sensitivity deflecting yoke. This permits the wide angle deflection with approximately the same power required to scan a color picture tube having 70° deflection angle and 2 in. neck diameter.

It uses electron-gun assembly with unitized cathode construction supported by glass beads. The heaters are also supported from the same glass beads. The tube has an integral glass-button base having straight-through leads fitted with a keyed wafer. It has an integral protective window which is sealed to the faceplate with a clear resin. This construction eliminates the need for a separate safety-glass window and its companion dust seal in the receiver.

Color Chassis CTC10, -11 — Yoke Substitution

When RCA yoke stock #109457 is used on the CTC10 and 11 chassis, the following changes should be made as shown in the schematic. Also, a check should be made against the schematic.

Add two soldering lugs to the holes marked 7 and 8. Move components from lug 2 to lug 8.



Add jumper wire from lug 7 to lug 8.

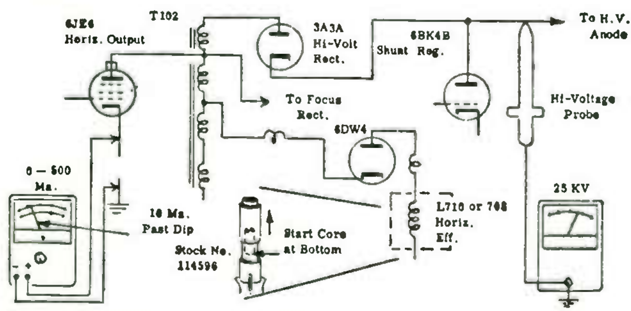
Add a 47pf ±5% 3kv (106306) from lug 2 to 3.

Change the two resistors on lugs 5 and 11, 4 and 12 to 270Ω (502127).

CTC17, 17X, 21, 24, 25 and 25X Chassis Series—Extending Horizontal Output Tube Life

A close inspection and careful check should always be made of the horizontal efficiency coil adjustment if a "short life" is experienced for the 6JE6 horizontal output tube.

The usual horizontal deflection alignment procedure



should be modified to include the following adjustments: Adjust the core of the horizontal efficiency coil (see illustration) until it is even with the bottom of the coil form and start from this point. Then adjust the core ccw to obtain a minimum dip of the 6JE6 cathode current. Continue to turn the core in the same direction until the cathode current is increased to 10ma, beyond the minimum dip reading.

After these adjustments have been made, set the brightness control for minimum brightness and readjust the HV to 25kv. An accurate VTVM and probe should be used here.

TV Chassis CTC21 AFC Circuits—Circuit Description

Solid state components are used throughout this UHF/VHF tuner's AFC circuit. If the fine tuning is misadjusted, the IF frequency response is normally incorrect—producing a poor picture. The AFC circuit functions to sample the incoming signal, using the 45.75MHz picture carrier as a reference—keeping the local oscillator on the correct frequency at all times.

The manufacturer's service data shows basic AFC stages associated with oscillator frequency correction. From the output of the 3rd video IF amplifier the 45.75MHz carrier is coupled to the AFC buffer amplifier. The buffer amplifier's output feeds a discriminator which is followed by a dc voltage which controls voltage-dependent-capacitance circuits connected in parallel with the local oscillators in the VHF and UHF tuners. Capacitance of these circuits change with applied voltage — varying the capacitance — which varies the local oscillator's frequency.

The buffer amplifier, discriminator, dc amplifier and their associated components are located on a separate chassis mounted outboard on the main TV chassis front. A single, shielded, circuit board contains all the components.

A simplified schematic also indicates major components in the AFC circuit. The 45.75MHz carrier is coupled to the buffer amplifier input from the 3rd IF plate circuit. Both the base input and the collector output circuits are tuned for maximum transfer of the 45.75MHz carrier.

A 46.50MHz trap limits the high frequency pull-in range of the system to prevent the AFC system from functioning on a wrong higher frequency carrier: the 47.25MHz adjacent channel sound, for example. This could result in a condition called "lock-up" or "lock-out" in the receiver. The system is, therefore, designed to have a narrow pull-in range of from ±0.75 to ±1.25MHz.

The frequency of the carrier at the buffer amplifier's output is applied to a discriminator circuit tuned to 45.75MHz also. If any difference exists between the sampled carrier frequency and the reference frequency of the tuned discriminator circuit, it causes a dc voltage change at the dc amplifier's collector.

The main 10v B+ supply for the system is regulated by a zener diode. A reference adjustment resistor reduces this voltage so the reference voltage from the discriminator circuit equals +5v.

The dc voltage change at the dc amplifier's collector results in a voltage that differs from the +5v reference. When the toner's frequency is too high, the reference potential is less than +5v. But when the frequency is too low, the potential is greater than +5v.

Both the reference voltage and the correction voltage are fed to the VHF variable capacitance control circuit. Here the 0.1μf capacitor—connected to the control voltage input of this circuit—acts as a filter or "anti-hunt" network designed to prevent noise or other interference from affecting the automatic tuning.

When the tuner frequency is set too high, the reference potential is less than +5v and the frequency control transistor then becomes forward biased. This increases the transistor's junction capacitance—in turn lowering the oscillator frequency. Conversely, if the tuner frequency is set too low, the reference potential will be greater than +5v, the transistor's junction capacitance would be reduced and the oscillator frequency increases. The control potential in the UHF tuner affects a varicap diode, which is part of a variable capacitance circuit having a ground return. This circuit also contains a 0.1μf capacitor designed to eliminate interference effects.

The temporary AFC DEFEAT switch is actuated by the fine tuning control. When the VHF or UHF fine tuning control knob is pushed in to preset the oscillator, the AFC circuit is removed from the oscillator circuit. A manual AFC ON/OFF switch is located on the rear of the dial light dimmer control. Pulling the knob outward permanently defeats the AFC circuit.

A better understanding of the AFC function can be had by following the chain of events that occur throughout the closed-loop system when the channel is selected and fine tuned.

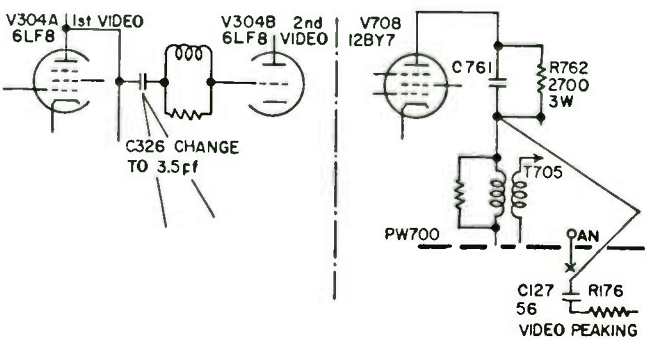
A particular channel is selected and the fine tuning is adjusted to the correct frequency—causing the picture carrier to appear at 45.75MHz. The discriminator output at this time is zero and the output at the collector of the dc amplifier is approximately +5v. This voltage appears on one side of the capacitance control circuit in the VHF tuner while the other side of the control circuit is connected to the fixed +5v reference supply developed in the bleeder network. With both voltages equal a 0v difference appears across the variable capacitance circuit and the local oscillator frequency remains unchanged.

If the fine tuning is mis-adjusted, causing the local oscillator to produce an incorrect frequency, the discriminator output is no longer 0v, but instead a voltage dependent on the degree of mis-tuning of the oscillator. This voltage in turn affects the voltage of the dc amplifier—the voltage dependent capacitance and the tuning of the local oscillator—which is returned to the proper frequency.

Color TV chassis CTC35 — Modification in Video Peaking Circuit

In some instances picture ringing and background noise may be encountered.

To minimize these effects, disconnect C127 from connecting point "AN" of PW700 board and reconnect to

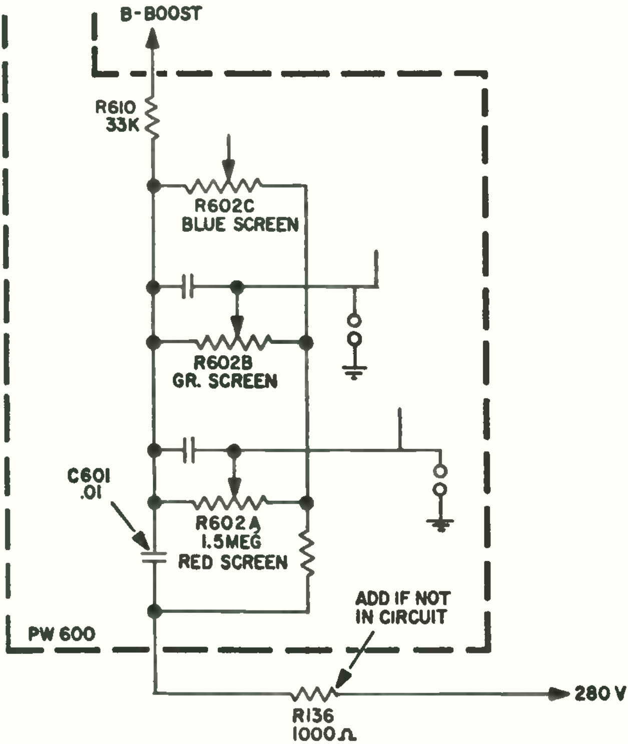


junction of T705 and C761 and R782. Change C326 PW300 board from a 5pf capacitor to a 3.5pf Stock No. 117531.

Color TV CTC22 Chassis — Capacitor Failure

Various field reports indicate some failures of C601, screen B+ boost filter. When replacement of this capacitor is required a 0.01μf 1kv ceramic capacitor, stock #79918 should be used.

When capacitor C601 is replaced, R610, a 33K resistor



may also need replacement and R136, a 1K resistor (stock #502210) should be added in series with B+ as shown in schematic. Late production will include this resistor.

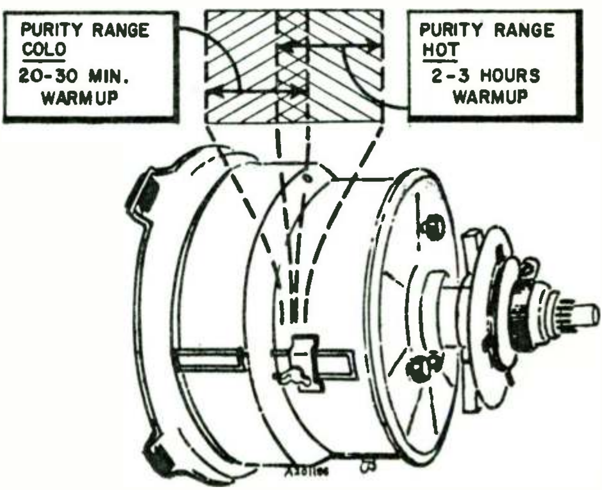
Color Chassis—Purity Adjustments

The effects of stray magnetic fields and the importance of North-South instrument orientation during purity adjustment are well known by most technicians. But it may be helpful to repeat detailed procedures.

Place the TV set in a North or South orientation, check center convergence, set center purity with the disc magnets, and set over-all purity by location of the deflection yoke.

Exact and lasting purity in any color receiver requires care during all adjustments. However, in TV sets using 90deg rectangular color CRTs, the *positioning of the deflection yoke* must be more *selective,* and instrument operating time must be considered. By a specific procedure, a stable purity setting can be obtained on rectangular CRTs that remains pure from initial warm-up time (20-30 minutes), up to and beyond any extended period of time.

RCA Victor service data for rectangular color equipment include a special note regarding purity adjustments; "If purity adjustments are made during minimum operating temperature conditions (20-30 minutes), the yoke should be set as close to rear edge of adjustment as is



consistent with good purity." Receiver warmup may be accelerated by operating the TV set at a high brightness level (without blooming) for approximately 10-20 minutes; preferably 20 minutes. (The yoke will arrive at approximately the same physical location, regardless of "cold" or "hot" setup.)

To clarify the action and importance of yoke position and warmup time, see illustration. As shown, a 90deg yoke housing, and simulated movement of the yoke within this housing (dotted lines extended into expanded areas above the housing). Notice there is a "range" through which purity is maintained as the yoke is moved forward or backward (the range represents slightly over ¼ in. of physical yoke travel). During "cold" conditions, the range extends in the forward direction—the yoke can be moved forward, *without losing purity.* During "hot" conditions, this range extends rearward.

The normal tendency would be to locate and set the yoke in the center of its purity range, compensating for any plus or minus change from "cold" to "hot" conditions — *this procedure is incorrect for rectangular CRTs.*

A further study of the illustration will disclose an *overlapping* area where purity *will remain stable* through all operating temperature conditions. Special attention must be given to locate the yoke in this "lasting" position.

If adjustment is made after a minimum warmup time (20-30 minutes), use the following procedure: Adjust center purity, slide yoke *forward* for good red field, then slide *rearward* until slightly impurity appears, *then* move slightly *forward* to just clear impurity.

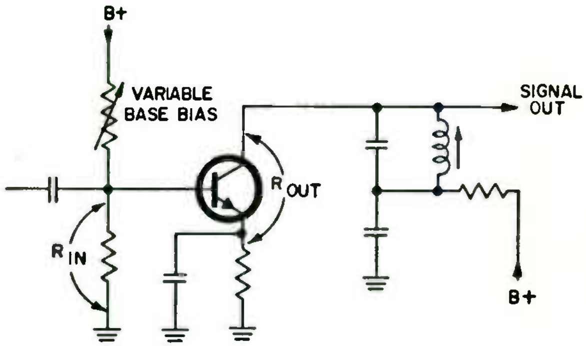
Use the following procedure for adjustment during "hot" conditions, after 2-3 hours operation: Slide yoke to *most forward* position for good red screen, *then* slide *forward* until slight impurity appears, *then* move slightly *rearward* to *just clear* impurity.

Although reference is made primarily to rectangular CRTs, the same procedures apply to round color tubes. The 21in. round CRT is somewhat less critical regarding yoke placement.

Quality performance from color television depends a great deal on proper setup—including purity. Technicians should remember the advantages of North-South orientation and proper yoke placement while making purity adjustments on color receivers, particularly those using rectangular CRTs. This procedure gives the best assurance of stable purity during the warmup period and operation.

Color TV Chassis CTC38/CTC40—Gain Control of Transistor Stages

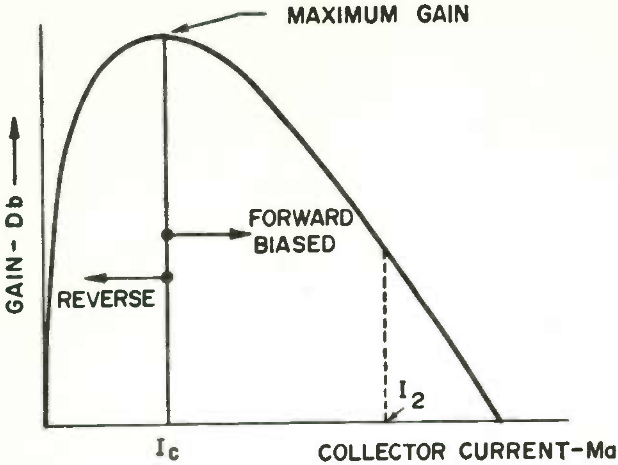
RCA solid-state television chassis employ variable gain stages to regulate the amplitude of particular signals in the automatic chroma control circuit and the 1st and 2nd IF stages.



A gain change is effected by varying the operating point (bias) of the transistor to be controlled. The transistors used in variable gain stages are especially chosen for a characteristic whereby the gain is a function of the collector-emitter current. The transistor characteristic curve shown illustrates that a stage using this type transistor will exhibit maximum gain at one particular value of collector current (Ic). On both sides of this maximum point, the gain diminishes, resulting in two modes of gain control—forward bias and reverse bias. Both of these systems of gain control are commonly used; the final choice is dependent upon other design considerations.

The basic difference between a forward bias and a reverse bias gain control system is that the collector current of the amplifier stage in the forward bias mode is made to increase for a reduction of gain, and collector current is made to decrease in a reverse bias system.

To understand the forward bias system it is first necessary to examine the transistor amplifier stage when it is at maximum gain. Under these conditions, the stage is designed to furnish a good impedance match to the transistor at its input and output terminals (R in and R out), and



the operating current (Ic) is chosen to yield the highest gain. If the base bias of the transistor is increased, the collector current will increase, to a new level I_2. The dotted line represents the new value of collector current (I_2), and is accompanied by a substantial gain reduction.

The cause of gain reduction is twofold: First, the internal gain of the transistor is lowered, and secondly, the input and output impedances (R in and R out) have been reduced thereby introducing mismatch of insertion loss.

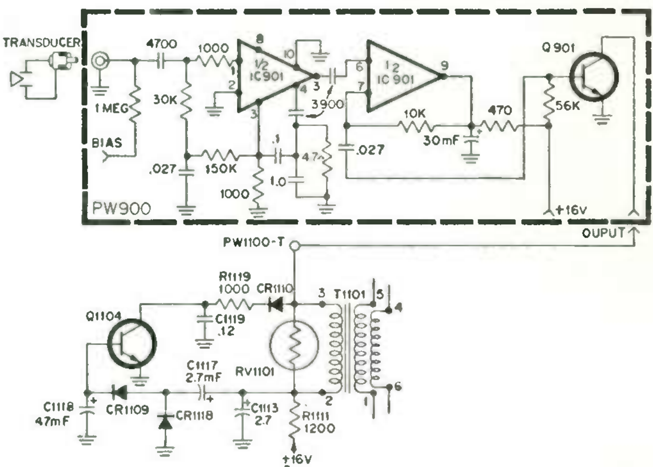
The forward bias control system is often used because the forward bias gain characteristic is more linear than the reverse current section of the curve. This does not mean however, that the reverse characteristics are undesirable. In fact many times it is advantageous to use the reverse bias system. When the nonlinearity of gain vs collector current is overcome by proper design, an advantage can be realized, in that gain reduction may be accomplished with a substantially smaller collector current change. This often results in simpler circuitry.

Color TV Chassis CTC42XR—Remote On/Off and Channel Functions

The CTC42XR remote control system uses an integrated circuit preamplifier and transistor driver stage (PW900) to amplify ultrasonic command frequencies emanating from the CRK13 four-function remote hand unit. The amplified signals of the PW900 board are applied to the primary of driver transformer T1101, located on the PW1100 remote board. The secondary voltages of this transformer drive tuned circuits that trigger the appropriate controlled functions.

