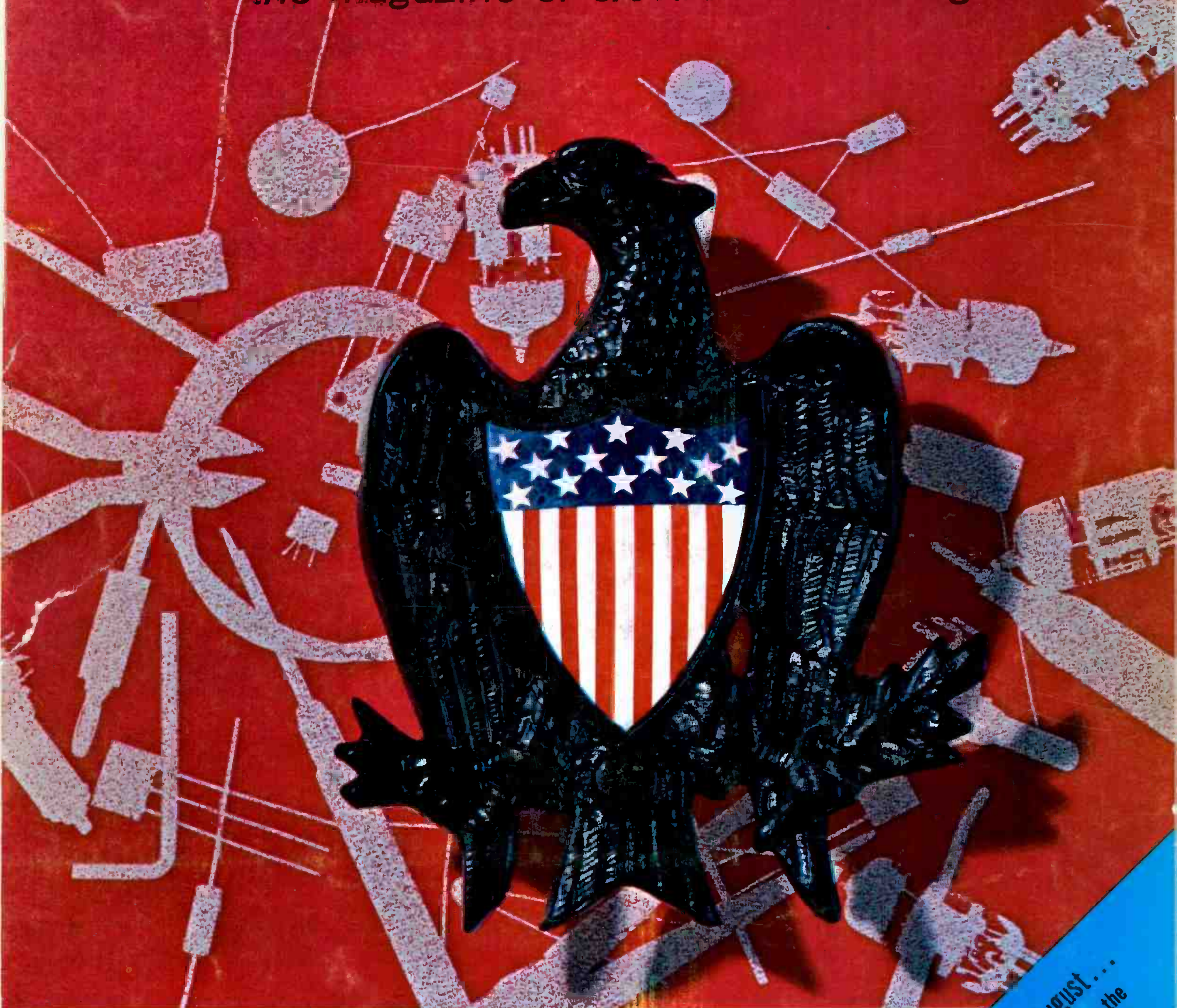
A HOWARD W. SAMS PUBLICATION

JULY 1967 75¢

PF Reporter®

PHOTOFACT

the magazine of electronic servicing



★ Thermistors and Varistors in TV

★ Sync from Video to Oscillators

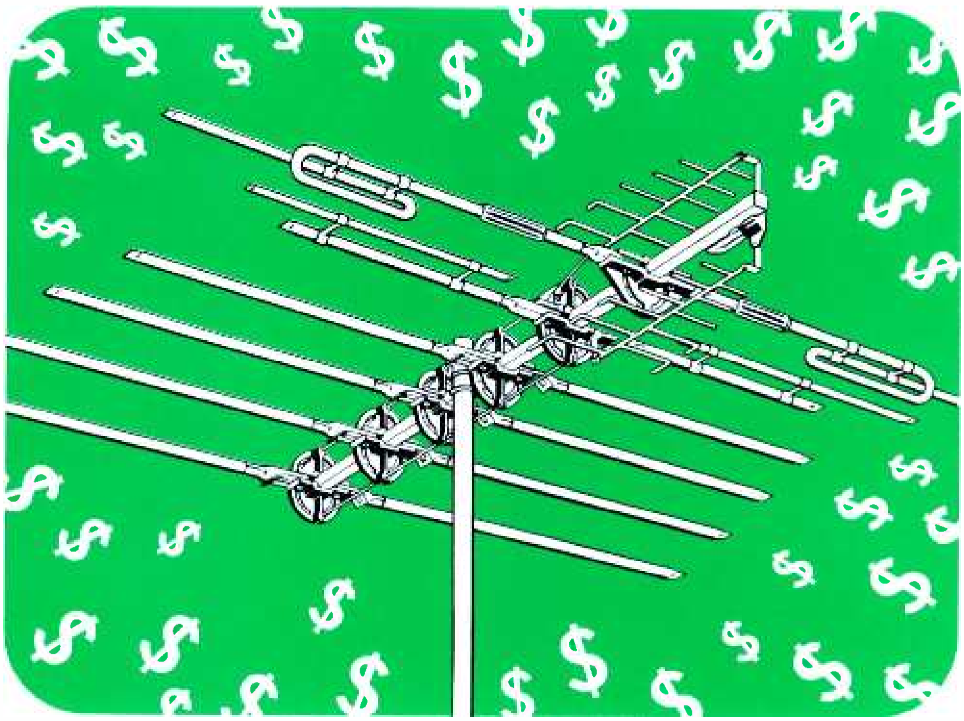
★ Sheet Beam Demodulators

★ Notes on Test Equipment

★ Many Hued Rasters

Beginning in August... a new series covering the THEORY & SERVICING of COLOR TV

Pull in more profits with Jerrold VUfinder® Antennas



Now—a line of antennas designed to deliver quality performance without eroding your profit margin. The Jerrold VUfinder 82-channel Antenna line. Perfect for bringing you the best in VHF, UHF color and black and white, plus FM reception:

- Excellent front-to-back ratio eliminates interference
- Unusual flatness assures greater color fidelity
- Sharp directivity eliminates ghosts, picks up strong, clear signals—even in difficult reception areas
- Tough, all-weather construction of vibration-proof, point-contact element locks, rugged Cycolac insulators and twist-resistant boom
- All parts snap into place—anywhere—on the ground or on the roof

In short, all the benefits of the Jerrold Colorpeak line—plus UHF—are available with Jerrold VUfinders.

Compact, rugged, easy to install, Jerrold VUfinders come in five models ranging between $17.95 and $79.95 List.

The VUfinder line is one of a complete spectrum of problem-solving Jerrold reception aids—Pathfinder, Paralog Plus, and Colorpeak antennas . . . Powermate pre-amplifiers, amplified-couplers, and splitters . . . coaxial cable, wall outlets, and wall plates. Get more details. See your Jerrold distributor, or write for our new catalog.

Swing with SPECTRUM '67

JERROLD

Focusing on one thing . . . better reception

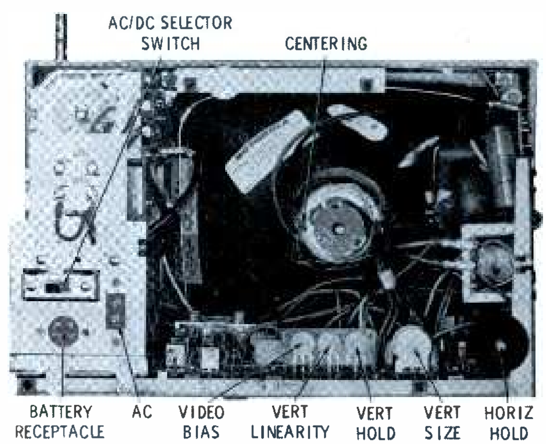
Circle 1 on literature card

PREVIEWS OF NEW SETS — Motorola

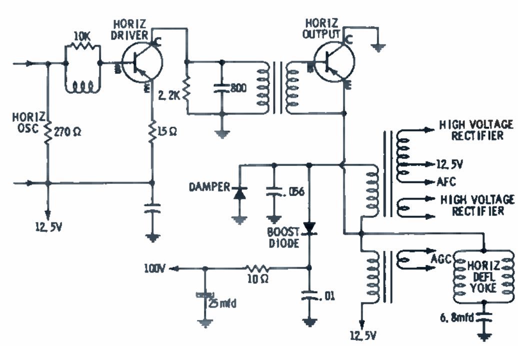
The solid-state complement of this 8" b-w portable consists of 22 silicon transistors, 2 germanium transistors, and 10 diodes. The germanium transistors are employed in the vertical and horizontal output stages. The only tube used in this chassis, other than the 9YP4 85° CRT, is a 1BG2 rectifier in the high-voltage circuit. Selection of either AC or DC operation is accomplished by a 2-position slide switch at the rear of the receiver. A transformer-powered, full-wave rectifier circuit is used for AC operation, with the output fed into a filter circuit. For DC operation, the rectifier and part of the filter is bypassed and the input fed directly into a pi-type filter.

Model XP201CU
Chassis 9TS-460A-09

Three common-emitter video IF circuits are employed in this chassis, along with a two-stage video amplifier section. In the audio section, two stages of sound IF are followed by a conventional ratio detector which, in turn, feeds an audio output circuit consisting of an amplifier stage, a driver (emitter follower), and an output stage. A keyed AGC system (gate and amplifier stages) directly controls the 1st and 2nd video IF's. AGC is supplied to the VHF tuner through a delay stage.



The multivibrator used in the vertical sweep circuit is similar to the one used in this manufacturer's tube-type chassis, except for the emitter follower (driver) inserted between the discharge and output stages. The horizontal oscillator, a Hartley type controlled by a conventional AFC circuit using back-to-back diodes, is directly coupled to a driver stage. The driver stage amplifies the oscillator signal to a level sufficient to drive the horizontal output stage. Transformer coupling between the driver and output stages provides current step-up and isolation. A separate silicon diode rectifies the horizontal pulse to supply a filtered 100 volts to the second anode of the CRT. It also provides protection for the horizontal output transistor in the event of a high-voltage arc.



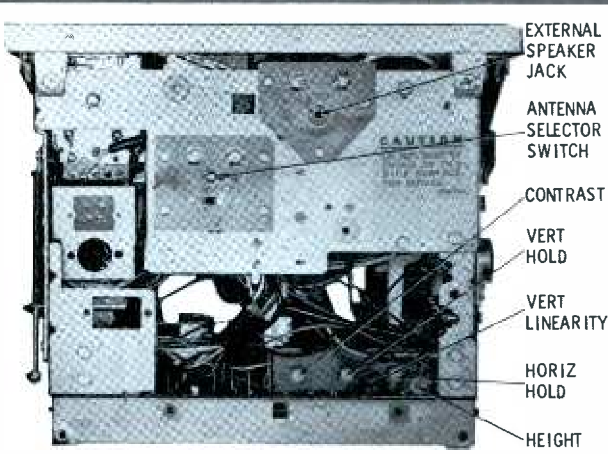
RCA PREVIEWS OF NEW SETS

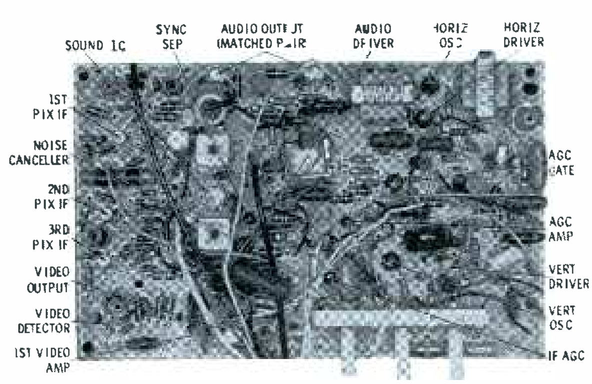
Model AJ-OOE
Chassis KCS157A

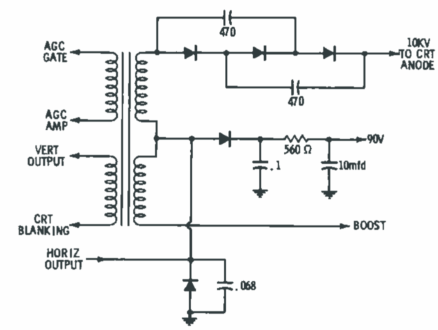
The 9" b-w portable shown here is completely solid-state. The CRT, a 9WP4, is the only tube employed in this "U"-shaped chassis. Most of the circuitry is contained on a single circuit board mounted on the horizontal portion of the chassis. The vertical output, horizontal output, damper, and regulator transistors are located on the vertical portions of the chassis.

In addition to the normal complement of transistors and semiconductor diodes, this chassis also employs an integrated circuit chip (IC) in the sound section. The same IC application is used in other chassis employed in this manufacturer's b-w and color line. Included in the chip are three sound IF and limiter stages, the sound detector, two audio preamplifier stages, and a power regulation stage. An equivalent circuit schematic and block diagram of the IC is included in the October '66 issue of PF REPORTER.

The receiver can be operated from 120 volts AC (full-wave rectifier) or 12 volts DC (direct-to-regulator circuit). Separate power cords are used for AC and DC operation so that the low voltage power transformer is automatically bypassed for DC operation. The customer controls are mounted on a "pop-up" control/speaker panel that is released by depressing a button at the right of the carrying handle. When the panel is closed, a microswitch automatically removes power from the receiver. A tripler high voltage circuit (shown here) provides approximately 10kv to the CRT anode. Focus voltage is provided by a single silicon diode.



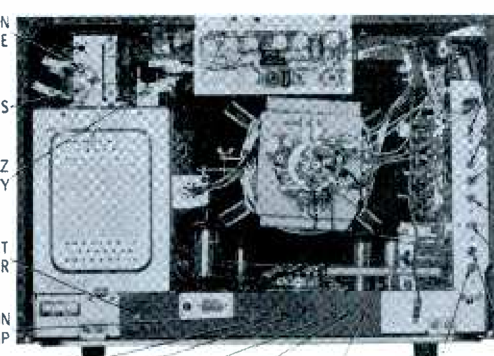


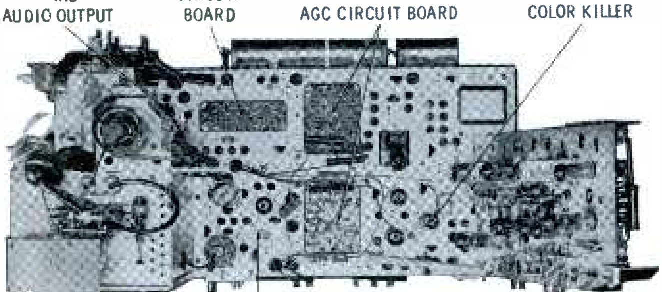


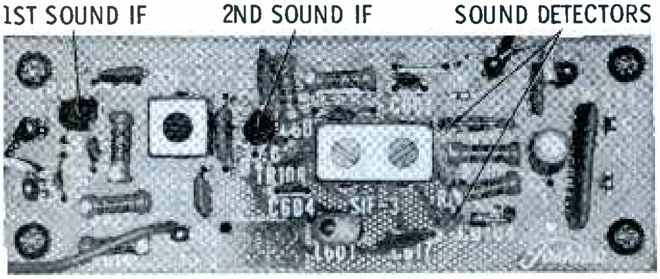
PREVIEWS OF NEW SETS — Sears

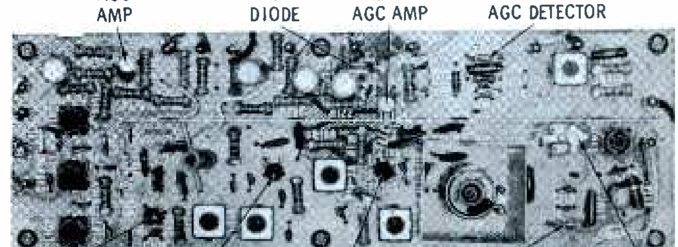
Shown here is Sears' 14" color receiver, manufactured in Japan by Toshiba. Although most of the circuitry is hand-wired on two chassis (one horizontal, one vertical), the video IF, sound IF, and AGC circuits are contained on two printed circuit boards mounted beneath the main horizontal chassis. Even more interesting, these circuits are completely solid-state. The three stages of video IF use NPN transistors, while the AGC amplifier and keyer stages use PNP types. The sound circuit consists of two transistorized (NPN) stages of sound IF, a ratio detector, and two tube-type audio output stages. A separate full-wave rectifier in the low voltage power supply provides the +12 volts needed for the transistor circuits. Other interesting features of this chassis include a blocking oscillator in the vertical deflection circuits and a manually operated degaussing circuit.

Model 7160
Chassis 562.10220

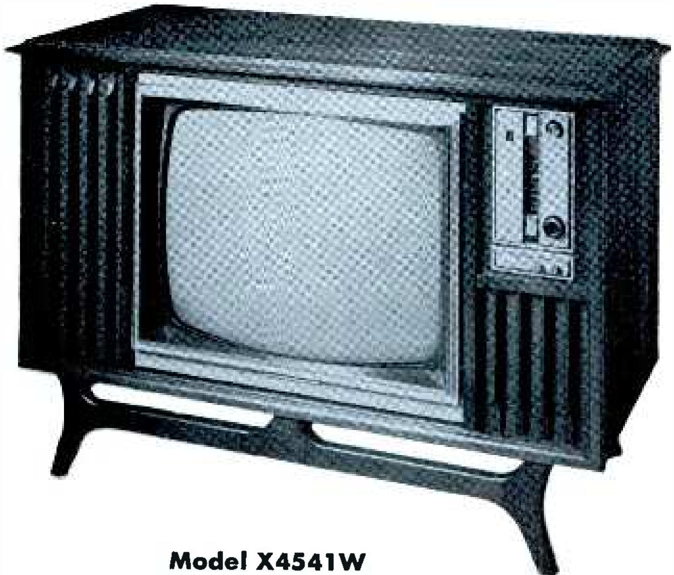








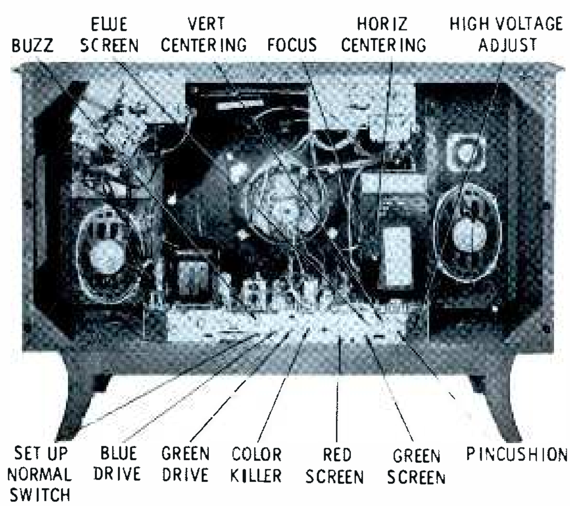
PREVIEWS OF NEW SETS — Zenith

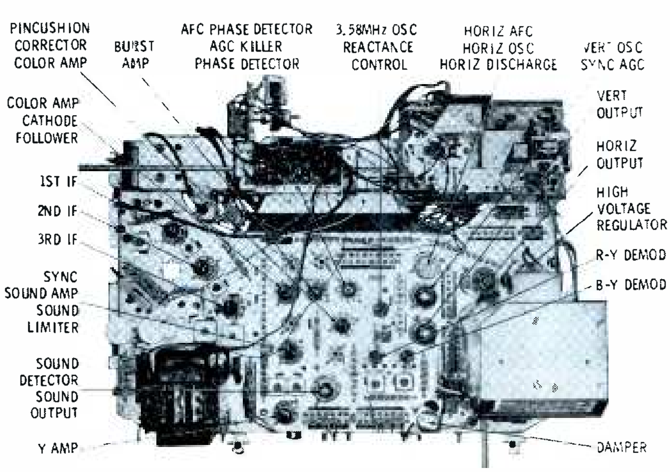


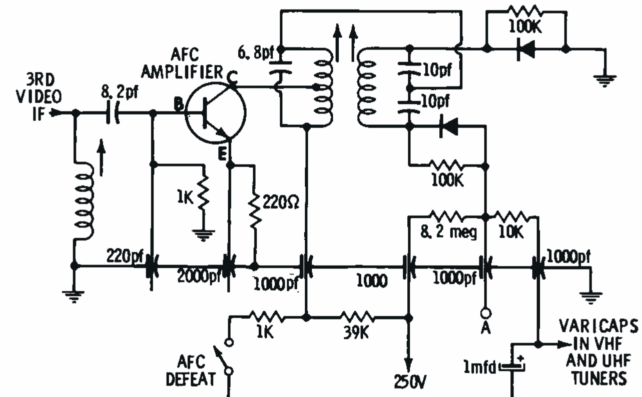
Model X4541W
Chassis 20X1C36

Most of the new circuitry employed in this 23" color chassis was described in detail in an article titled "Know Your 1967 Color Circuits" in the November '66 issue of PF REPORTER. These circuits include this manufacturer's new pulse-controlled, high-voltage regulator system (using a 6HS5 tetrode) and transistorized video driver circuit (inserted between the cathode follower and "Y" amplifier). Other changes that were discussed involve the chroma demodulator circuits and the addition of a selenium rectifier to increase the voltage applied to the screens of the CRT.

One new feature of this receiver not described previously is the automatic fine tuning control (AFC) shown here. A portion of the video IF signal is coupled from the plate of the 3rd video IF to the input of a transistor discriminator circuit. Any variation from the normal video IF carrier (dependent on setting of fine tuning control) is converted into a correction voltage by the discriminator and applied to varicap diodes across the oscillator circuits in the tuners. Normal, or "on frequency," voltage applied to the varicap diodes is approximately 3 volts (measured at point A). During VHF operation, the error voltage developed by the discriminator ranges between +5 volts and -2.5 volts and is added to (or subtracted from) the normal 3 volts, so that the voltage applied to the varicap ranges from 8 to .5 volts. During UHF operation, the voltage applied to the varicap will range from 4 to 2 volts.







