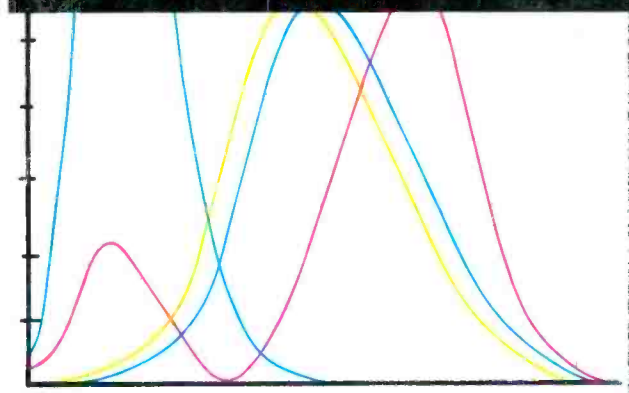
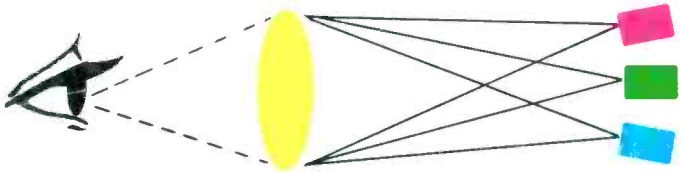
NOVEMBER, 1962 35 CENTS

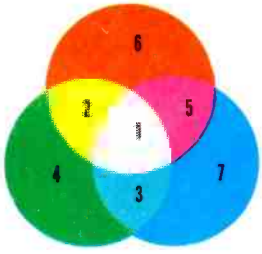
PF REPORTER

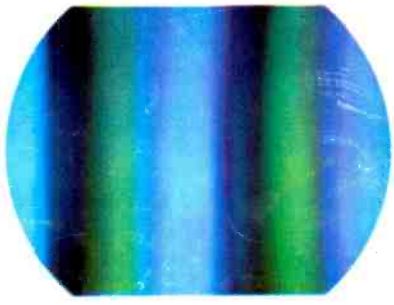
including Electronic Servicing





COLOR TV





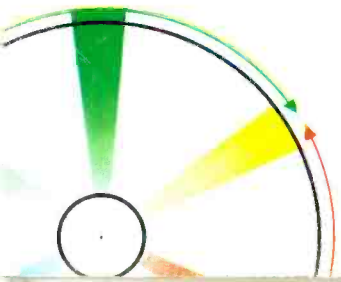
Corona—In the Cage and Out

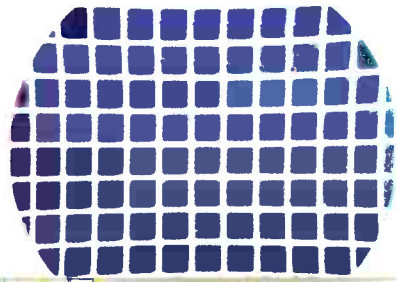
Objective: Pure White

A Look Inside a Color TV Station

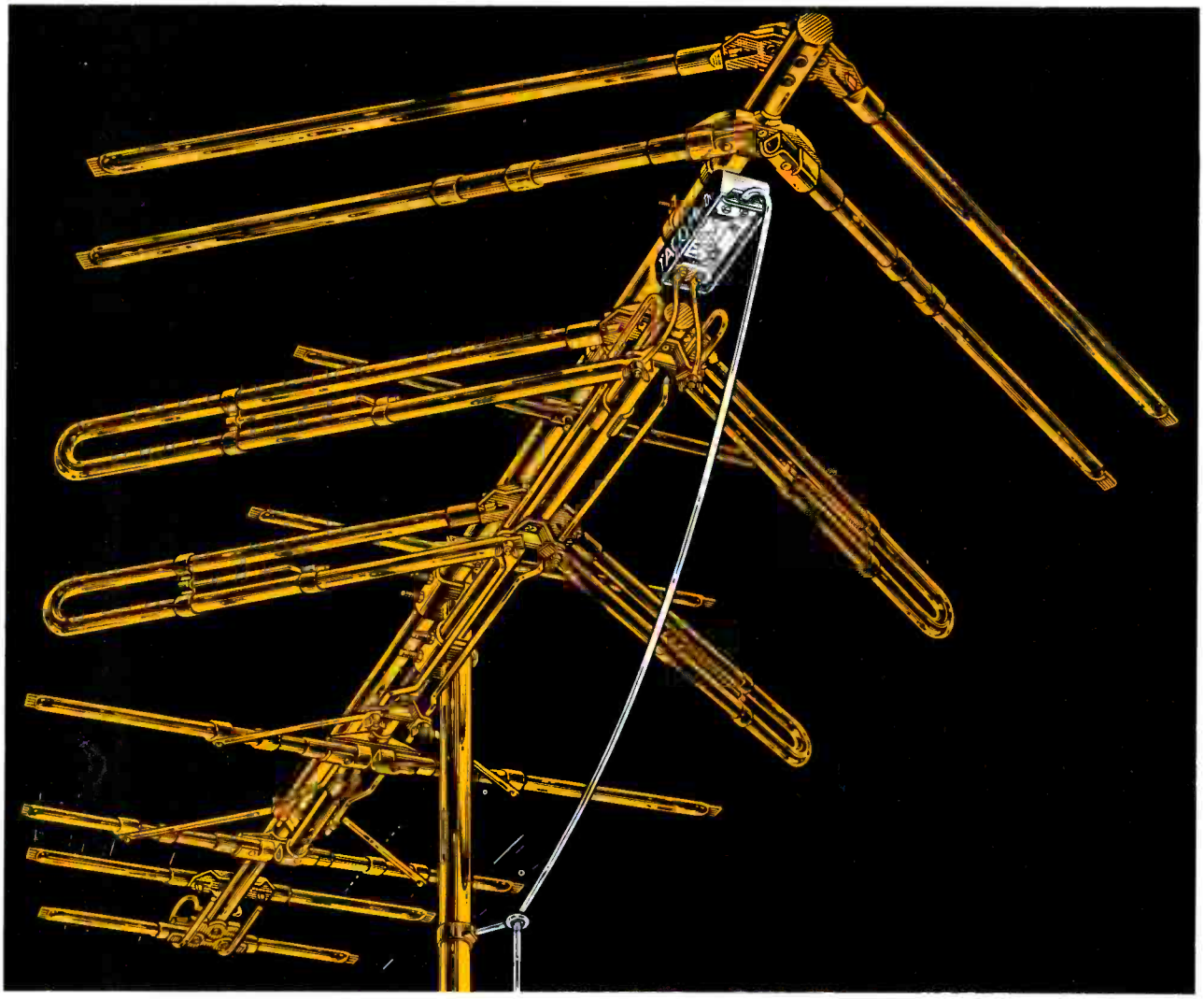
Color TV Service Aids

Chroma Demodulator and Matrix Stages





TACO T-BIRD ELECTRA



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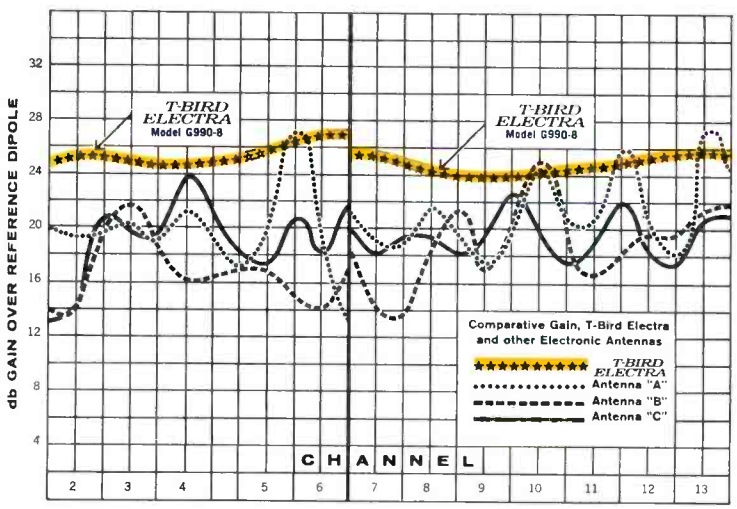
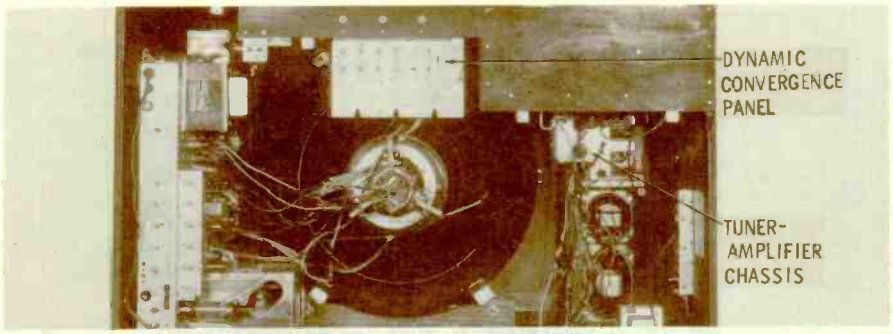
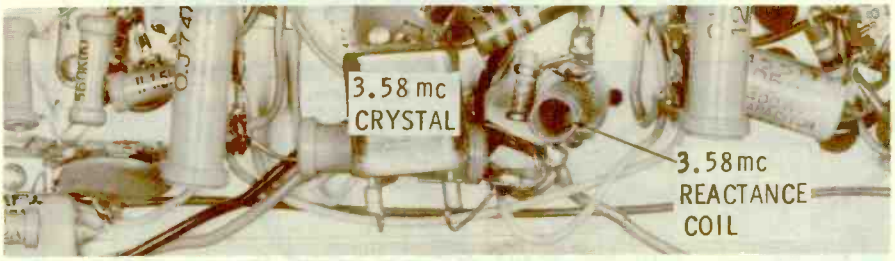
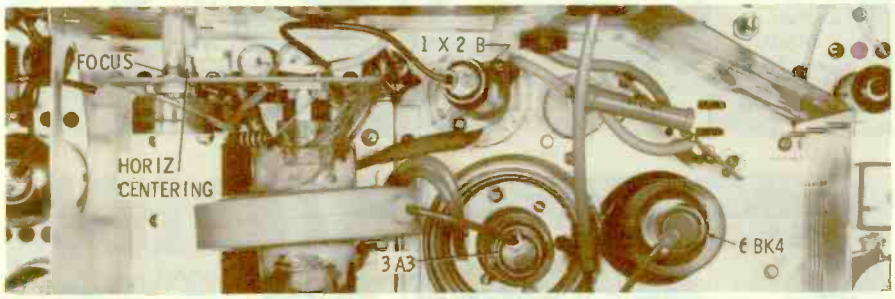


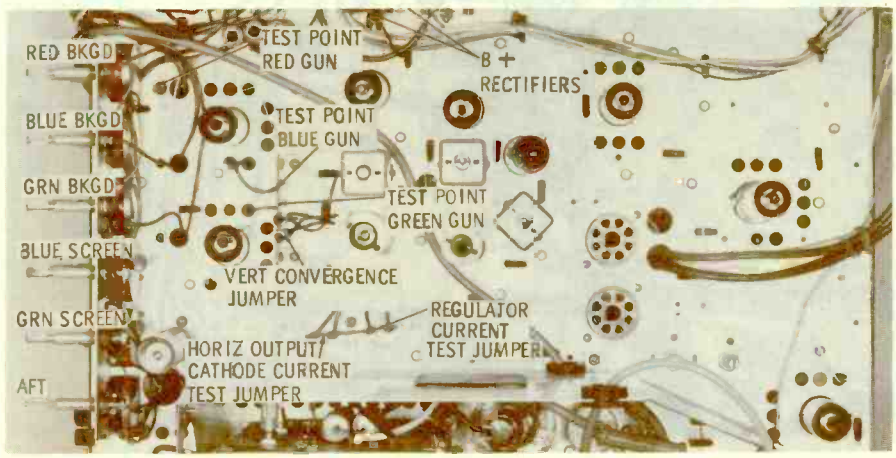
PREVIEWS of new sets

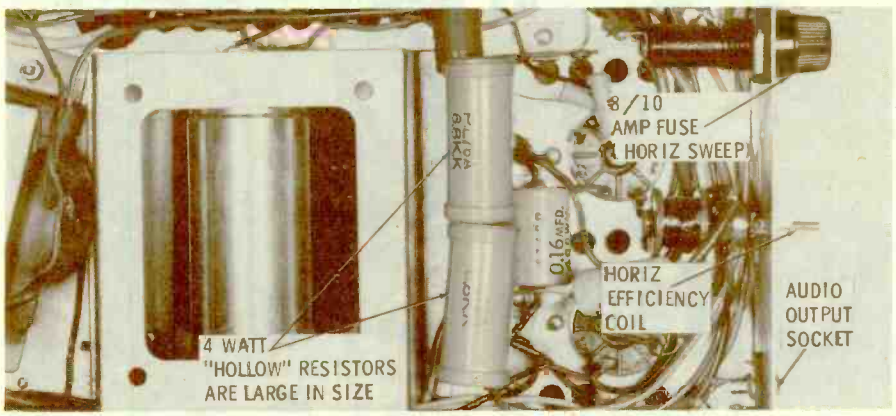
Delmonico











Delmonico
Model CC-210

This imported home entertainment center features a 21" color television (with 21FBP22 CRT), FM-AM tuner, four-speed phonograph, and stereo amplifier. Also included are provisions for adding an FM stereo adaptor.

The mode of operation (TV, FM, AM, PH) is selected by the four-position switch located on the radio control panel; other controls mounted on this panel include radio tuning, volume, tone, and on-off.

TV color, tint, brightness, contrast, vertical-hold, horizontal-hold, channel-selector, and fine-tuning controls are on a separate panel at the other side of the TV screen.

The switch-type tuner has a number of unusual features: electrical fine tuning, with an additional automatic-fine-tuning (AFT) control circuit to keep the oscillator on frequency; clearly marked channel numbers on the tuner face plate, to facilitate individual oscillator adjustment; a 7ES8 RF amplifier; and a 9A8 mixer-oscillator. The two tubes are wired in series, and their voltage is obtained from a separate winding on the power transformer—a point to remember if both of them fail to light.

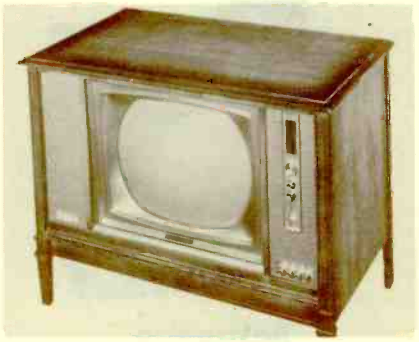
B+ voltage is obtained from the power transformer and two silicon rectifiers; protection for this circuit is provided by a thermistor and 5-amp fuse, series-wired in the primary winding of the transformer.

The IF frequency used in this receiver is in the 26-mc range, with the picture carrier appearing at 26.75 mc. After three stages of IF amplification, the signal is detected by two OA70 diodes (one for sound, one for video).

The horizontal sweep circuits (protected by an 8/10-amp fuse) include a 12BH7A AFC/oscillator, 6DQ5 output, 6AU4GTA damper, 3A3 rectifier, 6BK4 regulator, and a 1X2B focus rectifier. The high-voltage circuits and adjustments are similar to those in American-made color receivers. Connections to measure the current through the horizontal output and regulator tubes are conveniently located on the top side of the chassis; merely open the appropriate jumpers (marked on the chassis), connect your meters, and monitor the currents. (Various other color test points are marked on one of the photos.)

The convergence procedures and components for this receiver are similar in every respect to those used in American equipment.

PF REPORTER for November, 1962, Vol. 12, No. 11. PF REPORTER is published monthly by Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis 6, Indiana. Second-class postage paid at Indianapolis, Indiana. 1, 2 & 3 year subscription price: U.S.A., its possessions, and Canada: $4.00, $7.00, $9.00. All other countries: $5.00, $9.00, $12.00. Current single issues 35c each; back issues 50c each.



