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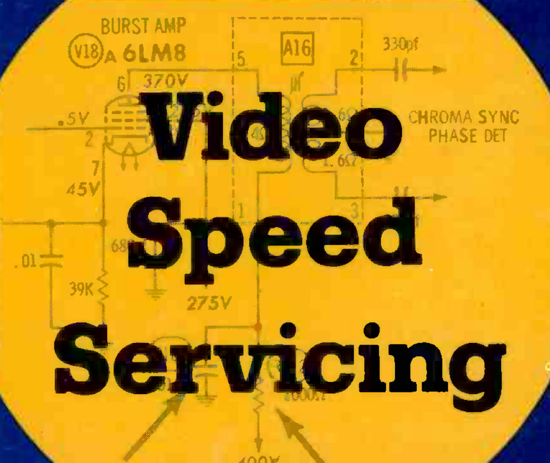
Time to Move?

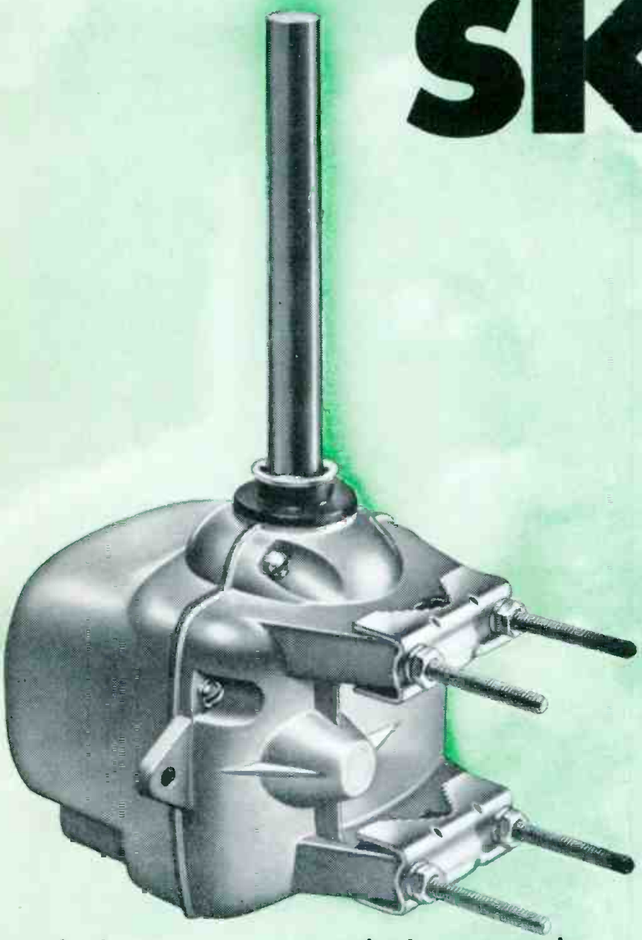
Color Tv Service Training



Video Speed Servicing

- Annual Index
- The Troubleshooter
- Color Countermeasures
- Notes on Test Equipment
- Tube Substitution Supplement

Help stamp out green sky



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Circle 1 on literature card

CDE CORNELL-DUBILIER

ANNUAL INDEX

The following code of symbols is used to identify regular department locations in the subject page listings: CCM, Color Countermeasures; Sym, Symfact®; TE, Notes on Test Equipment; TS The Troubleshooter; and VSS, Video Speed Servicing.

MISCELLANEOUS

NOTES ON TEST EQUIPMENT

OSCILLOSCOPES

PICTURE SYMPTOMS

TRANSISTOR TV

TROUBLESHOOTER, THE

TUBES

TUBE TESTERS

TUNERS, TV

VERTICAL SWEEP

VERTICAL SYNC

VIDEO

VIDEO SPEED SERVICING

VOM's

VTVM's

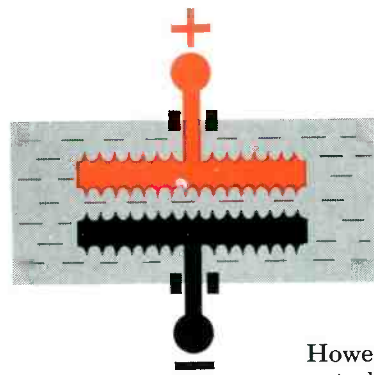
WAVEFORMS

YOKES

INDEX OF TITLES

MALLORY Tips for Technicians

Why some filter capacitors develop hum... and some don't



Aluminum electrolytic capacitors are widely used as filters in DC Power Supplies. This is because of their large capacitance in relatively small size. All in all, they do an efficient job of reducing ripple (hum) to acceptable levels.

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When high ripple currents are applied to polarized electrolytics, a thin oxide film forms on the so-called "cathode". It begins to assume the characteristics of a second anode. This in turn, has the same effect as placing two capacitors in series. Consequently, overall capacitance is reduced. Inevitably hum increases.

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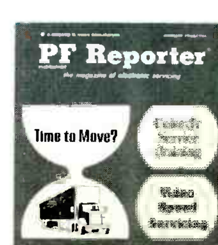
VOLUME 18, NO. 1 JANUARY, 1968

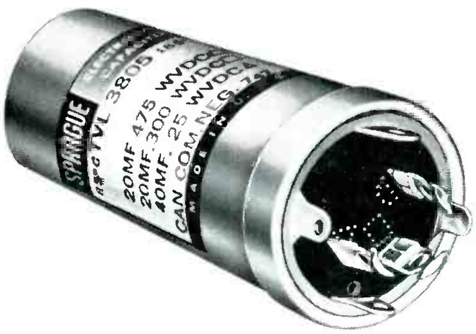
CONTENTS

ABOUT THE COVER



As any shop owner, manager, or service technician will agree, there are many facets to a successful service business. Some factors are business, or management, oriented; while others deal strictly with servicing problems. In any event, it must be conceded that both areas require attention if a busines and those connected with it are to prosper. Our cover this month illustrates that the content of PF REPORTER follows this premise of double coverage—with, of course, greater emphasis placed on servicing.

LET'S FACE IT . . . TWIST-PRONG CAPACITORS JUST DON'T HAVE THE "FITS-ALL" ABILITY OF STRETCH SOCKS



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PART 5

COLOR TV

service training

CHROMA CIRCUITS

Burst Amplifier
Reference Oscillator
Difference Amplifier
Demodulators
Color Killer

Part 4 of this series included a detailed block-diagram analysis of the chroma circuits which are most often encountered in present-day color receivers. Following this discussion, a discription of specific circuits currently in use was initiated. While space limitations make it impossible to analyze all of the circuits in use, reperesentative circuits from popular sets will be discussed in detail. Part 5 continues the analysis of the burst amplifier, reference oscillator, color killer, and ACC circuits.

RCA Closed-Loop ACC

In part 4 of this series, the final paragraphs were devoted to a discussion of the ACC (Automatic Chroma Control) used in RCA chassis CTC21, 28, and 30. This circuit is an *open loop* system. That is, the output of the ACC circuit is not used to control the gain of the amplifier which feeds it. By contrast, the ACC circuit used in the RCA CTC31 chassis is a *closed loop* system. The loop is from the grid of the first chroma amplifier, through the burst amplifier, through the ACC amplifier, and back to the grid of the first chroma amplifier. Fig. 1 is a simplified schematic of this circuit.

The color burst as well as the chrominance information are amplified by the first chroma bandpass amplifier. The plate load is the primary of the double-tuned transformer and one of the outputs from the secondary is fed to the burst amplifier. The burst amplifier amplifies the color burst and injects it into the reference oscillator circuit to control its phase.

First, consider the circuit with no burst signal present. The oscillator operates at its natural frequency and develops approximately 3.5 volts of negative bias at its grid. This voltage is applied to the emitter of the ACC amplifier and a positive potential of about 35 volts is present at the collector. Because of the voltage drop across R739, the DC potential at the grid of the first chroma bandpass amplifier is about +5 volts. (This bias voltage may vary considerably from set to set.)

During color operation, the color burst from the first chroma bandpass amplifier is fed through the burst amplifier, which is gated on during horizontal retrace, to the grid of the oscillator. This signal increases the drive and causes the bias to increase to about −8 volts. This 5-volt change in voltage at the grid of the reference oscillator is amplified by the ACC amplifier transistor and causes a 31-volt swing at its collector. The normal collector voltage is about 4 volts when a nominal 80-volt burst signal is applied to the oscillator grid. The bias voltage at the grid of the first chroma amplifier is approximately −5 volts under these conditions. If the amplified color burst signal increases in amplitude, the grid of the reference oscillator becomes more negative and the emitter current increases. This, in turn, causes the collector current to increase and the collector potential to swing in a negative direction. Finally, this negative-going voltage is used to increase the bias of the first chroma amplifier and reduce its gain.

Conversely, if the amplified color burst decreases in amplitude for any reason, the emitter and collector voltages of the ACC amplifier become less negative, decreasing the bias on the first chroma amplifier and increasing its gain. Thus, the burst amplitude at the grid of the oscillator is maintained at a constant 80 volts. This is the optimum level to properly phase the reference oscillator. Since the first chroma bandpass amplifier also amplifies the chrominance signal, it, too, is maintained at its optimum level, This, of course, is the more important function of the ACC circuit.

The principal advantage of the closed-loop ACC circuit is its ability to maintain a more nearly constant level of chrominance signal. The

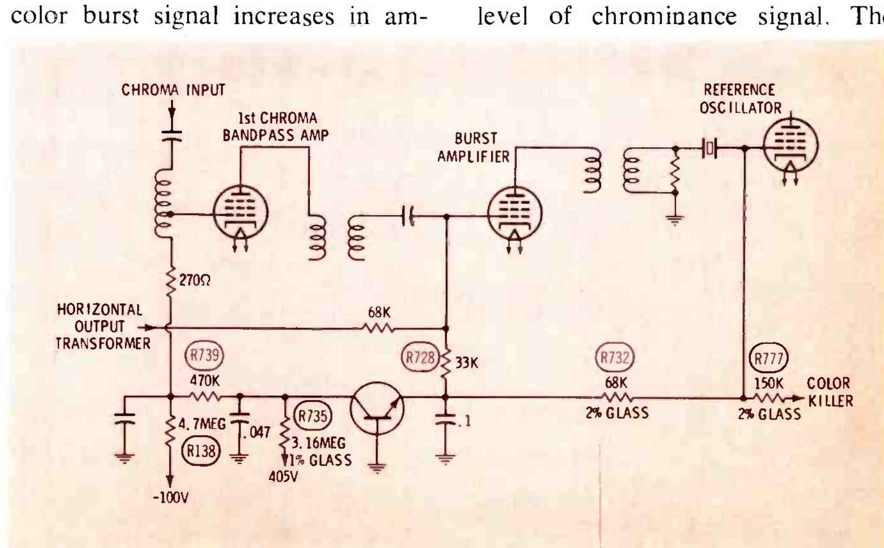

Fig. 1. Simplified ACC circuit of the RCA CTC31 chassis.

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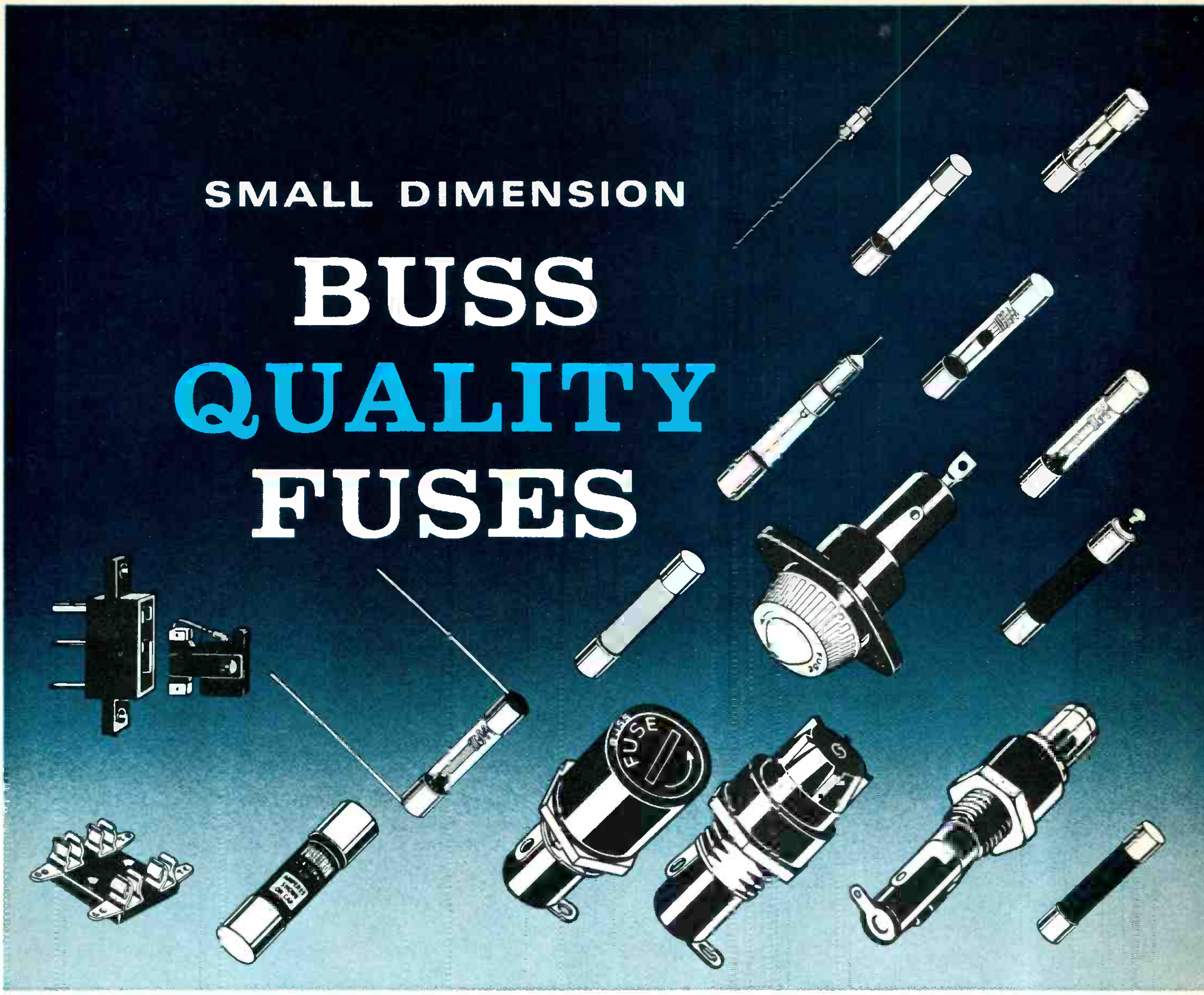

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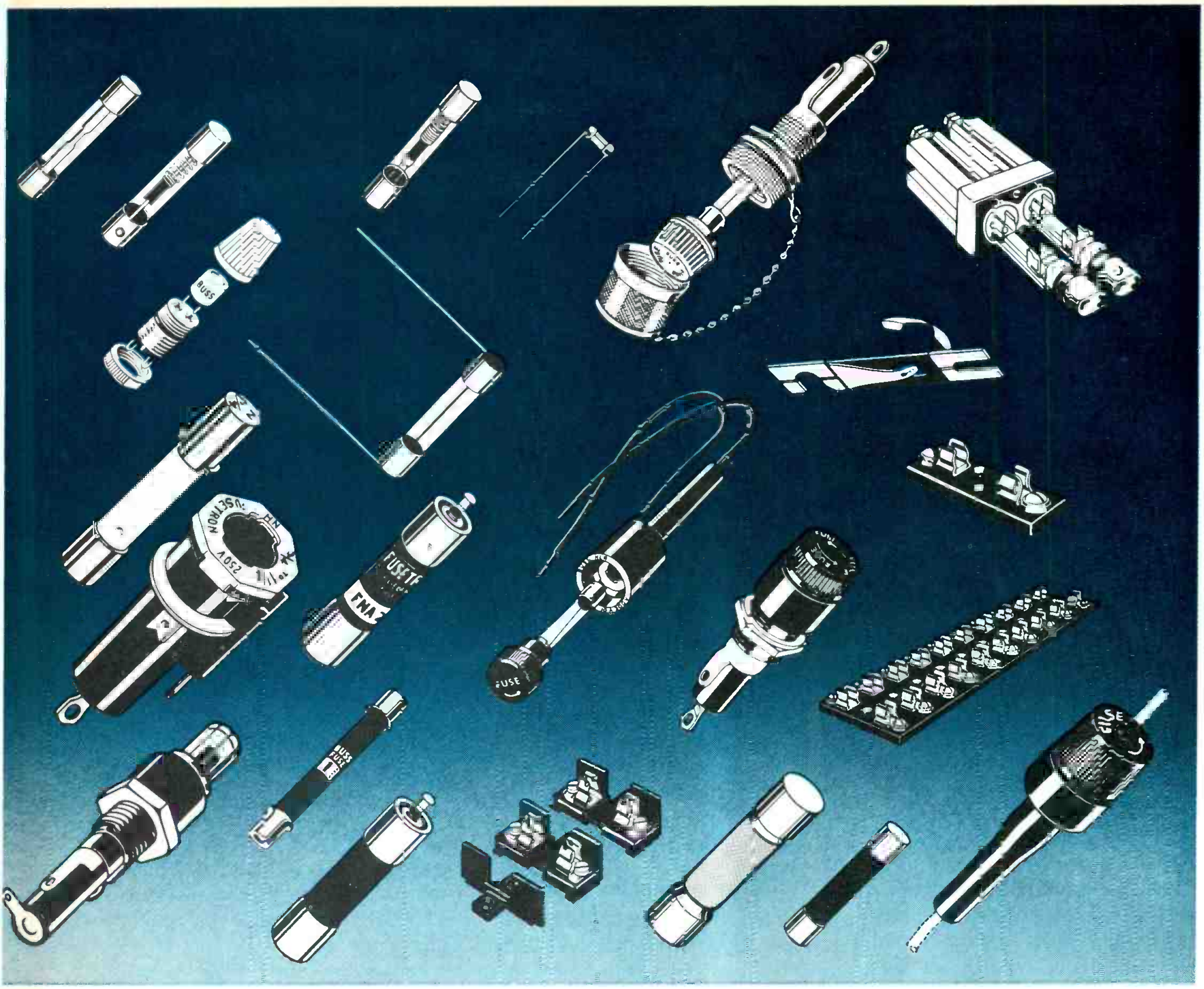

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curves shown in Fig. 2 demonstrate the characteristics of the two types of control, open-loop and closed-loop. Bear in mind that these curves illustrate the characteristics of the two basic systems and do not apply to any specific circuits.

Notice that R732, R777, and R735 are quite critical as to value, drift characteristics, and temperature coefficient. For this reason, glass resistors having close tolerance and low temperature coefficients are used.