SEE PHOTOFACT Set 695, Folder 4

Mfr: Motorola

Chassis No: TS-912A, B, YA, YB

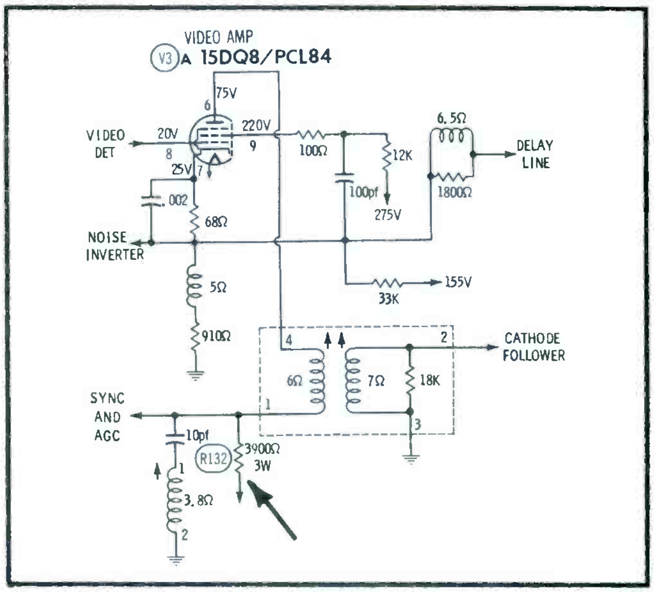
Card No: MO TS-912-1

Section Affected: Pix.

Symptoms: No color. No B+ on pin 6 of video amplifier.

Cause: Open resistor in plate circuit of video amplifier.

What To Do: Replace R132 (3.9K, 3W).



Mfr: Motorola

Chassis No: TS-912A, B, YA, YB

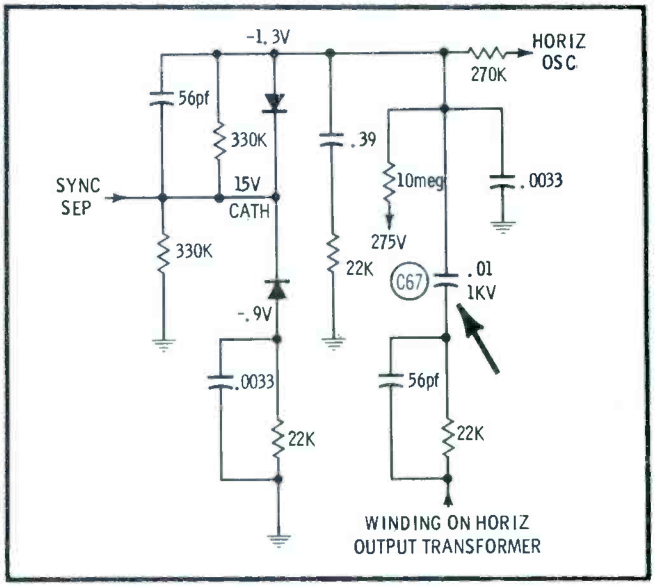
Card No: MO TS-912-2

Section Affected: Sync and raster.

Symptoms: Poor horizontal sync or intermittent raster.

Cause: Leaky or shorted capacitor which couples pulse from horizontal transformer to horizontal AFC circuit.

What To Do: Replace C67 (.01 mfd, 1KV).



Mfr: Motorola

Chassis No: TS-912A, B, YA, YB

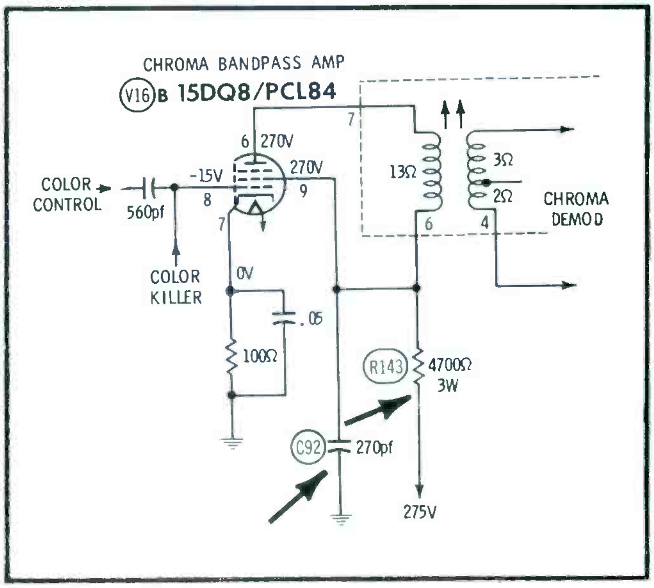
Card No: MO TS-912-3

Section Affected: Color pix.

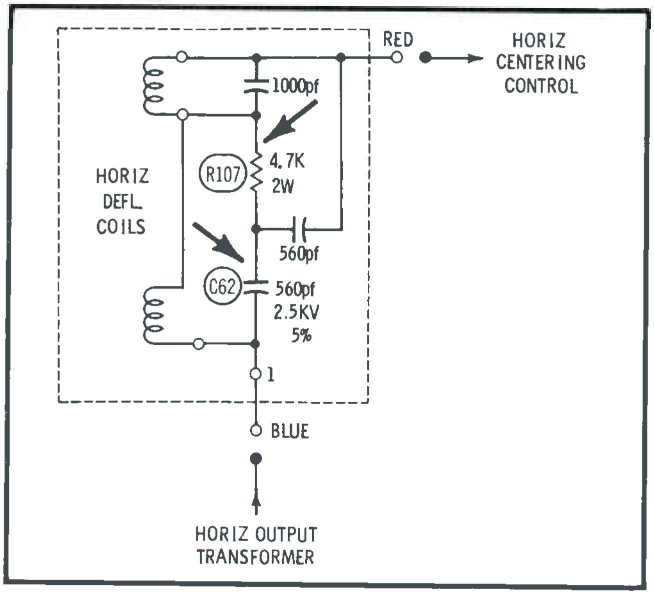
Symptoms: Weak or no color. Voltage low on screen grid of chroma bandpass amplifier. R143 may overheat.

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

What To Do: Replace C92 (270 pf) and R143 (4700 ohms, 3W).



SEE PHOTOFACT Set 695, Folder 4



SEE PHOTOFACT Set 695, Folder 4

Mfr: Motorola

Chassis No: TS-912A, B, YA, YB

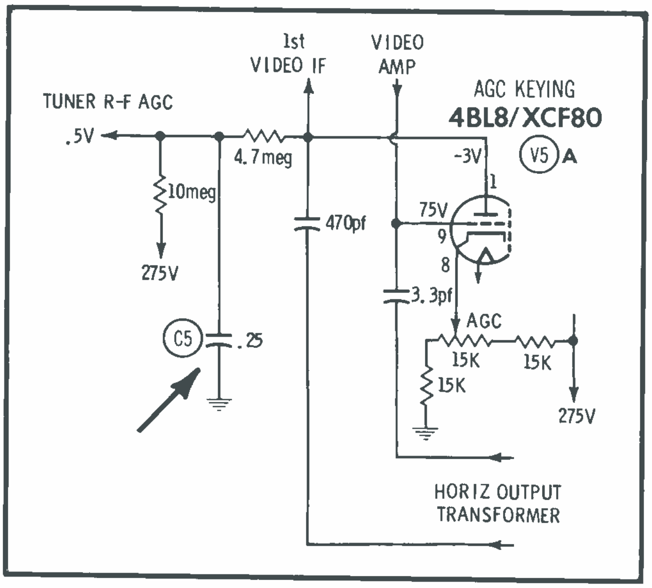
Card No: MO TS-912-4

Section Affected: Raster.

Symptoms: Ringing on left side of raster. R107 overheating.

Cause: Open capacitor in horizontal deflection coil circuit.

What To Do: Replace C62 (560 pf, 2.5KV, 5%) and R107 (4.7K, 2W).



Mfr: Motorola

Chassis No: TS-912A, B, YA, YB

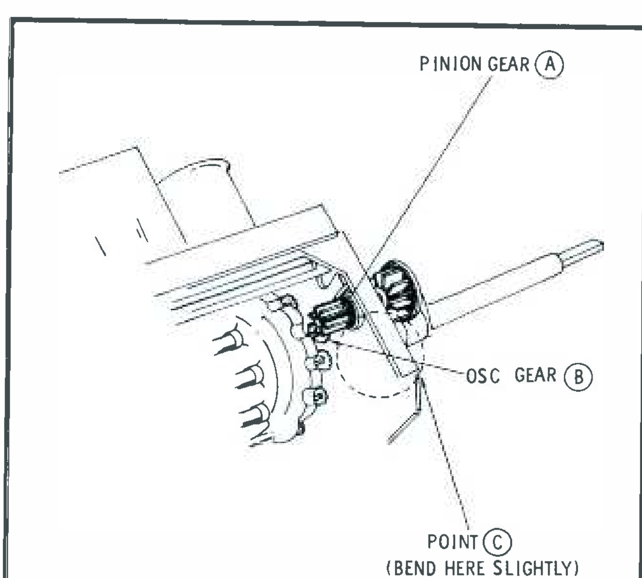
Card No: MO TS-912-5

Section Affected: Pix.

Symptoms: Overloaded pix on strong signal.

Cause: Leaky AGC coupling capacitor.

What To Do: Replace C5 (.25 mfd).



Mfr: Motorola

Chassis No: TS-912A, B, YA, YB

Card No: MO TS-912-6

Section Affected: Pix.

Symptoms: Fine tuning control does not function correctly.

Cause: Pinion gear (A) does not engage the individual oscillator gears.

What To Do: To correct this condition, the front housing of the tuner can be bent slightly with pliers at point C in the direction necessary to engage the oscillator gear.

SEE PHOTOFACT Set 802, Folder 3

Mfr: Truetone

Chassis No: 2DC1663A, 65A, 67A

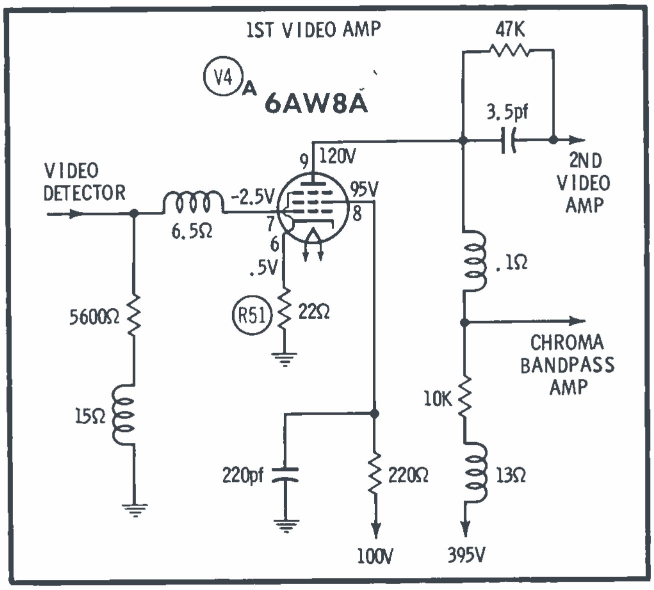
Card No: TR 2DC16-1

Section Affected: Pix.

Symptoms: No pix. Voltage high at cathode (pin 6) of 1st video amplifier.

Cause: 1st video amplifier cathode resistor open.

What To Do: Replace R51 (22 ohms) and V4 (6AW8A).



Mfr: Truetone

Chassis No: 2DC1663A, 65A, 67A

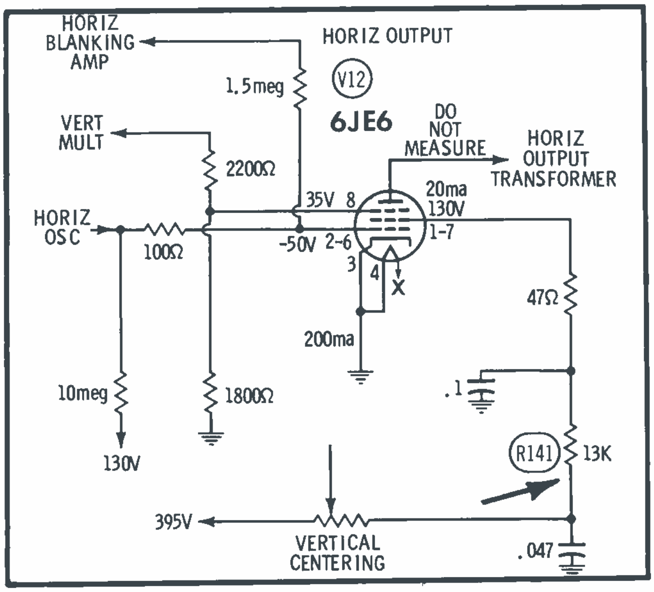
Card No: TR 2DC16-2

Section Affected: Raster.

Symptoms: Insufficient width after receiver operates for extended period.

Cause: Screen grid resistor in horizontal output circuit changes value, reducing voltage at screen grid (pins 1 and 7).

What To Do: Replace R141 (13K) and V12 (6JE6).



Mfr: Truetone

Chassis No: 2DC1663A, 65A, 67A

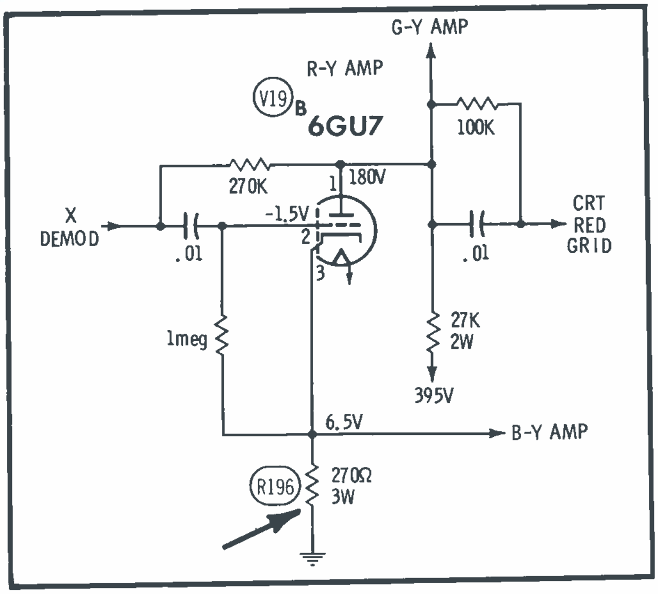
Card No: TR 2DC16-3

Section Affected: Color and b-w pix.

Symptoms: Pix contains too much red. Voltage high at cathode (pin 3) of R-Y amplifier.

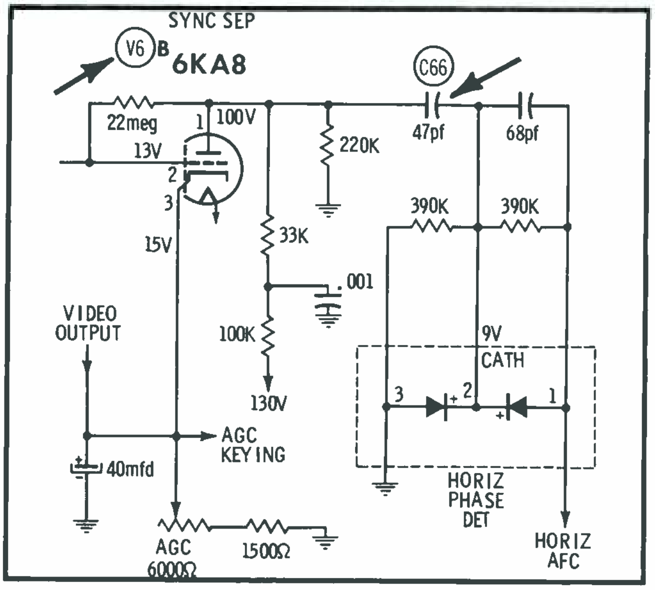
Cause: Cathode resistor common to R-Y and B-Y amplifiers open.

What To Do: Replace R196 (270 ohms).



VIDEO SPEED SERVICING

SEE PHOTOFACT Set 802, Folder 3



SEE PHOTOFACT Set 802, Folder 3

Mfr: Truetone

Chassis No: 2DC1663A, 65A, 67A

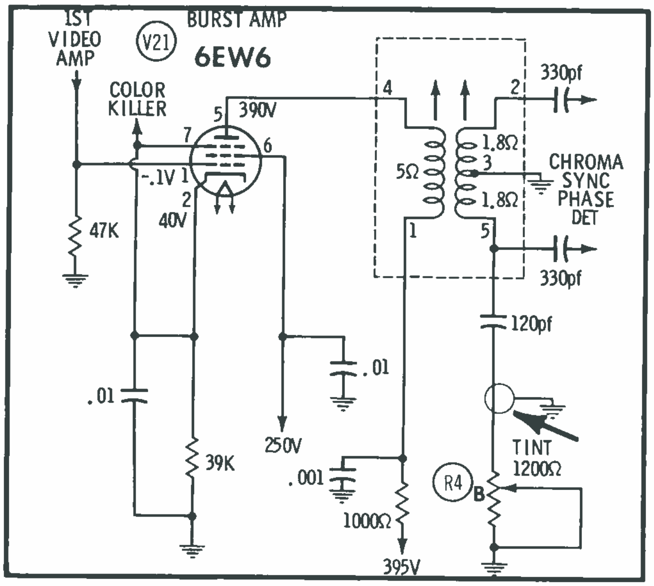
Card No: TR 2DC16-4

Section Affected: Sync.

Symptoms: Horizontal sync tears and drifts off frequency. Voltage high at pin 2 of horizontal phase detector.

Cause: Leaky coupling capacitor between sync separator and horizontal phase detector.

What To Do: Replace C66 (47 pf).



Mfr: Truetone

Chassis No: 2DC1663A, 65A, 67A

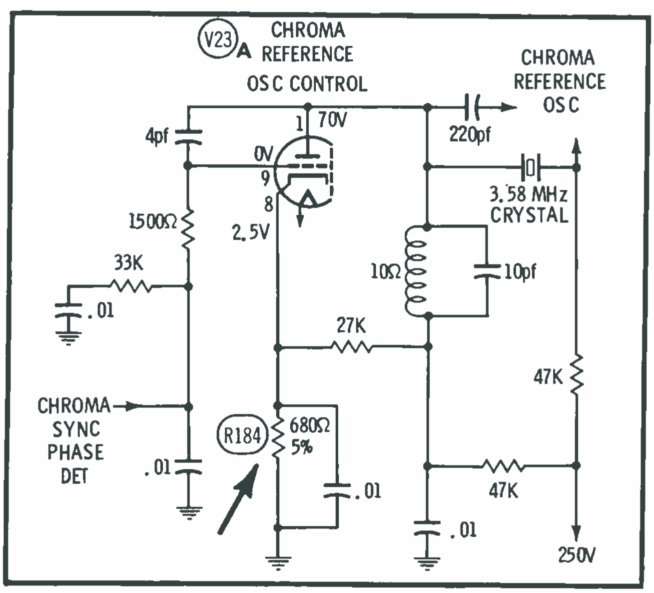
Card No: TR 2DC16-5

Section Affected: Color pix.

Symptoms: No control over tint; b-w pix normal.

Cause: Defective tint control cable.

What To Do: Replace tint control cable.



Mfr: Truetone

Chassis No: 2DC1663A, 65A, 67A

Card No: TR 2DC16-6

Section Affected: Color Sync.

Symptoms: Unstable color sync; b-w pix normal. Voltage varies at cathode (pin 8) of chroma reference oscillator control stage.

Cause: Cathode resistor of chroma reference oscillator control stage overheats and changes value.

What To Do: Replace R184 (680 ohms) and V23 (6GH8).

Zenith is honored to be the only TV manufacturer to win NATESA's "Friends of Service" award

five times!

Zenith supports the aims and objectives of the National Alliance of Television and Electronics Service Association. So we are especially proud to receive the NATESA "Friends of Service" award for the *fifth straight year.*

Zenith is the only TV set manufacturer to be so honored five times by NATESA.

NATESA members for many years have played a vital role in providing expert electronics service and in training new men for dedicated service to the public.

We at Zenith pledge our continued support and cooperation in NATESA's great program.

ZENITH® *The quality goes in before the name goes on*

Circle 2 on literature card

LETTERS TO the EDITOR

Dear Editor:

Your most recent publication showing an antique WE205B tube, in contrast to a modern nuvistor, brought on a flood of memories.

It was 1920 or thereabouts, and radio was sweeping the country. We, who had patiently wound our variocouplers on tubes made from Quaker Oats boxes had been relegated to the basement or the attic, together with our cat's whiskers and earphones. Now, due to that marvelous invention, the vacuum tube, and its companion, the loud speaker, we were invited back into the inhabited part of the house, even into the parlor.

I can still remember that this particular tube was called a "Navy tube," and cost $7.50, which was a hefty day's wages at that time.

Too bad your writer who commented on the cover picture didn't live through that wonderful by-gone era. To quote him—"Imagine the size and weight of those 1916 tube caddies." Well, son, I've got news for you. No one heard of a tube caddy in 1916. You could put one of every tube type in common use in your overcoat pocket. There were only 4 or 5 types—all triodes. The rectifier wasn't in general use—you didn't need one with a 6-volt automobile storage battery lighting the filaments and a 45-volt "B" battery (with a 22.5-volt tap). RF amplification hadn't been developed, so you needed only a detector tube and one or two amplifier tubes. Two types would do for the average home-made receiver. One 99 and one or two 101's did the job. Only the real dyed in the wool fan wanted or needed a 5-watt output tube such as the 205.

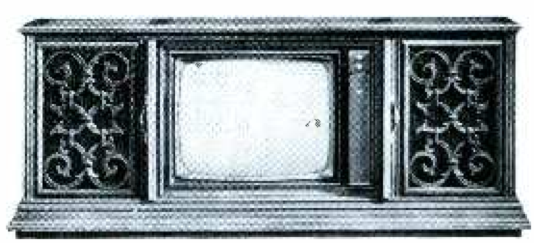
Anyway, much thanks to your art department for the handsome cover. As a stirrer up of nostalgia, it couldn't be beat.

R. A. Schmalz
Evansville, Ind.

We found the WE205B tube in a collection of radio memorabilia in the museum at Sams Technical Institute. It and the Nuvistor illustrated so well the great reduction in the physical size of electronic components that we picked it for the cover.
—Ed.