Noise Immunity Circuit

Shown in the illustration is the noise immunity circuit, transistor Q1104, that serves to minimize the possibility of the remote circuits being triggered by extraneous noise

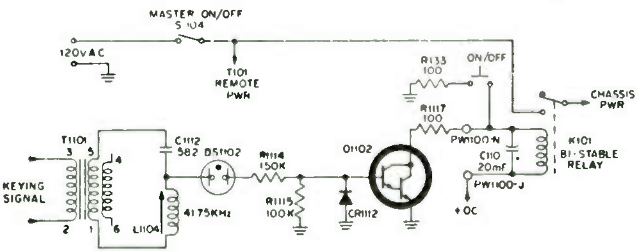


pulses, such as jingling coins, etc. Under normal conditions (when a valid remote signal is processed through the system) a steady dc voltage proportional to the amplitude of the ultrasonic signal will be developed across capacitor C1113. The noise immunity transistor (Q1104) is inactive at this time because it has no base current. When noise pulses occur, the voltage at C1113 will vary in relationship to the low-frequency amplitude changes of the noise. An ac signal appears at this point and is coupled through a capacitor, C1117, to be rectified by diode CR1109. The rectified ac produces a dc charge on capacitor C1118. When this noise-induced voltage exceeds approximately +0.6 to +0.7v, transistor Q1114 is biased into conduction. The load across the primary of transformer T1101, caused by the conduction of transistor Q1104 (through CR1110 and R1119), reduces the T1101 secondary voltage sufficiently to preclude erroneous remote control operation.

An additional component—voltage dependent resistor (RV101)—serves to limit the amplitude of the pulse on the collector of the driver transistor (Q901) to prevent breakdown.

Function Circuits Operation

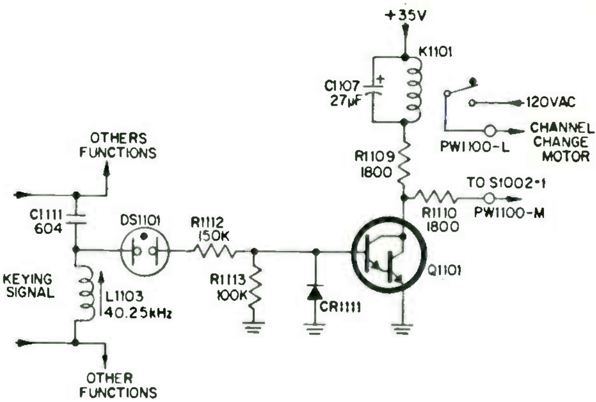
The On/Off circuit responds to a 41.75kHz command signal—as shown in the illustration. When a signal of that frequency appears across the series resonant circuit, consisting of capacitor C1113 and coil L1104, a neon bulb (DS1102) is ignited and acts as a low resistance path to



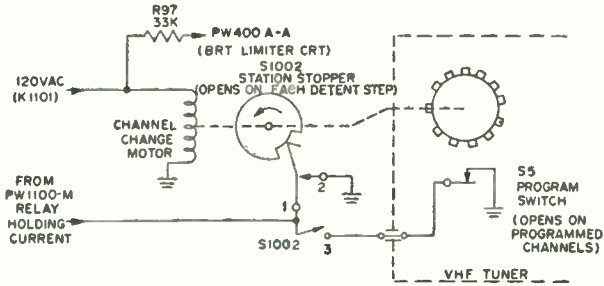
the base of a Darlington transistor, Q1102. Base current for this transistor is provided by the positive portion of the signal voltage obtained from the resonant circuit—through the conducting neon bulb and current limiting resistor, R1114 (150K). Diode CR1112 serves to conduct the negative portion of the signal voltage to ground.

The Darlington transistor is actually two transistors connected so that the individual betas of the transistors are compounded. This compounded transistor has an amplification capability (beta) of 1000 or more. A small base current at its input produces substantial collector current. The collector circuit of Q1102 controls a bi-stable relay (K101), which is powered from the —35v remote power supply that remains operative while the instrument master switch is on.

When the receiver is remotely turned ON, the Darlington transistor conducts, causing the bi-stable relay contacts to latch closed to complete the 120vac power circuit to the chassis. When the receiver is turned OFF, the bi-stable activates and latches to the OFF position. Manual ON/OFF is provided by a "push-push" switch on the front panel, which completes the ground path for the bi-stable relay by means of resistor, R133, a 100Ω resistor.



Remote Channel-Change, shown in the second illustration, is accomplished in a similar manner. The channel-change circuit responds to 40.25kHz signal. This causes Darlington transistor Q1101 to conduct, closing the contacts of the channel-change relay (K1101) to apply 120vac to the channel-change motor. Once the motor is activated by depressing the channel-change button on the remote hand unit (see illustration), the pull-in engagement of the armature closes contacts 1-3 on S1102 (station stopper switch), and they remain closed while the motor is activated. The rotation of the tuner shaft closes contacts 1-2 on S1102 to complete a path to ground for the channel-change relay. This relay holding current path connects to PW1100-M and the collector of transistor Q1101 through resistor R1110 (1800Ω), furnishing sufficient current to hold relay K1101 in an activated mode. The motor will continue to run after the keying signal is removed. Just prior to every detent position of the tuner, contacts 1-2 on S1002 open so that if the next channel is programmed "in," the motor stops—since the holding current path for the channel-change relay is opened. If the next station is



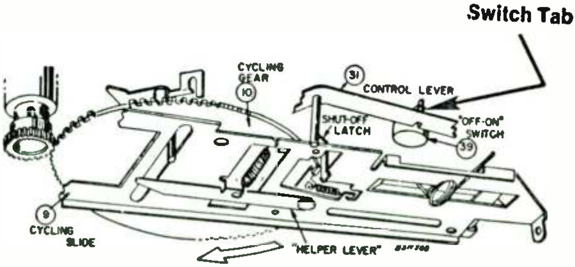
programmed "out," just prior to the opening of contacts 1-2 on S1002, the programming switch closes to furnish a holding current path for the channel-change relay through contacts 1-3 on S1102 and the programming switch. This action maintains the motor activated and prevents the tuner from stopping on an unwanted (unprogrammed) channel until desired channel is reached.

RCA
Console Models

Record Changer Models RP-230/231/232/233—Erratic or Improper Function Selector Operation

Erratic or improper function selector operation of these record changers may be resolved by one of the following procedures:

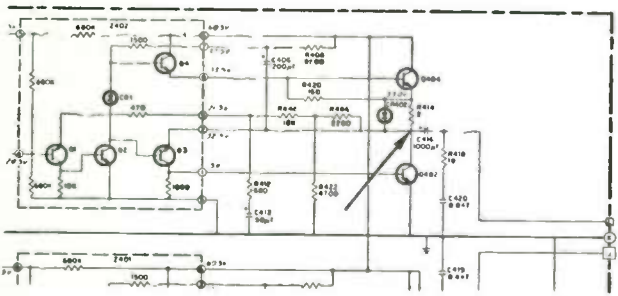
If the function selector is forced toward the "Select" position during the last record shut-off cycle, the control lever may warp downward causing the switch tab on the control lever to miss the switch assembly. In the event this occurs, and the control lever (Stock No. 126066) is bent, it must be straightened or replaced. Also the switch (Stock No. 108457) may be damaged.



The operation of certain changers (some early versions utilizing two switches) may be enhanced by the addition of a piece of plastic tubing (spaghetti) over the switch tabs. Each piece of tubing must be 3/16 in. long and fit snugly on the tabs.

Amplifier Models RS252, 253, 266—Coupling Capacitor, Quasi-Complementary Symmetry Output

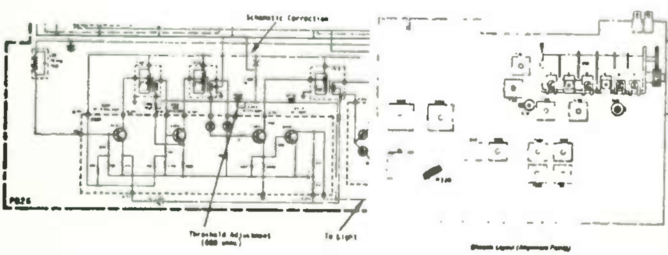
Normal dc readings at the output coupling capacitor (C416 or C417 in the illustration) in this type of amplifier is approximately one-half the full B+ voltage. Certain component failures can result in near B+ at this point and in turn damage the coupling capacitor.



Before replacing a defective coupling capacitor, be sure the voltage at this point is correct. Possible causes of increased voltage include: shorted capacitor C411 or C412 (in illustration); open printed circuit; defective Z401 or Z402 board.

FM/AM Tuner Chassis RC1238D—Stereo Indicator Threshold Adjustment

An FM STEREO INDICATOR THRESHOLD control has been added to the RC1238D FM/AM tuner chassis. The 600Ω control (Stock No. 136028) replaces fixed resistor R320 in the FM stereo circuitry. In the event the control re-

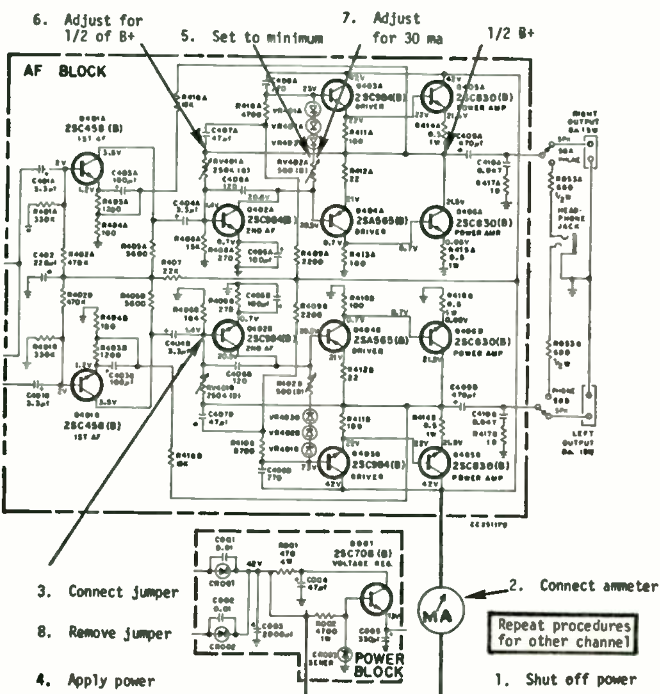


quires resetting, use a stereo FM signal simulator generator and adjust the control so that the light fires between a 5% and 8% 19kHz subcarrier level. If a generator is not available, tune in a known medium-to-weak FM stereo station and adjust the control so that the light just fires.

Amplifier Models SS4000/VS4000/VS6025/VS6060—Audio Output Bias Adjustments

When servicing the AF block, and if any transistor or other related components require replacement, it is imperative that the BIAS controls be reset. Misadjustment of these four controls (two per channel) can result in repetitive component failures. Balanced operation of each channel may be obtained by the following procedures: (Refer to partial schematic shown.)

Remove power to the amplifier and connect a 0-to-50ma milliammeter in series between the positive (red) lead



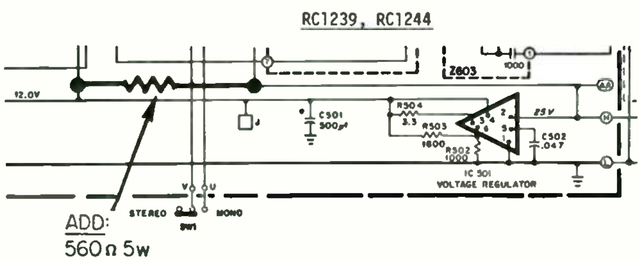
from the 42v supply and the AF board. Then connect a jumper from the base of transistor Q402B to ground (short out R406B) to turn OFF the channel not being ad usted. Apply power to the instrument and set variable resistor RV402A to minimum. Measure the B+ (nominally 42v) and adjust RV401A for half of the measured voltage at the junction of C409A and R414A (collector of transistor Q406A). Adjust RV402A for a 30ma indication on the milliammeter and remove the jumper used between the base of transistor Q402B and ground.

The bias setup is now complete for one channel. Leave the milliammeter connected for adjustment of the other channel.

Remove power from the amplifier and connect a jumper from the base of transistor Q402A to ground (short out R406A). Then apply power to the amplifier and set variable resistor RV402B to minimum. Adjust resistor RV401B for 21v (½ of the supply voltage at the junction of C409B and R414B, collector of Q406B). Adjust RV402B for a 30ma indication on the milliammeter and remove the jumper used to short the base of transistor Q402B to ground.

TV Combination Models Using an RC1238/RC1239/RC1244 Radio Chassis —Voltage-Regulator IC

The modification shown in the accompanying schematic was made during the production of these chassis to optimize the reliability of the voltage-regulator IC. In the event

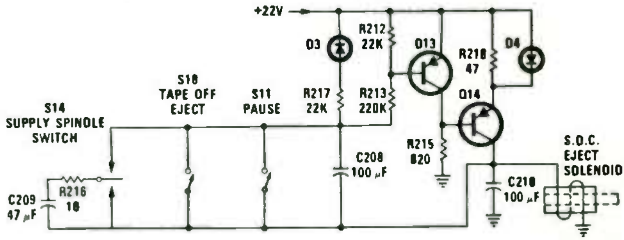


it is necessary to replace the voltage-regulator IC in one of these chassis, this modification should be included.

Cassette Recorder Model YZD572—Automatic Cassette Eject

The YZD572 cassette recorder has a special circuit that senses the end of the tape or that the power is OFF and ejects the tape cassette. When the cassette is ejected at the end of a tape, the instrument is turned OFF.

The schematic shows the simple circuit used for the



automatic cassette eject function. A solenoid (S.D.C.) ejects the cassette when energized by the conduction of transistor Q14.

Tape-motion-sensing switch S14 is part of the tape-supply spindle. When the tape is moving, the movable wiper of S14 alternately closes the contacts of the switch—much like the brushes and commutator of a dc motor. When the tape motion stops, switch S14 can be open or touching either contact. When the tape is moving, transistor Q13 conducts because increased base current is available. The base current for Q13 serves as charging current for capacitor C208.

Capacitor C208 never reaches a full charge because the tape-motion sensing switch (S14) alternately connects C209 across C208 and then discharges it. This action assures continuous base bias for Q13 while the tape is in motion. When the tape stops, S14 no longer cycles and capacitor C208 assumes full charge. With C208 fully charged, Q13 has no base current and is cut off. When Q13 is not conducting, transistor Q14 conducts and energizes a solenoid. As the cassette is ejected, S10 (discharge switch) closes and discharges C208. This prevents the cartridge from being ejected if it, or another, is immediately reinserted. Diode D3 forms an alternate discharge path for C208.

The cassette is also ejected when the power is switched OFF because the emitter voltage of transistor Q13 decays much faster than the base voltage, due to the charge on capacitor C208. Thus Q13 switches OFF within one second after the power is removed and the solenoid is energized to eject the cassette before the 22v power supply decays below a useful level.

A pause button (switch S11) is provided to allow the user to stop the tape motion without triggering the eject circuit. Obviously, the cassette will not automatically eject when the power is turned OFF as long as the pause button is ON.

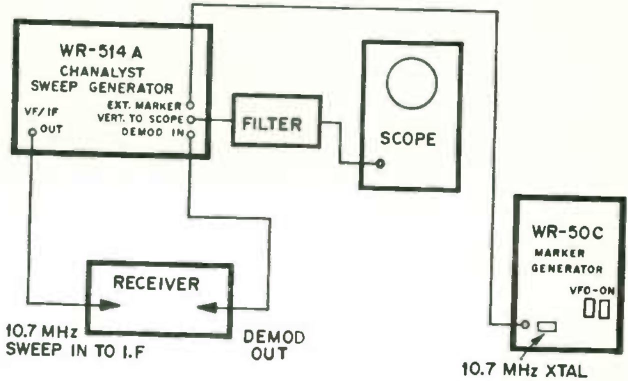
Easy FM Alignment Markers

Many stereo FM receivers use double-tuned IF stages to achieve the wide-band response required for low-distortion reception of FM multiplex. Because alignment is critical for lowest distortion, sweep alignment of the IF stages and ratio detector is often specified in service data. Sweep alignment requires the use of 10.6MHz and 10.8MHz marker frequencies, which are sometimes difficult to obtain. This article describes an easy way to obtain the required markers.

The test equipment required for proper FM sweep alignment includes a sweep generator providing a 1MHz wide sweep centered at 10.7MHz and a marker generator to obtain 10.6MHz and 10.8MHz markers. The RCA WR-514 Chanalyst or WR-69 sweep generator (used with WR-70 Marker Adder) are well suited for the marker insertion technique to be described. The RCA WR-50 RF Signal Generator is used to supply the 10.6 and 10.8MHz markers.

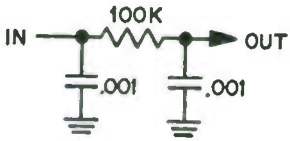
The sweep generator (WR-514 is illustrated) is connected to the IF input through a dc blocking capacitor—as described in the service data for the receiver—and adjusted to obtain a sweep response curve of correct amplitude. The WR-50, serving as a marker generator, is setup to furnish the 10.6MHz and 10.8MHz markers in the following manner:

Connect the marker generator to the Chanalyst sweep generator (or marker adder) as shown in the illustration. Install a 10.7MHz crystal in the front panel crystal socket



of WR-50. Set WR-50 generator's V.F.O. dial and range switch to obtain a 100kHz signal. Set an RF Output and Xtal-Osc switches of WR-50 to HIGH and V.F.O. switch to ON. Adjust the RF attenuator on WR-50 to obtain markers of correct amplitude.

With the conditions described, the WR-50 is actually feeding two signals (100kHz and 10.7MHz) to the Ext-Marker input of the WR-514 sweep generator. These signals enter the marker-adder section of the generator, where because of the relatively high signal levels, cross-modulation produces 10.6MHz (10.7MHz − 100kHz) and 10.8MHz (10.7MHz + 100kHz) products plus the original 100kHz and 10.7MHz inputs. The output signal of the marker adder is the normal sweep response curve, plus prominent 10.6MHz and 10.8MHz marks and a residual 100kHz component which is filtered out by the pi-section filter in series with the scope input—as shown in the illustration.