Packard Bell Model 21CC4
Chassis 98C6

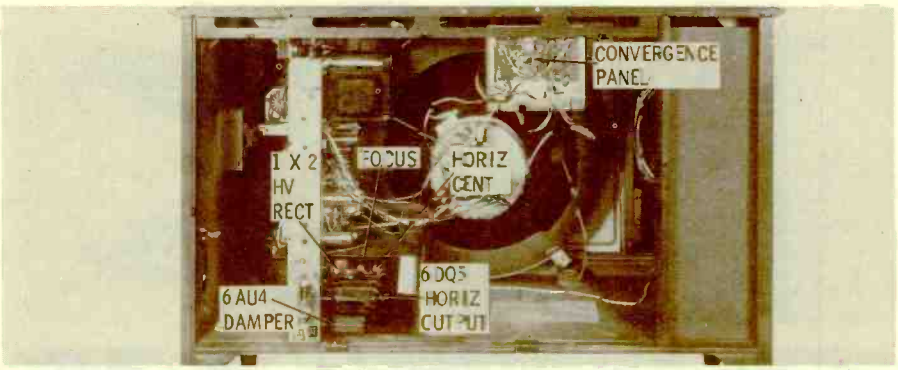
This model comes equipped with a 21FBP22 color picture tube; others available in this line contain a bonded 21FJP22 CRT. The turret tuner utilizes a 6GK5 RF amplifier and a 6CG8A mixer-oscillator. A switch, mounted on the rear of the tuner shaft, completes an electrical path to the appropriate channel-indicator-light, each time the tuner is switched to a different channel. (The lamp panel is shown in one of the photos.)

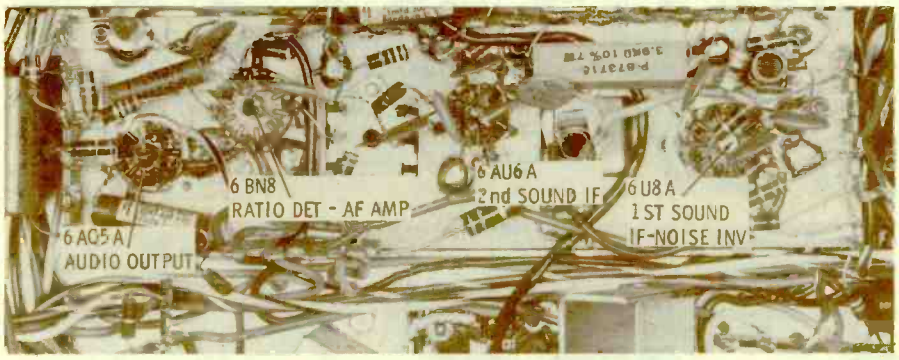
An additional panel is mounted on the underside of the chassis to furnish a place for convenient field installation of a remote-control assembly. Two remote units, in kit form, are available for use in this set; mounting and wiring instructions are packed with the units.

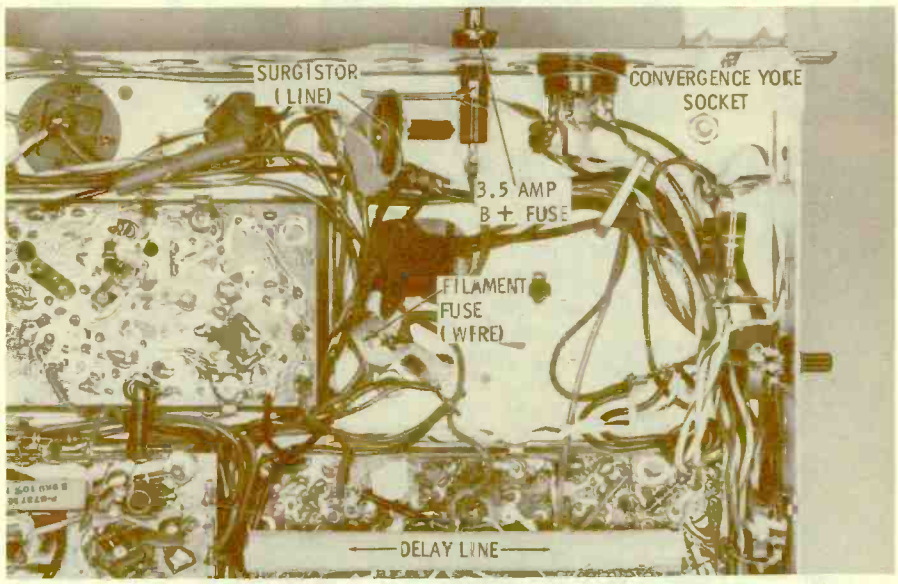
B+ for this receiver is developed by a full-wave doubler circuit utilizing a power transformer and two silicon rectifiers. A thermistor protects the primary winding of the transformer, while a 3.5-amp fuse protects the B+ circuit from overload. Other protective devices in this chassis include a wire fuse for the main filament line (the CRT and voltage regulator tubes obtain filament voltage from a separate filament winding), and a ¾-amp fuse for the horizontal sweep circuit.

The tube complement of the horizontal sweep stages is familiar: 6CG7 AFC/oscillator, 6DQ5 output, 6AU4 damper, 3A3 HV rectifier, 1V2 focus rectifier, and 6BK4 regulator. Tubes used in the color section are: 6U8A first chroma bandpass/color killer, 6AW8A second bandpass/burst amplifier, 6BN8 color sync phase detector/killer detector, 6GH8 chroma reference oscillator and control tube, 12AZ7 X demodulator/Z demodulator, 12BH7A B-Y/R-Y amplifier, and 12BH7A horizontal blanking/G-Y amplifier.

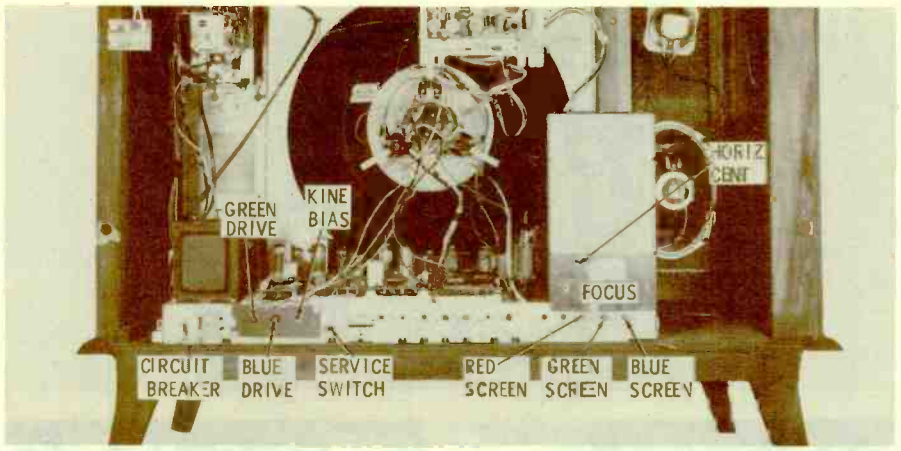
Operating controls for channel selection, fine tuning, brightness, color gain, hue, horizontal hold, vertical hold (killer threshold inside), contrast (vertical linearity inside), tone (height inside), and on-off-volume are mounted on the front of the cabinet. This set also has an internal brightness-range control mounted on the printed circuit board, under the 6AW8A video amplifier tube. Set this control in the following manner: Turn the brightness range full counterclockwise, turn up the external brightness to a point where the raster blooms, and then turn the range control clockwise to a point where blooming no longer exists; finally, return the brightness to a normal setting.

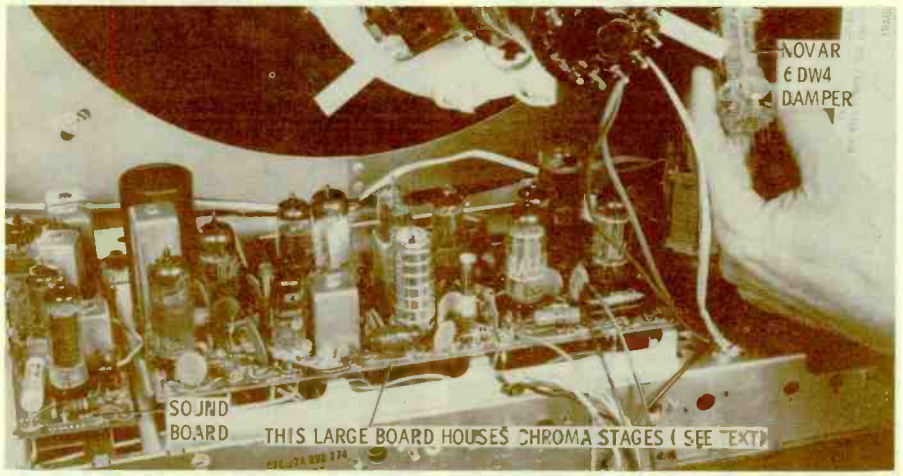






RCA





RCA Model 213G276MV
Chassis CTC12A

All color receivers introduced by RCA for 1963 contain this new horizontally mounted chassis. A total of four printed-circuit boards hold the majority of the components in this set. The largest board contains all the color-signal stages, plus the video output tube (a 12BY7A).

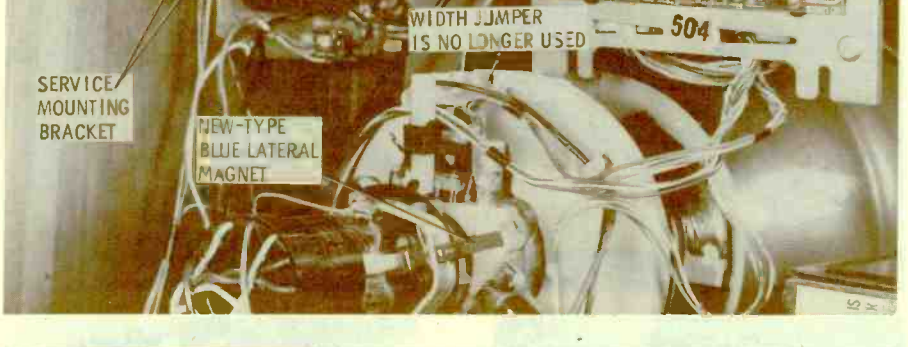
This tube is the *third* amplifier following the video detector. The pentode section of a 6AW8A is used as the first video amplifier, and the triode section of this tube operates as a second amplifier stage for the luminance signal only; the chrominance and sync signals are taken off at the plate of the first video stage, as in previous RCA color sets.

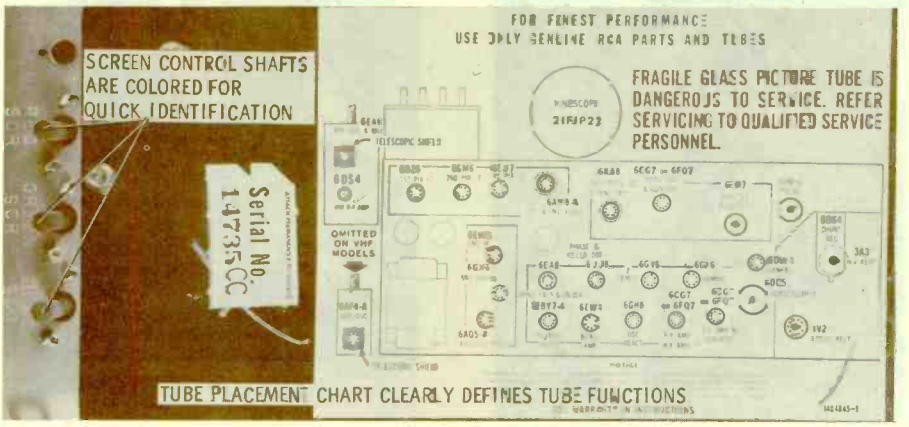
A newly designed 6JU8 (containing four diode sections) is used as a chroma phase detector and killer detector; other color-circuit tubes which differ from those used in the CTC11 chassis include two 6GY6's as X and Z demodulators, a 6FQ7 R-Y/B-Y amplifier, and a 6FQ7 G-Y amplifier/blanker. The bandpass amplifier/color killer is a 6EA8.

B+ for this transformer-powered set is developed by two silicon rectifiers wired as a full-wave voltage doubler. Protection for this circuit is provided by a circuit breaker in series with the primary winding of the transformer. This winding has a 128-volt tap, to be used in areas of high line voltage. The main filament line is protected by a wire-link fuse; filament voltage for the picture tube and 6BK4 regulator is obtained from a separate winding on the transformer.

The width jumper which was connected to the yoke in this manufacturer's previous color receivers has been discontinued. Also, you'll find a new type of blue-lateral magnet mounted on the neck of the CRT (see photo). To position the blue beam horizontally, slide the magnet in or out of its sleeve.

The switch-type tuner makes use of a 6DS4 nuvistor (a new, remote-cutoff triode) and a 6EA8 mixer-oscillator. The tuner is mounted separately from the chassis in this receiver, but may be temporarily attached to a bracket on the left rear corner of the chassis to facilitate shop servicing.





Zenith Model 6015W
TV Chassis 27KC20Q
Remote Chassis S-56864

The metal-cabinet model shown here is one of the smallest sets available in the new color television line introduced by Zenith. It comes equipped with an all-transistor remote control having CHANNEL UP, CHANNEL DOWN, ON-OFF-VOLUME, and SOUND-MUTING functions. To prevent erroneous keying, the remote receiver is completely shielded; one of the pictures demonstrates removal of the shield.

The low voltage for this chassis is developed using a power transformer and a full-wave voltage doubler with two silicon rectifiers. Last year's chassis made use of two 3DG4's in this application. These rectifiers are mounted on the top side of the chassis, where they can easily be replaced without removing the chassis from the cabinet.

The receiver is protected by 3/10-amp B+ and 10-amp line fuses located on top of the chassis near the rectifiers, and a 5/10-amp horizontal-sweep fuse near the high-voltage cage.

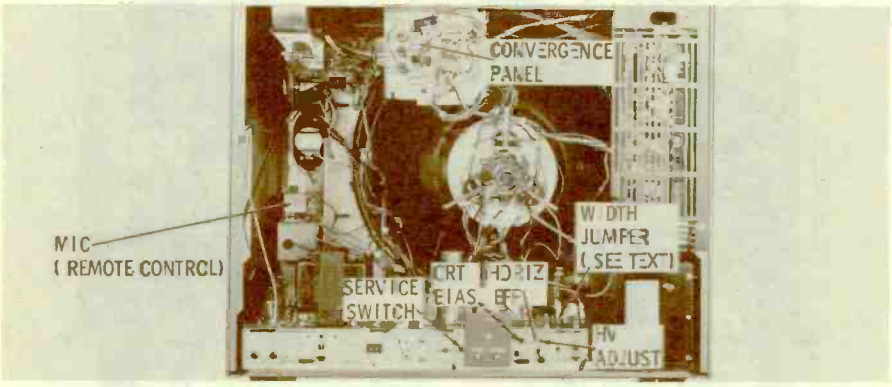
A clamping diode, wired in the input to the Y amplifier, provides a controlled bias to this stage, and prevents picture blooming at high contrast and brightness settings.

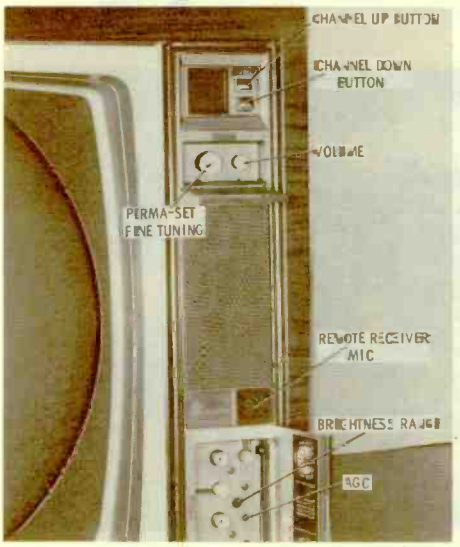
The first color amplifier tube has been changed to a 6HL8, replacing the 6GH8 used in last year's models. This tube provides reserve gain for the color signals. In the vertical circuit you'll find a 6GL7, a cousin of the popular 6EM7 used in this circuit last year. Another new feature in the vertical circuit is the thermistor in the deflection yoke; it senses temperature changes and maintains vertical stability during warmup.

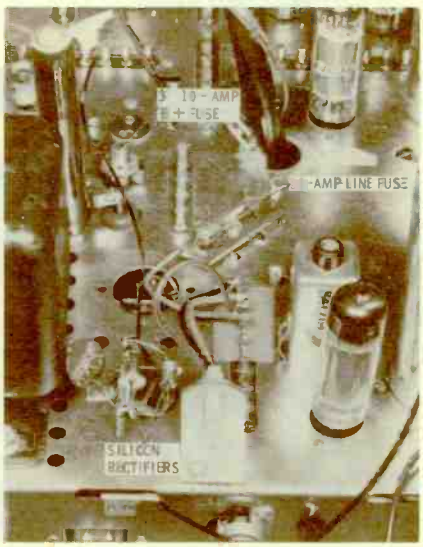
The width of the raster can be increased by moving the *blue* yoke lead (coming from the horizontal circuit) from the dummy connector on the chassis to the adjacent connector.