The hottest thing in electronics hardly gets hot at all

(RCA's solid integrated circuit, that is)

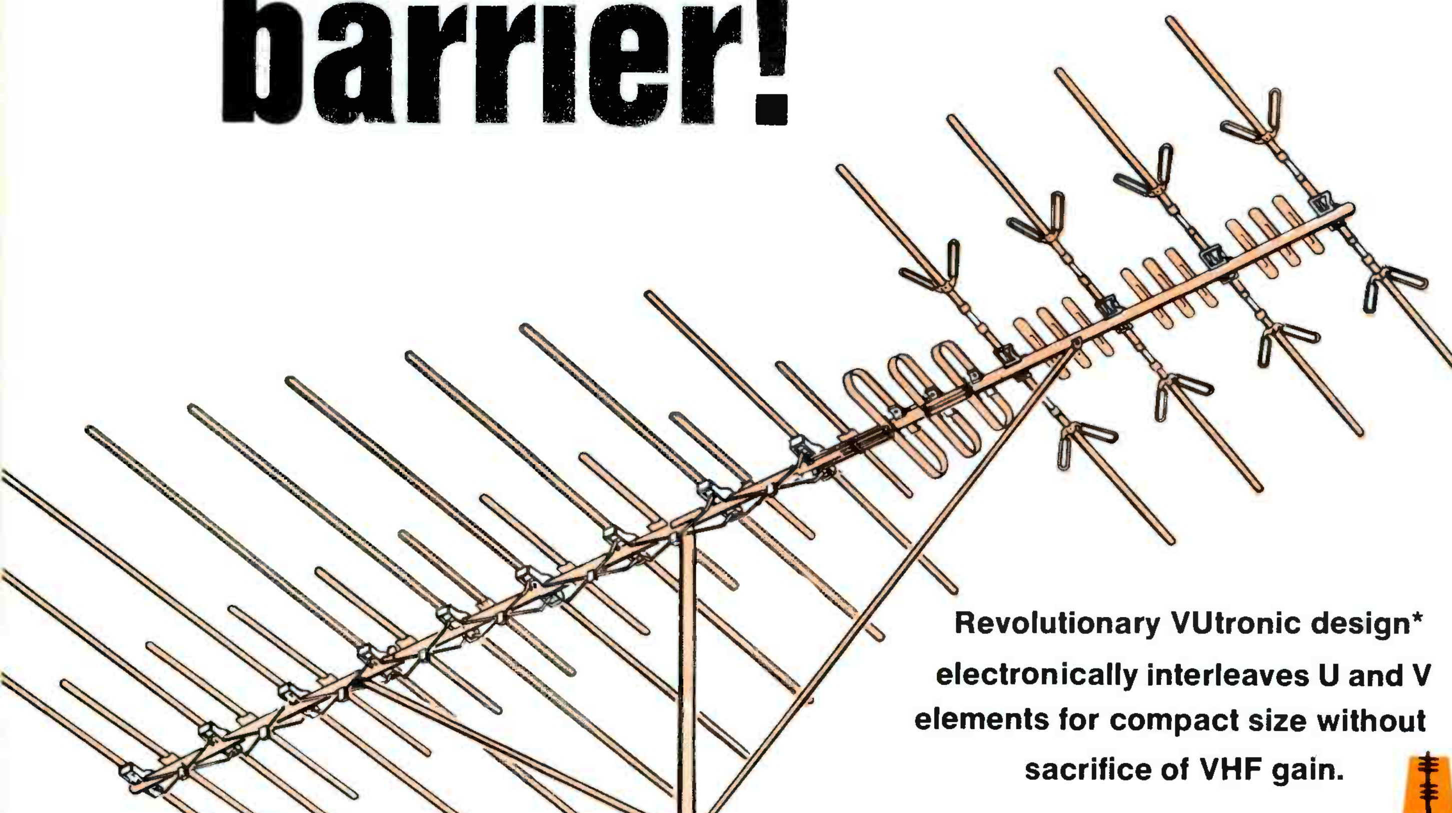


With the tiny chip there are few heat problems and low power consumption. And because integrated circuits run cooler, parts can be placed closer together to enhance design convenience. One day you may see stereo cabinets with more real storage space, and color TV sets the size of a transistor radio. At RCA Victor we've taken a step into tomorrow by using integrated circuits now in new color and black and white TV and in stereo phonographs. They're not only the most advanced products of their kind, they are more reliable than ever before.

RCA The Most Trusted Name in Electronics

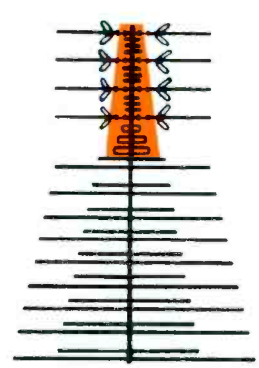
Tmk(s)®

Channel Master smashes the 82 Channel size barrier!

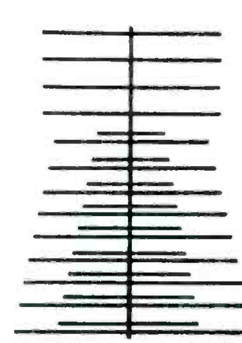


Revolutionary VUtronic design* electronically interleaves U and V elements for compact size without sacrifice of VHF gain.

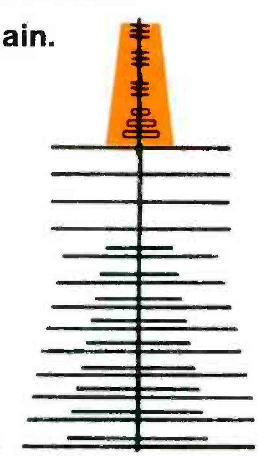
Deep Fringe
Model 3661-G
Same VHF gain as
Color Crossfire
Model 3610-G



Fringe area Model 3661G has **all** UHF elements contained **within** the over-all length of the VHF section



A VHF only antenna with exactly the same VHF gain as the 82-channel Model 3661G is also practically the same size.



Usual design 82-channel antenna would have to be 34% longer to provide the same UHF and VHF gain as Model 3661G Color Crossfire 82.

*Patent Applied For

New Color Crossfire 82

UHF/VHF Antennas plus FM/FM Stereo

Totally new concepts in UHF/VHF design are joined with Channel Master's proven Crossfire principle to produce the first 82-channel antennas that meet UHF reception needs yet also provide unsurpassed VHF gain...and with no appreciable increase in over-all size.

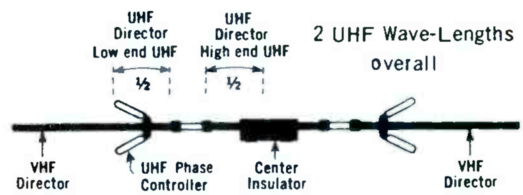
Here is another example of a major development from Channel Master Laboratories where, as always, leadership begins with research.

Until now, antenna manufacturers have created combination UHF/VHF antennas by coupling a UHF section to the front of a VHF antenna. To avoid costly, unwieldy, and unsightly construction, this has always meant sacrificing VHF gain. Now Channel Master fills the 82-channel gain gap with Color Crossfire 82 antennas designed for metropolitan to fringe areas where maximum VHF gain is as important as UHF reception power.

In addition to the famous Channel Master Crossfire VHF Proportional Energy Absorption Principle, these new antennas employ unique series-fed folded UHF dipoles with carefully engineered dimensions so that they literally "disappear" and operate as a perfect 300 ohm line at VHF frequencies... no "lossy" couplers required as is the case with the usual parallel-fed UHF elements.

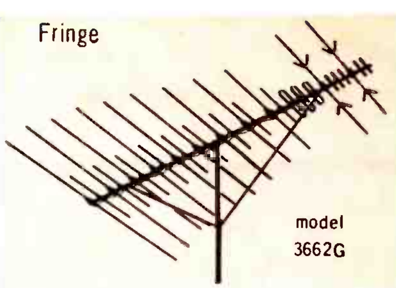
And, of course, every Color Crossfire 82 antenna features Channel Master's famous E.P.C. golden coating and rugged preassembled construction.

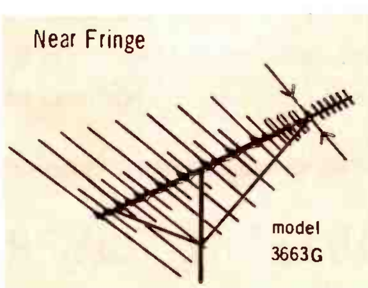
HERE'S THE SECRET

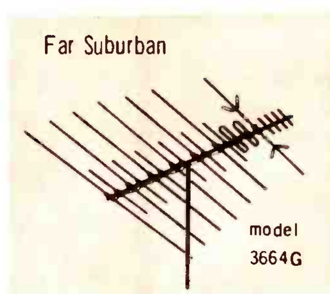


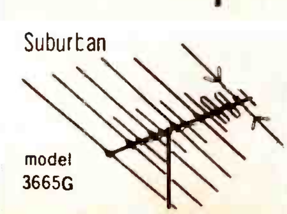
VUtronic design employs unique dual-function co-linear directors (on all but three metropolitan models) serving both UHF and VHF sections. This permits space-saving inclusion of the UHF elements **into** the physical structure of the full-power VHF array. The exclusive UHF phase controller "whiskers" boost UHF gain by making each full-wave director the equivalent of two full wave lengths.

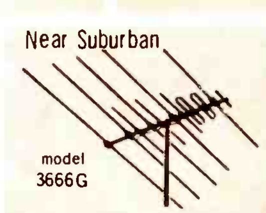
Now the first and only complete line of full VHF Power 82-channel antennas.

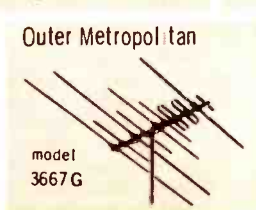


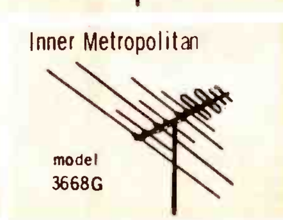












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Ellenville, N.Y.

Circle 5 on literature card

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PF Reporter®

PHOTOFACT

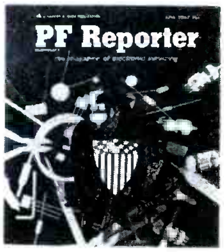
the magazine of electronic servicing

VOLUME 17, NO. 7 JULY, 1967

CONTENTS

ABOUT THE COVER

This month our country is 191 years old! Though we can't claim to have invented freedom, we have developed it to the highest state-of-the-art. So it is with electronics. Through the opportunities available in America, the electronics industry has developed from Ben Franklin's 15¢ kite to the giant $21-billion industry of 1967. If the eagle on our cover looks proud, it's because she is. So are we.



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BEWARE
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You'll never see your doctor advertise a special sale on appendectomies . . .

You'll never see your lawyer announce cut-rates for divorce cases . . .

You'll never see your dentist hold a "2-for-1" sale on extractions . . .

AND You'll never see the day when you can take your TV set in for a service "bargain" and be sure you're getting a square deal!

"Bargains" in home electronic service are as scarce as the proverbial hen's teeth! Here's why—

The expert service technician, just like other professional people, must undergo years of study and apprenticeship to learn the fundamentals of his skill. And a minimum investment of from $3000 to $6000 per shop technician is required for the necessary equipment to test today's highly complex sets. Finally, through manufacturer's training courses and his own technical journals, he must keep up with changes that are developing as fast as they ever did in medicine, law, or dentistry. Those best equipped to apply modern scientific methods are almost certain to be most economical for you and definitely more satisfactory in the long run.

Unfortunately, as in any business, there will always be a few fly-by-night operators. But patients, clients, and TV set owners who recognize that you get only what you pay for, will never get gypped. "There just ARE no service bargains" . . . but there is GOOD SERVICE awaiting you at FAIR PRICES!

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DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS, FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

Circle 6 on literature card

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THE ELECTRONIC SCANNER

news of the servicing industry

Development Programs

The industry is becoming acutely aware that a shortage of trained technicians exists. The solutions to the problem are as varied and numerous as the solution seekers. One thing is apparent, however. Few companies and organizations are content to sit and "let George do it." Everyone is busy, there is free contact among the various groups, and positive programs are being launched. This is refreshing.

We have previously mentioned some of these programs. Here are some new ones:

Admiral's National Service Division, announced that a record 6,250 service technicians attended Admiral electronics service clinics during the 1967 model year.

The training schools will help alleviate the shortage of trained television technicians caused in part by the sharp increase in color TV set sales during the past 2 years. Many of these training schools were held at distributor service centers throughout the country. Most of the seminars were headed by the company's field engineers or graduates of the Admiral Electronic Service Training Center (AESTC).

The training seminars and AESTC make up only a small part of Admiral's commitment to quality customer service. For exampe, to expedite service, Admiral maintains a spare parts inventory valued in the millions of dollars. This does not include the inventory at distributor locations.

In addition, more than 1-¼ million pieces of service literature were distributed during the 1967 model year. Instructional textbooks, color slides, and other teaching aids also have been prepared by the Service Division, supplementing the AESTC program.

The **Electronic Industries Association's** Service Committee has launched a long-term program in the areas of recruiting, training, and upgrading the electronics technicians needed in ever increasing numbers by consumer electronic product retailers and servicers.

The "EIA Service Technician Development Program" embodies the latest phase in the association's long-standing effort to provide adequate service support for the increasingly numerous and complex products of the consumer electronics industry.

The Service Committee set forth a series of action areas for what is conceived as a long-term, well-financed, and continuous activity. The areas are:

1. Career guidance by means of brochures, films, exhibits, lectures, and every other form of effective communication to make potential service personnel and the people who counsel them in the schools aware of the career opportunities awaiting them in the electronics service field.

2. Vocational education upgrading to bring electronics vocational education in this country up to the level of sophistication demanded by the revolutionary technology today transforming consumer electronics—via teacher institutes, correspondence courses, bulletins, scholarships, etc.

3. Coordination with the service activities of manufacturers, distributors, dealers, and other interested industry groups.

EIA activity in the service field goes back to the origins of the Service Committee, which for three decades has encouraged and sponsored service technician recruitment and training. Six basic laboratory manuals in electricity and electronics and three volumes on "Advanced Servicing Techniques," published by the committee, are in wide use in schools throughout the country. In addition, EIA's Educational Coordinating Committee has maintained close touch with other educational groups and its popular brochure on careers in electronics was recently issued in a revised edition.

NEA Recognizes Washington Technicians

At NEA's May 7th Board of Directors Meeting, a resolution was passed giving those technicians previously certified by the Washington State Electronics Council as "Certified Electronics Specialist" equal status to those technicians who are now recognized in 13 other states as NEA Certified Electronic Technicians. The Washington State group recently adopted the NEA Certification Program's technical and theory test as their official test.

Changes Name

Viking Industries Inc. of Hoboken, N. J., a leading manufacturer of cable and electronic equipment for the CATV industry, changed its name to **Vikoa Incorporated.**

In announcing the name change, Executive Vice President Ted Baum said: "We changed our name to avoid confusion with other companies using the name Viking. Our rapid growth during the last two years has

Circle 9 on literature card

Mergers & Expensions

Formation of Mitsumi-Cinch in Tokyo, Japan, as a joint venture of United-Carr Incorporated and Mitsumi Electronic Products was announced by **Cinch Manufacturing Company.**

Under terms of the agreement between Mitsumi and United-Carr Incorporated, parent company of Cinch, Mitsumi-Cinch will produce and distribute Cinch electronic components.

Cinch recently opened one of the most modern, efficient electronic components plants in the nation. The plant, which includes 100,000 square feet of manufacturing space, provides Cinch with its fourth production facility for the company's line of electronic connectors, sockets, terminal boards, etc. Cinch also opened another new plant in Elk Grove Village, Ill., in late May.

Electro-Voice, Incorporated and Gulton Industries, Incorporated reached agreement in principle on the acquisition of Electro-Voice by Gulton Industries.

The transaction is subject to the execution of a detailed agreement, to the approval of the directors of both companies, to the approval of the stockholders of Electro-Voice with respect to the entire transaction, and to the approval of the stockholders of Gulton with respect to the authorization of a new preferred stock. It is presently contemplated that the transaction will be completed in July of this year.

made us acutely aware of this problem."

The company was originally incorporated as REGO Insulated Wire Corp in 1960. Later, when emphasis shifted from wire products to include active electronic equipment, the name was changed to Viking Industries.

Fifth Award

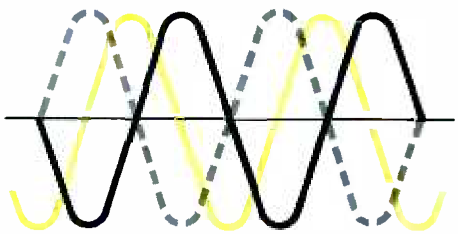
For the fifth straight year, **Zenith** has received the National Alliance of Television and Electronics Service Association's "Friend of Independent Service" Award. Zenith is the only TV receiver manufacturer to be chosen five times for this recognition by NATESA.

Check SBA

Independent retailers who have sought space in shopping center complexes only to learn that their financial standing was not sufficient to meet the lease requirements should contact their nearest branch office of the Small Business Administration, the **National Federation of Independent Business** advises.

Under a recent ruling the SBA will under certain conditions guarantee such leases generally for not less than five years nor more than 20. The business must put in escrow with the agency a sum equal to one-fourth of a year's minimum rental. A service charge of not more than 2-½% of the yearly rent will also be required.

Sheet-Beam



High-level chroma demodulation, as employed by Zenith, eliminates the need for a G-Y demodulator and color difference amplifiers.

Demodulators

By CARL MOELLER

Introduction

We have experienced the evolution of the black and white TV from the complicated and costly device of some twenty years ago to the compact, inexpensive and greatly simplified set of today. Now we can expect the designers of color sets to continue this evolutionary trend. Even now, color TV design has progressed to the extent that a great number of models of excellent design are available at a moderate cost. The purchaser of today's color set is assured of getting a product that will give him years of satisfactory performance with a minimum of maintenance expense.

Never-the-less, we can expect even further refinements as designers strive for greater reliability and simplicity, thus providing a "better product at less cost". One area of development is in chroma demodulators.

The Sheet-Beam Tube

One of the recent developments in chroma demodulation is the sheet-beam demodulator. The "heart" of this high-level demodulator is the pair of 6JH8 "sheet-beam" tubes which were developed specifically for this circuit. Fig. 1 shows the basing diagram and a cross sectional drawing of this tube.

The 6JH8 has two plates and a pair of balanced deflectors to direct the electron flow to either of these plates. After leaving the cathode, the electron beam is controlled in magnitude by the control grid as in a conventional pentode. The focus electrode then shapes the space charge into a beam or sheet which is accelerated by the accelerating electrode. Passing into the region of their influence, this beam is directed to one or the other of the plates, depending on the instantaneous potentials of the deflectors.

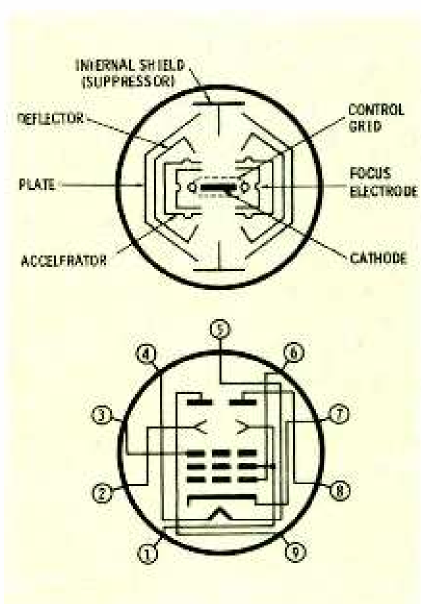


Fig. 1. 6JH8 cross-section and base.

Consider this tube under conditions such that the two deflectors are at equal potential and a sine-wave signal is applied to the control grid. Since the beam splits equally between the two plates under these conditions, the signals at the plates are equal in amplitude and phase, and, of course, 180 degrees out of phase with the grid voltage. Gain is achieved as in a conventional pentode.

Now assume a constant voltage applied to the control grid and a sine-wave signal applied in "push-pull" to the deflectors. When the left-hand deflector is negative, the electron sheet is directed to the right-hand plate and away from the left-hand plate. This causes the left plate to swing positive while the right plate swings negative. Thus the plate signals are 180 degrees out of phase with the deflector signals and also with each other. Gain is realized because a small deflector signal can control a relatively large plate current and thus produce large voltage variations across the plate load impedances. Since a small portion of the actual signal applied to the deflectors is sufficient to direct all the sheet electrons to one plate, the circuit should be considered as a gate instead of an amplifier.

Phase Relations

Consider the time when the left-hand plate is gated ON by its deflector. The voltage at the plate will be controlled by the instantaneous control grid voltage. If this voltage is a sine-wave of constant amplitude, the plate voltage becomes a function of the phase angle of the grid voltage with reference to the deflector sine-wave. (The deflector voltage at the left-hand deflector is the referance phase throughout this discussion). If the grid signal is in phase and both are positive, the instantaneous plate voltage is minimum. Conversely, if the grid signal is 180 degrees out of phase, the plate voltage will swing in a positive direction. During the half-cycle when the deflector is negative, no plate current flows. For phase relations other than these, the plate signal will vary between its limits.

If we consider once more the time when the left-hand plate is gated ON, but assume a control-grid voltage of constant phase that is changing in amplitude; we will see that the plate voltage swings with the grid voltage as before. However, if we examine the two halves of the tube, we find that although the *magnitude* of the plate signals depends on the magnitude of the grid signal, the *difference in magnitude* of the plate signals depends on the *phase* of the grid signal.

From Fig. 2, we find that the requirements for one half of a chroma demodulator are fulfilled. The 3.58MHz oscillator signal is applied to the deflectors in push-pull and the chroma signal is impressed on the control grid. For example, if the chroma signal is 180 degrees out of phase with the reference, the plate will swing in a positive direction. If this positive-going voltage is applied to the red gun of a CRT, red is produced in the raster. The amplitude of this signal applied to the demodulator grid controls the magnitude of the plate swing and ultimately determines the degree of saturation of the red light viewed on the CRT.

