A HOWARD W. SAMS PUBLICATION

NOVEMBER 1966 | 50¢

PF Reporter®

PHOTOFACT

the magazine of electronic servicing

1966

JANUARY-AUGUST

2,400,000 color sets sold

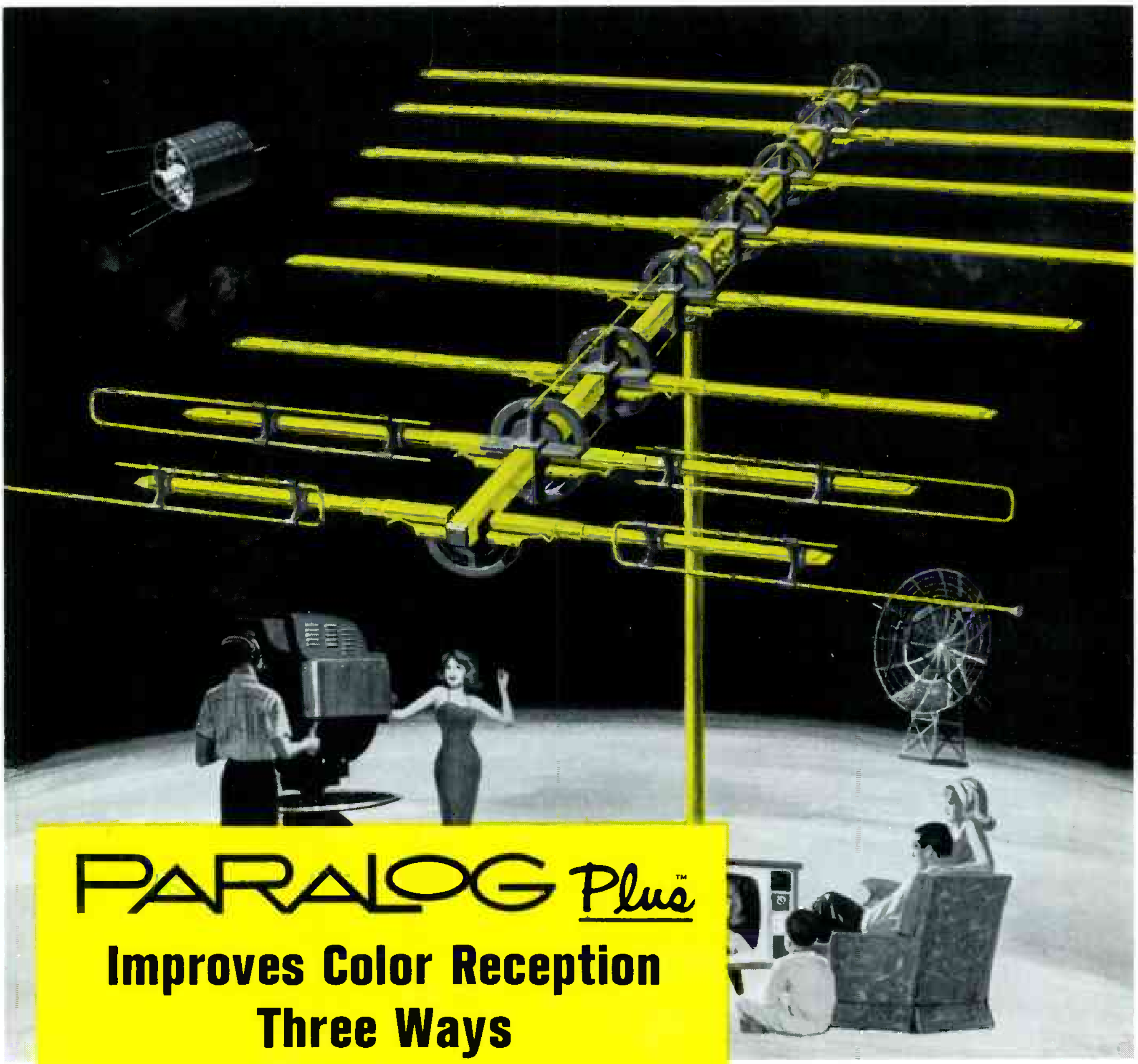
Know Your 1967 Color Circuits

Servicing Bandpass Amplifiers

plus . . .

- Color Chaos
- Remote Control
- Pay TV
- New Tube & Transistor Data

ENGLEWOOD, COLO. 80110
4660 SO. MARIPOSA DR.



PARALOG Plus™

Improves Color Reception Three Ways

1. Plus GAIN—to provide sharper directivity to eliminate multipath reception.

2. Plus FLATNESS—to eliminate tilts which cause incorrect colors on the TV screen. Industry experts say that color antennas must be flat within ± 2 db. Paralog-Plus antennas are flat within ± 1 db per channel.

3. Plus MATCH—to prevent color-distorting phase shifts.

The unique feature of the Paralog-Plus is a BI MODAL DIRECTOR system. Its parasitic elements combine two hi-band directors into a single director covering all lo-band channels, plus the entire FM band. Thus, more of the elements work to bring in any given channel.

Plus—300 and 75 ohm outputs for match to *either* twinlead or coax. And full, flat gain over the entire FM band.

Plus these quality mechanical features: Self-cleaning wedge-snap locks that tighten with vibration, Cycolac insulators to eliminate cumbersome cross feed points, Golden Armor coating, Square boom construction, One-piece antenna array—and more.

Check on how these plus features can help make plus profits for you. See your Jerrold distributor, or write:

DISTRIBUTOR SALES DIVISION
401 Walnut St., Phila., Pa. 19105

JERROLD

Circle 1 on literature card

KNOW YOUR '67 COLOR CIRCUITS

by J. W. Phipps

Models and CRT Sizes

Most of Admiral's '67 color line is made up of 23" and 25" consoles using rectangular CRT's in three basic chassis. However, one 21" console and five 25" solid-state combination models are also included in the new model group. Andrea has increased the screen size of their new line to 25"—available in four consoles and one custom unit for built-in applications. The rectangular CRT used by this manufacturer features a bonded safety glass, as do most of the big-screen picture tubes for the coming year. Three chassis are used in Dumont's '67 color models, which offer 19", 23", and 25" screens.

While most color manufacturers are keeping within the 19" to 25" size range, General Electric has brought forth an 11" portable model (to be described later). Also included in this manufacturer's line are 19", 23", and 25" models using the new KC chassis. Emerson has come up with six 23" models, six 25" models, and one 19" table model. Three chassis are used in the new line. 23" and 25" picture tubes are used in Hoffman's new four-model group. A new 19" portable is to be introduced soon.

Two types of 21" round picture tubes are included in Magnovox's '67 color sets. One uses a bonded face plate, while the other uses a separate safety glass. 21", 23", and 25" screen sizes are also offered by this manufacturer. Motorola's new color line consists of 46 models and includes three picture tube sizes—21", 23" and 25". Thirteen of the models are carryovers from last year and use the TS-A914 chassis. The new models employ the TS-918 chassis. A new Motorola developed and manufactured rectangular picture tube is used in the 21" models. Olympic is offering a variety of 23" and 25" sets for '67. Also included is a 19" portable model which is convertible to a console (using a swivel base), or to a consolette (using attachable legs). Offered on many of the console and combination sets is Olympic's new "Color Glide"—a multicolor vertical bar mounted on the control panel and color coded to correspond to the adjusting range of the tint control. A light glides along this bar to help the viewer adjust the picture for the proper hue setting.

Philco is using four basic chassis in a new line comprised of 19", 21", 23" and 25" models. Six chassis are used in RCA's '67 line. Four of the chassis are new—CTC21, CTC24, CTC25, and CTC25X. Screen sizes include 19", 21", and 25". Many models are equipped with one of two remote control systems. Setchell Carlson continues to offer "Unit-Ized" chassis in both 23" and 25" models. Sylvania's line for the coming year features 19", 21" (round), and 25" sets. The 19" screen size is offered in a portable table model, while the 21" and 25" sizes are console sets. Rounding out the line-up for the coming year is Zenith's 19", 21" (round) and 25" screens.

Luminance Channels

The Y signal circuits of most receivers have changed very little. However, there have been a few changes. Admiral's H12 chassis (used in 23" and 25" sets) employs three video IF stages and two video amplifier stages. Tube types are relatively common except for the 6BN11 double-pentode compactron used in the 1st video amplifier and sound IF stages, and a 6AF9 double-pentode shared by the 2nd video amplifier and burst amplifier. Andrea uses three video-amplifier stages. A triode-pentode 6AW8A is used in the first two stages and a 12BY7A pentode is used in the 3rd video stage.

General Electric's KC chassis employs three video-amplifier stages—the first two use NPN transistors and the third stage uses a 6AG9 pentode. A tuning meter with a separate transistor amplifier and diode detector (shown in Fig. 1) is also employed in this chassis. A tank circuit and silicon diode in the emitter-base circuit of the transistor detects the 45.75-MHz picture IF carrier, which is amplified and coupled to the meter. A silicon diode in the collector circuit of the transistor serves as a meter damper. As the fine tuning is adjusted, the meter pointer moves to the right with an increase in the picture carrier. Collector voltage is developed across the cathode resistor in the audio-output stage and applied to the collector through a potentiometer in the base circuit which adjusts the full-scale deflection of the meter.

General Electric's 11" HC chassis makes extensive use of compactrons throughout all circuit func-

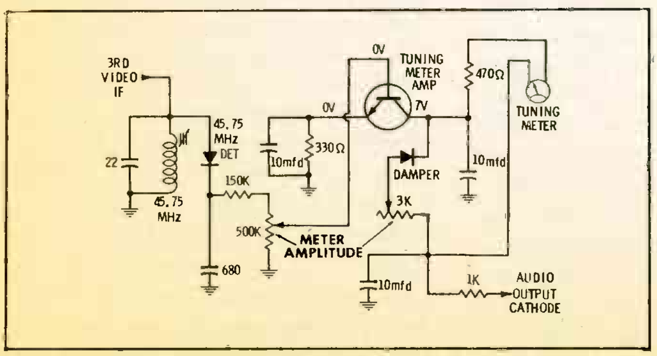


Fig. 1. Tuning meter circuit in General Electric KC chassis.

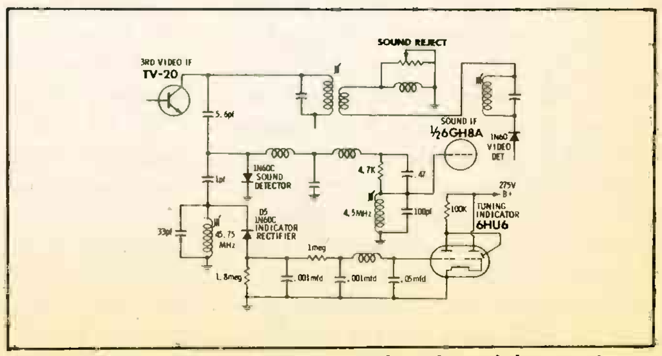


Fig. 2. Tuning indicator circuit employed in Philco receivers.

PF REPORTER, November, 1966 Vol. 16, No. 11 PF REPORTER is published monthly by Howard W. Sams & Co., Inc., 4300 W. 62nd, Indianapolis, Indiana 46206. Second-class postage paid at Indianapolis, Indiana. 1, 2 & 3 year subscription prices; U.S.A., its possessions and Canada: $5.00, $8.00, $10.00. Other countries: $6.00, $10.00, $13.00. Current single issues 50¢ each; back issues 65¢ each.

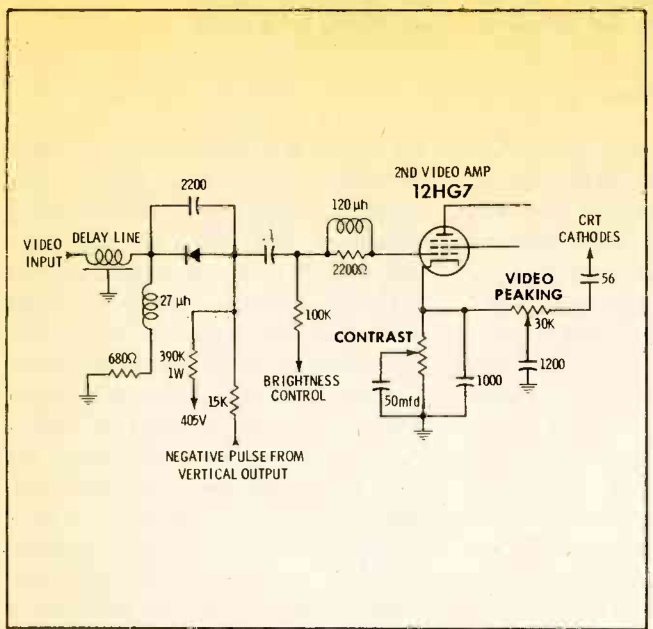


Fig. 3. Blanking and video peaking in RCA chassis.

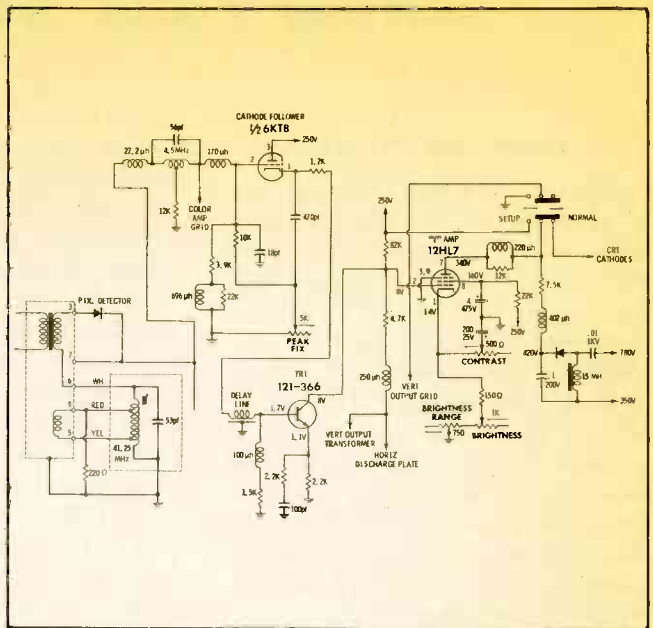


Fig. 4. Final luminance channel in Zenith's new chassis.

tions. In the luminance channel, a double pentode 8AR11 performs in the 1st and 2nd video IFs, an 8BQ11 pentode functions in the 3rd IF stage, and the pentode section of a double-triode/pentode is used in the single video amplifier stage.

Shown in Fig. 2 is Philco's new tuning eye, used in chassis 17M-T80B, 17NT82, and 17QT85A. The purpose of this customer aid is to provide an accurate means of fine tuning. The tuning eye employed in the system is a fluorescent-target, vacuum tube type with a bar type presentation. Operation of the tuning indicator is based upon a properly aligned receiver. The indicator circuit operates from the video carrier level and assumes that when the video carrier is at maximum, the receiver is properly tuned for the best b-w picture, best color without beat, and the proper sound level. The 45.75-MHz video carrier appearing across the sound detector is coupled through a 1-pf capacitor to a tuned LC circuit. (The 5.6-pf and 1-pf capacitors provide isolation between the indicator and video circuits). The video carrier signal developed across the tuned LC circuit is rectified and filtered to DC by the diode and pi-section filter in the grid-cathode circuit of the indicator. Maximum DC is developed when the station is correctly tuned. When the ray-control electrode (diode portion of indicator) is less positive than the fluorescent target (plate) the electron stream between cathode and plate will be deflected and a shadow will appear. The less positive the ray-control electrode, the wider the shadow. As a station is tuned in, the amplitude of the video carrier increases and develops an increasingly negative voltage in the indicator rectifier circuit. This negative potential biases the indicator DC amplifier (triode section), causing an increase in plate voltage and consequently, an increase in the potential applied to the ray-control electrode, which reduces the shadow and causes the "eye" to close.

Except for the addition of the tuning indicator to the three chassis indicated, the luminance channel circuitry in Philco's new line remains unchanged and continues to use transistors in the video IF, AGC, and video-driver circuits. Andrea, Dumont, Emerson, Hoffman, Magnavox, Motorola, Setchell Carlson, and Sylvania also continue to use luminance circuitry basically identical to that used last year.

Shown in Fig. 3 is the new vertical blanking circuit employed in RCA chassis CTC 19. A similar blanking circuit is used in Chassis CTC 20 and CTC 24 — the only variations being a different value of bias resistor (to B+) and the addition of another resistor to lower the amplitude of the vertical pulse from the output transformer. During normal video scanning, the diode is forward biased and passes video information through the coupling capacitor to the grid of the 2nd video stage. During vertical retrace a negative pulse from the vertical output transformer is applied to the diode, reverse biasing it. At the same time, the negative pulse is also applied to the grid of the 2nd video amplifier, driving the grid more negative. The negative pulse at the grid is reflected as a positive going pulse at the plate. This positive pulse is then applied to the CRT cathodes, cutting off the CRT during vertical retrace. The amplitude of the blanking pulse at the plate will decrease as the brightness is decreased or the contrast increased. Therefore, the amplitude of the blanking pulse will depend on the brightness and contrast control settings. However, one of the notable features of this blanking circuit is its ability to cut off the CRT cathodes during vertical retrace, regardless of the brightness or contrast control settings.

Another feature added to the CTC 19 chassis, a peaking control, is also shown in Fig. 3. Electrically located in the cathode circuit of the 2nd video amplifier, the control provides added peaking when rotated clockwise. The rear apron of the CTC 19 chassis has been changed slightly to accommodate the new control. The AGC and color killer controls have been combined in a dual-concentric unit and the vertical linearity control relocated to the spot vacated by the color killer. The new peaking control now occupies the position formerly held by the vertical linearity control.

The new Zenith 23XC36, 23XC-

38, and 23XC38Z chassis also contain Y circuit refinements and changes not found in previous Zenith chassis. A transistor driver stage has been placed between the output of the cathode follower and the input of the Y amplifier, as shown in Fig. 4. The purpose of the driver stage is to provide additional video drive to the cathodes of the picture tube. The video input to the cathode follower stage is approximately 6 volts p-p. Since the gain of a cathode follower is always less than unity, approximately 3 volts p-p is coupled to the transistor driver stage. With a voltage gain of 3 through the driver, approximately 9V p-p is present at the input of the Y amplifier. As shown in Fig. 4, a new 12HL7 pentode has replaced the 12GN7A that was used in the Y amplifier of previous chassis. The 12HL7 is similar to the 12GN7A, but has only half (approximately) the transconductance —a factor which increases the gain and stability of the 12HL7. To help provide additional video drive to the CRT cathodes, the 12HL7 plate voltage has been increased by an "extra" power supply (shown in Fig. 4) between the 350 volt B+ line and the 12HL7 plate.

Additional video peaking coils are used throughout the Y circuitry (from the video detector to the CRT cathodes). Improved peaking with the Peak Pix control is accomplished in part by the addition of a peaking coil in series with the blue and green gain controls.

Chroma Circuitry

The big news in chroma circuitry changes centers around RCA Chassis CTC 21 — the new top-of-the-line chassis for this manufacturer. Basically the color stages in the CTC 21 are of CTC 17X design; however, there are several new and interesting features.

The quadruple 6JU8 diode used in the color sync stages of the CTC 17X has been replaced by three separate solid-state detectors. One for AFPC control, one for the color killer detection function, and one for automatic chroma control. Fig. 5 is a simplified schematic of the AFPC stage used in the CTC 21. It should be noted that the tint control has been moved from the secondary of the burst transformer (as in the CTC17X) to a phase shift network in the reference feedback circuit. In the CTC17X chassis, adjusting tint changed the phase of the incoming burst signal. However, in the CTC 21, adjusting tint alters the phase of the 3.58-MHz reference signal coupled to the AFPC and killer detectors. The range of the tint control is ±45°. With the oscillator on frequency and in phase with color burst, the phase of the reference signal applied to the AFPC diodes produces equal conduction of both diodes, resulting in no correction voltage at point A. When the oscillator drifts off frequency, one diode will conduct more than the other, developing a correction voltage (at point A) of the polarity needed to bring the oscillator on frequency and in phase.

The simplified schematic in Fig. 6 illustrates the color killer detector circuitry used in the CTC21. This noise-immune circuit operates much the same as the 6JU8 circuit in the CTC17X chassis. With no color burst applied, the diodes conduct nearly equally and no correction voltage is developed at point A. The color killer operates, biasing off the bandpass amplifier. During color reception (color burst applied), the diodes conduct unequally and a negative voltage develops at point A. This negative voltage is sufficient to cut off the color killer, allowing the bandpass amplifier to conduct.

The CTC21 automatic chroma control (ACC) is shown in Fig. 7. To better understand the operation of the ACC detector, it is necessary to review the basic operation of the chroma bandpass and killer stages. With no color signal received the color killer maintains the bandpass amplifier at cutoff by applying −8 volts to the bandpass grid. When a color signal is received, the color killer detector cuts off the color killer, which reduces the bias on the bandpass amplifier grid to −1.8 volts and allows it to conduct. Refering again to Fig. 7, note that a reference signal (45 volts p-p from a special winding on the oscillator transformer) is applied to both diodes. The secondary of the burst transformer also feeds each diode with an incoming burst signal separated by a 180° phase relationship (transformer action). With no color burst applied to the circuit, the diodes conduct equally and the voltage at point A remains at approximately −8 volts (due to conduction of the color killer). During color reception, the phase relationship between the burst signals applied to the diodes causes unequal conduction. The bottom diode (in phase) conducts very little and maintains approximately the same voltage output; the upper diode (out of phase) conducts more. In this unbalanced condition, a negative voltage is developed at point A that is proportional to, and varies with, the amplitude of the incoming burst signal. The chart in Fig. 7 indicates the approximate bandpass amplifier grid voltage at different levels of burst signal. Note that the grid voltage and burst level are directly proportional — as the burst level decreases, the grid voltage also decreases (goes positive).

The ACC action can best be summarized as follows: the amplitude of the incoming burst signal is compared with a reference feedback signal (of fixed amplitude) from the output of the 3.58-MHz oscillator. Any difference in amplitude between the two signals develops a negative

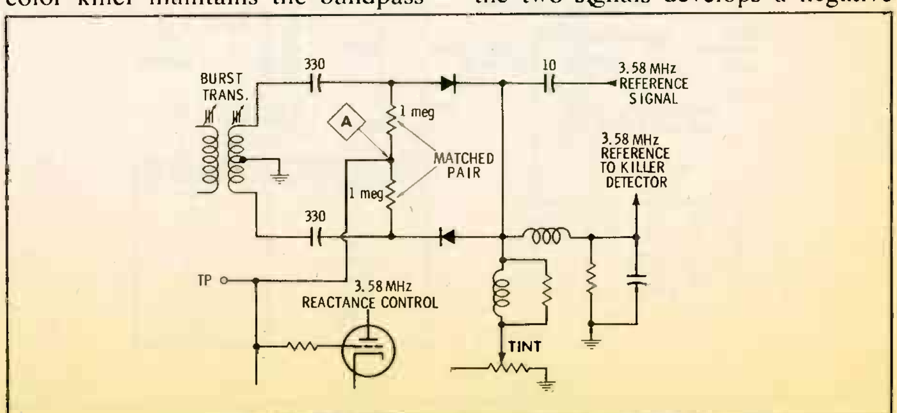


Fig. 5. Simplified schematic of RCA Chassis CTC21 AFPC circuit.

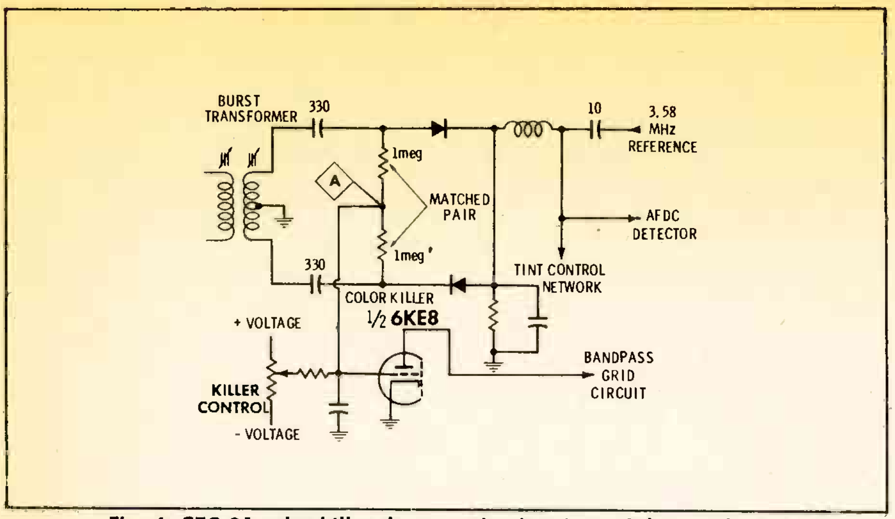


Fig. 6. CTC 21 color killer detector circuit using solid-state diodes.

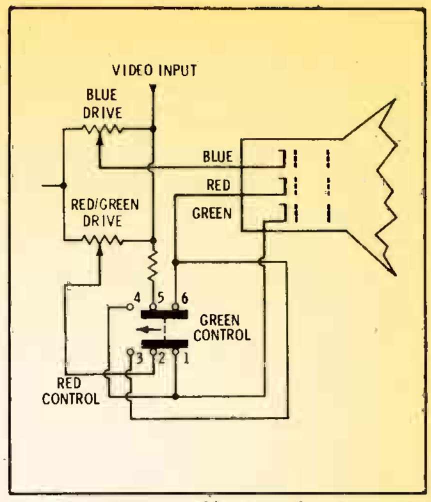


Fig. 8. CTC21 red/green drive circuit.

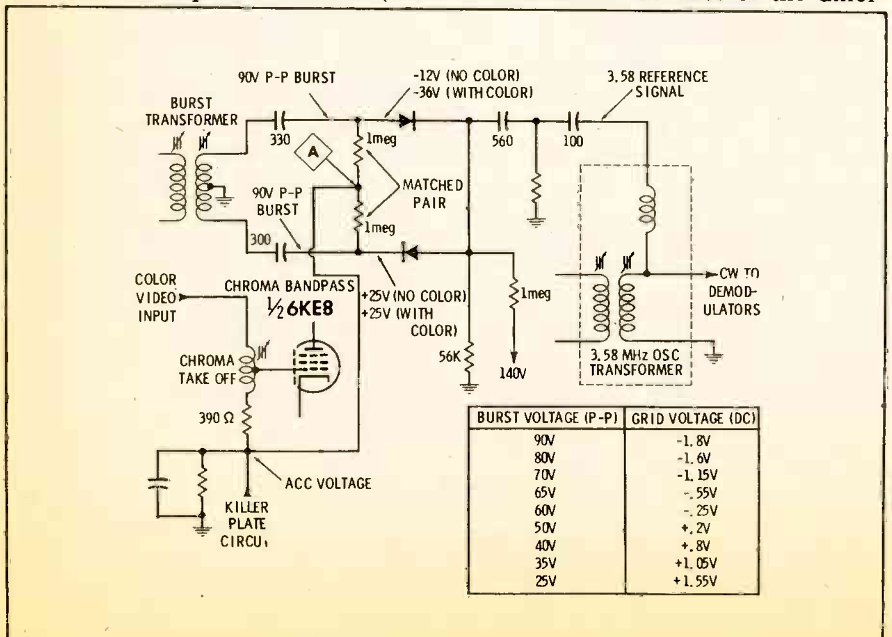
voltage at the junction of the two 1-megohm resistors. This negative potential is applied to the control grid of the bandpass amplifier and either increases or decreases the gain of that stage, depending on the level of the incoming burst signal. In this manner, the output of the chroma bandpass amplifier stage is held constant during spurious signal level changes and prevents fading or other saturation of the color signal produced on the screen.

It should be noted in Fig. 7 that the pentode section of a 6KE8 has replaced the 6GH8A formerly in the chroma bandpass stage of RCA's 25″ receivers. The triode section of the 6KE8 functions in the color killer circuit (Fig. 6).

Other RCA chroma circuitry changes also appear in Chassis CTC 21. A new two-position switch (located on the rear apron of the chassis) is used to control red or green video drive to the picture tube, as shown in Fig. 8. Changing the position of the switch interchanges the connections to the red and green cathodes, thus, connecting the drive control to either cathode. If black-and-white tracking cannot be obtained (especially after picture tube replacement) it may be necessary to change the position of the switch.

The CTC 21 picture tube bias circuit is also a departure from the circuitry used in the CTC 17X. In the chassis used last year, a "Kine Bias" switch set the average plate voltage on the color difference amplifiers and thus biased the picture tube. The switch was located in the blanker stage plate circuit, controlling the blanker pulse fed to the common cathodes of the difference amplifiers. In the CTC 21 chassis, the "Kine Bias" adjustment is a potentiometer — part of a voltage divider network across the 405-volt B+ line. The control changes the DC potential applied to the control grids of the picture tube. As shown in Fig. 9, the red, green, and blue grids are connected through individual 1.5-megohm resistors to the control slider. The variable control makes possible a fine adjustment of picture tube bias conditions, resulting in increased efficiency of the picture tube and less blooming at higher brightness settings.

General Electric's 11″ HC chassis closely follows the chroma circuitry found in the CB chassis introduced last year and the KC chassis introduced this year. However, there are a couple of major differences. One is the tube complement, which is almost exclusively compactrons in the HC chassis, and the other is the color demodulator circuitry. The HC chassis uses a modified version of the CB chassis' balanced-diode synchronous detec-



BURST VOLTAGE (P-P)	GRID VOLTAGE (DC)
90V	-1.8V
80V	-1.6V
70V	-1.15V
65V	-.55V
60V	-.25V
50V	+.2V
40V	+.8V
35V	+1.05V
25V	+1.55V

Fig. 7. RCA automatic chroma control varies bandpass gain.

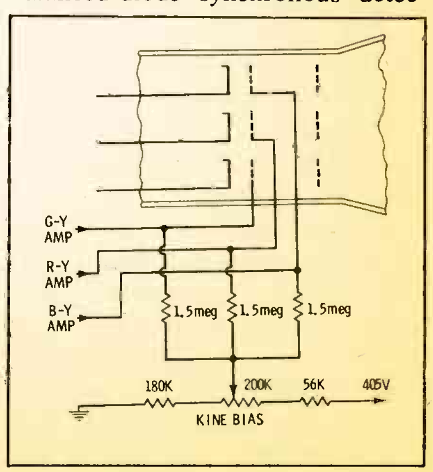


Fig. 9. Variable Kine Bias control employed in RCA chassis.

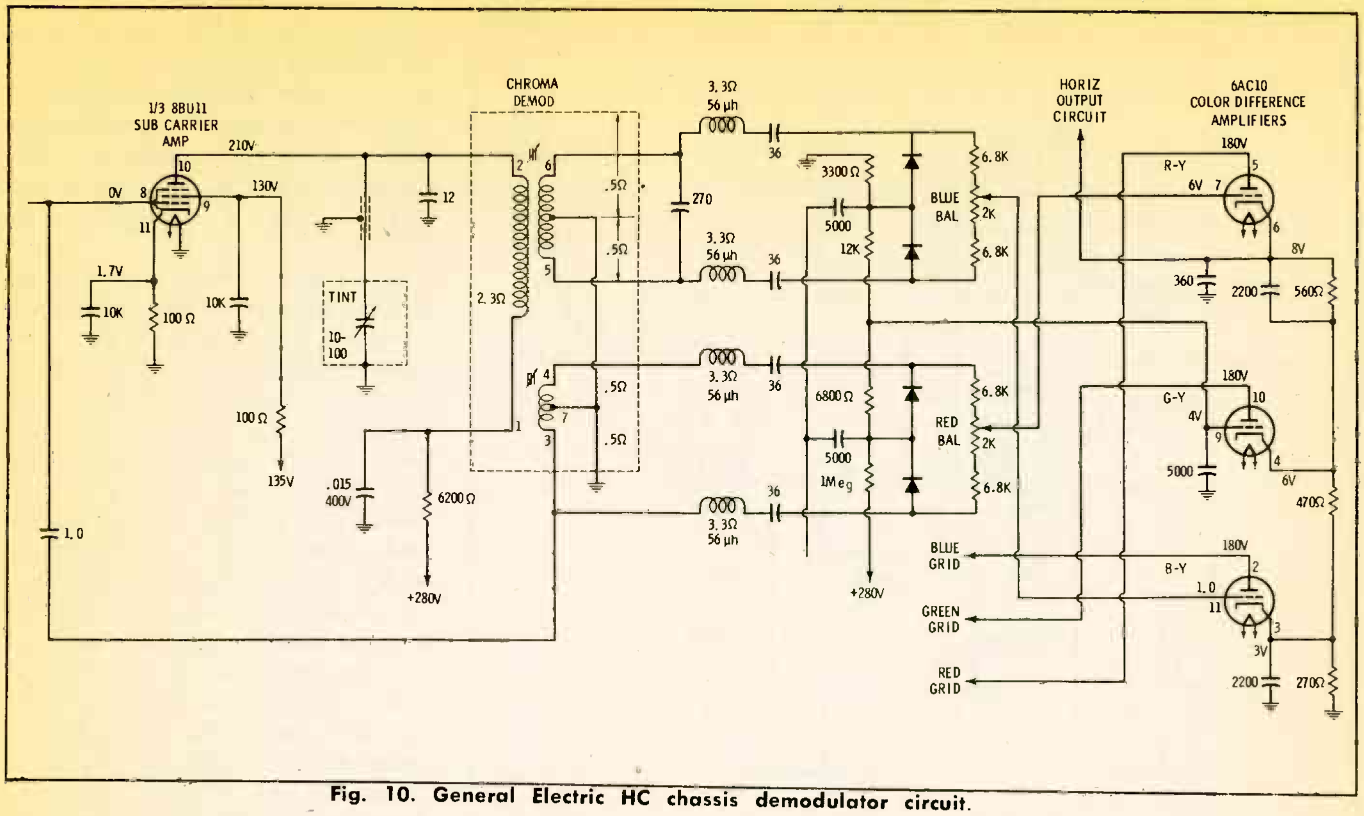


Fig. 10. General Electric HC chassis demodulator circuit.

tor network. As shown in Fig. 10, the new circuit develops the G − Y signal from the difference between the red and blue signal. Note that no provision is made for adjustment of the G − Y signal; instead, the input to the G − Y amplifier is a fixed value and dependent upon the blue and red balance adjustments.