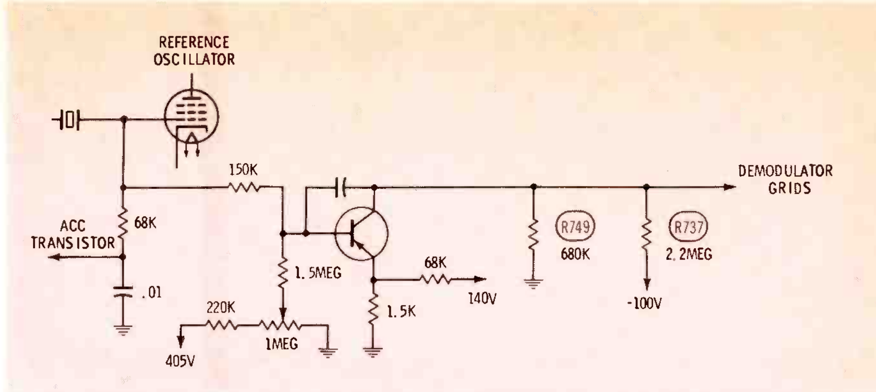

Fig. 3. Simplified color-killer circuit of the RCA CTC31 chassis.

RCA Color Killer

Incorporation of closed-loop ACC made it necessary to revise several other circuits in the RCA chroma system. Since the color burst is amplified by the first chroma amplifier, color-killer bias had to be fed to a different stage; the demodulators were chosen. The use of transistors in the ACC and color killer is also a significant departure from earlier RCA designs.

A simplified schematic of the color-killer circuit used in the RCA CTC31 chassis is shown in Fig. 3. The base voltage of the killer transistor is established by the setting of the killer control and the potential at the grid of the reference oscillator. Under no-color conditions, the base potential is about .5 volt positive with respect to the emitter and the transistor is cut off. Since the transistor is cut off, the collector voltage is determined by the voltage divider, R737 and R749, connected between the blanker grid and ground. Since the blanker grid is about −100 volts, the collector voltage is about −25 volts. This voltage is also present on the screen grids of the demodulators and keeps these tubes below cutoff.

When a color burst is applied to the reference oscillator, the grid swings negative and the killer transistor is driven into saturation. This clamps the collector voltage to the emitter potential, raising the screen voltage of the demodulators to about 2 volts, well above cutoff. Notice that the color-killer transistor operates either at saturation or cutoff. Thus, variations in color-burst amplitude have no effect on the bias supplied to the demodulators.

RCA Reference Oscillator

The RCA CTC31 chassis uses an injection type reference oscillator which is similar to the one used in the CTC18, CTC20 and CTC24 chassis. Fig. 4 is a simplified schematic of the oscillator used in the CTC31. Basically, the oscillator is of the tuned-plate, tuned-grid, electron-coupled type. The frequency is determined by the crystal in conjunction with the small trimmer capacitor shunted across it.

As with any TPTG oscillator, the oscillator plate tank (L704) is tuned slightly above the oscillator frequency. In this circuit, it is adjusted so that the self-bias developed at the oscillator grid is −3.5 volts with no burst signal applied. In earlier models using the injection oscillator, the counterpart of L704 was not adjustable. In the absence of a color burst, the oscillator runs at the reference frequency, but with a random phase. When the burst is injected through T702, this signal pulls the oscillator into phase with it. The oscillator is stable enough to remain properly phased until the arrival of the next burst.

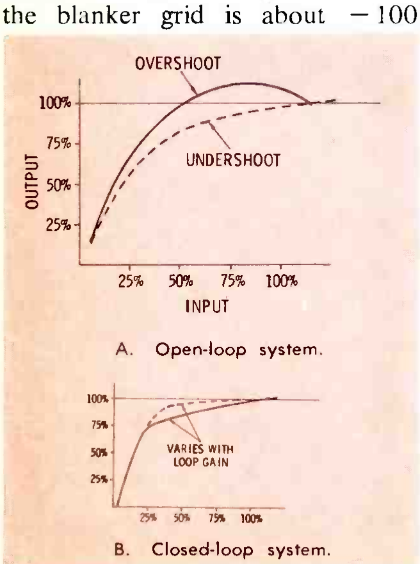

Fig. 2. Characteristics of open-loop and closed-loop control systems.

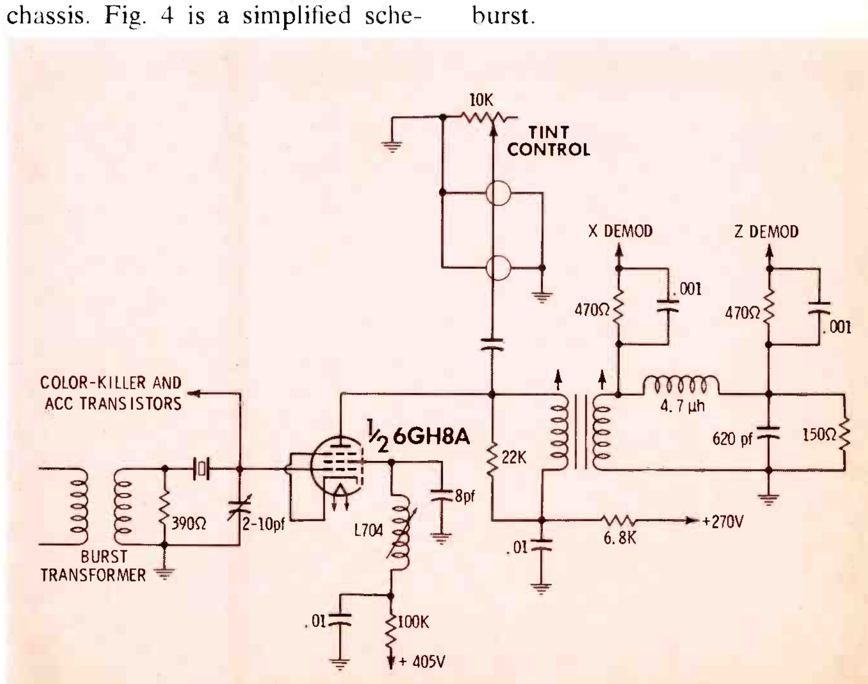

Fig. 4. Simplified reference oscillator circuit of the RCA CTC31 chassis.

Admiral Burst Amplifiers and Reference Oscillators

Fig. 5 shows the burst amplifier and reference oscillator circuit of the Admiral 1G1155 and other chassis. The more recent chassis, 3H10, 4H10, 5H10, and 4H12, use essentially the same burst amp and oscillator circuitry except for the tube type. The chroma signal from the plate of the first chroma bandpass amplifier and a positive enabling pulse from the horizontal output transformer are both fed to the burst-amplifier grid. The enabling pulse, having an amplitude of 50 volts, brings the tube out of cutoff and the color burst is amplified to a peak-to-peak amplitude of about 170 volts. The large value of cathode resistance, 39K ohms, prevents saturation. During the time that V5 is conducting, the drop across R166 charges C120. Between pulses, current flows upwards through R166 to discharge C120, maintaining an average cathode bias of about +45 volts. This prevents the chrominance signal from appearing in the plate circuit of the burst amplifier.

The reference oscillator is an injection type, electron-coupled oscillator and its operation is similar to that of the RCA circuit discussed above. The self-bias under free-running conditions (no color) is —.3 volt. When a burst signal is injected, this bias swings negative and the negative excursion is used to operate the color killer and the ACC circuit. The output of the reference oscillator is coupled through the plate transformer, L35, to the phase shifting circuits, L36, C129, and L37, which establish the correct phase of the reference signal for R−Y and B−Y demodulation. C128 and R6, the tint control, are used to shift the phase of the reference signal without disturbing the phase displacement between the R—Y and B—Y axes.

Admiral ACC and ASC Circuits

As shown in Fig. 5, the ACC circuit used in the chassis series 1G1155-1, 2G1156-2, 2G1157-1, 3G1155-2, and 3G1155-3 has two variations. In the solid-line drawing, the ACC control voltage is taken from the grid of the reference oscillator and, after filtering, is used as bias voltage for the first chroma amplifier. Since the oscillator grid swings more negative as the color burst increases in amplitude, the chroma-amplifier gain is reduced as the level of the composite chrominance signal (chroma and color

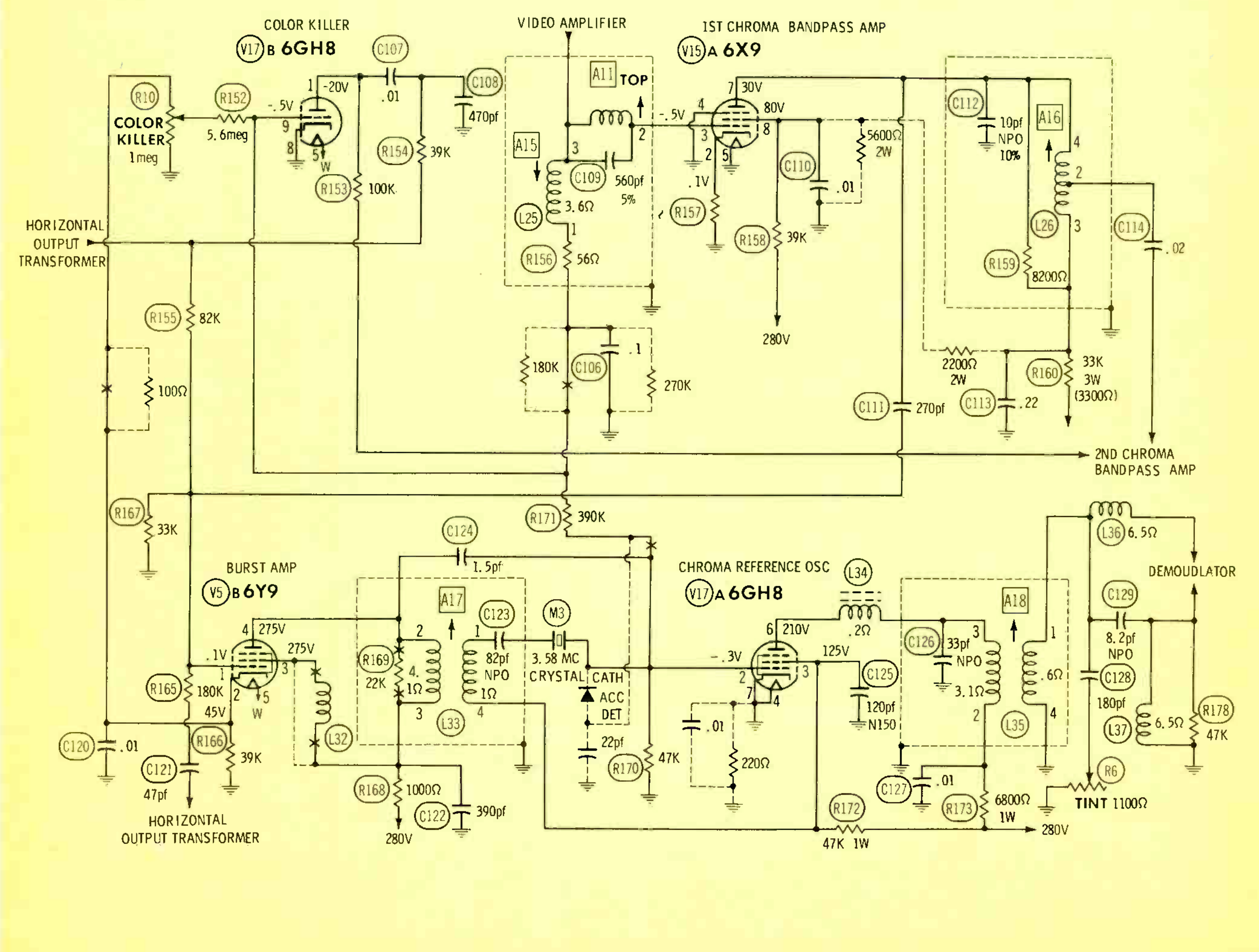

Fig. 5. Reference-signal circuits of the Admiral 1G1155 chassis.

burst) increases. The operation of the dashed-line circuit is much the same, although a diode detector has been added. Since this addition increases the amount of the control voltage, a divider network, 180K ohms and 270K ohms, is also added to the circuit.

The ASC (Automatic Saturation Control) circuit used in the 3H10NC57-1 chassis is shown in Fig. 6. This circuit, as well as the one described above, is a closed-loop system. A portion of the output from the first chroma amplifier is rectified by X11 and the negative voltage which is produced is used, after filtering, to control the gain of the first chroma amplifier. Thus, as the chrominance level increases, the bias increases to reduce the amplifier gain and vice versa. If this were the only control voltage, the dynamic range of saturation would be seriously limited (the degree of color saturation of the picture would remain constant regardless of the degree of saturation of the scene being televised). To prevent this, a second voltage is combined with the bias derived from X11. The negative voltage at the grid of the reference oscillator, which is proportional to the color-burst amplitude, is also fed to the grid of the first chroma amplifier. Thus, sufficient bias is always available to maintain the desired dynamic range of saturation.

Admiral Color Killer

The color-killer circuit shown in Fig. 6 is typical of many of the circuits used in late-model Admirals. The positive cathode bias of the burst amplifier is divided across the threshold control, R9, and negative voltage is obtained from the grid of the reference oscillator. In the absence of a color burst, this negative voltage is slight and the color-killer tube will conduct if plate voltage is supplied. The source of plate voltage is the positive pulse from the horizontal-output transformer which is fed to the left side of C128. Current flows through V15A, charging the right side of C128 to a negative potential. Between pulses, C128 partially discharges through R170 and the negative voltage which is developed holds the second chroma amplifier below cutoff. When a color burst is received, the negative voltage at the grid of the reference oscillator increases and cuts off the color-killer tube. This allows C128 to completely discharge and the cutoff bias is removed from the second chroma amplifier.

Notice that the setting of R9 affects the bias of the first chroma amplifier and, if R9 is misadjusted, the operation of the ASC circuit will be impaired. To properly set R9, adjust all front-panel controls for proper operation and set the color control at mid-range. Turn to an unused channel, set the color-killer control fully clockwise, and then adjust it until the color in the snow almost disappears.

Zenith Burst Amplifier and Reference Oscillator Circuit

The chroma-reference circuits of Zenith's 20X1C36 and 20X1C38 are shown in Fig. 7. In many respects, they are similar to the circuits of the RCA CTC25 chassis discussed under the heading "Circuit Analysis of Reference Oscillator Circuits" in Part 4. The composite chrominance signal from the plate of the first chroma amplifier and a positive enabling pulse from the horizontal-output transformer are fed to the grid of the burst amplifier. Since the color burst is coincident with the enabling pulse, the burst is separated from the remainder of the chrominance signal and amplified. The positive cathode bias of about 45 volts is developed by conduction through R176 while the

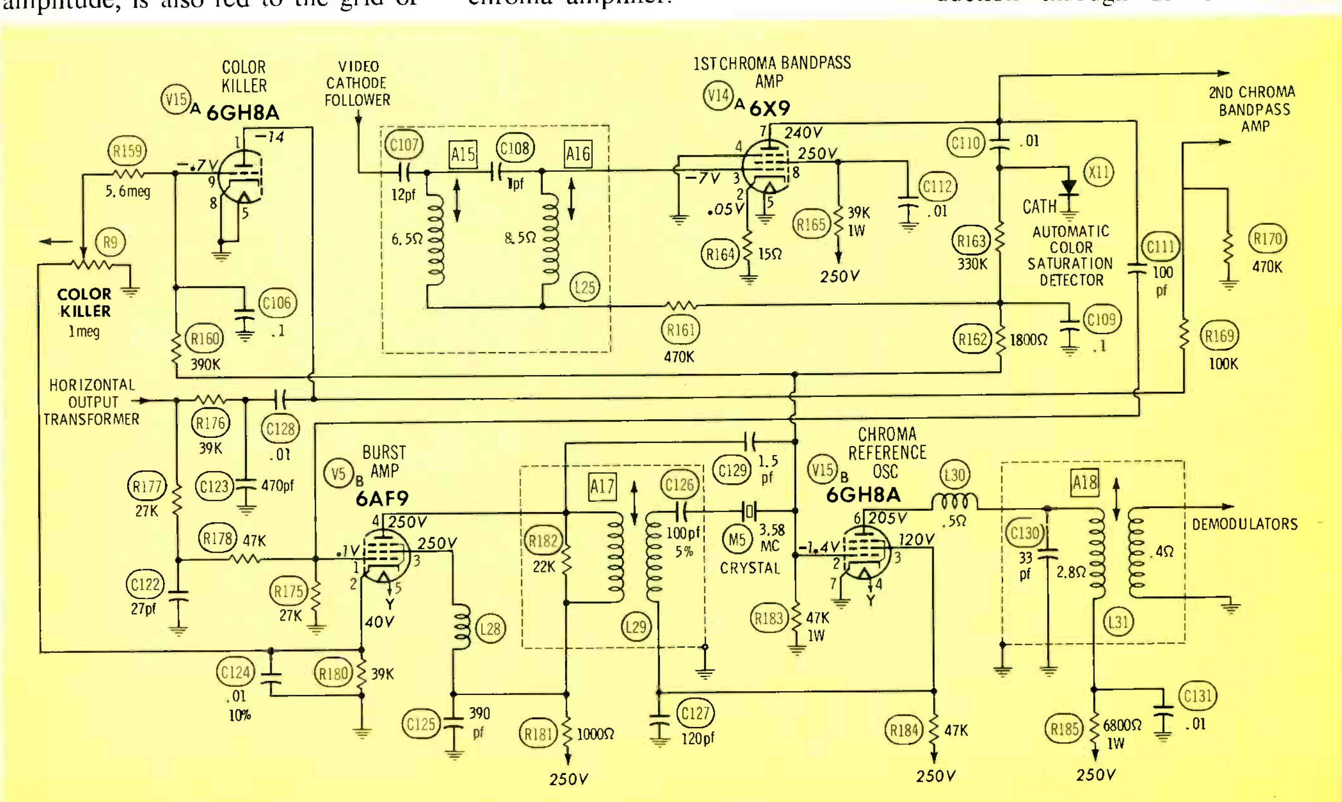

Fig. 6. Reference-signal circuits of the Admiral 3H10NC57-1 chassis.

tube is gated on, and this voltage is sustained between pulses by the charge stored in C127.

The output of the burst amplifier is fed to the chroma-sync phase detector and to the ACC and color-killer detector. The hue control, R3, in conjunction with C131 allows the viewer to vary the phase of the amplified color burst.

The chroma-sync phase detector compares the relative phases of the reference oscillator signal from L30 and the color burst from the burst amplifier. Any phase error is converted to a voltage error which is used to change the conductance of the chroma reference-oscillator control tube. The operation of this type of circuit was explained in Part 3 of this series.

The reference oscillator is typical of the type of oscillator used in conjunction with an AFC tube. Since the system of chroma demodulation used by Zenith requires four reference signals in quadrature, a special output transformer is used instead of the usual RLC phase-splitter network.

Zenith Color-Killer and ACC Circuits

The color-killer and ACC circuit of the Zenith 20X1C36 chassis is also shown in Fig. 7. The color-killer and ACC detector is a conventional phase detector, but, since the phase relationship of two inputs is constant, the amplitude of the output becomes a function of the amplitude of the color burst. When no burst is present, the output is −.7 volt, but, during normal color reception, this potential increases to approximately −6 volts. If the amplitude of the color burst decreases from its normal value for any reason, the detector output also decreases.