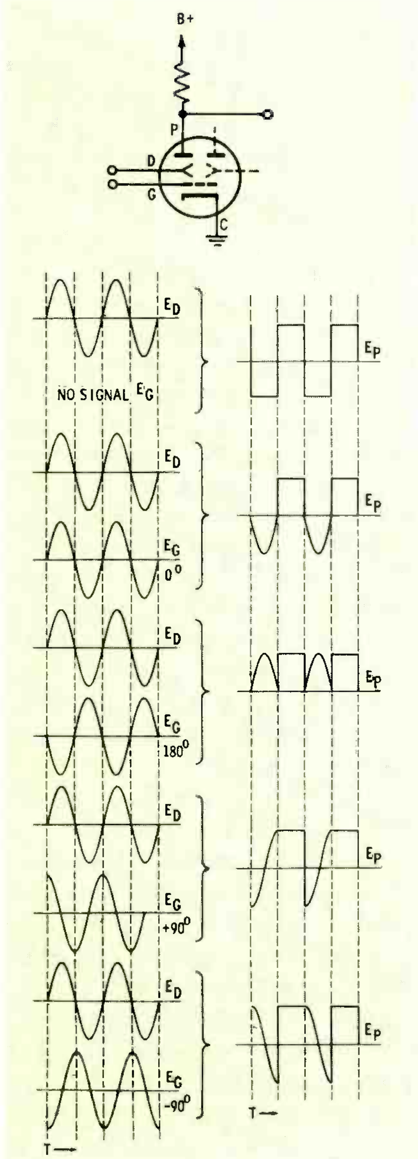


Fig. 2. Phase Detector Wave-forms

Demodulation

Fig. 3 is a simplified schematic diagram of the sheet-beam demodulator with pertinent waveforms. The 3.58MHz filters located in each of the plate circuits have been deleted for the purpose of clarity. The function of these filters is to remove the 3.58MHz ripple and reduce the rectified outputs of the tubes to voltages which vary about the plate voltage. Their magnitudes,

• *Please turn to page 61*

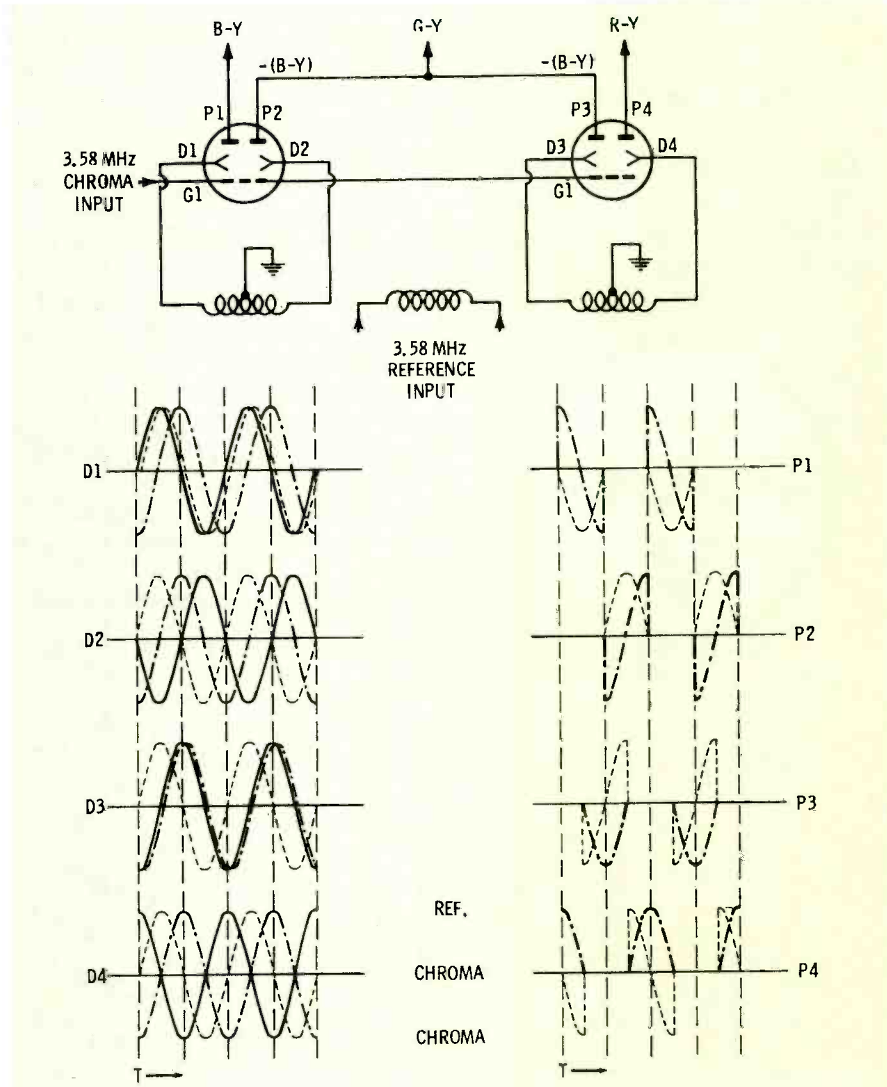
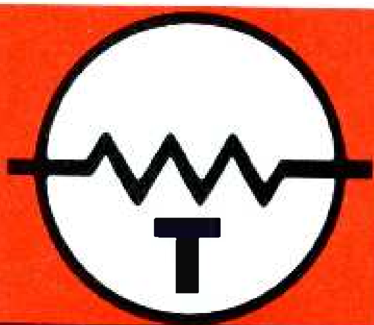


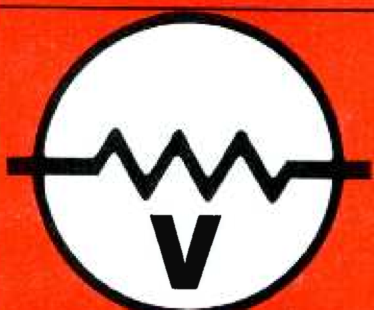
Fig. 3. Sheet-Beam Demodulator Waveforms.



THERMISTORS and VARISTORS in TV

by Rufus Turner

Responding to heat and voltage, these sensitive resistors are used to stabilize and protect various circuits and components.



Circuit designers have at their disposal several "self-variable" resistors for use as automatic control devices. These devices change resistance in response to some phenomenon applied to them. Thus, the magnetoresistor responds to a magnetic field, the photoresistor to light rays, the varistor to voltage, the currector to current, and the thermistor to temperature. Of these, the thermistor and varistor are found most often in TV receivers.

Thermistors

All resistors are temperature sensitive to some extent, usually showing lower resistance when hot than when cold. But the thermistor (the name comes from "thermally sensitive resistor") exhibits this effect to a more pronounced degree. Actually, temperature sensitivity has been designed into the thermistor. One type of thermistor has a positive temperature coefficient (its hot resistance is higher than its cold resistance); the other type has a negative temperature coefficient (its hot resistance is lower than its cold resistance).

Thermistors are available in a wide variety of nominal resistances, power dissipations, and positive or negative temperature coefficient values. Depending upon type and intended application, they are usually made from metallic oxides, semiconductors, or ceramics and are supplied in rod, disc, bead, or washer shapes. Table I lists some common hot and cold resistance values for typical thermistors (or thermistor-like control resistors) used in TV receivers.

TABLE 1
Typical Thermistor Resistance

Resistance (in ohms)	
HOT	COLD
0.1	7500
0.18	30,000
0.24	820
0.51	15,000
0.60	5100
3.8	75
9	600
11	60
20	250
31	260
40	375
43	600
50	150
75	950

In a great many practical cases, circuit resistance may be stabilized by inserting the correct thermistor—a relatively simple step. For example, the cold resistance of a particular circuit may be so low that excessive current flows and may damage the circuit when the power is first switched on. But as the circuit warms up, its resistance increases to a safe value—often too late to forestall component damage. This circuit has a positive temperature coefficient of resistance which may be expressed as an increase of so many ohms-per-ohm of nominal resistance-per-degree centigrade (ohms/ohm/°C). If a suitable thermistor having the same numerical coefficient, but in the negative direction (a decrease in resistance equal to the same number of ohms/ohm/°C), is properly connected in the circuit, its negative coefficient will cancel the circuit's positive coefficient, and the net circuit resistance will remain the same under hot and cold conditions. This correction is automatic and fast.

Thermistors in Filament Strings

One such circuit, in which the thermistor provides automatic, protective adjustment of current, is the series-filament string found in many TV receivers. Here, the filaments of the tubes have low cold resistance and if unprotected, will draw excessive current for a short time after the set is first turned on. This can destroy a tube, and will always shorten tube life. The correct thermistor, installed in the circuit, limits the initial current to a safe value and gradually increases the current as the filaments warm up and increase in resistance.

Fig. 1 shows the basic arrangement for thermistor control of series-filament current. Here, a negative temperature-coefficient thermistor, R1, is connected in series with the power input and the series string of filaments (V1, V2, V3, V4 . . . . Vn). A common temperature-dependent resistance range for such a thermistor is 145 ohms cold and 40 ohms hot. In this circuit, the hot voltage drop across the thermistor, plus the sum of the hot voltage drops across the filaments, must equal the power-line voltage (usually assumed to be 117 volts). In other words, the thermistor is the only dropping resistor in the string. However, when the sum of the filament voltages is significantly lower than the line voltage, and the hot resistance of the thermistor is not sufficient to drop the excessive line voltage, a fixed resistor must be connected in series with the thermistor to provide the additional voltage drop. This added resistor is represented by R2.

Series-filament circuits are often split into separate legs when (1) the sum of the filament voltages is higher than the line voltage; (2) two different filaments must be grounded because of hum problems, RF considerations, or coupling problems; or (3) more effective regulation is obtained if the filaments are controlled in smaller groups rather than in the full string. A circuit of this type having two legs (A and B) is shown in Fig. 2. Here, thermistor R1 controls the filaments (V1A, V2A, V3A . . . VnA) in Leg A; and thermistor R3 controls those in Leg B (V1B, V2B, V3B . . . VnB). Since the legs are in parallel with each other and with the power line, the total voltage drop across each leg must equal the line voltage. This means that each thermistor must reduce the line voltage to the sum of the hot voltage drops of the filaments in the leg in which it is employed (R1 drops the line voltage to E1 in Leg A, and R3 drops it to E2 in Leg B). When E1 or E2 is significantly lower than the line voltage and the corresponding thermistor is unable to supply the required voltage drop, a fixed resistor (R2 and R4) must be inserted to provide the extra drop. Observe that the filaments of two tubes (VnA and VnB) in this circuit may be grounded at a common point (X) when each of these tubes is hum prone or sensitive to RF pickup.

In some receivers, notably those using tubes with ruggedized filaments, automatic control of the series-filament current is not required. However, when a pilot lamp is used in such a circuit, the more fragile filament of the lamp is easily burned out by the initial surge of heavy current. Therefore, a thermistor is used just for lamp protection. This arrangement is shown in Fig. 3. The pilot lamp, in series with thermistor R1, is connected across one half of dropping resistor R2. Thus, the thermistor controls current through the lamp. Current through the filaments (V2, V3 . . . Vn), which requires no control, flows through resistor R2. This application also uses the nonlinear volt/ampere characteristic of the thermistor: As the applied voltage is increased, thermistor current increases only a small amount up to a certain critical voltage.

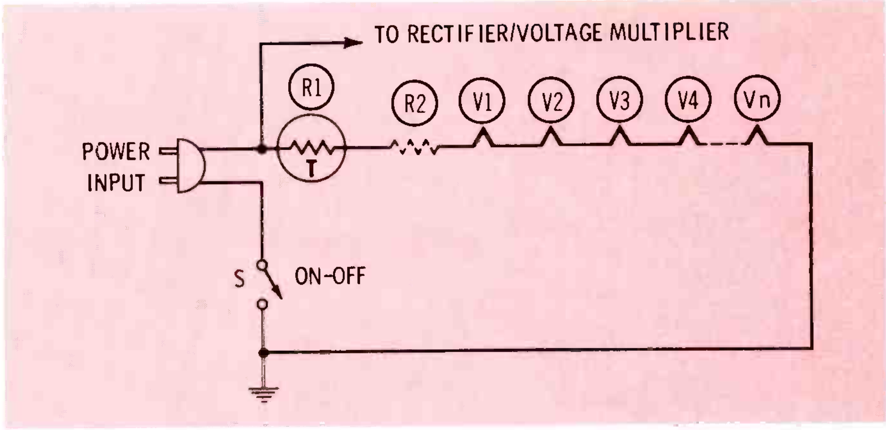


Fig. 1. Thermistor-controlled series filaments.

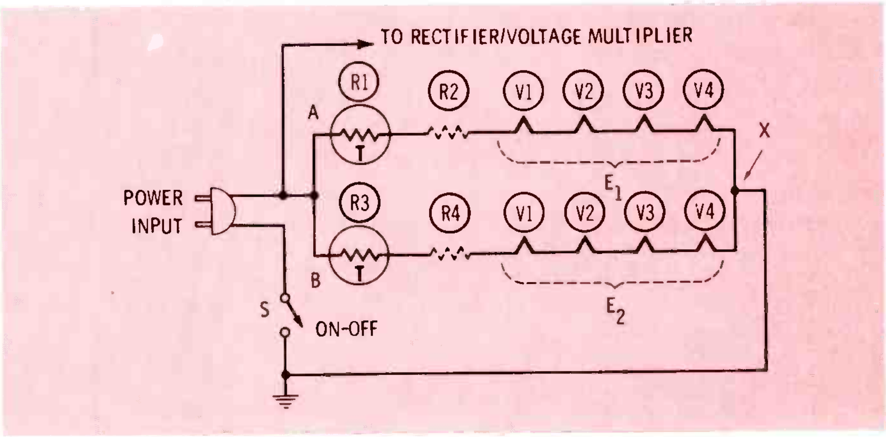


Fig. 2. Split filament circuit with dual thermistor control.

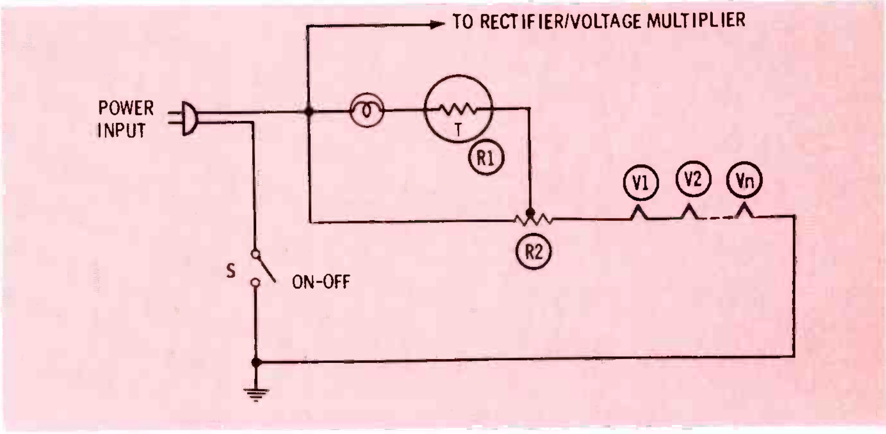


Fig. 3. Pilot lamp circuit protected by thermistor.

Thermistors in Deflection Circuits

As the resistance of the wire in the coils of the vertical deflection yoke changes with temperature, the height and vertical linearity of the picture change accordingly. Without some form of compensation, this can cause severe changes in the size and quality of the picture.

Fig. 4 shows a thermistor connected in series with the vertical deflection coils to keep the resistance of the deflection system (and thus, the picture condition) constant. In this arrangement, R2 is a thermistor properly chosen with

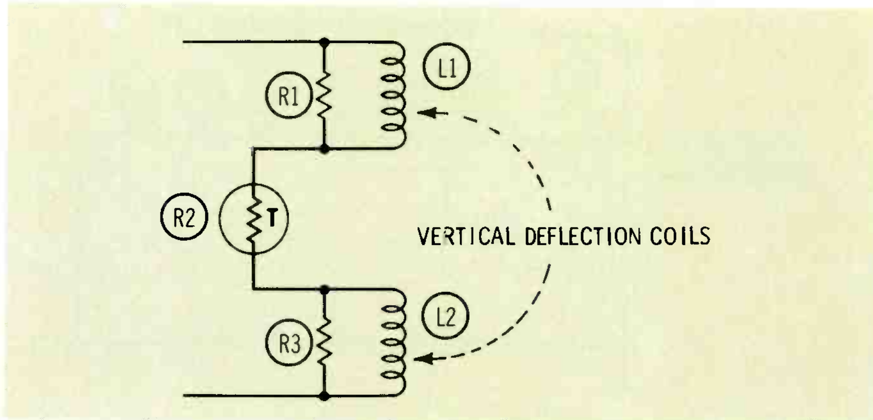


Fig. 4. Thermistor connected in series with deflection coils.

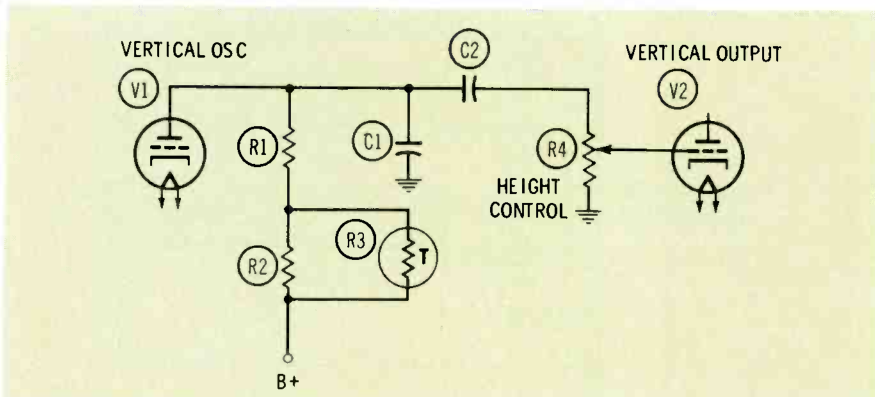


Fig. 5. Thermistor employed in vertical oscillator circuit.

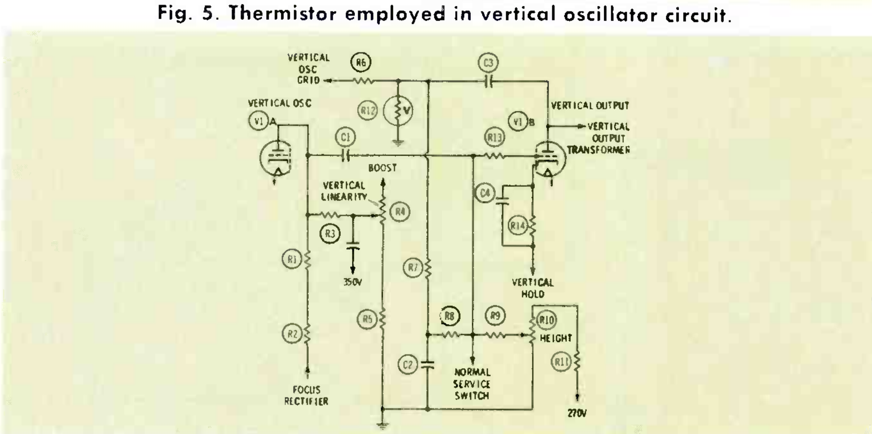


Fig. 6. VDR in deflection circuit of RCA CTC12 chassis.

respect to the hot and cold resistance and current values of coils L1 and L2. The thermistor is mounted inside one of the coils so that it experiences the same temperature variations as the coils. Conventional damping resistors (R1 and R3) shunt the coils to prevent ringing. Occasionally, the thermistor is connected in parallel with the coil, or in series with one of the damping resistors.

In Fig. 5, the thermistor (R3) is inserted in series with the B+ line and the plate load resistor of the vertical oscillator tube (V1). The oscillator output signal is developed across R1, R2, and R3.

The thermistor is mounted inside one of the coils of the vertical deflection yoke. If the deflection circuit is uncompensated (no thermistor), the picture shrinks vertically as the receiver warms up. This is because the hot resistance of the coils is less than the cold resistance. However, in the circuit in Fig. 5, the low hot resistance of the thermistor causes the DC plate voltage of the vertical oscillator to increase, producing a corresponding increase in the oscillator output signal, which is applied to the grid of the vertical output tube. This, in turn, provides a proportional increase in the vertical deflection and maintains constant height and linearity.

Servicing Thermistors

All types of thermally sensitive resistors, whether they are called thermistors or some trade name, are critical components because they must satisfy a given set of interrelated operating conditions—cold resistance, hot resistance, maximum current, power dissipation, and temperature coefficient (magnitude and polarity). This means that a defective thermistor demands an exact replacement, one which is identical not only in electrical ratings, but also (usually) in size and shape.

Replace a defective thermistor only after the cause of the failure has been determined and corrected. Some possible troubles are a grounded thermistor, intermediate ground in the filament string, and mechanical damage of the thermistor. Ordinarily, thermistors are rugged for their size and ratings and often will outlast the sets in which they are installed.

Varistors

A varistor (the name comes from "variable resistor") changes its resistance in accordance with voltage. The higher the voltage applied to a varistor, the lower the resistance. It is this action which gives the varistor its more common name, voltage-dependent resistor or VDR.

Like thermistors, varistors are available in a wide variety of values of nominal resistance, power dissipation, and in the case of varistors, resistance-versus-voltage coefficient. They are made from ceramic or semiconductor materials and are also supplied in rod, disc, wafer, or washer shapes. The VDR's found in TV receivers usually resemble conventional resistors.

Table 2 shows the voltage/resistance relation for one particular type of VDR. The resistance is "nonohmic," that is, it does not vary according to Ohm's law ($R = E/I$), but is proportional to some power of the applied voltage (the exponent indicating this power depends upon the VDR composition and design). Note from Table 2

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TABLE 2
Typical VDR Voltage/Resistance

Voltage (volts)	Resistance (ohms)
20	10 Meg
30	3.75 Meg
40	2 Meg
50	1.67 Meg
60	1 Meg
80	533K
100	333K
150	150K
200	50K

that the resistance decreases nonlinearly from 10 megohms to 50K ohms as the voltage is increased from 20 volts to 200 volts (in this instance, a voltage change of 10 to 1 produces a resistance change of 200 to 1).

VDR's in Deflection Circuits

There are many places in a TV circuit where VDR's might be used for amplitude stabilization or supply voltage regulation. At present, they are found in the vertical deflection circuit of some color receivers.

Fig. 6 shows this application of a VDR in an RCA CTC12 chassis. Here, the VDR (R12) provides automatic gain control for stabilizing the circuit against variations in tube gain, supply voltages, and components. In this instance, the VDR is connected in the grid circuit of the vertical output tube and controls the bias of this stage. However, it is also connected (through R6 and an RC filter) to the grid of the vertical oscillator (V1A); thus, it also controls the bias of this stage.