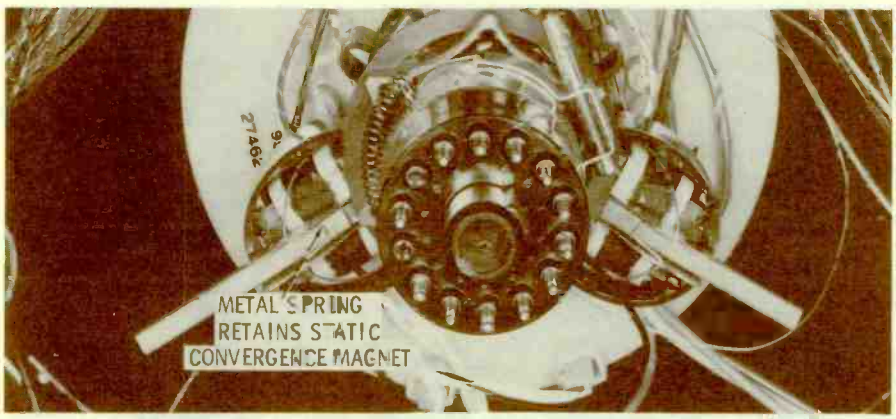
Auxiliary operating controls for brightness range and AGC are adjustable—with a screwdriver blade—through holes in the front control panel. A killer threshold control, new this year, is adjustable through the hollow shaft of the contrast control. Other controls adjustable through hollow control shafts on the front panel include the FRINGE-LOCK, inside the VERTICAL HOLD, and the HEIGHT, inside the BRIGHTNESS control.

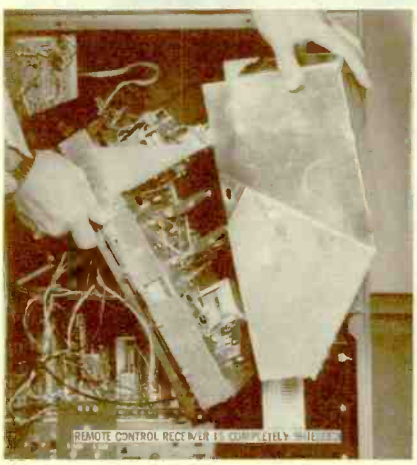
The setup procedures for purity, convergence, gray-scale tracking and high voltage remain much the same in this chassis as in previous Zenith color receivers.

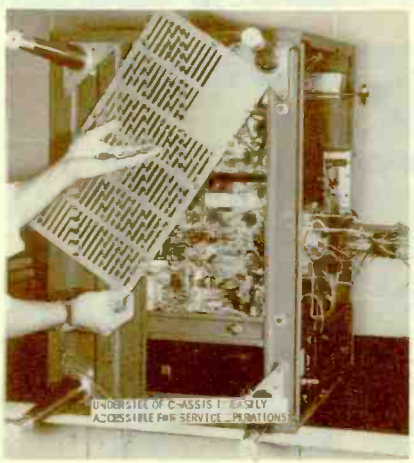












See PHOTOFACT Set 550, Folder 2

Mfr: RCA **Chassis No.** CTC11

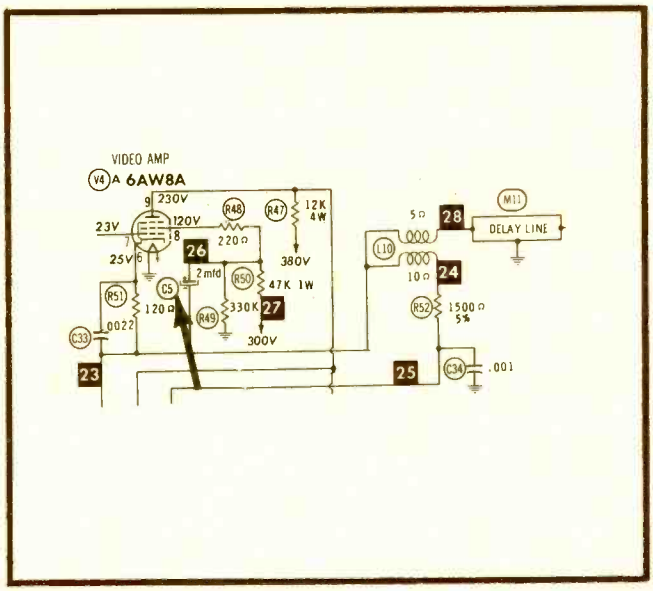
Card No: RCA CTC11-1

Section Affected: Pix and Sync.

Symptoms: Excessive contrast and unstable sync—looks like video overloading due to AGC trouble.

Cause: Leaky screen-bypass capacitor in first video-amplifier stage.

What To Do: Replace C5 (2 mfd—350V).



Mfr: RCA **Chassis No.** CTC11

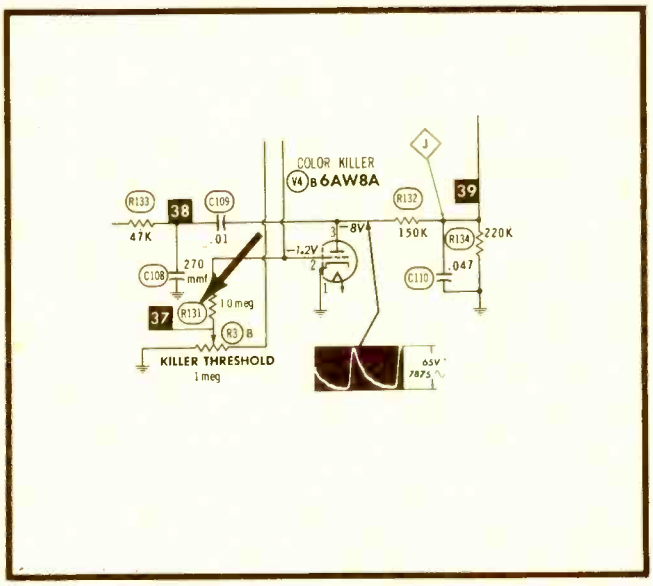
Card No: RCA CTC11-2

Section Affected: Color.

Symptoms: Gradual loss of color.

Cause: Decrease in value of grid resistor in color-killer stage.

What To Do: Replace R131 (10 meg).



Mfr: RCA **Chassis No.** CTC11

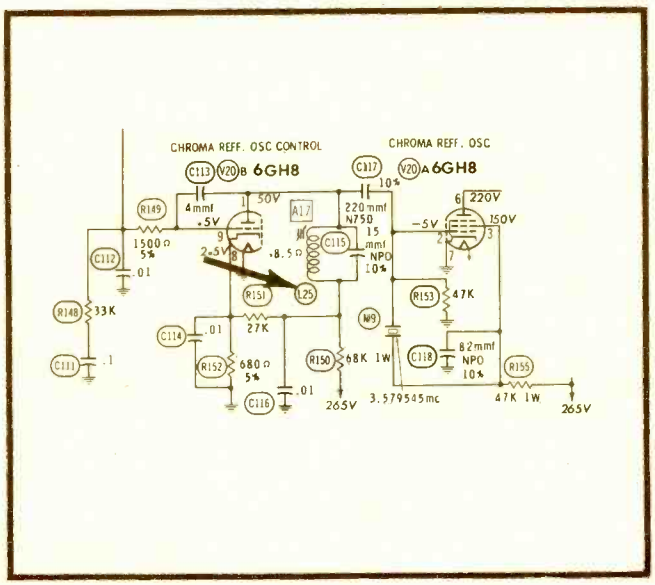
Card No: RCA CTC11-3

Section Affected: Color.

Symptoms: Colors change during color program.

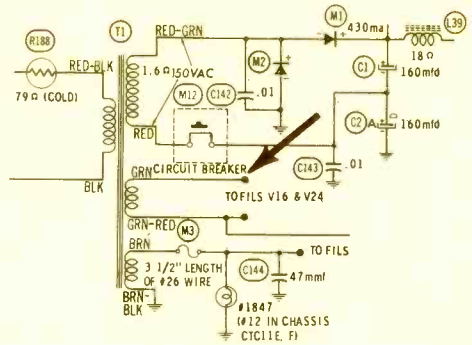
Cause: Color AFC circuits not properly adjusted.

What To Do: Ground TP1 (in chroma sync phase detector), and adjust reactance coil L25 for stable color presentation. Then unground TP1 and check tint control for proper setting. (This adjustment can be performed with chassis in cabinet.)



See PHOTOFACT Set 550, Folder 2

See PHOTOFACT Set 550, Folder 2



Mfr: RCA **Chassis No.** CTC11

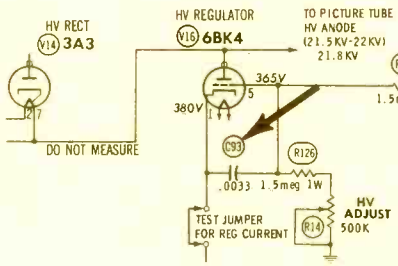
Card No: RCA CTC11-4

Section Affected: Raster and Sound.

Symptoms: Circuit breaker opens at frequent intervals, interrupting B+ to all circuits. No shorts or arcing evident inside set.

Cause: Excessive voltage (steady-state or transient) on power line.

What To Do: Check AC line for abnormally high supply voltage or sudden voltage fluctuations. In some cases, use of step-down line transformer is advisable.



Mfr: RCA **Chassis No.** CTC11

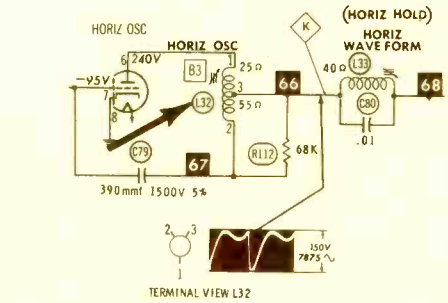
Card No: RCA CTC11-5

Section Affected: Raster.

Symptoms: Blooming and poor focus at high brightness settings. Horizontal-sweep and high-voltage tubes okay.

Cause: Intermittent short in capacitor connected between grid and cathode of HV shunt regulator.

What To Do: Check to see that leads of C93 (.0033 mfd) are not close enough together for a short to occur between them. If leads are not shorting, replace C93. Also replace V16 (6BK4).



Mfr: RCA **Chassis No.** CTC11

Card No: RCA CTC11-6

Section Affected: Raster.

Symptoms: Width decreases by 1" or 2" for short intervals, or rapidly jumps back and forth from normal to slightly narrow condition.

Cause: Intermittently shorted turns in horizontal oscillator coil.

What To Do: Replace L32.

See PHOTOFACT Set 599, Folder 2

Mfr: Zenith **Chassis No.** 29JC20,-Q

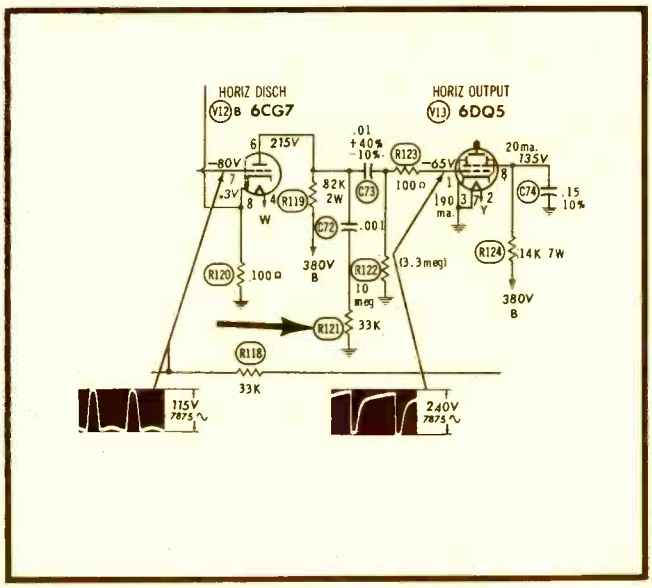
Card No: ZE 29JC20-1

Section Affected: Raster.

Symptoms: Insufficient width. Less than normal drive signal and DC bias voltage at grid of horizontal output tube.

Cause: Resistor in horizontal sawtooth-forming circuit changed in value.

What To Do: Replace R121 (33K).



Mfr: Zenith **Chassis No.** 29JC20,-Q

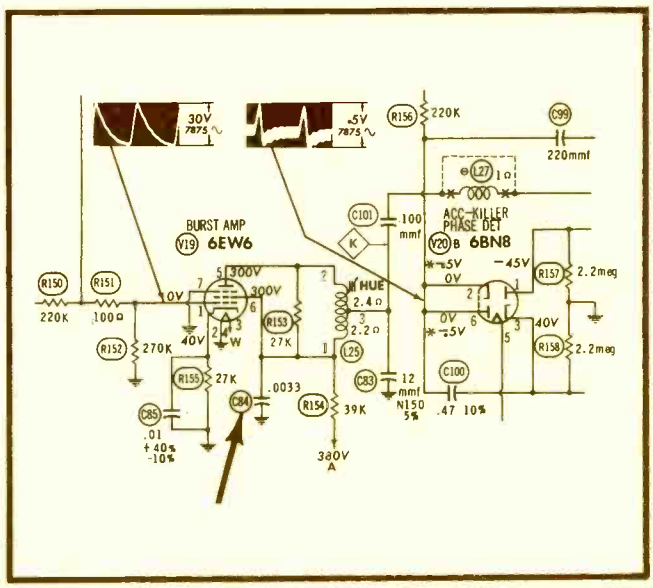
Card No: ZE 29JC20-2

Section Affected: Color.

Symptoms: Loss of color. Low voltage at plate (pin 5) of burst amplifier V19 (6EW6); incorrect bias at grid (pin 8) of color-killer phase detector V20B (6BN8).

Cause: Leaky screen-bypass capacitor in burst amplifier.

What To Do: Replace C84 (.0033 mfd); also R154 (39K), which may have been damaged as a result of defect in C84.



Mfr: Zenith **Chassis No.** 29JC20,-Q

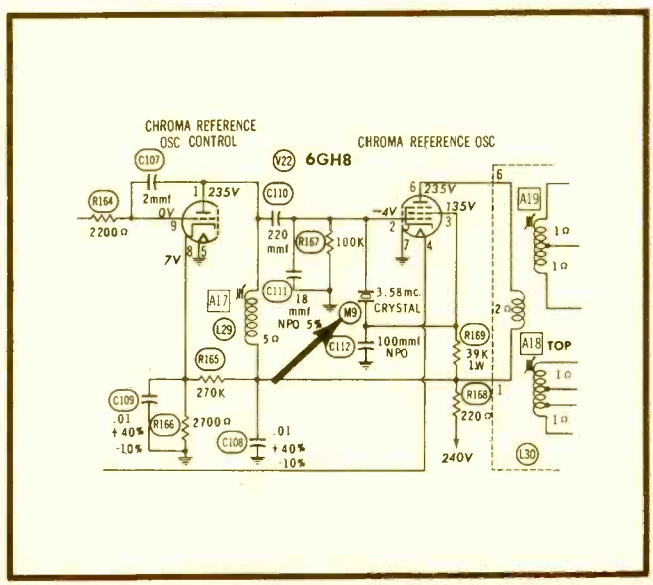
Card No: ZE 29JC20-3

Section Affected: Pix.

Symptoms: Picture tinted during black-and-white reception. Gray-scale tracking adjustments not effective. Tubes and voltages in video and chroma circuits all okay.

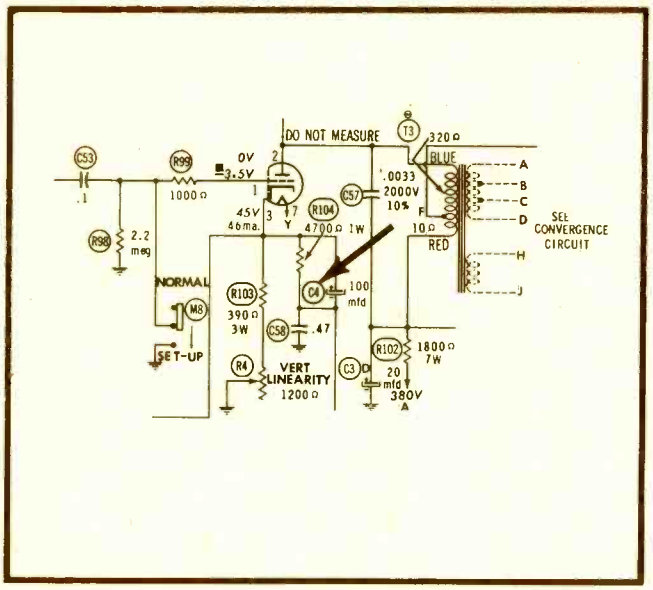
Cause: Defective 3.58-mc crystal.