The output of the detector is filtered by C64 and used as bias for the grid of the first chroma amplifier, V4B. Under no-color conditions, V4B is near saturation and the screen potential is about 75 volts. This voltage is at one end of a series network consisting of R165, R17, and R164. The opposite end of R164 is connected to the grid of the horizontal discharge tube which is 65-volts negative. When R17 is properly adjusted, the voltage at its junction with R164 is about −28 volts. This voltage is used to bias the second chroma amplifier below cutoff. C118 is a bias filter which integrates the horizontal pulses from the horizontal discharge tube.

During color reception, the grid bias of V4B increases to −6 volts and the screen and plate voltages rise to 225 volts. This would cause the voltage at the grid of the second chroma amplifier to rise to a positive potential if it were not for the clamper diode connected across C118. The actual bias of the second chroma amplifier is 0 volt.

As stated before, the output of the color-killer and ACC detector is −6 volts under conditions of normal color reception. If the chrominance level varies from its normal value, the detector output will also change. Thus, a decrease in chroma level reduces the negative bias on V4B, increasing its gain. Conversely, an increase in the chroma level increases the bias on V4B to reduce its gain. Notice that small variations in bias on V4B do not affect the bias of the second chroma amplifier because of the action of the clamper diode. This, too, is a closed-loop system.

General Electric Reference Circuits

Fig. 8 shows the burst gate and subcarrier amplifier circuits of the General Electric HC chassis. The output of the chroma-bandpass amplifier is fed to the cathode of the burst gate tube, V5B, and the 100-volt enabling pulse from the horizontal-output transformer is fed to the grid. This allows the color burst to be separated from the composite chroma signal and amplified. The positive enabling pulse causes the grid of V5B to draw grid current, charging C72 and C73. Between pulses, these capacitors discharge through R87, developing about 85 volts of bias. This bias, of course, holds the tube below cutoff between pulses.

The output from the burst-gate tube is coupled through L20 and excites the 3.58-MHz crystal, caus-

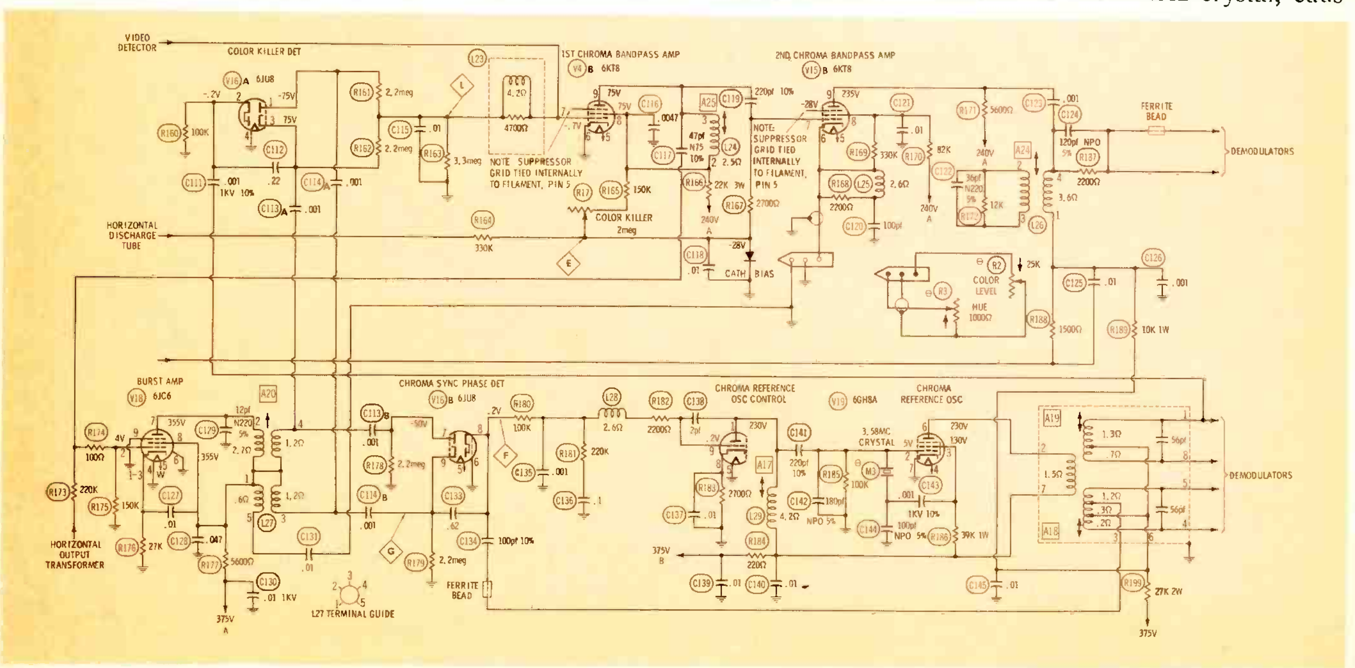

Fig. 7. Reference-signal circuits of the Zenith 20X1C36 chassis.

ing it to ring. Because of the high Q of the crystal, this ringing continues throughout the interval between color bursts. Each successive color burst rephases the crystal if there has been any drift. The amplitude of the ringing signal at the grid of V5C is large enough to overdrive the tube, and thus the output remains constant throughout the interval between bursts.

C86, connected between the plate of V5C and ground, shifts the phase of the reference signal to provide tint control. Quadrature reference signals are required, so a transformer having two secondaries is used as the plate load of V5C.

No color-killer circuit, as such, is used in this chassis. Since the demodulators have no output unless there is a reference-signal input, and since the 3.58-MHz crystal "rings out" if there is no color burst, the modulators are, in effect, cut off during b-w operation.

Motorola Reference Circuits

The burst amplifier, chroma sync amplifier, color killer, and demodulator of the Motorola A22TS-918A are depicted in Fig. 9. The chroma cathode follower (not shown) drives both the chroma bandpass amplifier and the burst amplifier. An enabling pulse from the horizontal-output transformer turns on the burst amplifier, V16A, during the horizontal retrace interval, allowing the color burst to be separated from the composite chrominance signal.

The interstage transformer between VI6A and V16B is tuned to the burst frequency. The network consisting of R4, L31, and C149 is a phase-shifting network which allows the phase of the burst to be adjusted for correct hue. V16B further amplifies the color burst and feeds it, via the 3.58-MHz crystal, to the chroma-demodulator tube. Notice that the positive pulse applied to the screen grid of V16B gates this tube on during the horizontal retrace interval only.

The chroma-demodulator tube not only demodulates the chroma signal, but serves as the reference oscillator as well. This combination of both functions in a single tube was not noted in any of the other makes of sets examined. Since this particular portion of the color training series is limited to reference-signal and associated circuits, the method of demodulation will be discussed at a later time. At present, we will consider only the functions of the cathode, control grid, and screen of V15.

Consider V15 as an electron-coupled Hartley oscillator. In the absence of color bursts, oscillations are sustained by virtue of the split-inductance tank typical of a Hartley oscillator. During color reception, the amplified color burst is injected through the crystal to the grid of V15 and rephases the tank circuit to synchronize it with the burst signal. In this respect, the oscillator is similar to the injection-locked oscillator used in a number of other sets.

Since the oscillator is an integral part of the demodulator circuit, there is no way to split the oscillator phase prior to demodulation. As we shall see later, chroma demodulation may be achieved so long as the phase of either the reference signal *or* the chroma signal is split. Motorola's decision to split the phase of the latter instead of the former is unique but equally acceptable.

The color-killer circuit is similar to the ones used in many of the sets discussed in the preceding pages. In the absence of color, a pulse from the horizontal-output transformer causes V5B to conduct, charging C131 and producing cutoff bias for the chroma amplifier. During color reception, the cathode current of V15 increases (because of the increased oscillator activity) and this drives the cathode of V5B positive into cutoff. Since C131 cannot charge when V5B is cut off, the bias is removed from the chroma-bandpass amplifier.

Summary

From an examination of the circuits described in this issue and the latter portion of Part 4 of this series, we observe that there is a great degree of similiarity among the several burst amplifiers. The main variation is in the method whereby the composite chroma signal and gating pulse from the horizontal-output transformer are injected into the circuit. The most common circuit configuration combines these two signals at the grid of the burst amplifier, but it is not unusual to have the chroma signal fed to the cathode and the positive enabling pulse fed to the grid.

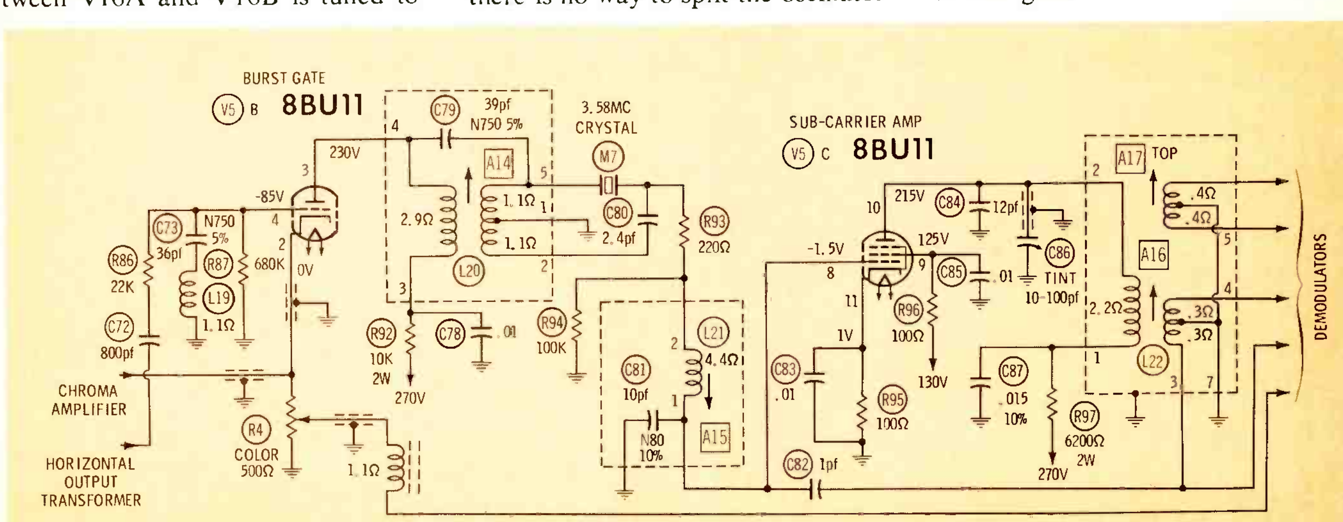

Fig. 8. Burst gate and subcarrier amplifier circuits of the General Electric HC chassis.

Two other variations are technically feasible but are not widely used, if they are used at all. A negative enabling pulse could be fed to the cathode of the burst amplifier while the chroma signal is fed to the grid, or both signals could be fed to the cathode. Notice that when a signal is fed to the cathode, the impedance of the source must be relatively low and a significant load is placed on the source. This is typical of any grounded-grid amplifier configuration.

Three basic methods of phasing the reference signal are in vogue. The system wherein the phase of the output from the oscillator is compared with the phase of the color burst is quite popular. The two signals are compared in a phase detector whose output controls an AFC tube. This circuit is similar to many horizontal-oscillator circuits which employ an AFC circuit. A second popular reference-oscillator circuit, using injection locking, is also used extensively in horizontal-oscillator circuits. In this type of circuit, the color burst is injected directly into the tank circuit of the oscillator and the phase of the oscillator is controlled by "brute force." A third system uses no reference oscillator at all. Here, the color burst is amplified and fed to a final amplifier which resembles an oscillator but has insufficient feedback to sustain oscillation. The stage simply "rings" throughout the interval between color bursts to provide a continuous reference signal.

Reference oscillators take several forms, but all of them are crystal-controlled or crystal-stabilized. A pentode tube in an electron-coupled configuration is most popular. Nearly any oscillator configuration is possible, but the Hartley and the tuned-plate, tuned-grid types are popular.

Most color-killer circuits are similar in design, although the means of sensing the color burst varies from one make of set to another. Usually, if the reference oscillator is controlled by an AFC tube, an additional phase detector is used to operate the color killer. If an injection-locked reference oscillator is used, the oscillator-grid bias is normally used to control the color killer. In either event, the color-killer tube is cut off during color reception. The threshold control is set at the point where colored snow in an unused channel just disappears. In sets having an ACC circuit, the setting of the color-killer threshold may be critical. Follow the procedure recommended by the manufacturer or the one contained in the appropriate PHOTOFACT folder for the chassis being repaired.

Part 6 of this series will cover the operation of various chroma amplifiers, demodulators, and color-difference amplifiers. ▲

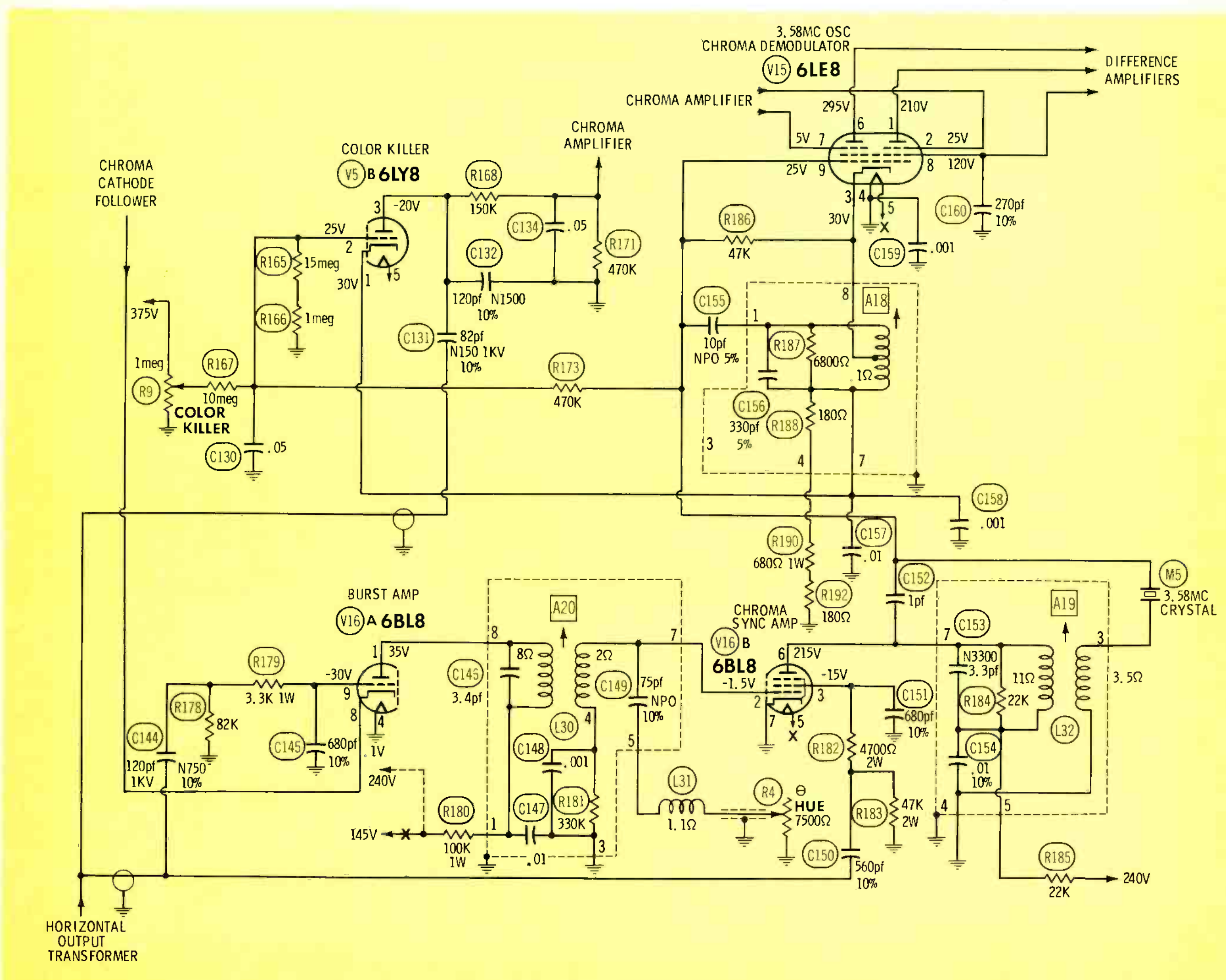

Fig. 9. Reference-signal circuits of the Motorola A22TS-918A chassis.

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COLOR SPECTRUM™ ANTENNAS

are "signal customized" for better color reception...

"the ANTENNA that captures the RAINBOW"

FINCO has developed the Color Spectrum Series of antennas — "Signal Customized" — to exactly fit the requirements of any given area.

There is a model scientfically designed and engineered for your area.

Check this chart for the FINCO "Signal Customized" Antenna best suited for your area.

STRENGTH OF UHF SIGNAL AT RECEIVING ANTENNA LOCATION	Strength of VHF Signal at Receiving Antenna Location: NO VHF	VHF SIGNAL STRONG	VHF SIGNAL MODERATE	VHF SIGNAL WEAK	VHF SIGNAL VERY WEAK
NO UHF		CS-V3 $10.95	CS-V5 $17.50 / CS-V7 $24.95	CS-V10 $35.95	CS-V15 $48.50 / CS-V18 $56.50
UHF SIGNAL STRONG	CS-U1 $9.95	CS-A1 $18.95	CS-B1 $29.95	CS-C1 $43.95	CS-C1 $43.95
UHF SIGNAL WEAK	CS-U2 $14.95	CS-A2 $22.95	CS-B3 $49.95	CS-C3 $59.95	CS-D3 $69.95
UHF SIGNAL VERY WEAK	CS-U3 $21.95	CS-A3 $30.95	CS-B3 $49.95	CS-C3 $59.95	CS-D3 $69.95

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

NOTE: In addition to the regular 300 ohm models (above), each model is available in a 75 ohm coaxial cable downlead where this type of installation is preferable. These models, designated "XCS", each come complete with a compact behind-the-set 75 ohm to 300 ohm balun-splitter to match the antenna system to the proper set terminals.

THE FINNEY COMPANY

34 West Interstate Street • Dept. 310 • Bedford, Ohio 44146

Circle 6 on literature card

NOTES ON TEST EQUIPMENT

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

by T. T. Jones

Fig. 1. HV probe has built-in meter.

High Voltage Probe

With the recent rash of publicity about X-rays, we're all aware now that the anode voltage in a color set should be accurately measured each time the set is serviced. This requirement does present a problem, since many servicemen do not like to carry more than a caddy on a house call.

Pomona has an answer to the problem in their Model 2900 High Voltage Test Probe (Fig. 1.) This instrument fits in the caddy, is self-contained, accurate, easy to use, and best of all, it's only $19.95. Since a good accessory HV probe costs between $10 and $20, and you still have to buy the meter, the Model 2900 seems especially attractive.