A high-amplitude vertical pulse (from whatever cause), coupled from the vertical output transformer and V1B through capacitor C3, decreases the resistance of R12. This, in turn, decreases the positive voltage between the grid of V1B and ground. At the same time, this causes the negative grid bias of V1B to increase. This action decreases the gain of V1B and reduces the vertical pulse amplitude. Meanwhile, the output of the vertical oscillator (V1A) is decreased proportionately, since the VDR also acts on the grid of that tube, as mentioned previously.

Thus, with the automatic control provided by the VDR, the raster height remains independent of the line voltage and of variations due to gain changes (tube and stage generated) over a wide range. Therefore, the height remains constant during warmup of the set.

Servicing VDR's

Like thermistors, VDR's are critical components. A resistor which has a different resistance for each value of applied voltage, and a different resistance-versus-voltage curve for each stock type is indeed critical. This means simply that a defective VDR demands an *exact* replacement.

In the line with the aforementioned servicing practice, replace a damaged VDR only after determining the cause of failure and then correcting it. Some possible troubles are voltage overload, shorted resistors (such as R7, R8, or R11), excessive heat from other components, and mechanical damage of the VDR. ▲

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Thoroughly understanding the operation of a circuit is half the servicing battle. Combine the understanding with proven troubleshooting techniques and you've won. Sync circuits are no exception—read on and be a winner.

SYNC
From Video To Oscillators

by Ellsworth Ladyman

The function of the horizontal and vertical sweep sections of a television receiver is to initiate and control deflection voltages to reproduce sweep in accordance with the transmitted signal. The oscillators of these circuits are controlled by sync signals that are transmitted as part of the composite video signal. The sync pulses must be removed from the video signal and delivered to the oscillator grids at the correct amplitude and polarity, if the receiver is going to reproduce "a picture" in synchronization with the transmitted signal. The removal of the sync pulses and their subsequent coupling to the oscillator grids is the function of the sync separator, vertical sync coupling, and horizontal sync coupling circuits.

Sync Separator

Operation of the sync separator is simple, although modern day receiver schematics can present a complex view of the circuit to a beginning service technician. The sync separator is usually combined with another stage in a dual purpose tube; the other stage can be located in various other circuits such as: sound, AGC, video, etc. The other half of the 6GH8 sync separator stage in Fig. 1 happens to be a sound IF stage.

Circuit theory is very simple; the tube is biased to the point that conduction will not occur on signal voltages below the sync level. Therefore, the tube is cut off during video signals and conducts during sync signals. Only the sync pulses are present in the output circuit. Effectively, the stage acts to "clip" the sync pulses from the video signal and is sometimes referred to as "a sync clipper."

The signal now present in the output circuit is composed of vertical sync pulses, horizontal sync pulses, and equalizing pulses. Segregation of these pulses is accomplished by a form of "filtering"; circuit action of these networks is as follows:

Vertical Sync Coupling

Vertical sync pulses of 60 Hertz must be separated from the horizontal sync pulses, which have a repetition rate of 15,750 Hertz. This is an RC time constant circuit with the values of the components chosen to make the time constant long compared to the duration of the horizontal sync pulses.

The time constant of a vertical integrator is 45 microseconds, the duration of the horizontal sync pulses is 5 microseconds, and the duration of the equalizing pulses is 2.5 microseconds. When a signal comprised of vertical sync pulses, horizontal sync pulses, and equalizing pulses is applied to a vertical integrator circuit, the following action takes place. (See Fig. 2)

1. The horizontal sync pulses, lasting only 5 microseconds, cause the capacitor to charge slightly, then discharge rapidly through the resistor (point A, Fig. 2)
2. Equalizing pulses with a duration of 2.5 microseconds cause the capacitor to charge approximately one-half as much as the horizontal pulses did, then discharge rapidly through the resistor. The capacitor charge and discharge caused by equalizing pulses is almost negligible (see point B, Fig. 2)
3. Vertical sync pulses have a duration of 190.5 microseconds, allowing the capacitor ample time to charge to the peak value of the signal voltage. When the first vertical pulse is applied to the circuit the capacitor charges. At the end of the first pulse, this charge starts to leak off through the resistor but, due to the short time interval between pulses, the discharge of the capacitor is negligible. The succession of vertical pulses charges the capacitor to the amplitude of the incoming sync pulses. At the end of the series of vertical pulses, the capacitor starts to discharge through the resis-

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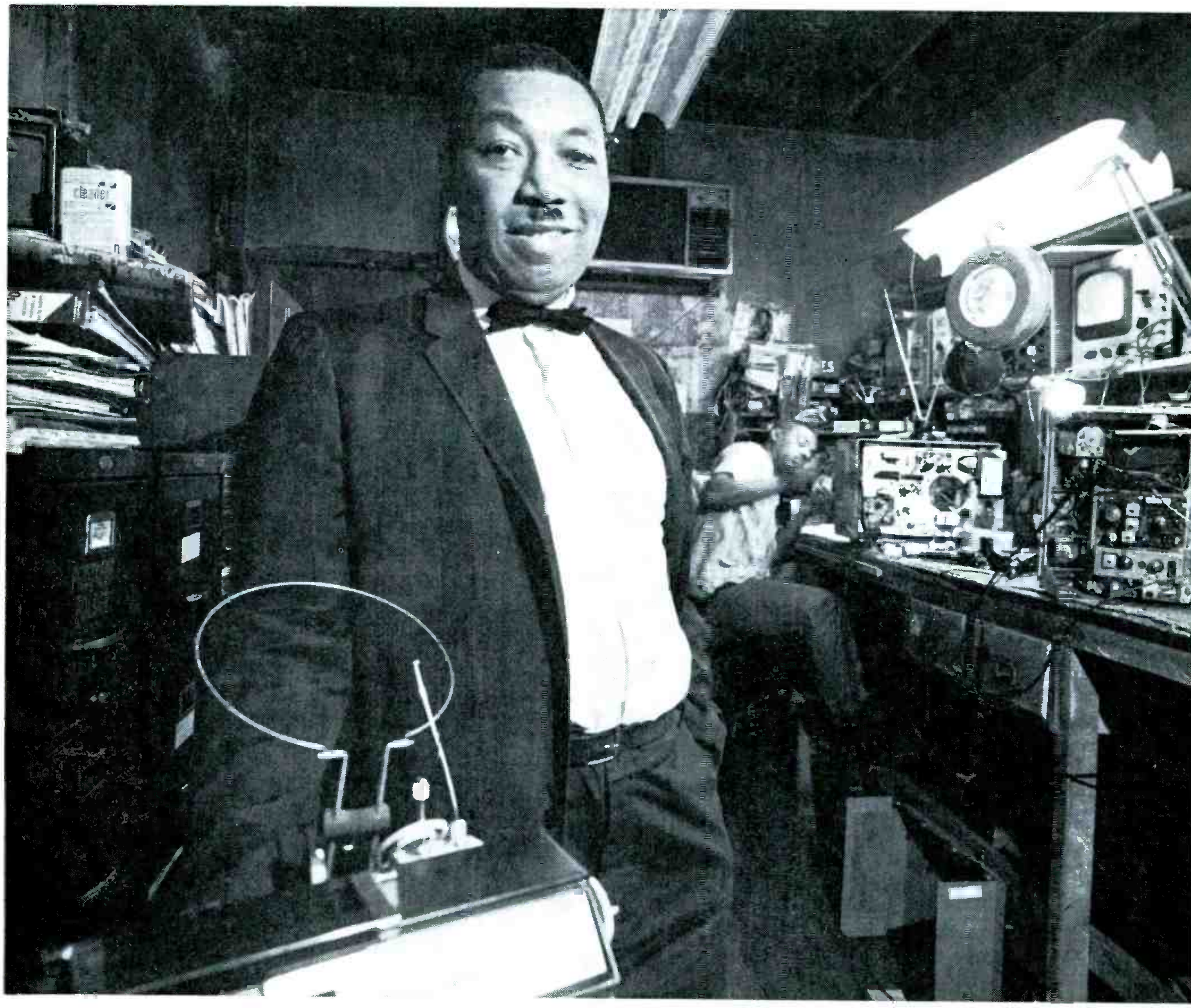

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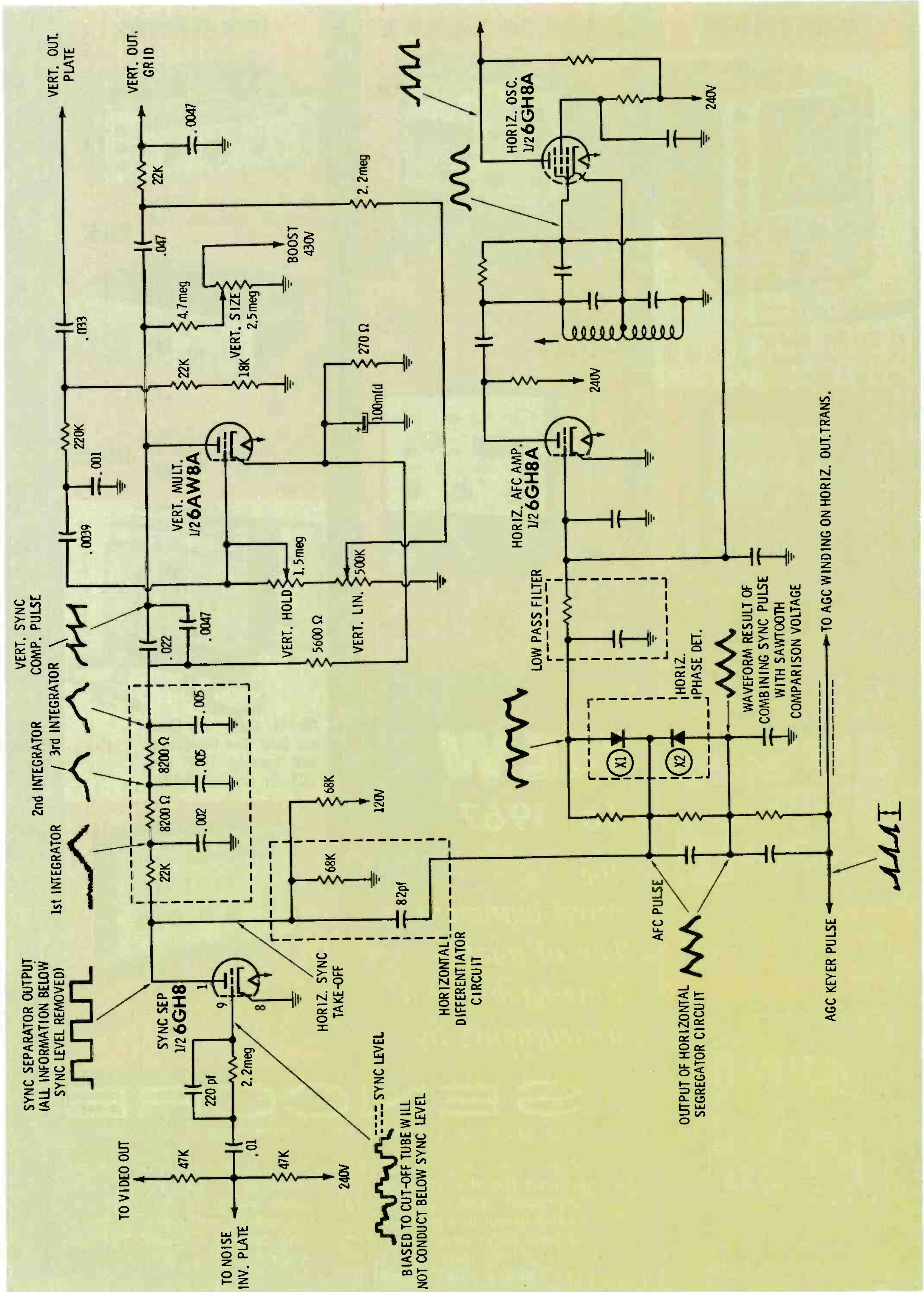

Fig. 1. Sync separator is ½ of 6GH8 triode-pentode.

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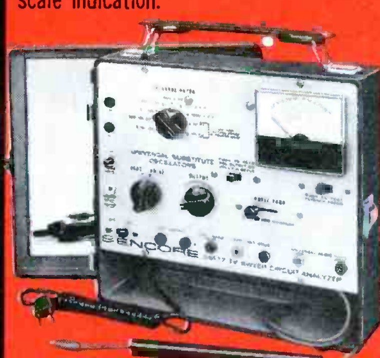

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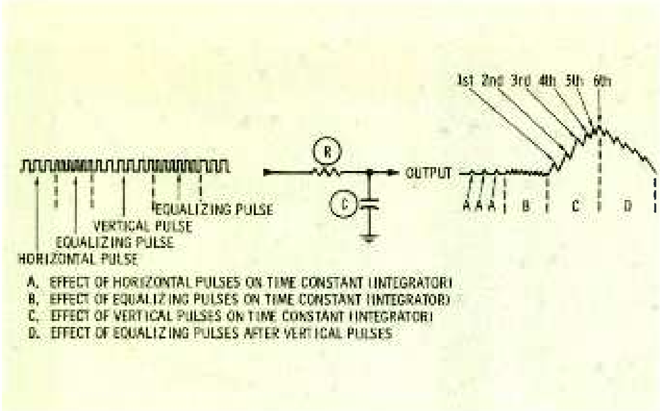


Fig. 2. Breakdown of the vertical integrator.

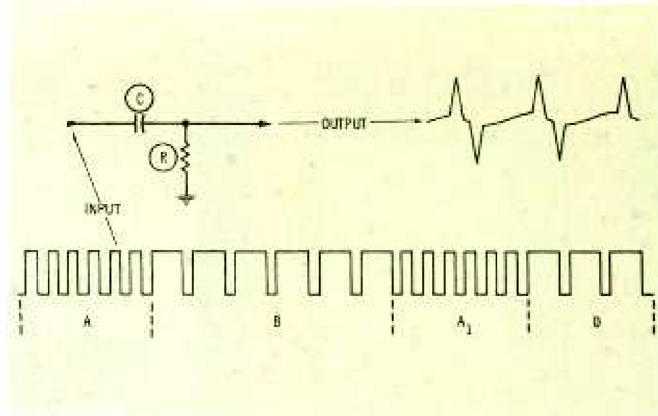


Fig. 3. Breakdown of the horizontal segregator.

tor. During the discharge period, 6 equalizing pulses are applied to the circuit, but due to their short duration (2.5 microseconds), they cannot hold the charge on the capacitor. Their effect is evident as a series of little "blips" on the downward slope of the integrator output waveform (see point D, Fig. 2).

With reference to Fig. 2, it is evident that the horizontal and equalizing pulses have very little effect on the vertical integrator and are effectively "filtered out" of the vertical signal. Adding or cascading integrator circuits results in improved wave-shaping with better and more positive control of the vertical oscillator. The output of the final integrator (Fig. 1) is applied to the vertical oscillator.

Horizontal Sync Coupling

Vertical, horizontal, and equalizing pulses are also present at the horizontal sync take-off point. The horizontal segregator (differentiator) works much in the same manner as the vertical integrator, differing slightly in configuration (see Fig. 3). The time constant of the horizontal differentiator is one micro-second and the duration of the horizontal sync pulse is five micro-seconds; consequently the capacitor has ample time to charge to the amplitude of the applied signal pulse.

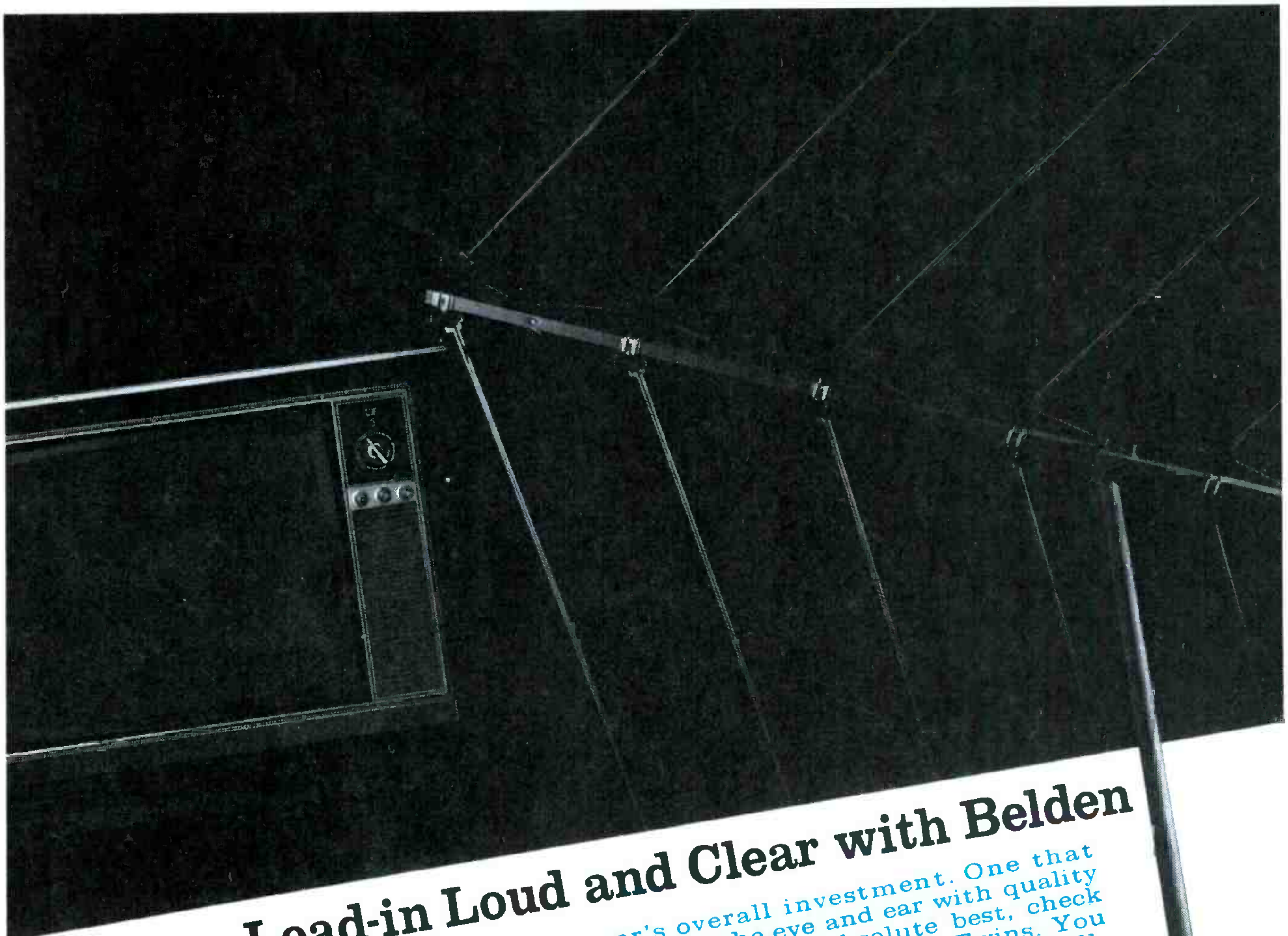
When a horizontal sync pulse is applied to the differentiator circuit, the capacitor charges rapidly; at the end of the charging period, it discharges rapidly through the resistor. The voltage across the resistor appears as a positive pulse during the rise time of the horizontal pulse (capacitor charge time) and as a negative pulse during the discharge period (see Fig. 3).

Equalizing pulses last for 2.5 microseconds and also charge the capacitor to the peak value of the applied signal pulse. The shorter duration of the equalizing pulses causes a much more rapid charge and discharge sequence then did the horizontal pulses and produces twice as many positive and negative going pulses across the resistor.

Vertical sync pulses charge the capacitor very rapidly and produce a positive pulse across the resistor. The long duration of the vertical pulse sustains this charge on the capacitor until the pulse ends. The capacitor then discharges rapidly through the resistor producing a negative pulse across it corresponding to the capacitor discharge time. Each succeeding vertical pulse has a similar effect on the differentiator.

The output of the differentiating circuit is composed of differentiated vertical, horizontal, and equalizing pulses. This output is then applied to the horizontal circuit. However, only those pulses (horizontal sync pulses) occurring at the horizontal frequency rate affect the triggering of the horizontal oscillator. Horizontal pulses also occur during vertical blanking; therefore, the horizontal oscillator does not fall out of sync during that time.

Next in line in the horizontal sync path is the horizontal phase detector. In modern day receivers the circuit illustrated in Fig. 1 is widely used. Two signal voltages are applied to the diodes X1 and X2. One of these signal voltages is the differentiator output, the other signal is received from the horizontal output circuit. The signal received from the horizontal output is compared to the signal from the sync separator. When these signals are equal in phase and amplitude, diodes X1, and X2 conduct equally. These rectified voltage pulses (output of X1 and X2) are then applied to a horizontal AFC amplifier tube across a low-pass filter network which removes any residual AC components in the signal. However, if the horizontal oscillator tries to drift off frequency, the comparison voltage pulse changes in shape and amplitude and causes one diode to conduct either more or less than the



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other. This will result in a change in the signal pulses to the oscillator grid. If the oscillator tends to run slower, the resultant correcting voltage at the output of the diodes will become more positive, while a more negative voltage results from the oscillator tending to run too fast.

Servicing Procedures

Most problems encountered by service technicians when confronted with faulty sync systems are in isolating the defect to a specific section. One of the quickest and easiest methods is by signal tracing with an oscilloscope. Once the symptom has been traced to a particular section (sync, AGC, video, etc.) the scope, used in conjunction with a VTVM, quickly isolates the defective component.

Sync Separator

Remembering that the sync separator is in the signal path and must act upon the signal to remove the video component, an analysis of the waveform at the sync separator input should be made. This will ascertain that the signal is being delivered from the video output circuit and either eliminate the preceeding circuits (video, IF's, and RF) or make them suspect. Should the signal at the sync separator grid be weak or distorted, check for gassy or low emission tubes and open coupling or shorted bypass capacitors in the video strip. Such unlikely defects as an open winding in a tuner balun transformer have been known to cause unstable sync.

The next point to check is the sync separator plate. The function of the sync separator is to separate the sync pulses from the composite video waveform. Therefore, the waveform present in the plate circuit should be representative of fairly clean sync pulses with, at most, only traces of video information visible. Should the signal at the grid be correct and the signal at the plate distorted, it is logical to assume the tube is not functioning normally.

The next step would be to check the operating voltages of the tube (grid and plate). Most manufacturers and all Sams PHOTOFACT schematics list the voltages present at tube pins under operating conditions. A check of the voltages at the grid and plate, and a comparison of these readings against the voltages shown on the schematic will determine quickly whether the defect is in the bias or supply circuits. If these voltages are normal, yet the output waveform is distorted, the defect is in either the vertical or the horizontal sync coupling circuits.