Hoffman has come up with some minor chroma circuit changes. In previous chassis, a current-operated relay (Fig. 11A) connected to the screen circuit of the X and Z demods fired three neon bulbs, illuminating the tint, intensity, and cinema controls when a color signal was received. The new color indicator circuit is shown in Fig. 11B. During color reception, the conduction of the bandpass amplifier triggers two transistors, connected in a "go-no-go" DC amplifier configuration, which in turn fires three neon bulbs. The sensitivity of the circuit is adjusted by a potentiometer in the emitter-base circuit of the 1st transistor amplifier.

Alignment and circuit changes are also evident in Zenith's new 23XC36, 23X38, and 23XC38Z series chassis. DC coupling has been improved and two new 6ME8 demodulator tubes (Fig. 12) have replaced the 6JH8 tubes used in last years chassis. Although the two tube types are similar, they are not interchangeable because of different operating characteristics. The internal plate construction of the 6ME8 greatly reduces secondary emission. Other changes involve the output circuit of the B − Y and R − Y demodulators (G − Y matrix) which has been modified to produce improved flesh tone reproduction. Also, the demodulator alignment (injection coil, quadrature adjustment) is now aligned to approximately 100°-105°. Chassis prior to this series

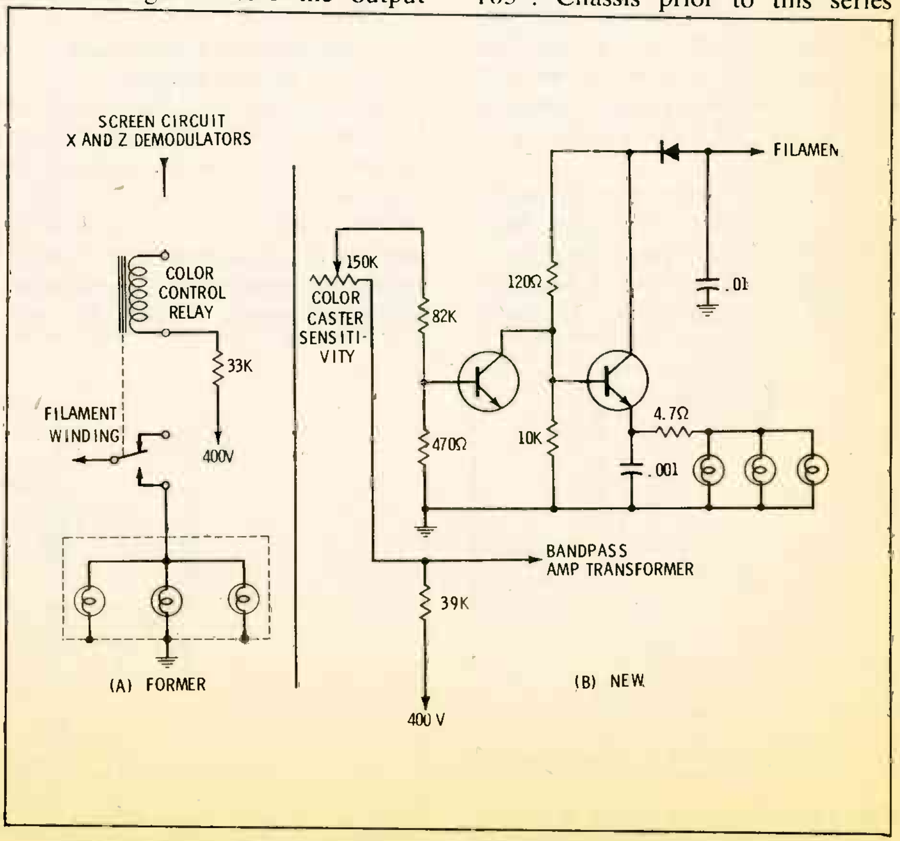


Fig. 11. Old and new color indicator circuits used in Hoffman chassis.

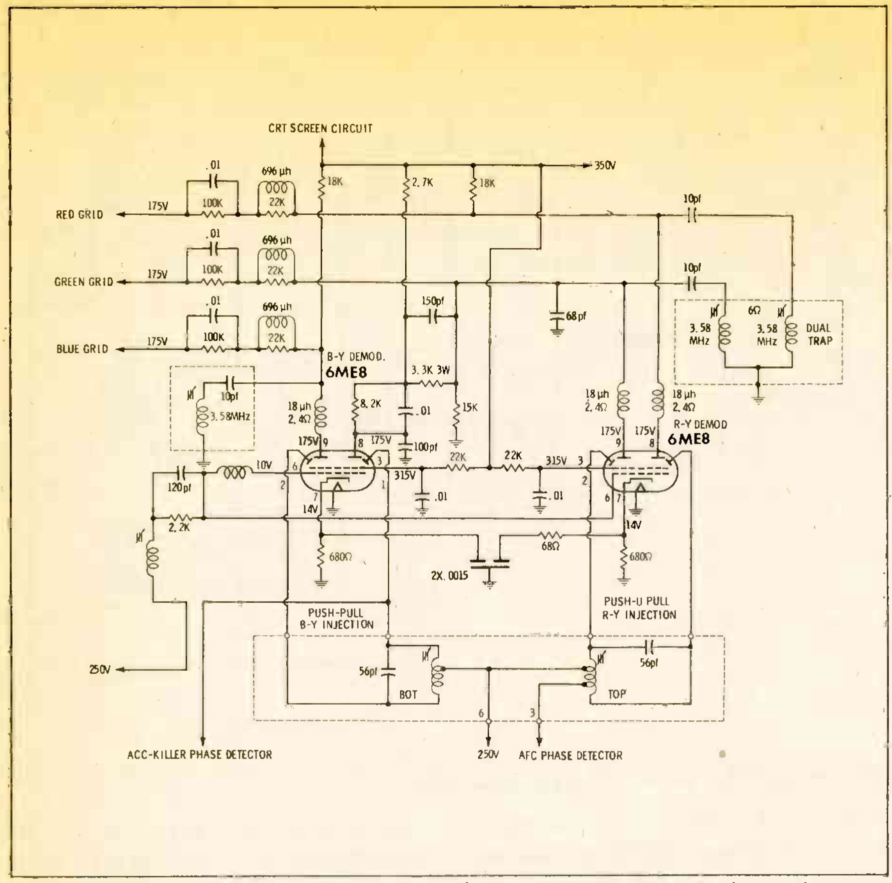


Fig. 12. Demodulator circuit in Zenith's new chassis series is changed.

were aligned for 90°. The reactance control and 3.58-MHz oscillator tube type has been changed from a triode-pentode 6KT8 to a 6GH8A of similar construction. Another tube change finds the 1st and 2nd color amplifiers both using one half of 6KT8 double-pentodes; whereas before, the 2nd color amplifier used a 6JC6.

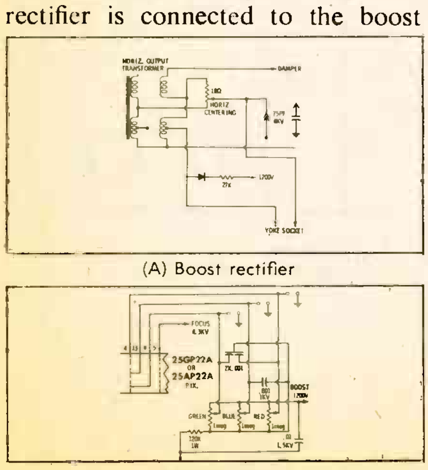
The CRT screen circuit supply voltages has been increased from 740 volts to 1200 volts. To provide the additional voltage, a selenium rectifier is connected to the boost voltage (Fig. 13A). To limit the voltage across the screen controls, they are returned through a 120K, 1-watt resistor to the 350-volt B+ line, as shown in Fig. 13B.

Horizontal Sweep and High Voltage

Few changes have been made in horizontal sweep and high voltage circuits. Most chassis continue to use the same focus and regulator circuits. One exception is Zenith's new pulse controlled high voltage regulator system, shown in the simplified schematic of Fig. 14. Although this particular system is new, the purpose of it is the same as that of other regulator designs—to maintain (regulate) the picture tube high voltage at a constant value during brightness (beam current) changes. This is accomplished as follows:

For a given brightness condition, the horizontal output transformer (primary and tertiary, or high voltage, windings) is loaded to a given power value. Assume that the high voltage is 25 KV for this condition. The primary winding is loaded by the regulator tube and the tertiary winding by the high voltage rectifier and picture tube. As brightness (CRT current) increases, the tertiary winding load increases. This increased load is reflected back to the primary winding, resulting in less ringing of the primary. Since damper tube conduction is directly proportional to primary ringing, it decreases and in turn, lowers the boost voltage. The decrease in boost voltage is coupled to the grid of the regulator, causing a decrease in regulator conduction, and a consequent increase in plate voltage. This decreases the loading of the primary winding, which tends to increase (or maintain constant) the pulse amplitude to the high voltage rectifier. Under unregulated conditions, an increase in brightness causes an opposite action within this regulator system.

One other interesting feature of Zenith's regulating system is the fact that the regulator conducts only during retrace time. This is accomplished by coupling positive pulses from the horizontal oscillator (oc-



(A) Boost rectifier

(B) Screen circuit

Fig. 13. CRT screen circuit in Zenith chassis uses increased voltage supplied by boost-boost rectifier.

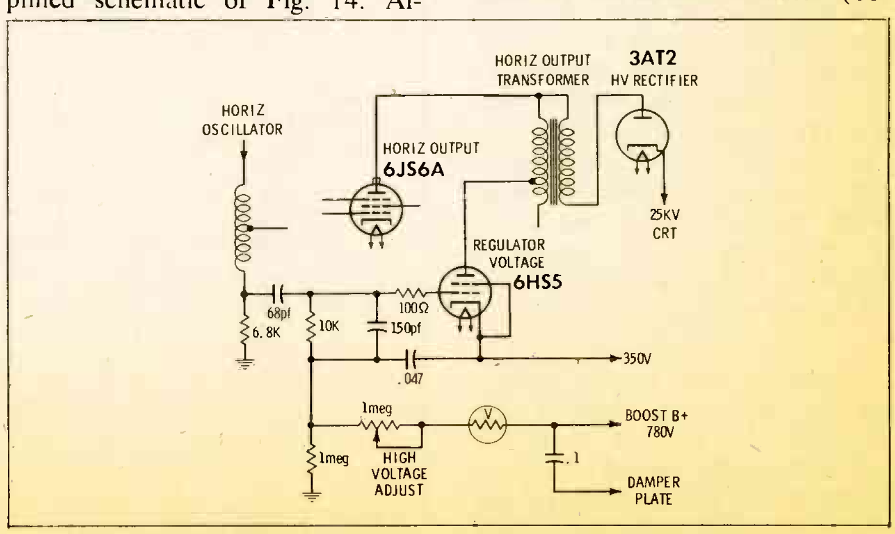


Fig. 14. Simplified schematic of Zenith's new regulating circuit.

curring during retrace time) to the grid of the regulator tube. With the regulator tube "gated" to conduct only during the retrace interval, it operates at higher efficiency, tube life is lengthened, and raster width is virtually unaffected.

Sound Circuits

The biggest news in sound circuitry comes from RCA, who, in March of this year, introduced the first TV set to use an integrated circuit. As described in the October '66 issue of PF REPORTER ("Highlights of the '67 TV Lines"), the circuit chip was employed in the sound section of chassis KCS153X, a 12" transistorized portable b-w receiver. Now, the same circuit chip is being used in the sound circuits of two 25" color chassis, CTC21 and CTC25.

Since the integrated circuit was discussed in detail in the October issue, it will be treated here only as a unit part of the audio system. Fig. 15 shows a simplified schematic of the CTC21 audio-output circuit, with the integrated circuit represented by a single block. It should be mentioned that this single block represents the sound IF, sound detection, and low-level audio amplification functions of the sound system (normally performed by 26 conventional components).

The input power requirement for the integrated circuit (IC) used in the CTC21 is 7 volts. This supply voltage is obtained from the emitter of the audio output transistor. The driver functions as a DC gain-feedback circuit to keep the emitter voltage on the output stage relatively constant. Any change in emitter voltage varies the bias on the driver base through the 47K-ohm resistor connected between the base and the IC input.

A protective diode is used in the output transistor collector circuit to prevent the collector voltage from exceeding 270 volts. Normally, the collector voltage should be approximately 160 volts, emitter voltage approximately 7 volts, and emitter current between 32ma and 40ma. Nominal emitter current is 36ma, with the IC drawing approximately 17ma of this. A 60-ma, fast-acting fuse is also included in the collector circuit of the audio output stage. The purpose of the fuse (a "wired-in" type) is to protect the transistor in the event a short develops in the output circuit.

Pincushion Circuits

The schematic in Fig. 16A shows the horizontal pincushion corrector circuit used in Motorola's new TS-918A chassis. Like the vertical pincushion corrector circuit employed in this chassis (identical to that used in the TS-A914 chassis), the horizontal corrector circuit uses both passive and dynamic correction. (Passive correction involves the changing of the waveshape or phase relationship of a corrective voltage or current by using only resistors, capacitors, coils, etc. Dynamic correction also involves the changing of the waveshape or phase relationships but uses an active element such as a tube or transistor that can vary the amplitude of the corrective voltage or current.)

A saturable reactor is used in the horizontal correction circuit (the vertical circuit operates on the modulation principle). The saturable reactor's unique characteristic of varying inductance makes it particularly adaptable to this type of circuit. Varying the DC current in the primary of the saturable reactor also varies the inductance of the secondary through core saturation. Increasing the current in the primary of the reactor reduces the inductive reactance in the secondary. From the foregoing it can be seen that by varying the current in the primary of the saturable reactor at a certain rate and amplitude, the impedance in the secondary can also be controlled at the same rate and amplitude. The horizontal pincushion corrector makes use of this characteristic by introducing a variable impedance (at a predetermined rate and amplitude) in series with the horizontal deflection yoke coils.

An inherent reaction of the CRT and yoke causes the pincushion error at the left side of the raster to be greater than the error on the right side. Because of the symmetrical action of the horizontal corrector circuit, the error on each side of the raster must be the same if equal correction is to be accomplished. Therefore, an additional error must be introduced on the right side of the raster to make both sides equal in pincushion error. This is accomplished as follows: A portion of the vertical trapizoidal waveform (W2, Fig. 16A) is integrated into a negative going parabolic waveform (W1) and applied to the control grid of the horizontal output tube. Since this waveform is negative going and at a vertical rate, no effect is noted at the top and bottom of the raster. As the negative portion of W1 progresses through its excursion, it progressively decreases the horizontal scan on the right side of the raster (shown in Fig. 16B), making the right pincushion error equal to the left.

Waveform W2, also present at the top of the horizontal pincushion adjust, is fed through an integrator network which changes it to a negative going parabolic waveform (W3) for application to the correct transistor base. After being amplified by the corrector transistor, the parabolic waveform is a positive going waveform (W4) across the primary of the saturable reactor, which acts as the collector load. W5 is the voltage waveform across the load. The reaction of the saturable reactor to the current of W4 creates a variable impedance in the secondary

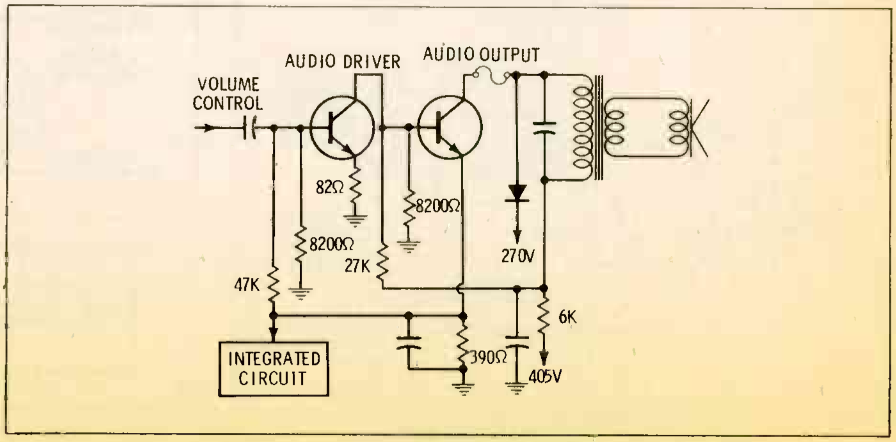


Fig. 15. Transistorized audio output circuit in CTC21 chassis.

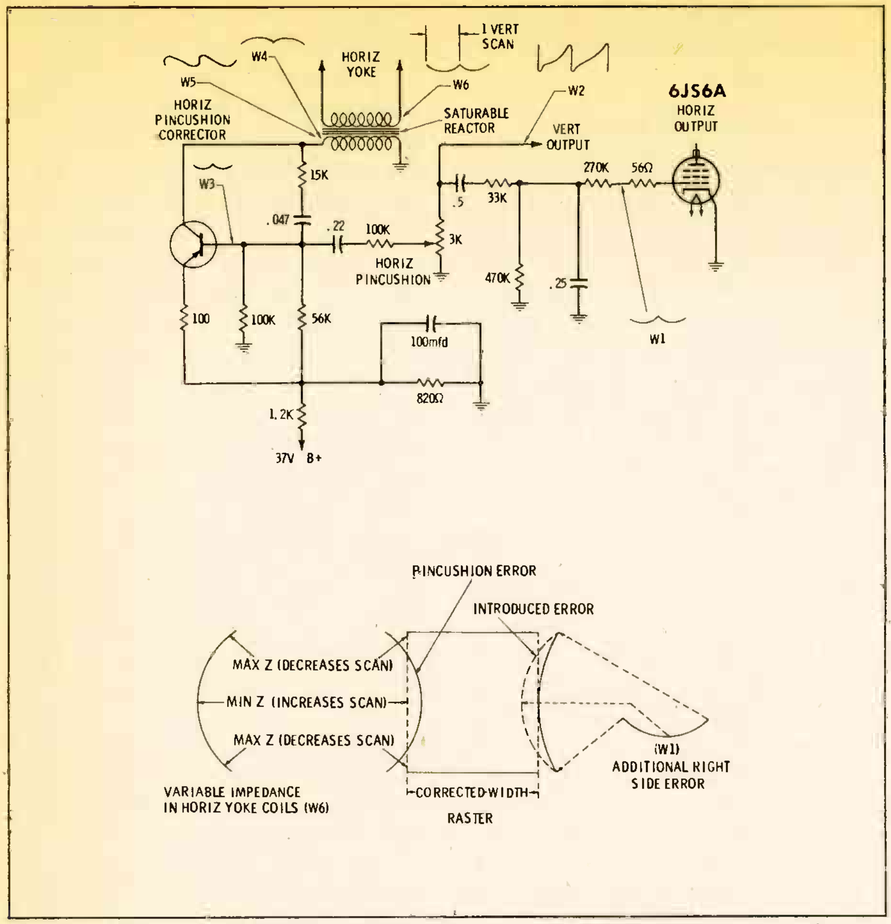


Fig. 16. Horizontal pincushion corrector circuit used in Motorola TS-918A chassis.

which corresponds to W6. The effect of one cycle of W6 on the raster is shown in Fig. 16B.

Other Circuits

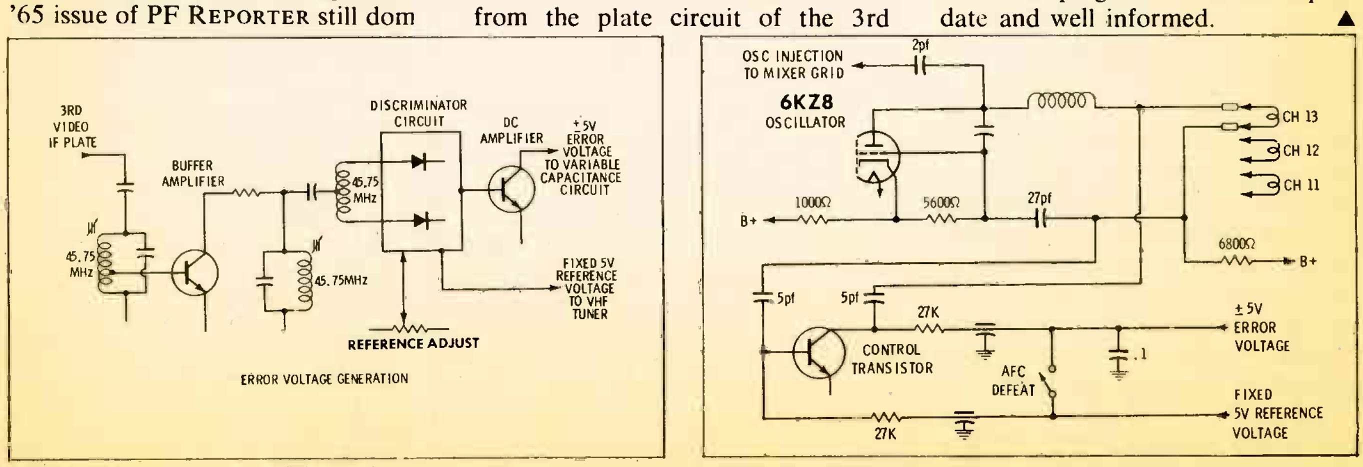
There are no new developments in low voltage power supply circuits. Most color TV manufacturers continue to use either fullwave voltage doubler configurations or bridge circuits with four silicon diodes.

Automatic degaussing is used in nearly all color receivers, with little change in circuitry. The degaussing methods described in the September '65 issue of PF REPORTER still dominate the majority of systems.

VHF and UHF tuner circuitry is also much the same as last year, with only minor refinements. There is one exception, however— RCA's new automatic frequency control system, shown in simplified form in Fig. 17. The purpose of the new AFC circuit is to correct for any mistuning of the fine tuning control or any drift that may occur in the local oscillator of the VHF or UHF tuner. Briefly, the operation of the system is as follows: A portion of the 45.75-MHz video carrier is fed from the plate circuit of the 3rd video IF to a buffer stage. Maximum transfer of the carrier frequency is accomplished by tuned tanks in the buffer input and output circuits. The carrier is then applied to a discriminator circuit which is tuned to the correct 45.75-MHz frequency. Any difference that exists between the sampled carrier frequency and the discriminator reference frequency (45.75 MHz) causes a DC voltage change at the collector of the DC amplifier stage. The DC amplifier supplies two output voltages to the input of the control transistor. One output is the ±5-volt correction voltage from the collector and the other is a constant 5-volt reference voltage obtained from the B+ supply. Any difference existing between the two voltages at the input of the control transistor is reflected as a change in capacitance in the frequency determining circuit of the local oscillator. Thus, the local oscillator frequency is altered in a direction opposite to the frequency error that originally existed.

Conclusion

This article has touched on only the new or most changed circuitry found in the color TV receivers for 1967. As indicated, many receiver circuits are beginning to stabilize in design. This fact is reflected in the decrease in major circuit changes. Circuit refinements, however, have continued, with many minor changes too numerous to mention here. Undoubtedly, there will be changes and refinements throughout the coming year and for many years to come. As changes in color and black-and-white television occur, they will be presented in PF REPORTER as an aid to keeping the technician up to date and well informed. ▲

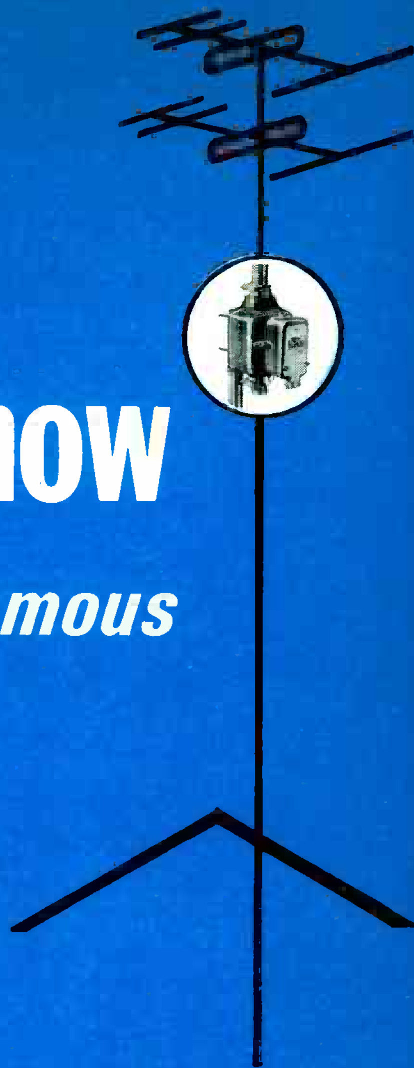


(A) Error voltage generator

(B) Variable capacitance control circuit

Fig. 17. Automatic frequency control circuit employed in CTC21 tuner.

install ALLIANCE Tenna-Rotor®...now



Profit now with world-famous Tenna-Rotors®.

You'll sell more than ever before. And they're twice as easy to sell!

In-store demonstrations sell on sight! Hook up a Tenna-Rotor . . . Every color set needs one . . . Then, watch their faces light up when you turn the dial and they see a beautiful color picture. Switch to black & white or FM Stereo. Same result: Tenna-Rotor pulls 'em in sharp, clear, bright and strong! **Use the color-TV delivery lag** to sweeten up **profits** with Tenna-Rotor sales, antenna and lead-in wiring jobs. Then, you'll be all set for fast, easy deliveries and installations.

Install the world famous Alliance Tenna-Rotor®

"TV's Better Color Getter"

The ALLIANCE Manufacturing Company, Inc.

(Subsidiary of Consolidated Electronics Industries Corp.) **ALLIANCE, OHIO**

Maker of GENIE® Garage Door Openers

Circle 2 on literature card

Subscription Prices: 1 year—$5.00, 2 years—$8.00, 3 years—$10.00, in the U. S. A., its possessions and Canada. All other foreign countries: 1 year—$6.00, 2 years—$10.00, 3 years—$13.00. Single copy 50¢; back copies 65¢

Indexed in Lectrodex.
Printed by the Waldemar Press Div.
of Howard W. Sams & Co., Inc.

A HOWARD W. SAMS PUBLICATION

PF Reporter™

PHOTOFACT

the magazine of electronic servicing

VOLUME 16, NO. 11 — NOVEMBER, 1966

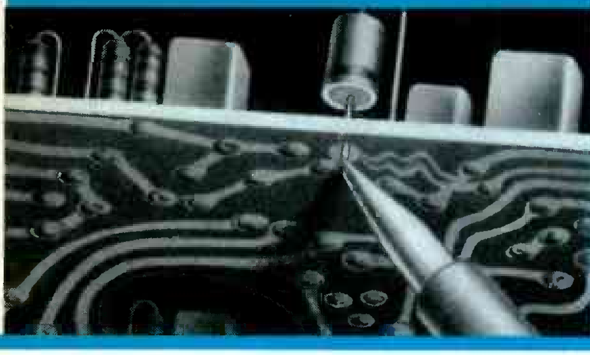
CONTENTS

About the Cover

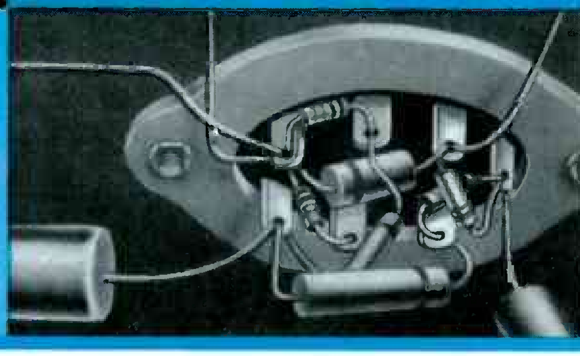
Five years ago this month, when our first annual color-TV issue was published, color television was relatively young, but promising. Since that time, even the most optimistic expectations have been realized in color broadcasting, sales, and servicing. This phenomenal growth has been particularly demanding of the servicing segment of the color TV industry. To answer the challenge of color servicing, the technician must keep abreast of the latest developments in circuit design and servicing techniques. The color oriented content of this issue, as illustrated by the cover, is directed toward this end.

Did you ever...

... lift a wire-lead component from a printed wiring board for testing?



... test or replace a capacitor or resistor on a crowded tube socket?



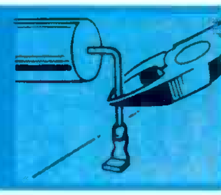
CUT YOUR TIME IN HALF with KWIKETTE* Soldering Aids ... the revolutionary connectors that practically let you do "in-circuit" component testing!

(six times actual size)

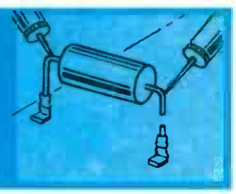
WIRE FLUX SOLDER

The KWIKETTE SOLDERING AID is not just another wire spring connector! It has a Copperweld wire inner core, an intermediate layer of flux, and an outer jacket of solder . . . *all you need is heat!* KWIKETTES are now being packed with Sprague Atom® Capacitors *at no extra cost to you!* Whenever you need tubular electrolytics, insist on pre-packaged Sprague Atoms from your parts distributor and you'll automatically get your KWIKETTE component connectors . . . the biggest boon to the service technician since the soldering gun!

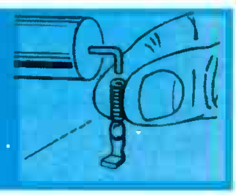
SNIP LEAD...



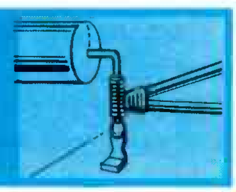
TEST...



SLIP ON KWIKETTE...



APPLY HEAT!



FREE TRIAL PACKAGE!

10 free KWIKETTE Soldering Aids are yours for the asking! Simply send your postcard request to KWIKETTE Center, Sprague Products Co., 105 Marshall Street, North Adams, Mass. 01247. Don't forget to include the name of your Sprague Distributor.

* trademark

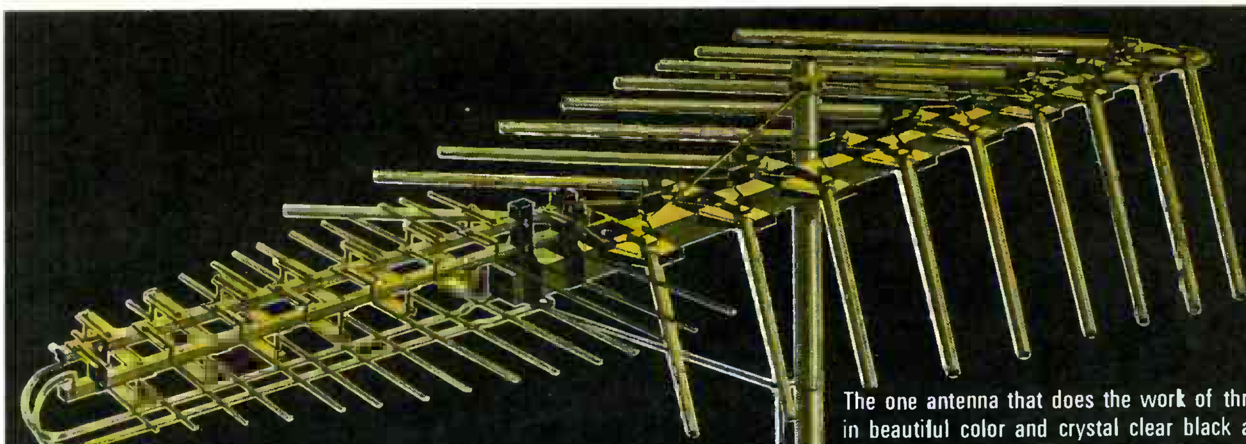
SPRAGUE®
THE MARK OF RELIABILITY

65-6107

WORLD'S LARGEST MANUFACTURER OF CAPACITORS

Circle 3 on literature card


SPRAGUE
85°C TVL 3805
20MF 475 WVDC
20MF 300 WVDC
40MF 25 WVDC
CAN COM NEG



The one antenna that does the work of three! Pulls in beautiful color and crystal clear black and white pictures on both UHF and VHF channels... plus the finest stereophonic and monophonic FM sound reproduction.

300-ohm models for normal reception areas from $18.50 to $59.95

75-ohm models for poor reception areas from $42.65 to $72.10

FINCO ALL-BAND UHF-VHF-FM ANTENNA
75 OHM Model CX-UVF-24 $72.10 List

FINCO ALL-BAND UHF-VHF-FM ANTENNA
300 OHM Model UVF-24 $59.95 List

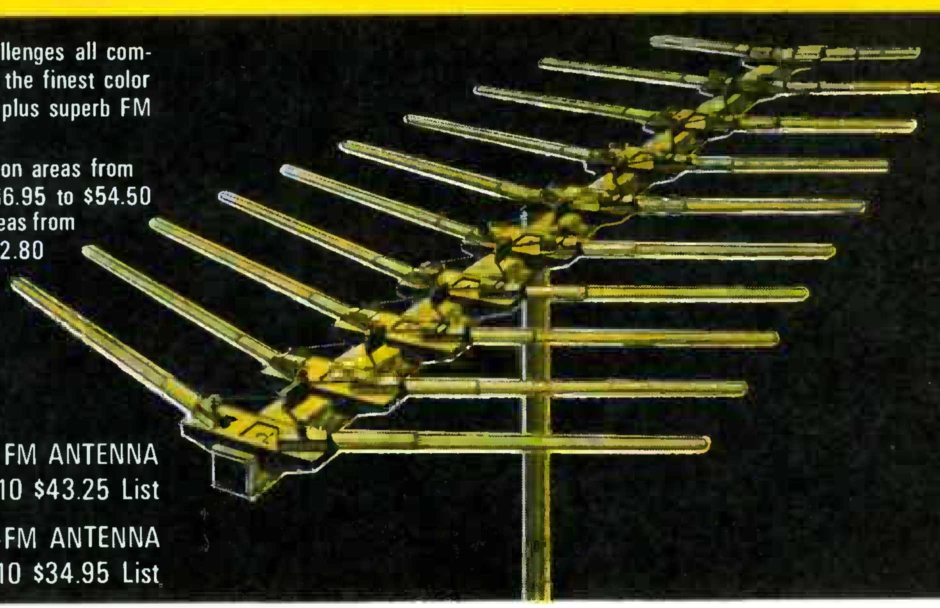
FINCO

introduces / 75-ohm COLOR VE-LOG ANTENNAS FOR UHF-VHF-FM RECEPTION

Finco's Swept-Element Antenna challenges all competition. Its unique design assures the finest color and black and white TV reception—plus superb FM and FM Stereo tone quality.