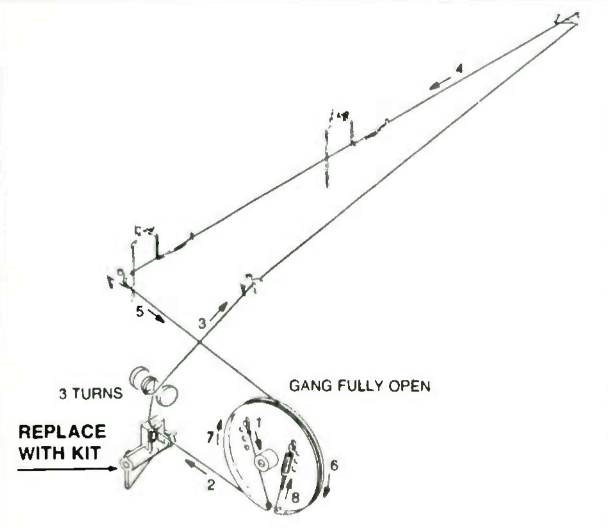


With practice this test instrument combination will provide the electronic technician with a straight-forward alignment technique.

Tuner/Amplifier Models VZT100/VST113—Dial Cord Guide Replacement

The RC1249 chassis uses a one-piece plastic chassis pan with a dial cord guide molded into the chassis, directly under the tuning shaft. In those chassis where failure of this guide is encountered, the following procedure is recommended for repair:

1) Remove any remaining portion of the broken plastic guide.
2) Drill ⅛ in. hole through the plastic chassis, ¾ in. from the front, and ¾ in. from the bottom.
3) Install new guide from Repair Kit 139918, and position as shown in illustration.
4) Restring the dial cord with three turns on the tuning shaft, and thread through the new guide. The new guide may be rotated slightly in either direction, to compensate for dial cord length variations.



REVISED DIAL CORD STRINGING DIAGRAM

Courtesy RCA Consumer Elect.

The dial cord string on some chassis may require shortening to accommodate this procedure. Other string guides on this chassis may be replaced with Repair Kit 139918 by drilling a ⅛ in. mounting hole through the locating key of the broken guide. After replacing any of these guides, restring the dial cord with three turns around the tuning shaft.

Amplifier Chassis RS238—Circuit Descriptions

Predriver/Driver Stages

Because of higher driver power requirements of the output stages, a predriver/driver circuit is used in the RS238. The predriver is a PNP transistor which acts as a voltage amplifier. The stage has an input impedance of about 1.5K to match properly the requirements of the preamplifier in the RC1218 tuner. The direct coupled driver stage employs an NPN power transistor. The base is directly coupled to the collector of the voltage amplifier transistor. Signal from the predriver stage appears across the 470 Ω predriver collector load resistor. It is evident that signal from the predriver stage is applied between the base and emitter of the NPN driver transistor and is amplified by the driver transistor.

The class "A" driver stage operates from a -30v source and supplies approximately .3w at very low distortion to the bases of the output transistors.

Output Stages

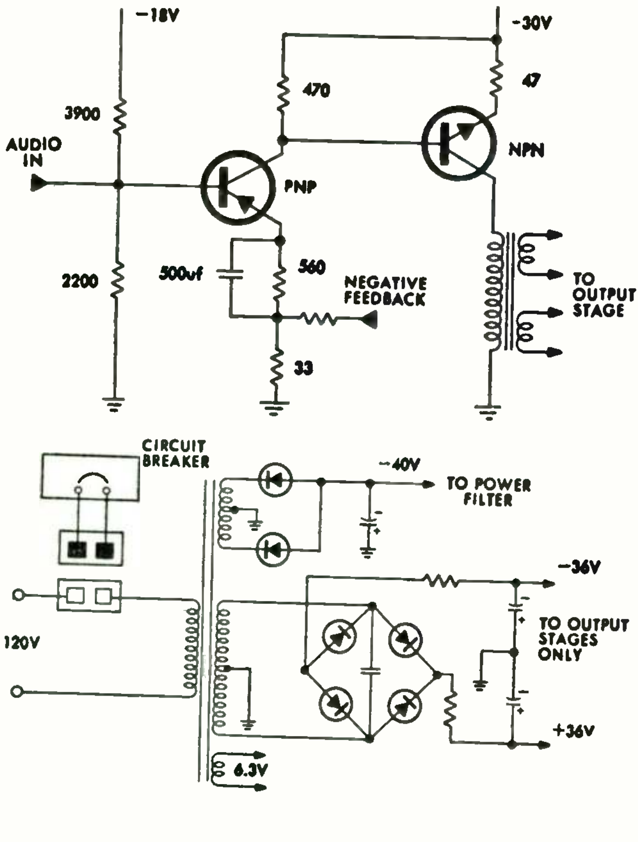
The output stages employ specially selected high beta alloy junction power transistors. These devices were selected because of their excellent beta linearity and because they yield low distortion at high power levels. Two power transistors are used in each channel in a familiar stacked class "B" arrangement employing a positive and negative 36v supply with about 25db of power gain when driving the 4 sealed speaker system used in the VJT70 series instruments.

Low distortion and excellent stability result from using negative feedback (in excess of 20db) to reduce the internal amplifier impedance to about 1/3Ω over the entire audio range.

Power Supply

Two independent rectifier/filter systems are used in the RS238 power supply. The output stages are powered by a center-tapped bridge that produces ±36v. A 36v supply can be used at these high power levels because the speaker voice coil impedance has been reduced to 4Ω in instruments using the RS238 amplifier.

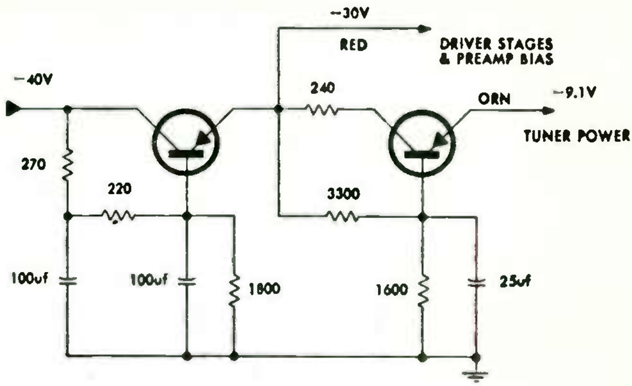
An auxiliary power supply operates from another secondary on the power transformer to furnish power for the remaining amplifier circuits and the RC1218 tuner. This full



wave circuit serves as a -40v source. After filtering, the -40v is applied to the collector of a power filter transistor.

Output from the power filter is a well filtered -30v. This -30v source furnishes emitter voltage to the NPN driver transistors. The predriver transistor bases are supplied from -18v that is obtained by a dropping resistor from the -30v supply.

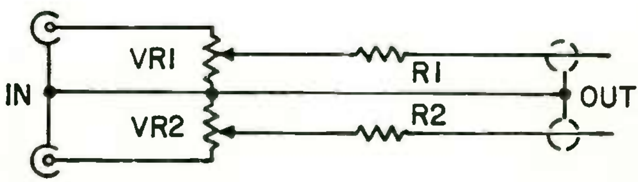
A second power filter transistor is used to obtain voltage (-9.1v) for the AM/FM and MPX circuits in the RC1218 tuner. The voltage at this point is very stable and no zener diode regulation is required.



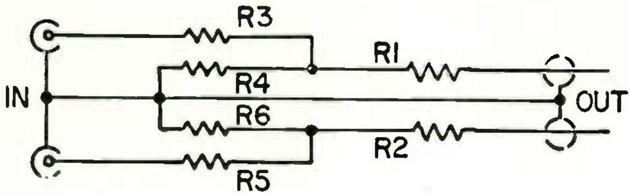
Tape Recorder Models YJC22, MJC28, YJG42/52, YJH32/36/38, MJG66/26 — Isolating/decoupling Circuits

Field reports mention the need for technical information concerning the matching of tape recorders, modules/players to external stereo instruments.

Simple isolating/decoupling circuit



Isolating-decoupling/level set circuit



Isolating-decoupling/1:2 attenuator circuit

Any models causing an objectionable disturbance in vol ume or tone quality when connected to external stereo i - struments should be corrected by the following methods:

Install a 47K to 68K, ¼ w, composition resistor in series with each center lead of the left and right channel cables.

This isolating/decoupling resistor eliminates the disturbance and permits tape unit to be used with all types of external stereo instruments.

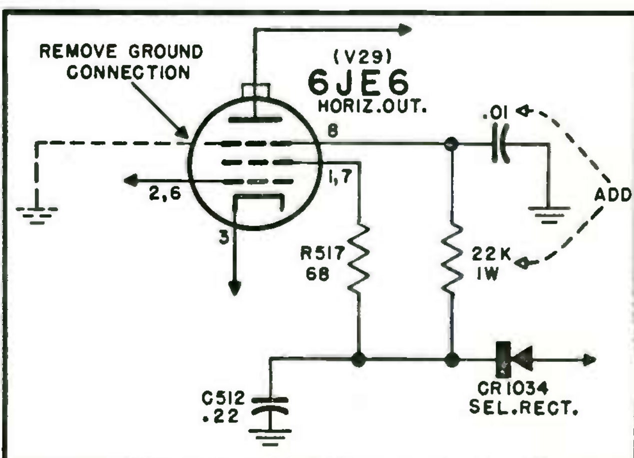
The illustrations show a series of networks that may be used, ranging from a simple 2 resistor type to a manual level-set type.

SETCHELL-CARLSON

Color TV

Color Chassis U800—Snivet Interference

"Snivets" are a form of interference produced by high-frequency oscillations in the horizontal output tube. They should not be confused with Barkhausen oscillations, since snivets appear in different parts of the raster as ragged vertical lines or weird distortions of vertical stripes and broken lines. Although snivet interference is usually bothersome only on UHF reception, it may be seen occasionally on weak VHF channels. Snivets may be minimized by placing a positive potential on the suppressor grid of the 6JE6. The

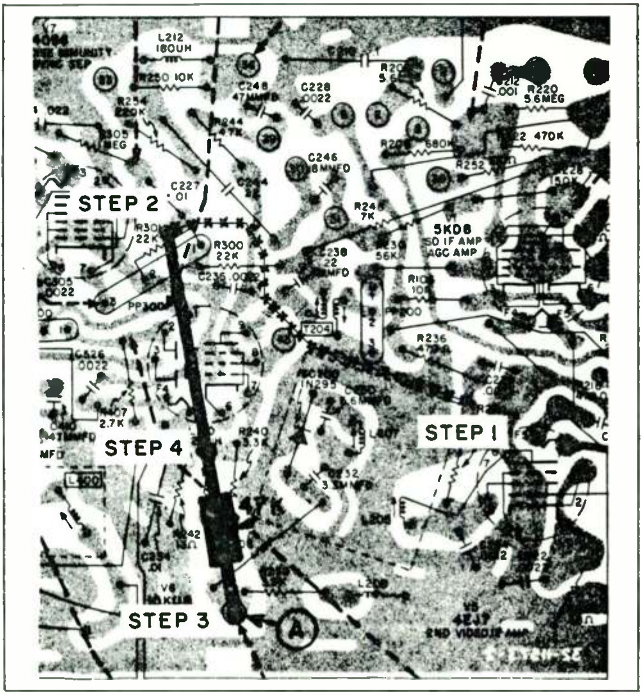


circuit used in current production U800 color chassis, places positive 30v on the suppressor (pin 8). Pin 8 has been disconnected from ground and fed from the screen supply through the 22K 1-w resistor. The .01μ ceramic disc by-pass capacitor is also added. If a snivet problem exists, check the circuitry of the CF1 unit and modify in accordance with the drawing. In extreme cases, it may be necessary to exchange 6JE6 tubes.

SYLVANIA
B&W TV

TV Chassis 573 19 in. Portable—Revisions in High Noise Impulse Areas

Some TV reception areas have sufficiently high noise impulse levels to cause the picture to momen-



Step-by-step revisions made on Sylvania's chassis 573 in high noise impulse reception areas.

tarily pull down from the top of the CRT screen. This type of action on portable TV receivers incorporating the 573 chassis can be cured by the following steps:

1. Unsolder the wire from R234 of the second IF amplifier.
2. Dress the wire through the hole adjacent to C227.
3. Solder one end of a 47K ¼ w resistor to point "A".
4. Connect the wire to the 47K ¼ w resistor and solder.

All 1965 TV Sets—Transistor Noise Gate Operation

A transistor noise gate is incorporated in all 1965 set for better noise suppression. The unit is located in series with the sync separator. Noise picked up from the detector output opens the sync separator circuit so it cannot trigger the sweep circuits.

The operation of the transistor noise gate located in the sync separator cathode circuit may be checked as follows:

Advance the AGC control as far as possible while still maintaining a stable picture. Short the noise gate transistor's base to its emitter (ground). The picture should have a tendency to bend and be otherwise unstable if the noise gate is operating properly since this partially opens the transistor.

If the transistor is shorted it may not be noticed unless the set is installed in a fringe area or an area where a great deal of noise is present. When the transistor is open the picture will be unstable.

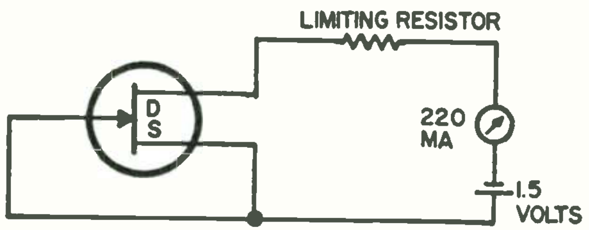
Testing Field Effect Transistors

The ordinary transistor tester runs into a brick wall when called upon to test a field effect transistor. In view of this fact, we will point out some ways of checking this type transistor and some of its characteristics.

First this type transistor is operated very much like a vacuum tube in that; (1) It has a high input impedance,

(2) it is voltage operated and (3) it is biased like a vacuum tube. This type transistor has a low noise level. There are two channel types, N-channel and P-channel. The former type is made of N-type semiconductor material with P-type material (gates) deposited and P-channel uses P-type material deposited for use as gates.

Unlike ordinary transistors, the input (gate) material is reverse biased to allow near zero or leakage current only to flow. The amount of voltage on this gate determines the current from source to drain. An ohmmeter may be used to check the front-to-back ratio of this diode junction the same way as in an ordinary diode or transistor junction. Caution: Some of these transistors for low signal levels are unable to withstand even ohmmeter currents and voltages. A suitable series current limiting resistor should be used on these types. Some of these transistors arrive from the vendor with a shorting ring to all terminals. This is to prevent static charges from breaking down the diode junctions, especially in IGFET's. When picking up or touching an IGFET device, the hand should be at ground potential. The leads can be

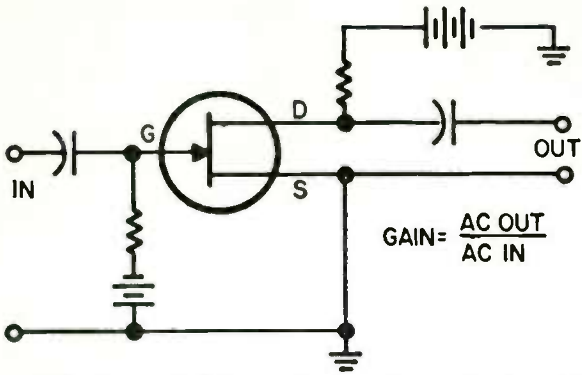


clipped together with a paper clip or spring clip while handling to prevent unsafe voltage appearing between elements.

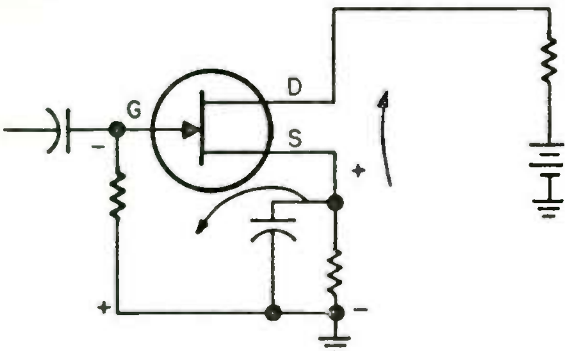
As in all transistors, the soldering iron tip must be at ground potential. Of course the circuit should be de-energized when removing or inserting a device.

A test for short or open on these transistors can be made by connecting the gate to the source terminal. Connect 1.5v through a milliameter from drain to source; 2 to 20ma of current should flow. Less than this indicates an open condition and more than this indicates a short condition.

The transconductance (Gm) of a FET transistor may be found by dividing the ac signal output current by the ac input (gate) signal voltage, and the gain (Gfs) may be

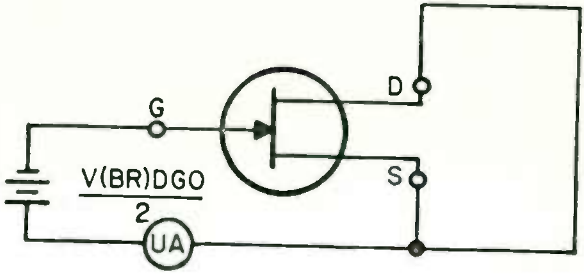


measured by connecting an amplier and comparing signal out to signal in. Shown in typical fixed and self-biasing arrangement.



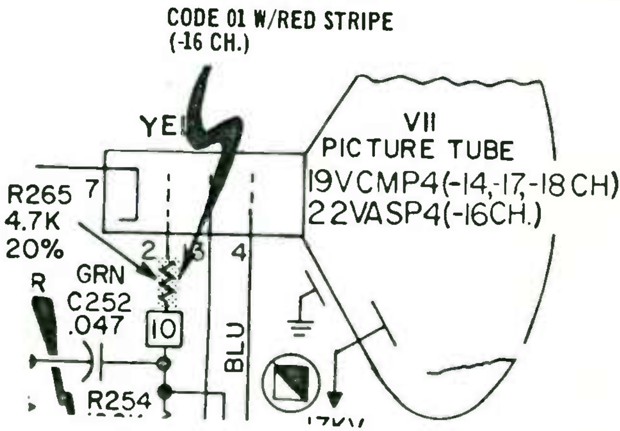
The illustration shows the connections to make gate leakage tests. The resistance in this circuit will be very large allowing only nanoamperes or microamps current flow. This is true especially of the IGFET's. Junction type resistances are very temperature-sensitive, similar to semiconductor diodes.