Disconnect the vertical integrator and horizontal sync take-off leads from the sync separator output. Check the sync separator plate again—the output should be clean and undistorted. Reconnect the integrator and horizontal take-off leads, ONE at a time. Observe the sync separator output after each connection. This should eliminate one section as a suspect and isolate the other section as a potential trouble spot.

Vertical Sync Coupling

The importance of the time constant of a vertical integrator circuit cannot be over-emphazied. The time constant is dependant on the values of the components that make up the circuit. It follows that any change of value in any of the components will result in a change in the time constant and , consequently, cause distortion of the output waveform. If previous test procedures have eliminated preceding circuits as potential trouble spots, check the integrator as follows: Disconnect the vertical integrator output lead and check the output waveform under "no-load" conditions. (If the chassis has paralleled filament connections, simply remove the vertical oscillator tube). This will eliminate the possibility of a malfunctioning vertical oscillator stage causing erroneous indications of a faulty integrator. NOTE: *All Sams* PHOTOFACT *schematics and some manufacturers' information include waveforms taken under actual operating conditions.*

Observation of the integrator output under "no-load" conditions should either eliminate the integrator as a potential trouble source or isolate it as the defective component. If the output is normal, the vertical sync symptom has been traced to the vertical oscillator stage, with the sync separator and sync coupling circuits having been eliminated as potential trouble sources.

Horizontal Sync Coupling

As in the vertical integrator circuits, the time constant of the horizontal differentiator is of primary importance. If the waveform taken at the differentiator output is distorted when compared to the waveform illustrated on the schematic, a careful check of the resistor and capacitor making up the differentiator should be made.

The output of the differentiator circuit is combined with a comparison voltage pulse from the horizontal section and applied to the horizontal phase detector. The comparison voltage should be checked with an oscilloscope, first to make sure there is a pulse, and secondly for shape and amplitude. Phase detector diodes such as used in the circuit illustrated in Fig. 1 must be matched; unmatched diodes will conduct unequally on equal drive signals and deliver an erroneous correction voltage to the horizontal oscillator. Diodes can be checked using an ohmmeter (front-to-back ratio) to determine closeness of the match. It is a good idea to check replacement dual diodes for front-to-back ratios, as rough handling can cause a shift or change in resistance.

The simplest method of troubleshooting an AFC circuit is by comparing waveforms obtained on the scope to those indicated on the schematic. If distortion is present at a specific point, ohmmeter and voltmeter checks will isolate the defective component. Defects in this circuit rarely occur as opens or shorts but are usually caused by value changes, mismatched diodes, or similar troubles.

In any electronic circuit where tubes are held at cutoff and conduction occurs only when signal pulses are applied to the control grid, an oscilloscope is a necessity for troubleshooting procedures. This is not to say you don't need a VTVM, because operating voltages (bias and supply) must be measured. But the larger percentage of circuit defects or circuit failures is caused by component value change rather than component breakdown. Value changes in waveshaping networks rarely affect the operating voltages; therefore, a scope is a must. ▲

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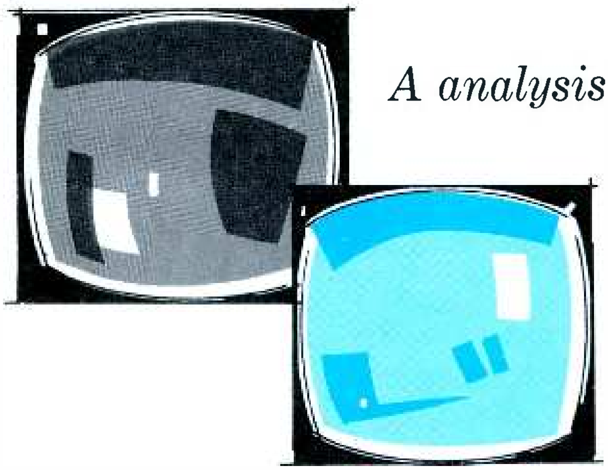

A analysis of the circuits and associated defects that produce

many hued RASTERS

BY ROBERT F. HEATON

When servicing a color television instrument for an off-hue raster, the initial analysis is performed by determining what type of hue (tint) defect is present. Basically, the majority of tint problems you'll encounter fall into two categories.

1. Those that upset the overall tint of the raster, with or without video information.
2. Those that cause incorrect color hue(s) during the reception of color programming.

The block diagram in Fig. 1 illustrates the stages that can cause both types of hue problems. The shaded blocks show those circuits associated directly with the picture tube. Failure in these circuits normally causes a shift on the screen from white to some predominant hue. Part 1 concentrates on problems of this nature. Part 2, in an upcoming issue, will discuss incorrect hues on a color picture, caused by failure in the color processing stages.

Tinted Rasters

When speaking of "tinted" rasters in this context, we refer to a change in color balance viewed on the picture tube during black-and-white reception. The raster becomes predominantly tinted by one of the primary colors—red, green, or blue—or some complementary color—yellow, cyan, magenta, etc. Troubles of this nature can be traced to the picture tube and/or its element control circuits. Generally, trouble develops in one of the four shaded circuit areas in Fig. 1: (1) The cathode circuits, including any drive controls; (2) The control grid circuits, including color amplifier stages; (3) Screen grid circuits and controls; (4) The picture tube itself.

The stages shown with dotted lines in Fig. 1—video amplifier, blanker, and purity adjustments—can affect picture tube conduction or the color of the raster. However, a defect in these stages normally causes an operational change in all three guns simultaneously. Notice the 3.58-MHz oscillator is solid and dotted. In some instruments, failure of the oscillator shifts demodulator operation to a great degree. The end result, via the color difference amplifiers, causes a predominant hue on the screen. An inoperative oscillator, for example, produces a no-color symptom.

In many instruments, the blanker sets the average conduction (and thus plate voltage) of all three color amplifiers. The amplifiers are DC coupled to the picture tube grids; any change in amplifier plate voltage causes a change in CRT bias. The blanker is common to all three color amplifiers, thus a defect in the blanker affects all three CRT guns. Symptoms produced by improper blanker action normally involve a change in overall brightness of the raster—while overall color balance is retained.

The video output stage is also common to all three CRT guns—in this case, the cathodes. The screen will normally have low brightness and/or contrast as a re-

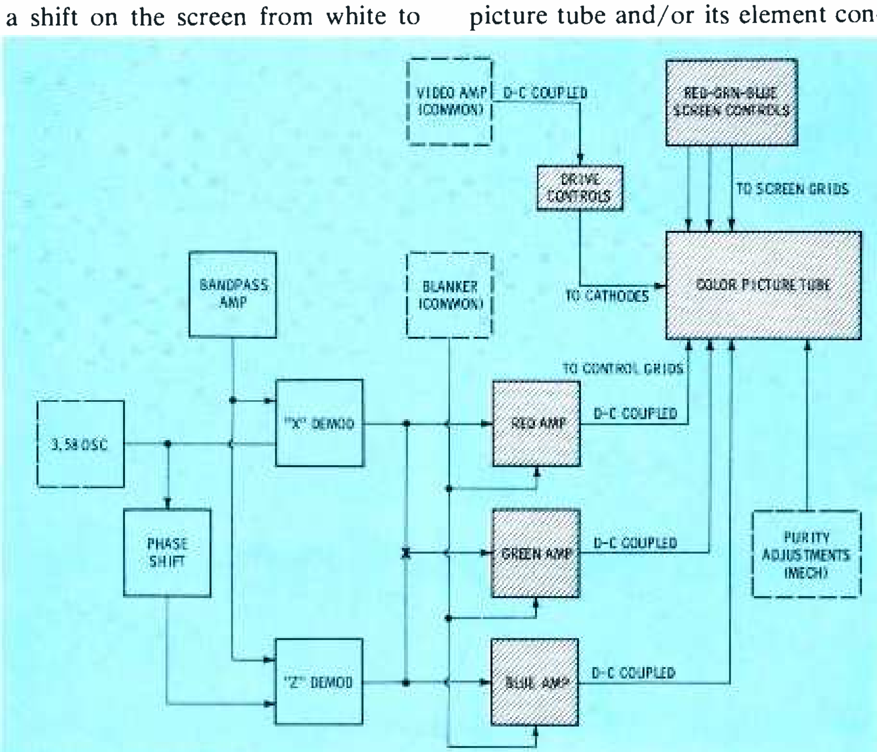

Fig. 1. Block diagram of stages that can cause hue defects.

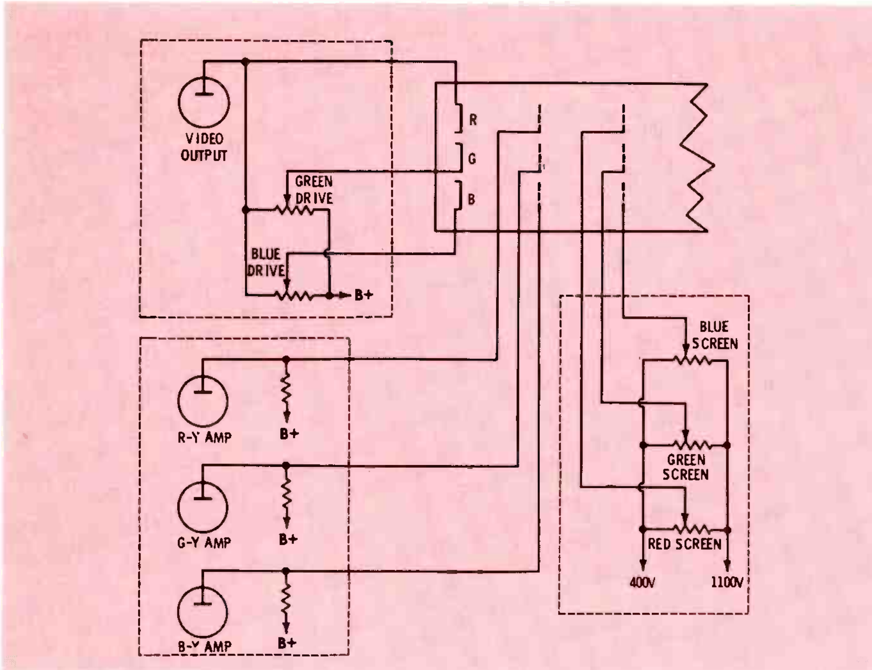

Fig. 2. Simplified schematic of tint control circuits.

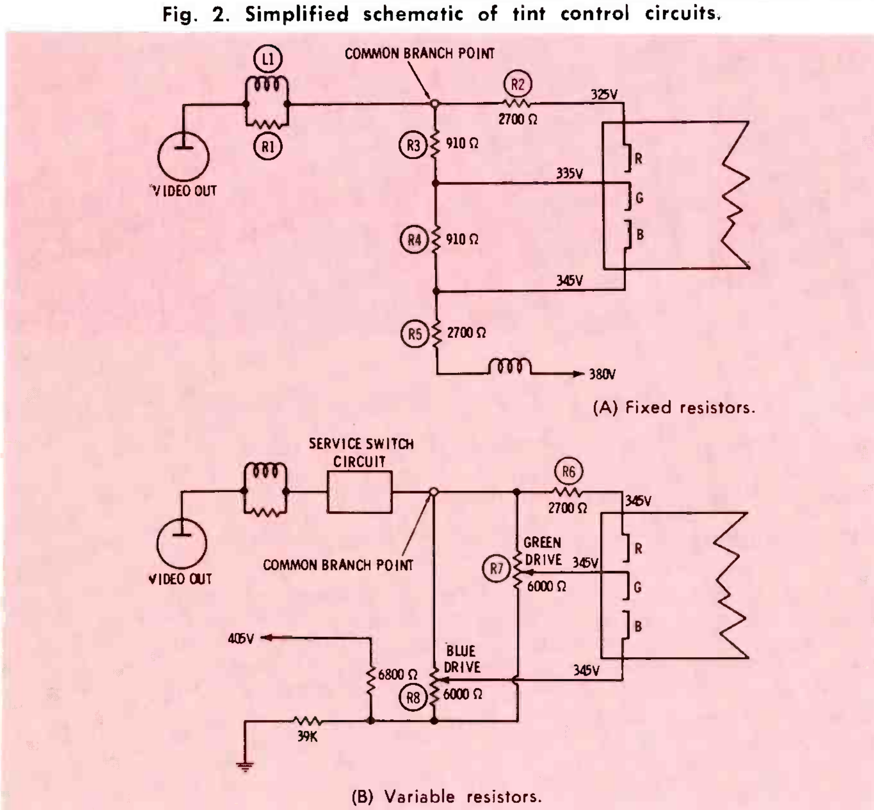

Fig. 3. Divider networks for cathode drive.

sult of video output trouble. A change in one particular gun produces a tinted raster and points to a defective drive control circuit.

Let's take an individual look at the four main circuit areas generally associated with a "tinted" raster. The simplified schematic in Fig. 2 shows the areas we will be concentrating on. We'll "branch" off with individual circuit illustrations as needed.

Cathode Circuits

As previously mentioned, a defect in the video output stage itself will generally affect all three CRT cathodes an equal amount. Low or high brightness may result, but white balance is retained. The area for testing becomes the drive controls (or divider networks) associated directly with the cathodes.

Earlier color instruments (before 1960) used fixed-resistor, divider

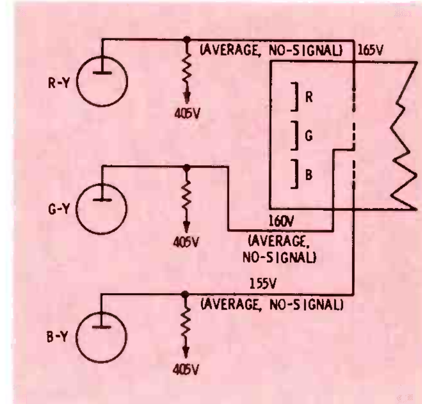

Fig. 4. Divider for control grids.

networks to obtain cathode drive compatible with the phosphors in the picture tube. As phosphor efficiency became more equal (later and better picture tubes), a simpler, but more refined, drive circuit was used. In instruments manufactured after 1960, variable drive controls replaced fixed resistors. Fig. 3A shows the fixed divider; Fig.3B, the variable type.

To produce a tinted raster, the cathode voltage of one or two guns must change. A defect causing this change can only occur in the networks after the "common branch point." Troubleshooting either system is the same—DC voltage checks of the cathodes. In older instruments (Fig. 3A), the service notes should be consulted for normal values expected. In the RCA CTC7 chassis, for example, the voltages shown in Fig. 3 are typical. Notice the voltages do not differ greatly. However, a change in value of R2, R3, or R4 can alter the relative division of voltages for the cathodes.

In newer color chassis, cathode voltages will be more equal because the phosphors are better matched for efficiency. Components in Fig. 3B that could cause tinted rasters would be R6, R7, or R8.

There are a couple of important points to remember when checking voltage on any of the tube elements. Make sure the voltages are reaching the tube pins as well as the socket pins. Check for poor (high resistance) or intermittent contact between the CRT socket and tube pins.

Control Grid Circuits

The majority of color chassis using low level demodulators are equipped with color-difference amplifiers. Commonly referred to as R-Y, B-Y, and G-Y, these amplifiers are DC coupled to the control grids of the red, green, and blue CRT guns. The plate circuit of each amplifier forms the control grid bias network for its respective gun. It is seen in Fig. 4 that grid bias is altered on a respective gun anytime conduction through the associated amplifier changes. The grid (and plate) values shown in Fig. 4 are average static voltages (no signal input to the color amplifiers). Under these conditions, a normal "white" raster is reproduced on the screen. Now, let's decrease conduction in the R-Y amplifier—say to the point where the plate voltage rises to 250 volts. This change is immediately evident on the screen—the raster shifts from gray to a reddish overall tint. Here's what happened: Amplifier conduction decreased, plate voltage increased; in turn, the control grid went more positive, increasing conduction through the red gun, while conduction of the green and blue guns remained unchanged. Contrast that result to a decrease in plate voltage of the same amplifier. Under these conditions, conduction through the red gun decreases, and the raster hue shifts towards cyan (combination of green and blue guns).

The same analogy applies to the G-Y and B-Y amplifiers. Any change that effects the operation of one amplifier (or combination of two), upsets the associated guns, producing a hue change in the raster. The saturation of the predominating color will of course vary, depending on the amount of change in operating conditions. A drastic increase in plate voltage on one amplifier—a nonconducting tube for example—could increase CRT conduction to the point of overloading the high voltage supply. The result could be a complete loss of high voltage and the raster.

If trouble in the difference amplifiers is suspected, analyze the color hue on the screen to help isolate which amplifier might be defective. When the screen shifts towards a primary color—red, green, or blue—look for trouble in the associated color amplifier. When the hue is shifted toward a complementary color—cyan, magenta, yellow—check the amplifier associated with the primary color that is decreased (or missing).

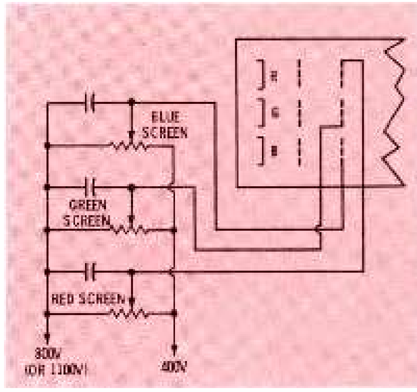

Fig. 5. Divider for screen grids.

Sceen-Grid Circuits

Fig. 5 illustrates the remaining circuits (external to the picture tube) that could cause an upset in the black-and-white raster. This system of screen grid control circuitry is typical of most color instruments. Screen voltage is adjusted by controls arranged in simple voltage divider networks across two B+

potentials — usually highest B+(400V) and B- boost (800V). (Late color chassis have a higher source (1100V) — usually called boosted-boost.) A large change in one (or two) of the divider circuits can cause a shift in raster hue—for obvious reasons.

Checking the circuit with a VTVM is simple. Place the probe on the slider of the control to be tested. At one end, the B+ voltage should be read; at the other end should be B- boost or boosted-boost voltage. Either the control itself can be bad, or the decoupling capacitor connected to the slider. Again, make sure screen voltage is present at both the CRT socket and pins.

Picture Tube

Improper color balance can also be caused by a defective or weak picture tube. One or two of the gun elements may develop any of a multitude of troubles—open, short, weak, etc. If the defects within the tube structure are drastic enough, it will be impossible to obtain gray scale set-up. However, don't condemn the picture tube as bad until the tube is confirmed by a tester—or, checks reveal circuitry external to the tube is normal. Tubes suspected of low emission can be checked by biasing off the appropriate guns, to permit viewing only the gun suspected of low emission. Viewing the individual guns one at a time, permits a check (similar to the one used for testing black and white tubes) to be performed. If the screen to be checked has a "silvery" appearance in the highlights of the scene, chances are the individual gun being checked has low emission.

Summary

Part One of this article has pointed out the four circuit areas in a color receiver that can cause an upset in the white balance on the picture tube screen. It has been pointed out that a defect in the circuits directly associated with the picture tube can cause the overall raster to take on a definite tint of some color. This defect is apparent on the screen with a black-and-white picture.

When a tinted raster appears on the screen, set up and follow a definite troubleshooting sequence—analyzing the screen in an effort to isolate which of the four circuit areas could be causing the defect. For example, you may elect to perform an operational check on the picture tube and/or check the tube with a CRT tester. If the picture tube checks good, circuitry external to the tube must be checked. Remember, an overall tinted raster usually can be tied directly to trouble in the cathode drive circuits, the screen grid circuit, or an upset in the operation of one of the color-difference amplifiers.

In an upcoming issue, Part Two of "MANY HUED RASTERS" will discuss defects that normally show up only when color programming is present. Coupling both Part One and Part Two together should equip you with a knowledge to service "tinted" defects of all types. ▲

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 May and September.

Sears	7165, 7166 (Ch. 562.10200/201)	889-2
Sylvania	12P15, 12P16 series (Ch. A04-1/-2)	889-3
Toshiba	719C1 (Ch. TAC-1001)	892-3
Truetone	HFP-1663A-66, HFP-1665A-66, HFP-1667A-66, (2DC1663/65/67)	893-3

The following TV sets are given schematic coverage in the Extra Contents.

Olympic	CT-910	892-9-S
	9P59, 9P60	888-10-S
Packard Bell	MSJ-202, MSJ-204	888-10-S
RCA	AJ005E, AJ009E/Y (Ch. KCS157A)	890-11-S
	AJ024A/B/H/Y, AJ025C/-E/M/W (Ch. KCS165A)	890-11-S
	AJ087E/M/W, AJ091 M/W (Ch. KCS164D/E)	891-10-S
	AJ097E/M (Ch. KCS156J)	891-10-S
	CTC 22 series	892- 9-S
Sylvania	DO2-7 thru -12	889-9-S
	DO6-1, DO6-2	889-9-S
Airline	GHJ-7147A, GHJ-7157A, GHJ-8087A, GHJ-8097A/B	891-1
	GHJ-8746A	890-1
	GMW-14447A, GMW-14457A	888-1
Ambassador	A-2502, A-2504, A-2505, A-2506	891-2
Aristocrat	AA-519	888-2
Arvin	87K58	890-2
Coronado	TV21-9367A	892-1
General Electric	M420DEB, PAM424CVY, PAM451CWD (Ch. DD)	889-1
Hoffman	WP7419A (Ch. 917-000026)	893-1
Packard Bell	MSJ-202, MSJ-204	893-2
Penncrest	2895A-48, 2896A-46	892-2
Philco	Q3562TN, Q3567WA (Ch. 17J25)	890-3
	Q3910WA, Q3912WA (Ch. 17J28)	891-3
	Chassis 17JT41, 17NT45	888-3

NOTES ON TEST EQUIPMENT

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

By T. T. Jones

New CRT Tester

The new Model 465 CRT tester from B & K has many new features. It has been some time since the 445 was developed, and as good as it was, the state-of-the-art has advanced rapidly in CRT tester/rejuvenators. The Model 465 keeps pace with the advances, and incorporates a feature or two which are different, and we think very good indeed.

The most outstanding feature is the calibrated heater-meter. The heater voltage is variable in steps of 0-3, 3-5, 5-8, 8-10, and 10-13 volts. All popular CRT heater voltages are prominently red-lined. This insures that the heater voltage will be exactly right regardless of the current drawn. There's no need for a separate switch for "color."

The 465 also has variable G1 and G2 voltages and a special meter sensitivity switch for testing CRTs with normally low emission. Time controlled rejuvenating is now featured in the B & K CRT tester, with a 25-mfd capacitor discharging through the circuit each time the "Dynamic Intensifier" button is pushed.