300-ohm models for normal reception areas from $16.95 to $54.50

75-ohm models for poor reception areas from $18.55 to $62.80



FINCO SWEPT-ELEMENT VHF-FM ANTENNA
75 OHM Model CXVL-10 $43.25 List

FINCO SWEPT-ELEMENT VHF-FM ANTENNA
300 OHM Model VL-10 $34.95 List

FREE! ALL FINCO CX-VL, CX-UVF AND UVF ANTENNAS COME WITH A FREE INDOOR SET-MOUNTED TRANSFORMER, VHF-UHF TRANSFORMER SPLITTER OR VHF-UHF SPLITTER.

MAKER OF THE WORLD FAMOUS COLOR FINCO BLACK / WHITE ANTENNA COMPONENTS AND ACCESSORIES

THE FINNEY COMPANY

34 WEST INTERSTATE STREET, DEPT. 310 BEDFORD, OHIO

Circle 6 on literature card

The Electronic Scanner

news of the servicing industry

Money Matters

Skyrocketing interest rates and the battle for deposits have apparently forced independent business proprietors to seek short term operating loans from sources other than their banks.

This is indicated in the most recent responses to the continuing year long field survey conducted by the **National Federation of Independent Business.**

While banks are still the chief source of financing, apparently the banks are not able to make available all the capital needed. The results of the survey, comprising some 6,000 respondents, show that approximately 49% report a bigger business volume than last year. In this category 100% report they depend on their local bank for their short term loan needs, but in addition, 60% also report they are also being forced to seek additional financial help from finance companies, and 27% report also seeking such aid from their suppliers.

Among this group, which reports higher volume than last year, the principal needs for capital appear to be for the purpose of carrying heavier inventory investments and heavier investment in accounts receivable.

Perhaps reflecting higher costs of goods, 59% who secure aid from banks, finance companies, and suppliers, have had to increase inventory investment, while 62% have had to expand investment in accounts receivable.

Sales

Continued improvement in sales and earnings for the first three months ended August 31 has been reported by **Curtis Mathes Manufacturing Company.** Net income for the period reached a record high of $1,073,043, up from $222,296 last year. Sales climbed to a high of $16,067,730 as compared with $6,934,585 a year ago.

According to President Charles Mathes, solid-state radios and tape recorders are now in full production and color television production capabilities have been increased "substantially."

Record six-month sales and 29% increase in earnings were achieved by **Dynascan Corporation.** Sales for the first-half climbed to a new high of $2,236,000, a gain of 16% over 1965 first-half sales of $1,925,000. Earnings rose 29% to $102,000, compared to 1965 first-half profits of $79,000. (The 1965 figures have been adjusted to reflect the sale on January 1, 1966 of the Mark Products Division.)

Six months earnings of **Viking Industries, Inc.,** increased 114% on a 42% rise in sales.

Sales totaled $8,075,423, against $5,685,351 in the like six-months period of 1965. Earnings after taxes amounted to $557,529, compared with $260,313 (adjusted for the 3 for 2 split in June, 1966). Viking Industries is a manufacturer of CATV cable and electronic parts and operates CATV systems.

Expansions

Aerovox Corporation announced plans to build a new 83,000 square foot facility at Moncks Corner, South Carolina for the manufacture of electrolytic capacitors and other precision electronic components.

To be built at an estimated cost of $2 million, the new Aerovox manufacturing complex will consist of electronic, chemical, and light manufacturing facilities, a clean room for the fabrication of high-reliability components, and 8,000 square feet of office space.

Start of a five-year, multi-million-dollar expansion of its resistor and other electronic component production facilities at Boone, N. C., was announced by **IRC, Inc.**

IRC will spend $1,230,000 on the first phase of the program this Fall. About half of the initial appropriation will go for new equipment and the balance for a 31,000-square-foot addition to be completed late next Spring.

IRC's Boone Division manufactures resistors, selenium rectifiers and diodes, and resistance specialists.

Sylvania Electric Products Inc., announced plans for a 23,000-square-foot addition to its Semiconductor Division plant in Hillsboro, N. C. Richard M. Osgood, Vice President and division General Manager, said the additional facilities will be used for manufacturing of germanium and silicon diodes and rectifiers and for engineering purposes. The present Hillsboro facility contains 55,000 square feet of space.

This is the second major expansion announced by the division in less than two months. The first expansion involved the construction of a 30,000-square-foot building adjacent to the division's headquarters at Woburn, Mass. In addition to the Hillsboro and Woburn plants, the division has a 26,800-square-foot plant at Wakefield, Mass. The total division employment exceeds 2,100.

Mergers and Acquisitions

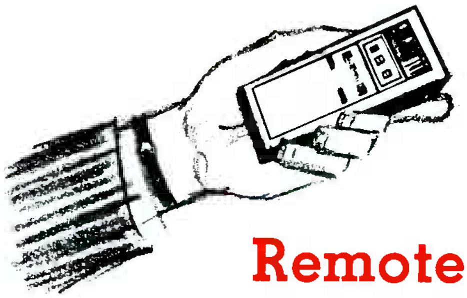
General Instrument Corporation announced completion of the acquisition of Signalite, Inc., New Jersey manufacturer of electrical and electronic circuit components. The Signalite operations will be incorporated into the General Instrument Semiconductor Products Group, under present Signalite management. General Instrument exchanged approximately 111,000 shares of its common stock for all of the common stock of Signalite, a privately held firm.

Signalite produces gas discharge electron tubes for varied electronic applications such as controlling rocket ignition, protecting nuclear power systems, monitoring communications equipment, etc. It also is one of the principal producers of glow lamps used in electronic circuits and in appliances and instruments as indicators and pilot lights. Its electron tube division was acquired from The Bendix Corporation in 1965.

Oak Electro/Netics Corp. has entered into a purchase agreement to acquire Hart Mfg. Corp., a tool and die manufacturer and metal fabricating concern with current sales at an annual rate of $1.2 million. Under terms of the agreement, the purchase price will be approximately $450,000.

Clarostat Manufacturing Company, Inc. announced that the acquisition of all the outstanding stock of Solar Manufacturing Corporation has been consummated. Clarostat has issued 81,550 shares of its common stock on a share for share basis for all of the outstanding stock of Solar. Solar is engaged in the manufacture of ceramic capacitors at Los Angeles, California.

• *Please turn to page 62*



Remote Control

by Robert F. Heaton

Servicing television remote control circuits requires the same approach as for other electronics apparatus—a basic understanding of the purpose and operation of a given system. Hence, valuable time is often lost in removing the "forest" presented by a (simplified?) schematic of the system—especially when multiple functions are complicated by various switches and relays. Granted then, the most feasible method is to bypass the trees and go directly to the roots by careful examination of the *end result* of the functions the remote system is to actuate.

All television remote control systems have the same general purpose—that of causing an electromechanical action via relays, switches, and motors. Of course, different functions are accomplished in various instruments, depending on the initial design.

The majority of black-and-white remote controlled instruments for example, include provisions to *change channels, adjust volume,* and *turn power on or off.*

Remote-equipped color television instruments usually have a more complex system: functions for changing *hue* (tint), and *color,* in addition to volume and channel, are the normal complement.

The Complete System

The block diagram in Fig. 1 illustrates a typical remote control system with all the "puff" removed. We have a transmitter, receiver, and our section for concentration—the control circuits.

The amplifier stages must have sufficient gain to build up the small signal from the transmitter. Usually, these stages have no tuned circuits, accepting and amplifying all frequencies in a particular band.

Following the amplifier stages is a single tuned circuit, having a wide passband for all the system's operating frequencies. Next are the individual tuned circuits for the particular functions desired.

The basic arrangement might appear as in Fig. 2. A black-and-white television with three functions is illustrated. T1 is tuned to narrow the passband, passing frequencies from 35.75 kHz to 43.25 kHz. The individual coils at the transistor inputs are then tuned to a particular frequency. Notice that all three relay control circuits are identical—this is usually the accepted design (in color or monochrome remotes).

It can be seen thus far, that any

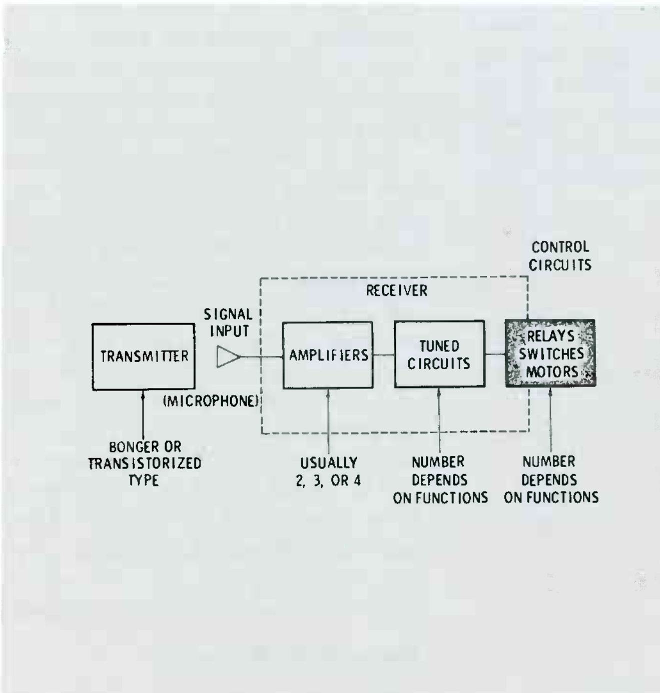


Fig. 1. A typical remote control system.

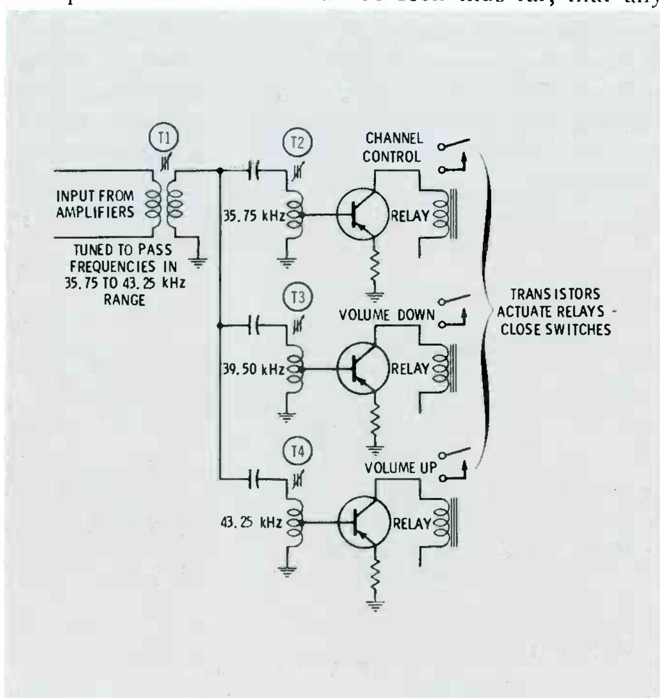


Fig. 2. Simplified schematic of a three-function remote control.

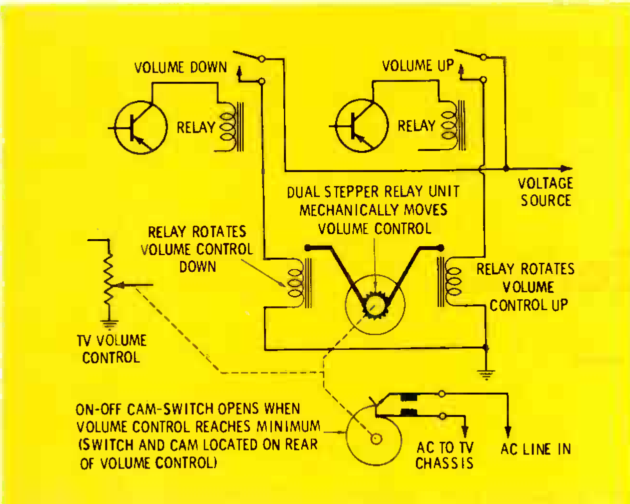


Fig. 3. Electromechanical actions of a single-direction stepper.

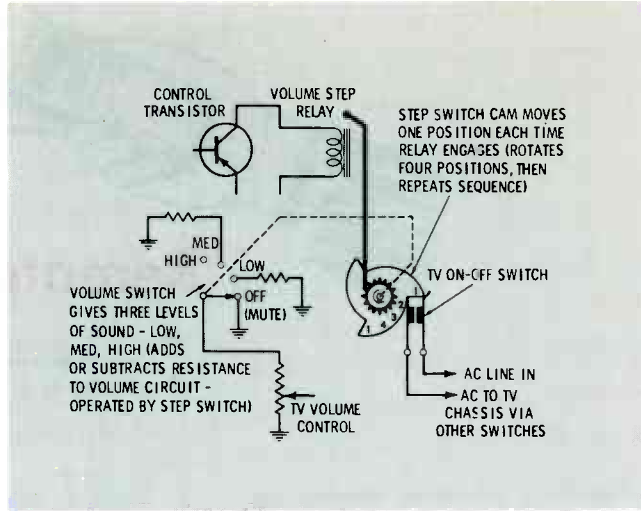


Fig. 4. Details of a double-direction stepper system.

defect that causes all functions to be inoperative will normally be found in the transmitter, amplifier, or their power supply circuits. An inoperative single function—no volume up for example—is logically a defect in that particular function-control circuit.

Simple Interconnection Control Circuits

Servicing some of these circuits in modern television design can become trying. The interconnection circuits bring together the electromechanical action for which the complete remote system is built. They include such units as: motors, stepper relays, bistable relays, cams, single and multiple switches, and tuner and motor shafts. Naturally, all these components are located on or around the tuner, volume control, etc. This sounds complicated, and often is—especially when the combination of mechanical and electrical actions must happen in a given sequence.

However, some relief is realized, for most television remote controls all have the same basic functions to perform—channel change, volume, on-off, color, tint, etc. Hence, once you become familiar with the sequence in a typical system, the odd ones can be understood easily by looking for the *similar* functions, switches, or circuits.

On-Off

Several manufacturers use a stepper relay system to change volume level. Often, the on-off volume function operates in conjunction with this relay. Fig. 3 illustrates the electromechanical operation of a single-direction stepper system.

This system uses a one-shot "bonger" transmitter. Each time the transmitter button (volume) is depressed, the transistor conducts, energizing the relay. The relay "rod" will mechanically engage the gear on the cam, and move it one position each time the relay is energized. The switch cam has four positions—off, low, medium, and high volume; this sequence then repeats itself.

The only purpose for the switch cam is to open or close the on-off switch, completing the AC power circuit to the TV chassis. In all positions other than off (number 1, as shown in Fig. 3), the switch leaf rides on the raised portion of the cam. In positions 2, 3, and 4, the switch contacts are closed, applying power to the TV chassis.

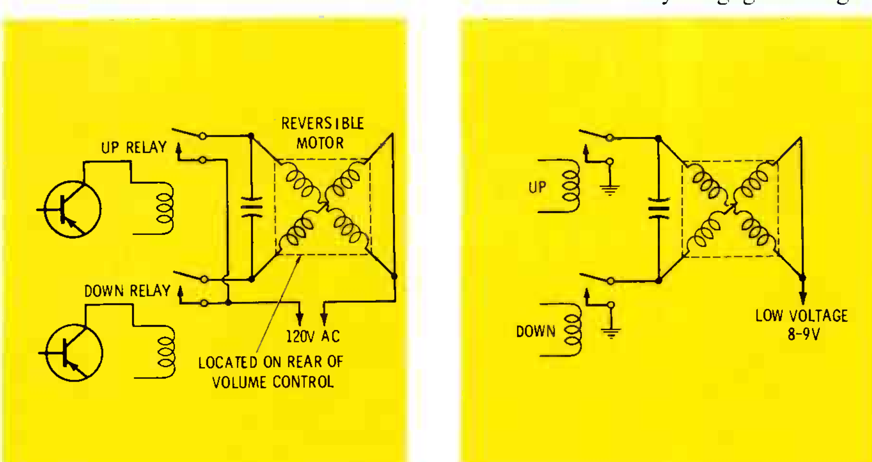
The volume switch (four positions) operates in conjunction with and in the same sequence as the stepper cam. In the off position, the high side of the volume control is grounded—muting the sound. Positions 2, 3, and 4 change the resistance shunting the volume control, giving low, medium, or high sound.

Fig. 4 illustrates a double-direction stepper system. Here, the action is similar to that above—up to a point. In this remote, the volume is changed by mechanically moving the control (in small steps) up or down. A dual-winding relay controls the direction of steps (clockwise or counterclockwise), depending upon which transistor (and thus stepper relay winding) energizes.

The on-off function is performed by a cam located on the rear of the assembly. When the volume control reaches minimum, the switch opens, turning off the TV chassis.

Motorized On-Off-Volume

A typical *motorized* volume system is shown in Figs. 5A and 5B.



(A) Line voltage. (B) Low voltage.

Fig. 5. Motorized volume systems.

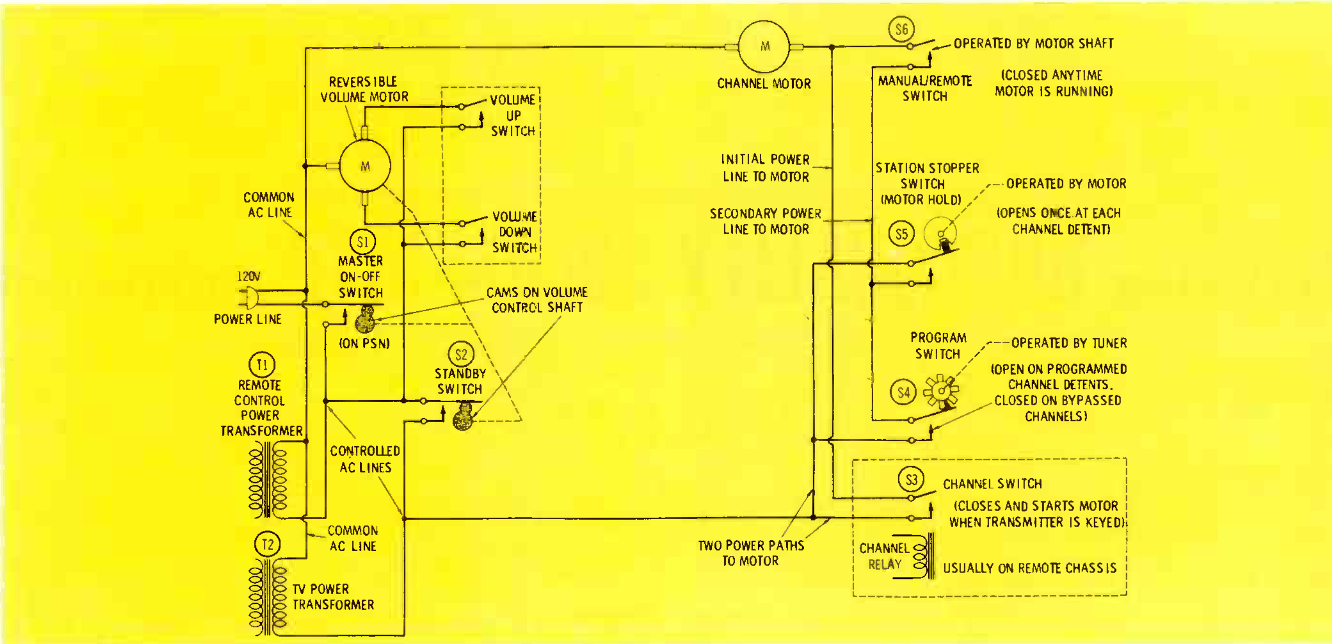


Fig. 6. A remote system with on-off,

This arrangement (used in many color receivers) should be easily understood and fast to troubleshoot.

Two transistor relays—volume up, volume down—and a reversible motor are the major components. Caution: Make sure the proper motor voltage is used if a motor is tested individually. The schematic diagram for a particular motor should be consulted first. *Motors may operate on 120VAC; others are low voltage types, requiring 8 to 9 volts.* Fig. 5A gives the 120V system; Fig. 5B gives the low voltage type. Notice in Fig. 5B that one side of the relay switch returns to ground.

In this circuit, the up or down relay switch completes the power path for one set of the reversible motor windings. If either switch is closed, the motor will run, mechanically turning the volume control. When the control reaches minimum volume, a cam engages the on-off switch, removing power to the TV chassis.

Complex Remote Interconnection Circuits

One of the more elaborate color remote interconnections for the on-off-volume and channel functions is shown in Fig. 6. This system has a number of switches typical of those used in other remote controls. Let's become acquainted with the major components shown in the diagram, their part in the overall system, and their normal sequence of operation. Along the way, we can build a logical list for other remotes, by referring to Fig. 7. The typical components are listed, and their usual purpose is given. We'll explain their operation, using the circuit in Fig. 6.

This remote system, used in many color television receivers, has several important particulars. The common side of the AC line connects to one side of the remote and TV power transformers and the channel and volume control motors. The AC return line (called controlled) is completed to the above components via a network of various switches. Let's follow the sequence of operation, noting the purpose of each component. We'll apply power, operate each switch, change channels, and change volume.

Power and Volume

The master on-off switch (S1, operated by a cam on the volume control) is initially closed by manually turning the volume control. With the switch in the on position, as shown in the schematic, an AC power path is completed to the remote power transformer (T1) and to one side of the volume up-down switches. (Note at this time, power

• *Please turn to page 60*

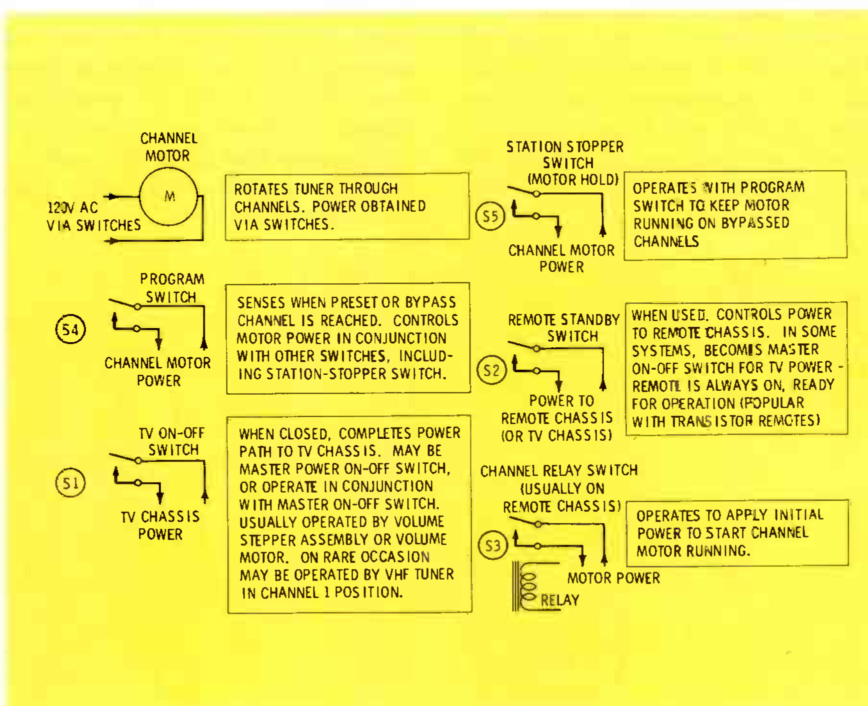


Fig. 7. System components and functions.

servicing HIGH-QUALITY SOLID-STATE equipment

by Allan F. Kinckiner

It was demonstrated in Part I of this article (September PF REPORTER) that the most effective way to reduce troubleshooting time is to condense various sections of multi-function solid-state equipment into blocks and apply the "logical suspicion" approach in localizing trouble. As a supplement to this method, it was recommended that the schematics covering the specific equipment be studied to determine the related functions of the various receiver sections and to aid in isolating the trouble.

But what if the schematic for a particular chassis is not available? This is the situation that the author has encountered many times when the shop was inundated by receivers and troubles. The following continuation of specific cases will deal with substitute aids for schematics, and will also discuss audio amplifier troubles.

Case No. 4: Magnavox R-205, R-208-08, etc.

Complaint: FM Troubles.

The first set had no FM and a defective 2nd FM-IF transistor. The second set, with no FM, had a defective FM mixer transistor. The third set, with weak FM, had a defective FM-RF amplifier transistor. Since no schematic was available at the time, a skeletal diagram (Fig. 7) was drawn after the third set was worked on. Voltages shown were those found on the third set: and although they are slightly different from those found in subsequent models of these sets, they show a relationship that holds for many individual sets. For example, some later sets have collector supply voltages about two volts less, with emitter and base voltages low by about the same percentage.

One condition found in the R-205 chassis was weak FM. A study showed that the condition prevailed only in chassis using a nontapped coil at the FM-RF amplifier collector. Your local Magnavox parts distributor can supply you with information and a coil to improve these receivers.

In addition to the skeletonized schematic of Fig. 7, which pertains only to one model of one make and which was drawn up primarily because the receiver's schematic was not then available, a chart was also prepared. This chart, shown in Fig. 8, pertains to models that were passing through our shop in fairly large

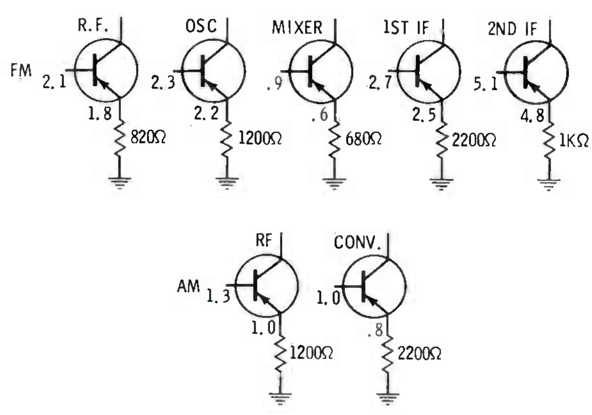


Fig. 7. Partial schematic of Magnavox R-205 used in place of full schematic.

Mfr. & Chassis	FM RF	FM Osc	FM MIX	1ST IF	2ND IF	3RD IF	AM RF	AM Conv
ADMIRAL 24A3	.2V 3.2M	.2V .4M	.2V .6M	.26V .7M	.3V 2.5M	.2V 2.6M	NA	.2V .5M
GE TU376	.25 1.4	.1 1.4	.1 .6	.27 1.7	.25 1.7	.26 1.8		.4 .4
MAGNAVOX R-204-084	.3 2.2	.1 1.8	.3 .88	.2 1.5	.3 4.8	NA	.3 .84	.2 .41
PHILCO N255T	.2 .95	.2 1.6	.1 .6	.1 .47	.3 3	.6 1.6	NA	.7 .83
RCA R-1218	.4 3	NA	.1 1.6	.3 2.7	.25 2.2	.15 2.4	.4 1.4	.1 .8

Fig. 8. Base-emitter bias and emitter current in RF—IF stages of five models.

volume. Even though schematics are available for these sets, referring to this chart has proven to be a time-saver in many instances. Note that each block contains only two values; the one in the circle is the bias (in volts) between base and emitter. The other value is the current of the transistor (in milliamperes), obtained by dividing the voltage drop across the emitter resistor by its resistance. These values are the most informative in determining the condition of a transistor; and on many occasions when this chart was used along with a correct logical suspicion, troubleshooting was cut to the time it took to locate and compare these values on the suspected transistor.

No similar chart was prepared for the multiplex stages for several reasons: Very little trouble has been experienced in this section; the voltages on transistors in this section vary more than they do in the stages covered in Fig. 8; and finally a normal signal applied to the input of a multiplex system is large enough to trace easily with a scope. Also because of this last reason, no similar chart was prepared for the audio amplifier stages.

Audio Amplifier Troubles

In addition to the pre-audio section troubles, the audio amplifier stages also contribute to the income of the service shops. Some troubles respond to troubleshooting procedures that have become routine for handling all types of service jobs; occasionally, some very unorthodox troubleshooting techniques have to be employed. One convenient aspect of servicing two-channel stereo systems is that the voltages in the defective channel can be checked immediately against voltages at identical points in the normal working channel. With some complaints

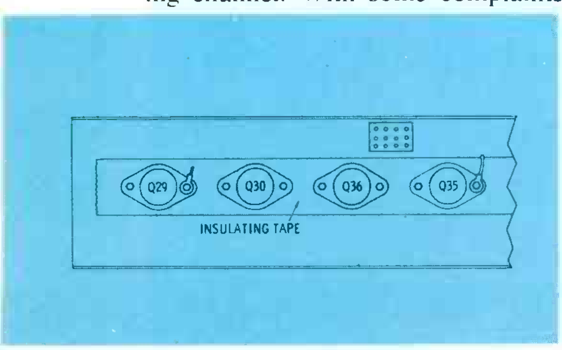


Fig. 10. Power transistor mounting.

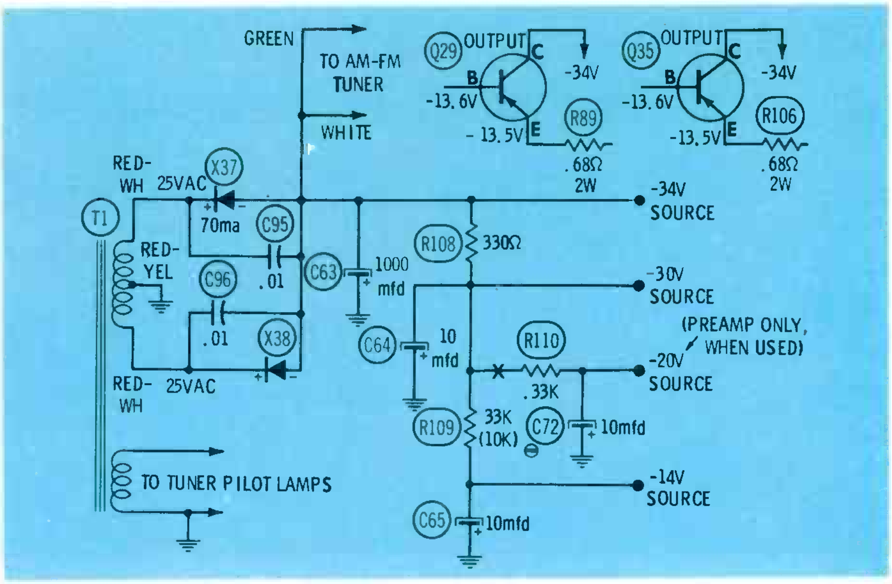


Fig. 9. Circuits in GE Chassis T-15.

it is even necessary to interchange corresponding transistors in the two channels. Caution: before putting a suspected transistor removed from one channel into the good channel make sure to test it for leakage or shorted conditions, and never turn on equipment with one transistor out of the circuit. Ignoring these cautions can, in some circuits, cause a chain reaction that will destroy other good transistors in the equipment. I am reasonably sure that you will find troubleshooting and repairing some of the late solid-state audio amplifiers to be considerably more difficult than correcting troubles in the circuits prior to the detectors.

Specific Cases

Case No. 1: General Electric amplifier chassis T-15.

Complaint: set dead.

This is the companion chassis of the TU-376-1 previously discussed. After pulling the chassis from its cabinet, it was quickly determined that the fuse was blown. A dead short was found to exist from the minus 34-volt source to ground. Disconnecting the pin and jack connections to the tuner failed to clear the short, definitely indicating that it was in the amplifier chassis. The fact, that the −34 volts was applied directly to collectors of Q29 and Q35 (Fig. 9) suggested disconnecting these collector leads. When the lead to the collector of Q35 was clipped it was found that the case of Q35 was grounding through the insulating tape (Fig. 10). Dismounting Q35 revealed a metal chip imbedded in the tape, but instead of just clearing the condition, a portion of the tape was cut out and replaced with the mica insulater usually employed for mounting this type of transistor.

Case No. 2: Magnavox Chassis R-204-12

Complaint: Intermittent high-pitched buzz.

With the set in the cabinet the buzz occurred about ten minutes after turn-on, lasted about two minutes, cleared up for ten minutes, and then cycled this way continually. On the bench it would not occur unless the chassis was covered and allowed to heat. By hooking the scope to alternate channels, it was determined which channel was acting up and the signal shown in Fig. 11 was traced. The frequency of this signal is approximately 400 Hz, but because of the sharp edges it sounded like a much higher frequency. A short study of the circuit suggested disconnecting the collector lead (a wrap-around connection) to Q16 in Fig. 13. The

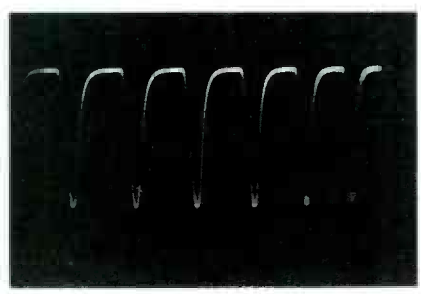


Fig. 11. Odd buzz signal scoped in Magnavox R-204-12.

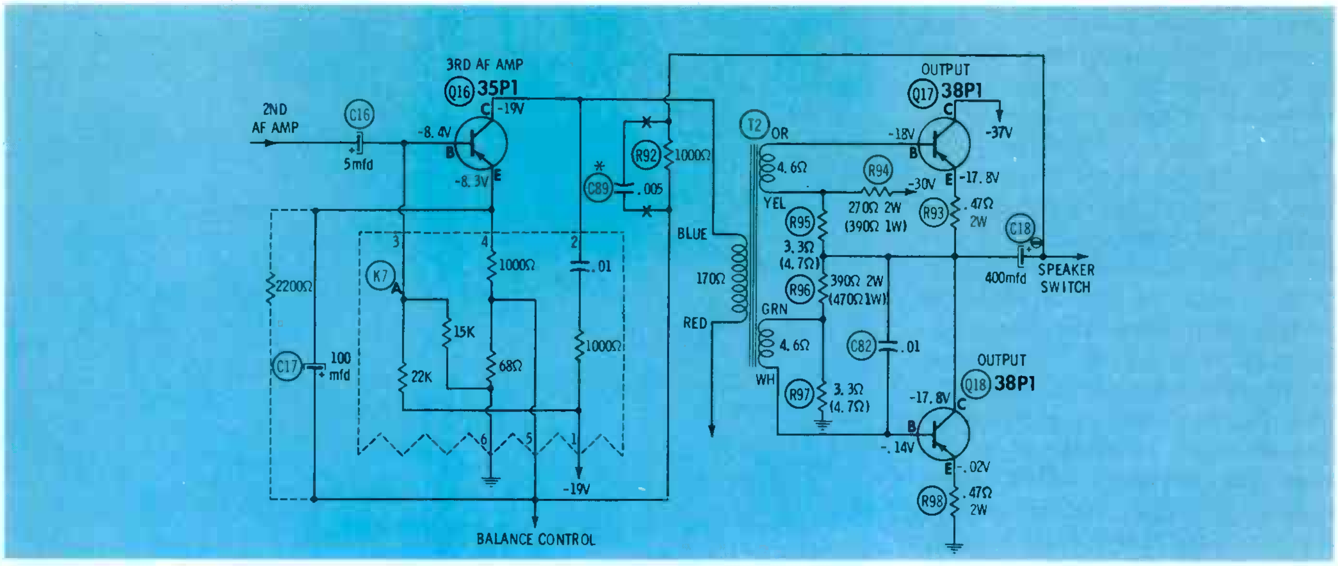


Fig. 12. Troublesome circuit causes buzz.

next time the buzz occurred, this lead was disconnected; the noise increased in intensity because feedback was removed, but the important point is that it proved conclusively that the buzz was generated in the output stages. Interchanging the output transistors of the two channels caused the buzz to occur in the other channel, proving one of the pair of output transistors to be the troublemaker. When a new pair was installed the condition was completely cleared up. It is recommended that the output transistors be replaced in pairs if replacing is necessary.