What To Do: Replace M9.



See PHOTOFACT Set 599, Folder 2

See PHOTOFACT Set 599, Folder 2



See PHOTOFACT Set 599, Folder 2

Mfr: Zenith **Chassis No.** 29JC20,-Q

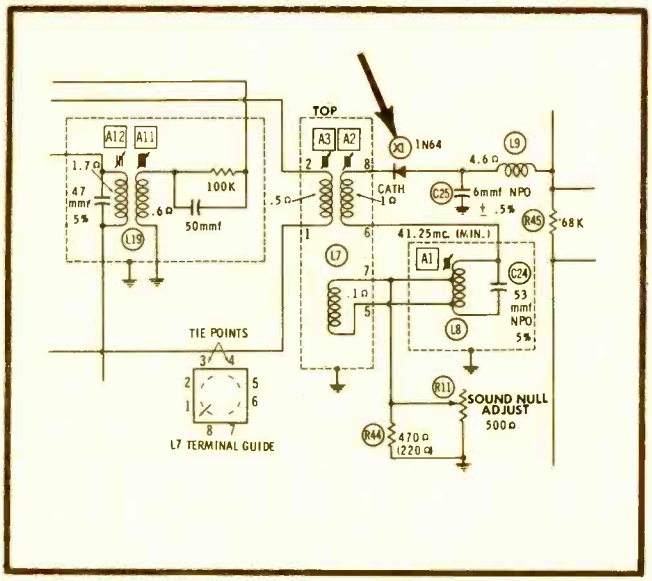
Card No: ZE 29JC20-4

Section Affected: Raster.

Symptoms: Poor vertical linearity; also, in some cases, not enough vertical sweep.

Cause: Leaky cathode-bypass capacitor in vertical output stage.

What To Do: Replace C4 (100 mfd—50V).



Mfr: Zenith **Chassis No.** 29JC20,-Q

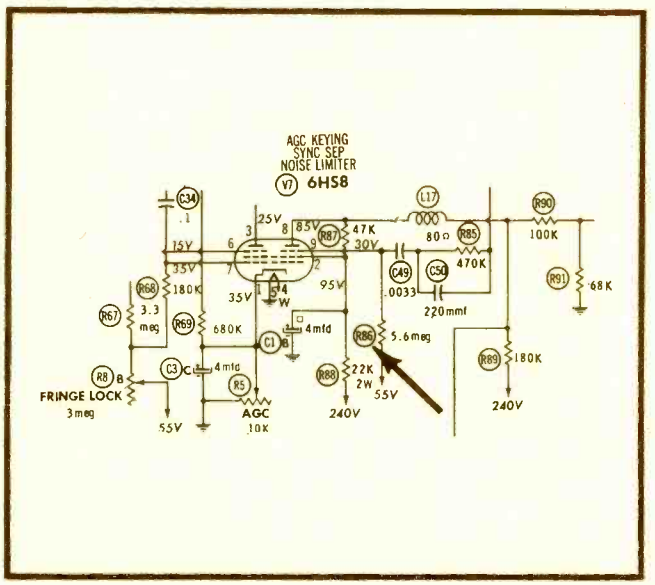
Card No: ZE 29JC20-5

Section Affected: Pix.

Symptoms: Intermittent loss of picture—sound and raster not affected. All tubes and voltages okay; no loose connections.

Cause: Defective video-detector diode.

What To Do: Replace X1 (1N64).



Mfr: Zenith **Chassis No.** 29JC20,-Q

Card No: ZE 29JC20-6

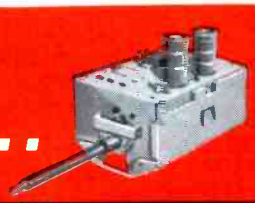
Section Affected: Sync.

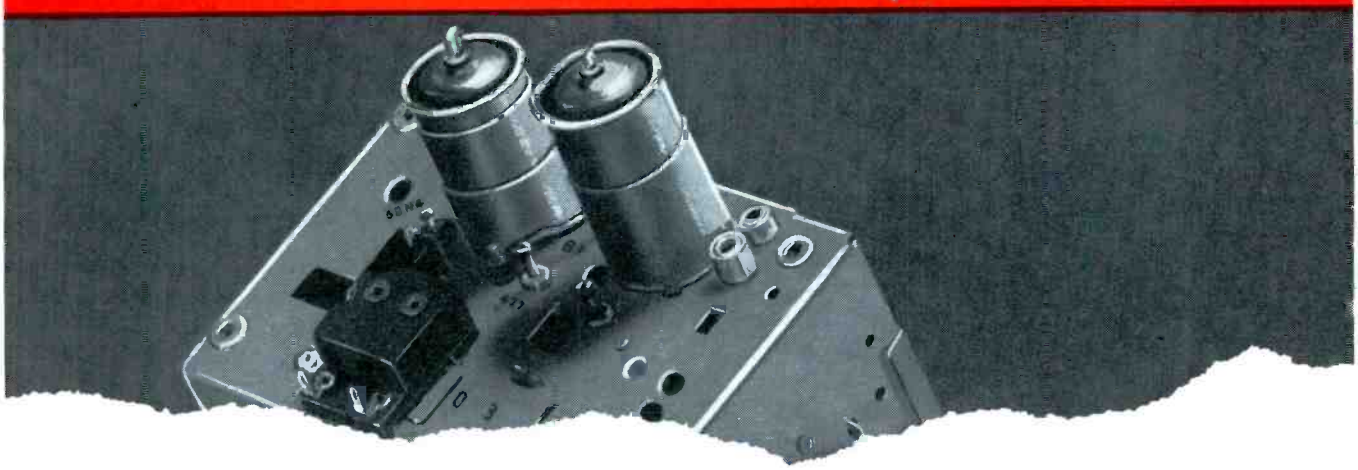
Symptoms: Unstable horizontal and vertical sync. Low voltage at pin 9 of sync separator V7 (6HS8).

Cause: Change in value of sync-separator grid resistor.

What To Do: Replace R86 (5.6 meg).

Standard Made It...





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Only BRAND NEW PARTS Used • 48 Hour Service on All STANDARD Tuners • Latest Testing Techniques Assure Proper Alignment • $3.00 Defective Tuner Trade-in Allowance Against a New STANDARD Replacement Tuner Carrying a 12 MONTH GUARANTEE

IN TV IT'S *Standard*

STANDARD has maintained uniform mounting centers for the last 13 years. Over 50% of the TV sets in existence today have STANDARD tuners—in the case of most other tuners one of the 8 STANDARD replacement models can be easily adapted or will fit directly in place of these units. All STANDARD replacement tuners carry a 12 Month Guarantee.

SEE YOUR AUTHORIZED STANDARD DISTRIBUTOR

MORE PROFIT FOR THE SERVICE DEALER • GREATER CUSTOMER SATISFACTION
GUARANTEED BY THE WORLD'S LARGEST TV TUNER MANUFACTURER

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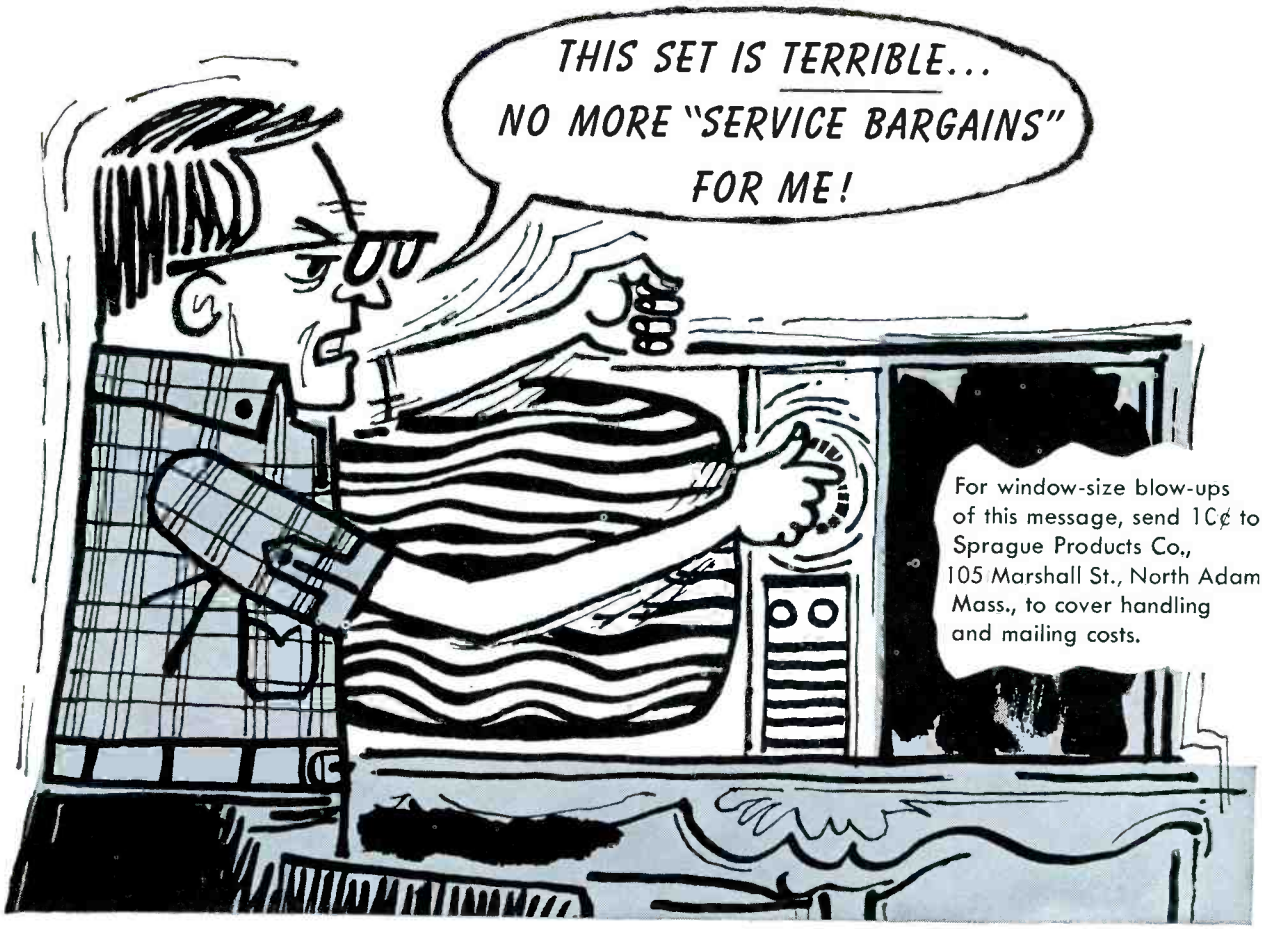

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 105 Marshall St., North Adams, Mass., to cover handling and mailing costs.

HOW TO BE SURE OF GOOD TV SERVICE...

1. Beware the Service "Bargain." If you shop around for cut-rate prices or extra-liberal service contracts, you're *asking* for trouble. A "something-for-nothing" offer usually means cut-rate parts and sub-standard service methods. The *reputable service dealer* spends years in study and training—thousands of dollars on test equipment, tools, and service manuals—countless hours in keeping up-to-date on new developments and service techniques. Because of this heavy investment, he can't *afford* to offer "bargains."

2. Rely on a Fully Qualified Independent Service Dealer. Well known and highly regarded by your friends and neighbors, his professional training and experience have made him a real technical expert. He takes pride in his work. He wants to stay in business. And he stakes his reputation and his future on satisfying *you*. So he'll use only component parts of the highest quality and latest design—plus his thorough knowledge and keen skills—to do the job right. Depend on him; he can't *afford* to let you down!

Your TV set provides you with a wealth of entertainment. Keep it in the best repair . . . at lowest cost . . . by calling your local TV-RADIO Service Dealer at the first sign of trouble!

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

6S-342 R1

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

PF REPORTER

including Electronic Servicing

VOLUME 12, No. 11 NOVEMBER, 1962

CONTENTS

ABOUT THE COVER

There is no longer any doubt that color TV is alive and "on the move." Its progress in the past year has been substantial enough to make even the skeptics sit up and take notice. This issue, complementing last November's all-color special, contains valuable information for those already experienced in color work, as well as for those just beginning.

LETTERS TO THE EDITOR

Dear Editor:

Your new *Symfact* is something I've wanted for years. I hope you enlarge on it, but it's a big help any way you look at it.

GERALD HESS

Versailles, Ohio

Dear Editor:

I'm pretty wild about your *Symfact* section on the 'BU8 in the September issue. I went through one of those circuits the hard way, just lately. Keep them coming!

M. P. WILLOUGHBY

Olivehurst, Calif.

Dear Editor:

I have just one word for *Symfact* — GREAT!

GERALD HOGAN

Cleveland, Ohio

Dear Editor:

Well done, on your *Symfact* feature. It's the best. I hope you carry through on all TV circuits. I'm going to save them and make a "Troubleshooter's Handbook" all my own.

FRANK D. MCCREERY

Providence Forge, Va.

Dear Editor:

I've just finished reading your *Symfact* on the 6BU8 sync separator. I think that is one of the best features you've had so far, although I find the entire magazine very good. I wouldn't be without it.

H. L. SMITH

El Paso, Texas

Thanks, fellows. The response to Symfact has been overwhelming, and you'll be seeing one every month. Anything to please!—Ed.

Dear Editor:

In the September article "Debugging B+," the center column on page 24 is doing battle with Fig. 2. It starts by saying, "On the negative half-cycle, M1 conducts as shown in Fig. 2A . . ." but the figure shows a positive half-cycle. Also, the arrows indicate electron flow, instead of current—I think. How about debugging the article?

BILL WHITE

Princeton, Fla.

Simply exchange the input waveforms so that Fig. 2A shows the negative half-cycle, and Fig. 2B the positive one. Then all will be well. Incidentally, Bill, the arrows do indicate electron flow, since that's what happens when conduction takes place.—Ed.

Dear Editor:

The September article "Calibrate Your Own Voltmeters" contains an error of omission. Mercury cells are available in two distinct voltages. In our line of batteries, single cells with an "R" suffix are 1.35 volts, while those without the "R" measure 1.4 volts. We make a mercury-type voltage-reference battery that has ½% accuracy. Also, the accuracy of any zinc-carbon is notoriously poor, because its voltage is radically affected by temperature, age, manufacturing tolerances, and all sorts of things. Even a brand-new one makes a poor voltage standard.

WM. F. MULLIN

Marketing Manager

P. R. Mallory & Co., Inc.

Indianapolis, Ind.

Thanks, Bill, for bringing these facts to our attention. This is the sort of information our readers can really use.—Ed.

Dear Editor:

We enjoyed your "And They Say Servicing is Fun?" article. I read it aloud to my wife, and we laughed till tears came to our eyes. We especially liked the part about the man watching the little line and hoping something would happen. The lady with the transistor radio was comical, too.

There is a lot of truth in the article about the headaches of a serviceman, but when you can read about them and laugh, the job seems a lot easier.

KENNETH WAGNER

Gresham, Ore.

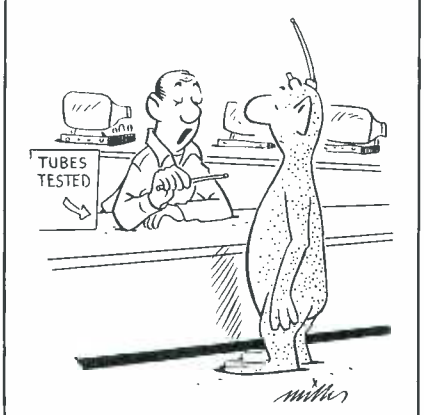
It's guys like "Charlie" who keep the service business alive, Ken. Glad you enjoyed the story.—Ed.

Dear Editor:

I've been trying for some time to locate a couple of pieces of test equipment; perhaps your readers could help. I know they're not built any more, but I'd like to find a Chanalyst or a Hickok Traceometer—both are tunable signal tracers. Got any idea where I can find them?

MERTON JONES

Newark, N.J.