Maximum voltages specified by the manufacturer indicate lowest voltages that may be applied between elements that will lead to device breakdown.



TV Chassis B10-16—Diode SC204 Protection

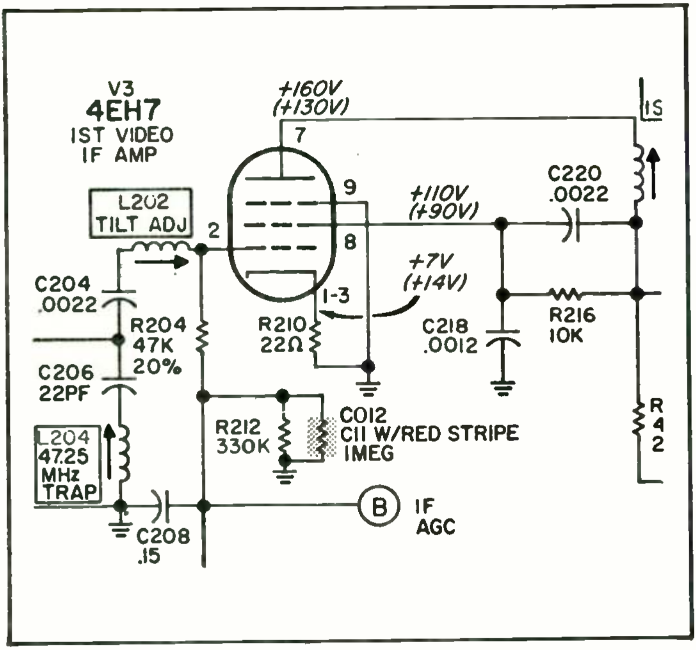
To protect diode SC204 when picture tube arc occurs, the following change was made: A resistor R265 (4.7K,



20% ½ w) was added in series with the green lead of the picture tube near the socket.

TV Chassis B10-3,-4 Code 11—Service Hint

To adjust for some 4EH7 first video IF amplifier tubes with high cut-off characteristic, the following change was made: A 1M, ½ w resistor was added across resistor R212, as shown in simplified schematic.



TV Chassis B10-3,-4 Code 12—Service Hint

A factory production change was made, using the new 4EH7 tubes with lower cut-off characteristics.

The 1M resistor was removed across resistor R212 as shown in the illustration.

SYLVANIA
Color TV

Color TV Chassis 580 — Color CRT Setup Procedures

Sylvania 580 chassis color sets using the Color Brite 85 picture tube may show excessive blooming at high brightness settings.

To reduce the effect of this blooming a new CRT setup procedure should be used. (1) Set the Kine Bias switch to its lowest bias position. This is the position towards the base of the TV set and causes maximum brightness. (2) Move the Service Switch to the service position. Set the background controls to ¾ full clockwise and all screen controls to their maximum counterclockwise position. (3) Advance one screen control until a horizontal line is noticed; then turn it counterclockwise until the line just disappears. Repeat the procedure for the remaining two screen controls. (4) Return Kine Bias switch to its maximum bias position; in this position the switch will be toward the top of the cabinet. Move the Service Switch back to its normal position. With the adjustments made as outlined above the picture should barely bloom as the brightness control is turned to maximum. Using a normal picture adjust the green and blue drive controls for optimum tracking at all brightness levels.

Color TV Chassis DO1 and DO2—Circuit Changes

Focus Range

Some D01 and D02 color chassis may have optimum focus when the focus control is turned all the way out or nearly all the way out. The range of this control can be centered by changing the location of resistor R464 from one side of R462 to the other side of R462. R464 is a 66 M resistor presently connected to the junction of the focus rectifier and the 4.7 M in series with the CRT focus grid. After this change the 66 M resistor will be located between the 4.7 M and the focus grid.

Killer Improvement

The 6KT8 tubes used in D01 and D02 color chassis have varying cut-offs. Because of this, killer action may be poor. If necessary to improve the operation, make the following changes. Remove R608, a 470 K resistor, from ground and connect it to pin 6 of the V16A. Install a 1N4092 diode across C608 (the point where R608 was removed) with its cathode to ground.

Horizontal Improvement

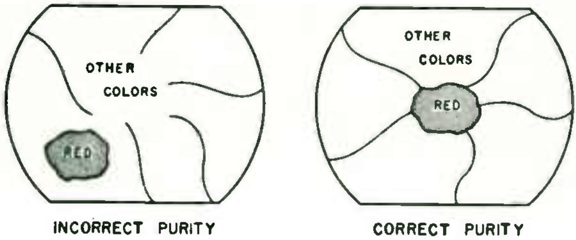
With certain signal conditions the D01 and D02 color chassis may exhibit poor horizontal hold or may lock off sync. A better locking range and greater stability may be obtained by installing a 10 M, ½ w resistor from the sync separator's plate to the grid.

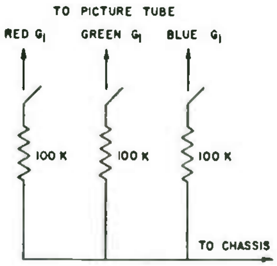
All 21 in. 70 deg glass shadow-mask CRTs—Color Purity

The deflection yoke should be moved back on the CRT neck toward the convergence assembly until neck shadow appears. At this point it is necessary to have only the red gun operating. The green and blue guns can be biased off by shunting 100,000 Ω between the No. 1 grids of the CRT and the chassis. A suitable switching circuit that can be used to control any gun is shown here.

For good purity is is necessary for the red, green and blue beams to land in the center of their respective dots. In general, when the red beam lands correctly, the green and blue beams are also landing correctly. The red field is used for purity setup since is shows up incorrect beam landing better than either the green or blue field.

The purity magnet, located between the convergence assembly and the blue lateral magnet, functions on a color tube exactly like the picture centering magnet on a monochrome tube. The strength of the purity field is changed by separating the tabs on the two flat rings. The direction of the field can be changed by





The red field is employed for purity setup because it shows up incorrect beam landing. Three 100 K resistors and switches can be used to control any gun.

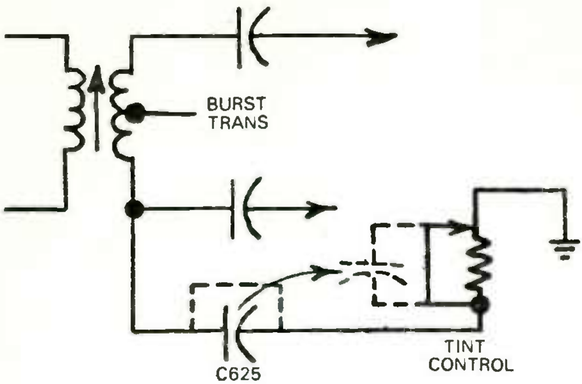
rotating the two rings together. The action of the purity magnet is followed more easily if the two rings are rotated together.

The purity magnet centers the beams correctly as they pass through the center of deflection of the yoke.

The red beam is landing correctly when the uniform red area is moved to the center of the picture tube screen as shown in the drawing.

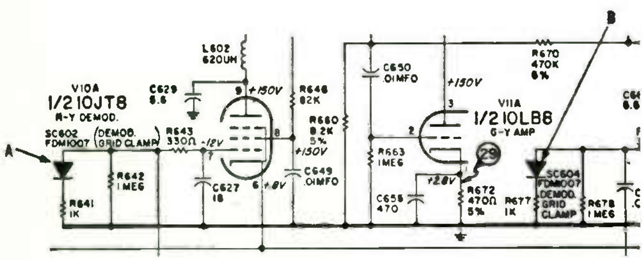
DO3 Chassis—Tint Control

If the tint control of DO3 chassis affects color, causes horizontal instability or left-hand oscillations the following modifications should be made. Remove C625 (120 pf in series with tint control) and install a jumper. Remove loop on tint control between the pot arm and pot end. Reinstall capacitor between arm and "hot" end of pot.



Color TV Chassis DO3—Screen Tracking Variation

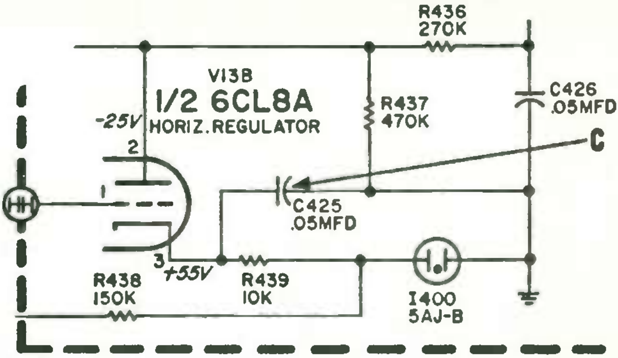
Intermittent changes in the red or blue screen levels may occur in a semi-permanent fashion if the bias clamping diodes (A and B) in the R-Y and B-Y demodulators



are defective. If a recurring need arises for screen rebalance on this chassis, check these diodes. A total diode short would cause a loss of color from the respective gun. Before seriously looking for trouble in the CRT or respective demodulator tube, check these bias diodes for a reasonable front to back ratio, using an accurate VTVM.

Color TV Chassis DO3—Failing Horizontal Oscillator

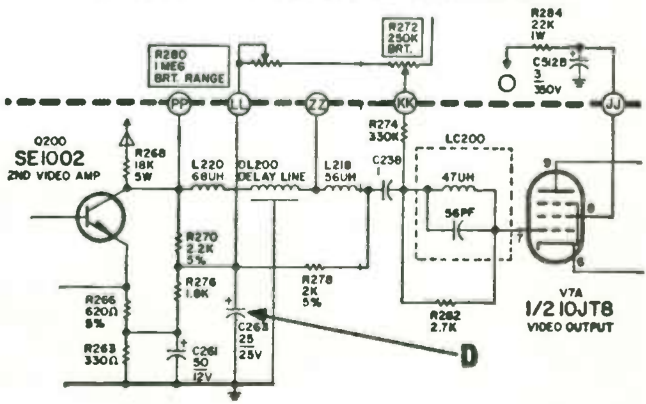
Intermittent failure of the horizontal oscillator may be caused by intermittent opening of a 0.5μf feedback



capacitor, C425 (C.) When this happens there is, of course, no horizontal drive and the circuit breaker will kick out. This trouble should be corrected by replacing the feedback capacitor.

If the picture flickers on and off intermittently and the quality of the picture is poor, the trouble may be traced to the brightness control circuit. The difficulty could be caused by a leaky 25μf capacitor, C263 (D), connected to ground.

Color TV Chassis DO5—Poor Video and Picture Flicker

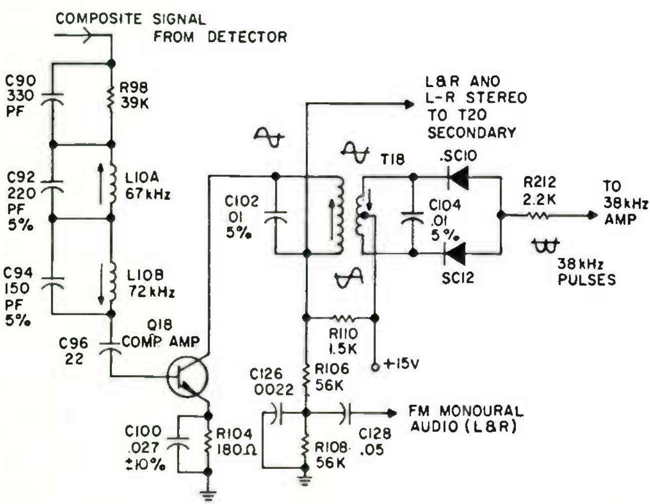


SYLVANIA

Console Models

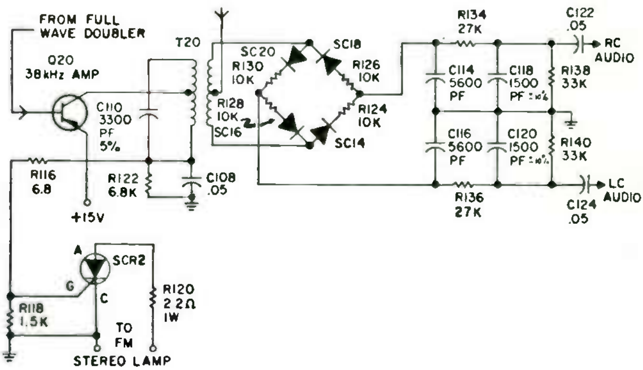
FM Stereo Multiplex Decoder — Circuit Description

A new version of an old circuit for proven good performance and known reliability—this multiplex decoder also makes service easier by its simplicity.



The composite signal containing monaural information from 0 to 15kHz, the 19kHz pilot carrier and the FM stereo signal at 38kHz± 15kHz is fed to traps L10A and L10B. These traps remove the unwanted SCA signals to feed a clean composite signal to the base of Q18 (see schematic). The 38kHz sidebands containing FM stereo audio information are coupled from the bottom of T18 primary to the secondary center tap of T20.

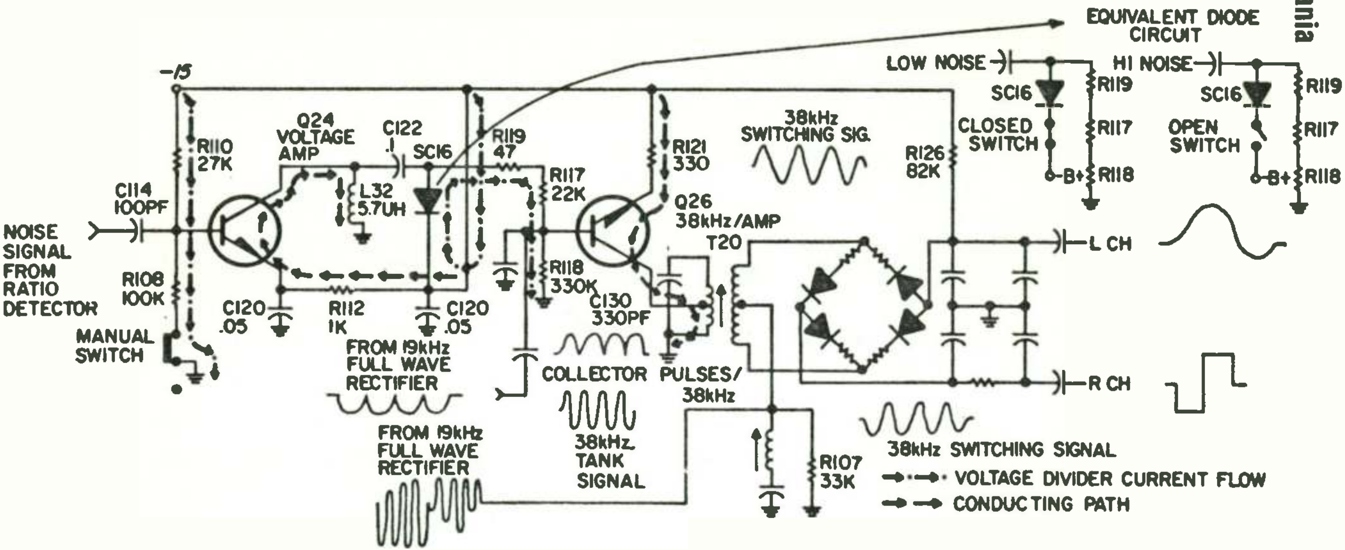
The 19kHz pilot carrier is removed by the tuned circuit T18 in the collector of the composite amplifier. The secondary of this transformer is center-tapped so that 19kHz information is present at SC10 and SC12 with a 180deg phase difference at the diodes. These diodes now perform the function of a fullwave rectifier and produce two pulses for every cycle of input signal. These 38kHz (2X19kHz) pulses drive Q20 at a 38kHz rate. The 38kHz switching signal present in T20, turn "on" the decoding and bias



diodes in the secondary of this transformer to give a left and right channel audio input for the stereo amplifier (see illustration).

Remember during alignment to always tune the 19kHz coils in FM stereo decoders for maximum output and the 38kHz coils for best stereo separation.

With this decoder system, 38kHz information will be present in T20 only when FM stereo is being broadcast, or when the 19kHz pilot carrier is present. The gate of the silicon controlled rectifier SCR2 is connected to the collector circuit of Q20. When Q20 is driven, the SCR will be turned on to close the circuit for the stereo indicator lamp indicating that a stereo signal is being received.


EQUIVALENT DIODE CIRCUIT
LOW NOISE
SC16
R119
CLOSED SWITCH
R117
B+
R118
HI NOISE
SC16
R119
OPEN SWITCH
R117
B+
R118
-15
Q24 VOLTAGE AMP
C122 .1
SC16
R119 47
R110 27K
C114 100PF
L32 5.7UH
R117 22K
R121 330
38kHz SWITCHING SIG.
R126 82K
Q26 38kHz/AMP
T20
NOISE SIGNAL FROM RATIO DETECTOR
R108 100K
MANUAL SWITCH
C120 .05
R112 1K
C120 .05
R118 330K
C130 330PF
L CH
R CH
FROM 19kHz FULL WAVE RECTIFIER
COLLECTOR PULSES/ 38kHz
38kHz TANK SIGNAL
FROM 19kHz FULL WAVE RECTIFIER
R107 33K
38kHz SWITCHING SIGNAL
VOLTAGE DIVIDER CURRENT FLOW
CONDUCTING PATH

FM Stereo Automatic Mode Switch

The automatic mode switching circuit is made of a high pass filter C114, a noise voltage amplifier transistor Q24, a diode rectifier switch SC16 and the 38kHz amplifier transistor Q26.