The Model 465 is housed in a blue leatherette-covered wood case, a striking contrast to the older models. There is more than ample room in the cable storage compartment—also a departure from previous models from this and most other manufacturers.

We loaned the Model 465 to several technicians to try out in the field. Each time we had to fight to get it back. 'Nuff said.

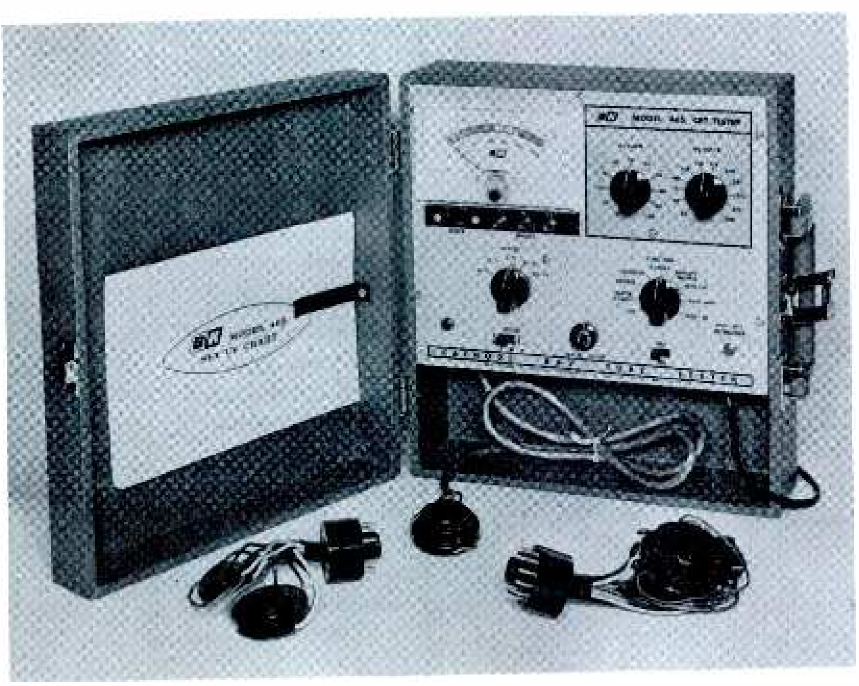

Fig. 1. New CRT tester has calibrated heater voltage.

B & K Model 465 Specifications

CRT's tested:
All presently manufactured TV types — both color and black-and-white.

Tests Performed:
Interelectrode shorts, emission, cutoff voltage, life test.

Corrective functions:
Three levels of cathode rejuvenation, removes shorts, welds open cathodes.

Size (HWD):
10½" × 11½" × 4½".

Weight:
7 pounds.

Power requirements:
117 VAC 60 Hz.

Price:
$89.95.

For further information circle 35 on literature card

Gm-Em Tester

Shown in Fig. 2 is Seco's new Model 107-C tube tester. Speed and convenience are the key points of this instrument. The setup for mutual conductance testing of most tubes requires the use of only filament and load controls.

There are six compactron sockets in the prewired section, which saves a terrific amount of time in testing these multisection tubes. There are 32 other sockets on the prewired panel. One of these is a blank 9-pin miniature for future use, and the others run the gamut of 7 and 9 pin miniature, octal, and nuvistor tube types. There are few common tubes which cannot be tested in the prewired section.

Those tubes which must be set-up in the Master Unit are tested for emission. The setup is still very fast since the tester employs lever switches. Two levers are used for heater connections, and another for the grid or plate—whichever is employed as the anode for the test. Additional switches may be employed to isolate pin connections as required.

The grid circuit test in the DMC section of the tester is fast—it reads as soon as the tube is plugged in. The indicator is a magic eye tube. The chart in Fig. 3 shows the amount of leakage which will open the eye to the "bad" region. The Master Unit checks for grid errors and H-K leakage when the tube is plugged in its socket. By a special procedure given in the manual, open elements can be identified with the Master Unit.

An interesting feature of the Model 107-C is the constant-voltage power transformer. This provides excellent regulation of the supply voltages without complicated circuitry. We found that the supply voltage for emission tests changed less than 4% with line voltages varying from 90 to 130 volts. As a side benefit, no fuse is needed. When a short causes an overload in the power supply, the transformer field collapses, automatically lowering the supply voltage.

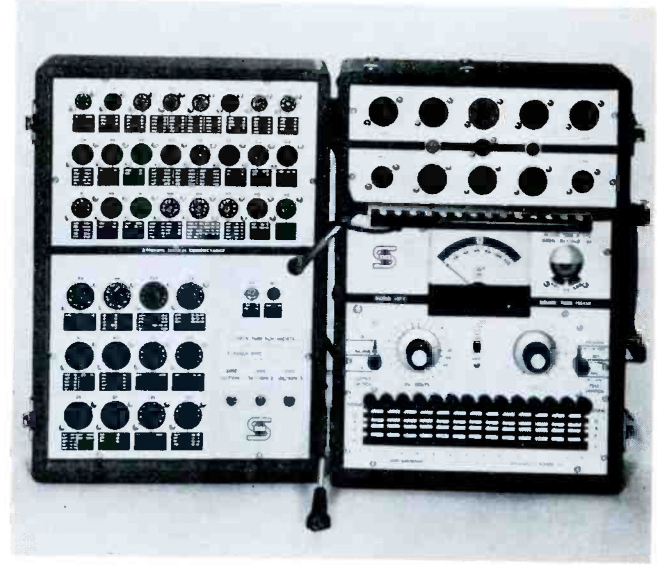

Fig. 2. New Gm-Em tester.

The Model 107-C is housed in a black leatherette-covered wood case. It's a pretty package but is somewhat of a heavyweight (15 pounds). Because of this, we wouldn't recommend it for outside jobs. As a bench instrument though, it's among the best. ▲

For further information circle 36 on literature card

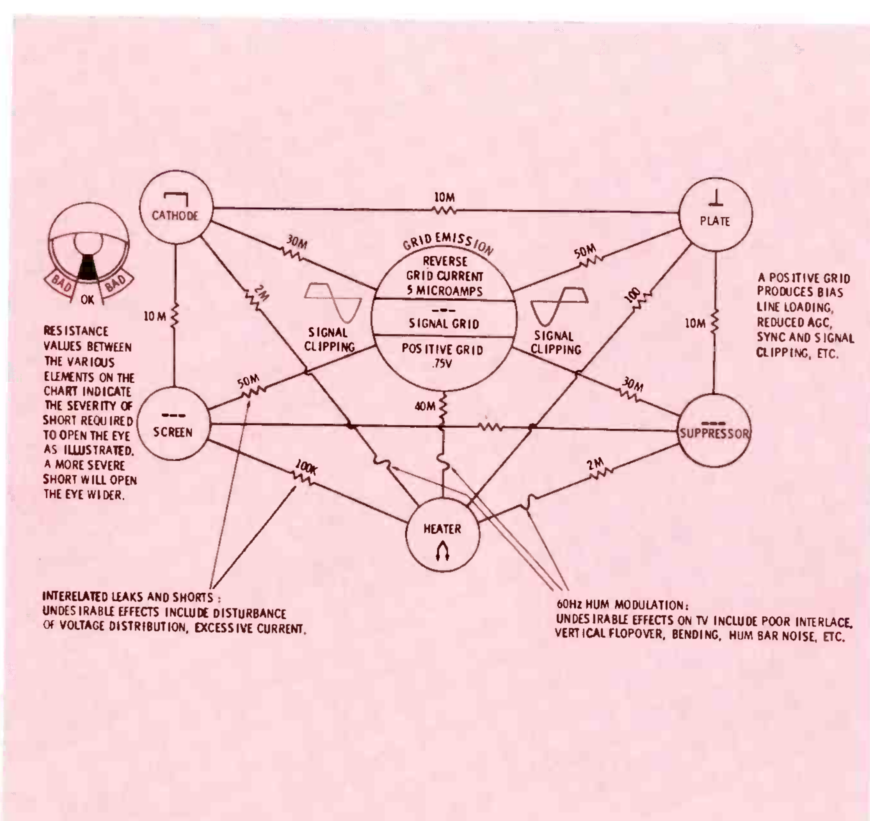

Fig. 3. Chart shows sensitivity of leakage tests.

Seco Model 107-C Specifications

Tube-socket complement:
- 8-pin octal
- 8-pin loctal
- 7-, 9-, and 10-pin miniature
- 9-pin magnoval
- 9-pin novar
- 10-pin decal
- 12-pin compactron
- 5- and 7-pin nuvistor

Tests Performed:
Interelement leakage, shorts, cathode emission (all types), transconductance (most types), open elements.

Power requirements:
105-130 VAC 50/60 Hz.

Size (HWD):
13″ × 9″ × 7″ (closed).

Weight:
15 pounds.

Price:
$198.50.

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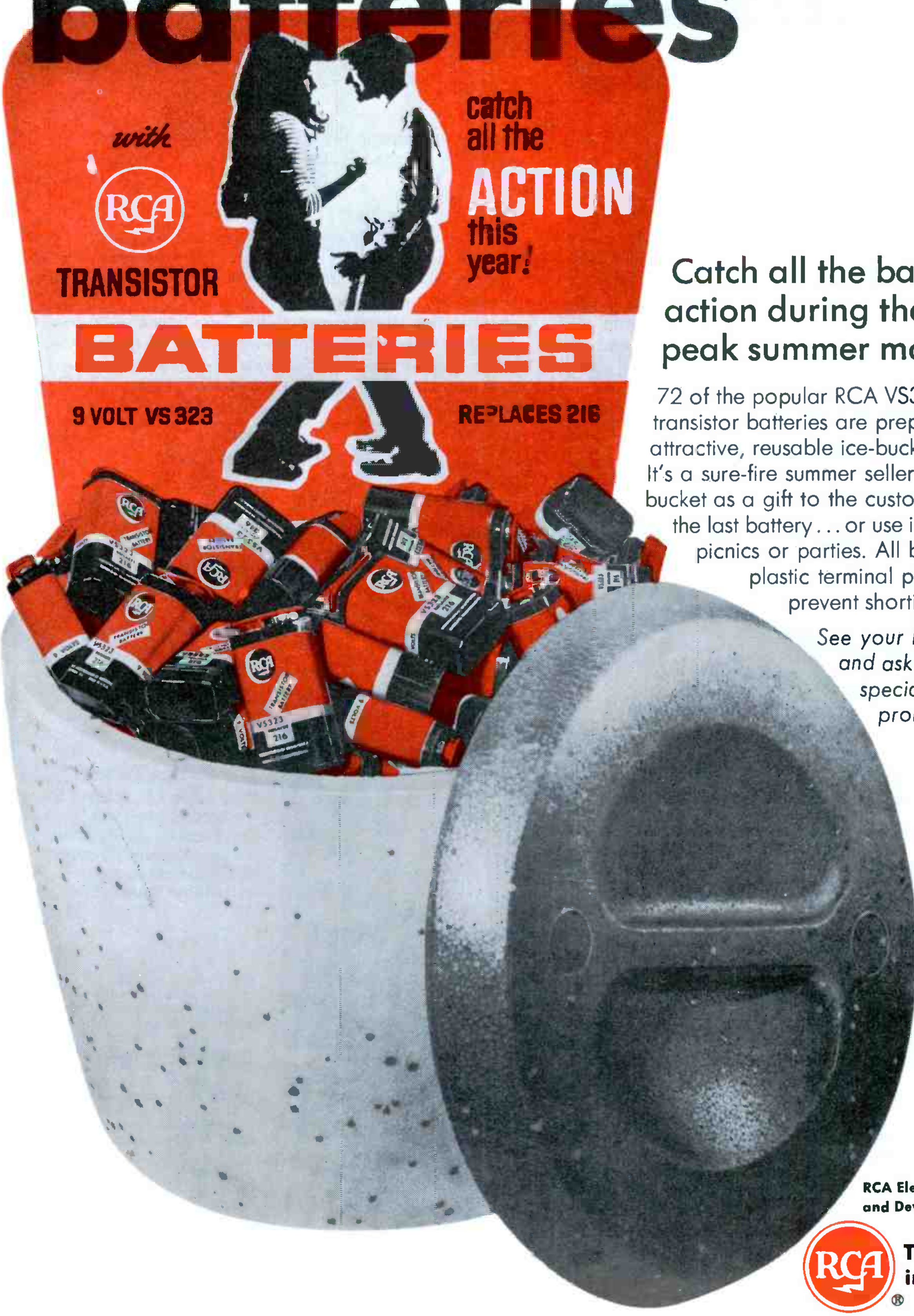

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THE TROUBLESHOOTER

answers your servicing problems

Substitute Cure?

I have an Admiral 25D6 chassis (PHOTOFACT Folder 540-1) with no color and poor vertical sync. Using the scope, I isolated the cause of trouble to two components in the 2nd video IF—C21 was discolored from excessive current caused by a shorted or leaky condition and R39 was also discolored and changed in value from the normal 68 ohms to 100 ohms. In addition to these defects, I discovered that R192, the 3.3k-ohm dropping resistor in the 270-volt source, had increased to 4K ohms. I replaced all defective components, including the 2nd video IF tube (6GM6), but the original trouble symptoms persisted.

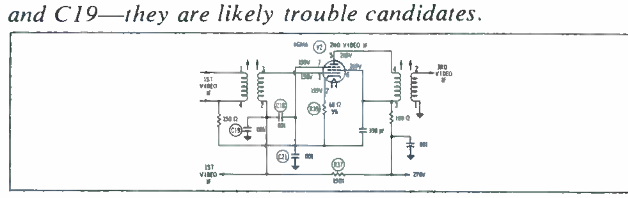
By accident, the 6GM6 was replaced with a 6AU6 and sync and color returned to normal. The cathode and suppressor grid pin connections are transposed on the two tube types; with the 6AU6 in the circuit, R39 is removed from the cathode circuit and placed in the suppressor grid circuit. All voltages are near normal with either tube.

Is it possible that the trouble symptoms were cured by the 6AU6 because the IF alignment was tampered with to offset the change in value of the defective components?

FRANK STEHNO

Omaha, Nebr.

The 6AU6 has a much lower transconductance than the 6GM6, which permits it to be operated with near zero volts bias without overloading and clipping the signal. I suggest you return the proper tube to its socket and perform normal voltage measurements. I'm sure you'll find that the grid bias is not correct. Measure from grid to cathode, not from grid to ground, and remember that the usual 10% tolerance does not apply to stacked IF's. Check R37, C18, and C19—they are likely trouble candidates.



BOOK REVIEW

Power Supplies For Electronic Equipment

Leo G. Sands; Hayden Book Co., Inc., New York, N.Y., 1967; 187 pages, 6" x 9", hard cover, $6.25; soft cover, $4.25

The volume begins with an historical analysis of the power requirements and circuits involved in the progression from battery operated radio receivers to transistor radio and television receivers. Voltage distribution, circuit grounds, balanced and unbalanced circuits, voltage regulation, and modern power supply requirements are also included in Chapter 1.

Chapter 2 deals with the design, characteristics, testing, and selection of primary and secondary batteries. Electromechanical generator applications and uitlity power systems are covered in Chapters 3 and 4. Chapter 5 is connected with the various types of power supply transformers and their applications, specifications, and color coding.

Rectifiers and rectifier circuits are the subjects of Chapter 6. The theory of operation of half-wave, full-wave, bridge, shunt, combination, and three-phase rectifier circuits is presented, along with an analysis of voltage and current relationships. Voltage multiplier circuits, such as the doubler and quadrupler, are also presented, as well as filament-type tube rectifiers, gas tube rectifiers, and semiconductor rectifiers.

Filters and voltage and current regulation are covered in Chapters 7 and 8. Chapter 9 discusses converters and inverters. The final chapter of this volume is devoted to power supply specifications. Size and weight, outputs, inputs, environment, overload protection, controls, and terminals are considered. ▲

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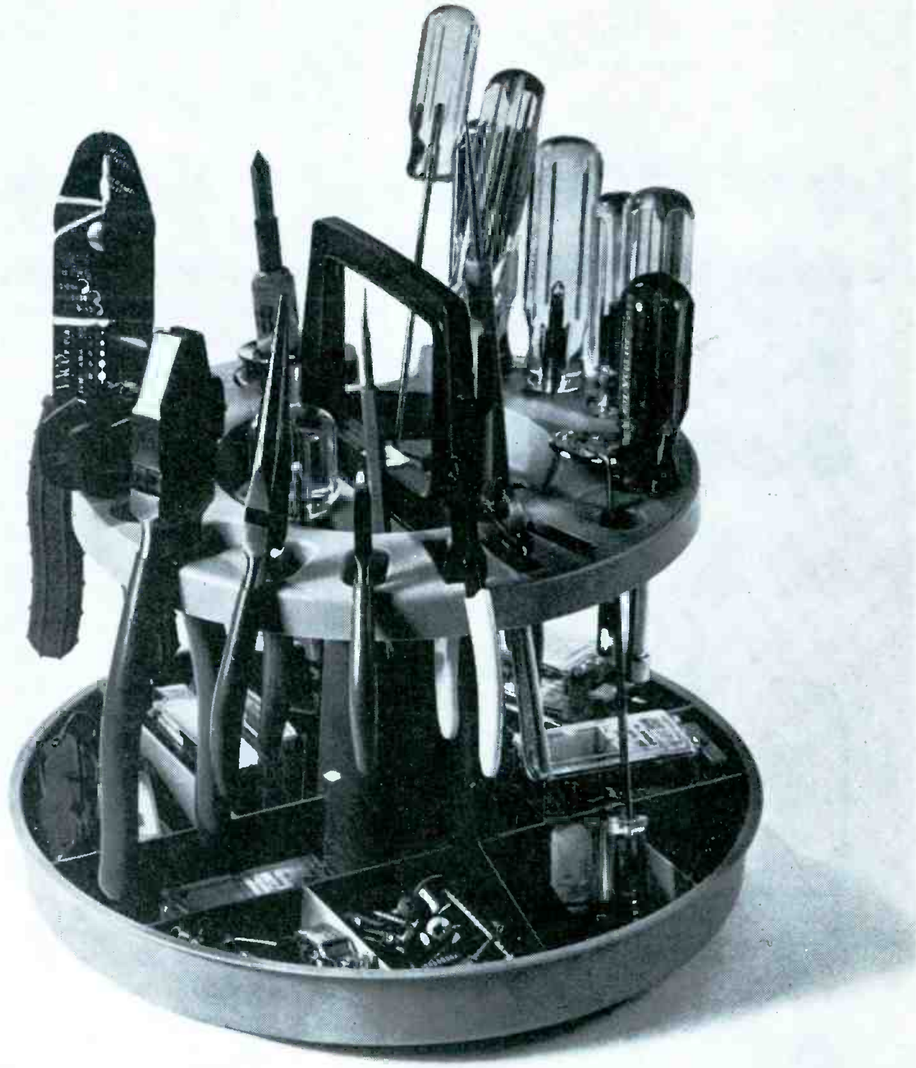

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PRODUCT REPORT

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

Peg Board Bottle Clips
(40)

Resistors, small capacitors, terminals, and other similar items found in electronics shops can be stored in empty baby food jars mounted on 1/8" thick pegboard with the aid of the combination dust-tight cover and holder shown here. Made of durable plastic, **Wickliffe Industries'** Handy Dandys are flexible enough to snap into the pegboard without breaking the holding prongs. The units are priced at $1.00 for 1 dozen, $2.50 for 3 dozen, $4.00 for 6 dozen, and $25.00 for 500.

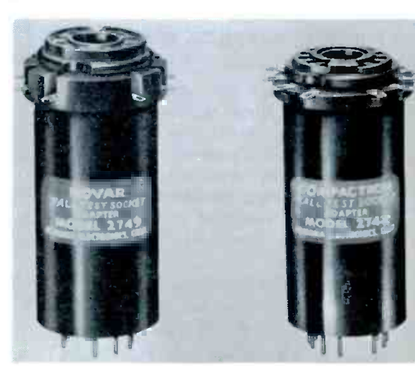
DC Scope
(41)

A wide-band, AC-DC oscilloscope especially designed for educational,

industrial, and service applications is announced by **Precision Apparatus.** Model S-55A is a lab-type instrument that combines high sensitivity and stability for a large variety of applications, from DC circuit analysis to high-frequency color TV work.

Specific features include an automatic sync that simplifies sweep frequency adjustment and speeds up the stabilization of patterns on the face of the CRT. The 500-KHz horizontal sweep permits brilliant display of high-frequency waveforms, such as the 3.58-mHz burst signal found in color TV receivers. A built-in regulated calibration voltage provides a rectangular signal to speed and simplify voltage amplitude measurements without external adapters. DC sensitivity is 70 millivolts per inch. AC sensitivity is 25 millivolts per inch. (Requirements for low DC measurements are typical to many new applications, including the growing medical electronic field).

A variable illuminated screen graticule is also provided, along with a camera mount bezel. The scope is priced at $169.95.



Test Lead Holder

(42)

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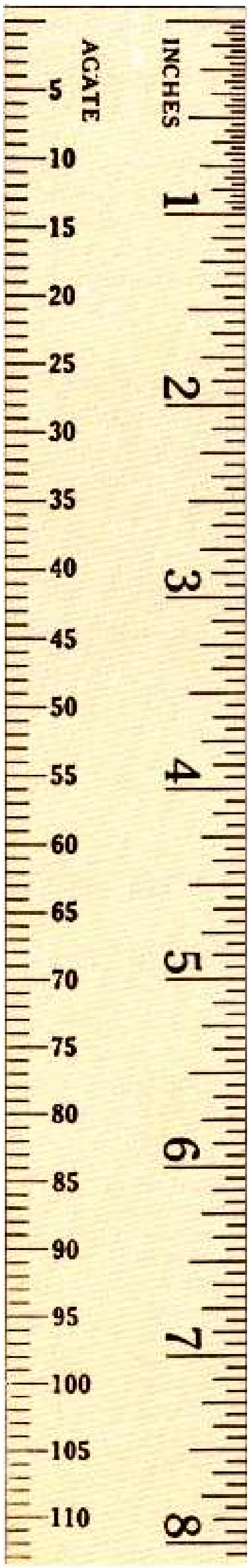

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DC MICROAMPERES: 0-50

DC MILLIAMPERES: 0-1, 10, 100, 500

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WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT

Circle 24 on literature card

store patch cords and cable assemblies used in electronic testing, has been announced by **Pomona Electronics Co.** The new rack, Model 2708, accepts cables up to 0.450" in diameter, which includes RG213/U, RG214/U, and other coaxial cables. Mounting holes are provided for easy installation on any vertical surface. The unit is fabricated from cold rolled steel and covered with a baked enamel finish. Price is $2.95.