Case No. 3: Admiral Stereo Chassis 24A3.

Complaint: Hiss in right channel.

The complaint on the job ticket of this set was listed as transistor hiss, and that is just how it sounded. What it looked like on the scope is shown in Fig. 13. A check of the schematic in Fig. 14, provided clues as to what troubleshooting procedure to use. The AM amplifier stages prior to the driver are capacitance coupled. By connecting the scope probe at the output of the right channel and temporarily disconnecting the coupling capacitors, starting with the last one and working toward the first stage, it was simple to pinpoint the origin of the hiss. C26 was disconnected. This action killed the hiss; but with C25 disconnected the hiss increased in volume because the loading of the base of Q19 by R1A and R2A was removed. This definitely indicated the hiss to be originating in the circuit of Q19; that is, between C25 and C26. Q19 was replaced without result, indicating the probability of a noisy resistor. Resistors R97, R98 and R100, the most logical noise makers, were changed. This also failed to effect a cure, but when R99 was replaced the hiss disappeared. R97, R98, and R100 were the most logical noise makers for two reasons: First because of their ohmic value (a high value resistor is more prone to become noisy) and second, because these resistors carry the most current in this circuit. In fact, it was a mild surprise to find that R99 was the culprit.

Conclusion

A quick and logical method to service high quality solid-state receviers has been presented in this text. First, study the receiver's schematic. Second, break the stages down in blocks as shown in Fig. 3. Third, use the logical-suspicion technique and when necessary employ the scope. By following these directions it is comparatively as easy to troubleshoot these receivers as it is to troubleshoot and repair vacuum tube equipment of similar types. ▲

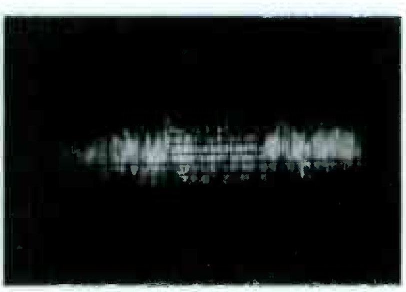


Fig. 13. Hiss in right channel.

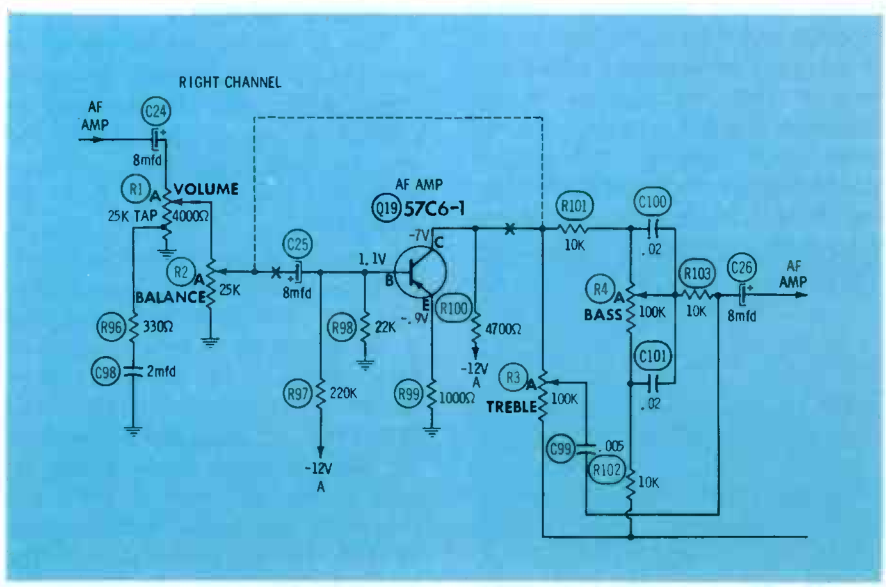


Fig. 14. Noisy resistor generated hiss.

Pay TV

by Leo G. Sands

Pay TV is inevitable and it will be here soon. The FCC has proposed rules governing "Subscription Television," which, when adopted, will make pay TV a national reality. It's been a long time coming because the road was often blocked. In California, the movie industry convinced the voters that they should ban pay TV, which they did. But the courts ruled that the ban was unconstitutional, and it was lifted.

Color TV was a long time on the way too. But, it's here now in such a big way that if you're in the TV service business and don't know how to service color, you had better find out fast if you want to stay in the business. Pay TV will be with us soon too. Now is the time to find out what it is and how you can expect to participate in it.

There are two kinds of pay TV. When transmitted on a closed circuit basis through cable, it is known as "Pay TV." When transmitted over the air, the FCC calls it STV (Subscription TV).

So what does all of this mean to the service technician? It means more business. Someone must install and service pay TV attachments and the STV unscramblers required by every STV subscriber. And, there will be a lot of unscramblers in service when STV gets going.

To get ready to service pay TV and STV equipment, the service technician should get familiar with pay TV and STV now, what it is, how it works and how to gear up for the pay TV and STV explosion. He must understand how unscramblers work and later, how to service them. At this time, actual STV decoder circuit information is secret and there will be more than one type of unscrambler.

So what are pay TV and STV? As we all know, all TV programs are paid for by advertisers except public service and educational programs. Pay TV and STV on the other hand, will not be sponsored by advertisers. Instead, the viewer pays the equivalent of an "admission ticket" for the privilege of watching a commercial-free program.

Pay TV and STV programs will include newly released movies, live or taped stage shows, sporting events, and specially produced TV shows.

The proposed STV rules authorize its transmission on a regular basis. Any television station or holder of or applicant for a TV station license may be authorized to engage in pay TV if the FCC concludes that such operation is in the public interest.

The broadcasting of commercials during STV broadcasts would be prohibited except for touting other STV programs before and after an STV program.

In an area served by five or more TV stations, the rules would impose no limitations on the number of daily hours during which STV programs could be broadcast. Where there are fewer TV stations, the hours of prime time STV broadcasting are limited.

The kind of equipment to be used by the station for scrambling STV programs is not specified in the proposed rules, but it must be "type approved" by the FCC. At present,

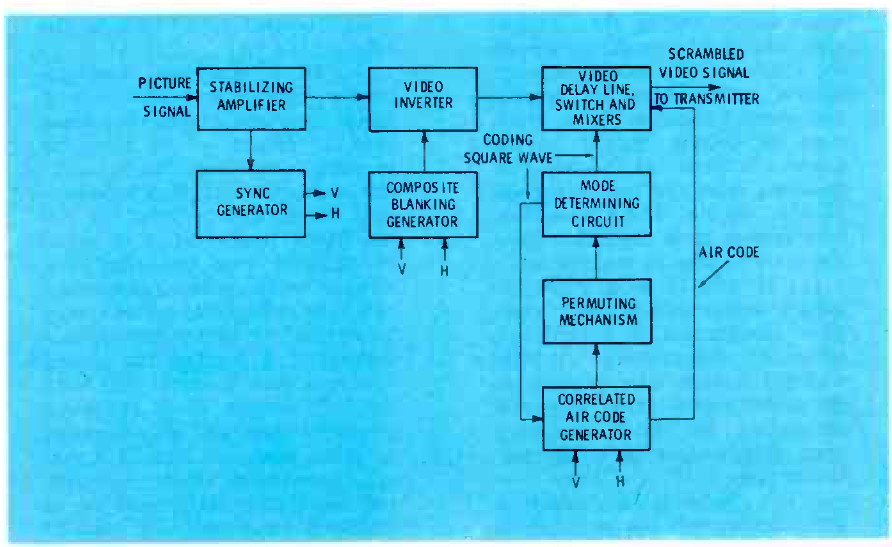


Fig. 1. Simplified diagram of picture coding system.

the only unscrambler in commercial use is the one developed by Zenith for use in its Phonevision STV system.

Picture Scrambling

Phonevision employs a scrambling technique in which each picture field is separated into horizontal seven-line strips with alternate strips shifted right or left. The vertical relationships of the strips are shifted from field to field by an electronic square wave switch. There are 14 possible phase positions of the strips, and any field may be transmitted in any of the 14 modes. Transitions from mode to mode are made during the vertical blanking interval under the control of decoding information during that period.

In essence, scrambling is achieved by shifting of the phase or delaying the lines of the video signal with respect to sync pulses.

Looking at the screen of a TV receiver, the viewer sees a confusing and unintelligible picture, made even more so by the persistence of human vision. When desired, picture intelligibility may be further impaired by transmitting the picture as a negative with black and white inverted.

The composite video signal (uncoded program) from a studio, video tape playback machine, or flying spot scanner is fed through a stabilizing amplifier to the video coding system, as shown in Fig. 1, and then as a coded video signal to the TV transmitter or network. The scrambled over-the-air signal includes "Air Code" pulses without which the TV receiver decoders will not decode the scrambling.

Picture Unscrambling

The TV service technician is, of course, primarily concerned with the equipment used by STV viewers,

Proposed Additions To Part 73, FCC Rules and Regulations

§ 73.641 Definitions

(a) *Subscription television.* A system whereby subscription television broadcast programs are transmitted and received.

(b) *Subscription television broadcast program.* A television broadcast program intended to be received in intelligible form by members of the public only for a fee or charge.

§ 73.642 Licensing policies.

(a) Subscription television service may be provided only upon specific authorization therefor by the Commission. Such authorization will be issued only to:

(1) The licensee of a television broadcast station;

(2) The holder of a construction permit for a new television broadcast station; or

(3) An applicant for a construction permit for a new television broadcast station.

(b) Application for such authorizations shall be made in the manner and form prescribed by the Commission. If the Commission, upon consideration of such application finds that the public interest, convenience, and necessity would be served by the granting thereof, it will grant such application. In the event it is unable to make such a finding, the Commission will then formally designate the application for subscription television authorization for hearing and proceed pursuant to the provisions of section 309(c) of the Communications Act and the Commission's rules and regulations applicable thereto. The Commission may impose such conditions upon the grant as may be appropriate.

(c) Holders of subscription television authorizations shall complete construction of subscription television transmitting facilities within 8 months after issuance of the authorization unless otherwise determined by the Commission upon proper showing in any particular case.

(d) A subscription television authorization will not be issued or renewed for a period longer than the regular license broadcast time that may be devoted to subscription broadcasting.

(e) Except as they may be otherwise waived by the Commission in authorizations issued hereunder, the rules applicable to regular television broadcast stations will be applicable to subscription television operations.

§ 73.643 General operating requirements.

(a) No commercial advertising announcements shall be carried during subscription television operations except for promotion of subscription television broadcast programs before and after such programs.

(b) Charges, terms, and conditions of service to subscribers shall be applied uniformly: *Provided, however,* That subscribers may be divided into reasonable classifications approved by the Commission, and the imposition of different sets of terms and conditions may be applied to subscribers in different classifications.

(c) Any television broadcast station licensee or permittee authorized to broadcast subscription programs shall broadcast, in addition to its subscription broadcasts, at least the minimum hours of programs required by § 73.651 of the rules.

(d) If a television broadcast station supplies the only Grade A signal to a community, not more than 15 percent of its nonprime broadcast time (including subscription and nonsubscription broadcast time during that period), and not more than 50 percent of its prime broadcasting time (including subscription and nonsubscription broadcast time during that period), may be devoted to subscription broadcasting; if it supplies the second or third Grade A signal, not more than 25 percent of its nonprime broadcast time, and 60 percent of its prime broadcast time; if it supplies the fourth Grade A signal, not more than 50 percent of its nonprime broadcast time, and 75 percent of its prime broacast time; and if it is one of five or more stations supplying a Grade A signal to the community, there is no limitation to the amount of period of the applicant's television broadcast authorization.

(e) No subscription television authorization shall be granted to a television broadcast station licensee or permittee, or to an applicant for a construction permit for such a station, having any contract, arrangement or understanding, express or implied, which:

(1) Prevents it from rejecting or refusing any subscription television broadcast program which it reasonably believes to be unsatisfactory or unsuitable or contrary to the public interest; or substituting a subscription or conventional program which in its opinion is of greater local or national importance; or

(2) Delegates to any other person the right to schedule the hours of transmission of subscription programs: *Provided, however,* That this rule shall not prevent a licensee, permittee, or applicant from entering into an agreement or arrangement whereby it agrees to schedule a specific subscription television broadcast program at a specific time; or

(3) Prevents it from making a free choice of subscription programs, whatever their source; or

(4) Deprives it of the right of ultimate decision concerning the maximum amount of any subscription program charge or fee.

§ 73.644 Equipment and technical operating requirements.

(a) Subscription television equipment must be approved in advance by the Commission pursuant to the "type approval" and "type acceptance" procedures now established by Part 2, Subpart F — Equipment Type Approval and Type Acceptance — of the Commission's rules and regulations.

Additional proposed rules concerning equipment and technical operating requirements will be announced at a later date.

[F.R. Doc. 66—3327; Filed, Mar. 29, 1966; 8:45 a.m.]

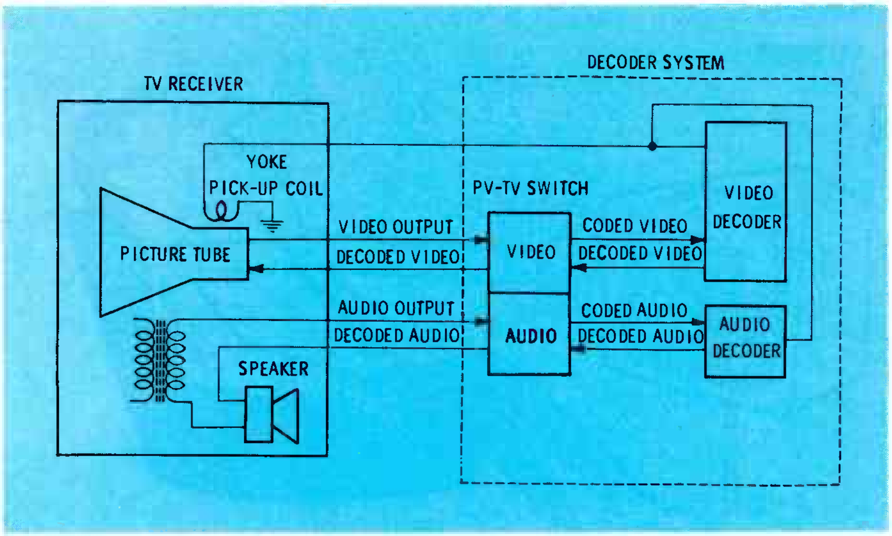


Fig. 2. TV set and decoder connections.

which consist of a decoder and a TV set. Different types of decoders are required for black-and-white and color TV sets. The Phonevision decoder is connected to the TV set through simple taps and an inductive pickup, as shown in Fig. 2. When the decoder's PV-TV switch is in the "TV" position, the TV set may be used for normal receiving.

The video section of the decoder consists of the PV-TV switch, video inverter, video decoder, and associated timing and logic circuits as shown in the block diagram, Fig. 3. The function of the decoder is to delay the lines that were not phase shifted or delayed before transmission and vice versa.

The scrambled video signal is picked up at the grid or cathode of the TV receiver picture tube and fed to the decoder. The unscrambled video signal from the decoder is fed back to the receiver picture tube. The horizontal sync signal, required by the decoder, is picked up inductively from the picture tube's horizontal yoke.

From the PV-TV switch, the coded signal is fed to a phase splitter which yields two signals of equal amplitude but of opposing polarity. The inverting switch enables selection of either a normal or inverted (negative) picture signal, depending upon which type of signal is being broadcast. The phase splitter also feeds a sync pulse separator which yields the required vertical sync pulse for generating blanking and gating pulses from the vertical blocking oscillator.

The video signal, as selected by the inverting switch, contains the air code signals which are tone bursts within the individual line-trace intervals of the post-equalizing portion of the vertical retrace interval, and which are fed to the air code burst separator. The air code bursts are fed to filters which pass or reject air code bursts, depending upon their frequencies.

The separated air code bursts are fed through a permuting switching mechanism to the mode determining circuit. It generates a square wave decoding signal which may assume any of 14 phase conditions as determined by the air code bursts.

The square wave is fed to the video decoder which alternately activates its video delay line to compensate for the presence or absence of delay of lines during transmission.

The Sound Channel

At the program source, the audio signal is fed to a sound coder where it is displaced 2625 cycles upward and passed through a pre-emphasis stage, as required for FM.

The Phonevision decoder contains both the video and audio decoders. The coded audio signal is decoded by heterodyning it downward in frequency by an amount equal to the upward shift introduced at the transmission point.

The audio section of the decoder, as shown in Fig. 2, is inserted in series with the TV speaker.

Since mysterious electronic devices are often referred to as "black boxes," the decoder, at this stage of the STV game, can be considered as a black box. It contains an array of relatively simple electronic circuits whose characteristics and interconnections are still confidential.

Alternates

While Zenith's Phonevision is the most well known STV technique and will probably be the first to be used in the future, other systems employing different techniques will undoubtedly be proposed.

Techniques are now being developed which will digitize the picture and sound channels, both of which will be transmitted as coded pulses. While digital information usually requires greater bandwidth, new band compression techniques are being developed. Decoders for such systems will consist of logic circuits and digital-to-analog converter circuits.

• *Please turn to page 68*

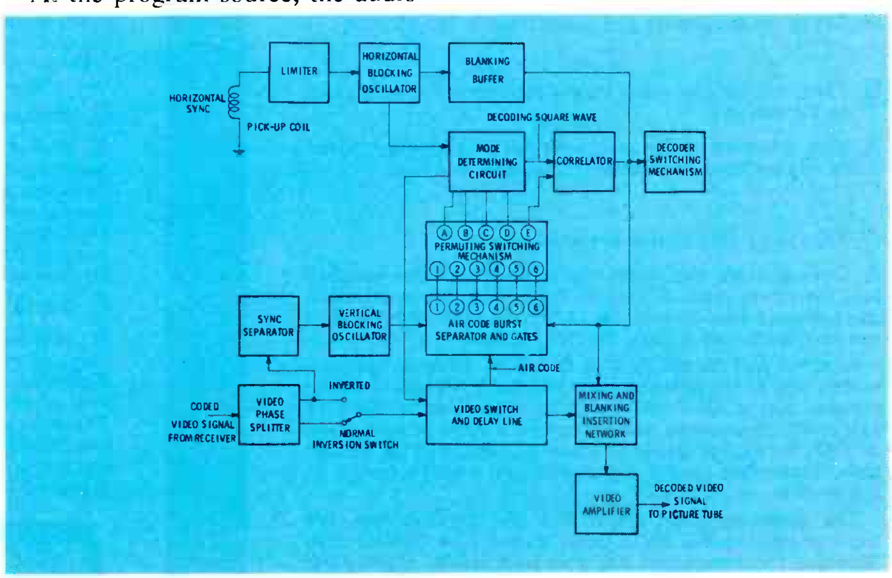


Fig. 3. Block diagram of video decoder.

Precision Apparatus

hallmark of quality in test equipment

For over three decades, knowledgeable professionals in industry, service, laboratory and educational fields have relied on Precision Apparatus Test Equipment. Today, through the experience and marketing know-how of Dynascan Corporation, Precision Apparatus offers greater reliability and performance—maximum versatility—in all applications. Today, the Precision Apparatus line represents the industry's outstanding values in test equipment.

Each Precision Apparatus instrument is designed, engineered and built to meet your most critical needs of accuracy, versatility, reliability. By every standard, they are the hallmark of quality in test equipment.

ES-550B WIDE BAND OSCILLOSCOPE

Rugged, dependable performance. Automatic horizontal sweep synchronization. Wide-band 5 mHz vertical amplifier. Extra-high 10 Mv RMS/inch sensitivity allows measurement as low as 2 Mv. Wide-band vertical amplifier. **$279.95**

E-310 SINE & SQUARE WAVE GENERATOR

Only moderate cost, low distortion generator with both sine and square-wave coverage from 5 Hz to 600 KHz. Pre-aged tubes provide long-term stability. Over 7′ of logarithmic scales for more accurate settings. **$199.95**

E-200C MULTI-BAND SIGNAL GENERATOR

Unique! AVC substitution voltage system permits accurate alignment. Over 7′ of etched dial scale from 88 KHz to 440 mHz with FM and TV band channels indicated. Each unit individually hand-calibrated on all bands. **$119.95**

120 VOLT-OHM-MILLIAMMETER

2% DC accuracy. Exclusive extra-low ohm scale for accurate readings to 0.1 ohm, extremely important for solid state measurements. Mirrored scale. Solid state protected meter movement. Transit meter movement protection. **$51.95**

V75 VACUUM TUBE VOLTMETER

Special built-in battery eliminator assures ohm-meter accuracy. Rugged uni-probe speeds operation. Special calibration on 1.5 VAC and 5 VAC scales assures maximum accuracy. **$59.95**

120M VOLT-OHM-MILLIAMMETER

Offers all of the convenience features of the 120 plus the extremely high accuracy of 1½% on DC and 3% on AC. **$61.95**

PRECISION APPARATUS

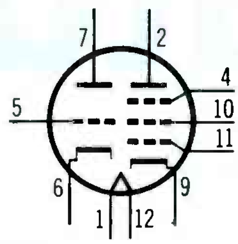
Division of Dynascan Corporation
1801 W. Belle Plaine Avenue
Chicago, Illinois 60613
Where Electronic Innovation Is A Way Of Life

Circle 10 on literature card

TUBE and TRANSISTOR DATA

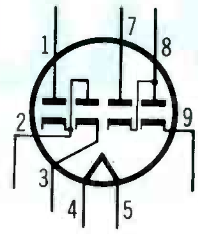
RECEIVING TUBES

6AG9
Pentode—Video Amplifier
Triode—AGC Amplifier
Fil.—6.3V @ 0.82A



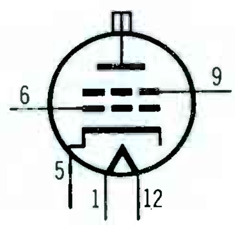
12HE

8JU8A
Color Killer Detector
Fil.—8.4V @ 0.45A



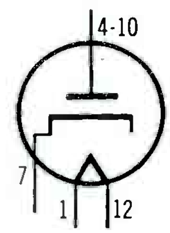
9PQ

6EF4
High Voltage Regulator
Fil. 6.3V @ 0.2A



12HC

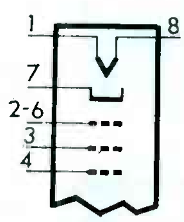
25CG3
Damper
Fil.—25.0V @ 0.45A (11 sec)
PIV.—5KV @ 350 ma



12FX

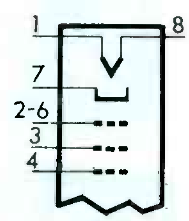
CATHODE-RAY TUBES

12CUP4
Protection—none
Deflection—114°
Filament—4.2V @ 0.45A (11 sec)
Grid 2—50V



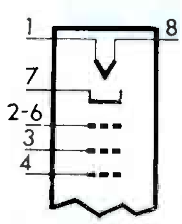
8HR

19GFP4
Protection—tension band
Deflection—114°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—400 V



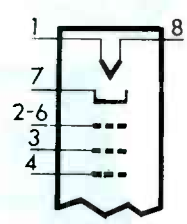
8HR

16CJP4
Protection—tension band
Deflection—114°
Fil.—6.3V @ 0.45A (11 sec)
Grid 2—400 V



8HR

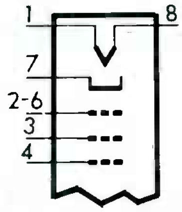
19GQP4
Protection—none
Deflection—114°
Filament—6.3V @ 0.3A (14 sec)
Grid 2—50V



8HR

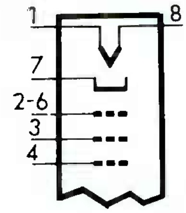
CATHODE-RAY TUBES

19GRP4
Protection—tension band
Deflection—110°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—500V



8HR

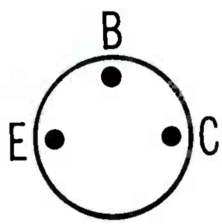
23GJP4A
Protection—tension band
Deflection—110°
Filament—6.3V @ 0.45A ((11 sec)
Grid 2—50V



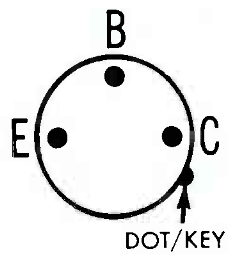
8HR

TRANSISTORS

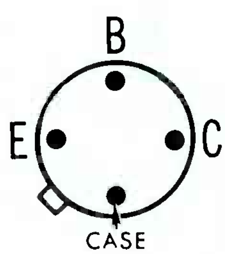
AC153
AF Amplifier
PNP—Germanium



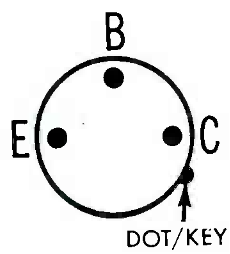
2SA31
AM IF Amplifier
PNP—Germanium



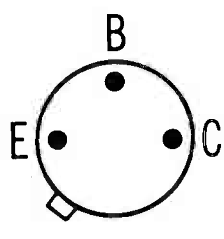
AF102
VHF Amplifier
PNP—Germanium



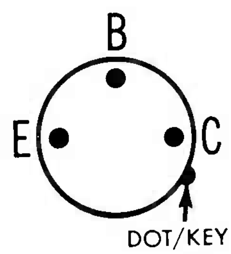
2SA49
AM RF Amplifier
PNP—Germanium



2N3241
AF Amplifier
NPN—Germanium



2SA53
AM RF Amplifier
PNP—Germanium



• *Please turn to page 55*

OK, Watch Watchers!

We want you to time your next service  call with our watch!

Buy our Color Commander color bar generator. If it doesn't save you time, return the Color Commander within 10 days and keep the $10.95 Timex.

What makes us so sure you'll save time? Amphenol's exclusive technique of color alignment. Only Amphenol gives you a:

1. **Single cross bar that immediately centers the raster.**
2. **Single dot for fast, constantly accurate static convergence.**
3. **Three-bar color array that isolates your working bars—the 3rd, 6th and 9th.**

Your Time is Money

If you're spending 45 minutes on a color alignment job, the Color Commander technique can cut that to as little as 27 minutes. That could mean two or three more calls a day—$24-$36 more income. Result: The Color Commander could pay for itself in two to three weeks.

Become an Amphenol Watch Watcher

Take advantage of this limited time offer. Cut out this coupon and beat the Watch Watcher rush. For the name of your nearest Amphenol distributor, write Dan O'Connell, Head Watch Watcher, Amphenol, Box 134, Broadview, Illinois 60153.

Watch Watcher Special

Count me in on the Watch Watcher Special. I understand I will get a lightweight, compact, completely solid state Amphenol Model 860* Color Commander along with a Timex watch to time my savings all for **$169.95**

Model 860AC $20.00 higher*

*Suggested resale prices

AMPHENOL

TM

Circle 11 on literature card

Notes on Test Equipment

analysis of test instruments . . . operation . . . applications

by T. T. Jones

NTSC Generator

Fig. 1 illustrates the long-awaited model 380 color-bar generator from **EICO.** Representing a major price breakthrough, the 380 generates a choice of 11 colorbars precisely to NTSC specifications, in addition to the usual dot, line, and crosshatch patterns, and costs just $159.95.

The color-bars are available in the three primary gun colors, and the secondary mixture colors (yellow, magenta and cyan). In addition, the generator has bar outputs at the exact R−Y, B−Y, I, and Q phase angles for alignment of demoduators. These single bar outputs are fully saturated by means of the auto luminance level stage (Fig. 2.). This stage has a bias resistor in the emitter circuit, whose value is chosen by a switch ganged with the color selector switch. The color selector switch selects taps on a delay line connected to the 3.58-MHz oscillator; these taps select a fixed amount of delay, which represents phase angle difference with the burst frequency, which is also provided by the 3.58-MHz oscillator.

The system provides color bar outputs which are very stable with respect to amplitude and phase angle, and by proper choice of component values, represents outputs well within NTSC specifications.

The sync circuits are the usual countdown multivibrators, based on a 189-kHz crystal oscillator. The countdown sequence is unusual, but the end result is still the normal vertical and horizontal sweep rates.

The sweep outputs are split, part going to the RF and video outputs thru a phase splitter, part fed to the auto luminance stage, and part keying the shapers for the chroma sync gates.

The resulting video or RF sync output is extremely close to a standard TV station signal. The burst pulses appear to lie a bit close to the horizontal pulse, but they lock in perfectly on a color TV receiver.

EICO Model 380 Specifications

RF Output
Frequency:
TV channel 3 (62.25 MHz) crystal-controlled.
Level:
10,000 or 50,000 microvolts.
Impedance: 300 ohms.
Video Output
Level: 0-10 volts peak-to-peak.
Impedance: 4.7k ohms.
Horizontal lines:
13, variable thickness.
Vertical lines:
10, variable thickness.
Crosshatch:
13 × 10, variable thickness.
Dots:
130, variable size.
Composite sync:
Crystal-controlled 15.75 kHz, 60 Hz
Colors:
Yellow, I, red, R−Y, magenta, Q, B−Y, blue, cyan, green, white. All to NTSC standards.
Semiconductor complement:
33 transistors, 22 diodes, four power rectifiers.
Power Requirements:
117 VAC, 60 Hz, 4 watts
Size (HWD):
8½" × 5¾" × 6⅜"
Weight:
4 pounds
Price:
$159.95 (wired)

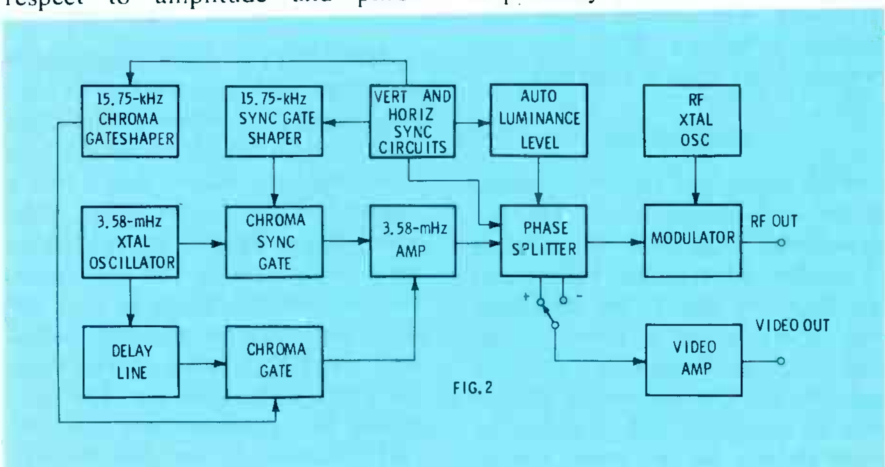


Fig. 2. Condensed block diagram.

Fig. 1. New NTSC color-bar generator.

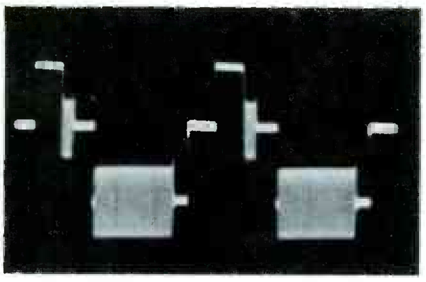


Fig. 3. Waveform shows well-shoped horizontal sync pulse.

The burst pulse is shown in Fig. 3, which illustrates a single color bar at a sweep rate of ½ the horizontal frequency.

Horizontal lines and vertical lines are both variable thickness, so the dots are variable in size both horizontally and vertically.

The unit is housed in the same style case as the other **EICO** instruments, with a cast bezel. The outputs jacks are BNC and the necessary test lead is included.

Channelizer

With stereo FM popularity rising at the same rate as color TV, the serviceman finds himself in need of another piece of test equipment; one that can check the operation and separation of a stereo multiplex receiver accurately, quickly, and simply. The instrument should also be compact and portable to avoid pulling the set under test to the shop just for a simple test or adjustment. The unit should also be reasonably priced. The above description fits SENCORE'S MX11 Channelizer to a T.

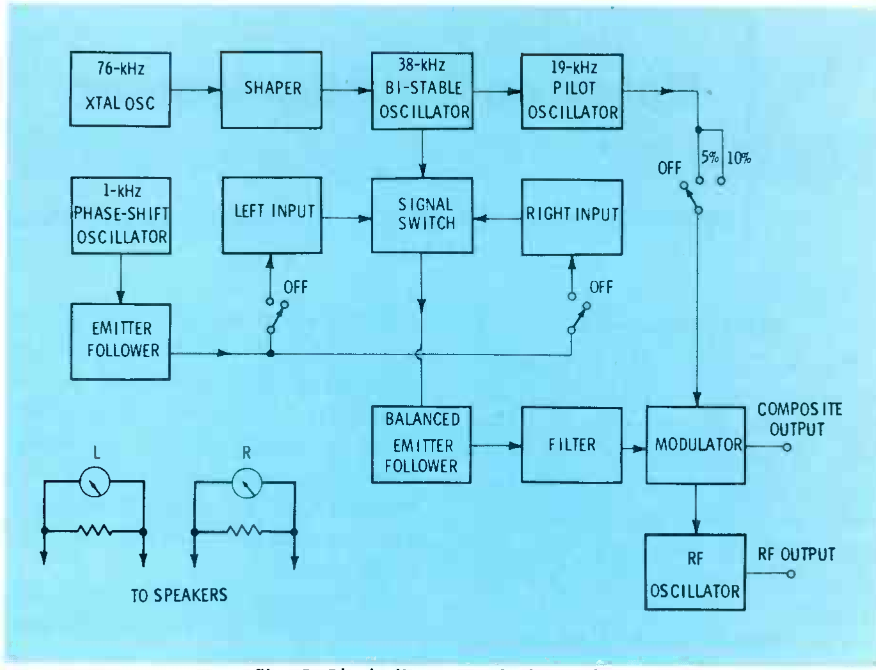


Fig. 5. Block diagram of Channelizer.