The instrument is so simple to use its hardly worth mentioning. You just connect the ground lead, touch the probe to the ultor cap, and read the meter. There's no range switch to fumble with, no interpreting or mental arithmetic, and no guess work. The instruction sheet packed with the instrument gives a complete list of safety precautions to be observed while working with high voltage. Perhaps it does not sufficiently stress the fact that the ground lead must be connected before touching the probe to the ultor. Otherwise, you're liable to get a little jolt.

The heart of the tester is the meter in the handle, which is a 50 microamp movement. It's calibrated in 1 kilovolt increments, but the divisions are wide enough so you can interpolate ¼ kilovolt steps. The tester is shipped with a shorting wire across the meter, and it was necessary to disassemble the handle to remove the short before the first use. This gave us a chance to check the construction of the tester. It's constructed of high-impact plastic and appears as though it will stand years of banging around, but we recommend the styrofoam shipping box be used to store the instrument in the caddy.

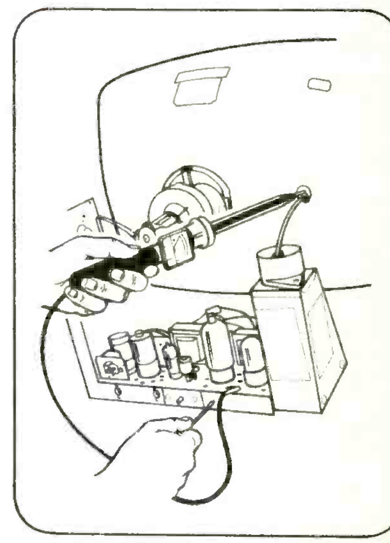


Fig. 2. The Model 2900 in use.

Pomona Model 2900 Specifications

Range:
0-30 KV DC

Input impedance:
600 Megohms.

Accuracy:
± 3% fullscale.

Power requirements:
None.

Size (LWD):
14¾" × 1¾" × 1½".

Weight:
8 ounces.

Price:
$19.95.

For further information circle 70 on literature card.

Fig. 3. New transistor tester has no Beta Cal control.

Transistor Analyzer

The new Seco Model 260 transistor analyzer is the one of the simplest we have used. By simple we mean easy to use, though the circuit is also quite simple.

The in circuit testing procedure consists of: turn on the instrument, switch it to "Dynamic," connect the E, B, and C leads, and read the meter. If the needle moves upscale, the transistor is OK. If the needle doesn't move, reverse the PNP-NPN switch. If it still doesn't move, the transistor should be removed from the circuit for further tests.

The circuit for the dynamic check is shown in Fig. 4. Qx is the transistor under test. The circuit is a regenerative oscillator, operating at about 7kHz. If the transistor is capable of amplification, it will also oscillate, and there will be considerable voltage developed in the tank circuit C1-L1. A portion of this voltage is tapped off through R2, C2, R3, and C3, rectified by the diodes, and read on the meter. The actual voltage doesn't matter, since the presence of any voltage at all indicates the transistor is oscillating and is OK.

• *Please turn to page 29*

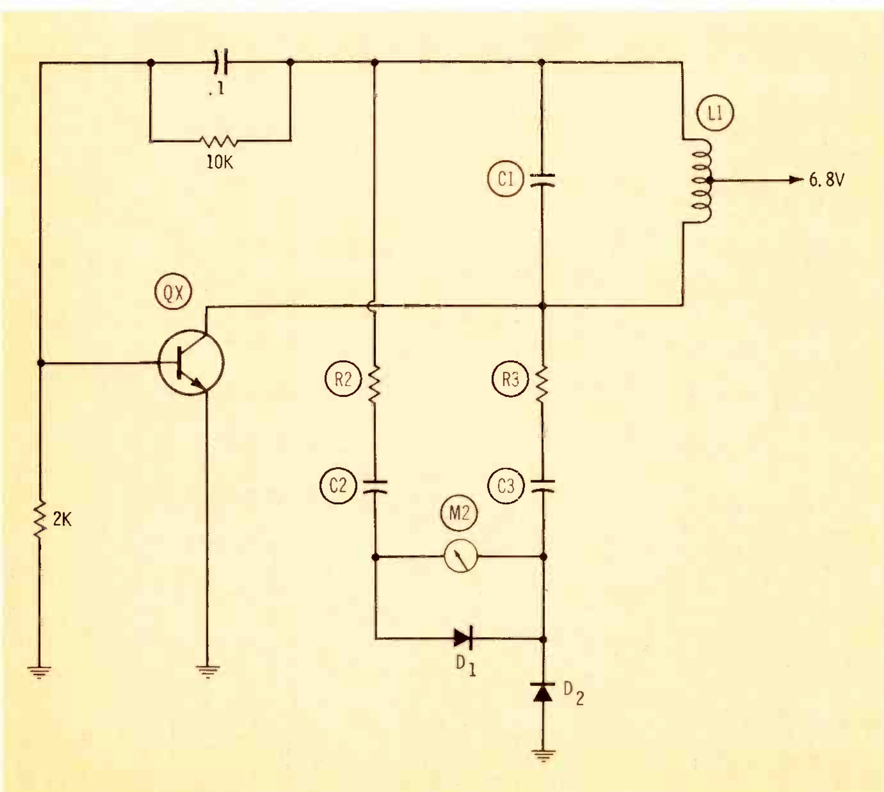
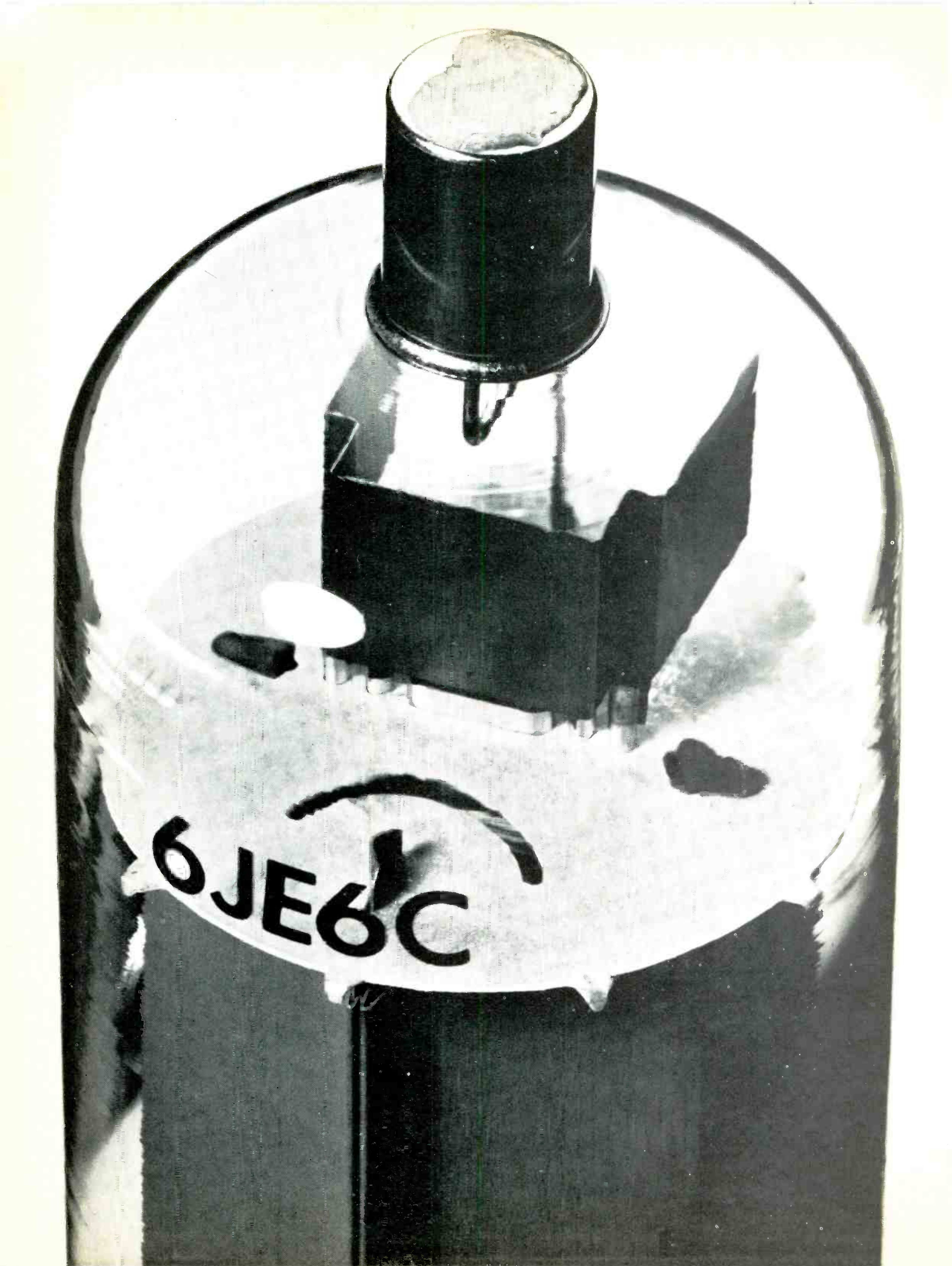


Fig. 4. Dynamic test measures oscillating ability.


6JE6C

The cool new "C." It has more life.

When the horizontal deflection tube in a color TV set goes dead, chances are you've been replacing it with our 6JE6-A.

(You learn by hard experience what's best. Who needs callbacks?)

But this doesn't mean that what's best can't be made even better. At least it doesn't to Sylvania electronic engineers.

That's the reason for our third-generation 6JE6-C. (We skipped "B" altogether.)

The "C" is the new workhorse of color television.

We've given the plate wings.

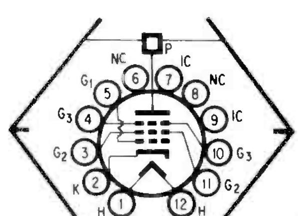
It's been so designed that it acts as a superior heat sink. It holds more heat. Radiates it out from a larger surface. Dissipates it more quickly.

The new tube runs cooler and has longer life.

And it still costs the same as the "A".

It should mean fewer replacement calls.

Try the "C" and see.



Big plate fins absorb heat and radiate it out of the tube.

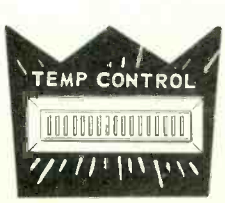
SYLVANIA
A SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

Circle 8 on literature card

ONLY ONE COLOR GENERATOR IS WINTER PROTECTED

Sencore's Color King puts an end to cold weather instability.

Transistors just don't perform properly on those cold, cold winter days. So, when you bring in an ordinary solid state color bar generator from a freezing car or van, you wait and wait for stable patterns. Even then you can't be sure.



Only Sencore's new Color King is truly winter protected. Only the Color King has a built-in heating element surrounding the critical timing circuits. The instant you plug in the generator, this heating element warms up these circuits; also driving out excessive humidity. When optimum operating temperature is reached, a thermostat automatically turns off both the heating element and the Temp Control indicator light. Now you know the circuits are rock stable.

Protect yourself this winter. Go for the hot one. The CG141 Color King. The color generator that works when its hot and works when its COLD.

That's why the **Sencore Color King** stays sold.

Only $149.95 User Net

SENCORE

NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT
426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

Circle 9 on literature card

NOTES

(Continued from page 25)

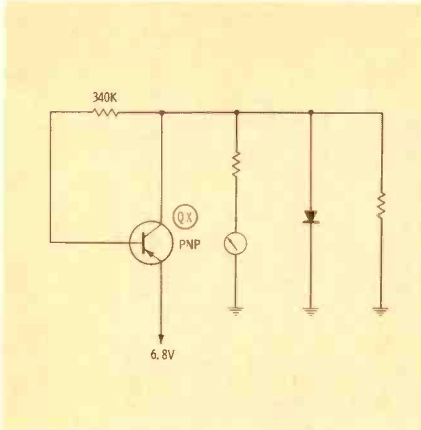


Fig. 5. Schematic of Beta test.

The Model 260 also includes a very simple Beta test. The transistor is inserted in the socket and DC Beta is immediately indicated. The Beta Cal control usually found in transistor testers has been eliminated by the circuit shown in Fig. 5. The 340k resistor is quite large compared to the internal resistance of the transistor, so it effectively regulates the Base current to 20 microamps. With this current fixed, then the meter can be calibrated in Beta, the ratio of base current to collector current. For NPN transistors the meter and voltage connections are transposed.

The Model 260 also measures I_{CBO} and I_{CEO} out of circuit. The power supply is a full-wave bridge, zener regulated. The case is leatherette-covered wood, and all leads are furnished. ▲

SECO Model 260 Specifications

Tests performed:

Quality on a relative scale.
Beta; 0-200, 0-1000. Base current 20 μA signal, 1 mA power. VCE 6.8v.
I_{CEO}; 0-2 mA, 0-100 mA power (VCE 6.8v).
I_{CBO}; 0-200 μA signal and power (VCB 6.8v).

Size (HWD):
4¼″ × 7⅜″ × 8¾″.

Weight:
4¼ pounds.

Power requirements:
115 VAC 60 Hz.

Price:
$69.50.

For further information circle 71 on literature card.

THE ELECTRONIC SCANNER

news of the servicing industry

Electronic Sales Up

Despite some slow-downs earlier in the year, the electronics industry in 1967 will show a 10% gain in total factory sales over 1966, according to Robert W. Galvin, president of the **Electronic Industries Association.**

Preliminary estimates of the EIA Marketing Service Department, Mr. Galvin said, indicate that total factory sales in 1967 will reach about $23 billion for a new record. Continued growth in 1968, he added, will bring an additional rise of more than 5% and combined industry sales of $24 billion.

Color television set sales rebounded from summer doldrums and 1967 factory sales are expected to total 5.5 million or more compared with 5 million in 1966, the EIA president said. In 1968 the industry believes color receiver sales will exceed 6 million. Rising sales of FM radios and magnetic tape equipment also are helping to push total consumer product sales close to $5 billion.

Component sales for the year are estimated at $5.75 billion, Mr. Galvin said, compared with $5.64 in 1966, but the increase has been chiefly in newer product areas such as color TV tubes and integrated circuits.

Both imports and exports of electronic products by the United States rose in 1967, Mr. Galvin noted, but exports rose at a faster rate. During the first eight months exports were up 29% and imports 18%.

CB Industry Moves

Television, radio and magazine messages carrying the story of citizens two-way radio to the consumer market-place will spearhead the CB industry's 1968 advertising and publicity program, enthusiastically approved by the Citizens Radio Section of the Electronics Industries Association at its recent quarterly meeting in Los Angeles.

The newly-formed CB manufacturers' group will launch early in the year a market development program to greatly expand public awareness of the value of CB radio through consumer-oriented literature, highway signs, feature articles and store displays as well as public-service messages in mass media.

Wins Service Award

Melvin C. McKenzie, the owner of a radio and TV store in Bay City, Michigan, has just received the third Community Radio Watch Distinguished Service Award to be given in the State of Michigan.

The award—a plaque and two hundred dollars in U.S. Government Savings Bonds—was presented to McKenzie for his quick radio notification which helped keep a fire from doing considerable damage to downtown Bay City, Michigan.

Mr. McKenzie radioed a report to his wife, who was working his base station, immediately notifying her of the fire and the location. His wife then telephoned the report to the Bay City Fire Department.

Earlier this year, a Detroit area fuel truck driver, Fred R. Howe, received the first Community Radio Watch Distinguished Service Award for notifying the authorities of a woman who had been thrown through her vehicle's windshield as the result of an accident. And later Charlie Jones, a driver for the Detroit Department of Street Railways, received the fifth Distinguished Service Award for saving apartment dwellers from being caught in a conflagration which occurred in the small hours of the morning.

Mergers & Expansions

Belden announced that a new plant will be constructed during 1968 at Jena, La., to produce insulated copper wire and cable. Approximately 200 employees will initially staff the new facility upon its completion late next year.

Belden's President Robert W. Hawkinson said a 43-acre site was selected at Jena in central Louisiana, for the Chicago-based company's fifth manufacturing plant. The facility will offer more than 150,000 sq. ft. of space including about 8,000 sq. ft. for offices. It will be designed to permit further expansion to meet future increases in production capacity, Hawkinson said.

Production of color television picture tubes has been started in Monterrey, Mexico by Sylvamex Electronica S.A., a subsidiary of **General Telephone & Electronics International.** Bernard T. O'Dea, President of Sylvamex, said the operation was begun to meet the anticipated growth of color TV in Mexico. 26,000 square feet has been added to Sylvamex's 60,000-square-foot plant to provide space for production of 10-inch and 25-inch color picture tubes for Mexican TV set manufacturers.

IRC's Board of Directors approved in principle an agreement of merger with TRW Inc. A preliminary arrangement to combine the firms was announced on October 3rd.

The IRC Board also agreed to reconvene to consider action on the definitive merger agreement, which will be submitted to IRC's stockholders for approval at a special meeting in January. The agreement is also subject to approval by TRW's Board of Directors.

The addition of two new facilities to the training network of **Sams Technical Institute** has been announced by Howard W. Sams, Chairman of the Board, Howard W. Sams & Co., Inc.

A new 15,000 square foot building recently completed in Fort Wayne's Interstate Industrial Park will provide facilities for 400 student enrollments this fall in the northern Indiana area. Initial classes are under way there with additional classes planned for September.

The addition of Bramwell Business College in Evansville adds a complete range of business courses to the STI curriculum. It is the second Evansville STI facility serving southern Indiana. Established in 1919, Bramwell is a resident school offering day and evening programs in seven business subject areas.

The new training facilities in Fort Wayne and Evansville, together with the Indianapolis Center, will bring Indiana STI student enrollment in full-time resident courses to 2,225 by this fall. An additional center in Dayton has 300 students enrolled. Centers are planned for other key cities in the nation, Mr. Sams announced.

General Instrument and **Jerrold** announced that their respective Boards of Directors have approved the acquisition of Jerrold by General Instrument on the basis previously announced. The formal merger documents, pursuant to which General Instrument will issue seven-tenths of a share of its Common Stock for each outstanding share of Common Stock of Jerrold, have been signed.

As previously announced, the merger is subject to approvals of stockholders and receipt of a favorable ruling of the Internal Revenue Service.

Oak Electro/Netics formally dedicated a new television tuner assembly plant near Seoul, Korea in ceremonies attended by officials of the U.S. and Korean governments.

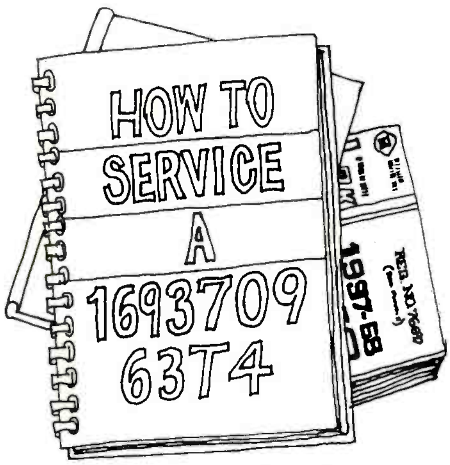
O/E/N Korea is expected to have an annual production rate of 2 million tuners by 1969. It is the third Far Eastern production facility established in the past five years by O/E/N. The other Far Eastern operations are an 84,000 square foot tuner assembly plant in Hong Kong and a Japanese facility in Hachioji that produces components assemblies for Japanese companies.