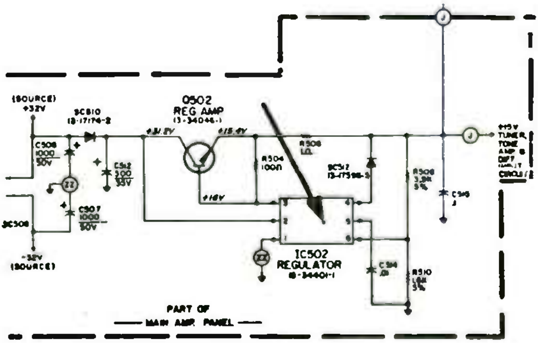
The purpose of this circuit is to switch to monaural when the stereo FM signals get objectionably noisy. A manual "Auto" switch on the front panel defeats the decoding circuit when the noise level holds the switching circuit at the threshold level, switching the decoder in and out of its operating mode.

Under normal conditions the noise level is low allowing the 38kHz amplifier to maintain conduction. The 38kHz sine-wave energy is injected into the time division multiplex switch for left and right channel signal recovery.

When the FM stereo signal level drops, the noise level rises. The high pass filter, C114, feeds the noise voltage to the base of Q24. Q26 base is forward biased by the voltage drop across R117 because of the voltage divider current flowing through SC16, R119, R117, R118. L32, a high impedance collector load for Q24, develops the noise signal SC16 rectifies.

SC16 becomes reverse biased by the noise signal rectification producing a negative dc potential at its anode. The current through the resistance network R119, R117 and R118 is switched off and the forward bias removed from Q26. The 38kHz sine wave is removed turning off the multiplex switch. Only monaural sound is recovered.

Stereo Hi-Fi Amplifier Chassis R63—Service Information

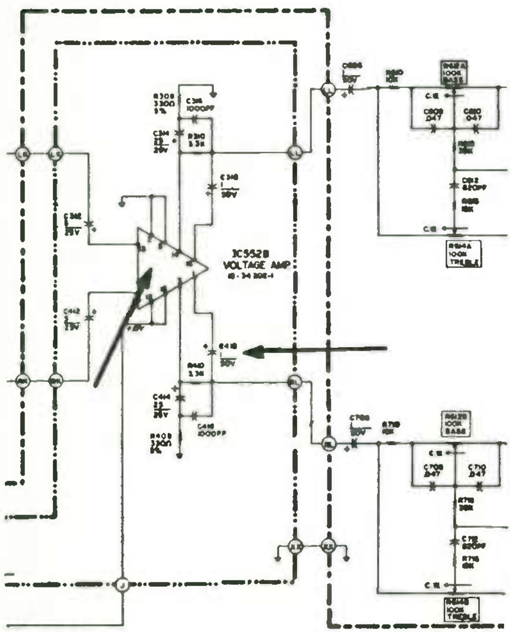


Symptom: FM cuts out, FM hum and noisy background on AM reception

Cause: This symptom could possibly be caused by a bad IC502 (15 v regulator chip). Each time the FM receiver cuts out the 15 v supply voltage would increase .5 v.

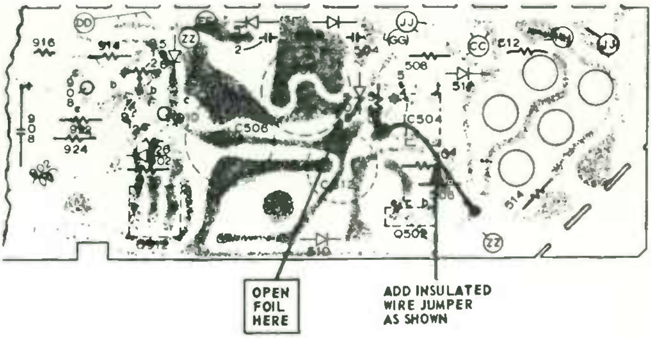
Stereo Hi-Fi Amplifier Chassis R63—Service Information

Symptom: Low volume on the right channel.
Cause: This problem could possibly be caused by a shorted capacitor C416 and integrated circuit IC552.



Amplifier Chassis R62/R63/R64—Power Hum

Power hum on the R62, R63 and R64 chassis, most noticeable when the amplifier is operated through the auxiliary inputs, will be reduced by opening the ground



foil near capacitor C507 and then running an insulated wire jumper on the bottom of the printed circuit panel as shown.

Hi-Fi Terms and Their Meanings

Receivers are made up of two basic sections: The amplifier and the tuner. The terms associated with the amplifier will be explained first.

How does an engineer arrive at all the different ratings? The whole thing is done by looking at a music power curve. By running a signal through an amplifier, increasing the power until distortion occurs, then analyzing the amplifiers action with a distortion analysis.

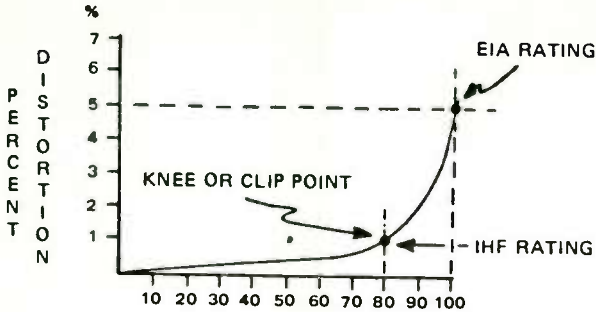
There are two ways amplifiers are rated. EIA (Electronic Industry Association) and IHF (Institute of High Fidelity). The difference between the two rating techniques, EIA and IHF, is the point of reference for the analysis.

An amplifier rated in both methods is still the same amplifier and only the reference point for the analysis has changed.

The IHF rating would seem more desirable because the percentage of distortion is less. Power-wise, the EIA rating would make the amplifier seem more powerful. Look at it this way: IHF is like relating a car's cruising speed to its top speed (EIA). Somewhere the added output will cost more in gas consumption. Likewise, a higher audio power output will generate additional distortion.

IHF ratings are read or taken at the clip point of the knee of the power curve. This rating is more desirable, as

POWER CURVE
100 WATT AMP (EIA RATING)



there is always less distortion though the number will always be less than EIA figure.

RMS—This means root mean square and is the more meaningful rating of an amplifier's ability. RMS is also the continuous power performance and is measured by running a sustained tone through at a prescribed wattage output and without discernable distortion. For example, an amplifier EIA rated at 100w with 5% distortion can handle a continuous wave (CW) signal power of 50w total.

Instantaneous Peak Power is not a rating that is measured by a manufacturer. It is just a term used to make an amplifier look better. The IPP rating (when given) is arrived at by doubling the EIA rating. A 100w EIA rated amplifier would be rated at 200w IPP.

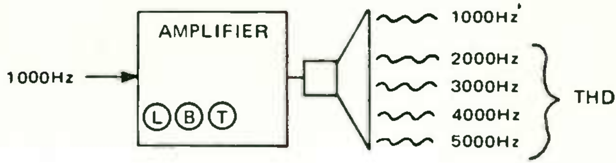
Total Harmonic Distortion (THD)

Nonlinear amplifiers produce harmonic distortion by mishandling the applied signal. This simply means that you don't get out what you put in. For example, when a signal is run through the amplifier and is mishandled by the nonlinear quality, the input signal and integral harmonics are present in the output.

An amplifier rated at a low percentage of THD is good. The lower the percentage, the better the amplifier.

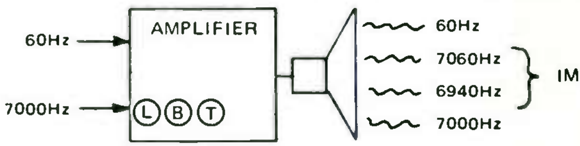
Intermodulation Distortion (IM)

Intermodulation distortion is somewhat similar to THD as it occurs as a result of nonlinear performance. The dif-



ference between IM and THD, is that IM results in sum and difference frequencies when two signals are fed to the amplifier.

The nonlinearity in the amplifier mixes the two input signals resulting in the two input signals plus two other



signals—the sum of 60Hz and 7000Hz, and the difference of 7000Hz minus 60Hz. Here again, the lower the percent of IM, the better the amplifier performance.

Frequency Response

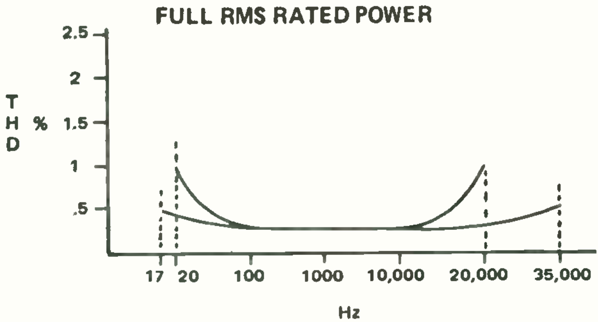
The exceptional human ear can hear frequencies from about 40Hz to 17000Hz. Amplifiers are designed to handle an audio range from 17 to 35000Hz, and the wider the range of sound amplification, the better the amplifier.

Power Bandwidth

The power bandwidth is the range of frequencies over which an amplifier can produce half its rated continuous power (RMS) without exceeding its rated distortion set by the IHF standard.

Damping Factor

The damping factor is the degree of loading provided by an amplifier to overcome the tendency of a speaker to vibrate after the signal from the amplifier changes or ceases. The higher this rating number, the better the unit—a number of 10 or better is good.


FULL RMS RATED POWER
2.5
2
1.5
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100
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10,000
20,000
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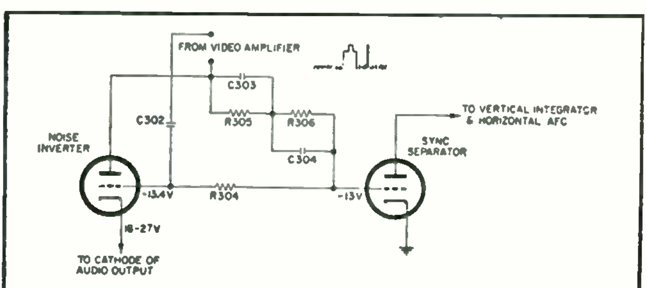
Hz

WESTINGHOUSE

B & W TV

TV Chassis V-2435 — Sync Operation and Troubleshooting

The positive going composite video signal at this circuit's input causes the tube to draw grid current and charge C303. When the sync pulse drops to the video level, C303 discharges through R305 to the B+ line. Discharging the capacitor to the B+ line instead of ground produces a steeper discharge curve to prevent noise pulses getting through the sync separator. A negative voltage is produced which biases the tube. Bias level depends on the incoming signal strength. A low frequency filter (R306/C304) prevents sync instability caused by low frequency signal variations—including airplane flutter. One-half of the double triode serves as a noise inverter to provide stable sync if noise pulses get to the sync circuits. The composite video signal is coupled through C302 to the noise inverter grid. It is biased by a negative voltage from the



Westinghouse chassis V-2435 sync circuit.

sync separator grid (dependent on signal strength) and by a positive voltage applied to the cathode from the audio output tube cathode. The tube is biased so that noise pulse amplitudes greater than sync pulses will cause the tube to conduct. When the tube conducts a negative-going noise pulse appears at the plate. The pulse mixes with the composite video signal at the junction of R305/C303 cancelling the noise pulse.

Trouble in this section usually takes the form of complete loss of sync, loss of either vertical or horizontal sync, or instability. After substituting the tube, the next thing to do is use a scope. A scope is the only effective instrument to use to check the condition of video or sync signals. If the composite video signal from the video amplifier has the proper amplitude, follow the signal through the coupling capacitor into the sync separator grid circuit. There may be enough video signal on the grid, but the bias circuit of C303/R305 may not be producing correct bias because of an off-value component. The amount of bias is also dependent on the incoming video signal's peak value. In a situation where the bias and the video signal are normal but no sync pulses appear, check the plate voltage. If it is low, or missing, look for off-value resistors, shorted or leaky capacitors.

Of course, sync failure can be caused by faults outside the sync circuitry. For example, if sync pulse amplitude is low, look for trouble in IF-detector-video amplifier sections.

V-2437-7 Chassis Tuner — Production Changes

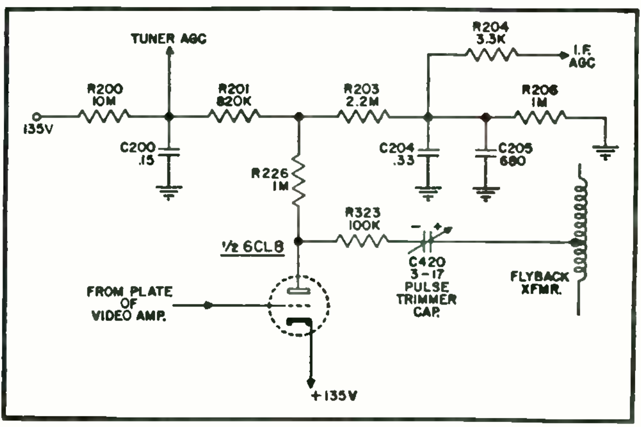
Some of these chassis, used in models H-P3370/1-/3 use a 470V070H04 tuner. This tuner is electrically similar to the 470V099H01 tuner (except for the low side coupling capacitor) found in the V-2416 chassis manual, TV1077. Tuner 470V099H01 is not adaptable for UHF but tuner 470V070H04 is adaptable.

Chassis V-2438—Keyed AGC Circuit

The keyed AGC circuit in this chassis uses a triode (½ 6CL8) as a coincidence amplifier. Two signals must be applied at the same time before the tube will conduct. The two signals are the horizontal sync portion of the composite video signal—applied to the grid of the AGC tube—and a large positive pulse from the fly-back transformer—applied to the plate. The circuit is shown here.

By connecting the tube's cathode to 135 v and the grid to the plate circuit of the video amplifier, the triode is cut off. When a horizontal sync pulse is applied to the AGC tube's grid, it is brought out of cut-off. Before the tube conducts, however, it must have B+. This is supplied by a large positive pulse which is capacitively coupled from the flyback transformer. Plate voltage, therefore, is supplied at the rate of 15,750 cps.

The horizontal sync pulses applied to the AGC tube's grid and the large positive pulse applied to the plate are both 15,750 cps. Since the sync pulses control the phase of the pulses from the flyback trans-



Westinghouse Keyed AGC circuit

former, the condition of coincidence is satisfied. When these signals are applied to the tube simultaneously, it conducts.

When the tube conducts, the pulse trimmer capacitor charges. When the sync pulses are absent, the tube cuts off. Capacitor C420 discharges thru R203 and R206 to ground producing a negative voltage drop across these resistors. This negative voltage is quite high and must be reduced to a level of —1 to —5 v before it can be used to control the gain of the set.

To reduce the negative voltage to a useable level, R200, R201, R203 and R206 are connected between +135 v and ground. This is a simple series circuit in which current flows from ground through the resistors to the +135 v source and produces a voltage drop across each resistor. When the AGC pulse trimmer capacitor discharges, current flows from the capacitor thru R203 and R206 to ground. This current flow opposes the current flow produced by the 135 v across the four resistors. The resultant AGC voltage will be negative when the incoming signal is strong enough to overcome the positive voltage on the line.

The AGC voltage varies in value according to the amount of incoming signal strenges. A strong signal at the video amplifiers' plate is coupled to the AGC tube grid. This decreases the AGC tube bias, allowing it to conduct more heavily. The increased current causes a larger negative voltage to appear on the AGC line, which is used to decrease the RF amplifier and IF stage gain.

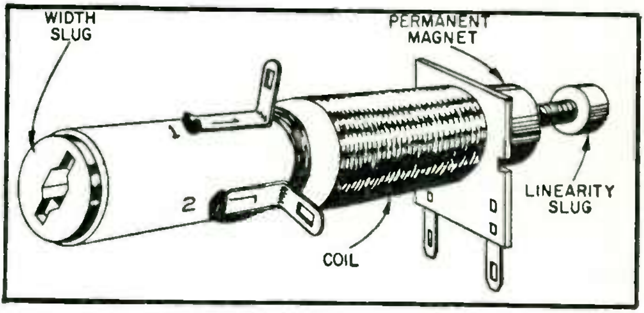
The pulse trimmer capacitor C420, is mounted on the side of the flyback transformer cage. Adjusting it changes the horizontal pulse amplitude applied to the AGC tube plate. This varies the amount of AGC tube conduction and hence the voltage.

The control is adjusted with an insulated screwdriver. Select the strongest channel in the area, turn the trimmer until the picture begins to bend at the top. Then back the trimmer off slightly until the bend disappears.

The AGC time constant permits fairly rapid changes in AGC voltage and reduces airplane flutter.

TV Chassis—Width and Linearity Coil Operation

Horizontal width and linearity coils are installed in many Westinghouse chassis. The coil shown here is mounted on a form with a permanent magnet on



Westinghouse width and linearity coil.

one end. It is connected in series with the horizontal yoke winding. It can modify the sweep current flowing through this winding. While the width end of the coil is a regular inductor, the magnet on the other end changes the waveform to compensate for circuit non-linearity.

TV Chassis V-2443 — Horizontal Instability

This problem takes many forms — weaving in the picture, unstable sync when channels are changed, or a critical hold control. Realign the ringing coil first. The ringing coil or the capacitor across it may have become open. Observe the applied B+ on a scope for evidence of hum caused by an open electrolytic. Just to be sure, bypass all electrolytics connected with the multivibrator.

The most likely source of trouble is the AFC diodes or its filter network. The front-to-back ratio of the diodes may have changed, or leakage may have developed in the packaged filter circuit.

TV Chassis V-2478 — 600 kc Beat

Early production of the 12 in. portable (chassis V-2478) may show a 600 kc beat pattern on a number of channels if the 2nd IF tube (4EJ7) is replaced. To correct this, an RF choke, Westinghouse number 230V065H-01, should be added between pin 5 of the 4EH7 and pin 4 of the 4EJ7 tubes. This change can be made easily from the top of the board by cutting the 2 in. blue filament wire between the two tubes and soldering the RF choke in its place.

Chassis with a choke already added can be identified by a small red mark on the bottom of the chassis, on the right side front. The back cover must be removed to locate the identification mark.

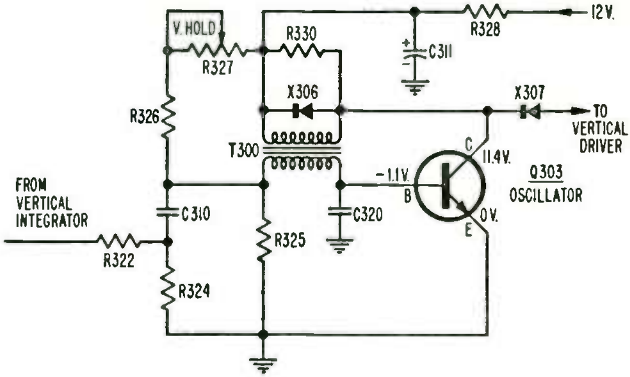
If receivers show the 6-kc beat, check for the choke. If none is present, add the choke as described.