Tape Cartridge Cleaner
(43)

A new cartridge-type head cleaner for use on 8-track stereo cartridge machines has been introduced by **G. C. Electronics.** The new "Musi-Kleen" cartridge kit consists of a regular 8-track cartridge equipped with five replaceable "Kleen-Tape" belts and the cleaning solution for use on the belts. The cartridge is merely inserted into the machine and the machine then turned on for approximately one-half minute to completely clean the built-up oxide and dirt on the cartridge heads.

The entire package is housed in a clear plastic container which can be easily stored in the glove compartment of an automobile for use on auto stereo tape playing machines. Price on the Musi-Kleen cartridge is $5.95.

Tube Tester
(44)

A faster, more versatile tube tester, the TC142 Mighty Mite V, has been announced by **SENCORE.** With a new Magnoval socket added, the unit checks all the latest tube types—over 3,000 foreign and domestic tubes in all.

A new horizontal in-line switch arrangement assures faster setups. Full emission, grid leakage, and shorts tests are provided. Each tube is tested under full rated load to detect borderline and tough-dog defects. The unit's high sensitivity of 100 megohms, or one-half microamp of grid current, tracks down intermittent, leaky, or otherwise hard-to-find tubes. Using the time-proven stethoscopic approach, the tester picks out true interelement shorts, with each element individually tested against all of the others, one at a time.

Compact and completely portable, the TC142 is housed in a vinyl-clad steel case with detachable hinged cover for full protection when the tester is not in use. An up-to-date setup booklet is also included. The complete unit is priced at $74.50.

PA Speakers
(45)

The speakers shown here are being dubbed the "60-second speakers" because a screwdriver is the only tool needed to mount and connect them and adjust the volume. The **Atlas** AP-30 series comprises four 30-watt models designed for high-performance sound reinforcement paging and talk-back systems.

The features that effect so much savings in time and labor in installation and wiring are: built-in 70-volt or 25-volt line transformers, screwdriver adjustable watts/impedance switch, screw terminals for solderless connection to line, terminal cover plate is also a cable strain relief clamp, and omni-directional 3-way adjustable mounting bracket. Prices start at $40.50.

Solid-State Color Generator
(46)

A new, solid-state color generator featuring complete stability in all service extremes is introduced by **B & K.** Designated Model 1242, the new unit gives the serviceman instant performance without adjustments, whether hot or cold.

The generator is designed to produce station-quality waveforms for quick, easy convergence and color adjustments of TV sets in the home or shop. The unit has only two front panel controls—an amplitude control and a pattern selector switch for dot, crosshatch, horizontal line, vertical line, and color patterns. Other features include over 5000 microvolts of RF output on channels 3 and 4, a built-in gun killer with "Miniclips" for easy connection, a vinyl-clad steel case with storage space for all leads, and a regulated, transformer power supply using a zener diode.

Only 2" high by 6¾" wide 9¾" deep, the Model 1242 weights just 2 lbs., complete with all cables. Price is $99.95.

Punch and Chisel Sets

Four matched (47) sets of the most popular sizes and styles of punches and chisels, each packaged in clear vinyl tool bags, have been introduced by **Kraeuter Tools.** Offered are new 12-piece and 5-piece punch and chisel sets, a 4-piece pin punch set, and a 3-piece chisel set.

The 12-piece punch and chisel set, desniated No. 23412, includes six punches and six chisels: four different sizes of pin punches, a center punch, a machine drift punch, three cold chisels, diamond point chisel, cape chisel, and a round nose cape chisel. The 5-piece punch and chisel set (No. 23405) includes a drift punch, a center punch, a pin punch, and two of the most popular cold chisels.

Two separate sets containing either punches or chisels are available in addition to the mixed sets. A 4-piece pin punch set, No. 23404, includes four of the best-liked sizes of pin punches. The 3-piece chisel set, No. 23403, provides a selection of favorite cold chisel sizes.

The 12-piece punch and chisel set (No. 23412) is priced at $13.00, the 5-piece set (No. 23405) at $5.00. The 4-piece pin punch set (No. 23404) sells for $4.00 and the 3-piece chisel set (No. 23403) is listed at $3.00. ▲

Sheet Beam

(Continued from page 29)

of course, depend on the color being transmitted.

The circuit which combines the —B-Y and—R-Y color components into the G-Y signal has also been deleted for simplicity. The 3.58MHz referance signal is applied to the deflectors at four different phase angles separated by 90 degrees (in quadrature), but the phase splitting circuit is not shown.

In Fig. 3, the left-hand family of curves shows the reference voltage at each of the deflector plates and two different chroma signals which might be present, at different times, at the control grids. The right-hand curves show the voltages which are produced at each plate for the two different chroma signals. The zero axis for these curves is the voltage at the plates with no chroma signal applied.

Consider the first chroma signal, (the dashed curves). Since they lag the D1 voltage by ninety degrees, the signal voltage at P1 consists of a series of half-cycles changing from maximum positive to maximum negative. When these are filtered to an average value, there is no change in the output voltage. At P2, the signal is inverted from P1, but again it produces no change in the output voltage. Since the chroma signal is in phase with the reference at D3, a series of negative pulses appear as the output of P3. Filtering these produces an average voltage which is negative with respect to the quiescent condition. The signal at P4 is inverted from the one at P3, and thus a positive output results.

Analyzing the effect of the above chroma signal on the picture tube, we discover that the blue gun, which is controlled by P1, experiences no change. The green gun, which is controlled by the combined outputs of P2 and P3, conducts less. The red gun, controlled by P4, conducts more. Thus, the color produced is red with some blue and very little green.

If we consider the second chroma signal (the dot-dashed curves of Fig. 3), a second set of outputs are produced. Now P1 goes negative, P2 goes positive, and there is no change from the quiescent state at either P3 or P4. The blue gun conducts less and the green gun conducts more, while the output from the red gun remains unchanged. Thus the color produced is green with some red and very little blue.

Conclusion

An infinite number of hues which are a combination of red, green, and blue can be created by changing the relative phase of the chroma signal. Space considerations have limited this article to the use of only two examples. Remember that the phase relation of the chroma and referance signals determines the hue, and that the amplitude of the chroma signal determines the degree of saturation, or intensity, of the color.

For simplicity or discussion, we have deliberately avoided reference to specific amplitudes, gain, phase angles, etc. which enter into a detailed analysis of chroma demodulation. This information may be obtained from a number of textbooks on color TV such as Oliphant and Ray, "Color TV Training Manual" (second edition, Howard Sams catalog #20472). ▲

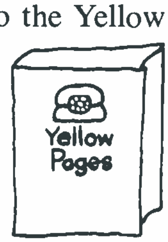
Are you eligible for the Bright Guy Awards?

It's easy to get them—and to get all the business they'll bring you. New customers. More sales. More money.

The Bright Guy Awards is the big program Sylvania's running this year to boost your sales.

Your Sylvania distributor can put your name and address in TV Guide ads in your area. The ads call you "the brightest serviceman in town" —and tell people in your town why they should call you.

You'll get into the Yellow Pages, too, under the heading "TV Service and Repairs."



Once again this year you'll be eligible for over one hundred valuable, interesting SMB-Bright Guy gifts, just for buying the Sylvania TV replacement parts you normally buy anyway.

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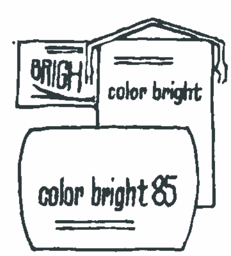
You're eligible for the Bright Guy Awards just by buying Sylvania's famous *color bright 85*® picture tube. And our other picture tubes, and our receiving tubes. So see your Sylvania distributor.



Sylvania Electronic Tube Division, Electronic Components Group, Seneca Falls, New York 13148.

SYLVANIA

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS GT&E

Circle 30 on literature card

INDEX TO ADVERTISERS

JULY, 1967

$FREE$ CATALOG AND LITERATURE SERVICES

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

ANTENNAS

75. *ALLIANCE* — Colorful 4-page brochure describing in detail all the features of Tenna-Rotors.
76. *ANTENNACRAFT* — 12-page catalog listing complete Antennacraft line of UHF, VHF & FM antennas for all types of installations.
77. *BLONDER-TONGUE* — Compact brochure detailing a line of all-channel products expressly designed to improve reception in the home and small MATV systems.
78. *COLORMAGIC*—Form FR-28-C describes a complete line of antennas and accessories.
79. *CORNELL-DUBILIER* — 16-page booklet illustrates color, black-and-white TV, and FM-stereo reception problems that are eliminated by the installation of a CDE antenna rotor system.
80. *DELHI*—Twelve-page catalog introducing a complete new line of home TV towers, ham towers, citizen's band towers, masts and telescoping masts.
81. *FINNEY* — Forms 20-338, 20-356, and 20-357 describing distribution amplifiers and antenna amplifiers for 300-Ohm and 75-Ohm TV and FM systems.*
82. *JERROLD* — New 4-page full-color catalog describes the new Paralog Plus antennas.*
83. *JFD* — Color Laser and LPV antenna brochures. New 1967 dealer catalog covering complete line of log-periodic out-door antennas, rotators, and accessories.
84. *MOSLEY* — Information on new Mosley MATV system for up to 8 TV/FM sets. Includes TV antenna, distribution system and outlets.
85. *WINEGARD* — 8-page color brochure on new Super-Colortron antennas: 5 VHF-UHF-FM, 4 VHF-FM, 3 UHF. Includes information on 6 new solid-state preamplifiers and 82-channel booster-couplers.

AUDIO

86. *ATLAS SOUND* — Catalog 556-67 illustrates and describes many new models of public address loudspeakers, microphone stands, and accessories for commercial sound applications.
87. *DUOTONE* — Catalog of accessory and maintenance items for the audiophile.
88. *ELECTRO-VOICE* — A comprehensive guide to microphones and microphone accessories is offered in pocket-sized brochure form.*
89. *JENSEN*—New electronic musical instrument louspeakers brochure, NY-2, containing newest additions to the line.
90. *KOSS*—Brochure about selected components from the Acoustech line.
91. *NUTONE* — 16-page full color booklet illusrating built-in stereo music, intercom, and radio systems.
92. *OXFORD TRANSDUCER* — Catalog sheets featuring speaker systems for automobiles.*
93. *TENATRONICS*—Flyer sheet about a home stereo cartridge player.

COMMUNICATIONS

94. *AMPHENOL* — 2-color spec sheets on new Model 650 CB transceivers and Model C-75 hand-held transceiver.*
95. *COMCO* — Spec sheet on the Model 626 marine radio-telephone.
96. *FANON* — 24-page handbook on intercom systems.
97. *GENERAL RADIOTELEPHONE* — Flyers on the Fieldmaster and MC-9 CB transceivers.
98. *MOTOROLA* — New brochure tells how to reach people on-the-move through use of personal two-way radio.
99. *PEARCE-SIMPSON* — Brochures and flyers on the complete line of CB transceivers.

COMPONENTS

100. *BUSSMANN* — Bulletin on BUSS Fustat Box Cover Units offers simple, low-cost way to protect work bench tools against damage and burnout. Units fit standard outlet or switch box, have fuse-holder plus a plug-in receptacle, pilot light, switch, etc.
101. *CENTRALAB* — 24-page replacement parts catalog No. 33GL.
102. *COLUMBIA WIRE* — 8-page supplement lists wire, cord, and cable.
103. *LITTELFUSE* — Pocket-sized TV circuit breaker cross-reference gives the following information at a glance. Manufacturer's part number, corresponding Littelfuse 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.*
104. *MALLORY* — New 1967 full-line catalog.
105. *QUAM-NICHOLS*—1967 general catalog of speakers.
106. *SONOTONE*—Data reference catalog on a line of nickel-cadmium batteries.
107. *SPRAGUE*—C617, a complete catalog of the Sprague line.*
108. *TRIAD* — 1967-68 replacement catalog. D-816 describes Switchcraft's new "traffic-tailored" audio dealer and distributor accessory merchandiser program.
109. *WORKMAN*—New coil catalog lists general and exact replacements for radio and TV schematic drawings and illustrations of all coils.

SERVICE AIDS

110. *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.*
111. *ELECTRONIC CHEMICAL* — Catalog sheets on aerosol sprays for servicemen.
112. *G.C.* — FR-67G flyer on color harnesses. FR-67A complete Audio-tex catalog.*
113. *INJECTORALL* — New 1967 catalog of chemicals and alignment tools.
114. *MIDSTATE TUNER* — 24-hour service on any make tuner is described in a colorful brochure.
115. *PERMA-POWER* — Chart shows correct brighter for every TV set in the field.
116. *PRECISION TUNER*—Mailing kit and replacement tuner list for same-day service.
117. *QUALITY TUNER SERVICE* — Introductory letter describing costs and service on all makes of TV tuners. Repair tags and shipping labels included.
118. *RAWN*—Bulletins on repair ideas using Plas-T-Pair knob and plastic repair kits. Also, bulletins on tuner cleaners and circuit coolers. Includes price sheets.
119. *SPRAYWAY* — Brochure on C-60 solvent cleaner and degreaser.

SPECIAL EQUIPMENT

120. *VACO* — 28-page, 4-color catalog on solderless terminals.

TECHNICAL PUBLICATIONS

121. *CLEVELAND INSTITUTE OF ELECTRONICS*—Free illustrated brochure describing electronics slide rule and four lesson instruction course and grading service.*
122. *PHILCO*—Information about Tech Data & Business Management service. Also, free parts catalog.
123. *RCA INSTITUTES* — New 1967 career book describes home study programs and courses in television (monochrome and color), communications, transistors, industrial, and automation electronics.
124. *RIDER*—Brochures on TV Tech/matics.
125. *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.*
126. *SIMPSON*—88-page booklet "1001 uses for the 260 VOM."*

TEST EQUIPMENT

127. *B & K*—New 1967 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.*
128. *EICO*—New long-form catalog of the complete Eico line.
129. *HICKOK*—Short form catalog plus specification sheets on the Models GC 660 color generator, CR-35 CRT analyzer/rejuvenator, and 860 Injecto-Tracer.
130. *JACKSON*—New line folder on "Service Engineer," test equipment includes push-button-operated color-dot/bar generator.
131. *LECTROTECH*—Two-color catalog sheet on new Model V6-B color bar generator, the latest improved model of the V6. Gives all specs and is fully illustrated.*
132. *MERCURY*—All-new-low-price color dot bar generator and Model 2000 conductance tube checker all for under $100.*
133. *PRECISION APPARATUS*—Illustrated catalog describing signal generators, oscilloscopes, and meters.
134. *SECO*—Operating manual for the HC8 in-circuit current checker.
135. *SEMITRONICS*—Brochure on the new Model 1000 transistor tester.
136. *SENCORE*—8-page full color catalog plus a new 4-page supplement catalog.*
137. *SIMPSON*—New 1967 16-page test equipment hrochure featuring a palm-sized VOM, Model 160.*
138. *SINGER*—Catalog GD-1 describing frequency meters and standards receivers for the two-way radio communications service.
139. *TRIPLETT*—Literature sheet on the new Model 600 transistorized VOM.

TOOLS

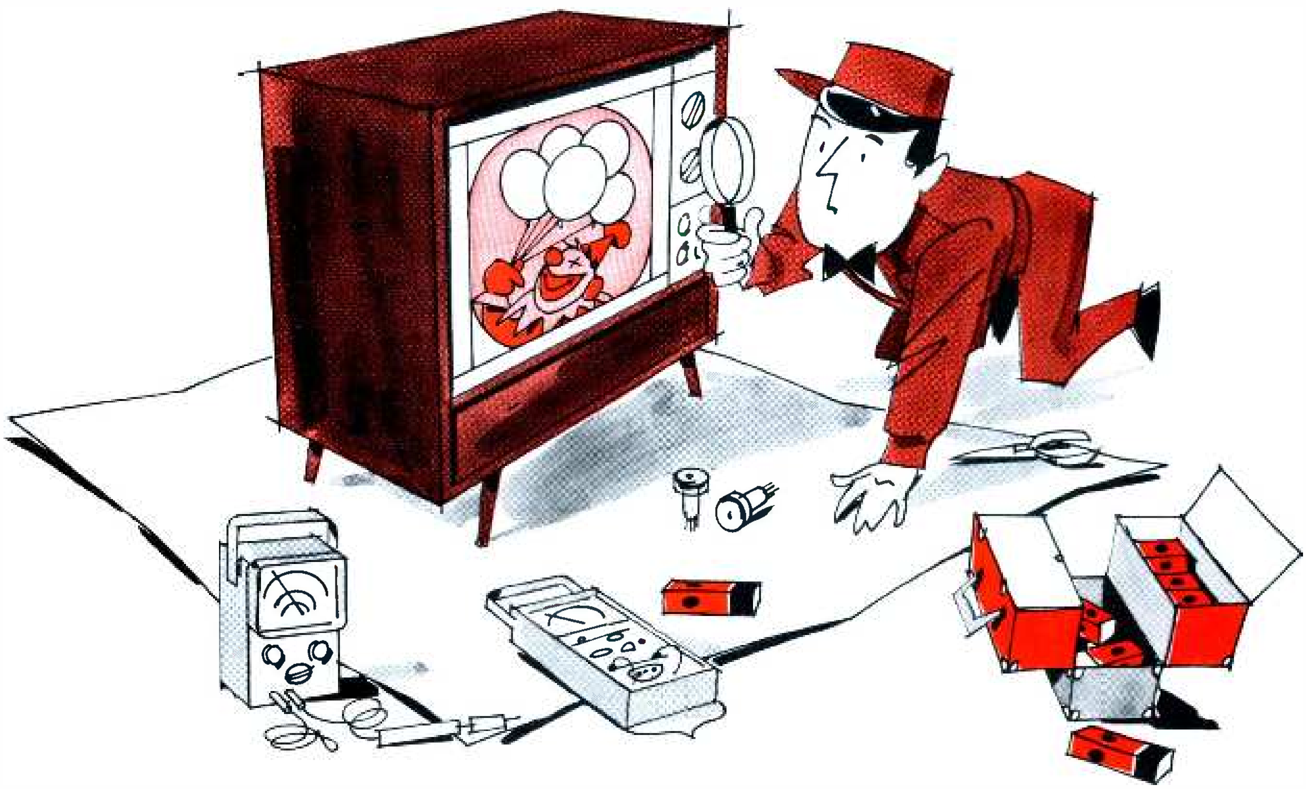
140. *ARROW*—Catalog sheet showing 3 staple gun tackers designed for fastening wires and cables up to ½" diameter.
141. *ENTERPRISE DEVELOPMENT* — Time-saving techniques in brochure from Endeco demonstrate improved desoldering and resoldering methods for speeding and simplifying operations on PC boards.
142. *XCELITE*—Bulletin N367 on a new 14-piece nut and screwdriver kit.*
143. *GENERAL SEMICONDUCTOR* — 26-page reference list covering 3000 zener and reference diodes.

TUBES AND TRANSISTORS

144. *IR*—Transistor cross reference guide—22 pages of detailed specifications on universal silicon and germanium transistors and a complete listing of more than 5000 devices which they replace.
145. *RADIO CORP. OF AMERICA*—PIX 300, a 12-page product guide on RCA picture tubes covering both color and black-and-white. Includes characteristics chart, terminal diagrams, industry replacement, and interchangeability.*

RCA's COLOR TV FASTCHECK #8

A PRIMARY COLOR MISSING?



If the color picture lacks one of the primary colors, use this procedure to localize the trouble:

Switch the set to an unused channel. If the raster is tinted, follow procedure A. If the raster is normal, follow procedure B.

PROCEDURE A (Color raster)

1. Make sure gray-scale tracking controls are set correctly.
2. Check and/or replace color-amplifier tubes. Remember that:
   white minus blue = yellow
   white minus red = cyan
   white minus green = magenta
3. If tubes are okay, measure tube-pin voltages with a VTVM or VOM. Use a tube-socket test adapter to avoid pulling the chassis.
4. If voltages are correct, use an RCA WT-115A Color Picture Tube Tester to check emission of the picture-tube guns.

PROCEDURE B (Normal raster)

1. Check and/or replace color-demodulator tubes. Note: If you suspect a faulty demodulator tube, interchange the demodulators; a faulty tube is indicated by a shift in colors in a color picture or bar pattern.
2. If tubes are okay, measure tube-pin voltages with a VTVM or VOM. Use a tube socket test adapter to avoid pulling the chassis.
3. If any voltage is incorrect, use conventional circuit troubleshooting methods to isolate the defect.

Your RCA tube distributor is your best source for top quality RCA receiving tubes for color TV, black and white TV, radio, and hi-fi. Increase customer confidence. Always replace with RCA receiving tubes.

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

RCA® **The Most Trusted Name in Electronics**

Give yourself a break you can depend on!

actual size
1¾"x1 3/16"x½"

#094077

Designed for the protection of television receiver circuits, the Littelfuse Manual Reset Circuit Breaker is also ideally suited as a current overload protector for all types of electronic and electrical control wiring such as model railroads and power operated toy transformers, hair dryers, small household appliances, home workshop power tools, office machines and small fractional horsepower motors.

CIRCUIT BREAKER CADDY

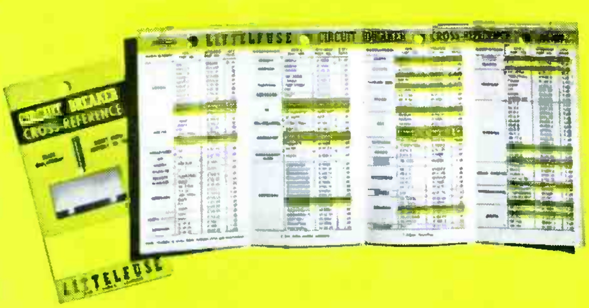
10 ratings, one each 2-1/4, 2-1/2, 2-3/4, 3, 3-1/4, 4, 4-1/2, 5, 6 and 7 amps.

#094076

SERVICE CADDY
Breakers and Fuses

One service call is all —8 breakers—one rating each 2-1/4, 2-3/4, 3, 3-1/4, 4, 4-1/2, 5 and 7 amps and 30 fuses—five each type C3/10, C1/2, C3-1/2, N3/10, N7/10 and N1.

Available individually packaged one breaker per display card; or 5 breakers of same rating per unit pack or as complete, versatile assortments for shop use or replacements in the field.



Included with each assortment:
Pocket size cross reference on color and black/white TV circuit breaker applications.
Form No. CBCRP-1266H

LITTELFUSE

DES PLAINES, ILLINOIS

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