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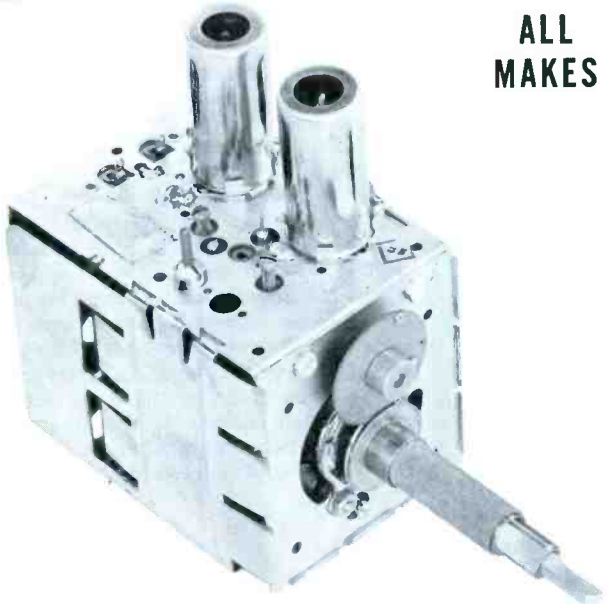

ONLY $8.50 INCLUDING

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24-HOUR SERVICE
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Tuners Repaired on Approved, Open Accounts

See your distributor, or use this address for fast, factory repair service

It just makes sense that a manufacturer of tuners should be better-qualified, better-equipped to offer the most dependable tuner repair and overhaul service.

Sarkes Tarzian, Inc., pioneer in the tuner business, maintains a complete, well-equipped Factory Service Dept. —assisted by Engineering personnel—and staffed by specialized technicians who handle ONLY tuner repairs . . . on ALL makes and models.

Tarzian-made tuners received one day will be shipped out the next. There is a 12-month guarantee against defective workmanship and parts failure due to normal usage. And compare our cost of $8.50 and $15 for UV combinations. There is absolutely no additional, hidden charge for ANY parts except tubes. Replacements available at low cost on tuners beyond practical repair.

Tarzian-made tuners are identified by this stamping. When inquiring about service on other tuners, always give tube complement . . . shaft length . . . filament . . . voltage . . . series or shunt heater . . . IF frequency . . . chassis identification. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

SERVICE MANAGER • TUNER DIVISION • DEPT. 3A

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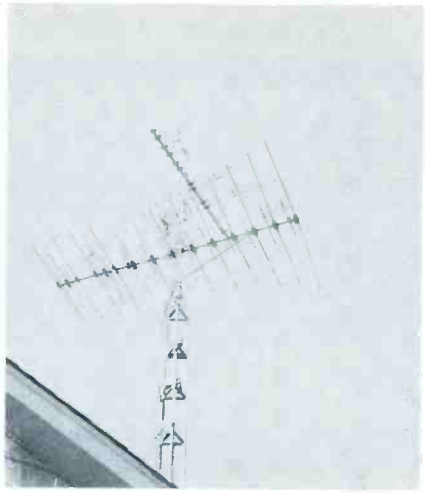

Dear Editor:

I thought you might be interested in this unusual antenna installation. We installed it for one of our customers who wanted to have a separate antenna for his children's set. He said he wanted it as compact as possible, and left the rest to us. The thing that complicated this problem was the fact that each antenna had to have its own rotator. The photo shows the arrangement we came up with. The topmost antenna is mounted on a ¾" pipe, which runs *through* the pipe of the lower antenna and the upper rotator, and is turned by the lower rotator. The bottom antenna is mounted on a ¼" pipe, large enough for the other to fit inside, and is turned by the top rotator.

J. EMBER

York, Pa.

Just goes to show what a little "Yankee" ingenuity can accomplish.—Ed.

Moving to a New Location?

If so, notify us by the 15th of the month to assure uninterrupted delivery of PF REPORTER.

Please be sure to give us both your old and new address, including your postal zone number. (Or better yet, enclose a current mailing label with your new address.)

Send to:

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4300 W. 62nd St.
Indianapolis 6, Ind.

are you replacing top quality tubes with identical top quality tubes?

You can, now! You can carry the identical tubes that you find in most of the quality TV sets you're servicing. Chances are, you were not aware that these sets were designed around special Frame Grid tubes originated by Amperex.

For some time now designers have been using many Amperex Frame Grid tubes in their quality TV receivers and we can tell you now that even more Amperex tubes are being designed into the sets you'll be handling in the future.

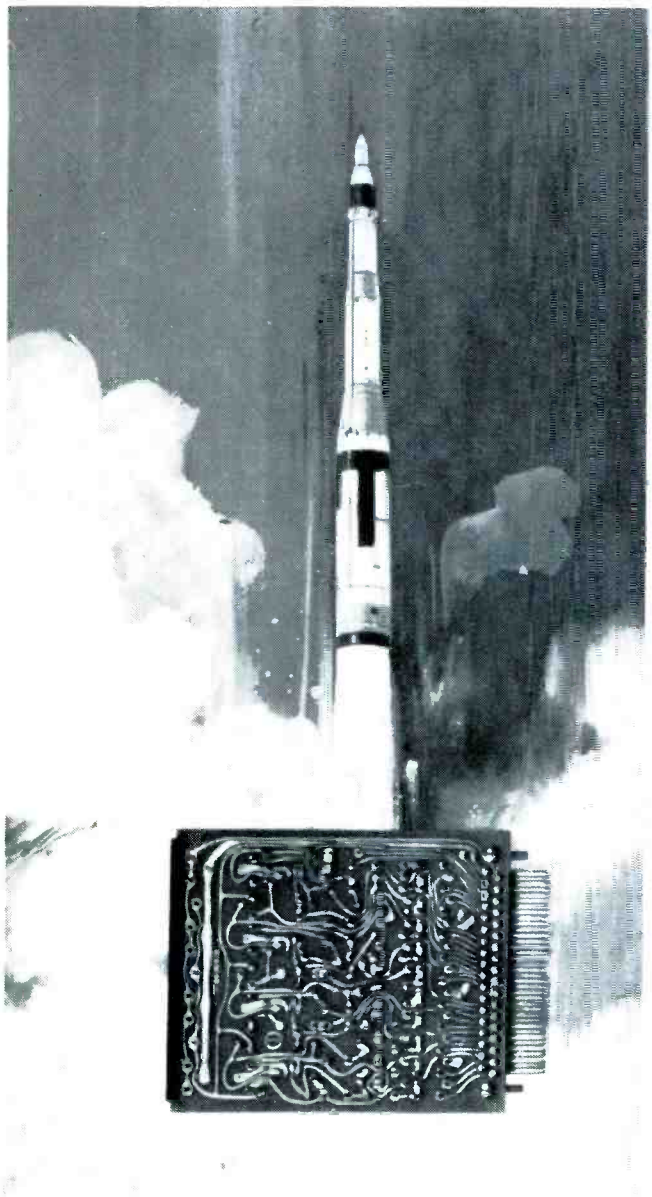
Compare, if you will, the performance of Amperex Frame Grid tubes with conventional IF tubes: they provide 55% higher gain-bandwidth, increase TV set reliability by simplifying circuits and they make your servicing easier, faster and more profitable because their extraordinary uniformity virtually eliminates time-consuming realignment when you replace tubes. Technicians are finding Amperex THE line to carry.

Tubes introduced by Amperex and currently being used by major TV set makers include:

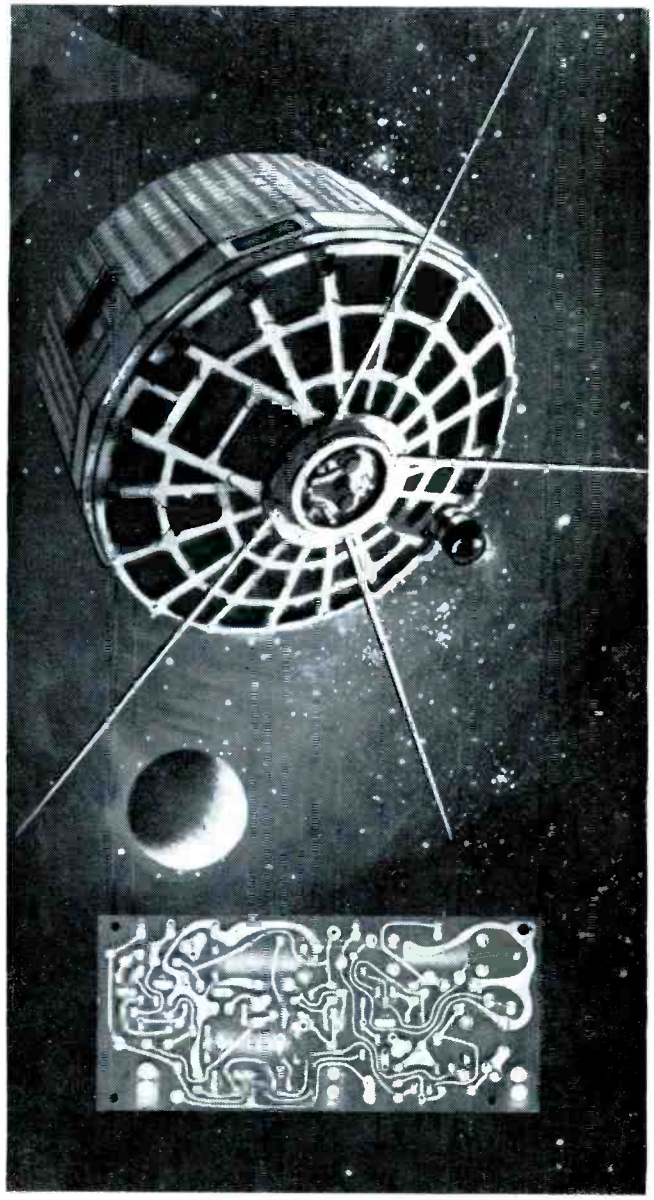
Frame Grid				*Others*	
2GK5	4GK5	6GK5	6EH7	6AL3	9A8
2ER5	4EH7	6ES8	6EJ7	6BL8	15CW5
3GK5	4EJ7	6ER5	6HG8	6BQ5	16AQ3
3EH7	4ES8	6FY5	7HG8	12AX7	27GB5

For optimum customer satisfaction and maximum profit operation for yourself, make room in your caddy right now for the identical, matchless-quality tubes designed into the original sets. Next time you visit your distributor look for the green-and-yellow box and ask about Frame Grid tubes for TV and other entertainment replacement applications. Amperex Electronic Corporation, 230 Duffy Ave., Hicksville, L. I., N. Y.
In Canada: Philips Electron Devices Ltd., 116 Vanderhoof Ave., Toronto 17.

This advertisement in the November Reader's Digest sealed circuits are the vital nerve systems for



RCA sealed circuit modules are used in the computer and communications of the U.S. Air Force Minuteman launching system, making possible high density of components, ease of maintenance, and rugged, reliable performance.



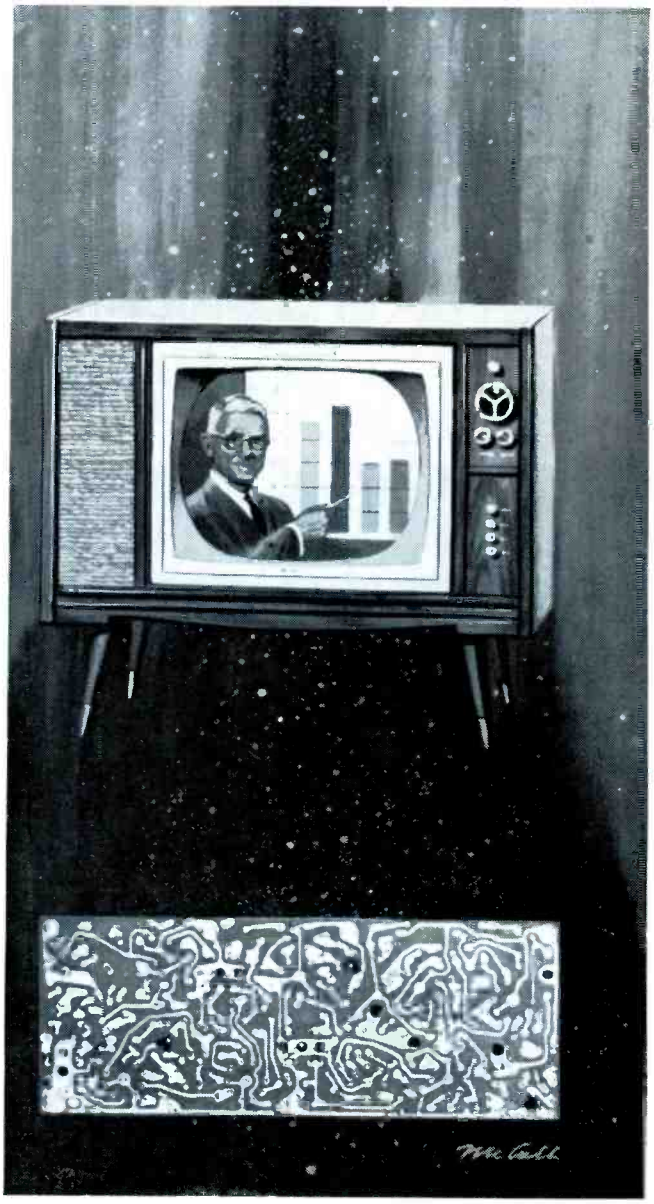
All five TIROS weather satellites, developed and built by RCA under the technical direction of Goddard Space Flight Center of NASA, have exceeded original goals; their lives enhanced by RCA-designed sealed circuitry.

How New Ideas in Sealed Circuitry

The circuit boards you see above are one of science's modern miracles used in satellites, space capsules, computers and TV sets. They differ in size—and design—and complexity—for their respective needs. But each one is the result of science's search for the utmost in reliability and efficiency. Precision-crafted sealed circuit boards eliminate old-fashioned hand-wiring and hand-soldered connections that can come loose or short-circuit. These modern circuits are etched

shows millions of Americans why Precision-Crafted the marvels of the Space Age . . . and today's TV

Electronic Computers such as the RCA 301 calculate data at fantastic speed for American defense, and all phases of industry and communications. Their electronic hearts are sealed circuit boards



Color TV instructs, informs, as well as entertains millions. Here, the reliability of RCA Security Sealed Circuit Boards* has been proved for eight long years in homes like yours from coast to coast.

are Changing Our Daily Lives

in copper which is permanently bonded to boards, protecting them from heat and moisture.

**In the early days of television, RCA, like all other manufacturers, had to depend on* all *hand-wired circuitry. Today for greater precision and reliability, two-thirds of RCA Victor TV circuitry is bonded on Security Sealed Circuit Boards.*

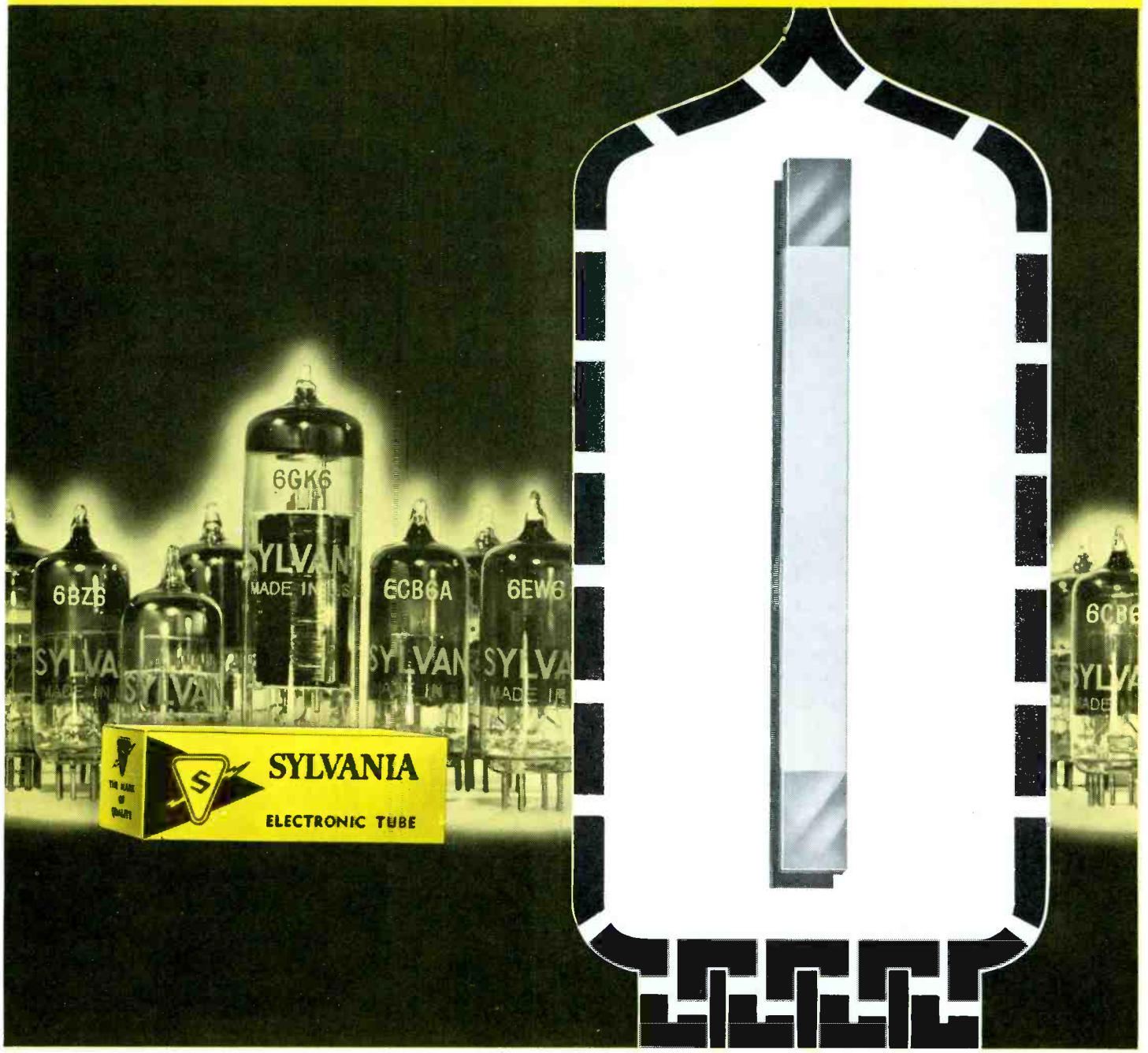
RCA The Most Trusted Name in Electronics
Tmk(s)®

New Sylvania LIFE-BOOST* Cathode dependability—fewer callbacks, more

Sylvania—first with the Sarong and Bikini cathodes—now announces a new development that significantly increases the reliability of Sylvania tubes. "LIFE-BOOST Cathode" is the name...the secret is an ultra-pure, uniform alloy made possible by Sylvania's leadership in powder metal technology.