TV Chassis V-2483 — Vertical Stages, Circuit Operation

Vertical Sweep

The vertical sweep section consists of three transistors; an oscillator, a driver, and an output amplifier. The oscillator which, because of the transformer coupling from collector to base, is immediately identified as a blocking oscillator. The oscillator is designed to have a free-running frequency of approximately 60cps but is synchronized by sync pulses from the vertical integrator network.

The transistor is an NPN type, which means that the base voltage should be ordinarily positive with respect to the emitter. In the case of a blocking oscillator the transistor remains cut off (blocked) for most of the cycle by the negative voltage on the base. The transistor starts conducting when B+ is applied. Collector current flows through the primary of T300 up to the time of saturation, charging C310 with the top side negative with respect to ground. When the saturation point is reached there is no further change in the magnitude of current flow through T300. The magnetic field around the primary collapses. This induces a pulse in the secondary winding which has the correct polarity to cut off the transistor. Capacitor C310 discharges slowly through R325 (150K), keeping the potential negative at the base. As soon as C310 has



discharged below the cut off point, the transistor once again conducts and another cycle is started.

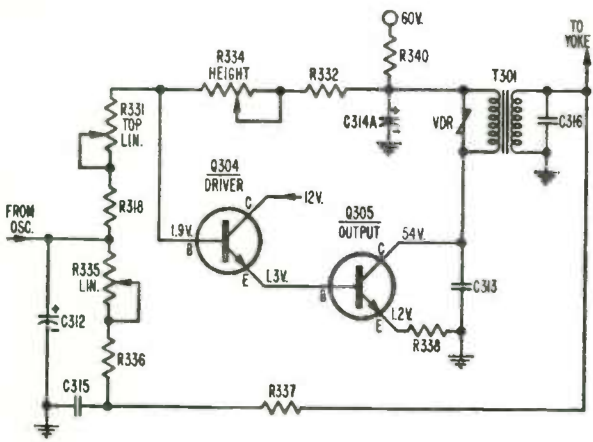
Synchronization of the oscillator is provided by a positive pulse from the integrator network. This is coupled by C310 to the base of the oscillator which causes it to conduct at that instant. The negative going waveform at the collector of the oscillator is present at the cathode of X307. This diode effectively isolates the voltage on the oscillator from the voltage on the driver stage because it is connected with the most positive voltage at its cathode and is, therefore, reverse biased. The negative-going vertical pulse overcomes the reverse bias and is passed on to the driver stage.

Of the other components, two deserve mention. C311 is a 10μf electrolytic that filters the vertical signal from the 12v supply. Diode, X306, across the primary of T300, conducts immediately after collector current has reached the saturation point. At this time the field around the primary collapses and reverses direction, placing a more positive potential at the collector of the oscillator than was possible with only the applied voltage. This is an undesirable condition because the transistor could conduct again.

The polarity of the diode across the transformer is important. The anode must be connected to the transistor collector. When the polarity of the induced voltage is positive at the anode, the diode conducts and acts as a short circuit for the pulse. The pulse is effectively dampened.

Vertical Driver and Output

The negative-going pulse from the vertical oscillator is shaped by the networks in the base circuit of the driver, Q304. The shaping networks have two adjustments — one for over-all linearity (R335) and one for linearity at the top of the picture (R331). The driver is an NPN transistor connected in an emitter-follower configuration. There is a current gain, but no voltage gain, from the driver and there is no polarity inverison since the output is taken from the emitter and direct-coupled to the base of the output amplifier, Q305.



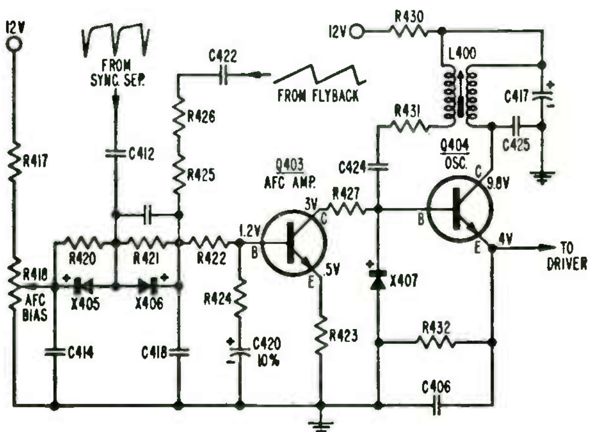
The output transistor is a high-power type mounted on a heat sink. Since this is an output device the supply is 60v. The polarity reversal caused by this amplifier makes the pulse positive-going in the primary of T301. Thus, during conduction of Q305, a sweep output voltage is developed in the primary of T301. During cutoff this collapsing field could generate a high peak voltage sufficient to damage the transistor. The VDR, however, in parallel with the transformer primary, acts to limit the voltage pulse to a safe value.

There are two filter capacitors in the output circuit. C314A (200μf) filters the 60cps vertical pulses from the supply voltage. C313 (0.01) filters any horizontal frequency that may be fed back from the blanking network through the secondary of T301.

TV Chassis V-2483—Horizontal Sweep Circuit Operation

The horizontal sweep section consists of an AFC circuit (a dual-diode network and AFC amplifier), an oscillator, a driver, a power amplifier, a diode damper and a tube-type high voltage rectifier. Even though four transistors are required, very few other components are used as compared to a multivibrator in a monochrome receiver.

The dual-diode requires two pulses to produce a correction voltage; the horizontal sync pulse from the sync separator and a sawtooth from the flyback. These two pulses combine in the diode network to produce a correction



voltage which is direct-coupled to the base of AFC amplifier, Q403. The network of C422, R426 and R425 reshape the sawtooth waveform being fed back from the flyback for use by the AFC network.

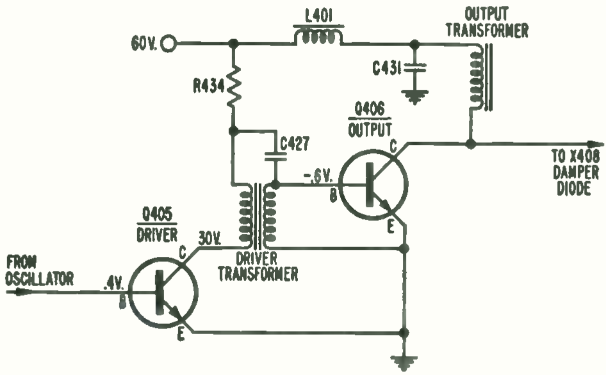
The AFC amplifier is a simple dc amplifier. Any small change in the correction voltage at the base is amplified and appears at the collector as a larger voltage change. This is coupled to the base of the oscillator, Q404, through R427 and serves as a reference voltage that C424 discharges to during the oscillator cycle. The oscillator frequency is controlled by this reference voltage.

The oscillator is a blocking oscillator type. Feedback is from collector to base through L400, R431 and C424. Assume that the transistor is conducting. The waveform in the primary of L400 has a maximum value of approximately 12v when the transistor conducts. The induced voltage in the secondary of L400 is the opposite; it begins at zero and has a maximum value of 12v. Whereas the waveform in the primary is negative going, the waveform in the secondary is positive going. After the waveform reaches its maximum positive value, it decays slowly to zero. The waveform coupled to the base of the oscillator by C424 tries to follow the waveform across the secondary of L400, but is modified slightly by the capacitor to produce a gradual rolloff. A charge is formed on C424. When it leaks off, the base voltage goes to a positive 0.6v (approximately), through the cutoff level of the transistor, and cuts the transistor off.

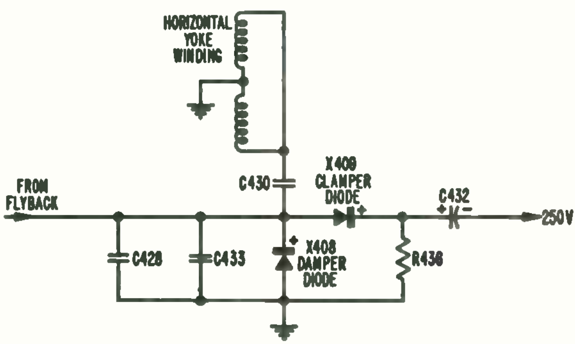
The conduction time of the oscillator and therefore its frequency, is determined by the value of C424, by the value of dc voltage at the junction of R427-X407, and by the presence of X407. The diode is connected in a reverse bias position so that the voltage at the base of the oscillator is clamped at a more positive value. Its removal or its change in conduction characteristics would change the frequency of the oscillator, possibly to the extent that horizontal sweep and high voltage would be cut off. Diode X407 also protects the base-emitter junction of Q404 from becoming dangerously back biased.

The output waveform which is taken from the emitter is basically square in shape, but with a high initial peak lasting a few microseconds that rises and drops off quickly. The entire pulse lasts for about 22μsec of the total horizontal scan time of 63μsec. This time, then, represents the "on" time of the oscillator.

The 22μsec positive-going pulse from the oscillator turns on the NPN driver transistor, Q405. Ordinarily, a square wave pulse would appear at the base of the output transistor, Q406, but with addition of C427 across the driver transformer, the result is a sawtooth waveform



produced at the base of the output transistor, Q406. The driver, Q405, has a push-off radial heat sink. Caution should be observed when probing around this circuit since the heat sink has collector voltage on it. No other parts should be allowed to touch the heat sink.



The horizontal output transistor, Q406, is also mounted on a heat sink at the right side of the chassis. Caution must be observed when probing around his area. Although there is no voltage on the heat sink, collector voltage appears on the transistor case and its two mounting screws. Basically, this transistor is a high-power switch which conducts for about 10μsec and is then cut off. This is sufficient to provide full scan because the energy stored in the yoke (an RL circuit) decays slowly.

The damper diode X408 minimizes any ringing that might occur in the yoke current during trace time. Damping action is similar to familiar tube type circuits except that a damper tube is not used. The job is done by a semiconductor device.

The clamper diode, X409, protects the horizontal output transistor from damage caused by momentary arc-over in the high voltage section.

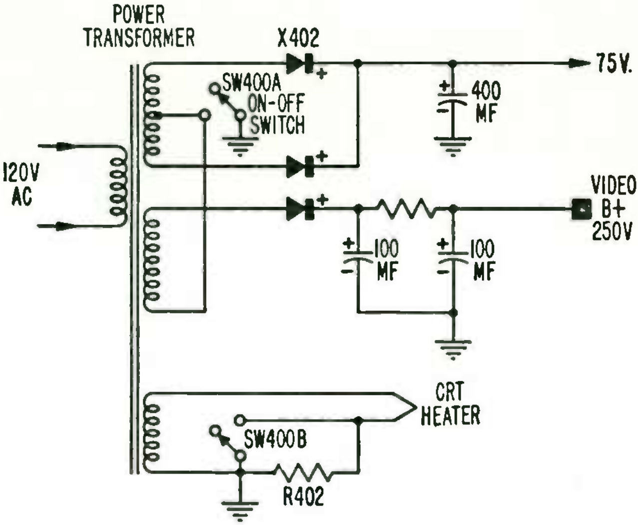
TV Chassis V2483-1—Power Supply—Circuit Operation

The power supply circuitry, as incorporated in this portable transistor television receiver must supply the following three levels of dc voltage: (1) An unregulated 250v for the video output stage. (2) A regulated 60v for the audio output, vertical output and horizontal driver and output transistors. (3) A regulated 12v for the remainder of the signal circuits.

The power transformer, which is connected to the 120vac line, is tapped at three different levels. One tap supplies the voltage for the CRT heater, the next tap feeds into the 250v rectifying circuit and the third is for a full-wave circuit which supplies 75vdc to the regulator circuitry. This voltage regulator produces the +12 and +60 regulated voltages.

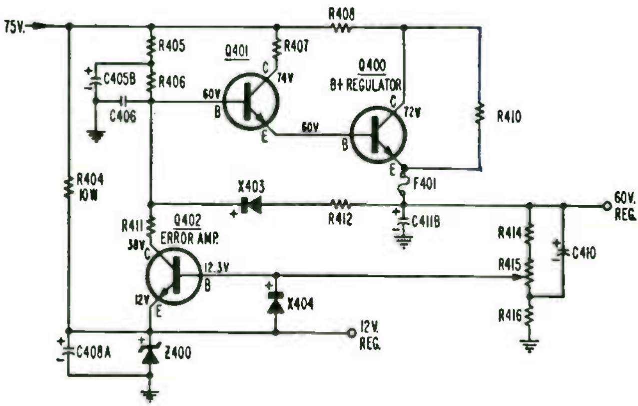
The 250v supply is provided by the conventional type half wave rectifier. Switch SW400A completes the circuit by returning the secondary of the 250v transformer winding to ground. AC ripple is filtered out by the pi-type configuration consisting of two 100pf electrolytic capacitors and a power resistor.

The second B+ circuit is a conventional full wave rectifier utilizing a single 400pf electrolytic capacitor for filtering out any ac ripple. The output of this circuit is a possible 75v which is applied to the voltage regulator circuitry.



Voltage Regulator

For proper operaton transistor circuits require well regulated supply voltages. Regulation protects the transistors if the line voltage is too high, too low or subject to surge. Input to the regulator circuits is 75v, providing for the 12 and 60v regulated output.



The 12v output is regulated by the use of a zener diode. A zener diode conducts heavily in a reverse bias direction when the potential across it exceeds a specified level. This is called the breakdown voltage. Zener diode is a 12v device that has the characteristic of maintaining 12v across itself regardless of the amount of current flowing through it. The 75v input to the circuit is applied across the series combination of resistor R404 and zener diode Z400. The emitter of the error amplifier (Q402) is connected to the junction of these two components. The impedance of the zener diode is such that the 75v will divide down to 12v at the emitter of Q402. If the 75v should increase. The zener diode impedance would decrease. (due to breakdown) thereby conducting more current and maintaining the emitter. The regulated 12v is used both by the signal circuits in the receiver and by the 60v regulator as a reference level.

The base of the error amplifier Q402 is connected to the 75v source voltage, through the tap on control R415, and resistors R414, R410, and R408. This dividing network results in approximately 12v at the base of the error amplifier. If the voltage increases, the base emitter junction of Q402 will become forward biased resulting in an increase of collector to emitter current through this transistor. This increased current will effect the voltage drop across resistors R405, R406 and R411 in such a way as to keep the voltage on the base of Q401 at a constant 60v. For example: If the 75v supply voltage should drop, the voltage on the base of the error amplifier (Q402) would decrease. This decreased voltage would result in an increase of the internal impedance of this transistor and an increase in the voltage at the base of Q401. If the supply voltage should rise above 75v, transistor Q402 would conduct more heavily resulting in a lower voltage at the base of Q401, thereby correcting for the original increase.

Controlling the base voltage of Q401 automatically controls the base voltage of the series regulator power transistor Q400 through the low impedance of Q401's base-emitter junction. This voltage control of the base of Q400 permits regulation of its collector-emitter current. Most of the current required by the 60v circuits flows through this transistor. It is for this reason that this transistor is a high power type and is mounted on a heat sink on the left side of the chassis. The outer case and the two connecting screws of the transistor have a potential of 60v on them and carry collector current. Not all the current for the 60v circuits flows through the series regulator transistor. For dissipating a higher-line voltage R410 (47 15w) is connected in parallel with Q400. If a short occurs in the 60v circuits, the fuse in the emitter of Q400 would open.

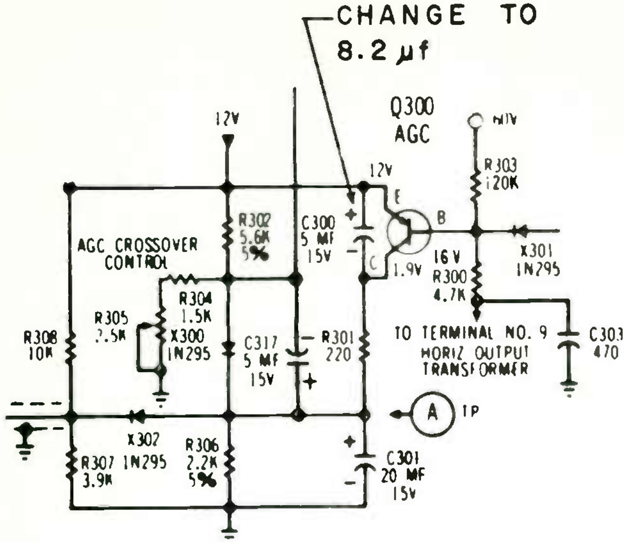
The two diodes, X403 and X404 are protective devices. Diode X403 is in parallel with the combined base-emitter circuits of Q401 and Q400 to prevent a reverse bias condition from damaging these transistors. If, for any reason, the base of Q401 should attempt to go less than 60v, causing a reverse bias condition, diode X403 would start conducting to prevent damage to the transistor junctions. Diode X403 is connected in such a manner that it will conduct only if the base of transistor Q401 attempts to go less than 60v. Diode X404 performs a similar function. It will become forward biased if the base of Q402 should attempt to go below 12v. The resultant shunting of current through the diode would serve to protect error amplifier transistor Q402.

Transistor TV Chassis V-2483-1 — Vertical Jitter, Vertical Instability

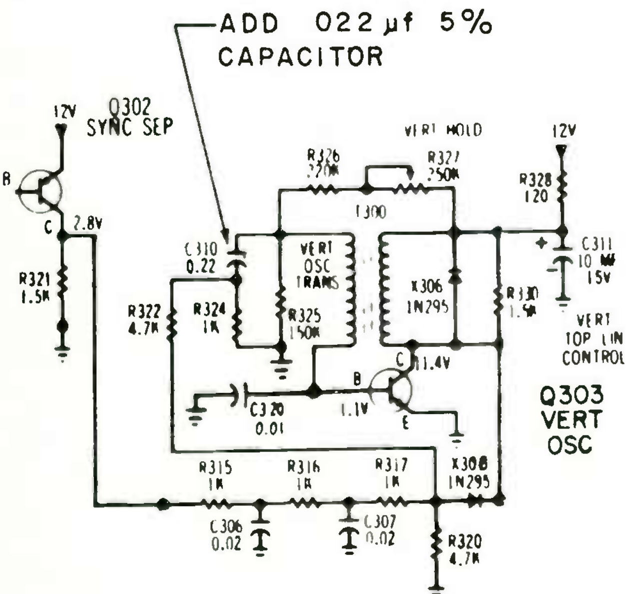
Vertical jitter can be caused by combined overloading and/or critical AGC setting. This condition may vary with signal levels and may occur intermittently.