NARDA Convention

Houston will host the "1978" NARDA Convention next month. The association decided that now is the time for dealers to start planning how to cope with the problems and deal with customers of tomorrow—hence the ten-year theme.

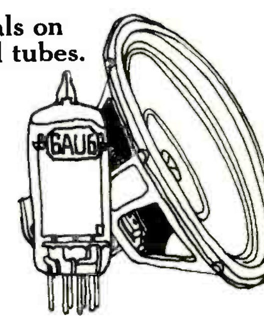
You may register for the convention, to be held in Houston, Texas, February 8th through 10th, by writing to: NARDA, 827 Merchandise Mart, Chicago, Ill., 60654. ▲

If none of these things attracts you to the Parts and Service location at our Open House, there's always the free doughnuts.

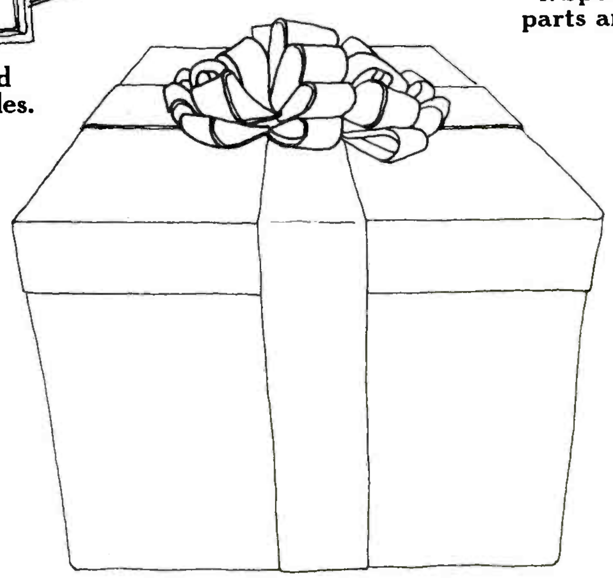


1. Free manuals and trouble-shooting guides.

2. Training on new products.

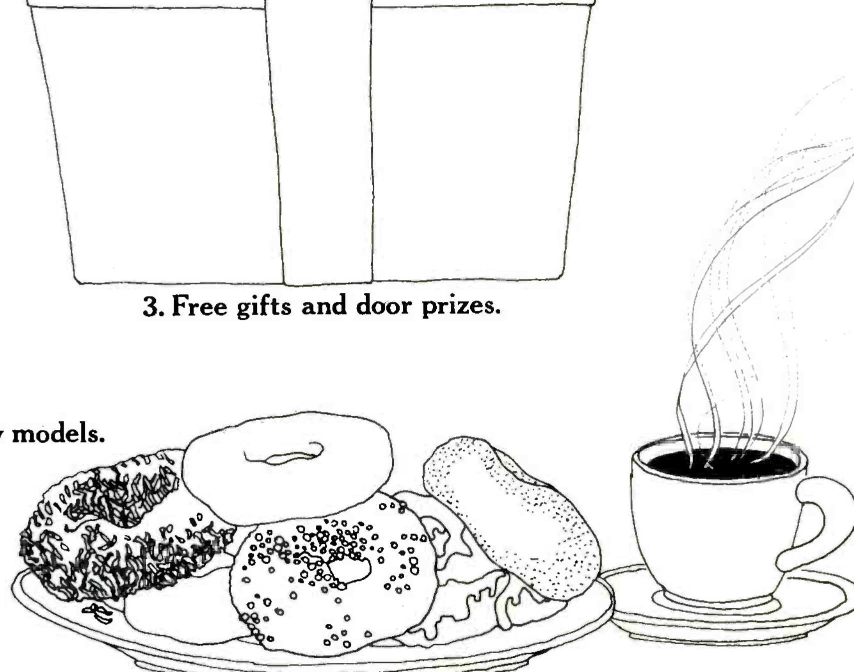


4. Specials on parts and tubes.



3. Free gifts and door prizes.

5. Preview of new models.



If you're feeling a little hungry during January or February, drop into our Open House at your Philco-Ford Distributor's or Parts and Service location.

PHILCO Ford

FAMOUS FOR QUALITY THE WORLD OVER

Philco-Ford Corporation, Philadelphia, Pa. 19134

LETTERS TO the EDITOR

Dear Editor:

I read Mr. Benzing's letter in the November PF REPORTER with much understanding. We service many Motorola color receivers and the same symptoms had us bugged for a while. While he found the defective component, the defect was of a different nature.

The inner conductor in early production was a tinned wire. During the tinning process some kinks occurred and these kinks caused the conductor to break after repeated heating and cooling cycles. When the set is then cold, the two parts come together and make contact. When the set is in use, the cable warms and expands, thus pulling the inner conductor apart. The capacity between the two parts passes some signal, with the best signal being those on the low band and, of course, the strong stations. Another problem we ran into was that the vertical sync was affected without a loss of picture, again usually on the low band only.

I hope this solution will help a lot of men save their hair.

R. ANDERSON
Palmer, Mich.

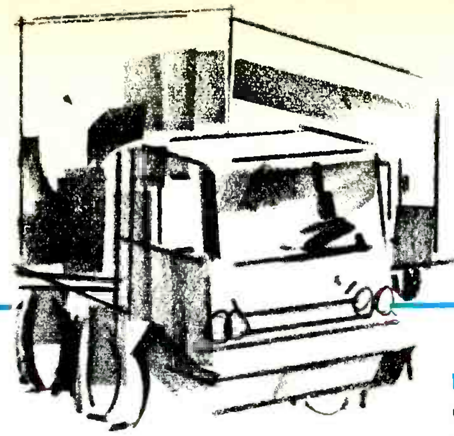
Dear Editor:

I have a foreign television set which the owner would like to have converted for American reception. This set is not listed in the PHOTOFACT Index and was last used in Sweden. Before we get too involved, do you think this conversion is practical? What about parts availability on future breakdowns?

H. HANSON
Ashland, Wis.

As a first step, I would advise you to read "Foreign TV Systems" in the July 1964 PF REPORTER. *General information is contained in this article. To be specific, Sweden uses the CCIR 625-line system. This would require retuning of the horizontal and vertical scanning oscillators. The vertical circuit would require component changes. Channels E-2 through E-11 and channel E-43 are in use in Sweden with 5.5-MHz picture-sound separation and 7-MHz channel separation. These correspond closely to our channels 2, 3, 7 through 13, and 43. The tuner oscillator coils must be retuned and the RF coils retuned to attain 7-MHz bandpass.*

The decision to proceed with the conversion must be made by you and the owner.—Ed. ▲



TIME TO MOVE?

■ Nearly every shop owner, at one time or another, ponders the question of if and when to relocate. The correct answer to both questions requires careful consideration of a number of factors, most of which are included in the following check list. ■

Ernest W. Fair

Change and movement are marked features of life in the business world today. Each year sees further increase, according to the statistics which study such trends. The change factor is so important today that virtually every multiple-store company has developed its own system for determining the profitable time to move to another location.

Few such firms wait until declining business makes it obvious that a move is required. Instead, they apply their check list each time lease renewal comes up, or any other development makes it wise to do such an analysis.

Survival for the single-outlet electronic service shop owner can be even more important, for his future depends on that one business. It is important to him that he anticipate the need for change of his business location well ahead of its being a necessity for survival.

We've condensed three of the aforementioned systems into the following check-list, and any reader may use it to determine whether or not it is time to move his shop location.

✔ Has the general area of the business operation started to show a decline in buying power of customers therein over at least a six-month period?

If no over-all temporary cause can be isolated, a drop in business is always a prime factor to consider. Residents in another area may possess not only better, but more stable buying power.

✔ Have recent developments resulted in major changes of traffic-flow into, around or through the area surrounding the shop?

If such a development is making it more difficult or inconvenient for customers to do business with your shop, then the situation is certain to be damaging in the long run. Naturally, any new location being considered must pass the favorable traffic flow test.

✔ Has the problem of customer parking at the present location become acute? Is there no method of handling it or no space available to solve it?

If this is a factor in patronage, the failure to find a solution can result in great loss of business. Change of location may be fully justified under such circumstances.

✔ Are virtually all of the other business establishments in the area being allowed to deteriorate in appearance by their owners?

Sometimes a drive to spruce-up can halt an area decline, but such cooperation is rarely obtained. A deteriorating business area not only fails to attract customers, but it actually repels them.

✔ Has the vacancy percentages of other business buildings in the area been steadily rising?

It is of particular importance to note when worthwhile business buildings continue to remain vacant over a long period of time. Invariably this is an indication that general business confidence in the particular area has disappeared, and usually for very good reasons. It's often more apparent to nonresidents than to the firms struggling to stay alive therein.

✔ Will expensive changes or expansion in the building be necessary immediately in order to build up the business in the future or even to hold your own for the present?

Where additional space in the immediate area is either too expensive or impossible to obtain for other reasons, or remodeling of an extensive nature will be necessary, it is sometimes wiser to seek another business home elsewhere.

✔ Are costs of doing business in the present location continuing to rise beyond safe margins and are they likely to continue doing so in the future, without a compensating rise in volume of business or net profit?

If increased business volume does not absorb such added costs, then a new location may be the most advisable step for the shop.

✔ Are there opportunities in another area which have such a great potential that the cost of making the move would be inconsequential?

In many cases such a situation will make a move very profitable even though one's shop is not in any unfavorable position at the present location. Utmost care must be exercised in checking, where this is the chief consideration behind a projected change of location.

✔ Will the loss of business closely tied to the present location be of any importance, and is it certain that this will be offset by the volume of new business that will be gained in the proposed location?

Gains of this nature can sometimes be an illusion, for overall increases in business cost on another location may more than offset the added volume. The gains should

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always be assayed against current losses and future costs.

✔ Will it be possible to obtain a lease in the new location which can be handled under a normal volume of business?

When a new location has many advantages over the present one but a costly and restrictive lease goes along with it, then the actual gain made by the move may be small indeed.

✔ Are the attitudes and approaches of the other business men around the present shop location such as to diminish the possibility of any favorable future for the area?

In business districts where general apathy has set in among the owners of the firms therein, the over-all effect will weigh heavily upon one's own business possibilities no matter how much aggressive effort is put into the shop in its present location.

✔ Are the new business ventures being made in the community all bypassing the general area of the shop's present location even though space therein is available for them?

When this occurs one can be certain that very thorough studies are being made, and the results are proving anything but favorable to one's present location. If this has occurred, you should start doing some close checking on your own.

✔ Has depreciation caught up with fixtures and equipment at the present location to the point where very large sums will need to be spent immediately?

If other indications have pointed to the possible need for a change in business location, this can be a big factor for scrap or salvage of present equipment and installing new equipment in a new location. This will eliminate a costly moving bill, which is always a very important factor.

✔ Is the time at hand when remodeling cannot be put off any longer? Wouldn't it be better to move into a new and modern business home than to bear this expense in a present location?

Even after the renovating has been done, it may be of questionable value and do little to better the present location.

✔ Are changes forthcoming in the type of other business firms in the area which could make it less desirable from the viewpoint of a large segment of present customers?

Usually, one step in such a direction leads to many others and the business area seldom returns to the personality which formerly existed.

✔ Have there been changes in the size of families, steadily mounting average-age figures for most residents, and similar factors covering the present location area?

This generally results in a slow but steady decline of average purchases by customers. Whenever such factors become evident, it is always a good time to seriously consider a change of location.

✔ Finally, during the last two or three years has there been a continuous movement of population from the present area of business to some other in the community? Do all indications point to this as being of permanent nature? If they do, seeking a new location now can not only be a wise step but one necessary to survival of one's business. ▲

PHOTOFACT™ BULLETIN

PHOTOFACT BULLETIN lists new PHOTOFACT coverage issued during the last month for new TV chassis. This is another way PF REPORTER brings you the very latest facts you need to keep fully informed between regular issues of PHOTOFACT Index Supplements issued in March, June, and September.

Airline		GEN-11468A (63-11468)	925-1
		GHJ-13668A, GHJ-14098A, GHJ-14148A, GHJ-14158A, GHJ-14548A, GHJ-14558A	928-1
Coronado		TV2-6610A	924-1
Delmonico-Nivico		CT-195, CT-197EA, CT-199	928-2
		PCT-198	926-1
Magnavox	Chassis	T925-01-AA	927-1
Penncrest		4877B-48, 4878B-46, 4886A-49, 4887A-47	924-2
RCA	Chassis	CTC27A/B	929-1
	Chassis	CTC30A/B/C/D/AA/AB/AC/AD/AE/AF	926-2
	Chassis	CTC31A/AA/B/P/R	928-3
	Chassis	CTC35A/AA/AB/B	925-2
	Chassis	KCS158B/C	924-3
Sears		7100 (Ch. 564.10012)	929-2
		8100 (Chassis 562.10300)	926-3
Zenith		20Y1C38	927-2

Production Change Bulletins

Admiral	Chassis 21A4, 21A4D, 21B4, 21C4, 21F4, 21UA4 21UB4, 21UC4, 21UF4	929-3
Sears Silvertone	5120, 5121 (Ch. 456/528.61240 thru 249 456/528.61414/415 456/528.61560 thru 569)	926-4

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This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about $100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Opportunities in Plants

And there are other exciting opportunities in the aerospace industry, electronics manufacturing, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal Government's FCC exam and getting your License is widely accepted proof that you know the fundamentals of Electronics.

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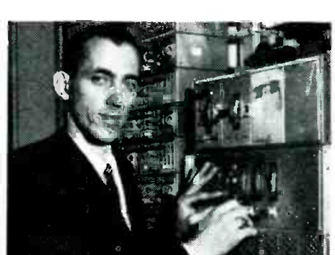

Thomas E. Miller, Jr., Engineer, Indiana Bell Telephone Company: "I completed my CIE course and passed my FCC exam while in the Navy. On my discharge, I was swamped with job offers from all over the country. My only problem was to pick the best one, and I did—engineer with Indiana Bell Telephone. CIE made the difference between just a job and a management position."

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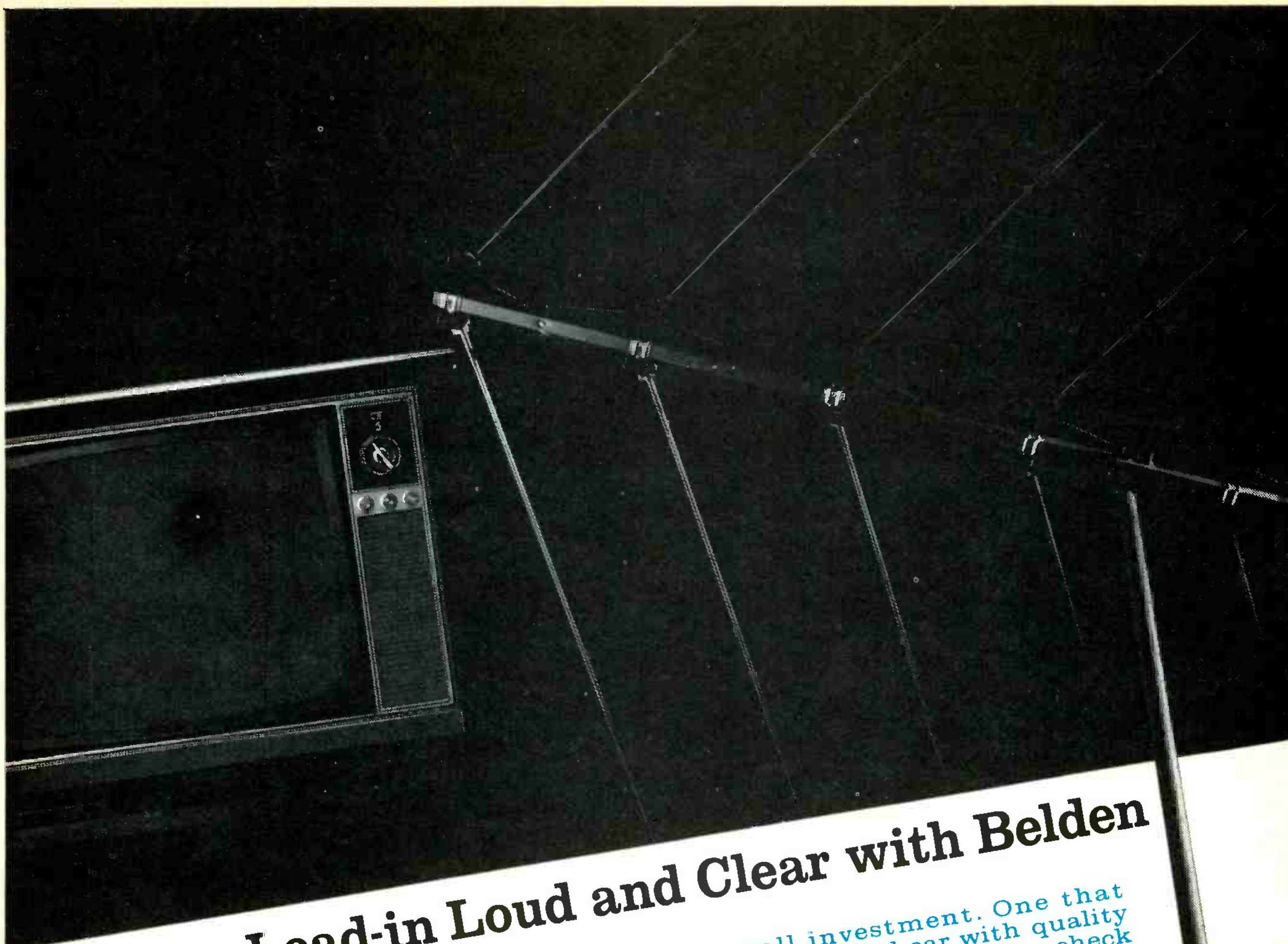

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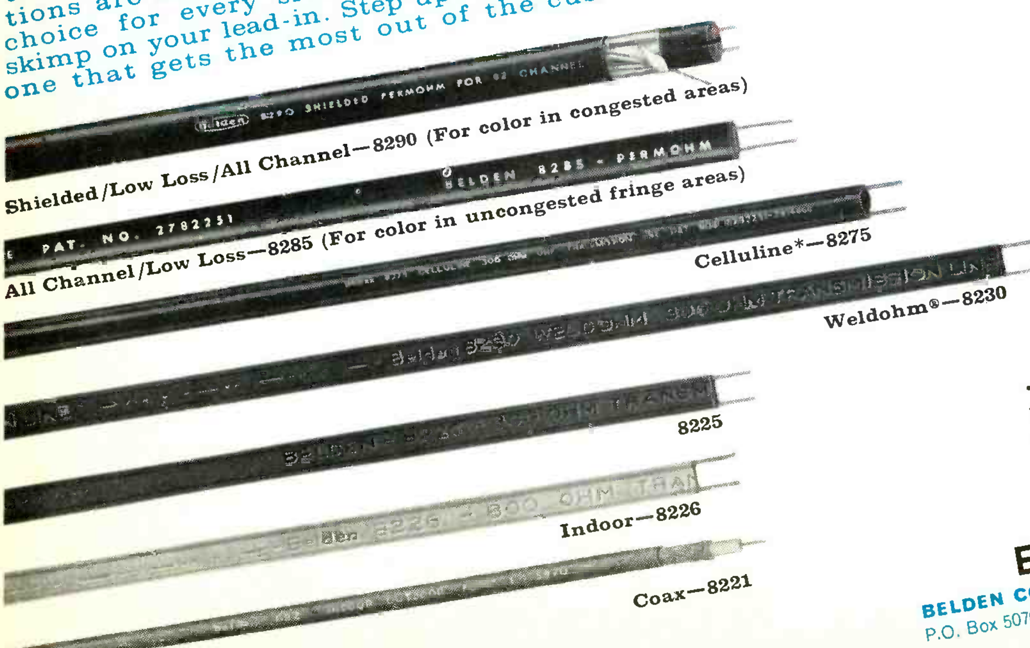
don't forget to ask them what else needs fixing?