Contrasted to conventional melted alloys, the LIFE-BOOST powder-metal alloy is so pure and uniform, with performance so predictable, that it eliminates any need for the usual "melt approval." Alloy uniformity inhibits the formation of leakage paths, which extends tube life. It also means better-controlled electron emission and regulated barium release throughout life—tube performance stays within specifications. Further, the new cathodes have 25% greater mechanical strength, which significantly reduces equipment failure in the field.

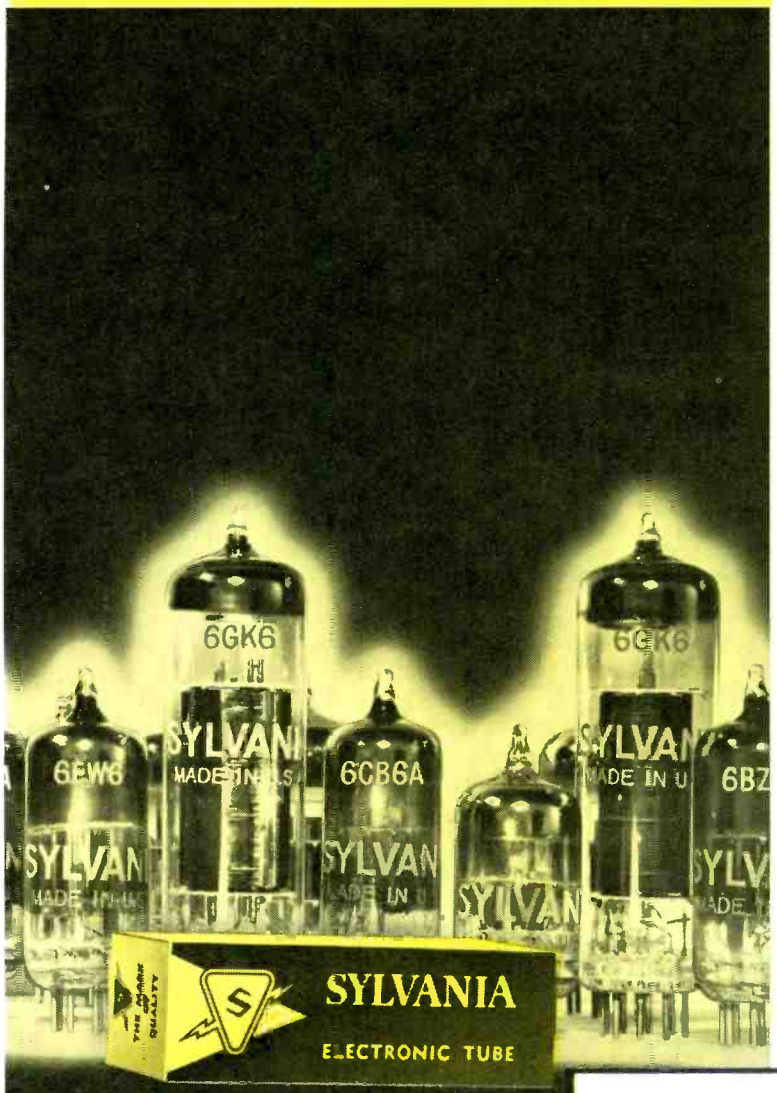
Precise control of alloy composition is the key. The basic pure nickel powder plus carefully controlled powdered reducing agents are thoroughly blended and immediately rolled into thin-gauge strip. Because no critical temperatures are involved, no impurities are introduced from crucibles and con-



tainers, forging hammers or hot-rolling equipment. And the powder process permits previously impossible or hard-to-attain combinations of wanted properties, such as electrical passivity and mechanical strength at high temperature.

A planned conversion of Sylvania tubes to the LIFE-BOOST Cathode is under way. See your distributor for dependable Sylvania tubes—the only ones with this new development that means fewer callbacks, more profitable servicing.

means greater profitable servicing



MORE THAN 80 TYPES already have the LIFE-BOOST Cathode. Here's evidence of what it can do:

...In 6DZ4 UHF oscillator: No failures, greatly improved stability

Test: 40 tubes operated at 130 VAC for 1500 hours in 40 TV sets (4 models, 3 manufacturers represented).

Failures: None resulting in set failure. (Statistical estimate: 1% per 1000 hours at 130 V, or about 0.3% per 1000 hours at 117 V.) Failure rate for same tube made with conventionally prepared cathode material: 13.1%.

Oscillator Grid Current: After 1500 hours at 130 V, 90% of LIFE-BOOST Cathode tubes had grid current between 550 and 950 μA. Only about 38% of the tubes with conventional cathodes remained within these limits after period of test.

...in 6GK6, used for critical vertical output: TV set manufacturer reports improved stability

Test: More than 1000 hours at 135 VAC line.

Results: No leakage problems, no slump in characteristics; tube can be used in vertical socket as well as other sockets of customer's TV set line.

Sylvania tests show significantly reduced sublimation (formation of leakage paths), and improved plate current stability under accelerated life test and heater cycling conditions with over-voltages applied.

...in RF pentodes: Reduced grid emission, no insulation breakdown

RF pentodes BZ6, CB6, EW6 and others, when subjected to life testing, showed reduced grid emission levels after conversion to the LIFE-BOOST Cathode. Insulation levels during and at the completion of life showed little or no change—an indication of improved stability—and end-point failures due to breakdown were virtually nonexistent.

REMEMBER—many Sylvania Distributors give S&H Green Stamps when you purchase Sylvania Receiving Tubes. S&H Green Stamps are America's most valuable stamps and are exclusive with your participating Sylvania Distributor.

*Trademark

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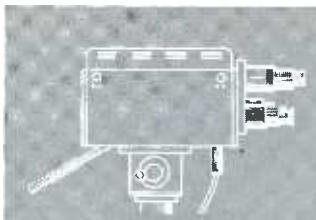

The Electronic Scanner

"Time-Saving" Service Clinics

Touring the country for **SENCORE** these days is Wayne Lemons, shown here (center) with the firm's President Herb Bowden (right) and Chief Engineer Bob Baum. Some of the clinics Wayne will conduct this month, telling the SENCORE "Time-Saving Program" story, will be sponsored by National Radio Parts and Bay Electronic Distributors, Brooklyn (Nov. 12th); K-R Services, Inc., Newark (Nov. 13th); Slate and Company, Bronx (Nov. 14th); and H. L. Dalis, L.I.C., (Nov. 15th). Of course, you all recognize Wayne as author of two recent Sams books, "Transistor-Radio Servicing Made Easy" and "Servicing Horizontal Sweep Circuits."

Color Servicing Course

Color-TV servicing schools are now being held at local **Admiral** distributors throughout the country by factory Field Engineers and color specialists, under the direction of Mr. I. F. Johnston, National Electronic Service Manager. Mr. Willis Wood, General Manager of the National Service Division, pointed out that the Admiral Color Schools consist of approximately 3 hours of lecture and 5 hours of actual workshop. Arrangements for attendance can be made through the Admiral distributor in your area.

Tape-Head Replacement Program

To help dealers cut stock requirements, **Nortronics** has introduced "Quik-Kit" mounting hardware for their line of replacement tape-recorder heads. The new hardware kits include any electrical components needed, along with detailed installation instructions and drawings. Parts for more than 250 models of recorders are included in the program, and others will be added periodically. The company is now conducting an extensive national advertising campaign to build consumer demand for replacement heads.

Dynamic Service Demonstrator

Transistor-radio servicing and troubleshooting techniques can be demonstrated effectively with a new training aid from **Motorola.** This device is in a fold-open carrying case which, when opened, reveals a circuit diagram of a complete transistor radio with working components mounted on it. The large size makes possible demonstration, illustration, and direct application of service techniques to large groups. All components are removable and are identified by their functions and values. Training sessions, using the new aid, can be arranged through local Motorola distributors.

New Facilities for Color-TV Tube Production

A 45,000-square-foot addition, to be devoted to color-TV picture tube production, will soon be added to the Chicago plant of **National Video Corp.** The new addition should be completed in December of this year. As soon as rectangular glass envelopes become available, the company expects to produce rectangular color CRT's. They also plan to make 90° color tubes that will be 5" shorter than 70° types now in use.

Our truck is a big tool box.

You can load up a VW Truck with 1,000 lbs. of tools or parts or equipment. And still have room for 800 lbs. more.

Our truck will actually tote 1,830 pounds; 800 more than a half ton.

Yet, the VW is 3 feet shorter and weighs only half as much as a half ton.

It's our boxy shape that does it.

Outside, the VW doesn't have a long front hood. Because our engine's in the rear. For extra traction.

Inside, there's 170 cubic feet of usable space. With a 4-foot-wide side doorway. And double side doors. And a rear door. (And, if you want it, another side doorway in the far side for 80 bucks* more.)

Anderson & George Murray of Orleans, Mass., carry a big table saw over the engine in back of their VW.

They also carry so many tools and stuff that people have said: "It looks like you have the shop right in the truck."

They do.

RCA

invites you on

A JOURNEY THRU TOYLAND

Get all these wonderful toys

FREE

with your purchases of RCA receiving tubes

Christmas is for children—and you can give any child a brighter, happier Christmas this year simply by buying the world's finest receiving tubes: RCA!

All the exciting, famous-name toys shown above are available FREE with the purchase of tubes through your participating RCA Distributor. See him right away to find out how your purchases of RCA receiving tubes entitle you to.....

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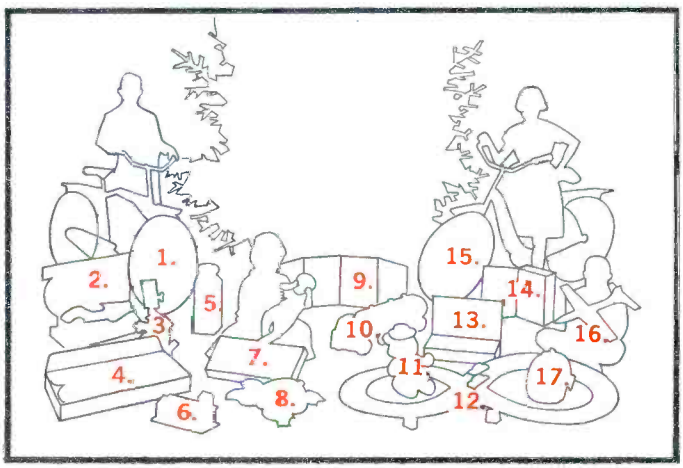
2. Duesenberg Kit JTT 36384
3. Mr. Machine JTT 48447
4. Dinner Set JTT 46375
5. Rocket Launcher Erector Set JTT 10202
6. Counting School House JTT 30973
7. Crying Thumbelina Doll JTT 05157
8. Zipper Frog JTT 71050
9. Chemistry Lab JTT 12152
10. Jumbo Gasoline Truck JTT 41277
11. Smokey The Bear JTT 78667
12. Auto-Rama Speedway Set JTT 19083
13. Engineer's Erector Set JTT 10172
14. Electric Metal Zoom Microscope and Lab JTT 13099
15. Roadmaster Girl's Bicycle JTT 1685
16. American Flyer Sky Streak 7 JTT 40006
17. Astronaut Helmet JTT 42028



It's RCA's way of wishing you and your entire family a Merry Christmas!

COLOR TV SERVICE AIDS

Tools and accessories to make color work go more smoothly.

Proper bench servicing of color receivers calls for the use of various inexpensive test accessories, which soon become indispensable to a shop handling any amount of color. More different types of service aids are needed than in black-and-white TV work, but the total number of units is not too great because of a high degree of standardization among color sets with respect to physical test arrangements. Here is a summary of the various types of color service aids, with pointers regarding their use. All are commercially available; in some cases, the serviceman can assemble suitable equipment himself.

Degaussing Coils

It has become standard procedure to demagnetize the color set as one of the first steps during the original installation, and thereafter as a preliminary to readjusting setup controls or checking for certain faults in the receiver. A "degaussing" coil has thus become a must item for color work. Excellent ones are available, but if you prefer to "roll your own," most specifications suggest winding a coil 12″ in diameter, containing slightly over 400 turns of #20 enameled wire. The coil is then bound with plastic insulating tape, and the ends connected to a line cord.

Power-line current passing through the coil creates a strong AC magnetic field that neutralizes small amounts of residual magnetism in metal components of the TV set. After thoroughly going over the set, back away about 6′ to 10′ before disconnecting the coil; the idea is to prevent remagnetizing the set with the collapsing lines of force that are produced when the line cord is pulled.

Not too much has been mentioned in the past about demagnetizing the *inside* of a color-TV cabinet in case of purity troubles. However, some interior components (especially CRT-mounting hardware) cannot be as effectively demagnetized from outside the receiver as from inside. If the technician works carefully, he can "degauss" stubborn magnetized spots without drawing the magnetization from the convergence or speaker magnets. An "inside job" is easier if done with a special coil, only 7″ or 8″ in diameter and wound with finer wire than the conventional coil.

CRT-Tester Adapters

Several regular TV test instruments can be utilized in color service work, if suitable accessories are added. One example is the CRT tester or reactivator. The only mechanical adaptation needed, to test each of the three guns in a color CRT individually, is to transpose connections to the proper pins of a standard 14-pin color CRT socket so the color tube can be plugged into the 90° (duodecal) socket of the tester. Of course, the guns not actually being tested are left disconnected; a rotary switch or a set of toggle switches are provided for choosing the gun to be tested. Connections are shown in the chart.

90° Black and White	Color (common to all guns)
Cathode — 11 Grid — 2 Accel. — 10 Focus — 6 Fil. — 1, 12	Focus — 9 Fil. — 1, 14

Gun:	Red	Blue	Green
Cathode	4	13	5
Grid	2	12	6
Accel.	3	11	7

Gun Disabler

One service aid which is very nice to have is simplicity itself—three 100K-ohm resistors with a common ground lead at one end, and individual clip leads at the other. Commercial units have refinements such as cases and individual slide switches, which make the resistors a great deal less awkward to handle.

What's it for? You don't *have* to use it at all, but you'll save a lot of time by doing so. It simply furnishes a means of biasing off one or more of the CRT guns as part of several routine service procedures. You can do the same thing by turning down the screen controls (or background pots, if used); but then you've upset the gray-scale adjustments and have to readjust these before you're through. In many instances, this wastes time because a complete resetting may not have been necessary.