The MX11 is quite simple both in layout and operation. The circuit layout is as follows: The crystal-controlled 76-kHz master oscillator feeds the shaper stage, which shapes the signal into pulses. The pulses key a 38-kHz bistable oscillator, which forms the subcarrier. The 38-kHz subcarrier is then fed to a switching stage, and mixed with the 1-kHz audio signals from the phase-shift oscillator. The subcarrier is suppressed and just the 1-kHz sidebands are fed through an emitter-follower to a modulator stage. The modulator output is available at the front panel to simulate a discriminator output. The output of the modulator is also fed to a 100-MHz oscillator, and then to the RF output leads. The 38-kHz bistable oscillator also keys a 19-kHz pilot oscillator, whose signal is also fed to the modulator.

Figure 4. New light-weight MPX generator.

Sencore MX11 Specifications

RF Output
Frequency:
100 MHz (adjustable 90-105 MHz).
Level: 3000 microvolts.
Impedance: 300 Ω
Composite Output:
Level:
2 volts peak-to-peak.
Impedance:
1000 Ω
19 kHz Pilot accuracy:
± .01%
Semiconductor complement:

5-2N1304	1-2N1178
5-2N404	1-2N2614
2-2N406	4-1N34A

Power Requirements:
8 size "C" cells, 12 ma drain.
Size (HDW):
3" × 10" × 8"
Weight:
5½ pounds
Price:
$99.50

To check the separation, connect the RF output cable to the antenna terminals of the receiver under test. Turn the left and right signals on and tune the receiver for a 1-kHz note. Keeping the volume control low, connect the left and right speaker leads to their respective speakers. The meter circuits in the MX11 have built-in 8-ohm load resistors, so the speakers may be

• *Please turn to page 66*

This part speaks for the whole radio.

This box speaks well of you.

To the listener, the speaker is the most important part of the radio. Reason enough that it be of the highest quality and reliability. And when it says Delco on the box you can be certain you've got it: genuine OEM quality.

Delco Radio Parts are designed by engineers who specialize in automotive radios. Delco Radio speakers, for example, provide greater efficiency and sensitivity per ounce of magnet than any other speakers built. And since nearly half the cars on the road have Delco Radios as original equipment, you are assured of a vast pre-sold market.

Doesn't it make sense to stock the best for your customers?

They know Delco's reputation. So, the next time you reorder, remember your United Delco Supplier. He handles the most widely advertised, merchandised and recognized name in the parts business.

Why not let Delco Radio speakers say something nice about you?

GM | United Delco

Delco Radio, Division of General Motors, Kokomo, Indiana.

SERVICING BAND PASS AMPLIFIERS

by David King

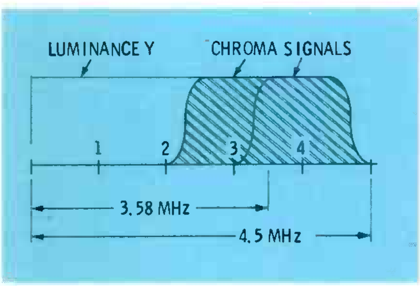


Fig. 1. Color frequency spectrum.

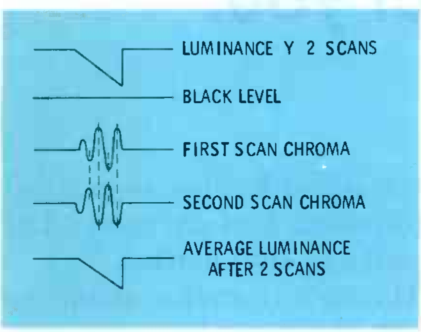


Fig. 2. The luminance signal after two successive scans.

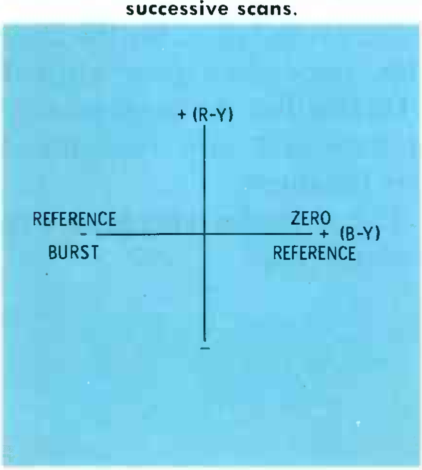


Fig. 3. Vectors of chroma signal.

In color television the bandpass amplifier is the major link between the black-and-white (luminance) section and the color (chroma) section. Before going into a study of the different types of bandpass amplifiers used in color circuitry, it might be wise to review the theory behind the chroma signal.

In order for the NTSC color system to be compatible with black-and-white receivers certain compromises have to be made with the color signal. Since the eye is not as sensitive to fine variations in color as it is to variations in brightness, the chroma band is restricted to a total bandwidth of slightly more than 2 MHz, as shown in Fig. 1. In fact, today's modern receivers produce excellent color pictures with 1-MHz bandwidth. The RCA CTC16 is an excellent example.

To prevent the chroma signal from interfering with the luminance signal in black-and-white receivers, the chroma signal is interlaced. In Fig. 2 the luminance for two successive scans is shown. Chroma and luminance information for two successive scans remains essentially the same, but notice that the chroma signal has shifted 180° in the second scan. "Persistence of vision" will prevent the eye from seeing the variations between the two scans and the eye will see only the average light which is the original luminance signal.

Interlace is accomplished by choosing a color carrier that is an odd harmonic of one-half the line frequency; this causes the polarity of the color subcarrier to be 180° out of phase with the succeeding

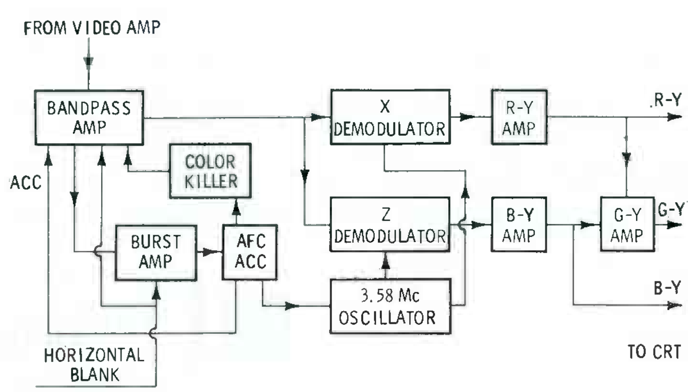


Fig. 4. Block diagram of chroma stages.

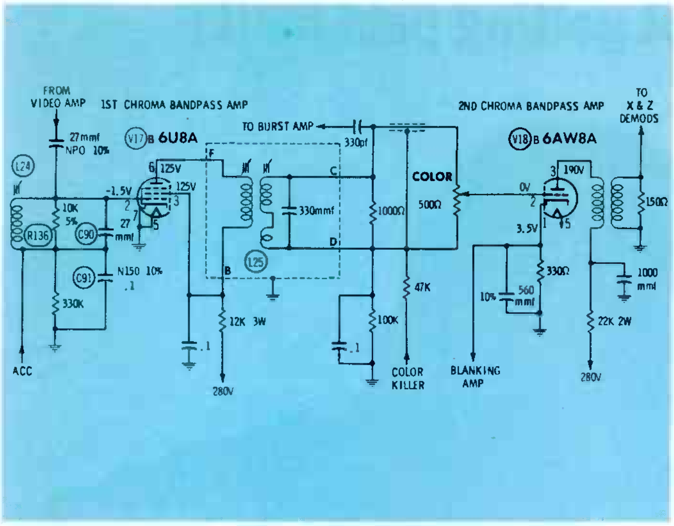


Fig. 5. Two-stage bandpass circuit in RCA CTC-7A.

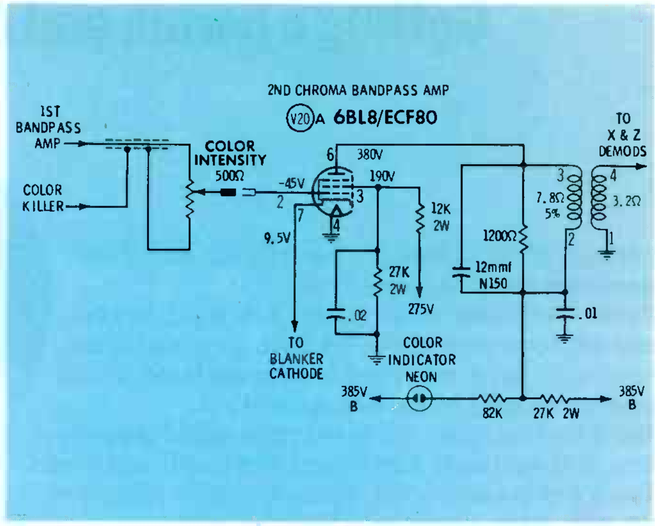


Fig. 6. Two-stage circuit with color indicator light.

scan. The subcarrier frequency is 455 times one-half the line frequency or 3,579,545 Hz.

As the vector in Fig. 3 shows, the chroma signal is switched or two-phase modulated at the subcarrier frequency. The carrier is then suppressed and sent in eight cycle "bursts" which appear on the "backporch" of the horizontal sync pulse. The color receiver phase locks its 3.58-MHz oscillator to the burst with its AFC and reinserts the chroma subcarrier into the color demodulators for chroma output. Since the chroma signal is phase modulated it is necessary that phase shift through the entire receiver be kept to a minimum. Any phase shift in the bandpass amplifier will appear as an undesirable shift in the tint of the color picture.

Fig. 4, a block signal of the chroma circuitry in a color receiver, shows the central position of the bandpass amplifier. The primary functions of the bandpass amplifier are: to separate the chroma frequencies from the video frequencies, and to drive the chroma demodulators. The bandpass amplifier also functions as the color killer gate to prevent color modulation of the black-and-white telecasts. Quite often the bandpass amplifier also provides the burst to the burst amplifier, uses automatic color control (ACC), and blanks the color burst to prevent color demodulation during horizontal retrace. Fig. 5 shows the two-stage bandpass amplifier which was used in the RCA CTC7A and is still used in several sets today. The first stage is capacitance-coupled from the video amplifier by a 27-pf capacitor. L24, R136, and C90 make up the first tuned circuit. Proper bandpass characteristics, to prevent phase shift, are extremely important, so 5% and 10% tolerance components are used. The negative ACC voltage from the chroma sync phase detector is fed to the bottom of L24, and C91 is used for decoupling. The ACC voltage is dependent upon burst amplitude; the ACC acts as an automatic gain control to increase amplification in the chroma amp during weak signal conditions and to reduce gain during strong signal conditions. Gain is sacrificed by using a low voltage on the first stage plate to ensure proper bandpass. L25 is slightly overcoupled and damped for a wide bandpass and the output is fed through a 330-pf capacitor to the burst amplifier, and through coax to the Color Level control which acts as a gain control. The color killer voltage is fed to the bottom of L25 and decoupled by an R-C network. When no color burst is present, a high negative voltage cuts off the 6AW8 to prevent color snow. The cathode resistor is shared with the blanking amplifier. During the horizontal blanking period the cathode goes approximately 70 volts positive which prevents the 3.58-MHz burst from appearing during retrace. The plate circuit is similar to the preceding stage but has no tuning adjustments.

Though the Motorola TS-908 (Fig. 6) is quite similar to the

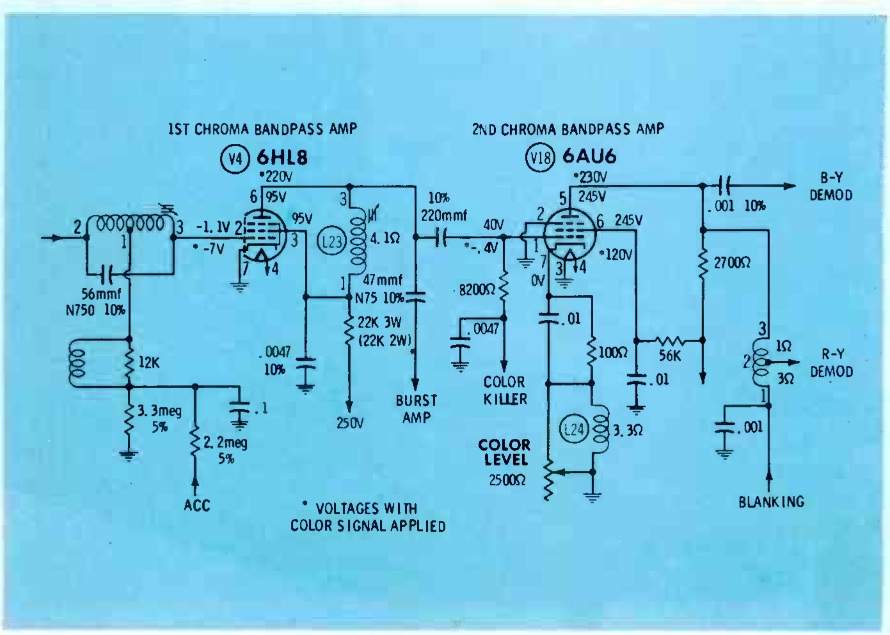


Fig. 7. The Zenith bandpass stages.

successful service shop beats rising costs with B&K television analyst

"As every serviceman knows, major TV repairs represent an increasingly large part of the service business and the average time per repair has increased"...

says Willard Horne of Horne Radio and Television in Evanston, Illinois.

After more than 25 successful years in the service business, twenty of them in the same location, Mr. Horne can be considered an authority on how to keep a business profitable. Mr. Horne says, "In order to be successful, our 3-man shop has to be competitive on the large jobs as well as the small ones. With the increase in bench time that we were experiencing and the limitations on what we could charge, there was a reduction of profit that had to be stopped. Then we bought a B&K Model 1076 Television Analyst."

"Now our customers get the same extra-value service on the big repairs and the small ones," said Mr. Horne. "We use the Television Analyst for troubleshooting a wide variety of complaints, particularly for those that require touch-up alignment, location of IF overloads and color convergence. We are more competitive now that we use the B&K Television Analyst because we spend far less time on the jobs that used to be dogs, with benefits both to the shop and our customers."

B&K Model 1076 Television Analyst checks every stage in a black and white or color TV receiver. Nine VHF RF channels, 20 to 45 MC IF, audio, video, sync, bias voltage and AGC keying pulse are available. The model 1076 provides its own standard test pattern, white dot, white line crosshatch, and color bar pattern slide transparencies. It includes a blank slide which can be used for closed-circuit-TV display floor promotion. Its net price is **$329.95.**

Find out how you will increase your TV service profits with a B&K Model 1076. See your distributor or write for Catalog AP 22.

B&K

B & K MANUFACTURING CO.
DIVISION OF **DYNASCAN** CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613

Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.

Circle 14 on literature card

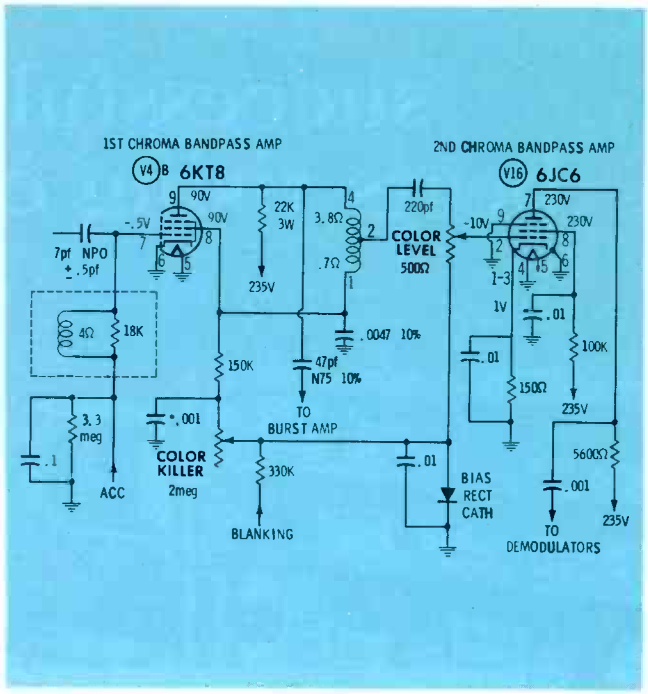


Fig. 8. Color killer in first bandpass amplifier.

CTC7A, notice the color indicator light. When there is no color signal the 6BL8 is not conducting and no voltage appears across its plate resistor. When a color signal appears the killer is disabled and the voltage across the plate resistor lights the lamp. The 1965 Motorola WTS-907 uses the same circuit but the neon lamp is omitted and a feedback resistor to the grid of the color killer is added to ensure more positive action of the color killer.

Zenith's 27KC20 (Fig. 7) is also quite similar to the RCA CTC7A, but the differences are worth noting. The 4.5-MHz trap which is usually located immediately after the video detector is placed in series with the grid circuit of the first stage. The two stages are impedance coupled and L23 is the only control of bandpass. The burst-amp takeoff and application of color killer voltage are both similar to the CTC7A, but notice that horizontal blanking is not applied to the cathode circuit and that gain (or color level) is adjusted by varying degeneration from the cathode circuit. The purpose of L24 is to resonate with the stray capacitance and to neutralize any undesirable phase shift which might occur at high bias settings. The output of the second stage is R-C coupled to a phase shift transformer which feeds the demodulators. The horizontal blanking is applied to the demodulator.

The Zenith 24MC32, Fig. 8, has an interesting feature that sets it apart from other circuits. The first stage acts as part of the color killer. ACC voltage fed to the first stage during no-color conditions is around −.1 volt, and screen voltage is approximately 110 volts. When color bursts are received, the ACC voltage decreases to as much as −14 volts. The resulting increase in screen voltage raises the voltage on the bottom of the Color Level control causing conduction of the second stage, thereby allowing color reception. During black-and-white reception the positive pulse from the horizontal discharge tube is clamped at ground level and the negative going pulse is then stored by

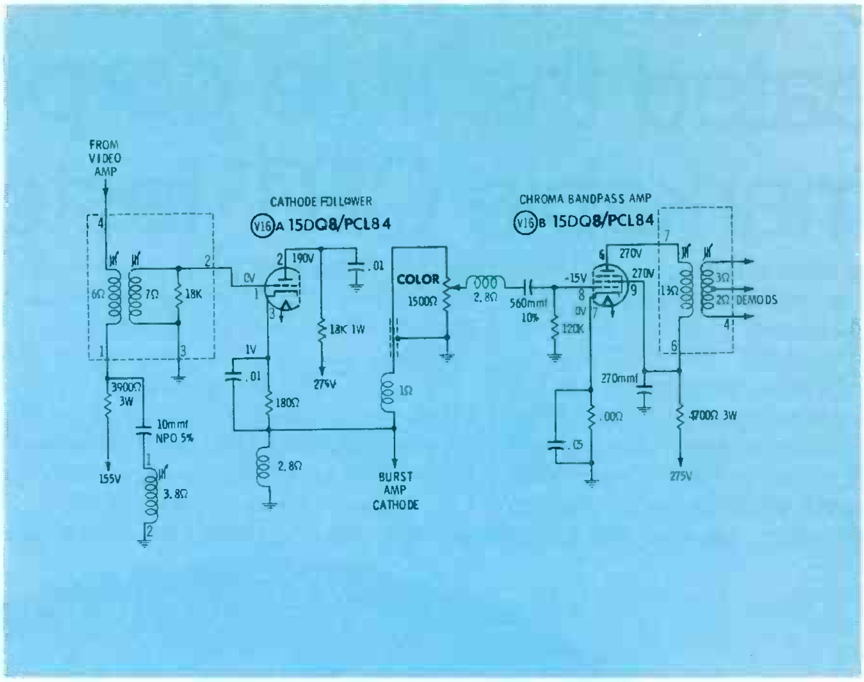


Fig. 9. Bandpass stages in Motorola TS-912Y.

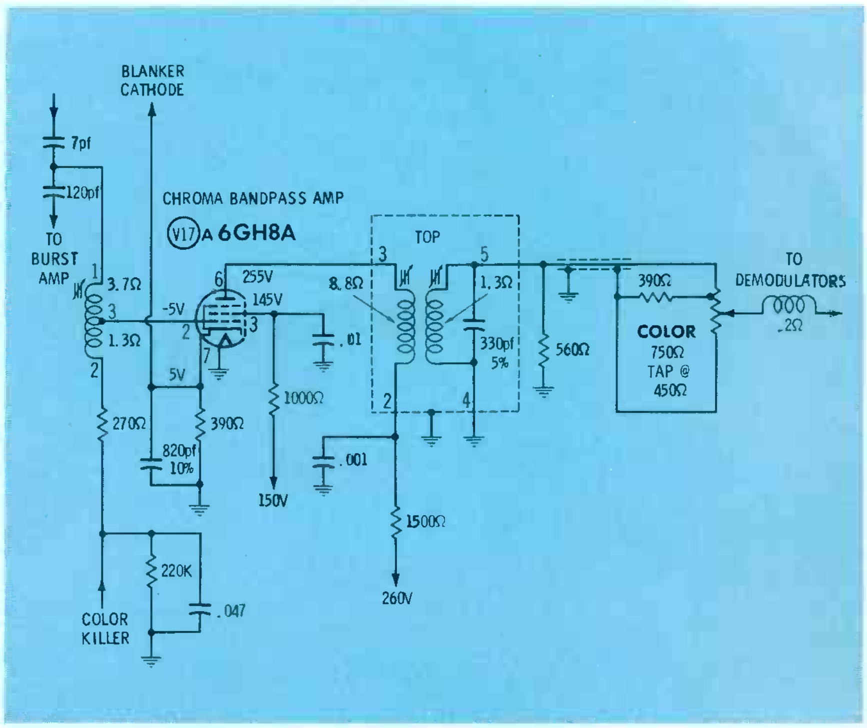
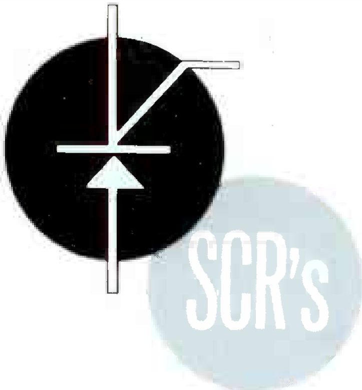


Fig. 10. Single-stage bandpass amplifier in RCA CTC16.

the .01-mfd capacitor, which holds the grid of the 6JC6 below cutoff. As in all other color receivers the color killer is set for colorless noise on an unused channel. The output circuit is quite similar to the 27KC20 and again the horizontal blanking is applied to the demodulators.

The chroma circuits in the Motorola TS-912Y, Fig. 9, are radically different from other color receivers and the bandpass amplifier is no exception. A brief glance will point out that the input is transformer coupled, there is no ACC, and there is no horizontal blanking. Transformer coupling of the input is needed because the cathode-follower first stage has a gain of less than unity. Since this model does not have a conventional chroma sync detector there is no ACC. The one-tube demodulator in this model

• *Please turn to page 52*



in Home-Type Dimmers

by S. E. Lipsky

In recent years, devices used in industrial electronics have found their way into the household. With the event of mass home construction, certain electronic equipment has become attractive to the homeowner by enhancing the value of his home and improving his everyday living. An excellent example is the electronic light dimmer, controlled by *silicon controlled rectifiers* (SCR's).

Although light dimming is as old as the incandescent spotlight, little practical use was found in everyday applications because of the expense and bulk of the dimming element. Typical dimmers utilized variable resistors, adjustable autotransformers, saturable reactors, magnetic amplifiers, and thyratron control circuits. Perhaps the greatest limitation of these devices was their cost, but most of them were wasteful of power. For these reasons, light dimming was confined to the studio or theater, where the expense could be considered worthwhile.

The recent development (and availability at reasonable cost) of the silicon controlled rectifier has made household light dimming a practical reality—and, in fact, something of a fad. As a result, many opportunities to sell, install, and service these devices have been created. You can expand your servicing operations to include this field, as you probably have all the required service equipment.

There are two basic types of continuously variable light dimmers: the full-range control, which provides brightness from off to full with one potentiometer, and has a push-type control to turn off the light at any setting; and a partial-brightness control that can be turned up to about 70% brightness, with a push control for full intensity.

Theory of SCR Operation

The basic use of the SCR as a light dimmer depends on its ability to control large amounts of current with very small control, or gate, currents. Because the SCR is saturated when *on*, the voltage drop across it is quite small, and the power and heat loss are relatively small. An SCR is rated by current-carrying capability and by the peak voltage it will withstand in the *off* or *on* state. Household dimmers generally utilize 7-amp, 200-volt devices similar to the 2N1774.

To understand how these dimmers work, let us briefly examine how an SCR operates. This device is essentially a PNPN semiconductor switch. It becomes a three-terminal device when a connection is made to the gate—one of the four semiconductor layers shown in Fig. 1. (A simplified equivalent of this device appears as two internally connected transistors, one PNP and the other NPN, as shown in Fig. 2. When anode terminal A is made positive with respect to cathode C, the two transistors—although forward biased—are essentially cut off; the SCR is said to be in a "forward-blocking" or *off* state. This action is due chiefly to the low current gain of both transistors. Injection of current into the gate terminal increases the gain of the NPN device, which saturates through regenerative action. The SCR is then triggered, or *on*. It will stay on until the anode current is reduced to a level below that required to sustain conduction. Once the SCR is *on*, the gate loses control in much the same way as does the grid in a thyratron.

The SCR as a Dimmer

SCR dimmer circuits differ in their method of triggering the gate. Fig. 3 is a diagram of a simple circuit utilizing an NE83 neon tube. When the switch is open, the 1-mfd capacitor charges through the 270-ohm resistor and the 10K potentiometer. When the capacitor charges to the firing voltage of the neon tube, the SCR triggers and conducts over some portion of the input cycle—how much of the cycle depends on the potentiometer setting. The

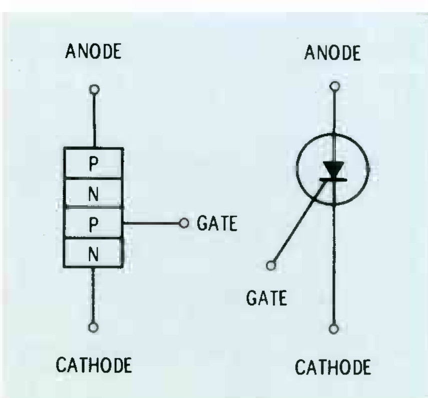


Fig. 1. SCR is actually PNPN switch.

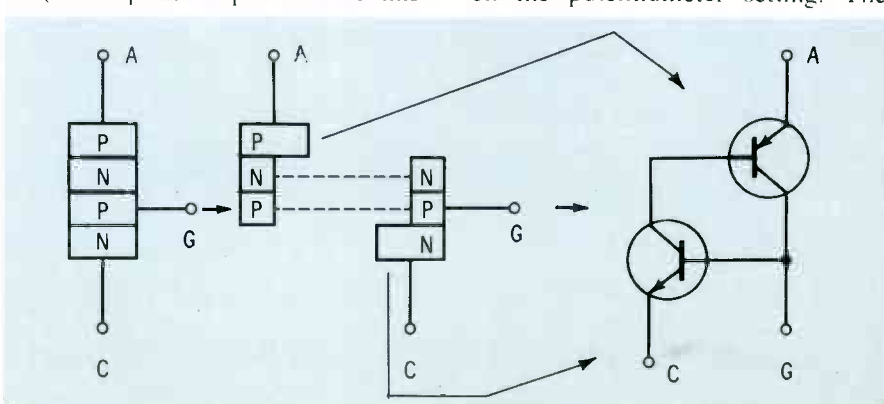


Fig. 2. Equivalent of SCR is two internally connected PNP and NPN transistors.

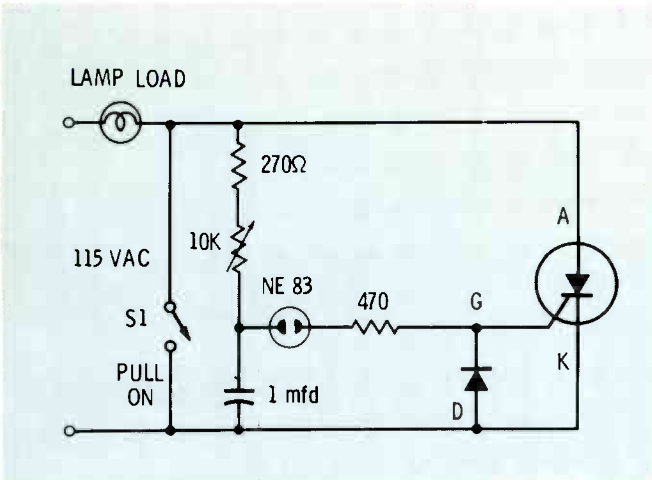


Fig. 3. Silicon-controlled gate is triggered by neon tube.

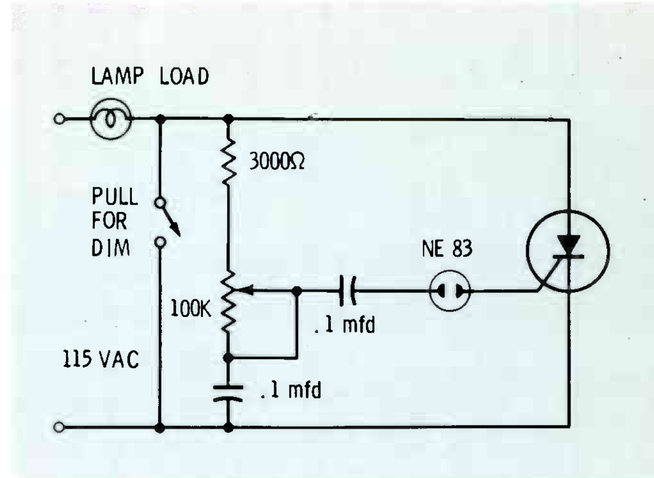


Fig. 4. Capacitors control neon firing and SCR triggering.

lamp brilliance is controlled by varying the pot so that the firing angle and load current are varied. The 47-ohm resistor and diode clamper D prevent a negative voltage from being applied to the gate. Such a voltage would disrupt the forward-current characteristic of the device. This type of dimmer provides approximately 75% brilliance at minimum potentiometer resistance, and for this reason a switch is necessary to bypass the SCR for full brightness.

Fig. 4 is an alternate scheme that utilizes two capacitors to trigger the NE83. These simple half-wave dimmers are most popular for the control of incandescent-lamp loads of approximately 300 watts. The diode clamper is not needed in this circuit because the capacitor isolates DC from the gate.

To overcome the 70% brilliance limitation, a fullwave-bridge dimmer circuit is often used. Fig. 5 illustrates this type of configuration. The SCR is phase-controlled over *both* halves of the cycle. The additional current provides full brilliance, eliminating the need for a switch. The clamping diode is no longer necessary, either, because the control circuit is never reverse biased. The primary-circuit switch permits the dimmer to be turned off with control at any *dim setting*.

Lower-cost SCR units have made possible a simplified fullwave bridge circuit by permitting the use of two SCR's instead of four diodes. Fig. 6 is the circuit of such a dimmer. The action is exactly the same as that of the dimmer shown in Fig. 3, except that it includes two SCR's connected in a fullwave bridge arrangement. The advantage of this circuit is that the total load current is carried by one SCR for half the cycle and by the other SCR during the second half. This reduces the power dissipated by the unit and thus reduces heat-sink needs.

Servicing SCR Dimmers

Fig. 7 is a photograph of several SCR's in the 300-watt range, showing how heat-sinking has been applied. These units are compact and relatively simple.

Servicing SCR dimmers requires very little equipment. You'll need a small shelf stock of 200-volt SCR devices equivalent to GE types C11, C20, C22, and C30 and Motorola

• *Please turn to page 88*

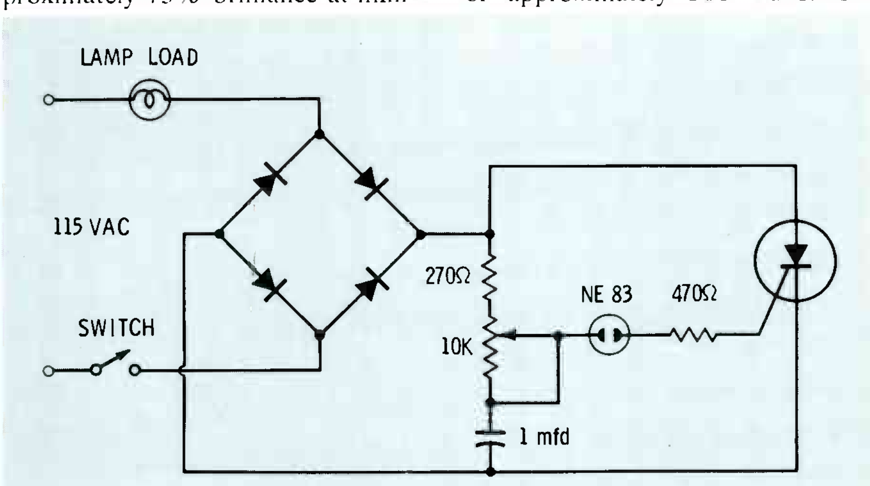


Fig. 5. Four diodes in a fullwave bridge circuit give greater brilliance and eliminate the need for a switch.