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Circle 18 on literature card

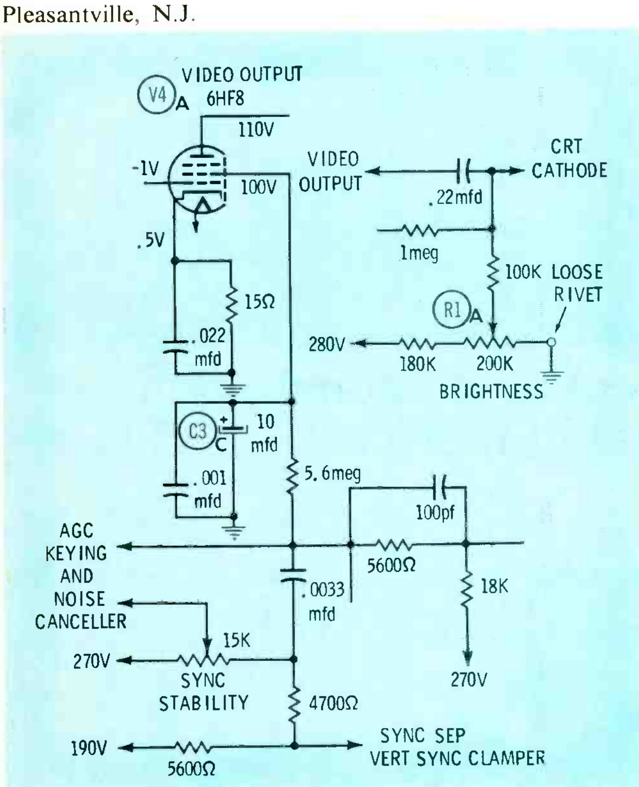
THE TROUBLE-SHOOTER

High Voltage Missing

A Zenith Chassis 14M23 (PHOTOFACT Folder 739-4) has no high voltage. Initial troubleshooting revealed an 850-ohm reading between terminal 7 of the flyback and the plate of the high-voltage rectifier. After replacing the flyback with one of the replacements listed in the PHOTOFACT, the set produces only 15kv (as opposed to the normal high voltage of 19.5 to 20.5kv) and the raster width is reduced. Boost voltage is approximately 450 volts (normally 740 volts). The amplitude of the waveform at the grid of the horizontal output tube is 100 volts p-p (normally 180 volts p-p), while the waveform at the grid of the horizontal oscillator is normal. The voltage at the cathode of low-voltage rectifier X2 measures 255 volts (normally 290 volts). However, when the horizontal output tube is pulled, the voltage at X2 increases to 285 volts.

CHARLES CATTERMOLE

Pleasantville, N.J.



Your description of the trouble symptoms indicates reduced drive to the horizontal output tube, causing it to draw excessive current. However, there are other factors to be weighed before a definite diagnosis can be made. First, is the reduced low voltage a direct result of the increased load caused by excessive current in the horizontal output circuit? To answer this, measure the horizontal output cathode current. If it is more than 160 ma, the excess current could be pulling the high voltage down. If

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the horizontal output cathode current is near normal or below normal (doubtful), the trouble is probably related to a defect within the low-voltage supply, or a defect within another circuit that is pulling the low voltage down. With reduced low voltage, the output of the horizontal oscillator will not be sufficient to drive the horizontal output stage. Or, the original diagnosis of low horizontal output drive may be related to a defect within the plate circuit of the horizontal oscillator—a leaky or partially open C57B could be the culprit.

Before attempting to prove the preceding diagnosis, recheck all connections to the replacement horizontal output transformer, making sure that you have not overlooked a dummy terminal or connected the wrong wire to the wrong terminal, etc. Then, proceed to uncover the reason for the low drive voltage.

Sync and Brightness Troubles

We have recently experienced a couple of unusual troubles that might be of interest to other service technicians. One involved vertical rolling in an RCA KCS136YA chassis (PHOTOFACT Folder 704-2). The rolling occurred only on Channel 2—Channels 5 and 11 locked in normally. Troubleshooting the sync circuits did not uncover any defects. The trouble was finally traced to a bad electrolytic (C3C) in the screen circuit of the video ouput stage.

Another unusual defect involved an RCA KCS142 chassis (PHOTOFACT Folder 768-4) that displayed a dark picture. At first, we thought the trouble was caused by low emission in the CRT, but a check of the picture tube revealed no defects. All circuit voltages checked normal. Finally, while probing around, we discovered that the rivet on the ground end of the brightness control was loose.

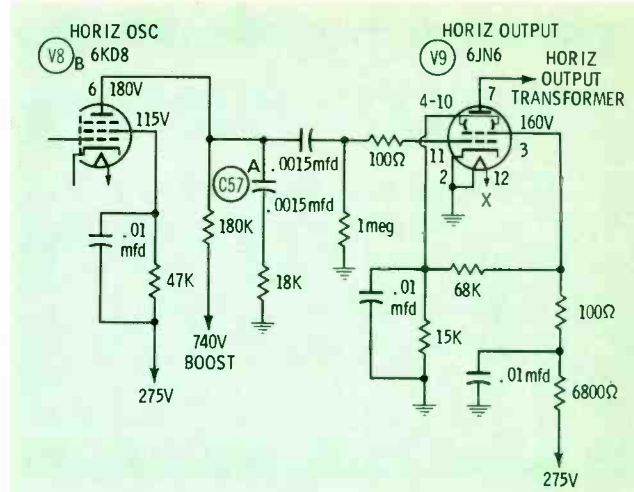
Circle 17 on literature card

Circle 25 on literature card

Resoldering the rivet completed the ground path and the CRT returned to normal brightness.

C. E. Combs

Atlanta, Ga.



Obviously, in your location, the signal from Channel 2 is not as strong as that from Channels 5 and 11. With C3C leaking, the amplitude of the sync pulses was further reduced, so that a combination of the two factors resulted in insufficient input to the sync separator and clamper. The loose rivet on the ground end of the brightness control opened the circuit, placing the full 280 volts on the CRT cathode—producing the obvious result.

Tips on Zenith Chassis

In the Troubleshooting column in the October '67 issue, Mr. C. H. Alexander described a vertical sync

Circle 26 on literature card

problem he encountered in a Zenith chassis. I've experienced the same symptom in Zenith chassis, and the cause of the trouble was an open screen bypass capacitor in the video output stage.

In the same column and issue, another technician (Mr. N. Wise) described the high-voltage problem he was experiencing with another Zenith chassis. I've had many such problems with Zenith chassis and have worked out a system of diagnosis that seems to work quite well. I've divided high-voltage troubles into "squeal" and no-squeal" symptoms. The presence of squeal with a high-voltage problem can indicate a dead horizontal oscillator, shorted capacitor (180 pf) between the plate and cathode of the damper tube, an open filter section, or perhaps a shorted 1K3 high-voltage rectifier.

A "no high voltage" symptom without squeal can be caused by an open dropping resistor in the plate of the horizontal oscillator. After checking this resistor, try drawing an arc from the plate of the high-voltage rectifier. If no arc can be drawn, or if the arc is weak, disconnect the yoke from the horizontal output transformer. If high voltage returns, or increases, replace the yoke with a new one. If the high voltage does not return, or if the arc is still weak, replace the horizontal output transformer. This procedure has worked with approximately 90% of the high-voltage problems I have encountered in Zenith Chassis.

MAX GOODSTEIN

Flushing, N.Y.

Thank you for sharing your tricks-of-the-trade with us. Your technique concerning the "squeal" and "no squeal" categorizing of high-voltage problems in Zenith chassis is unique. Obviously, the Zenith chassis you refered to with regard to the vertical sync problem was not a Zenith 14M-21/X chassis. This particular chassis does not have a screen bypass capacitor in the video output stage — the screen is connected directly to the 125-volt B+ line.

Ion Spot and Halation

I have a Zenith 17B20 (PHOTOFACT Folder 429-2) that displays an ion spot and halation after the set is turned off. The picture has good definition and contrast at low brightness. How can I get rid of the ion spot and halation?

G. KEIL

Freeport, Ill.

The ion spot and halation you are experiencing is a result of the fact that the high voltage does not decay as rapidly as the sweep voltage when the set is turned off. The high voltage may remain for as long as two or three minutes unless the set is operating at high brightness, which quickly discharges the high-voltage filter capacitor or aquadog coating of the CRT.

Several types of spot-killer circuits have been designed into many chassis to provide quick removal of the ion spot after the set has been turned off. One such circuit uses an extra switch ganged to the on-off switch to decrease the CRT bias when the set is turned off. The same effect can be realized by merely turning up the brightness control before turning the set off. Other types of spot killers include a switch that removes the B+ from the brightness control when the set is turned off, resulting in increased CRT conduction and quicker current drain. Another type applies a positive voltage to the CRT grid to accomplish the same quick current drain. An automatic spot killer using an NE2 neon bulb has also been used. ▲

SEE PHOTOFACT Set 796, Folder 3

Mfr: Magnavox

Chassis No: T/U 904

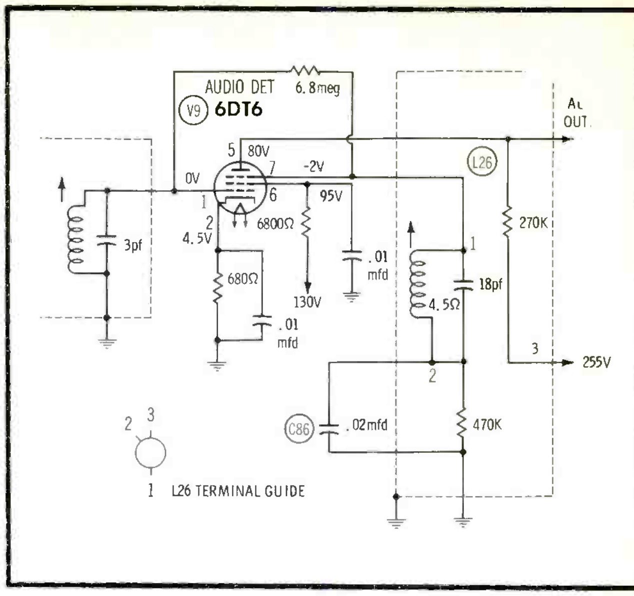
Card No: MA T/U 904-1

Section Affected: Sound.

Symptoms: Buzz in sound.

Cause: Open capacitor in quadrature circuit of audio detector.

What To Do: Replace C86(.02 mfd).



Mfr: Magnavox

Chassis No: T/U 904

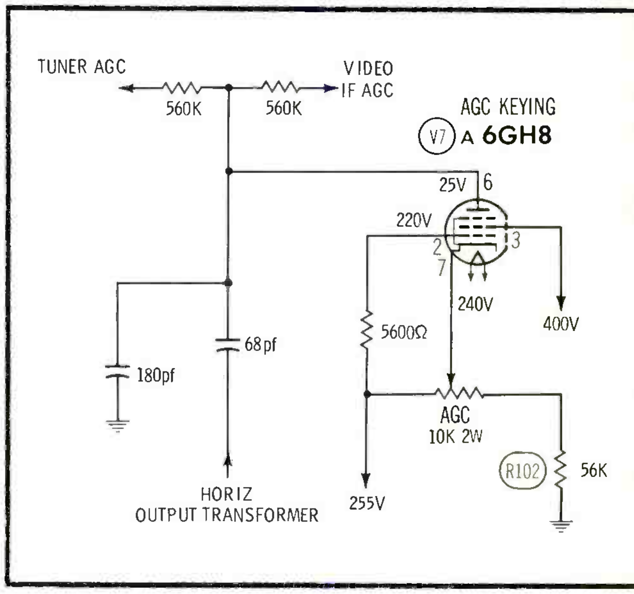
Card No: MA T/U 904-2

Section Affected: Color pix.

Symptoms: Video overload on strong station signal.

Cause: AGC keying circuit cathode resistor overloads and opens.

What To Do: Replace R102 (56K); also V7 (6GH8).



Mfr: Magnavox

Chassis No: T/U 904

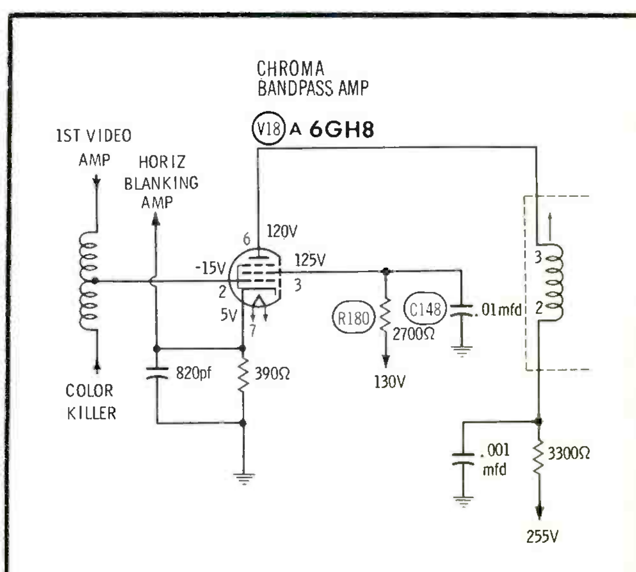
Card No: MA T/U 904-3

Section Affected: Color Pix.

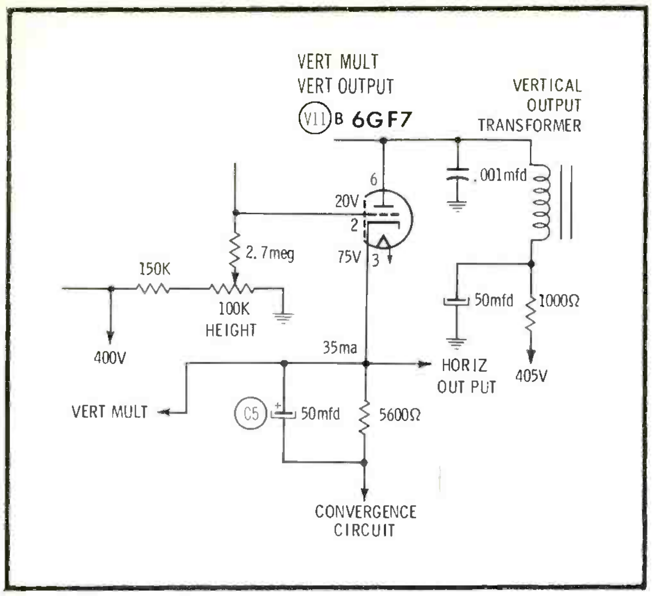
Symptoms: No color pix; black-and-white normal. Low voltage on screen grid (pin 3) of chroma bandpass amplifier.

Cause: Leaky screen grid bypass capacitor in chroma bandpass amplifier circuit.

What To Do: Replace C148 (.01 mfd) and R180 (2700 ohms).



SEE PHOTOFACT Set 796, Folder 3



SEE PHOTOFACT Set 796, Folder 3

Mfr: Magnavox

Chassis No: T/U 904

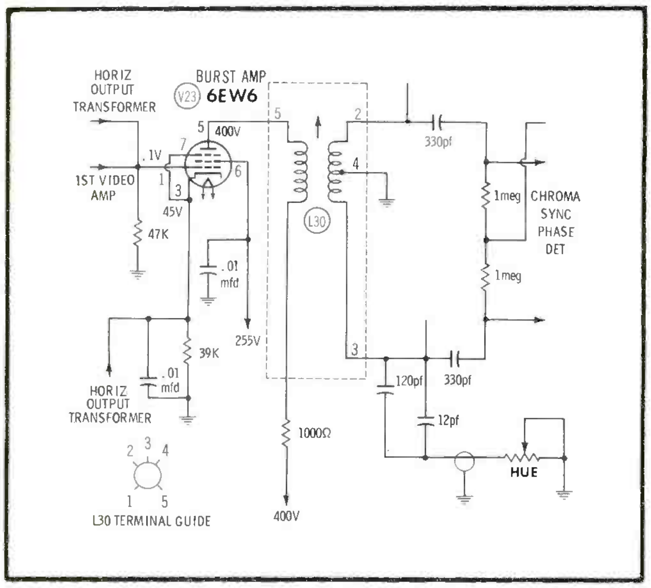
Card No: MA T/U 904-4

Section Affected: Raster.

Symptoms: Vertical jitter.

Cause: Defective cathode bypass capacitor in vertical output circuit.

What To Do: Replace C5 (50 mfd).



Mfr: Magnavox

Chassis No: T/U 904

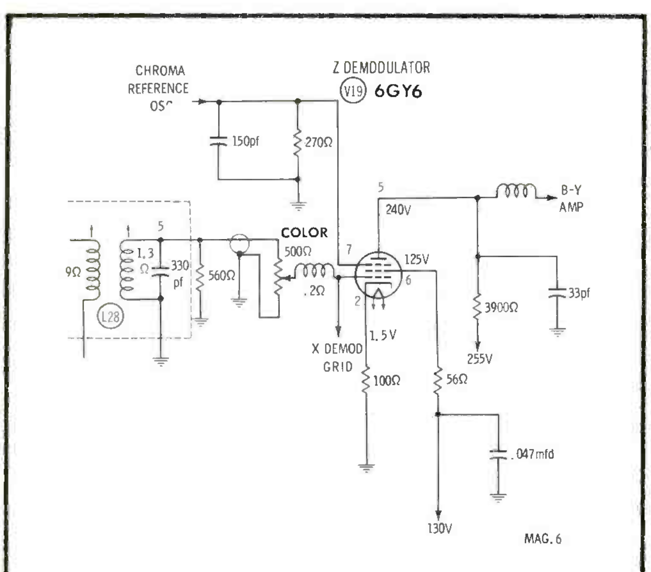
Card No: MA T/U 904-5

Section Affected: Color sync.