To correct this problem, change the 5 μ f electrolytic capacitor, C300, connected collector-to-emitter of the AGC transistor, Q300, to an 8.2 μ f capacitor as used in C420 application in the same chassis. In other words, substitute a new capacitor, C420, 218V063B01 in place of C300, 218V060H04. Use only C420, 218V063B01 as the replacement since it has special internal resistance characteristics.

If you encounter vertical hold instability, which may act as one-way vertical roll or the vertical hold may not lock near center range of the control, add a 0.022 μ f capacitor, 5%, in parallel with capacitor, C310. This will extend the vertical lock-in range. If difficulty continues, you should check the vertical oscillator transistor, Q303.



CHANGE TO
8.2 µf
Q300
AGC
12V
R303
120K
12V
E
B
C
R302
5.6K
5%
C300
5 MF
15V
16V
X301
1N295
AGC CROSSOVER
CONTROL
1.9V
R300
4.7K
R304
1.5K
R305
2.5K
X300
1N295
R308
10K
C317
5 MF
15V
R301
220
TO TERMINAL NO. 9
HORIZ OUTPUT
TRANSFORMER
C303
470
A
TP
X302
R307 1N295
3.9K
R306
2.2K
5%
C301
20 MF
15V



ADD 022 µf 5%
CAPACITOR
12V
Q302
SYNC SEP
B
C
2.8V
R321
1.5K
VERT HOLD
R326
220K
R327
250K
12V
R328
120
T300
C310
0.22
VERT
OSC
TRANS
X306
1N295
C311
10 MF
15V
R322
4.7K
R324
1K
R325
150K
R330
1.5K
VERT
TOP LIN
CONTROL
C
11.4V
B
1.1V
E
C320
0.01
Q303
VERT
OSC
R315
1K
R316
1K
R317
1K
X308
1N295
C306
0.02
C307
0.02
R320
4.7K

TV Chassis V2483-1-2-3 — Tuner Replacement

The manufacturer indicates that two different transistor VHF tuners were used for these chassis. If the original tuner is part no. 470V171D01/3, it can be replaced by another tuner having the same part number. If, the original tuner is part no. 470V168D01/3, however, a conversion kit is required for its replacement. A conversion kit, no. 110V003H23, must be ordered separately, and permits the installation of part no. 470V171D01/3 tuner.

In addition to installation instructions, the conversion kit includes one 756V105B01 switch, one 771V725A01 retainer and switch, plus five 760V056S04 screws, retainers and tuner mountings.

Remote Receiver V-2386 — Some Troubles and Remedies

Several shorted tubes have been found in these receivers and some had low gain. Shorted 40 kc amplifier tubes caused no operation on any function. Weak tubes in the 40 kc amplifiers and relay amplifiers reduced sensitivity of one or all remote functions.

Bent or dirty relay contacts are another source of trouble. These troubles can be found by making a visual check of the relays.

To check the relays and their associated amplifiers: For Channel Up function — use an insulated jumper and short the grid (pin 2) of relay amplifier V6A to ground. The Volume Change circuit is checked by shorting the grid (pin 2) of the Volume Change relay amplifier V7A to ground. If the Volume Change relay amplifier grid is grounded at the same time as one of the Channel Change amplifier grids, volume will change either up or down, depending on which Channel Change relay is closed.

Note that relay K1 ground is in the circuit of K2 and K2 ground is in the circuit of K1. Do not forget to check the back contacts for proper grounding in the de-energized relay.

These checks do not eliminate the AGC or relay bias circuits as a source of trouble. Voltage and resistance measurements must be made here.

The only sure way to check the remote receiver up to the relay amplifiers is to use a signal generator capable of providing accurate 39 kc, 40 kc and 41 kc signals. Defective discriminator transformers, resistors and capacitors can be found in this manner.

TV Tuner Replacement — Kit No. 6

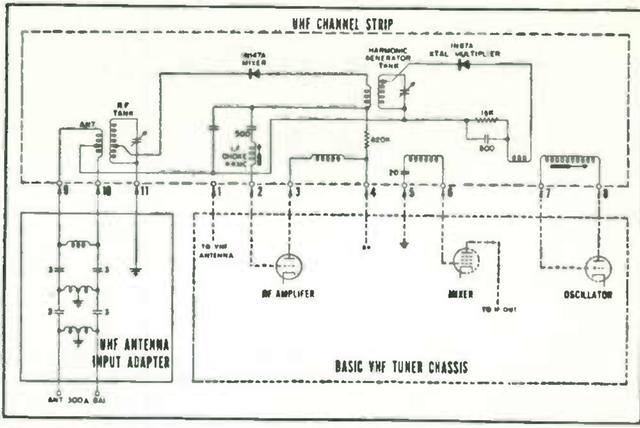
Tuner 470V064H01 is used in conjunction with tuner replacement kit No. 6 to replace several other tuners which are no longer available. A revised tuner, 470V064H01W, is being used as a replacement for the older 470V064H01. The newer "W" type tuner has the filament connection in a dlifferent location than the original tuner. If the "W" type tuner is used, connect the filament lead to the last feedthru located at the extreme left rear of the tuner. The next feedthru forward and in the same line, has no connection.

Adapter And UHF Channel Strip

A circuit of the UHF Antenna input adapter (enclosed by a solid outline), a typical UHF channel strip (enclosed by long dashes), and a simplified representation of the basic VHF tuner (enclosed by short dashes) is shown here. From left to right on the UHF channel strip contacts provide the following connections:

Contacts 9 and 10 connect to the antenna input adapter. A common ground between the strip and the VHF tuner body is provided by contact 11. Contacts 1 through 8 make connections with the wiper contacts that were part of the VHF tuner before the UHF antenna adapter was installed.

If we now skip over to contacts 7 and 8 on the strip (these correspond to the oscillator control grid contact and plate contact on the VHF tuner), we find



Westinghouse interconnecting circuitry for UHF channel strip to VHF tuner. Connections apply only when the channel selector is set on a UHF channel position.

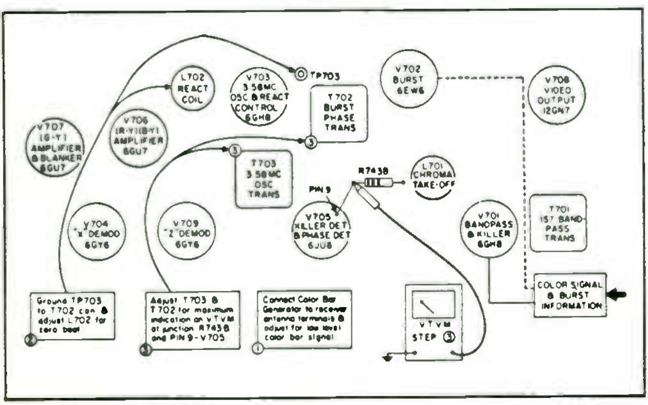
a tuneable winding which is the primary of a transformer. This winding tunes the VHF oscillator to a frequency which, when passed through the tuned xtal multiplier, is 44 Mc higher than the center frequency of the input UHF signal.

The xtal multiplier output is transformer coupled to the incoming UHF signal tapped from the RF tank. The result of this mixing is an IF signal having a 44 Mc center frequency. This IF signal is fed through a 44 Mc coil and through contact 2 to the RF amplifier control grid. Strip contact 1 grounds the VHF antenna input.

WESTINGHOUSE
Color TV

Color Chassis V-2476-1 — Color Demodulator Phasing Adjustment, Field Procedure (See TEKFAX No. 900 Jan 1965)

To check the color demodulator phasing adjustment in the field, connect a rainbow type color bar generator to the antenna terminals of the receiver and adjust for a normal color bar pattern on the screen of the color picture tube. Then proceed as follows: (1) Set the tint control to the center of its range, and turn the killer control fully counterclockwise. Shunt the green and blue picture tube grids to ground through 100,000Ω resistors at points "MM" and "L" on Chroma Board. (2) Observe the bar pattern on the picture tube with the tint control at the center of its range, adjust T702 so that the sixth bar is about the same brightness as the background. (3) Rotate the tint

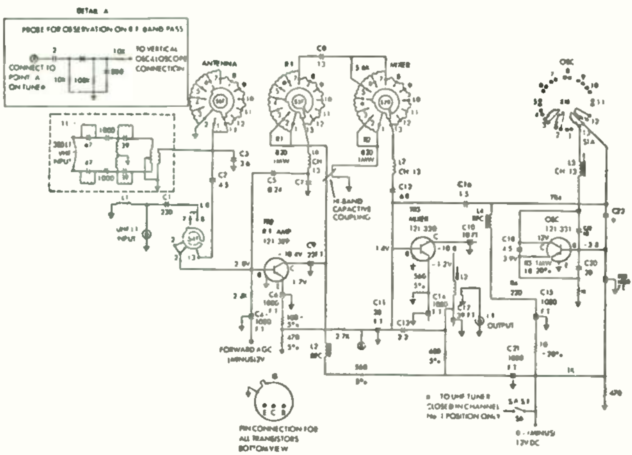


control from one extreme to the other. At one extreme, the seventh bar should be about the same brightness as the background. Repeat the adjustment of T702 until the above conditions are obtained at or near the extremes of the tint control range. After adjustment, return the tint control to the mid-position where the sixth bar is the same brightness as the background. (4) Move the 100,000 Ω shunt from "L" to "H" and observe the bar pattern on the picture tube for correct B-Y output, (third and ninth bars at same brightness level as the background). (5) Move the 100,000 Ω shunt from "MM" to "L" and check for correct G-Y output. The first and seventh bars should be the same brightness level as the background. Readjust the killer control, using color snow, so that color just disappears from the raster. Check on color signal to assure setting is not killing on color.

ZENITH
B&W TV

TV Chassis 1M30T20 — Circuit Operation

The UHF tuner is a transistorized continuous type. These tuners essentially are the same as the transistorized UHF tuners used currently except for the −12 v, fed directly from the power supply of the associated TV receiver. (No dropping resistor is required.)



The VHF tuner is a transistorized rotary-switch employing three transistors as RF amplifier, mixer and oscillator. The signal from the antenna transformer is applied to the base of the RF amplifier, TR2. The RF amplifier, as in any VHF tuner, is one of the most important stages in the receiver. The RF stage provides about 40 db gain with a low signal-to-noise ratio. The output of TR2 is fed directly to the base of the mixer transistor, TR3. The signal of the lower frequency channels is fed directly, but note that the higher frequency channels are capacitively coupled to the base of TR3.

Forward AGC (a negative voltage in this tuner) is applied to the base of the RF stage from the tuner AGC delay circuit in the main chassis. The AGC action of the RF stage is transferred partially to the mixer stage because of the direct connection of the emitter of TR2 to the base of TR3. The mixer stage provides about 20 db gain.

The oscillator TR4, is a specially designed high-frequency transistor which would oscillate readily without any visible form of feed-back. To stabilize the circuit, small values of fixed capacitors are connected between electrodes. The output from the oscillator is taken from the base of TR4 and coupled into the base of the mixer by the capacitors C16 and C22.

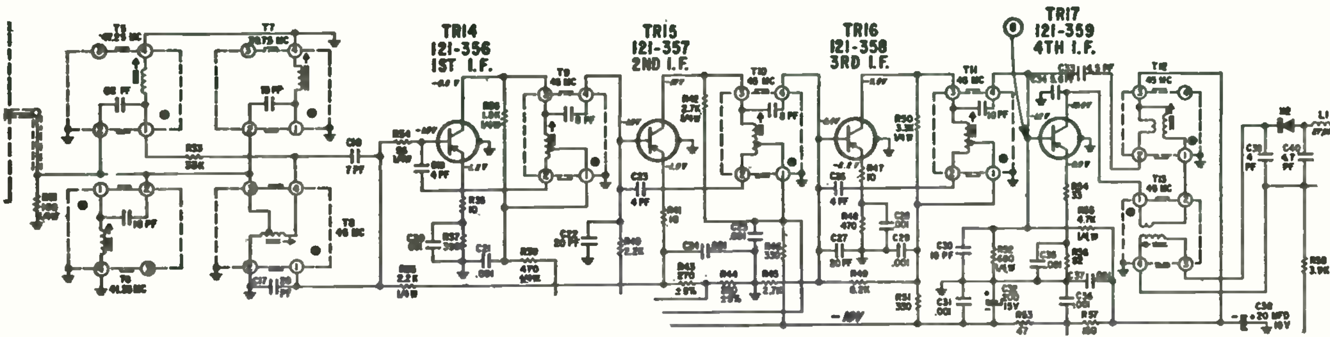
IF Amplifier Stages

The IF output from the VHF tuner is applied to the base of the 1st IF transistor by the IF input transformer (T8) and the coupling capacitor C18 (7 pf). The coils T5, T7 and T6 are the adjacent sound (47.25 Mc), adjacent video (39.75 Mc) and associated sound 41.25 Mc) traps respectively.

Four IF stages are used to provide for good selectivity and high gain. Each IF stage with a transistor can provide a sufficiently wide response, because of the inherently low impedance involved, so that all four IF stages can be tuned to the same frequencies (not staggered) to provide the required gain.

The IF amplifier circuit consists of transistors TR14, TR15, TR16 and TR17. Note that the 1st, 2nd and 3rd IF circuits are closely similar, but the 4th IF transformer is split into two separate transformers, T12, the primary winding, the T13, the secondary; both link-coupled together. As far as function and alignment are concerned, both of the 4th IF transformers can be considered and are in effect the same as one transformer having two adjustable coils.

All four IF transistors are connected as common emitter type circuits. The 1st and 2nd IF transistors are


TR14
121-356
1ST I.F.
TR15
121-357
2ND I.F.
TR16
121-358
3RD I.F.
TR17
121-359
4TH I.F.

designed for AGC action. The AGC voltage is taken from the emitter of the AGC output transistor, TR23, and applied to the base of the 2nd IF transistor. The 2nd IF transistor controls the 1st IF by using the tap-off at the junction of R41 and R43, to the base of TR14. The other tap-off at the junction of R43 and R44 is used to supply a portion of the IF signal to the emitter of the tuner AGC delay transistor (TR13).

The transistors in the IF section are specially designed for each stage. Because high frequency transistors tend to oscillate rather easily, each interstage IF coil has a feedback winding coupled back to the base of the associated transistor through a small (4 pf) capacitor. Feedback capacitors C19, C23, C26 and C33, are used to stabilize each of the four circuits to prevent regenerative feedback coupling that would normally cause unwanted oscillations.

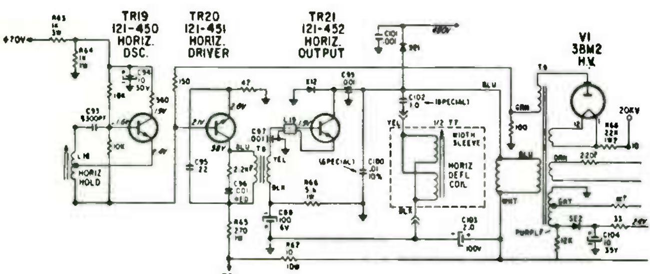
Focus Correction Magnets-23 in Models

Two corrector magnets are used in all 23 in. models to obtain straight, sharply focused sweep lines across the face of the CRT. The magnets are mounted on the deflection coil support bracket. Adjustment is made by bending the flexible arms sideways and up and down. Correct adjustment has been made at the factory and readjustment should not be required unless the brackets have been accidentally bent out of position. If this occurs, proceed as follows: With the vertical and horizontal size controls, reduce the size of the picture to a point where the four corners and sides are visible. (In some receivers it is not possible to reduce the picture sufficiently to see all sides and it may be necessary to shift the picture with the centering control to view one side at a time.) 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: Misadjustment of the corrector magnets may cause pincushioning, barreling, keystoning, poor linearity, etc.

Transistor TV Chassis 1Y21B55 — Horizontal Osc and Output Circuit Description

The horizontal oscillator circuit employing the TR19 transistor is similar to the typical sinewave oscillator used in present day tube receivers. The hold control coil L18 with the parallel capacitor C90 form the 15.75kHz resonant circuit.

The pulse output from the collector of TR19 is a series of positive going pulses. They are applied directly to the base of the horizontal driver transistor TR20 to amplify the power sufficiently to drive the horizontal output transistor TR21. Horizontal driver transformer T8 matches the impedance of TR20 collector to the base of horizontal output transistor TR21. With the transformer inversion the negative portion of this drive pulse is sufficient to drive TR21 into sharp cut-off and the positive portion saturates the horizontal output transistor during trace time.



During beam retrace and first half of the trace, transistor TR21 is cutoff. During the first half of the trace, the negative current required is supplied by the damper diode X12. During the second half of the trace, transistor TR21 is biased into conduction to supply the positive current required. The damper diode X12 suppresses the oscillation at the end of the retrace interval.

The horizontal section of the deflection yoke in series with the dc blocking and linearity correction capacitor C102 is connected across the output circuit of TR21 and also in parallel with the primary of the horizontal sweep transformer. Voltage from the 24v supply winding is a series of negative pulses (dc voltage being derived during the trace portion) that have the exact frequency and phase as the sweep generator output at the transmitter. These pulses cause a linear saw-tooth current to flow in the deflection yoke.

The pulses developed by the horizontal output transistor TR21 are stepped up and rectified by the HV rectifier 3BM2 to develop the high anode voltage for the CRT.