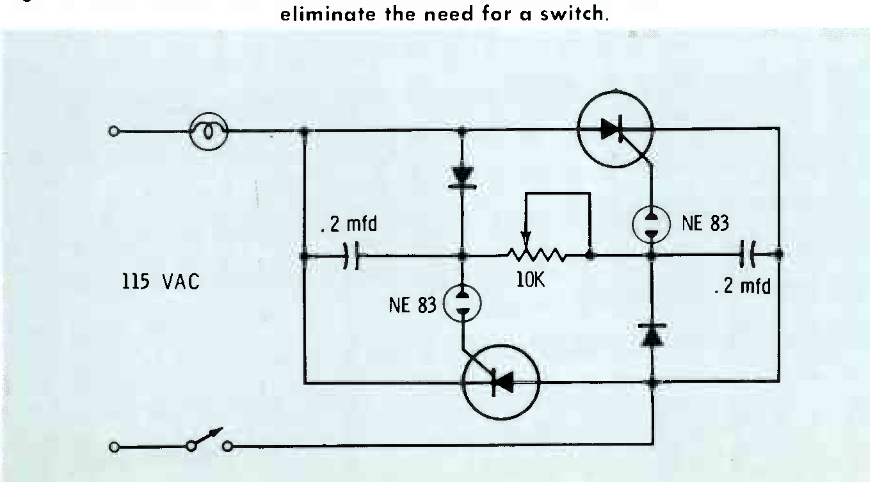
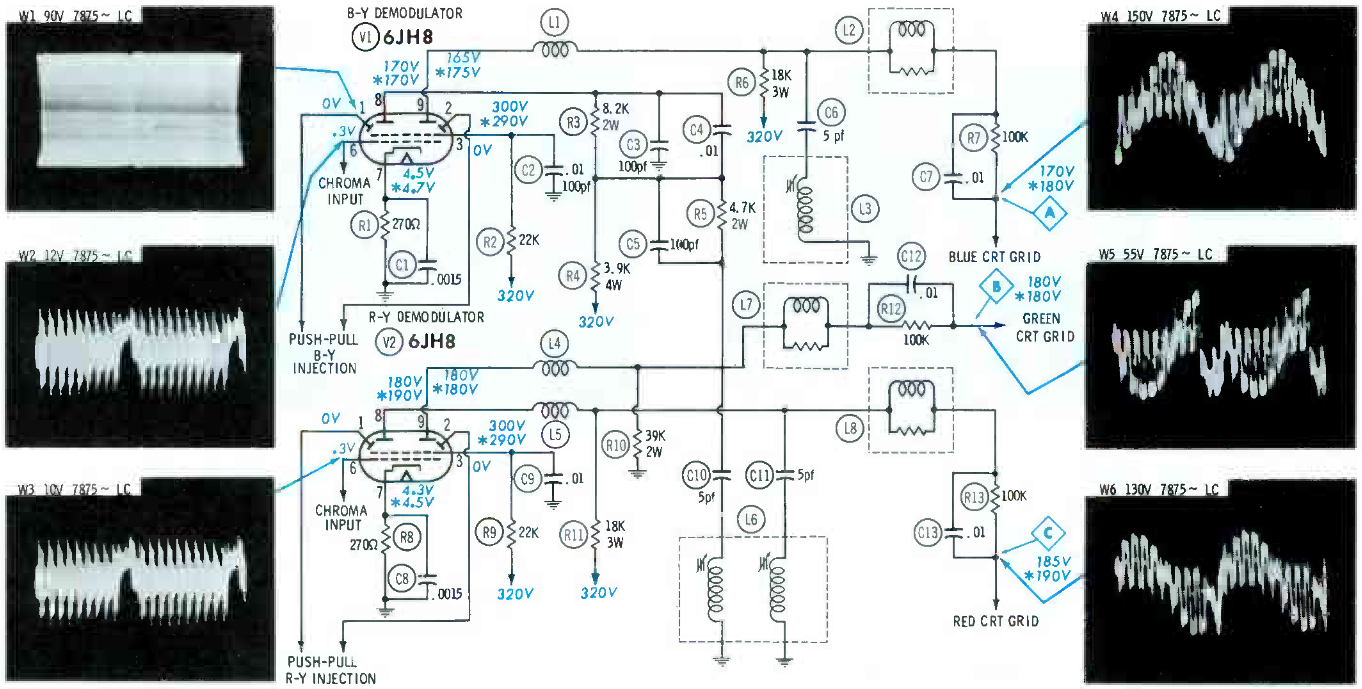


Fig. 6. This fullwave dimmer circuit uses two silicon-controlled rectifiers with two diodes instead of four.

Sheet-Beam Demodulator



DC VOLTAGES taken with VTVM—color bar generator connected but not operating. *Indicates voltage taken with generator operating — see "Operating Variations.

WAVEFORMS taken with wideband scope; TV controls set to produce normal color-bar pattern on screen. LC (low-cap) probe used to obtain all waveforms.

Normal Operation

Color demodulator circuit using sheet-beam type tubes (all Zenith models to date) has advantage over triode type demodulators in that additional stages are not needed for amplification and signal inversion. High-level output of sheet-beam tube is sufficient to drive CRT grids direct. Purpose of color demodulator circuitry in color receiver is to recover two portions of chroma information modulated and broadcast on a carrier at same frequency but with phase difference of 90°. Sheet-beam tube has two signal plates but only one cathode. Chroma reference oscillator signal is fed to control plates 180° apart, and as a result, cathode current is switched from one signal plate to the other on alternate half-cycles of reference signal. This results in positive going signal at one plate and negative going at other. In actual practice two tubes are used. The color signal is applied to control grids (Pin 6) of both V1 and V2. The chroma reference signal is supplied to control plates (Pins 1 and 2) of both tubes, but with 90° phase between tubes. Result is positive going B-Y signal at pin 9 of V1 and positive going R-Y signal at pin 8 of V2. Same signals, except negative going, are present at other signal plates and are combined by voltage divider and RC circuits consisting of R3, R4, R5, R10, C3, C4, and C5 to produce G-Y signal. L1, L4, and L5 along with tunable traps L3 and L6 are used to remove 3.58-MHz information from V1 and V2 outputs. B-Y, R-Y, and G-Y signals are connected to their respective CRT grids, the luminance signal is applied to the cathodes, and final matrixing is accomplished in the CRT.

Operating Variations

A, B, C — DC level maintained by CRT bias control and signal plate DC voltage of demodulator tubes. CRT bias, G2, and gain controls set CRT DC operating levels. For normal b-w pix, point A is 170 volts; B, 180 volts; C, 185 volts. Generator signal causes voltages to rise slightly (5 to 10 volts). CRT bias control varies voltages about 50 volts to maximum 15 to 20 volts higher than normal.

Pin 9 V1 Pin 8 V2 — B-Y and R-Y signal plate voltages deviate slightly between signal and no-signal conditions. Pin 9 of V1 (B-Y) measures 165 volts with no signal, 175 volts with normal signal, and 185 volts at maximum signal. Voltages on Pin 8 of V2 (R-Y) show similar variations. Both dependent upon generator output and color control setting.

Pin 7 V1, V2 — Cathode voltages show normal increase when signal is applied to grid—about .2 volts. Grid bias remains constant.

WAVEFORMS — W2 and W3 amplitudes dependent on generator output and color control setting. Weak color pattern displayed on screen with 3 to 5 volts p-p input, normal is 10 to 12 volts p-p, or 18 to 20 volts p-p at maximum generator and control settings. W4, W5, and W6 amplitudes relatively stable through variations in input signal; however, content distorted when input signal increased beyond normal. Distortion causes incorrect and smeared colors. W1 increases to about 100 volts p-p without input signal.

Symptom 1

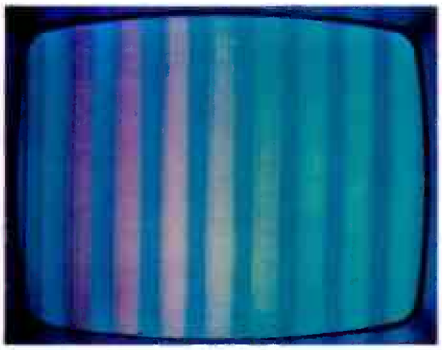
Red Colors Weak

Red in B-W Pix

Coil Lead Open

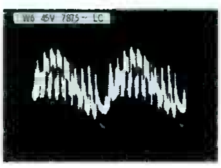
(3.58-MHz Reference Signal)

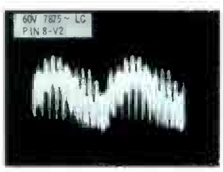
Symptom Analysis

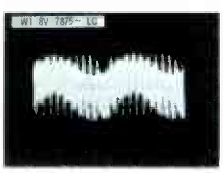


Orange and magenta almost nonexistent. Impossible to get proper flesh tones with tint control. Reds appear weak in color-bar pattern, other colors slightly off-shade. B-w picture has reddish tint, but can be compensated for with G2 controls.

Waveform Analysis

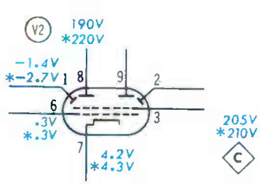






W6 (red grid) shows normal content but amplitude low (45 volts p-p compared to normal 130 volts p-p). Explains loss of reds in picture since waveforms W4 and W5 (not shown) are near normal. Waveform at R-Y signal plate of V2 (Pin 8) shows same symptoms; isolates trouble to input circuitry. W2 (not shown) normal, but normal waveform at control plate of V2 (Pin 1) missing. Instead of normal content (3.58-MHz RF) W1 is nearly same as W2 at signal grid (pin 6).

Voltage and Component Analysis



Voltage measurements confirm waveform analysis. Low cathode voltage with signal, little difference between signal and no-signal conditions, and high R-Y plate signal indicate this section of V2 is not conducting properly. Negative voltage at control plate of V2 (Pin 1) is most obvious clue. The 3.58-MHz reference signals at control plates turn tube sections on and off. With this signal missing at pin 1 of V2, R-Y demodulator section does not conduct properly. Increased plate signal causes excess red grid bias, causing red background.

Best Bet: Scope; then VTVM

Symptom 2

Blues Weak

Blue in B-W Pix

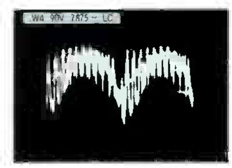
R2 Value Increased

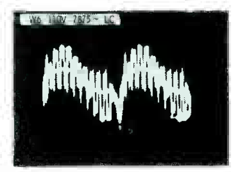
(Screen Dropping Resistor—22K)

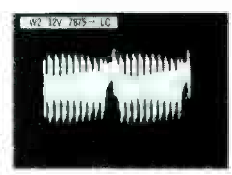
Symptom Analysis

Colors using blue incorrect on station color picture. White portions tinted blue. All colors appear weak on color bar pattern but close observation shows this caused by blue background. B-w setup controls produce normal b-w screen, but color picture lacks blues.

Waveform Analysis

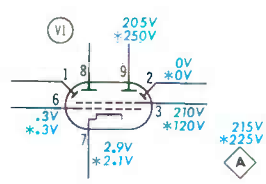






Waveform W4 at blue CRT grid shows reduced amplitude (approximately 90 volts p-p compared to normal 150 volts p-p). Content is incorrect. Negative going portion is near normal but positive going portion, which causes CRT to conduct, is greatly reduced. Waveform W6 (R-Y input to red grid) is slightly reduced, but content is normal. This, along with normal input waveform (W2) indicates trouble in B-Y demodulator section of V1 or associated circuitry.

Voltage and Component Analysis



High B+ at point A explains blue tint of b-w picture. Abnormal W4 explains weak blues in color picture. V1 signal-plate, screen-grid, and cathode voltages all point to decreased conduction. Most obvious clue is screen voltage—approximately 120 volts, normally about 290 volts. Loss of accelerating effect lowers conduction. R2 has increased to 220K. If R2 increases further or opens, brightness and focus will be affected and will be impossible to adjust setup controls for b-w picture. Defective R9 causes similar symptoms in reds.

Best Bet: VTVM, with careful circuit analysis.

Green Missing

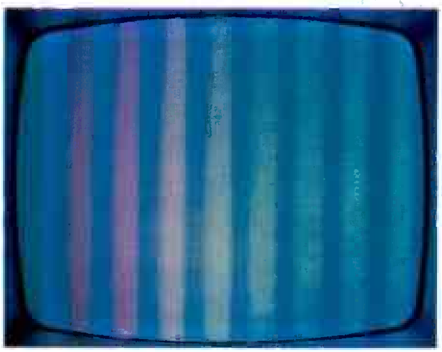
Symptom 3

Magenta in B-W Picture

R4 Increased

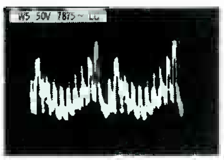
(Plate Dropping Resistor—3.9K)

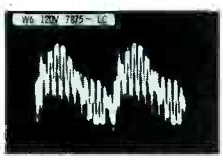
Symptom Analysis

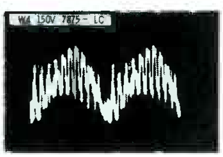


Color picture is predominantly red, magenta, and blue. Impossible to get correct colors with tint control. Color generator bar pattern also shows little or no greens. Symptom indicates b-w setup problems, but gain and green G2 controls have no effect on picture.

Waveform Analysis

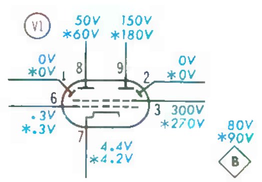






Waveform W5, G-Y input to green CRT grid (point B), shows near normal amplitude and content — waveforms W4 and W6 measure 50 volts p-p at points A and C. Blue and red CRT grid waveforms are normal. Scope troubleshooting of this symptom helps by showing technician that proper waveforms are available at CRT grids to produce proper color pattern; however, further work with VTVM is required to isolate the trouble.

Voltage and Component Analysis



DC voltage at point B verifies that green CRT gun is cutoff. Low B+ (80 volts; normally 180 volts) makes it impossible for G-Y signal to trigger green CRT gun into conduction. Near normal voltage readings at G-Y signal plates (Pin 8 of V1 and pin 9 of V2) and other demodulator tube elements isolate defective circuitry. Plate voltages measure about 60 volts (normally 170 to 180 volts). Demodulator tubes still operate near normal even with severe reduction of B+ at G-Y signal plates. Low bias voltage at point B causes symptom.

Best Bet: VTVM will locate.

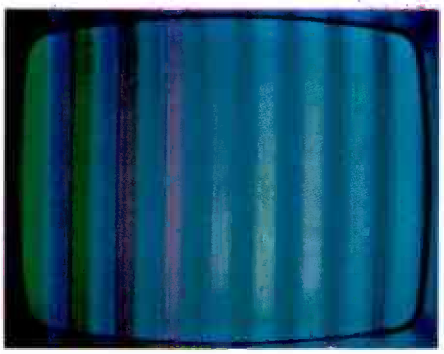
Reduced Reds

Symptom 4

Greens and Blues Normal

C13 Open

(CRT Grid Coupling—.01mfd)

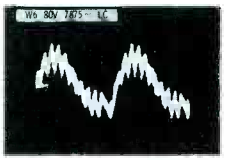


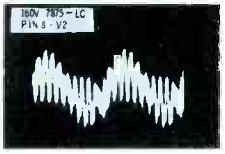
Symptom Analysis

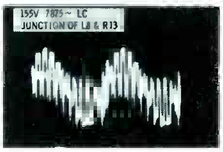
Very little red in picture. Greens and blues appear normal. Symptom is more pronounced on relatively weak station color signal. Color bar generator pattern also shows weak reds. Normal b-w picture eliminates b-w setup and associated circuitry as trouble sources.

Waveform Analysis

Input signal to red grid of CRT (W6) explains why red portions of color picture are weak—amplitude is low (80 volts p-p compared to normal 130 volts p-p). W6 also shows that high-frequency detail is missing. Although not shown, waveform check at R-Y signal plate of V2 (pin 8) is helpful in isolating trouble. It shows normal amplitude and content. Scope check at junction of L8 and R13 pinpoints defective component.







NO VOLTAGE CLUES

Voltage and Component Analysis

Voltages at all tube elements and at points A, B, and C—with and without signal—remain well within normal tolerances and give no troubleshooting clues. C7-R7, C12-R12, and C13-R13 form parallel RC networks for decoupling and high-frequency emphasis of B-Y, G-Y, and R-Y signals. Normally, C13 offers low-impedance path for high-frequencies in R-Y signal. With capacitor open, highs are attenuated by R13 and almost no information reaches red grid. Open C7 or C12 would cause loss of blues or greens.

Best Bet: Scope will pinpoint.

Symptom 5

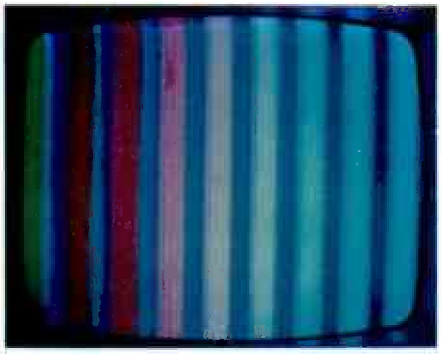
Greens and Reds Weak

Blue B-W Pix

R1 Increased

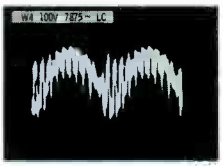
(Cathode resistor—270 ohms)

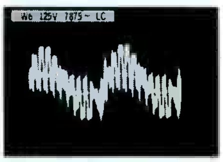
Symptom Analysis

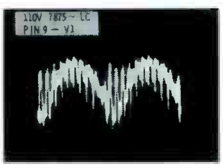


B-w picture is tinted blue. Impossible to get correct gray scale setting because blue cannot be extinguished. Station color picture is mostly blue and red. Color generator pattern shows blues near normal, with greens and reds weak and off-color due to blue background.

Waveform Analysis

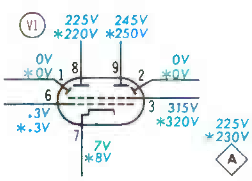






Waveform W4 at blue grid of CRT is low in amplitude (100 volts p-p; normally 150 volts p-p). Positive going peaks that cause blue gun conduction are greatly suppressed. W5 (not shown) and W6 are near normal and help isolate trouble to B-Y circuitry. Waveform at B-Y signal plate of V1 (pin 9) is similar in amplitude and content to W4. Although not shown, input signals W1 and W2 are near normal, throwing more suspicion on V1 and associated circuitry.

Voltage and Component Analysis



Symptom and waveform analysis call attention to blue grid of CRT (point A) as obvious voltage checkpoint. Excess voltage here—approximately 50V high—both with and without color signal, explains blue screen on both black-and-white and color programs. Both signals plates of V1 show high B+ potential as does screen grid. Reduced tube conduction is suspected. Cathode voltage of 8 volts (normal 4.7 volts) confirms. R1 measures about 950 ohms—higher resistance or open resistor causes excess brightness and loss of focus.

Best Bet: Scope; then VTVM

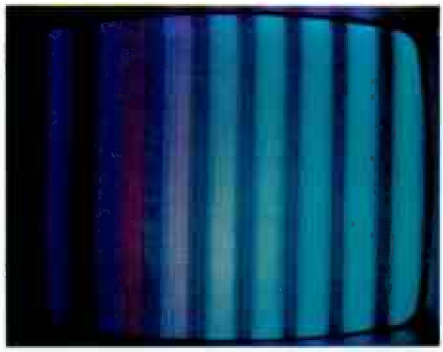
Symptom 6

Reds Weak

Greens and Blues Normal

R11 Increased

(Plate Dropping Resistor—18K)

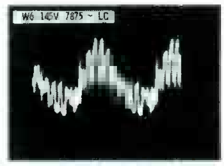


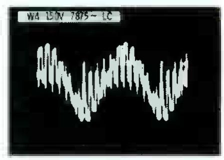
Symptom Analysis

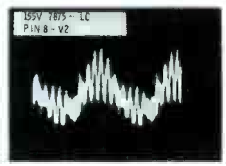
Station color picture lacks reds. Impossible to adjust hue control for proper flesh tones. Color bar pattern also shows reds very weak and other colors near normal. B-w picture is tinted cyan. Impossible to get red line when attempting b-w setup.

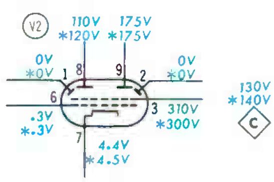
Waveform Analysis

Output of R-Y demodulator waveform W6, is of sufficient amplitude to cause gun conduction (145 volts p-p; normally 130 volts p-p). Content shows positive going spikes are slightly narrower than normal, but should produce red color bars. B-Y signal (W4) normal. Waveform at R-Y demodulator signal plate is similar to W6 in content and correct in amplitude. Waveform analysis inconclusive, but indicates demodulators operating well enough to produce near normal picture.





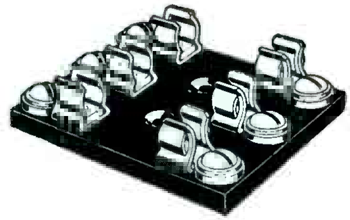




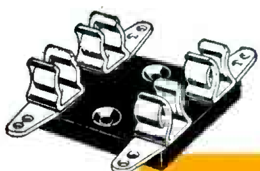
Voltage and Component Analysis

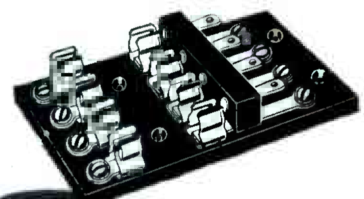
Symptom analysis indicates red CRT grid (point C) logical checkpoint. Voltage here shows why reds are missing in color picture and b-w setup. B+ is about 50 volts low, cutting off red gun. DC voltage on signal plate of V2 (pin 8) is low—120 volts, normally 190. Normal cathode voltage (with signal) eliminates overconduction as cause of low plate voltage and makes B+ path prime suspect. Resistance check reveals R11 has increased to 33K. Incorrect B+ voltage in demodulator stage upsets CRT grid bias.

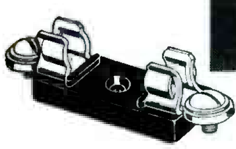
Best Bet: Careful VTVM work will locate.



BLOCKS FOR BUSS FUSES







Single pole, multiple pole, small base, full base, molded base, laminated base, porcelain base – signal activating fuse blocks and special blocks of all types for BUSS Small Dimension fuses.

Fuse blocks to meet JAN and Military specifications.

Get full data for your files, write for BUSS bulletin, Form SFB – it gives a comprehensive picture of the complete line of Small Dimension fuses and fuse mountings.

For fuses and fuseholders of unquestioned high quality for every protection need, *insist on . . .*

BUSS QUALITY

BUSSMANN MFG. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

Circle 19 on literature card

COLOR Chaos

by Jack Darr

Well, I was sitting there staring into space when suddenly the phone rang. Glad to have any excuse to get away from the little transistor TV which was whipping me like a dirty dog, I answered "Hellooooo!" in my most syrupy telephone voice. "Oh, it's you." It was my Little Buddy again.

Fig. 1. If her head isn't really pointed, you're in trouble.

Fig. 2. If you see things like this sober, you are in deep trouble.

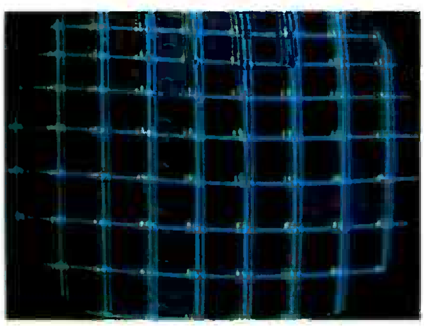


Fig. 3. Haven't seen this many lines since the last beauty contest.

"Hey, friend! I got one for you! You've never seen anything like it!" (This I doubted—I've seen some lulus. But anything to get away from the little monster for a while). "I thought of you right away, friend!" (I'll bet he did. With friends like I got, I ain't got any enemies on back-order, I'll tell you that.) Anyway, I agreed to run out to the house and look at it, and away I went.

It was an RCA CTC-11, and Little Buddy was sitting there looking at one of the oddest pictures I'd ever seen (Fig. 1). Maybe he was right, at that. It was a lulu.

So, we started in fiddling with it. This was really a three-color tube: all I could see was rainbows, and changing the program made it even worse (Fig. 2). I went out to the truck and got the dot-bar generator, and put a cross-hatch pattern on the screen. This looked even wilder. Did you ever see a pattern with two blue lines, two red lines and a brown one? (Fig. 3) Neither had I, until then.

A bit of judicious finagling with the magnets on the neck helped, but not a heck of a lot. The best we could do was a peculiar-looking pattern like Fig. 4. For no reason at all, I tried the color bars, and they looked worse. (Fig. 5)

I said to Little Buddy, "Get the dolly; this is a hospital case!" We loaded it up and lugged it to my shop. Happily pushing the portable back under the shelf, and treading heavily on my conscience's toes (the portable was supposed to be ready by that afternoon), I got things ready.

I knew about what it was going to look like, but I tried a test-pattern slide on it anyhow. (Fig. 6) "Wow! It ain't linear" said LB. I agreed, and started fiddling with things on the back of the chassis. Well, this was odd. I could get fair linearity, but the raster was just a little bit off—about 6 inches below the top of the screen! Something told me that this wasn't normal, so I moved the vertical centering control. That's all I did, too. The control moved but the raster didn't. The picture never budged. just sat there and writhed like a belly-dancer. That did it.

"Out!" I yelled, and began yanking knobs off, while LB crawled under the cart and started taking out bolts. After finding the extension cables kicked back under the bench, we got the chassis out and propped up on the bench. Then, away we went. It didn't take long to find out that this chassis had been very severely serviced at, but not repaired! In fact, I decided that I'd finally found a TV set with *everything* wrong with it.

A litle checking here and there showed us that we had a genuine 100% foul-up on our hands. Any resemblance between this chassis and the schematic in Sams 550-2 was purely accidental. Like the 22K resistor in the B+ with the same voltage on both ends, instead of +380 on one end and +270 on the other (R87). Unhooking the obviously 'unburned' resistor showed that it was exactly 22K, but the wires still read the same — zero. Something told me this wasn't right.

There were a few other odd little things, like the big fat tubular electrolytic jammed into the frame at the top of the chassis, and a group of solder joints that had been made with a welding torch. So, we stopped and made up a little list, like the

Mikado. Here's what we had, for openers:

- Extremely bad convergence.
- Purity off.
- Very weak video; no effect from contrast control at all.
- Vertical linearity very poor; only 8 bars showing on crosshatch.
- Vertical centering 8 inches off, control had no effect.
- B+ voltages in all circuits far off schematic values, but supply voltages well in tolerance.
- Intermittent loss of focus, width, and brightness-control action.

And oh yes, the tuner was very noisy! But outside of this, it was in good shape; the cabinet didn't have a scratch on it!

So, away we went in a cloud of burnt oil. Starting with the B+, we checked every capacitor and resistor in the voltage supply network. This isn't as long a job as you'd think, if you've got the schematic right in front of you. This is a nice straightfaced resistive dropping network, and all the filter capacitors are in a group on what was now the top of the chassis, as the poor thing stood on the bench.

First, we lifted all the leads with the blobby joints from the electrolytic, and checked it. It was good, but the sizes were a pod off. It was a replacement (**Ha!**) for C3, a 4-section capacitor of 80-50-10 at 450 volts and 20 at 25 volts. Whoever the clod was that had stuffed it in there, he didn't use my favorite method. If I can't get exactly the right size for a replacement electrolytic, I use the next bigger one. Works a lot better. He'd used a 40 for the 50, a 60 for the 80, and we quit checking about there; it had to come out. We put in an exact replacement. After this, we started in on the others; specifically, the one which had the big fat tubular 100-mfd hooked across it. (No, he didn't; Clod hooked it right across the old one).

Sure enough; the replacement capacitor was good, but the original had a very high power factor, about 80-90%. Following the yellow wire, this turned out to be the cathode capacitor in the video output stage, C2D, which should have been a 50-mfd. at 75 volts. So, out came C2 and in went a replacement.

Along in here, we found out why the odd reading on the 22K resistor. A wire was missing, and we found it over on C3, hooked to +380 volts. (Well, it was a red wire, and the rest of them were too! You can't win 'em all!) We moved it back over to where it used to live. We found later that this straightened out some voltage problems. This lead fed the X and Z demodulators, the 3.58-MHz oscillator, the burst amplifier, and even the vertical output tube's grid.

Along about here, we found ourselves tripping over that vertical centering control. Somehow or other, Clod had managed to get it hooked up so that the current flowed through it backward! The slider wire was on the end of the control, and vice versa. The current through this control also feeds the screen grid of the 6DQ5, the 6BK4 cathode, and the damper plate; little things like that. Somewhere in this mess, we were getting the pulse that caused the odd ripple in the raster when this control was moved. Could have been due to the increased ripple from small filter capacitors.

After losing our place the standard number of times having to go back to B+ and start all over, we finally got the voltage supply circuits straightened out and checked against the schematic. Figuring that it would work like this, or at least it had when RCA built it, we took our courage firmly in our hands and turned it on. (Plugged into a well-fused outlet, of course).

Checking of currents in the horizontal output stage and regulator showed that things were well under control around there. So, we corrected the major misconvergence that was plainly visible. This included turning two of the static magnets a quarter of a turn so that they had some effect. Now, things looked better. Checking the tracking and purity, we got a pretty fair country picture. (Fig. 7.) We heaved a sigh and went off to get a well-earned cup of coffee.

When we got back, it hadn't exploded yet, so we started the nicest part, figuring up the bill.

There's a moral to this story, even if it isn't really a fairy tale. The moral is this: if you must work amongst all the pretty colored wires, have a schematic of the thing there so that you can tell where the heck those wires all go when you put 'em back! There's no substitute for accurate service data (and enough sense to use it). Yes? What did you say? What about the intermittent loss of width, focus and brightness control trouble? Oh, nothing. It wasn't a bad picture tube, as you (and both of us) suspected at first. It was just what you'd expect after Clod had been workin on it; a cold solder joint! ▲

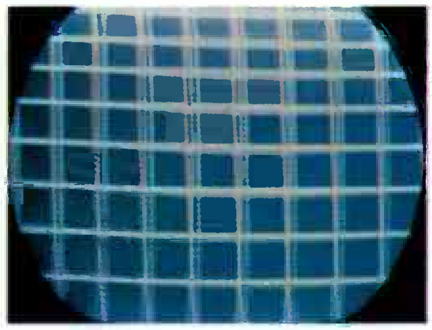


Fig. 4. Better, but far from good.

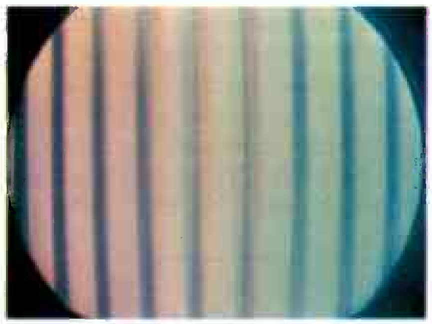


Fig. 5. Color-bar pattern, contrast and color controls wide open.

Fig. 6. Clod pulled the vertical linearity up until the raster filled the screen —the heck with linearity!

Fig. 7. The end of the story; a 'sellable' picture. (Honest! This is the same set!)

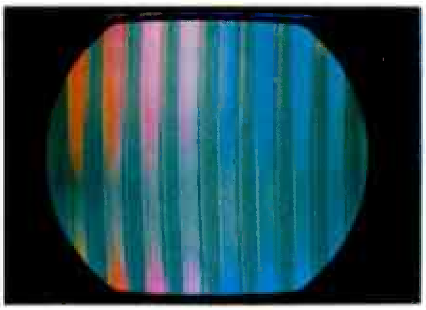
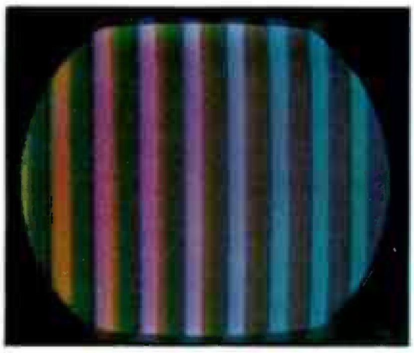


Fig. 11. Hum caused by H-K leakage.

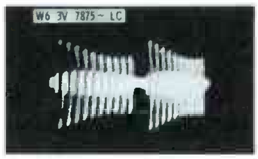
has 3.58-MHz traps in its plate circuit so horizontal blanking of the 3.58-MHz burst is not necessary. Another noticeable difference is the common cathode-coupling between the first stage and the burst amp. The Color Level control and killer voltage application are conventional, but notice the four tuning adjustments for proper bandpass.

This circuit has significantly higher signal levels than the previous circuits discussed and since there is no phase inversion in the first stage, it is similar to the newer single-stage bandpass amplifiers.

The RCA CTC16 bandpass amplifier in Fig. 10 uses only one



(A) Screen presentation



(B) Waveform at demods

Fig. 12. Bars of varying amplitude.

stage of amplification. The burst amp takeoff precedes the grid circuit; the color killer voltage is applied to the bottom of the input autotransformer, and the horizontal blanking is applied to the cathode. With the exception of the absence of a Color Level control, this circuite is quite similar to the second stage of the CTC7A bandpass amp.

The signal levels in the CTC16 amplifier are higher than its two-stage counterpart and the ACC is missing. Broad bandpass is aided by: the 270-ohm resistor in series with the input autotransformer, overcoupling of the output transformer, and damping of the demodulator input. Phase shift with variations in the setting of the Color Level control are minimized with the tapped control and series coil.

When servicing in the field, the use of visual signals to logically isolate the problem is essential. Since all of the color signals usually pass through the bandpass amplifier, it should immediately be suspected when a symptom is common to all the colors, or the symptom occurs only with color reception. The bandpass amp should be suspected in the event of complete color loss. Color shift is usually caused by the AFC or demodulator circuitry; but if the tint control has full range, suspect the bandpass amp, as decreased emission can effect bandwidth. Hum caused by heater-to-cathode leakage is shown in Fig. 11—there were no b-w symptoms.

In most chassis, color killer action is dependent upon color burst strength. With insufficient burst for color sync, the color killer will usually disable the bandpass amp, so the bandpass amp is usually not suspected when color sync is lost. However, in the Zenith 24MC32 chassis the color killer includes the screen-grid circuit of the first stage. Decreased cathode emission in the 6KT8 can cause loss of color sync accompanied by poor or non-existent color killer action.

When bench servicing bandpass amplifiers, the importance of using a good wideband scope and a low-capacity probe cannot be overemphasized. If the scope has sufficient gain, use a 10:1 probe for further isolation. Chroma frequencies range from 3 to 4 MHz, and if the probe loads the circuit, any measurements will be misleading.

A scope will quite often pinpoint troubles in chroma stages such as low output, misalignment, and hum. For example, if all the bars are not of the same amplitude, as in Fig. 12, suspect misalignment or more

• *Please turn to page 72*

Operates like a manual. *Aims like an automatic!*

The *Semi*-Automatic Colorotor!

If you're selling manual rotators, step up your sales with Channel Master's totally new concept in rotator controls that gives your customers pinpoint precision at an economy price!

For the first time in the design of rotator controls, Channel Master has put a motor instead of a meter into a non-automatic control unit. The new Semi-Automatic uses a second motor in the control unit which works together with the drive unit motor as a synchronized team. Up until now only automatic models have offered this quality feature, yet the semi-automatic is priced midway between a manual and an automatic.