The most important use for the "gun-killer" is in making purity adjustments, where you want only the red gun operating during most of the procedure. It also comes in handy during convergence to remove the blue dots or crosshatch lines from the screen, so you can concentrate on the relationship between the green and red dots or lines. When

• *Please turn to page 97*

SENCORE
SIMPLIFIES COLOR SERVICING

NEW! CA122
COLOR CIRCUIT ANALYZER

A simple approach to a complex problem

Here is an instrument that is designed to eliminate the guesswork in color TV servicing. A complete analyzer that provides all required test patterns and signals for testing from the tuner to the tri-color tube. Additional analyzing signals for injection at each stage including audio, video and sync, brings to life a truly portable and practical TV analyzer for on the spot service; virtually obsoleting other analyzers with the advent of color. Sencore's simplified approach requires no knowledge of I, Q, R-Y, B-Y, G-Y or other hard to remember formulas. The CA122 generates every signal normally received from the TV station plus convergence and color test patterns.

The CA122 offers more for less money:

TEN STANDARD COLOR BARS: The type and phase that is fast becoming the standard of the industry. Crystal controlled keyed bars, (RCA type) as explained in most service literature, offer a complete gamut of colors for every color circuit test.

WHITE DOTS: New stabilized dots, a must for convergence, are created by new Sencore counting circuits.

CROSS HATCH PATTERN: A basic requirement for fast CRT convergence.

VERTICAL AND HORIZONTAL BARS: An added feature to speed up convergence, not found on many other color generators.

SHADING BARS: Determines the ability of the video amplifier to produce shades (Y Signal) and to make color temperature adjustments. An important feature missing on other generators.

COLOR GUN INTERRUPTOR: For fast purity and convergence checks without upsetting color controls. Insures proper operation of tri-color guns, preventing wasted time in trouble shooting circuits when CRT is at fault.

A must for color . . .

a money maker for black and white TV servicing

ANALYZING SIGNALS: RF and IF signals modulated with any of the above patterns for injection into grid circuits from antenna to detector. IF attenuator is pre-set for minimum signal for each IF stage to produce pattern on CRT thus providing a check on individual stage gain. Sync and video, plus or minus from 0 to 30 volts peak to peak, have separate peak to peak calibrated controls for quick checks on all video and sync circuits. Crystal controlled 4.5 mc and 900 cycles audio simplify trouble shooting of audio circuits.

NEW ILLUMINATED PATTERN INDICATOR: A Sencore first, offering a rotating color film that exhibits the actual color patterns as they appear on color TV receivers. Locks in with pattern selector control.

You'll pay more for other color generators only.

Dealer Net **187.50**

NEW! PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

A portable wide band 3 inch oscilloscope for fast, on-the-spot testing. An all new simplified design brings new meaning to the word portability... it's as easy to operate and carry as a VTVM. Though compact in size, the PS120 is powerful in performance: Vertical amplifier frequency response of 4 MC flat, only 3 DB down at 7.5 MC and usable to 12 MC, equips the technician for every color servicing job and the engineer with a scope for field and production line testing. AC coupled, with a low frequency response of 20 cycles insure accurate low frequency measurements without vertical bounce. Sensitive single band vertical amplifier; sensitivity of .035 volts RMS for one inch deflection saves band switching and guessing. Horizontal sweep frequency range of 15 cycles to 150 KC and sync range from 15 cycles to 8 MC (usable to 12 MC) results in positive "locking" on all signals. New exclusive Sencore features are direct reading peak-to-peak volts —no interpretation; dual controls to simplify tuning; lead compartment to conceal test leads, jacks and seldom used switches. Rear tilt adjustment angles scope "just right" for easy viewing on bench or production line.

Size: 7″w x 9″h x 11¼″d. Weight: 12 lbs.

Dealer Net **124.50**
(with low cap. probe)

Kit **74.50**

A must for servicing color TV in the home . . . lowest priced broad band scope. All hand wired — all American made

SENCORE

SIMPLIFIES SWEEP CIRCUIT TROUBLE SHOOTING

SS117
SWEEP CIRCUIT ANALYZER

For Color and Monochrome Testing

A professional trouble shooter that helps you methodically walk the trouble out of "tough-dog" sweep circuits in monochrome and color receivers. The SS117 provides a positive but simple push button test on all circuits indicated in the block diagrams. These time-consuming circuits are checked step-by-step with tried and proven signal injection and substitution methods. All checks can be made from the top of the chassis or from under the chassis when it is removed from the cabinet.

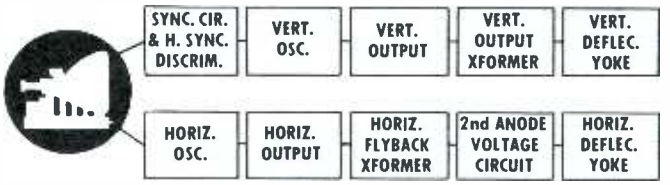
TV horizontal oscillator check is made by substituting a universal oscillator known to be good. Horizontal output check consists of a cathode current and screen voltage test. The TV horizontal yoke is checked by substituting a universal yoke from the SS117 and viewing brightness or restoration of 2nd anode voltage. Horizontal flyback is checked dynamically in circuit by measuring the power transfer to the yoke when TV is turned on. TV horizontal sync can be used to control the SS117 horizontal oscillator, providing a positive check on sync from the video amplifier to the TV oscillator. Vertical circuits are tested by simple signal injection from vertical yoke to oscillator for full height on CRT. The SS117 with the CA122 Color Analyzer provides a complete TV analyzer for virtually every stage in monochrome or color receivers.

External checks for AC, DC, peak to peak voltage readings and DC current in the upper right hand corner save using a separate VTVM. Accurate 2nd anode measurements up to 30,000 volts are made with a sensitive 300 microamp meter and the attached high voltage probe. AC outlets, all steel construction and mirror in the cover makes every servicing job easier.

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

Dealer Net **89.50**

The SS117 checks them all



FREE—A 33 RPM half hour permanent record packed with every unit explains each test.

FOR FASTER MORE ACCURATE TUBE TESTING

TC114 MIGHTY MITE TUBE CHECKER

This is the famous Mighty Mite, acclaimed by over 25,000 servicemen, maintenance men and engineers as "the best they've ever used." A complete tube tester that is smaller than a portable typewriter yet finds tubes that testers costing hundreds of dollars miss, thus selling more tubes and reducing call backs. A real money maker for the serviceman and a trusty companion for engineers, maintenance men and experimenters. The Mighty Mite has been acclaimed from coast to coast as the real answer for the man on the go. Even though the Mighty Mite weighs less than 8 pounds, new circuitry by Sencore enables you to use a meter to check grid leakage as high as 100 megohms and gas conditions that cause as little as one half microamp of grid current to flow. Thus, too, it checks for cathode current at operating levels and shorts or leakage up to 120,000 ohms between all elements. And it does all this by merely setting four controls labeled A, B, C, & D with new type easy grip knobs. Check these plus Sencore features... Meter glows in dark for easy reading behind TV set... The new Mighty Mite has large size Speedy-Setup Tube Chart inside of cover—cuts setup time for even faster servicing. New stick proof D' Arsonval meter will not burn out even with shorted tube... Rugged, all steel carrying case and easy grip handle.

The improved Mighty Mite will test virtually every radio and TV tube that you encounter, nearly 2000 in all, including foreign, five star, auto radio tubes plus the new Compactrons, Novars, Nuvistors and 10 pin tubes. Has larger, easy-to-read type set-up booklet for faster testing.

Size: 10¼" x 9¼" x 3½". Weight: 8 lbs.

Dealer Net **74.50**

Fast, Accurate . . . never lets you down

A must for color

TM116 TUBE TESTER MODERNIZING PANEL

New tube adapter for testing Compactrons, Novars, Nuvistors and 10 pin tubes in any tube tester except cardomatic types. Plugs into octal socket of your tube tester enabling you to test these new tubes in the same manner that your tester checks conventional tubes. Tube set-up chart included with each adapter.

Dealer Net **24.95**

SENCORE

TRANSISTOR CIRCUIT TESTING MADE EASY & PROFITABLE

TR110 TRANSI-MASTER

A new transistor tester that will analyze the entire transistor circuit in minutes. Transistors can be checked in-circuit or out-of-circuit. Here is how it works:
First, check the batteries or power supply with the 0 to 12 volt voltmeter. Next, check the current drain with the 0 to 50 milliamp meter. A special probe is provided so that you do not need to break the circuit. Intermittents caused by cracked boards can be localized by the current check.
If trouble is not located by now, isolate the trouble to a specific stage by touching the output of the harmonic generator to the base of each transistor and note spot where sound from speaker (or scope where no speaker is used) stops or becomes weak. The generator becomes a sine wave generator for audio stages to help find distortion.
If trouble points to a transistor, check it in a jiffy with the exclusive in-circuit power oscillator check provided by the TR110. A special probe is also provided for this.
If the transistor checks bad in-circuit, remove it and give it an out-of-circuit check with the oscillator check or the more accurate DC check.
The DC check is provided for comparison reasons, experimental or engineering work and to match transistors in audio output stages. Beta (current gain) is read direct or on a good-bad scale for service work.

Dealer Net **59.50**

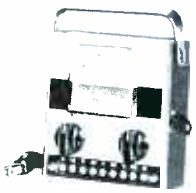
- **COMPLETE IN OR OUT-OF-CIRCUIT TRANSISTOR TESTER**
- **SIGNAL TRACER • VOLTMETER**
- **BATTERY TESTER • MILLIAMMETER**

TR115 TRANSISTOR DIODE-CHECKER

Tests transistors for leakage, gain, opens and shorts. Reads gain as good or bad or directly in Beta. Checks diodes for forward to reverse ratios. Tests them all from the smallest transistors used in hearing aids to the power types used in auto radios. Also lists Japanese equivalents. This simple to operate, time tested checker can be used with or without set-up chart for all servicing, experimenting and lab work. The industry's most popular transistor tester, used by Bell Telephone, Sears Roebuck, Edison and many others.

Dealer Net **24.95**
Kit **15.95**

NEW! BE124 BATTERY ELIMINATOR



An easy to use power supply that replaces batteries during repair time of transistor radios. Tapped voltages at 1.5 volt DC intervals from 0 to 12 volts are on front panel for easy connection and to insure center tap and bias voltages when required. Function switch converts meter to a trouble shooting 0 to 50 Ma current reading device to monitor the current drain of the transistor radio. Improved regulation and voltage calibrate pot. guarantee accurate well filtered output. Also for charging nickel cadmium batteries.

Dealer Net **24.95**
Kit **15.95**

HG104 HARMONIC GENERATOR

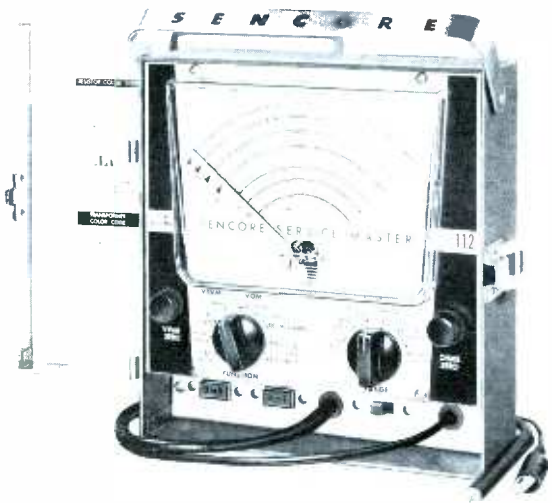
Finds Defective Stage in a Minute . . . a real time saver. Just touch the output leads of the HG104 to inputs and outputs of transistors and a clear 1000 cycle note from speakers will tell you whether or not the stage is defective. It works every time from speaker to antenna. Two leads and calibrated output (not found on pencils) are a must for speaker connection, grounding to prevent RF spray and front end checks. With batteries.

Dealer Net **9.95**

A NEW VERSATILE APPROACH TO CIRCUIT TESTING

SM112 SERVICE MASTER

A combination VTVM and VOM in one compact unit to simplify every testing need. The SM112 offers a conventional VTVM, operating from 115 volts AC for accurate bench or lab work . . . flip the function switch to VOM and two standard flashlight batteries power the unit as it is connected to a 5,000 ohms per volt meter. This Sencore first enables you to make voltage, resistance and current measurements anywhere anytime. And to top this, indicating arrows located along the left side of meter flash on and off as the controls are rotated to indicate the exact scale to read on any VTVM position or range. Hard to remember technical data is listed in the removable cover. One permanent probe is used for every test on VTVM or VOM. High voltage probe fits on end of permanent probe for measurements up to 30,000 volts DC. Standard specifications of 11 megohm input impedance on VTVM, 6 AC and DC voltage ranges from O to 1000 volts on both VTVM and VOM, 6 resistance ranges from 0 to 1000 megohms on VTVM, 2 ranges on VOM, and a 2 percent six inch meter provide all requirements for fast accurate measurements. Zero center scale and peak-to-peak measurements as added features create a truly great Sencore value.



Dealer Net ..... **only 79.95**

SENCORE COMPONENT CHECKING
MADE EASY BY SENCORE PARTS SUBSTITUTION

RC121 COMPONENT SUBSTITUTOR

A complete range of carbon resistors, capacitors, electrolytics and universal selenium and silicon rectifiers at your finger tips for on-the-spot substitution. Say goodbye to messy crumpled parts, unnecessary soldering and unsoldering when substituting components for test purposes only. Each section operates independently with a value close enough for every substitution need. Components in each section are isolated from chassis and from other sections. New electrolytic substitution section provides dual electrolytics as well as 25 single electrolytics. Exclusive surge protector prevents arcing, sparking or healing of single or dual capacitors being bridged. Electrolytics are automatically discharged when surge protector is released. Here are the values provided ...81 in all.

1. **CARBON RESISTORS**...12 resistors, 1 watt from 10 ohms to 5600 ohms. 12 resistors, ½ watt from 10 K to 5.6 megohms.
2. **POWER RESISTORS**...20 wire wound, 20 watts from 2.5 to 15,000 ohms.
3. **CAPACITORS**...10 capacitors at 600 volts from 100 MMFD to .5 MFD.
4. **RECTIFIERS**...Universal Selenium; .5 amps, 800 PIV. Universal Silicon; 5 amps, 800 PIV.

All your favorite Sencore Substitution time-savers in one compact unit.

5. **ELECTROLYTICS**...10 dual electrolytics from 2 MFD to 250 MFD at 450 V DC can be used as singles or tie them together and double capacity to form up to 25 separate single values. Both sections protected by surge protector.

All hand wired, complete with four test leads.

RC121.....Dealer Net..... **39.95**
RC121 (Kit)...Dealer Net..... **27.95**

H36 "HANDY 36"

Provides the 36 most often needed resistors and capacitors for experimenting, substituting and testing. 24 Resistors from 10 ohms to 5.6 megohms, 10 Capacitors from 100 mfd to .5 mfd, 2 Electrolytics 10 mfd and 40 mfd at 450 volts.

Dealer Net..... **12.75**

RS106 RECTIFIER TROUBLE SHOOTER

Substitutes for single and dual Selenium and silicon rectifiers, single and dual diodes. Gives you a positive check every time. A must for servicing voltage doubler circuits. Protected by a ½ amp. Slow Blow Fuse.

Dealer Net..... **12.75**

ES102 "ELECTRO-SUB"

Complete safe substitution for Electrolytic Capacitors from small transistor radio types to the largest used in Hi-Fi amplifiers. Contain 10 electrolytics from 4 to 350 mfd. Completely safe, has automatic discharge, surge protector circuit. Usable from 2 to 450 volts, DC.

Dealer Net..... **15.95**

PR111 "BIG 20" SUBSTITUTOR

For power resistor substitution from 2.5 to 15,000 ohms. Withstands up to 20 watts for normal testing time.

Dealer Net..... **12.75**

Time Saving Service Aids

BE113 DUAL TV BIAS SUPPLY

A single 0 to 20 volts DC bias supply or two separate 0 to 20 volts DC bias supplies—without interaction. Save time in AGC trouble shooting and aligning TV sets. Provides all TV biases recommended in photofact schematics and by all TV manufacturers. Well filtered—provides virtually pure DC with less than one tenth of one percent ripple. Calibration accuracy better than equivalent battery tolerance.

Dealer Net..... **12.75**

VB2 VIBRA-DAPTER

Checks 3 and 4 prong Vibrators faster and easier. Plugs into any tube checker; ideal for use with LC3 or the Mighty Mite. To check 6v. vibrators, set for 6AX4 or 6SN7; for 12v. vibrators, set for 12AX4 or 12SN7. Two No. 51 lamps indicate whether vibrator needs replacing.

Dealer Net..... **2.75**

FC123 FILAMENT CHECKER

Newly designed filament checker for continuity speed testing of all tube filaments including the new compactrons, novars, nuvistors and 10 pin tubes as used in new series TV receivers. Test leads are provided for CRT filament testing, continuity tests are AC or DC neon indicator voltage tests. TV cheater cord is used to power unit as a check on the cord to insure 115 volts AC on TV.