Symptoms: Color pix floats in and out of sync; black-and-white pix normal.

Cause: Bad ground connection to burst amplifier transformer.

What To Do: Resolder ground connection at terminal 4 of L30, burst amplifier transformer.



Mfr: Magnavox

Chassis No: T/U 904

Card No: MA T/U 904-6

Section Affected: Color pix.

Symptoms: No color pix; black-and-white pix normal.

Cause: Defective color control cable.

What To Do: Replace color control cable.

SEE PHOTOFACT Set 834, Folder 4

Mfr: Zenith

Chassis No: 25NC37

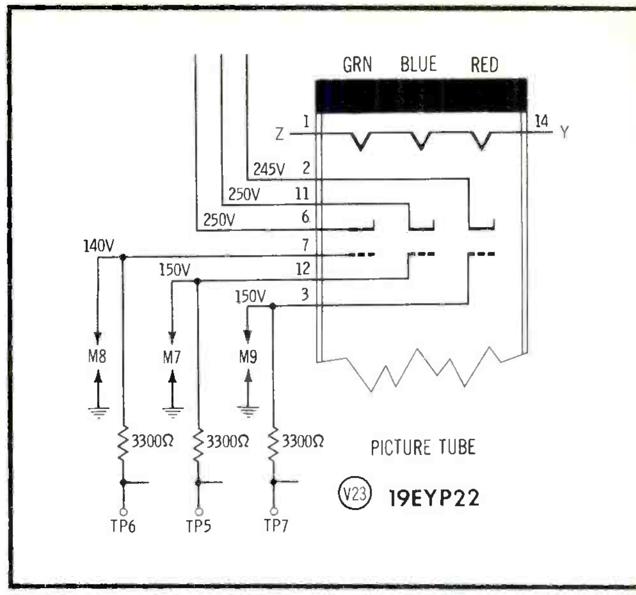
Card No: ZE25NC37-1

Section Affected: Raster; b-w setup.

Symptoms: Red-green and/or blue fields not obtainable.

Cause: Shorted spark gap at one of three screens of CRT.

What To Do: Replace defective spark gap, M7, M8, or M9.



Mfr: Zenith

Chassis No: 25NC37

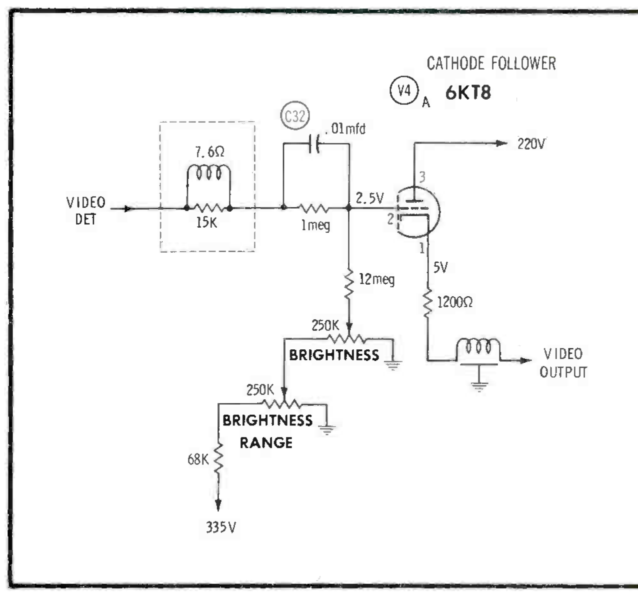
Card No: ZE25NC37-2

Section Affected: Raster.

Symptoms: Very dim raster.

Cause: Shorted coupling capacitor in cathode-follower stage of video amplifier.

What To Do: Replace C32 (.01 mfd).



Mfr: Zenith

Chassis No: 25NC37

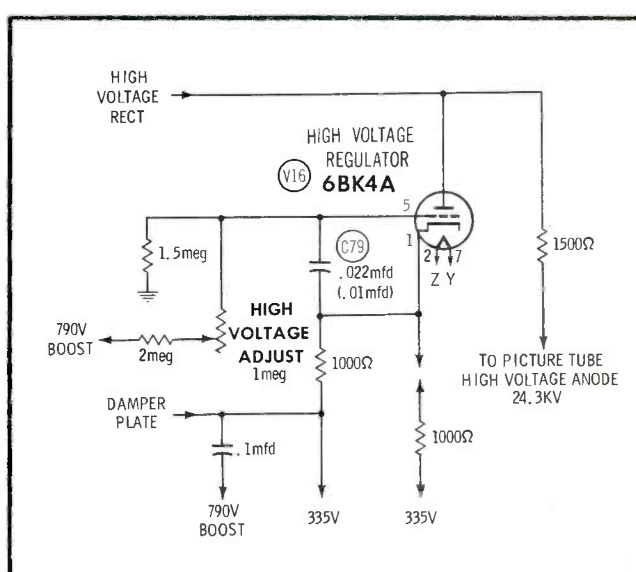
Card No: ZE25NC37-3

Section Affected: Raster.

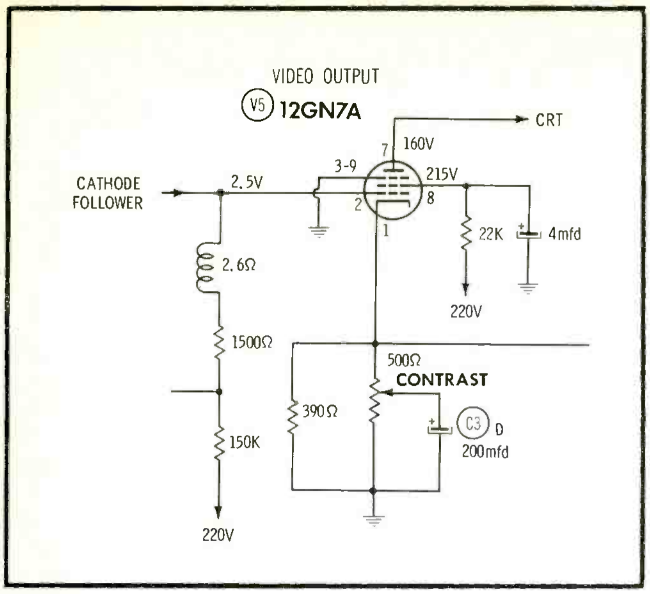
Symptoms: No focus.

Cause: Shorted grid-cathode capacitor in high-voltage regulator.

What To Do: Replace C79 (.022 or .01 mfd).



SEE PHOTOFACT Set 834, Folder 4



SEE PHOTOFACT Set 834, Folder 4

Mfr: Zenith

Chassis No: 25NC37

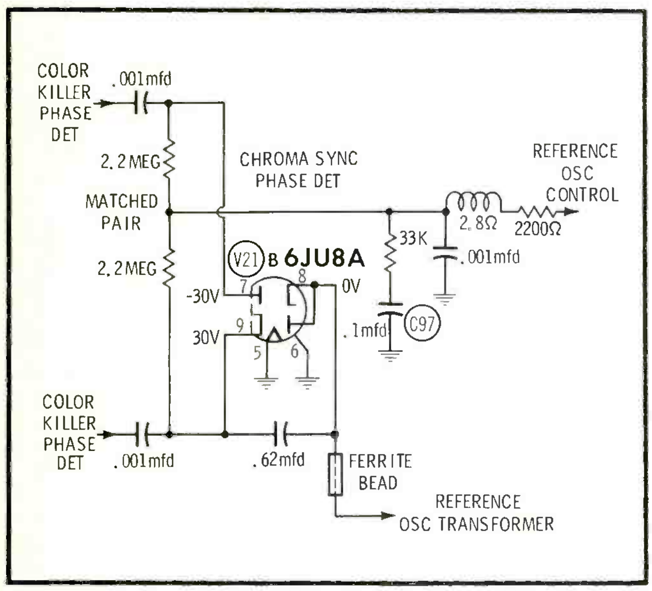
Card No: ZE25NC37-4

Section Affected: Pix.

Symptoms: Poor contrast; no control of contrast.

Cause: Open cathode filter capacitor in video output circuit.

What To Do: Replace C3D (200 mfd).



Mfr: Zenith

Chassis No: 25NC37

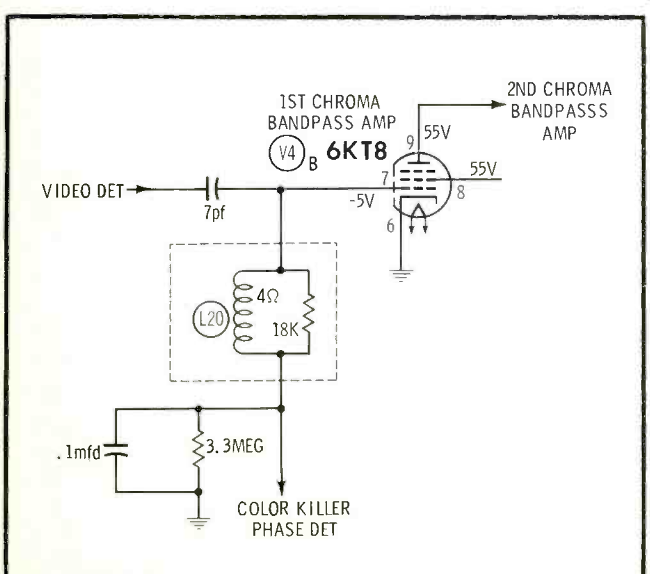
Card No: ZE25NC37-5

Section Affected: Color sync.

Symptoms: Color sync lost when channel is changed.

Cause: Shorted capacitor in chroma sync phase detector output circuit.

What To Do: Replace C97 (.1 mfd).



Mfr: Zenith

Chassis No: 25NC37

Card No: ZE25NC37-6

Section Affected: Color.

Symptoms: Color overshoot; blue shadow occurs on one side of figure; face may be shadowed blue or green.

Cause: Open peaking coil in grid circuit of 1st chroma bandpass amplifier.

What To Do: Replace L20, coil resistor combination.

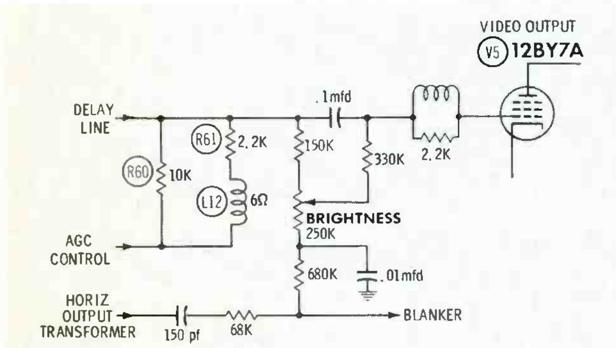
COLOR COUNTERMEASURES

SYMPTOMS AND TIPS FROM ACTUAL SHOP EXPERIENCE

Chassis: RCA CTC12, 15

Symptoms: Dim picture; no control of brightness.

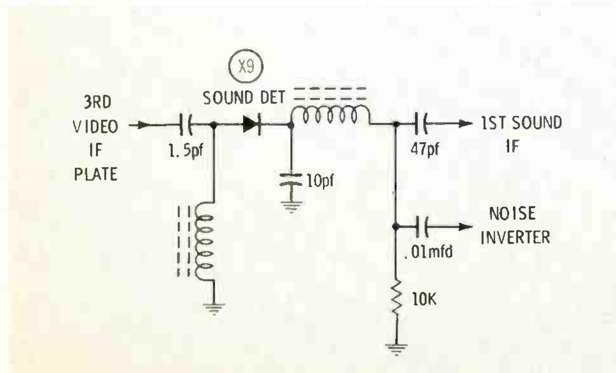
Tip: Rotating brightness control produces no change of brightness on screen. Common cause of trouble is open L12 in grid circuit of video output stage. Positive voltage for the brightness control is obtained from the cathode of the AGC keyer and noise inverter via L12 and R61. With L12 open, the only path for this positive voltage is via the 10K-ohm resistance of R60. This added resistance of approximately 7.8-K ohms reduces the positive voltage to a value lower than normally required for proper brightness control action.



Chassis: Packard Bell 98C7D, 98C8

Symptoms: Video overload when channel changed — clears up in 1 to 4 seconds. In some instances, audio disappears during video overload — depends on strength of station signal.

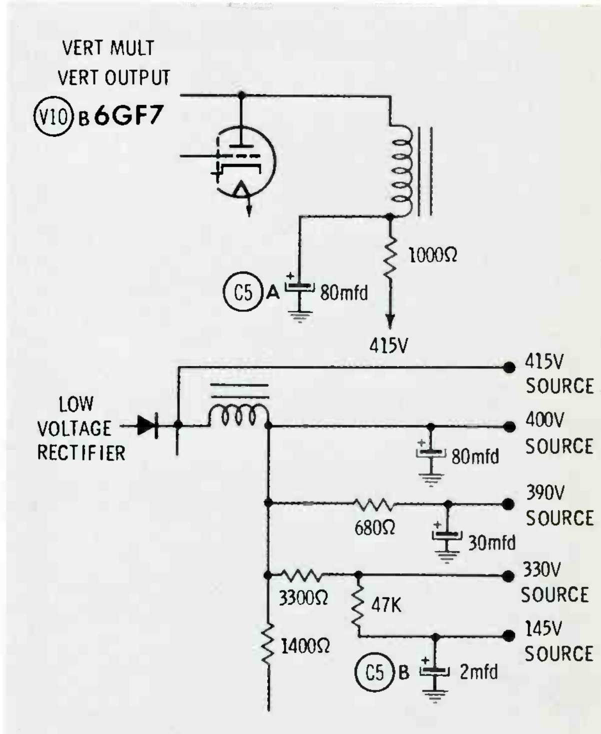
Tip: Possible cause is defective X9, sound detector diode.



Chassis: RCA CTC15

Symptoms: Picture fades intermittently—screen varies from half black and half white with retrace lines to completely black overall.

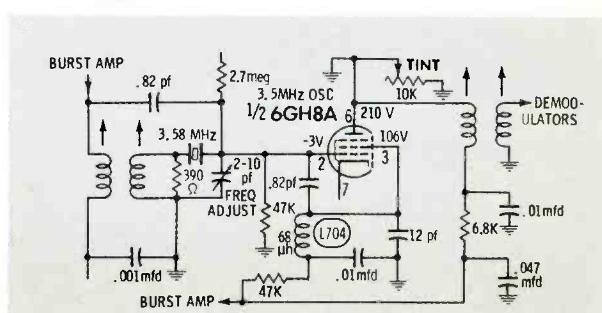
Tip: Trouble possibly caused by open filter capacitor C5, sections A and B. Section B of C5 is employed in the 145-volt B+ line that serves the screen grid of the 1st video amplifier—which accounts for blacking out of screen. Section A of C5 is connected to the primary winding of the vertical output transformer—thus the retrace lines. Bridge C5 with a known good capacitor of equal or near equal value—symptom should disappear.



Chassis: RCA CTC19, 20, 24

Symptoms: Green or purple horizontal bars appear on screen during b-w reception; however, picture appears normal during color reception.

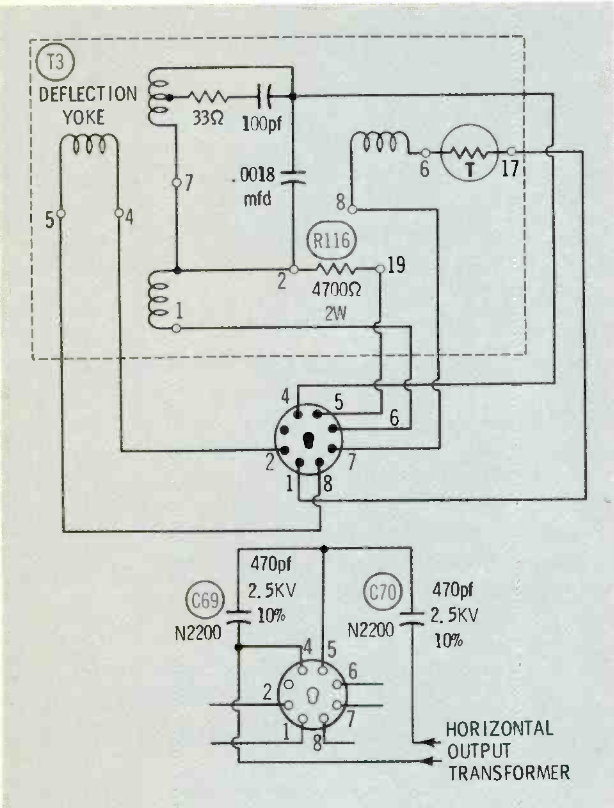
Tips: Possible cause could be shorted L704 in screen grid circuit of 3.58-MHz oscillator. Defect is hard to locate with resistance or screen voltage checks. With L704 shorted, noise is permitted to pass through oscillator to demodulators, causing interference on screen during b-w reception. When color is received, oscillator acts as amplifier for the incoming burst signal and the output is sufficient to demodulate color information.



Chassis: RCA CTC24

Symptom: Loss of high voltage; burnt resistor in yoke.

Tip: If R116 is burnt, check C69 and C70 for open or shorted condition. Either defect will unbalance the yoke and cause excessive current to pass through R116.



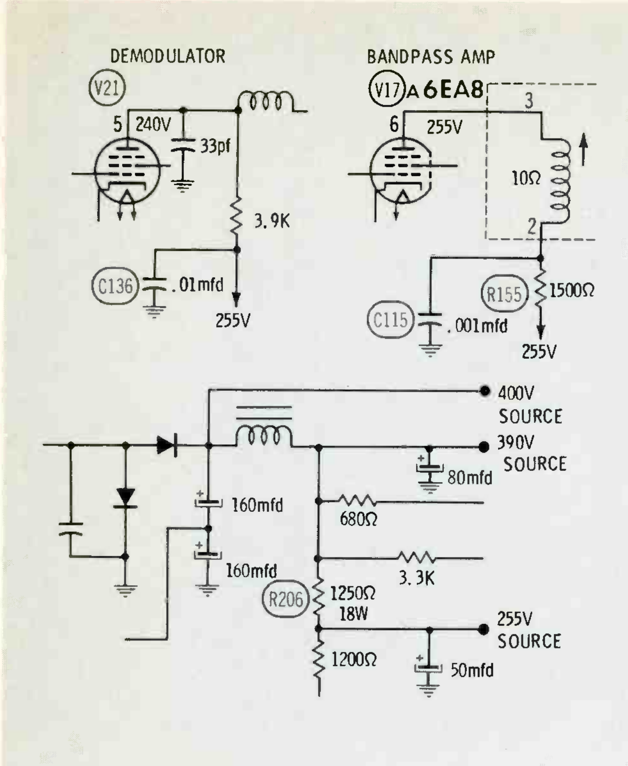
Chassis: RCA CTC12

Symptoms: No sound, no raster.

Tip: Preliminary check of B+ will uncover open R206 in 255-volt line. Failure of R206 in several chassis has been traced to the following causes:

1. Shorted C136 (decoupling capacitor) in plate circuit of Z chroma demodulator.
2. Shorted C115 (decoupling capacitor) in plate circuit of bandpass amplifier—also burns out R155.