MUCH GREATER ACCURACY! Exclusive new Semi-Automatic control unit provides almost 6 times more indicator travel than the compass control—more precise aiming—more accurate relocation of stations. Simple two-button control. Right button for clockwise rotation—left button for counterclockwise rotation. Antenna stops instantly when button is released.

BEAUTIFULLY STYLED. The control console has been beautifully styled by a top industrial designer to a sleek, contemporary look. These handsome new units have the grace and elegance to blend tastefully with the styling of the contemporary television sets in modern homes.

FAST, SIMPLE INSTALLATION. Uses economical, dependable 3-conductor rotator wire. No need to calibrate or compensate for different cable lengths. "Cut 'n Strip" Guide molded into bottom. Barrier terminal board prevents shorts. Built-in wire strain-reliever insures permanently tight connections.

Channel Master has the most complete antenna rotator Step-up line in the industry—choose from manual, Semi-Automatic, Automatic or Deluxe Automatic models.

CHANNEL MASTER
ELLENVILLE, N.Y.

Circle 21 on literature card

Poll shows appliance dealers prefer Channel Master color antennas by tremendous margin. We're not surprised. Read why.

When it comes to color antennas, we know our place. That it happens to be **first** place—and that Channel Master has been up there a long time—is a sweet thing to know. (Just try and budge us.)

But—once in a while—isn't it nice to have somebody else confirm what you've always known?

What happened was this: One of the nation's top three publications in the radio-TV-appliance merchandising field—(name on request)—made an independent survey of color set appliance dealers. Result? The lopsided box-score, in case you haven't noticed, is down below. Please observe that the opposition isn't even close.

Now as long as Channel Master Crossfires are up there we wanted to know why they're up there. So we requested the same publication to take a second poll. And just as we thought: Any specific brand of antenna may be preferred on many counts. But one reason leads all the rest. Performance! That's why the Crossfires are No. 1. They work better! (With color sets or black-and-white, naturally). This includes our VHF/FM series for suburbs-to-fringes, our Coloray ghost-killer series, and our Ultradyne Crossfire 82-channel FM or Ultradyne UHF only series.

To what do we owe our success? Our principles. (Unique engineering ones, of course. All of them patented or with patents pending.) They make the Crossfires the mightiest antennas ever developed. With remarkably high gain and up to 30-to-1 front-to-back ratios. (Maybe the competition's principles just aren't as powerful as ours.)

So call your nearest Channel Master distributor, join the rest of the gang, and come on up. The installation's fine and the profit's high.

High Man
On The
Totem Poll!

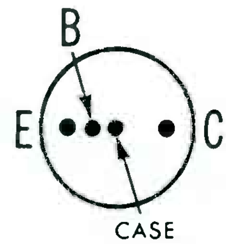
Circle 22 on literature card

Tube & Transistor Data

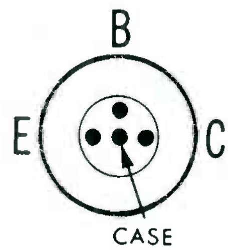
(Continued from page 29)

TRANSISTORS

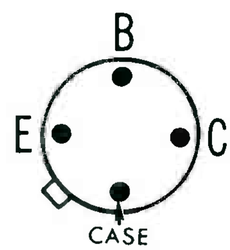
2SA70
AF Amplifier
PNP—Germanium



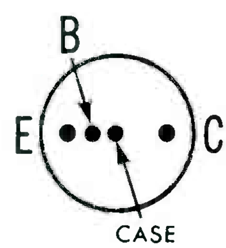
2SA239
Video IF Amplifier
PNP—Germanium



2SA92
AM RF Amplifier
PNP—Germanium



2SA241
FM Converter
PNP—Germanium

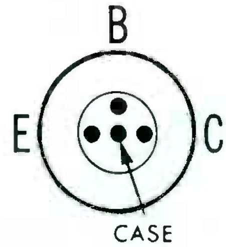


• *Please turn to page 54*

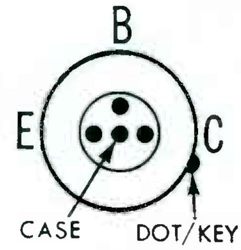
Tube & Transistor Data

TRANSISTORS

2SA267
AM Converter
PNP—Germanium

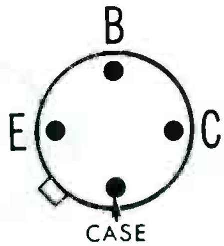


2SA361
VHF Amplifier
PNP—Germanium

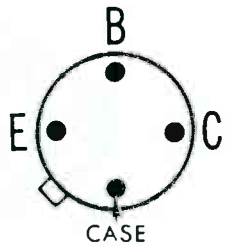


TRANSISTORS

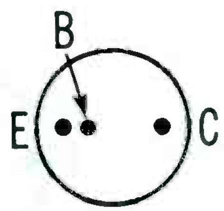
2SA379
VHF Amplifier
PNP—Germanium



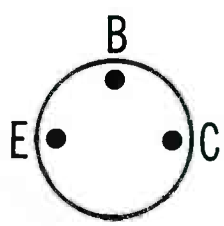
2SA432
VHF Amplifier
PNP—Germanium



2SB38
Horizontal Driver
PNP—Germanium

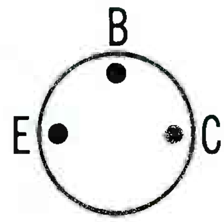


2SB346
AF Amplifier
PNP—Germanium

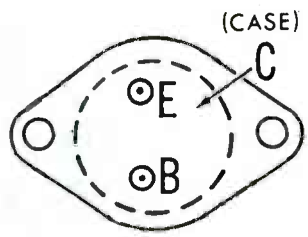


TRANSISTORS

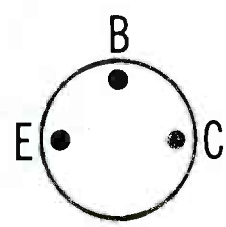
2SB385
AF Amplifier
PNP—Germanium



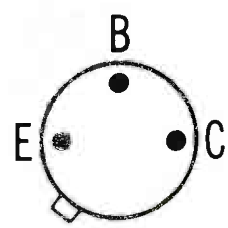
2SC41
Horizontal Output
NPN—Germanium



2SC115
Video Amplifier
NPN—Silicon



2SC727
Audio Output
NPN—Germanium



CG138

CG10

It's time you too switched to Sencore and saved $100 in the bargain. The new LO-BOY is a solid Sencore value — already selling at the rate of one every 8 minutes.

Small wonder. The LO-BOY outperforms the highest priced unit on the market . . . and gives you all this: • Ten standard RCA licensed color bars; NTSC phased colors. • All the patterns found on more expensive generators—crosshatch, individual vertical and horizontal lines, and adjustable white dots . . . all at the flick of a switch. No lines missing on crosshatch—14 horizontal and 10 vertical, same as our more expensive models. • Interlace control—a Sencore "first." Stops dot bounce that varies from set to set. • Rugged all steel construction with tough scuff-resistant vinyl finish. • LO in silhouette—not much bigger than a cigar box. • LO in warm-up time. All solid state design. • LO in troubles. All new **patent pending** counting circuits using new silicon transistors. Crystal controlled timers for the utmost in stability.

Timer controls brought right out on the front panel as simple operators controls. Adjusted as easily as the horizontal and vertical hold controls on a TV set, if they should ever jump. Absolutely eliminates timer instability.

Compare these features and you'll decide in less than 8 minutes that you need a new Sencore Lo-Boy.

SENCORE CG10. All solid state. New zener regulated battery power supply with long life "C" cells. The 12 volt battery supply can wear down to nearly 9 volts before the circuits are affected. New leakproof battery holders permit easy battery replacement without dismantling the unit. You don't have to hunt for a place to plug it in. Priced at less than the cost of a kit. ....Only **$89.50**

SENCORE CG138. A performance giant just like the CG10 except AC operated with a zener regulated power supply for added stability even with line voltage variations. Has 4.5 mc crystal controlled signal for fine tuning as recommended by color set manufacturers. ....Only **$109.50**

Every 8 Minutes of Every Business Day

SOMEONE BUYS A NEW SENCORE LO-BOY

STANDARD COLOR BAR GENERATOR

See America's most complete line of professional test instruments — at your Distributor's now.

SENCORE

NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT

426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

Circle 27 on literature card

Remote Control

(Continued from page 19)

is not applied to the TV chassis, or to the channel motor circuit. The only remote function operative now is the volume circuit.) If the remote volume-up switch is now activated, the volume motor starts turning, activating (in this instance, closing) standby switch S2.

With S2 closed, AC power is applied to the TV power transformer (T2), turning the TV receiver on. This action also completes the AC path to channel switch S3 located on the remote control chassis, and to one side of the program switch (S4) and station stopper switch (S5). Under these conditions, the television receiver and the remote control receiver circuits are completely operative—including the channel, color, and tint functions. (The color and tint motor circuits are not shown; they operate in the same manner as the volume motor circuit.)

Channel Change

If the channel button on the remote transmitter is pressed, the channel relay (located on the remote) is energized, closing channel switch S3; power is applied to and starts the channel motor. Several sequences of switch action occur after the channel switch is closed. Notice the three other switches associated with the motor control circuit. These are the manual-remote switch S6, the station stopper switch S5, and the program switch S4. The manual-remote switch (operated by the motor shaft) is connected in series with the motor hold and program switches. When the motor starts to turn, the armature pulls in, closing the remote-manual switch (it remains closed while the motor is running). With S6 closed, the station-stopper and program switches are active and prepared to control motor action.

When the motor starts to run, S5 comes out of the depression on the cam and closes; likewise, the program switch is activated for the tuner has started to rotate. Notice that these two switches are actually in parallel—if either switch is closed, a voltage path is completed, and the motor continues to run. The station-stopper switch remains closed for one channel change — that is, during each channel step, the cam (located on the rear of the motor assembly) makes one complete revolution (channel 3 to 4 for example).

The program switch will open only on programmed channels. If a programmed channel appears, the contact drops into the depression. However, if an unprogrammed channel is reached during this time (while the station-stopper switch is open), the program switch will be closed, completing the motor circuit, letting the motor continue to run. If a programmed channel appears during the time the motor-hold switch is in the depression (open) and the program switch is in the depression (open), the motor stops.

Here is a review of the motor control circuits: The channel switch on the remote control (S3) is activated and closes, completing the circuit to the station-stopper switch and the program switch. If either switch is *closed* at any time while the motor is running, the motor will continue to run. The motor stops *only* when both S4 and S5 are opened simultaneously — when a programmed channel is reached. The action of the switches is better understood if you notice that when either of the three switches (S3, S4, S5) is closed, the channel motor will start or continue to run.

Servicing

Troubleshooting remotes by the "end-result" method makes the repair job a bit easier. An example can be illustrated using the schematic in Fig. 6. Let's assume trouble exists in the channel-change function.

As your first step in servicing locate the motor, its power requirement (usually 120VAC), and the *common-line* connection to the input power. Next, trace the *controlled* line from the motor, via switches, to the AC return. In other words, establish how the motor power path is completed. Once the initial (most direct) path is found, manually close the switch (S3 in Fig. 6) that completes the path. If the motor starts, look for trouble in the remote chassis. If the motor fails to start, trace the common and return lines to the AC input terminals to locate an open circuit or defective motor. If the motor "hums" but fails to operate, check for a binding tuner. In Fig. 6, the initial path can exist via S1, S2, and S3; a secondary path can exist via S4 or S5, *but only if S6 is closed* (when the motor is running).

This procedure would work well regardless of the defective function —volume, color, etc. If stepper relays, bistable relays, or similar electromechanical components are encountered, establish first how the power to start the initial action is obtained.

You'll find remote controls are "starting to clear up" on your next service job. ▲

Scanner

(Continued from page 16)

Potpourri

Waldom Electronics, Inc. has announced a contest for unique solderless terminal and fastener applications, with cash awards for the winners. Called the "STF Sweepstakes" contest, its object is to compile as many reports as possible, describing unusual applications, regardless of whether the fasteners or solderless terminals used were Waldom's. The cash awards will be given to those authors of reports featuring applications that resulted in unusual economies or technical superiority.

For full details on the Waldom "STF Sweepstakes" contest and an entry form, write to: Mr. Sheldon Schwartz, Sales Manager, Waldom Electronics, Inc., 4625 W. 53rd Street, Chicago, Illinois 60632.

Seven closed circuit television systems, designed and manufactured by **Sylvania Electric Products Inc.,** have been installed in Sacred Heart Hospital in Eugene, Oregon, to transmit training information to the medical staff and educational programs to the patients.

The system allows the medical staff to watch surgery from the auditorium and lounges throughout the building, and a system in the nursery sends programs on infant care to mothers watching television in their rooms or in the lounges. Closed circuit equipment in the hospital chapel televises mass to bedridden patients. A camera installed in the kitchen advises patients of hospital menus for the week, and also shows the preparation of food.

A camera mounted outside the emergency entrance transmits a signal to a monitor at the hospital switchboard. Telephone operators can summon physicians and nurses to the emergency areas as they are needed.

In addition to the closed circuit equipment, 227 television receivers have been installed in patients' rooms. Adjacent to each of the hospital's 365 beds is a hand speaker which allows the patient to regulate volume and change channels. The speaker units also include controls for a voice communications system between the patient and the nurse's desk on each floor. The TV sets receive selected closed circuit programs as well as entertainment and news from commercial channels.

An outstanding feature of the 1966 Los Angeles Home Show was the All-Electronic Home of Tomorrow, with its myriad of ultramodern devices. Combining these devices into a unified whole is a **Jerrold** distribution system. The system supplies antenna signals to TV and FM outlets in every room of the house. It also ties together the closed circuit TV camera and tape recorder system. Prewired into the home, the system not only accommodates all of the electronic devices presently shown in the Home of Tomorrow, but provides for future developments as well.

Among the units featured in the All-Electric Home are: closed circuit TV/telephone systems, electronically controlled windows and lawn sprinklers, video and audio tape recorders, an electronic cooking center, and a wide variety of home entertainment devices.

Zenith Radio Corporation sales and earnings for the first half set new all-time records for the period. Earnings for the six months ended June 30, 1966 rose to $18,352,000, after provision for Federal income taxes of $17,625,000. This is 71% over the previous record first half earnings of $10,728,000 reported a year earlier. Sales for the period were $305,238,000, 54% ahead of the previous first six

months record of $198,036,000, set a year earlier.

All Zenith consumer product lines showed increases in unit and dollar sales. Color television was the most important factor in the sales increase with unit and dollar volume more than double the first six months of 1965. Zenith color TV sales in the second quarter of 1966 were substantially higher than the Company's total consolidated sales in the comparable 1964 period — only two years ago. Black-and-white television sales also continued at record levels. ▲

Your color wasn't off—it was the strawberry jelly that made their complexions so red.

Circle 36 on literature card

Notes

(Continued from page 32)

disconnected from the receiver if desired.

Adjust the receiver balance and volume controls so that each meter reads 0 dB. Turning off one channel at the generator will now give a system separation reading directly in dB on the meter of that channel. The meters are also calibrated "Hi-Good-Low".

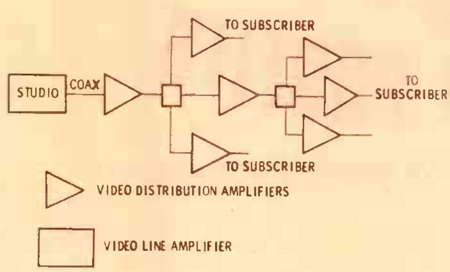
The MX11 is crystal controlled and completely transistorized. It's housed in the Econoline case and weighs only 5½ pounds. The price is light too—$99.50.

Pay TV

(Continued from page 25)

In STV, the signals are transmitted over-the-air with some of the required information missing. In some proposed systems the missing information would be transmitted over telephone circuits to TV receiver decoders, or generated by pay-as-you-use black boxes.

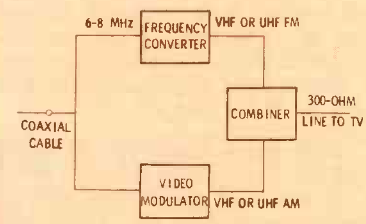
However, the technical system requirements for subscription TV have not yet been established by the FCC. The chief engineer of the FCC feels TSV should be limited to a single technical system for a number of reasons. He pointed out in a recent memorandum that the use of different STV systems would require provision of different decoding apparatus in order to receive several kinds of transmissions.



Wired Pay TV

Pay TV systems employing coaxial cable for program transmission directly to subscribers in CATV style are a form of CCTV (closed-circuit television) and is not STV as referred to in the newly proposed FCC rules. Wired pay TV may or may not be regulated by the FCC in the future when interstate transmission is not involved. It is already in use in Canada and in New York City on a limited scale, and was in use in California until it was temporarily banned in that state. Another such system is proposed for Miami Beach.

Unlike CATV, wired pay TV systems can transmit the video signal directly and the sound channel on an RF carrier through a coaxial cable network, as shown in Fig. 4. Since the highest frequency transmitted is below 10 MHz, far fewer repeaters are required than for CATV. The video signal could be applied directly to a TV receiver but, for the sake of convenience, a "black box" can be used at TV receivers. The black box contains a video modulator which delivers an RF signal, tuned to an otherwise unused TV channel, and a frequency converter for the FM sound channel, as shown in Fig. 5.



With the above type transmission, the signals are not scrambled. Since it is relatively easy to design and build an adaptor, scrambling techniques might be used to prevent program pirating.

Program Charges

Some STV decoders and wired pay TV adaptors, it is proposed, will be equipped with a coin box which activates the decoder when sufficient cash is inserted. Others will have a tape on which the charges for programs watched are recorded for future billing. As STV develops, more sophisticated collection techniques will undoubtedly be devised.

In Hartford, Conn., where Phonevision STV (Zenith) has been available for more than four years, subscribers pay a $10 installation fee and, after an initial three-month free period, a rental of $0.75 for the use of a decoder. Program charges average $1.00. Charges have ranged from $0.25 for educational and children's programs to $3.00 for a world's heavyweight championship boxing match.

Servicing

It is believed by the advocates of STV that millions of homes will be equipped with decoders. All of them must be installed and all will require service whether rented from a TV station, decoder manufacturer or distributor, or purchased outright by the subscriber.

At the outset, some of the furnishers of decoders will undoubtedly make the installations and handle servicing. Since it is doubtful that decoder manufacturers and TV stations will want to maintain extensive field service organizations, a vast new market will open up for the independent service shop. Payment for decoder servicing may be made by decoder renters or STV viewers owning their own decoders or both.

Test equipment required for servicing STV decoders will undoubtedly include a wide band scope for observing video, audio, tone, pulse, and code waveforms and for measuring frequencies with the aid of an AF signal generator. Scrambled signal simulators will probably become available which will be helpful when testing decoders when there is no STV signal on the air.

For servicing wired pay TV adaptors for unscrambled signals, a video signal pattern generator would be handy for simulating a TV program when none is being piped through the cable.

STV Timetable

STV is already on the air in Hartford. Upon receipt of authority from the FCC, STV operation is slated to start soon in Chicago, New York, Los Angeles, Washington, New Haven, San Francisco, and Philadelphia.

Until recently, NBC was the only network broadcasting color TV on a regular basis. Now, all three networks are deep in color TV and manufacturers have difficulty keeping up with the demand for color sets. Not long ago, FM-stereo was an idea. Now, almost 300 FM stations broadcast stereo programs. Soon, STV can be expected to blanket the nation. The TV service industry will benefit and should now be getting prepared to handle STV servicing. ▲

Circle 42 on literature card

The Troubleshooter

answers your servicing problems

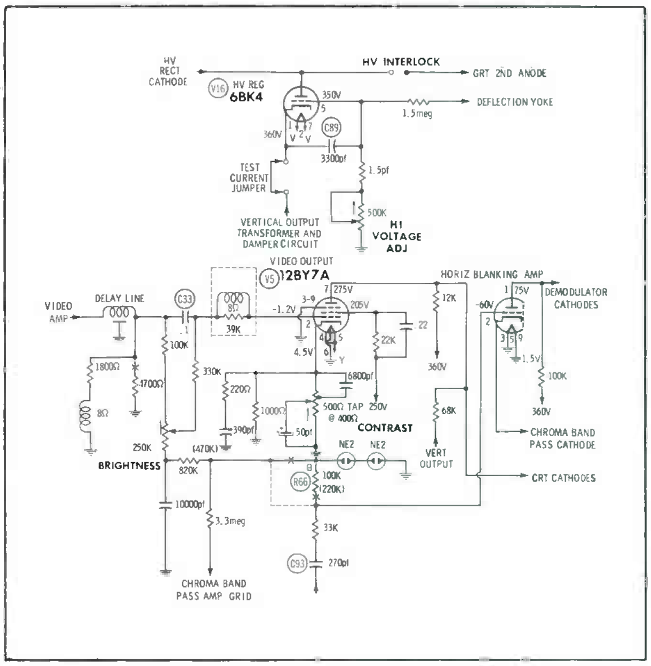
Reduced Raster, Blooming, and Focus Trouble

After replacing a bad picture tube in an RCA CTC10 color chassis (PHOTOFACT Folder 517-2) and restoring color with a new 3.58MHz crystal, I am still having trouble A satisfactory picture can be obtained only at about half the brightness control setting. Any higher setting results in picture blooming, reduced raster, and a severe out-of-focus condition.

B+, boost, high voltage (20kv), and horizontal drive are all within tolerance. All components in the regulator circuit have been replaced. Voltages and components in the video output stage have been checked, but the cause of the trouble still has not been found.

R. J. BERNSTEIL

Freeport, Pa.



The symptoms you have described are normally associated with poor voltage regulation; however there are also other causes. First, before looking for the trouble elsewhere, be absolutely sure the high-voltage and regulator circuits are functioning properly. Although you have indicated that the high voltage is normal and that the components within the regulator circuit have been changed, there is still a chance that the trouble exists within the regulator stage. Perform a horizontal sweep circuit adjustment as outlined on page 16 of the PHOTOFACT *Folder, making sure that the high voltage measures 24kv and regulator current does not exceed 850 microamps. If the regulator current does not reach the maximum of 850 microamps, even with the brightness control at minimum (dark raster), trouble exists in the high-voltage circuit or within the regulator circuit itself.*

Rotate the brightness control from minimum to maxi-

mum, monitoring the regulator current. The current should decrease as the brightness control is advanced and increase as the brightness is decreased. If regulator current does not decrease as the brightness control is advanced, an incorrect high-voltage adjustment, gassy regulator tube, or grid-to-cathode leakage is indicated. Grid-to-cathode leakage is usually caused by a leaky C89, and produces symptoms much like those you have described.

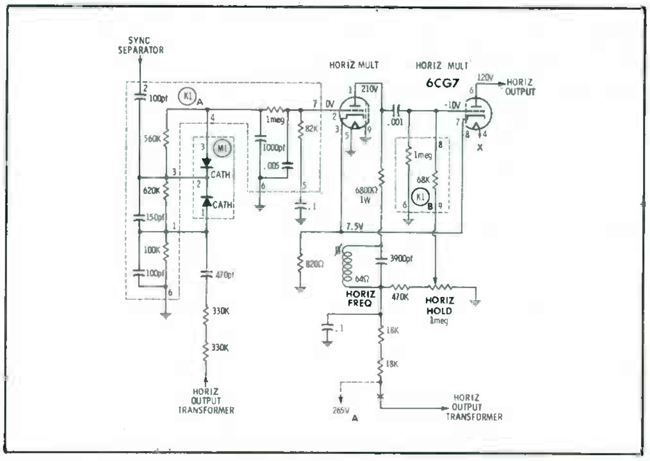
Other possible causes of this trouble include a leaky or shorted C93, which would place a high positive potential on the blanker tube grid and consequently, reduce or eliminate the negative potential ordinarily present at the junction of R66 and the neon regulators, NE2. This, in turn, would lower the bias on the grid of the video output tube (V5), causing increased condition of this stage and a resultant increase in CRT current. A leaky C33 could also produce the same symptoms. The preceding tips are the most likely sources of trouble. If the trouble cannot be located in the circuits or components mentioned, look for some other faulty component (there are others) that could cause excessive CRT current or decreased high voltage.

Intermittent Raster

I would like to share the following "tough dog" experience with the readers of PF REPORTER. Recently, we were called to service an Olympic HA Chassis (PHOTOFACT Folder 438-2) with intermittent raster. After the set was operated for a few minutes, it lost horizontal sync and a drive line appeared. Then it lost raster completely. Substituting the horizontal oscillator and output tubes did not clear up the trouble. Next we changed the damper and high-voltage rectifier, but the trouble persisted. After taking the set to the shop, we operated the set on the bench until it lost raster again. While probing for the trouble, I happened to change channels and discovered that when the set was switched to the unused channels, the raster returned. The set would loose raster only on active channels. With the aid of an analyst, we localized the trouble to the AFC circuit. After changing the AFC diodes, the set was restored to normal operation. I have never encountered or heard of the AFC diodes causing this particular trouble.

R. M. CARLSON

Attleboro, Mass.



Although it is desirable that both phase detector diodes have identical forward and reverse resistance characteristics, a 20% tolerance is allowable. From this it can be seen that a slight difference in characteristics will not adversely affect circuit operation. However, when the characteristics of either diode deviate beyond this allowable tolerance, unstable sync or a complete loss of sync occurs. In extreme cases of characteristic difference, or when either diode shorts, the multivibrator becomes inoperative, which in turn alters the operation of the horizontal output stage and results in loss of high voltage. In this particular case, the horizontal multivibrator continued to operate in its free running state when the receiver was tuned to an inactive channel. However, when a station signal was received, the negative horizontal sync pulse felt across the defective AFC circuit upset the free running condition of the multivibrator, making it inoperative. With inadequate or no drive, the horizontal output and high voltage circuits fail to operate properly and consequently, high voltage was either lowered or completely eliminated.

No Color

A Zenith color set, Chassis 25MC36 (PHOTOFACT Folder 773-4) suddenly quit, with no b-w or color picture. After restorting the b-w picture and sound, a color setup was attempted. The setup proceeded normally, until the color generator was switched to the bar pattern—no color bars appeared on the screen. All tubes checked good. The trouble appears to be in the color killer stage. What is the best troubleshooting procedure to use?

J. H. HUYBERS

Edmond, Wash.

Your preliminary diagnosis is probably correct. Assuming that the b-w picture is of good quality and that gray bars are present on the screen with the color-bar generator connected to the receiver, the most likely source of trouble is in the chroma circuits comprised of the 1st bandpass amplifier, burst amplifier, killer phase detector, color killer, and 2nd bandpass amplifier. With the color-bar generator connected to the antenna terminals of the receiver, use a wideband scope to trace these stages in the order that they are mentioned. If you do not have a wideband scope, use a VTVM to check grid and plate voltages on each stage. You will probably find that the 2nd bandpass amplifier is cut off by the color killer which is continuing to conduct during color reception. Normally, during color reception, the color killer is cut off by the burst signal from the killer phase detector and burst amplifier. This lowers the bias on the 2nd bandpass amplifier, allowing it to conduct and pass the chroma signal. However, with the burst signal absent, the color killer will continue to conduct, resulting in the no-color symptom you are experiencing. If the trouble cannot be isolated to any of the previously mentioned stages, check the chroma reference oscillator. A defect which completely disables the oscillator can also cause a no-color condition. ▲

Bandpass Amplifiers

(Continued from page 52)

likely a change in component value.

Occasionally a trouble will appear which seems to be caused by troubles outside the chroma section. In bandpass amplifiers which share the cathode resistor with the blanking amp for burst supression, an open cathode resistor will cause loss of brightness and loss of brightness control on black-and-white. Also, it will be impossible to receive color. The loss of color is the only symptom to indicate chroma circuit trouble. The same common cathode resistor can, if it increases in resistance, suppress color on the left side of the screen. This effect is caused by distortion of the blanking pulse.

Step-by-step voltage checks under color and no-color conditions are quite useful in finding components that are defective. In bandpass amplifiers which share their cathode resistor with the horizontal blanker the color killer voltage is −8 to −15 volts because the cathode still remains positive if no color signal is received. When a color signal is received the second stage begins to conduct and plate voltage drops from 245 to 235 volts. When a voltage out of tolerance is found, start resistance checks.

The Zenith 24MC32 (Fig. 8) will present some unique symptoms because of the color killer section in its first stage screen grid circuit. An increase in resistance of the plate load will affect color killer adjustment and, if the increase is sufficient, could completely kill the color by keeping the second stage cut off. A decrease in the same resistance would have an opposite effect and would also decrease color output.

In the Motorola TS-912Y the second stage plate circuit is rather critical because the output transformer is part of a phase shift network driving the chroma demodulator. A change in the plate load resistor could affect output Q and cause undesirable phase shift.

The input circuit of the RCA CTC16 single-stage bandpass amp can be affected by changes in the decoupling circuit. If, for example, the decoupling capacitor opened, there would be an almost complete loss of color signal at the grid. Or, a change in value of the 270-ohm damping resistor would cause undesirable phase shift. The plate load resistor is very small in comparison to plate resistance, so suspect trouble if there is a large change in plate voltage from no-color to color conditions—the bypass capacitor is possible leaky or the load resistor has increased in value.

There is nothing difficult in servicing bandpass amplifiers; the bandpass amplifier is one of the simplest circuits in a color receiver. Once its functions are understood service is extremely easy. The only essentials are a basic knowledge of circuit operation, a good VTVM, a low-cap probe, and a good wideband scope. ▲

Book Review

ABC's of Electronic Test Probes; Rudolf F. Graf; APG-1, Howard W. Sams Co., Inc.; Indianapolis, Ind.; 128 pages, 126 illustrations, 5½" x 8½", paperback; $2.25.

Much-needed and long-awaited, this book comprehensively covers its title subject. Without the knowledge found in these pages, the technician can scarcely begin to effectively use his scope or VTVM.

Furthermore, with the probes covered in this book, he can measure or display the voltage present at the points on schematics which are marked "do not measure."

Some of the probe types explained in detail are: direct and isolation, capacitive divider, high voltage, low-capacitance, and cathode-followers. Rectifier probes have a whole chapter devoted to them. The types covered include peak-reading and voltage doubler. Demodulator probes are extensively explained in another chapter.

The final chapter covers special-purpose probes such as signal-tracer, signal injector and clip-on current detectors.

The book is profusely illustrated, and includes construction details so that the reader may build most any type probe. With these probes, those "tough dogs" can quickly become puppies.

MOVING?
Don't Lose Touch . . .

Receive PFR as usual at your new address

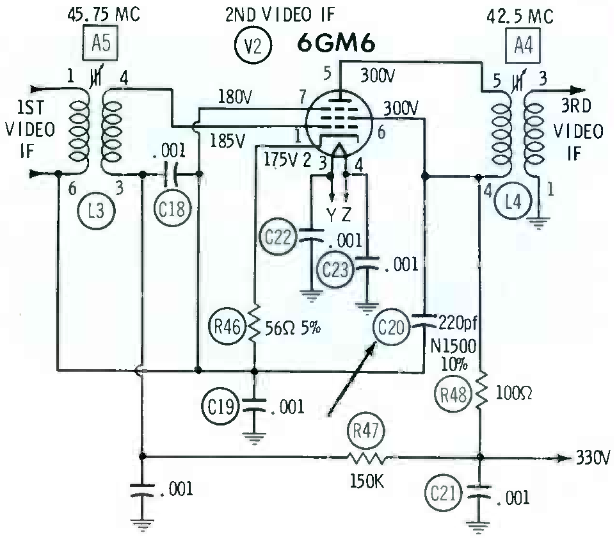
(Include old and new address.)
Write:

**PF REPORTER
Circulation Dept.
4300 West 62nd St.
Indianapolis, Ind. 46206**

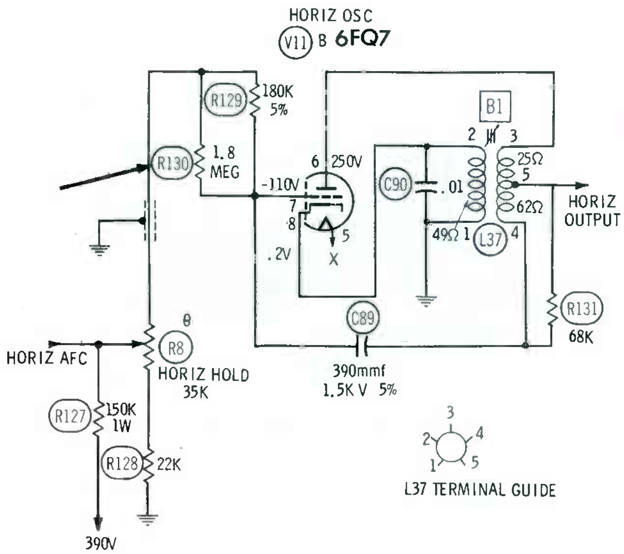
Color Countermeasures

Symptoms & Tips From Actual Shop Experience

Chassis: RCA CTC15
Symptom: Picture overload when on channel; no snow off channel.
Tip: Check for shorted or leaky C20 (220 pf) in 2nd video IF stage.



Chassis: RCA CTC15
Symptom: Continuous overheating of horizontal-output tube; plates slightly red.
Tip: Check for open R130 (1.8 megohms) in grid circuit of horizontal oscillator.



Product Report

For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Garage Opener

(77)

A new electronic garage door opener, the Electro-Lift, has been introduced by **Perma-Power Company.** The Electro-Lift (Model G-680) is especially designed for single car garages, and may also be used on two car garages with one-piece doors.

The all-transistor design of the Electro-Lift car and garage units (transmitter and receiver) provides solid-state dependability and reliability. The transmitter is completely portable and requires no car installation; it can be carried in purse or pocket, or clipped to the sun visor or under the dashboard. The receiver is affixed conveniently to the wall of garage for easy access, and uses pulse-tone modulation. This technique provides protection against unauthorized "phantom" operation of the garage door. A sensitive safety clutch permits the mechanism to exert just enough force to move the door reliably, but automatically stops the door instantly and turns off the motor if an obstacle is encountered. List price is $179.95.