Diode SE1 is used to rectify the horizontal pulses to provide a positive 500v for one CRT focus adjustment and CRT G2 terminals. At the same time, this diode acts to prevent any high peak voltages from developing across the collector of TR21. The diode X12 serves as the usual damper at the end of the flyback portion of a series of negative pulses to provide the 24vdc needed for the tuner, IF and AGC circuits. X13 also rectifies during the trace time and provides the 1.5kv needed for the video output circuits. This winding also supplies the horizontal blanking pulses for the CRT.

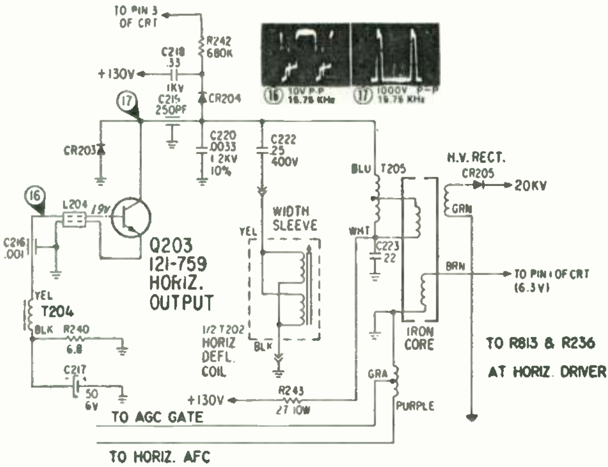
TV Chassis 12CB12ZX and 16DB12X—Fuse and Resistor Modification

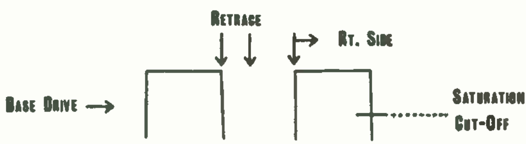
On any of the current 12v and 16v B/W receivers being serviced for any reason, an 11Ω 5w resistor (Zenith Part No. 63-10442-49) should be added in the heater string connected between the series diode and the 38HE7 tube. If the fuse is 1.25a, it should be replaced with a 1.8a slow blow fuse (Zenith Part No. 136-65).

If the service is as a result of either a fuse or series heater diode failure, the 38HE7 should be replaced.

TV Chassis 22AB55—Horizontal Output Circuit Description

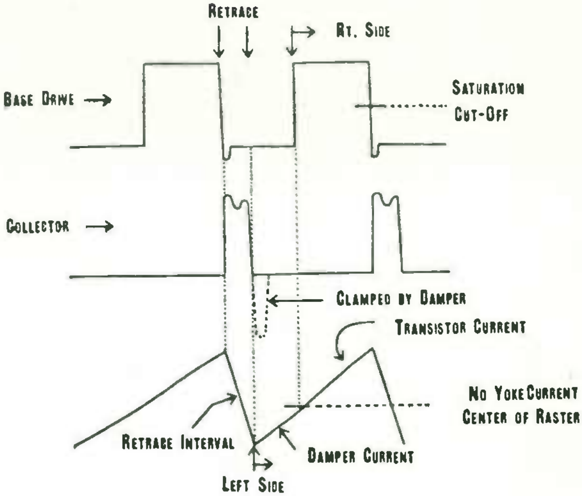
The base of the horizontal output transistor is connected to the top of the secondary winding of the horizontal driver transformer. The bottom of the winding is returned to ground through resistor R240. Bypassing is provided by capacitor C217. The emitter of Q203 is returned direct-





ly to ground. The ferrite bead (L204) over the base and emitter leads, suppresses "spooks" generated by the rapid switching of the base-emitter junction. The collector is connected to the primary of the sweep transformer T205, the deflection yoke and the damper diode CR203. The lower winding (primary) of T205 is returned to 130v through R243. The primary winding of T205 and the deflection yoke are in parallel from a current waveform standpoint.

Referring to the illustrations, when the base drive waveform swings positive (center of raster) the output transistor is driven to complete saturation. This causes a voltage collapse through the primary of T205, with a resulting current increase through both the output transformer and yoke. This increase in current deflects the beam from the center of the screen to the right edge. At the end of the scan (beginning of retrace interval) the base drive swings sharp-



ly negative. The undershoot appearing at the beginning of the negative portion of the square wave insure complete cut-off of the output transistor. As the transistor cuts off, the current previously developed collapses completely, resulting in a high collector voltage increase (1000v P-P). This high increase in voltage decays rapidly (end of retrace interval) and would tend to swing negative. However, at the beginning of the negative swing; the damper diode conducts, discharging the previously developed positive voltage appearing across the yoke and capacitor C220. The rapid voltage discharge results in a high increase of "negative" current through the yoke (beginning of scan at left edge). As the current decays back to zero, the beam is deflected to the center of the raster, where the output transistor takes over again, completing the cycle. Capacitor C222, in series with the yoke, maintains horizontal linearity.

The positive pulses developed at the output transistor are stepped up by the tertiary winding of T205. The pulses are rectified by diode CR205 to provide the required 20kv second anode voltage for the picture tube. The bottom of the tertiary winding is returned to the junction of resistors R813 and R236 in the horizontal driver base circuit. In the event of picture tube arc-over, a negative pulse would appear at the base of the driver, cutting it and the output transistor off during the time duration of the arc. This circuit protects the output transistor from transient pulses coupled through the sweep transformer during the arc.

The horizontal output transformer also contains windings to deliver negative going pulses to the AGC and horizontal AFC circuits. The winding terminating at the brown wire delivers 6.3v to the picture tube filament.

Horizontal retrace blanking for the picture tube is achieved by coupling a negative going sweep pulse (the same one used by the AFC circuit) through R233 and a neon bulb (PL201) to the grid of the CRT.

Diode CR204 (at the collector of Q203) rectifies the horizontal output collector pulses to provide the required dc voltages for the screen and focus elements of the picture tube. Filtering, after rectification, is provided by capacitor C218.

ZENITH
Color TV

Color TV Chassis 25LC20 — CRT Drive Connections

The red cathode is connected to receive maximum fixed output from the Y amplifier. The blue and green cathodes go to two gain adjustments providing Y signal variable coupling. Connections are made through a slip connector and terminal lugs arrangement from the three separate gun cathodes. This particular arrangement *may not* be the same on every receiver, however. This is determined at the factory and the arrangement depends on which CRT phosphor is least efficient. The least efficient phosphor gun cathode (usually red) is connected to receive Y amplifier maximum fixed output. If a new CRT is installed, the least efficient phosphor gun cathode should be connected to receive maximum Y signal. Generally, if a new CRT tube is installed, the red cathode gun lead should be first connected to the terminal marked R. All cathode leads go to a terminal strip near the chassis rear-center. These terminals are indicated R (maximum Y signal), B and G. If a black and white picture cannot be obtained during the tracking procedure, it will be necessary to interchange the connection, placing the least efficient phosphor gun lead on the terminal indicated R. The other two cathode leads should be connected to the remaining terminals.

Color TV Chassis 25MC36—CRT Removal

Place cabinet, face down, on a soft surface. Remove all components from the neck of the CRT.

To remove the purity ring and plastic mounting assembly, first loosen the bolt at one end of the mounting cable and disconnect the cable from the hooks at each diagonal corner. Then remove the plastic mounting assembly (with the purity rings). Remove the color clarifier shield assembly by removing its mounting bolts at the two diagonal corners. Lift the shield assembly straight off. Loosen strap using a 5/16 hex head wrench or screwdriver. Loosen the eight screws fastening the mounting brackets to the diecast escutcheon. Remove the CRT. Remove the magnetic shield (if used) from the bell of the CRT by sliding a knife or wire between the shield and tube bell to break the two-sided tape seal. Install the shield on the replacement tube in the same position using four pieces of double coated pressure sensitive tape (Scotch Mount brand No. 4032). Install the new CRT, taking note that the blue gun is on top, correctly positioned. Position the new tube, tighten the strap, and hten tighten screws fastening the mounting brackets. Reinstall clarifier shield assembly and CRT neck components.

Color Chassis—Black and White Tracking

If a color set is to have good black and white tracking, it must produce black and white pictures within the normal usable range o both he contrast and brightness controls. The three screen grid adjus'ments, the B and G gain, the screen bias adjustments, plus the brightness and contrast controls, are used for adjusting black and white tracking. During this procedure, the voltages on the cathodes, control grids, and screen grids of the picture tube guns are adjusted to produce black and white pictures throughout the usable range of the brightness and contrast controls.

To adjust, tune in a monochrome picture that displays an adequate range of light levels, light and grey objects, dark objects, etc. Set the brightness and contrast controls for a normal picture.

1. Set the CRT Bias and the three Screen adjustments to minimum (fully counter-clock wise).
2. Set the B/W switch to Set-Up position. In this position the vertical sweep is removed to facilitate adjustments.
3. Advance each screen adjustment to produce a white horizontal line of medium brightness through the center of the screen.

In some instances, the Red, Green, and Blue lines may not completely overlap to form a white line due to the removel of the vertical sweep and necessary vertical convergence waveforms. In such cases, adjust the three screen controls for Red, Green and Blue lines of approximately equal intensity. If one or more of the screen adjustments fail to produce a line, leave that particular screen setting (s) at maximum. Advance the CRT bias setting to produce a line of medium brightness for that particular Screen adjustment (s). Adjust remaining screen adjustments for a white line, or lines of approximately equal intensity.

4. Return the B/W Switch to "Normal" position.
5. Alternately adjust the Blue and Green Gain adjustments to produce a normal black and white picture.

Check over-all black and white tracking throughout the normal brightness and contrast range. Accuracy of Screen adjustments is important. If difficulty is encountered in obtaining good black and white tracking, picture tube drive connections should be checked and altered, if necessary.

Chassis 25LC20 and 25LC20QS — Improving Interlace

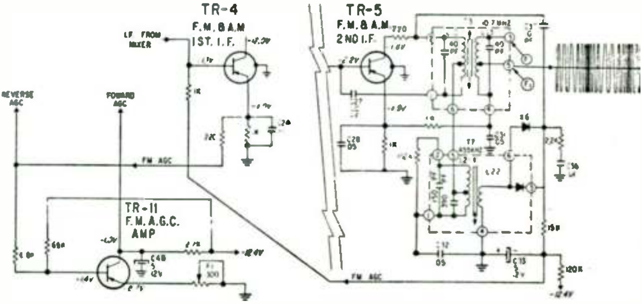
A connection between terminal "G" of the vertical output transformer (95-2109) and 390 v B + is being added in early production to further improve interlace. In the near future, this connection will be made internally in the vertical output transformer.

Change: Resistor R31 (in brightness control circuit) from 3.3 megohm to 2.2 M; Capacitor C93 from 47 mmf ($\pm$10%) to 75 mmfd ($\pm$20%), and Resistor R142 from 4.7 megohm to 2.7 M.

ZENITH
Console Models

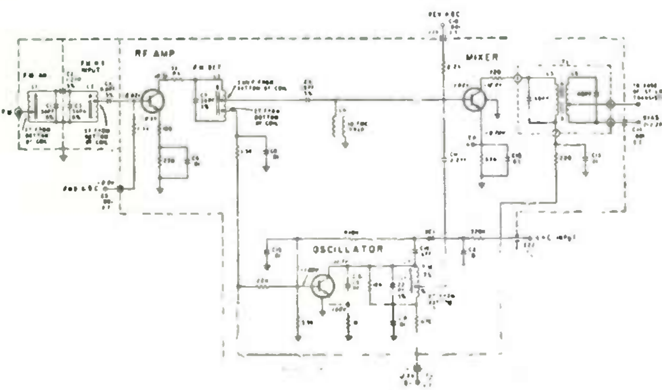
FM Multiplex Receiver Chassis 25ZT120 — FM/AGC Circuit Description

Under no signal conditions the 1st IF transistor receives its base voltage of −1.3v through a parallel voltage divider network. One leg consists of 120K resistor in series with a 15K resistor, in series with an X6 AGC diode and the secondary of T7, 455kHz IF transformer to ground. The other leg consists of 120K resistor in series with a 1K resistor that connects to the base of the 1st IF transistor through T1 and T8. The mixer transistor obtains its base voltage from the emitter of the 1st IF. This feeds through a 220Ω and a 2.2 K resistor in series applying approximately a



−1.02v under no signal conditions at the base of the mixer. In addition, the RF amplifier also obtains its base voltage from the emitter of the 1st IF amplifier. The voltage at the base of the AGC amplifier is a combination of the voltage from the 1st IF emitter through the 220Ω , and 68K resistor from B− resulting in approximately −1.4v at the AGC amplifier base. The actual RF amplifier base voltage is obtained from the collector of the AGC amplifier; the gain of the AGC amplifier is adjusted by potentiometer R1. This control is adjusted so that under no signal conditions the voltage on the collector will be − 1.0v.

When an FM signal is received, a 10.7MHz IF signal is available in T3 2nd IF transformer. A portion of this signal is removed from the 2nd IF transistor collector through C30 and 10 pf capacitor. This FM modulated signal is detected by diode X6 and produces a voltage that reduces the forward bias on X6. This reduces current flow which in turn reduces the negative voltage at the junction of the 15K and 120K resistors. With a power supply voltage of 12.4v and with no RF signal at the FM tuner, one could expect a base voltage at the first IF of approximately − 1.30v. With 60μ v of RF signal, into the FM tuner, this would be reduced to approximately − 1.21v and with 100kμv at the input of the RF tuner, the voltage would be approximately − .52v. Even with extremely strong signals the voltage on



the 1st IF amplifier will always be negative. This voltage can be considered as a positive going negative voltage. This IF transistor can then be considered to be controlled by a reverse AGC voltage. In other words. the forward bias of this transistor is being reduced. As the bias is reduced on the base of a PNP transistor, the gain of the transistor is also reduced and so is the magnitude of the IF signal at the collector. IF amplifier overload with resulting distortion will be eliminated. To prevent other sources of overload, with resulting distortion, AGC must also be applied to both the RF amplifier and mixer transistors. Since the mixer transistor obtains its base voltage from the emitter of the 1st IF transistor, then as the gain of the 1st IF is reduced, so will be the negative voltage available at the emitter of the first IF. See illustration. As a result the − 1.02v at the base of the mixer will be reduced to something less than this. Again we have a positive going negative voltage being controlled by the developed AGC. If we reduce the forward bias of a transistor, we reduce its gain. The base of the AGC amplifier receives its voltage from the 1st IF emitter and since this now a positive going negative voltage, the − 1.4v on the base of the AGC amplifier will also be reduced. When this occurs we are reverse biasing this AGC amplifier, the gain of the amplifier is reduced and the current in the collector circuit is also reduced. When the collector current is reduced, the voltage at the collector rises to something greater than a − 1.0v and we now have a negative going negative voltage applied to the base of the RF amplifier. Since we now have a forward AGC bias on the RF amplifier, we drive it into saturation causing its gain to be reduced. Perhaps at this point an explanation of forward bias will be in order.

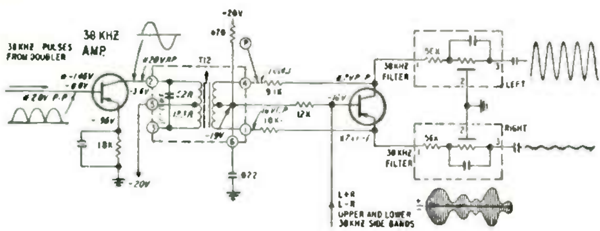
The gain of a transistor can be reduced by forward biasing it into saturation. If transistor gain is strongly dependent on collector voltage, then gain may be reduced by lowering the collector voltage. Usually this done by increasing emitter current and including a large dropping resistor in the collector. At high current, the IR drop across the dropping resistor reduces the collector voltage, thus reducing gain. Forward AGC on the RF amplifier accomplishes several purposes. First, the gain of the RF transistor is reduced. As the current increases in the collector circuit, its impedance becomes extremely low and there is a complete mismatch between the collector and its tuned circuit. As a direct result of this mismatch the gain of this circuit is reduced. In the base the current has also become quite high and its impedance becomes extremely low — in effect it acts as a swamping device across the FM-RF input coil. It would be the same as putting a short across this coil extremely reducing its "Q."

FM Multiplex Receiver Chassis 25ZT120—Biplex Detector Circuit Description

The 121-347 PNP transistor used in the Biplex detector circuit, although not a bilateral transistor, exhibits bilateral characteristics. As a result, its function can be best explained by the operation of a normal bilateral transistor.

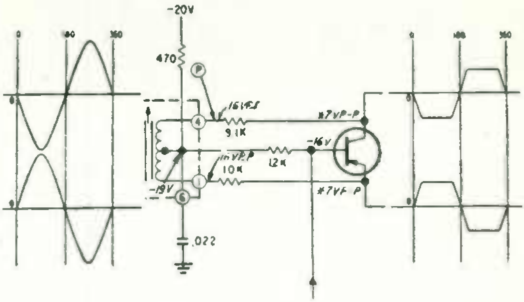
A bilateral transistor is a special type in which the collector will serve as the emitter and the emitter will serve as the collector under certain conditions. When switched by a properly applied ac voltage, in push-pull, sufficient in value to overcome the cutoff bias normally applied, the bilateral transistor will pass current in both directions in accordance with the alternations of the switching voltage. The switching voltage in this case is the regenerated 38kHz subcarrier signal.

The transistor is not biased in the conventional manner. For the following refer to the illustration. The base is biased at −16v while the collector and emitter are both



biased at −19v (as shown at the center-tap, terminal No. 6 of transformer T12). The −19 and −16 are obtained from the voltage divider consisting of the 1.2K and 470Ω resistors and TR12. Note that the collector and emitter are connected to the opposite ends of the 38kHz output transformer secondary winding (part of T12). Under no-switching voltage conditions, the transistor is biased to cut off due to the 3v difference between the 16v at the base and the 19v at the emitter. To forward bias the transistor and cause current flow, the voltage at the emitter must be positive or less negative than the voltage at the base. The required forward bias is supplied by regenerated 38kHz subcarrier (a CW signal) when the value of the 38kHz voltage exceeds the reverse bias between base and emitter.

Referring to the illustration showing the input and output waveforms of the 38kHz switching signal only, note that



the upper 38kHz input wave supplies the positive bias from the emitter to the base on the first half-cycle. At the same time, the lower wave supplies the negative bias from the collector to the base. During the second half-cycle the reverse is true, but the action of the transistor is the same due to the bilateral effect.

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