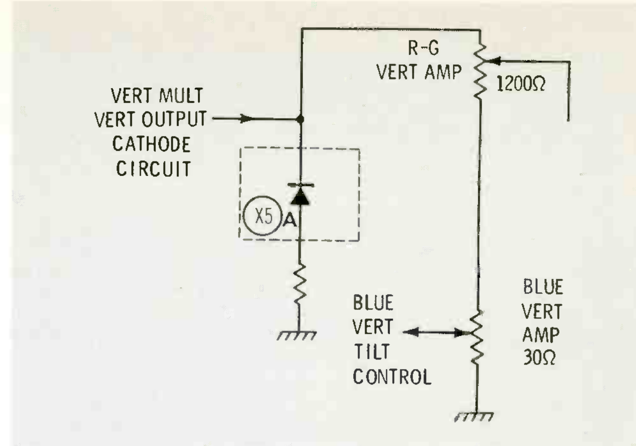
"This one is a cream-puff . . . it was owned by a little old lady on Social Security, who used it once a week to watch 'Batman'!"



Chassis: Motorola WTS-907

Symptons: Bottom of raster shrunk.

Tip: Possible cause of trouble is defective X5 (silicon rectifier) in vertical convergence circuit.



Who Said Trouble Doesn't Pay?

Share your troubleshooting experiences and techniques with the other readers of PF REPORTER—and get paid for doing it. If you've recently run across an out-of-the-ordinary trouble, briefly describe the symptom(s), cause, and cure. Or, if you have an unusual troubleshooting technique that has proved successful, pass it along. Both typed and hand-written material are acceptable. Submit it to:

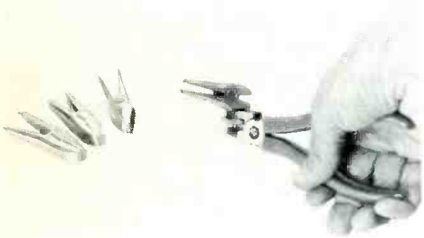
PF REPORTER
4300 W. 62nd Street
Indianapolis, Indiana 46206

PRODUCT REPORT

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

Lamp and Magnifier
(60)

The tool shown here is particularly useful for assembling micro components or any other type of work involving the manipulation of small parts or extreme accuracy. Announced by **Swing-O-Lite, Inc.**, the Fluorescent Magnifier-Lamp combines a 5" diameter magnifying glass lens with a 13" focus. The arm has a 45" reach and is counter balanced. A choice of P, C, or W mounts is available, together with a color selection of brown, tan, and grey. Price is $33.60.



Swivel-Head Plier Set
(61)

A new plier with interchangeable heads that rotate 360° has been announced by **Jensen Tools and Alloys.** Using this tool, the technician can reach into previously inaccessible areas —around corners, into blind spots that cannot even be seen. Eight locking positions are provided at 45° intervals (relative to the plane of the handles). The new Swivel-Head plier thus functions as a standard straight plier and as an angled plier with a choice of eight separate angles to match the work.

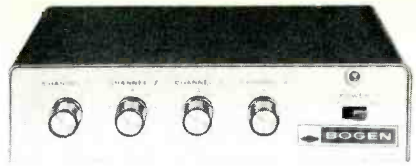
Furnished in the set are four interchangeable heads of drop-forged tool steel. Included are a long-nose head with serrations on the gripping surfaces, a shorter duck-bill head with serrations, a duck-bill head without serrations, and a retainer-ring head with pins (.06" diameter) at the extreme ends. The pins also have serrations. Overall length of the plier without head is 6". The complete set (plier handle and four heads) is furnished in a compact vinyl case and is priced below $15.

Transistor Tester
(62)

This factory-wired and calibrated unit is completely portable and requires no external source. It will test low- and high-power transistors and has sockets for both NPN and PNP transistors to allow convenient transistor matching for complementary symmetry applications.

The **RCA** instrument tests transistors in circuit and out of circuit for DC beta from 1 to 1,000, and out-of-circuit transistors for collector-to-base leakage as low as 2 micromperes, and collector-to-emitter leakage from 20 microamperes to 1 ampere. Low-impedance circuitry assures more reliable in-circuit testing.

Collector currents are adjustable from 20 microamperes to 1 ampere in four ranges, permitting most transistors to be tested at their rated current level. A complete "DC forward current transfer ratio curve" can be plotted from the instrument readings. Three color-coded test leads are provided for in-circuit testing and for out-of-circuit testing of those transistors that will not fit into the panel sockets. Price of Model WT-501A is $66.75.



Mixer-Preamplifier

(63)

A mixer-preamplifier that extends the capability of public address systems or tape recorders has been announced by **Bogen Communications.** Named the Bogen MX6A-T, it is an AC-powered, all-silicon, solid-state unit that can be used singly to add four more microphones or other signals to an existing system. Up to three MX6A-T units can be paralleled to provide 12 individual inputs. The three mixers can be mounted "piggy-back" if desired.

Measuring 9¼" × 6" × 2½" and weighing less than five lbs., installation of the new unit requires only plugging into existing equipment for instant operation. The design of the mixer-preamplifier employs all-silicon semiconductors and printed circuits.

The four inputs can handle either high- or low-impedance microphones or electric guitars, each under continuous control through individual volume controls. In addition, two of the four channels will accept tuner or crystal cartridge signals. The output of the MX6A-T is capable of driving any packaged amplifier through its auxiliary input, and it will also drive power amplifiers with 5-volt or better sensitivity. The unit uses standard phone jacks for high-impedance microphones and guitars; screw terminals for low-impedance microphones; RCA-type phono jacks from the output to the auxiliary input of public address amplifiers or tape recorders. Price is $74.85.

Digital Ohmmeter

(64)

Direct digital display of resistance measurements is provided by a new Digital Ohmmeter, Model DMS-3200/DP-170, announced by the **Hickok Electrical Instrument Company.**

The new instrument provides direct digital readout of resistance measurements from .001 ohm to 1000 megohms in ten ranges with an accuracy capability of ±0.1% full-scale ±0.1% of reading. Of special interest is the low power applied to the resistor under measurement—maximum 1 mw. Four-terminal input with "guard" terminal permits accurate measurement of both extremely low and high resistances.

All-electronic *Nixie*-type display tubes are used for readout, and decimal point indication is automatically displayed. 100% overrange capability is provided, and display time is variable, with provision for holding a reading indefinitely.

The unit features all-solid-state design, utilizes glass-epoxy printed circuit boards, measures 9" × 7" × 13" and weighs 13 lbs. Price is $560.

High Voltage Test Probe

(65)

The first CRT high-voltage test probe to be offered with a built-in voltmeter has just been introduced by **Pomona Electronics.** The Model 2900 is small enough and light enough to be carried in a tube caddy, and may be used on any color or black-and-white television set.

With the Pomona test probe, high voltage adjustments can be made in

the home without the need for extra equipment. All a technician has to do is ground the instrument, contact the high-voltage anode with the probe tip, and read voltage (up to 30 KV) from the self-contained meter. The probe contains no batteries, and needs no warm-up time. Net Price: $19.95.

Pattern Generator
(66)

Leader Electronics announces development of a new ultra compact completely solid-state Color Bar Pattern Generator designated the LCG-387. The instrument is designed for convergence and synchronizing adjustments in color and monochrome TV receivers. It is used extensively in production testing and field servicing, and the only connections are made to the TV receiver antenna input.

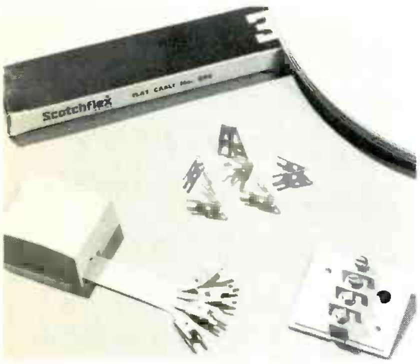
Crystal controlled oscillators of 189 KHz and 3.563795 MHz are incorporated in the device for the sync and color burst signals respectively. Flipflop and logic circuitry are incorporated to generate stable and reliable sync and signal pulses. Only transistors of the silicon epitaxial planar type are employed to insure high performance and reliability. Price is $140.00.

Field Effect Meter
(67)

A new completely portable solid-state field-effect volt-ohm-milliameter, said to provide all the advantages of a VTVM with none of the disadvantages, has been announced by **SENCORE.**

Designated the FE14, the compact instrument represents a new approach to circuit testing. With 15-megohm input resistance on DC, and 10-megohm input impedance on AC, the FE14 accurately measures voltages with a minimum of circuit loading. Unlike a VOM, which changes loading with each range, the FE14 is constant on all ranges.

A mirrored scale to prevent parallax error is included as a standard feature. Both meter and internal circuitry are said to be fully protected against AC overload. The FE14 is priced at $59.95 complete with test leads, less batteries. Optional high-voltage probe 39A19, is $9.95.



Low Voltage Connector
(68)

A new low-voltage electrical connector designed for use in control systems, sound installations, and other electrical applications of 30 volts or less has been announced by the **3M Company.**

It is called "Scotchlok" brand self-stripping connector No. 560. Preinsulated tap splices, inline splices, and pigtail splices can be made with one connector without stripping, twisting or soldering, according to 3M.

The new connector features a self-stripping "U-type" element encased in white polypropylene. Connections are made by driving the "U-type" element down over the conductors with pliers. The spring compression reserve in the "U-type" element supplies holding power and electrical contact with strong, permanent pressure. A hinged cover attached to the connector's case then is snapped into place for additional protection.

Designed for use on No. 14-18 gauge solid or stranded copper wire, the connector is available in 4-unit blister packs priced at 49¢.

Combiner/Splitters
(69)

A series of accessories called combiner/splitters that provide single-downlead installation in systems using separate antennas has been announced by **Blonder-Tongue Laboratories, Inc.** The units are designated Models UVF-1 and UVF-c/s for UHF/VHF/FM installation and Model UV-c/s for UHF/VHF.

Model UV-c/s provides separate outputs for an all-channel TV set or converter. This unit mounts indoors either on the back of the set or on the baseboard. Models UVF-1 and UVF-c/s are designed for systems delivering reception on TV channels 2 to 83 and on FM. These weather-proof combiner/splitters can be used indoors or outdoors. Both units can take a single 300-ohm down-lead carrying signals for channels 2 to 83 plus FM and split it into three outputs: one for the FM set and two for the TV set (one for channels 2 to 13; one for channels 14 to 83). The UVF-1 is the deluxe model recommended for all reception areas. It offers high isolation between UHF, VHF, and FM sections. The UVF-c/s is recommended for general applications. Prices for the three units are: Model UVF-1, $14.95; UVF-c/s, $6.25; and UV-c/s, $3.75. ▲

BOOK REVIEW

Know Your Sweep Generators: Robert G. Middleton; Howard W. Sams and Co., Indianapolis, Indiana, 1967; 176 pages, 8½" x 5½", soft cover; $3.25.

An understanding of the design and application of sweep generators is essential for those technicians who service TV and FM receivers. Equally as important is the related subject of sweep alignment.

This text covers both subjects in a manner that electronic students, as well as service technicians, will find comprehensive and thorough. Review questions at the end of each chapter help the reader evaluate his understanding and retention of the subject matter. In addition, an appendix located at the back of the book outlines various experiments that involve the use of the sweep generator, thus providing practical application of the knowledge obtained. Included in the outline of each experiment is a list of the materials and equipment needed, a step-by-step description of the procedure, and a reference to the specific portion of the text that relates to that particular experiment.

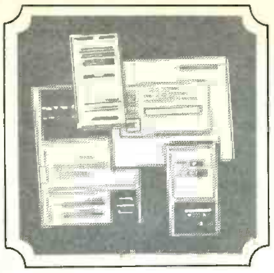
The text begins with a discussion of the basic principles of sweep alignment, including resonant circuits, frequency response, bandwidth, characteristics of an FM test signal, and response-curve displays. Methods of FM test-signal generation are dealt with in Chapter 2.

Chapters 3 through 6 cover specific types of sweep generator design including beat-frequency, wideband audio-frequency, wide-band RF, and UHF types. Chapter 7 is devoted to a section-by-section analysis of the trouble symptoms and troubleshooting and servicing procedures associated with sweep generators.

"Constructing Sweep-Generator Kits" is the title of the final chapter. A detailed description of the various aspects of kit building is presented, along with testing and adjusting techniques. ▲

INDEX TO ADVERTISERS

January, 1968



$FREE$ CATALOG AND LITERATURE SERVICES

*CHECK "INDEX TO ADVERTISERS" FOR FURTHER INFORMATION FROM THESE COMPANIES

ANTENNAS

100. *ALLIANCE* — Colorful 4-page brochure describing in detail all the features of Tenna-Rotors.
101. *BLONDER-TONGUE* — Flyer sheet on new "Colortap" outlet plates and plugs for 300Ω leadin.
102. *DELHI*—Twelve-page catalog introducing a complete new line of home TV towers, ham towers, citizen's band towers, masts, and telescoping masts.
103. *FINNEY*—4-color brochure with description and technical details on new Finco color spectrum frequency dependent antennas for UHF-VHF-FM, VHF-FM, and UHF. Form 20-413.*
104. *JERROLD*—New 4-page full-color catalog describes the new Paralog Plus antennas.*
105. *JFD*—Color Laser and LPV antenna brochures. New 1968 dealer catalog covering complete line of log-periodic outdoor antennas. rotators, and accessories.*
106. *MOSLEY* — Catalogs on CB, Amateur radio, and TV/FM antennas.
107. *WINEGARD*—Fact-finders on "Color-Line 82" coaxial cable pack, "Transcoupler" cut-to-channel Yagi antennas, and "Red-Head 82" solid-state antenna preamplifier.*

AUDIO

108. *ATLAS SOUND*—Specification sheets on new models AP-15, AP-15T, and APT-34T paging speakers.
109. *BELL P/A*—Complete specifications, operating instructions, and schematics on the new "Carillon" series amplifiers.
110. *ELECTRO-VOICE* — Pocket-size guidebooks for EV microphones, Hi-Fi loudspeakers, and systems.
111. *GIBBS*—Literature for use of reverberation units with audio amplifiers.
112. *OXFORD TRANSDUCER*—Bulletin A-109 features speaker installation in automobiles, hospitals, and recreation rooms.
113. *RACON*—Catalog C66ST on horns, drivers, sound columns, and accessories.
115. *UNIVERSITY SOUND* — New 28-page 1968 commercial sound product catalog.

COMMUNICATIONS

116. *AMPHENOL*—2-color spec sheets on new Model 650 CB transceivers and Model C-75 hand-held transceiver.*
117. *CUSH CRAFT*—Full line catalog of base station antennas for CB and Business Band radios.
118. *MARK PRODUCTS*—Flyer sheets CB659 and AM661 on antennas and accessories for CB and Ham radios.
119. MOSLEY—Catalogs on antennas for TV/FM, CB, and Ham use.
120. *SQUIRES SANDERS*—Bulletin on the "Commodore" CB rig.

COMPONENTS

121. *BELDEN*—Catalog 867, a 56-page catalog of the complete Belden line.*
122. *BUSSMANN*—12-page booklet listing the complete line of BUSS and FUSETRON small dimension fuses by size and type, also indicates proper fuseholder—also shows list prices. Ask for BUSS Bulletin SFUS.*
123. *CENTRALAB*—24-page replacement parts catalog No. 33GL.
124. *CORNELL-DUBILIER* — New 4-page Color-lytic list.
125. GRAYHILL—52-page catalog of switches.
126. *MALLORY*—Bulletin 4-82 describes radial and axial lead tantalum capacitors.
127. *MILLER*—Catalog 167, a 156-page general catalog with complete cross-reference guide to the J.W. Miller Line.*
128. *LITTELFUSE*—Pocket-sized TV circuit breaker cross reference gives the following information at a glance. Manufacturer's 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.*
129. QUAM-NICHOLS—New catalog No. 67 has complete detailed information on the entire Quam line.
130. *SPRAGUE*—C617, a complete catalog of the Sprague Line.*
131. *TEXAS CRYSTALS*—12-page catalog of crystals including engineering data, specifications and prices.
132. *WORKMAN*—46-page catalog #100 on resistors, fuses, circuit breakers, brighteners, adaptors, and test accessories. Cross-reference charts included.*

SERVICE AIDS

133. *CASTLE TUNER*—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.*
134. *GC*—FR-67, the full-line catalog.*
135. *MM BUSINESS FORMS* — Brochures about and samples of two new professional service contract forms designed to earn extra money.
136. *PERMA-POWER*—New 4-page catalog of TV accessories.

SPECIAL EQUIPMENT

137. *ATR*—Literature about DC-AC inverters up to 600 watts load.
138. *WINDSOR ELECTRONICS*—Booklet entitled "The Open Door to TV Profits".

TECHNICAL PUBLICATIONS

139. *CLEVELAND INSTITUTE OF ELECTRONICS* — Free illustrated brochure decribing electronics slide rule and four lesson instruction course and grading service.*
140. *RCA INSTITUTES*—New 1968 career book describes home study programs and course in television (monochrome and color), communications, transistors, industrial, and automation electronics.*
141. *SAMS, HOWARD W.* — Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics, including special new 1967 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

142. *B & K*—New 1968 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.*
143. *EICO*—New spec sheet describes model 100A4 multimeter with DC sensitivity of 100K ohms per volt.*
144. *HICKOK*—Quick reference catalog No. 67D gives brief descriptions and prices for complete test equipment line.
145. *LECTROTECH*—Two-color catalog sheet on new Model V6-B color bar generator, the latest improved model of the V-6. Gives all specs and is fully illustrated.*
146. MERCURY—All-new 16-page test instrument catalog.
147. *SECO*—Operating manual for the HC8 in-circuit current checker for horizontal output tubes.*
148. *SENCORE*—New 12-page catalog on all SENCORE products.*
149. *SIMPSON*—Reprint: "A Guide to the Selection of Multitesters." Explains how to evaluate multitesters before you buy.*
150. *SINGER*—Brochure about the DM-4 deviation monitor scope.
151. *TRIPLETT*—New panel meter catalog D-68 with complete line of measuring instruments.*

TOOLS

152. *ARROW*—Catalog sheet showing 3 staple gun tackers designed for fastening wires and cables up to ½" diameter.
153. *CHANNELLOCK*—Updated catalog #66 with price schedule.
154. *ENTERPRISE DEVELOPMENT*—Time-saving techniques in brochure from Endeco demonstrate improved desoldering and re-soldering methods for speeding and simplifying operations on PC boards.*
156. *SWING-O-LITE* — Catalog sheet on Models BBM-9 and BB45 low-priced bench lamps.*
157. *VACO*—Catalog SD-127 about rachet box wrenches.
158. *XCELITE*—Bulletin N867 describes hollow-shaft nutdrivers which speed lock-nut/screw adjustments.*

TUBE AND TRANSISTORS

159. *RCA*—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.*