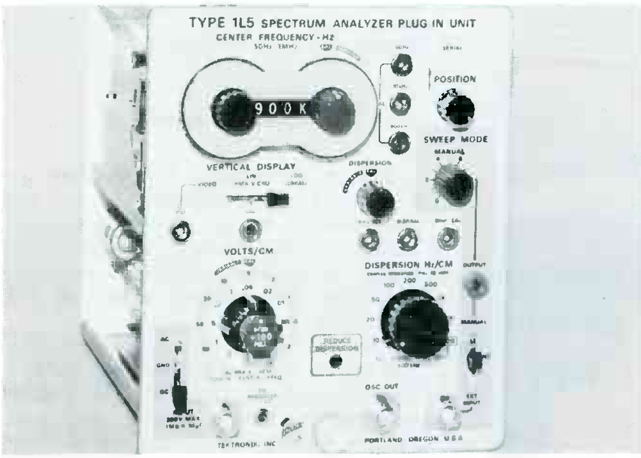
125-Watt Inverter

(78)

A new solid-state inverter permits operation of portable TV sets, phonographs, lights, P.A. systems and many standard household electrical appliances from a 12-volt DC battery. It may be plugged into a cigarette-lighter socket, or connected directly to the battery with a color coded battery-clip adapter accessory. Automatic thermal overload protection and a "start" switch for "hard-to-start" items are featured in this new model manufactured by **Electro Products Laboratories, Inc.**

Model TI-100A converts the battery power in cars, trucks, trailers, boats and other 12-volt DC sources to 117-volt AC, 60 Hz. It may be operated in any position and is ideal for the camper, traveler, outdoor sportsman, or home hobbyist. The 12-volt DC source is fuse protected.

Overall size: 3½" high, 6¼" wide, 6¼" deep; weight 6¾ lbs. Suggested list price is $46.50.



Spectrum Analyzer

(79)

Tektronix, Inc. announced a new spectrum analyzer plug-in for its Type 530, 540, 550, and (with adapter) 580 series oscilloscopes. The Type 1L5 Plug-In Unit extends laboratory display capabilities of a Tektronix oscilloscope to include spectrum analysis in the frequency range of 50 Hz to 1 MHz.

Permitting simple and accurate measurements directly from the CRT display, the Type 1L5 offers resolution range of 10 Hz to 1kHz coupled to calibrated dispersion, and analyzer sensitivity of 10 uV (RMS)/cm to 2 V (RMS)/cm. A recorder output is available for providing a DC-coupled analog output of the spectral display for chart recorders or other uses. Price of the Type 1L5 is $950.

Tape & Head Spray

(80)

Kleer Tone Spray No. 1633-6S is a new product from **Colman Electronic Products** designed to clean and lubricate tape recorders and players. While recommended for all types of players and recorders, it is particularly useful on the new Auto Tape Players, which because of their location, become dirty rapidly and are difficult to clean by conventional methods. The spary contains a silicone that forms a film of lubricant on the head and tape, preventing excessive wear of the tapes.

MATV Amplifier

(81)

Jerrold Electronics Corporation has announced the availability of its new "Gibraltar" Model 3660 solid-state MATV system amplifier. The unit is reported to provide a minimum of 40-dB gain with flat response across the full VHF band.

The unit is capable of handling over 100 outlets and can be used for 12-channel operation in large MATV systems such as in motels, hotels, apartment houses, nursing homes, and schools. Flat response across both TV and FM bands provides excellent color TV and FM performance. Solid-state circuitry insures high reliability. Specifications: GAIN, 40 dB. OUTPUT CAPABILITY, +50 dBmv per channel for 7-channel operation. GAIN CONTROL, 10 dB. IMPEDANCE, 75 ohms. NOISE FIGURE, 9 dB.

High-Power Speaker

(82)

The weatherproof HPR-75 speaker for electronic siren and mobile public address use is now available from **Atlas Sound.**

Designed for high-power mobile applications, the 75-watt HPR-75 speaker mounting bracket is cast in one rigid piece of aircraft aluminum for secure mounting under all conditions of severe mobile service. The bracket has space for a concealed wire connection.

Weatherproofed and ruggedized, the Atlas Sound HPR-75 high power speaker will take heavy duty abuse on service vehicles, automobiles, and trucks wherever vibration is a problem.

Specifications: Power, 75 watts. Impedance, 16 ohms. Frequency response, 275-8000 Hz. Dispersion, 100°. Dimensions, 8-11/16" bell diameter, 8¾" deep. List price, $83.75.

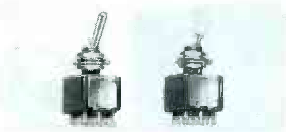
Screwdriver Kits

(83)

Two new Series 99 "Plastic View" kits, each containing a regular size (1-1/16" x 4-1/8") Service Master handle and a selection of interchangeable, single-end, screwdriver blades, have been introduced by **Xcelite Incorporated.**

The kits are compact and can be easily carried in hip pocket or tool box, and an eyelet is provided in the zipper case so the kits may also be hung on a wall or pegboard tool rack. See-thru, clear plastic case front permits instant identification of tools.

Handles furnished with the kits are of shockproof, breakproof, amber (UL) plastic. A patented spring device holds blades firmly yet allows easy insertion and removal. The handles will accept any of the interchangeable screwdriver, nutdriver, and other blades in the manufacturer's Series 99 line.



Subminiature Toggle Switches
(84)

C & K Components, Inc., producers of quality electromechanical products, announces the availability of its new Model 7301 3PDT Subminiature Toggle Switches.

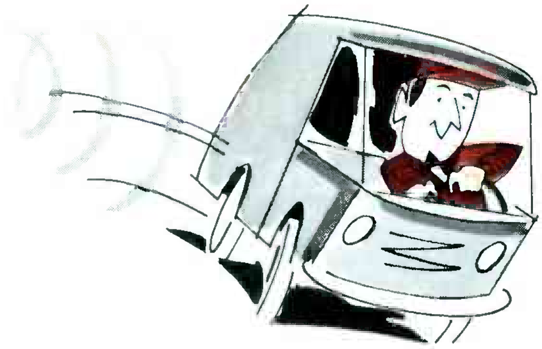
Featuring 40,000 cycles minimum life, the new Model 7301 is of rugged construction and has excellent appearance. Competitively - priced, these made - in - America subminiature toggle switches can be used in virtually any manual switching operation. Bat-handle operating levers are standard, however, plastic caps in a choice of 10 different colors are available on request at no additional cost.

Test Socket
(85)

A 10-pin decal base adapter (model 2610), used with the new 6Y9, 6X9, and 6U9 tubes, has been added to the series of tall test socket adapters offered by **Pomona Electronics Co.**

The adapter is tall enough to rise above the top of a captive tube shield, hence measurements may be taken from the exposed test tabs. Other models in the series are available to fit 7-pin, 9-pin, and 10-pin miniature tube bases.

RCA's COLOR TV FASTCHECK #6



No color?

Use this procedure to narrow down the trouble area...

If the receiver produces a normal black-and-white picture but no color during a color broadcast, try the following steps, in order:

1. Tune to a channel broadcasting color, or feed an rf color-bar signal into the antenna terminals.
2. See that the fine-tuning and color (saturation) controls are correctly set.
3. Rotate the color-killer threshold adjustment in the direction which disables the color-killer stage. *If locked-in* (in sync) *color appears*, reset this control as recommended by the set manufacturer.
4. *If color appears out of sync*, look for trouble in the automatic frequency and phase control (AFPC) circuits. Use a color-bar generator, and follow the AFPC adjustment procedures described in the manufacturer's service notes.
5. *If no color appears*, determine whether the color is lost in the circuits which handle the *composite* signal (antenna to bandpass amplifier) or in circuits that handle the *separated* color signal, as follows:
6. Feed a color-bar signal into the antenna terminals and use a scope to check the composite signal at the video detector.
7. If color-bar waveforms are absent or badly distorted, check for trouble, including poor bandpass, between the antenna terminals and video detector.
8. If color-bar signals are present at the video detector, check the burst keyer or separator, bandpass amplifier, color-killer, and the 3.58 MHz oscillator stages and their associated circuits.
9. Once the inoperative stage is found, use voltage and resistance measurements to pinpoint the circuit defect.

This ad is still another in a series of color TV service hints from RCA. To keep your customers satisfied, always replace with RCA receiving tubes. Your local RCA Distributor is your best source for top quality receiving tubes for color TV.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.

RCA® The Most Trusted Name in Electronics

Quick-Freeze

(86)

The time-consuming job of locating intermittent components in electronic circuits can be shortened by the use of a new aerosol freezing agent. The product, "Component Freeze," was developed by **Miller-Stephenson Chemical Co., Inc.** Sprayed on a suspected resistor, capacitor, or other circuit element, it reduces the surface temperature of the component to —50° F. in seconds for a "Go-No-Go" test. This saves the time lost in waiting for a circuit to cool off before testing for the intermittent component.

Dynamic Microphones

(87)

Sonotone Corporation now offers a new line of dynamic microphones for use in PA systems, tape recorders and learning laboratories as well as in professional equipment. They feature high quality performance, dependable service, and stylish design, with a choice of 7 models in 200-ohm, 600-ohm, 10,000-ohm and 50,000-ohm impedances. For use with solid state as well as tube equipment, they have polyester film diaphragms to withstand high temperatures and humidity.

Hash Hushers

(88)

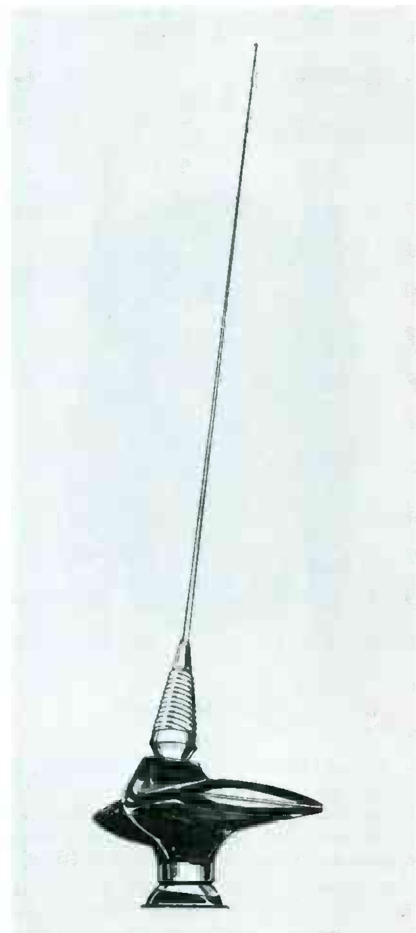
Hash Husher kits are designed to reduce the electrical interference caused by ignition noise pulses. These new kits, developed by **Hallett Manufacturing Company**, consist of electronic RL filters that snap in place between spark plugs and leads, plus a special, filtered, coil-to-distributor high tension lead. Hash Hushers fit all standard gasoline engines, won't affect mechanical or electrical operation, and can be installed in minutes. The suggested list price for the Model HH-8 Hash Husher kit is $12.95.

Cathode Current Test Adapter

(89)

A new 9-pin Novar color test adapter Model 2599, designed for measuring the cathode current of 6JE6 and 6KM6 horizontal output tubes, is announced by **Pomona Electronics Co.**

The unit provides alligator clip test leads running from the interrupted No. 3 pin of the adapter. When the adapter is installed between tube and tube socket, the technician can measure cathode current and adjust the circuit to operate within specifications. Net price $3.75.



Mobile CB Antennas

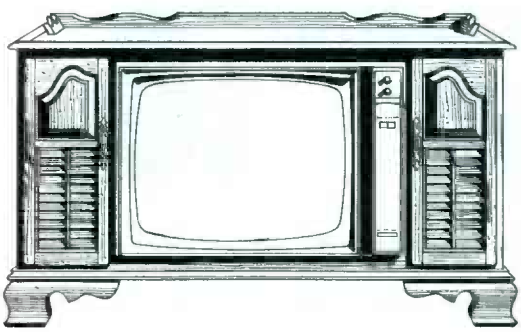
(90)

A spiral-shaped printed-circuit coil, waterproofed and shock-suspended inside a wing-shaped ornamental base, is featured in **Antenna Specialists'** new "Mach III" CB mobile antennas.

Technically known as an "involute transducer," the new circuitry is said to be precisely uniform in construction, and subject to virtually no breakdown from vibration. The antennas are DC grounded to provide an excellent VSWR, 1.3-1 across the band. Fine tuning is provided with a base adjustment.

The futuristic base unit is molded from cyco-lac plastic of the same type used in auto racing bodies. It is jet black in color with a smooth satin finish, trimmed in silver. Net prices range from $12 to $25 depending on mounting hardware.

It pays to be particular in outer space. That's why RCA builds weather satellites for NASA using solid integrated circuits—the most reliable kind of circuitry ever made.
And it pays to be particular about performance. That's why RCA Victor was the first to adapt this kind of circuitry for use in the sound system of some of its newest color and black-and-white TV sets – the most reliable TV on the market.



The Most Trusted Name in Electronics

Tmk(s)®

(Continued from page 44)

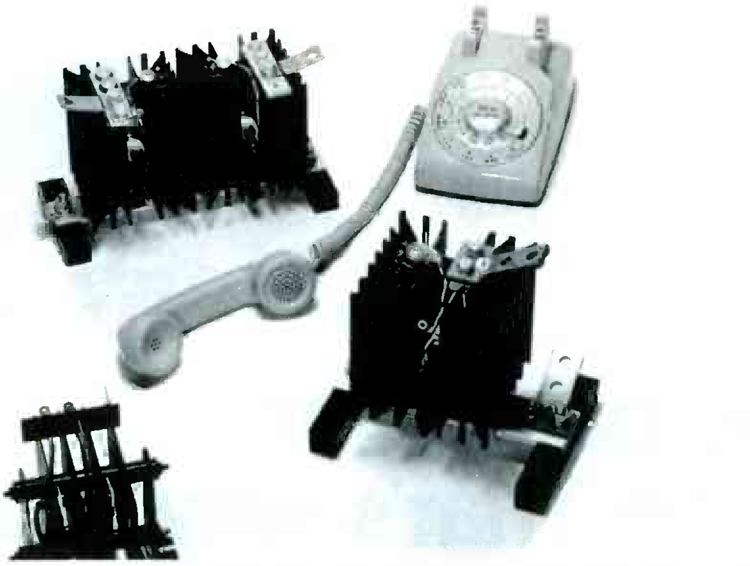


Fig. 7. Several different configurations can be used as heat sinks for SCR's.

types MCR 1304-4 and MCR 808-4. The NE83 neon tube is a specially designed triggering device that uses radioactive trace material to keep its firing voltage constant. This bulb should also be stocked. Potentiometers needed are the common push-switch type. However, in SCR applications, linear taper is required; logarithmic tapers cause erratic action. All other servicing components are standard.

The first step in servicing an SCR dimmer is to determine the nature of failure. If loads greater than the rated capacity of the unit are being used, it is possible an SCR unit may have failed as a result of thermal runaway. Replacing the SCR will correct the fault only temporarily. If heavier loads are to be dimmed, higher-power units (25-amp type) must be used, in which case the heat-sinking requirements are more severe. Some SCR units can be directly interchanged. Louvered outlet covers may improve overheating problems; however, operation well within the rating of the unit is always desirable.

Another common cause of failure is the attempt to handle fluorescent lights with the dimmer types described here. Special SCR dimmers are available with ballasts designed for this purpose.

The next step in servicing the SCR dimmer is to analyze the circuit configuration. Over the past few years, several commercial dimmers have been introduced to this field, and it is not uncommon to find a certain SCR incorporated in a number of different circuits. The circuits described here are the most common. Since the number of parts involved is small, conversion of an

Circle 72 on literature card

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Act of October 23, 1962; Section 4369, Title 39, United States Code)

1. Date of Filing—September 23, 1966
2. Title of Publication—PF REPORTER
3. Frequency of Issue—Monthly
4. Location of Known Office of Publication (Street, city, county, state, zip code)—4300 W. 62nd St., Indianapolis, Marion County, Indiana 46206.
5. Location of the Headquarters or General Business Offices of the Publishers (not printers)—4300 W. 62nd St., Indianapolis, Indiana 46206.
6. Names and Addresses of Publisher, Editor, and Managing Editor.

PUBLISHER (Name and address)—Howard W. Sams & Co., Inc., 4300 W 62nd St., Indianapolis, Indiana 46206.

EDITOR (Name and address)—William E. Burke 4300 W. 62nd St., Indianapolis, Indiana 46206.

MANAGING EDITOR (Name and address)—James M. Moore, 4300 W. 62nd St., Indianapolis, Indiana 46206.

7. Owner: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.)

Continental Casualty Co., 310 S. Michigan Avenue, Chicago, Illinois 60603; Goldman, Sachs & Co., 20 Broad Street, New York, New York 10005; H. Hentz & Co., 72 Wall Street, New York, New York 10005; David H. Hertel, 30600 Salem Drive, Bay Village, Ohio 44140; Robert E. Hertel, 5810 Windsor Drive, Mission, Kansas 66222; The Lincoln National Life Inc. Co., P. O. Box 238, Church Street Station, New York, New York 10008; Loriot & Co., c/o Manufacturers Hanover Trust Co., 40 Wall Street, New York, New York 10000; James A. Milling, 711 Kessler Blvd., W. Dr., Indianapolis, Indiana 46208; Alden C. Palmer, R. R. 1, Danville, Indiana 46122; Reing & Co., Box #491, Church Street Station, New York 15, New York; L. F. Rothschild & Co., 120 Broadway, New York, New York 10005; Hilbert Rust, Box 303-A, R. R. 2, Carmel, Indiana 46032; Salkeld & Co., c/o Bankers Trust Co., P. O. Box 407, Church Street Station, New York, New York 10008; Howard W. Sams, 5001 Buttonwood Crescent, Indianapolis, Indiana 46208; Sigler & Co., c/o Manufacturers Hanover Trust Company, New York, New York 10015.

8. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages or Other Securities (If there are none, so state)—None.

9. Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder or holder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 percent or more of the total amount of the stock or securities of the publishing corporation.

10. This item Must Be Completed for All Publications Except Those Which Do Not Carry Advertising Other Than the Publisher's Own and Which Are Named in Sections 132.231, 132.232, and 132.233, Postal Manual (Sections 4355a, 4355b, and 4356 of Title 39, United States Code)

	Average No. Copies Each Issue During Preceding 12 Months	Single Issue Nearest to Filing Date
A. Total No. Copies Printed (Net Press Run)	87,983	84,830
B. Paid Circulation		
1. Sales through dealers and carriers, street vendors and counter sales	11,506	10,635
2. Mail Subscriptions	68,603	66,517
C. Total Paid Circulation	80,109	77,152
D. Free Distribution (including samples) by Mail, Carrier or other Means	3,803	4,135
E. Total Distribution (Sum of C and D)	83,912	81,287
F. Office use, Left-over, Unaccounted, spoiled After Printing	4,071	3,543
G. Total (Sum of E & F—should equal net press run in A)	87,983	84,830

I certify that the statements made by me above are correct and complete.

(Signature of editor, publisher, business manager, or owner)
WILLIAM E. BURKE, Editor

old circuit to a new configuration may be economical, especially if the SCR units are intact.

Dimmer components can be easily tested. The SCR can be tested with an ohmmeter. However, a test jig utilizing one of the circuits will allow a plug-in check of any suspected SCR. Noisy potentiometers are easily detected by their erratic control function. Careful visual examination may also give a clue to the fault. SCR units in economy packages sometimes use soft-solder seals. These seals give no trouble under rated loads but may fail if overloaded. Look for signs of the unit having been subjected to excessive temperatures.

Servicing by direct part replacement may be the quickest if the SCR units are functioning. Always determine the load ratings first to be sure that the dimmer is operating within its limits. AC voltage measurements may be misleading because sinusoidal waveforms are not encountered at many points. Oscilloscope measurements may be made at the load and anode points to see if the firing angle varies as it should with control setting.

Special Considerations

Radio interference problems are often introduced by SCR dimmer circuits. This is usually due to the commutation process in the triggering. One cure is to shield the load conductors in conduit. The addition of several .01-mfd disc capacitors across the load will often cure the trouble.

Some early dimmer circuits used center-tapped controls and switches. These controls may not be readily available; if replacement is needed, a circuit revision may be better.

Conclusion

Dimmers have found increasing application in modern homes. Servicing of these devices is a comparatively simple matter provided the dimmer is used properly.

New installations are a source of revenue. They are not difficult to make, because most lighting-load dimmers fit directly into existing switch boxes. The cost of the inventory required to service these devices is quite nominal and the added business potential may be profitable. ▲

INDEX TO ADVERTISERS

November, 1966

FREE Catalog and Literature Service

**Check "Index to Advertisers" for further information from these companies.*

ANTENNAS

90. *ALLIANCE* — Colorful 4-page brochure describing in detail all the features of Tenna-Rotors*
91. *ANTENNACRAFT* — Four-color catalog sheet about the new *"Big-Shot-8"* VHF-UHF-FM antenna designed for city and suburban use.
92. *BLONDER-TONGUE*—Compact brochure detailing a line of all-channel products, expressly designed to improve reception in the home and small MATV systems.*
93. *EASY-UP*—Data on roof mounts, towerettes, and self-supporting towers.
94. *FINNEY*—Form 20-353 about the *Finco-Axial* 75-ohm antenna system for UHF-VHF-and FM.*
95. *GC ELECTRONICS* — Catalog FR-28C about *Color Magic* antennas and accessories.
96. *JERROLD* — New 82-channel antenna catalog. Includes models for metropolitan to fringe-area reception of UHF, VHF and FM—color and black & white.*
97. *JFD*—*Color Laser* and *LPV* antenna brochures. New 1966 dealer catalog covering complete line of log-periodic outdoor antennas, indoor antennas, rotators, and accessories.
98. *WINEGARD*—Literature on/new 82-channel 2-set coupler; new 82-channel variable line tapoffs; new VHF-UHF matching transformers and color brochure on new sales aids.

AUDIO

99. *ADMIRAL* — Folders describing line of equipment; includes black-and-white TV, color TV, radio, and stereo hi-fi.
100. *ATLAS SOUND*—Catalog 566-67 illustrates and describes many new models of public address loudspeakers, microphone stands, and accessories for commercial sound applications.*
101. *BENJAMIN*—Catalog on models 200 & 200FM compact stereo systems.
102. *CLEVELAND ELECTRONICS*—Catalog sheets about *"Cathedralsonic"* self-contained reverberation kit, and the *"Babe"* solid-state reverb kit.
103. *JENSEN*—New brochure No. OJ featuring a full line of rear seat speakers.
104. *OAKTRON*—"The Blueprint to Better Sound," an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.
105. *OXFORD TRANSDUCER*—4-page catalog describing speakers, musical instrument, & communication loud speakers.
106. *PERMA-POWER*—Catalog sheet about a new 25-watt solid-state megaphone.
107. *SCOTT*—Full-color 20-page brochure features the new line of stereo consoles. Included are many informative articles on high fidelity and complete explanations, in non-technical terms, of the more technical aspects of stereo consoles.
108. *SONOTONE*—4-color flyer sheet SAH-105 describes new solid-state *Velocitone Mark V* stereo cartridge.
109. *TURNER MICROPHONE*—New 20-page general catalog.

COMMUNICATIONS

110. *ACTION*—Intercom equipment catalogs No. 701.
111. *AMPHENOL*—2-color spec-sheets on new Model 650 CB transceiver and Model C-75 hand-held transceiver.*
112. *COMCO*—Brochure and spec sheet on a remote control unit for base stations.
113. *CUSH CRAFT*—Citizens Band antenna brochure. Includes specifications on the *Ringo* ½ wave vertical, 3 and 4 element beams, ground planes and the *Blitz Bug* coaxial lightning arrester.
114. *GELOSO*—Installation manual for Page and Call systems.
115. *MOSLEY ELECTRONICS*—Folder about "Talk Power" and new stacked CB beams.
116. *MOTOROLA*—Brochure TIC 2042B describes high-power business-band base stations.*
117. *RAYTHEON*—Brochures about *Webster* mobile antennas and accessories for CB and Amateur bands. Also, *Raytel* TWR 8, 9, 11, & 11T CB transceivers.
118. *SONAR*—Brochure on monitor receivers.

COMPONENTS

119. *BUSSMAN*—*Tron* waterproof in-the-line fuseholder for use on any circuit of 600 volts or less operating in exposed locations such as: Yard Lights, Marine Equipment, etc. Takes wide range of wire and cable sizes. Two fuseholders available—one for 13/32"x1½" fuses, another for 13/32" x1⅜" fuses. Ask for BUSS Bulletin SFH 11.*
120. *CENTRALAB*—Catalogs offered on electrolytic capacitors, PEC's, and auto radio shafts and bushings.
121. *CORNELL-DUBILIER*—64-page replacement component guide, 112-page electrolytic capacitor reference, 4-page brochure "The Magnificent 12."
122. *LITTELFUSE*—Pocket-sized TV circuit breaker cross-reference gives the following information at a glance: Manufacturer's part number, corresponding *Littlefuse* part number, price, color or b/w designation. A second glance gives trip ratings and acquaints you with a line of caddies. Ask for CBCRP.*
123. *MERIT COIL & TRANSFORMER* — 180-page complete-line catalog, stock control forms No. SR-216, and *Merit* cross-reference pamphlet No. 716.
124. *OAK*—New eight-page, two-color catalog describes a full line of rotary, pushbutton, lever and slide switches available from electronic distributors throughout the country. Form SP-228.
125. *SWITCHCRAFT*—Bulletin 164 describes a new multi-circuit lever switch with positive detent guide and spring loaded lifter to prevent accidental actuator bypass of switch positions. Two or three positions, locking or non-locking. Palladium contacts rated at 3 amps A.C. non-inductive load, 200 watts max.

SERVICE AIDS

126. *CASTLE*—How to get fast overhaul service on all makes and models of television tuners is described in leaflet. Shipping instructions, labels, and tags are also included.*
127. *CLEVELAND INSTITUTE OF ELECTRONICS* — New pocket-sized, plastic "Electronics Data Guide" of formulas and tables, including frequency and wavelength, dB formulas and table, antenna lengths, and color code.*
128. *ELECTRONIC CHEMICAL*—Brochure of aerosol chemicals for controls, tuners, and tape heads. Also brochure on *Frigid-Air*.*
129. *LAFAYETTE RADIO ELECTRONICS* —1967 Catalog, No. 670 featuring two-way radios, stereo hi-fi, tape recorders, test equipment, and components.
130. *LUXO*—Forms 107 & 910 about counter-balanced and magnifying bench lamps.
131. *MID-STATE TUNER*—Informative flyer and shipping labels on 24-hour service for all TV tuners.*
132. *PRECISION TUNER*—Literature supplying information on complete low-cost repair and alignment service for any TV tuner.
133. *QUALITY TUNER SERVICE*—Introductory letter describing costs and service on all makes of TV tuners. Repair tags and shipping labels included.
134. *RAWN*—New catalog and instruction bulletins about knob and plastic repairs, and denture repairs.
135. *STACO*—Brochure about the new 1000 series autotransformers.
136. *SWING-O-LITE*—Bulletin about spring-balanced bench lamps and magnifying lamps.
137. *WALDOM*—New 4-page brochure covering a full line of nylon hardware and strapping.

SPECIAL EQUIPMENT

138. *PERMA-POWER* — 4-page catalog on *Electro-lift* garage door openers.
139. *SQUIRES SANDERS*—CCTV cameras and accessories.
140. *TERADO*—Brochures about portable 110 VAC power supplies.

TECHNICAL PUBLICATIONS

141. *HAYDEN*—New 64-page catalog listing books published by the Hayden Book Company, Inc. and John F. Rider Publisher, Inc. for the electronics service technician, student, and hobbyist.
142. *PHILCO*—Information about Tech Data & Business Management Service. Also, free parts catalog.*
143. *RCA INSTITUTES*—New Career Book, "Your Career in a World of Electronics," describes programs and courses in television, telecommunications, automation and industrial electronics, drafting, and computer programming.*
144. *HOWARD W. SAMS*—Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics, including special new 1966 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

145. *AMPHENOL*—Spec sheets on the *"Commander"* line of color test equipment.*
146. *B & K*—New 1966 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.*
147. *EICO*—1966 short-form catalog is 48-pages long. Describes a complete line of test instruments, CB and ham equipment, hi-fi components, and miscellaneous electronic equipment.
148. *HICKOK*—Catalog sheet on the DP-140 event counter.*
149. *JACKSON*—Catalog on "Service Engineered" test equipment featuring the new *X-100* color generator.
150. *LECTROTECH*—Two-color catalog sheet on new model V6-B color bar generator, the latest improved model of the V6 color bar generator. Gives all specs and is fully illustrated.*
151. *MERCURY* — Complete catalog of new fall line of test equipment.
152. *PRECISION APPARATUS*—Illustrated catalog describing signal generators, oscilloscopes and meters.
152. *SECO*—Catalog sheet on new model 107C tube tester with constant voltage transformer and eye-tube indicator.*
153. *SEMITRONICS*—Brochure on the new model 1000 transistor tester.
154. *SENCORE* — New 4-color catalog about *Econoline* test equipment.*
155. *SIMPSON*—Flyer giving specifications of model 604 multi-corder for measuring and recording volts, amps, milliamps, and microamps.
156. *TRIPLETT*—Data sheets and catalogs on the complete line. Features *630 APLK VOM* with overload protection and transistorized switching circuit. Also, an AC/DC education-type meter.

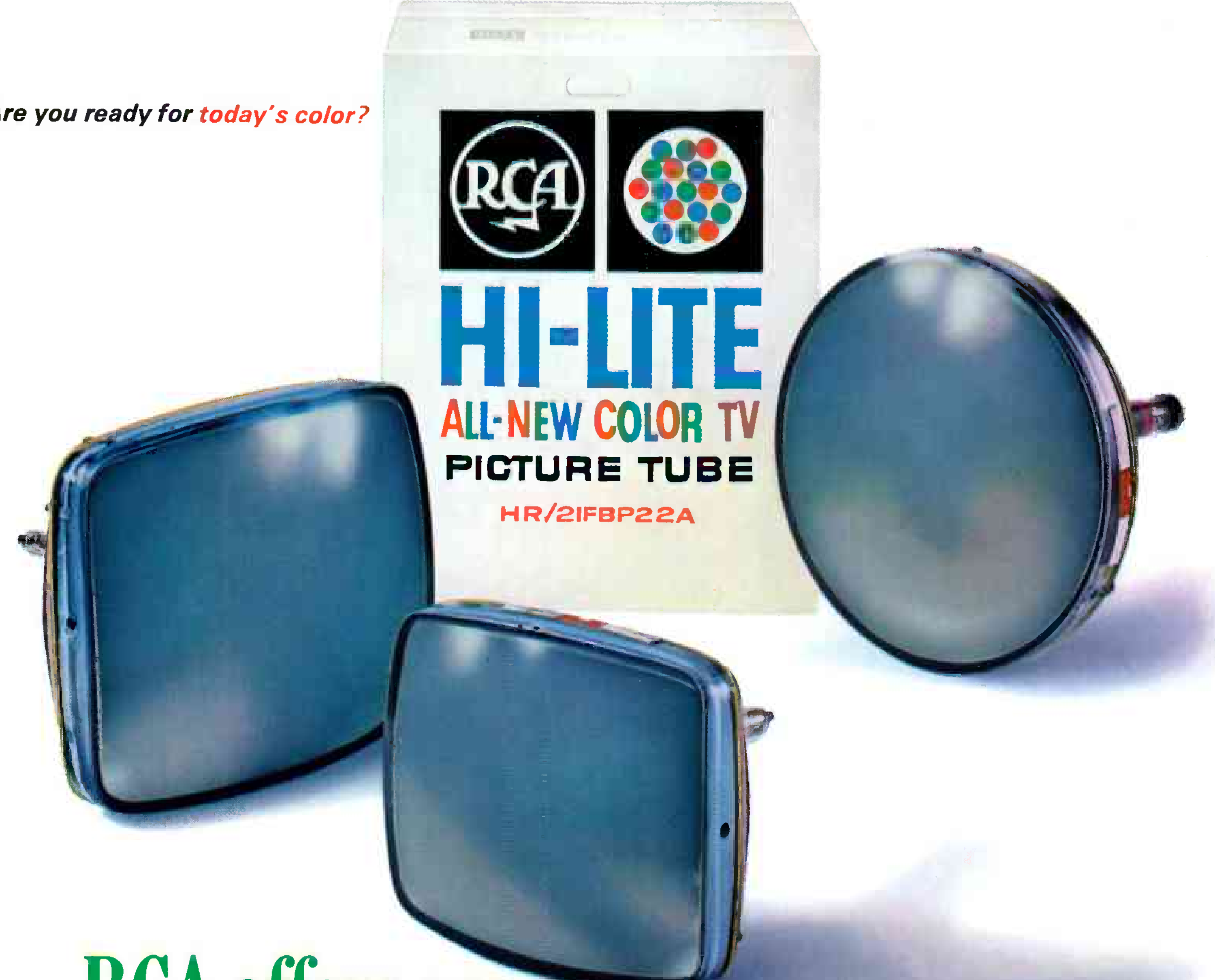
TOOLS

157. *ARROW*—Literature describing 3 staple guns.
158. *ENTERPRISE DEVELOPMENT* — Time-saving techniques in brochure from *Endeco* demonstrate improved desoldering and resoldering methods for speeding and simplifying operations on PC boards.
159. *VACO*—Gift catalog for the 1966-67 holiday season.*
160. *XCELITE*—Form S766 describing 2 new *Series 99* "Plastic View" kits, each containing a plastic handle and a selection of interchangeable screwdriver blades.

TUBES & TRANSISTORS

161. *AMERICAN ELITE* — Technical data book for *Telefunken* tubes, semiconductors, and components, with list of comparative types.
162. *INTERNATIONAL RECTIFIER* — Catalog F-66, 34-pages of semiconductors and allied devices.
163. *KEMLITE*—Brochures on xenon flash-tubes for photographic and signaling purposes, also laser pumps.
164. *RADIO CORP. OF AMERICA* — PIX 300, a 12-page product guide on RCA picture tubes covering both color and black-and-white. Includes characteristics chart, terminal diagrams, industry replacement, and interchangeability.*
165. *WORKMAN*—Transistor cross-reference for use with *Miracle Five* transistor line that replaces 2,977 entertainment-type transistors.

Are you ready for today's color?



RCA offers you a replacement color picture tube that meets OEM specs

RCA Hi-Lite picture tubes are all-new... glass, gun, the works! They're RCA's best... the same quality... the same tubes... that go into original equipment sets. And because they incorporate the latest technological advances of the world's largest color picture tube manufacturer, you literally "up-date" your customer's color set each time you install one. Here is picture brightness and color fidelity at its finest, available for the service trade in 19-inch and 25-inch rectangular and 21-inch round tube types.

RCA Electronic Components and Devices, Harrison, N. J.

The Most Trusted Name in Electronics