Dealer Net..... **3.95**

HM119 "HANDYMAN"

A Sencore time-saver to eliminate wasted time behind TV sets. Imagine, a cheater cord with on-off switch, dual extension cord, up to date filament checker, universal fuse checker, handy trouble light, neon voltage and continuity checker, pin straighteners and cord wrapper all in one complete unit.

Dealer Net..... **9.95**

ALL AMERICAN MADE
ALL HAND WIRED

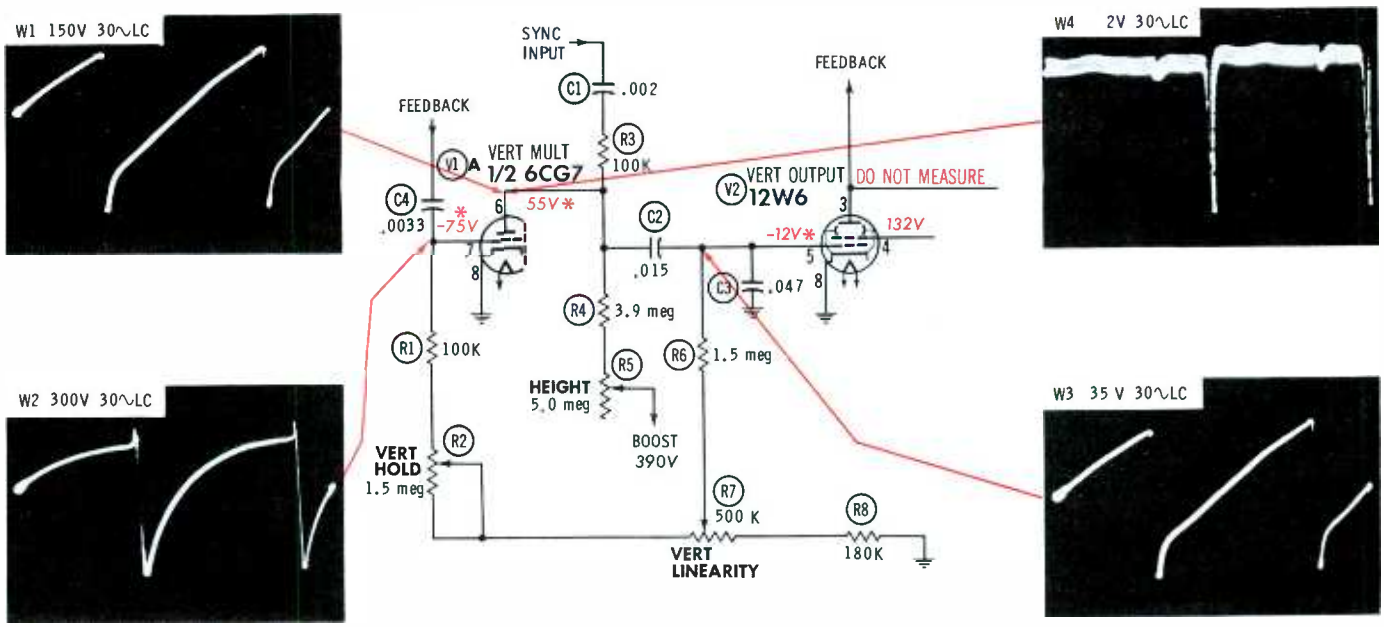
SENCORE

ADDISON, ILLINOIS

Rf REPORTER Symfact

Vertical Multivibrator

Control Circuits



DC VOLTAGES taken with VTVM, on active channel. * means voltage will vary when signal is applied or control is adjusted. See "Variations."

WAVEFORMS taken with wide-band scope; receiver controls set for 50-volt p-p video to CRT. Low-cap probe (LC) used to obtain all waveforms.

Normal Operation

Triode and pentode form combined vertical multivibrator-output stage. Feedback from plate of V2 to grid of V1A sustains oscillation. Only the grid and control circuits are covered here; output transformer and feedback components will appear in December, 1962 *Symfact*. Circuit illustrated has feature common to many late-model sets: grounded cathode in output stage. Required operating bias is applied to grid via linearity control, which taps off portion of grid-leak bias developed by V1A across R1, hold control R2, and common ground resistor R8. Linearity and hold controls wired in series cause greater interaction between sections of multivibrator than in circuits using linearity control as cathode resistor. Vertical hold varies time constant of oscillator grid circuit, as in most other multivibrators. Sawtooth drive signal for output is developed in usual way, by charging capacitor from boost voltage through height circuit; but unusual here is inclusion of coupling capacitor C2 in sawtooth-forming network. Signal at plate of V1A is divided across C2, and C3, so W3 has much less amplitude than W1. Negative sync pulses (W4) are coupled via C2 to output grid, amplified, and fed back to grid of V1A to keep circuit in sync.

Operating Variations

PIN 6 DC voltage remains constant with or without sync signal, but can be varied from 35 to 65 volts by adjustment of height control; waveform amplitude ranges from 90 to 170 volts as control is turned.

PIN 7 DC voltage shifts to −60 volts under no-signal conditions, because loss of sync input signal causes minor change in output-tube operation which affects V1A through feedback network. Linearity adjustment causes bias change at pin 7 that induces vertical rolling.

PIN 5 DC voltage does not change when sync signal is removed; however, it varies from −9 to −17 volts with adjustment of linearity control. Waveform amplitude does not change, regardless of linearity and height settings.

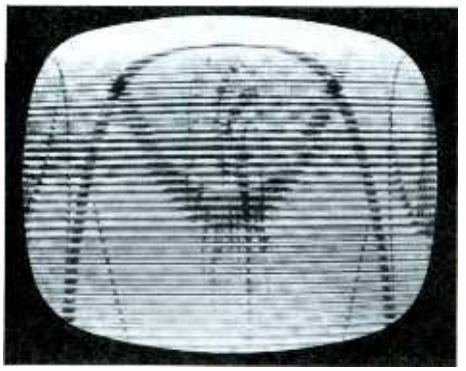
W4 Sync-pulse waveform was taken with vertical sweep temporarily disabled by jumpering junction of R4 and R5 to chassis.

SYMPTOM 1

Severe Nonlinearity

Compression at Top—
Bottom Stretched

C3 Open



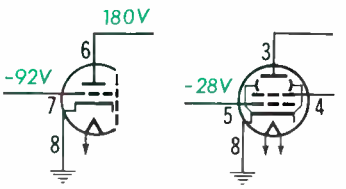
Symptom Analysis

Uneven scanning, with lines spread far apart except at top of screen, indicates severe waveshape distortion. Overlapping sections of picture lock into sync. Instead of being folded over, pattern is split; middle appears at top and bottom of screen. All three controls are operative, but adjustment will not correct trouble.

Waveform Analysis

W1 and W3 jump to 300 volts, and operating frequency changes to 120 cps—as evidenced by display of four cycles in all waveforms. W3 is developed across high resistance of R6-R7-R8 rather than relatively low reactance of C3. Therefore, its shape is more like square wave than sawtooth; in addition, virtually full value of W1 is placed on grid of V2. Contortions in positive-going slope of W2 are produced by faulty waveshape of feedback signal from plate of V2; "flat spots" correspond to most stretched-out areas of raster.

Voltage and Component Analysis



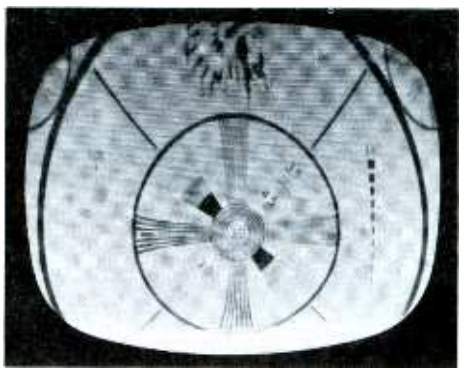
High plate voltage on V1A is incidental result of distortion in W1, which makes average value of this waveform more positive than normal. To help pinpoint reason why W1 fails to divide properly across C2 and C3, highly negative voltage on grid of V2 is most significant clue. C2 is obviously not leaky; if it were, grid voltage would shift in positive direction. Since more than twice normal bias is built up in grid circuit, great increase in impedance between grid and ground is evidently involved in trouble.

SYMPTOM 2

Bottom Foldover

Raster Stretched at Top

C2 Leaky



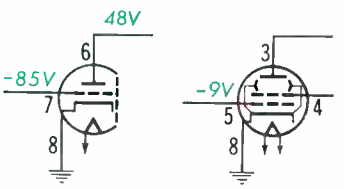
Symptom Analysis

Foldover indicates positive peaks of W3 are driving output stage into saturation. Most likely cause, other than faulty 12W6, is decrease of bias on this tube. Plenty of height is obtainable, but linearity is poor. Control adjustments only tend to aggravate condition. Foldover becomes worse during operation.

Waveform Analysis

W1, W2, and W3 all have slight waveshape distortion, but this might not be noticed except in side-by-side comparison with normal waveforms. Careful checking is also required to spot decrease in amplitude of W1 and W3, and increase in W2. Normal height is obtained with W3 amplitude less than normal—another sign of insufficient bias on V2. Lack of flat positive peaks on W3 indicates foldover being caused by saturation of output transformer rather than V2. This distorts feedback signal, producing "bump" near top of W2.

Voltage and Component Analysis



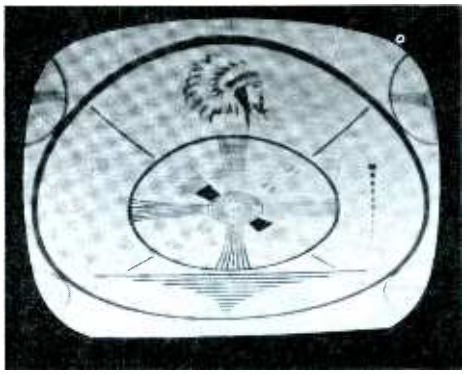
Grid voltage of V2 is –9 volts with linearity set near midpoint—confirming suspicion of not enough bias on output stage. Most probable trouble is leakage in C2, which would provide path from grid to positive DC source. Slightly low voltage on pin 6 could be due to leaky capacitor, or simply due to lower-than-usual setting of height control. Therefore, this measurement is not much help in troubleshooting minor faults. Defective capacitor which actually caused this symptom had 20-megohm leakage resistance in ohmmeter check.

SYMPTOM 3

Bottom Compression

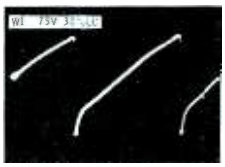
Insufficient Height

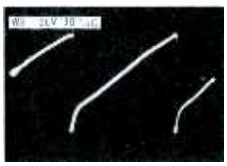
R4 Increased in Value



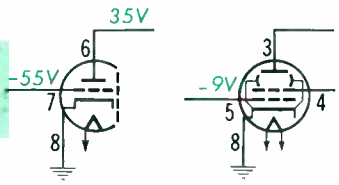
Symptom Analysis

Customer will probably put up with symptom until it reaches this condition. Screen cannot be filled by adjusting height control; only effect of increasing setting is to make linearity worse. Rotating linearity control for additional sweep causes vertical roll and extreme foldover at bottom of screen.





Voltage and Component Analysis



Waveform Analysis

All waveforms drop in amplitude, but shape is scarcely changed. W1 and W3 are more greatly affected by this trouble than W2, indicating fault in area of circuit between multivibrator and output stages. Since peak-to-peak values of W1 and W3 are in approximately same ratio as in normal circuit, C2 and C3 are correctly performing AC voltage division; thus, both capacitors are probably okay. Decrease of drive-signal amplitude could be caused by defect that results in slow charging of sawtooth-forming network through height control.

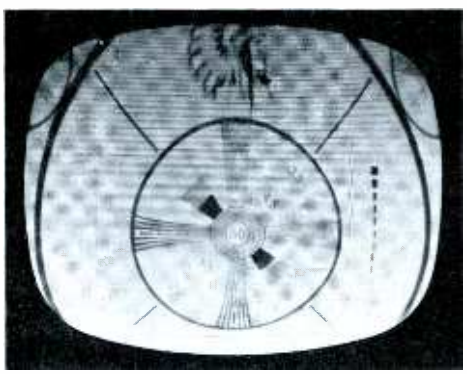
Voltage on pin 6 is far enough below normal to furnish useful clue. Expected value, 55 volts, is unobtainable at any setting of height control. Boost voltage at control arm checks normal, pinpointing trouble to circuit including control, series resistor R4, and C2. Resistance check of V1A plate circuit shows R4 has increased in value to 7 megohms. Defective control could cause similar symptom, plus "jumpy" sweep when control is turned. Bias on V2 is low, as in Symptom 2, but drive signal is too weak to produce foldover.

SYMPTOM 4

Nonlinearity

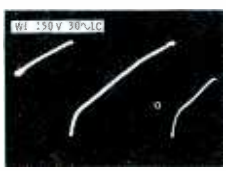
Moderate Foldover at Bottom

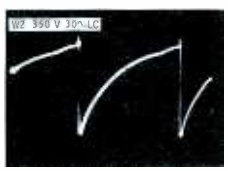
R7 Arm Open



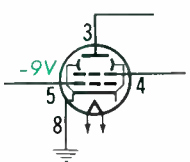
Symptom Analysis

Visual indication is similar to symptom 2, but milder—less foldover. One important clue quickly comes to light: Rotation of linearity control has no effect on vertical sweep. Trying to correct sweep by means of height control causes vertical roll, in addition to marked increase in foldover at bottom of screen.





Voltage and Component Analysis

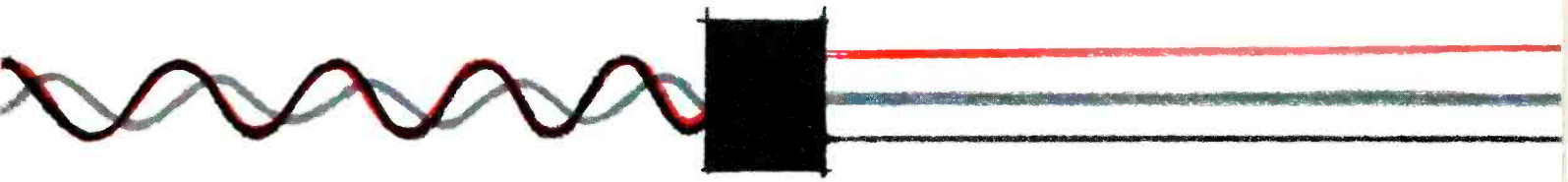


Waveform Analysis

W1 and W3 are normal in shape and amplitude, even though trouble is in grid circuit of V2—here's proof that waveforms in a troubled area do not always disclose presence of fault. Conversely, waveform distortion may not mean trouble close at hand; it may be byproduct of abnormal operation elsewhere in set. Example is small "bump" near positive peak of W2 (same as in Symptom 2). Normally, negative feedback voltage from V2 retards rise in V1A grid voltage. Saturation in V2 halts feedback, and W2 begins steep climb.

Only real clue is voltage on pin 5—it's not negative enough, and is unaffected by turning linearity control. Inability to adjust voltage ties trouble to grid-bias network; fault could be either poor contact on linearity-control arm or open R6. Incidentally, drift in value of R6 will cause gradual stretching at top of raster and compression at bottom; this is good point to remember if vertical linearity changes during warmup. Open resistor causes "floating grid" on V2, and symptoms may vary according to condition of rest of grid circuit.

Chroma Demodulator and Matrix Stages



Finding out how red, blue, and green are recovered from the chroma signal . . . by Thomas A. Lesh

Occasionally a color-TV owner will complain that color pictures are deficient in certain hues — for instance, all shades of red appear as pastels, or all blue objects look too purplish or greenish. In certain other cases, both monochrome and color pictures will contain an overall tint of one hue, which cannot be removed by means of the color controls or setup adjustments (purity, convergence, and gray-scale tracking). The best way to solve problems such as these is to start at the grids of the color CRT and work back toward the chroma demodulators.

The average color-TV technician finds himself in somewhat unfamiliar territory when he delves into this portion of a color set. As yet, he hasn't had much opportunity to apply his theoretical knowledge of how signals are mixed to reproduce various colors. Even if he has had a fair amount of practice in making chroma-sync and demodulator-phasing adjustments, he's likely to have followed the prescribed step-by-step procedures without much concern for understanding the principles involved. At this point, he needs to fill in the middle ground between these "school book" and "recipe book" approaches. By relating theory to actual practice, he will pave the way for intelligent analysis of troubles.

It's particularly important to learn

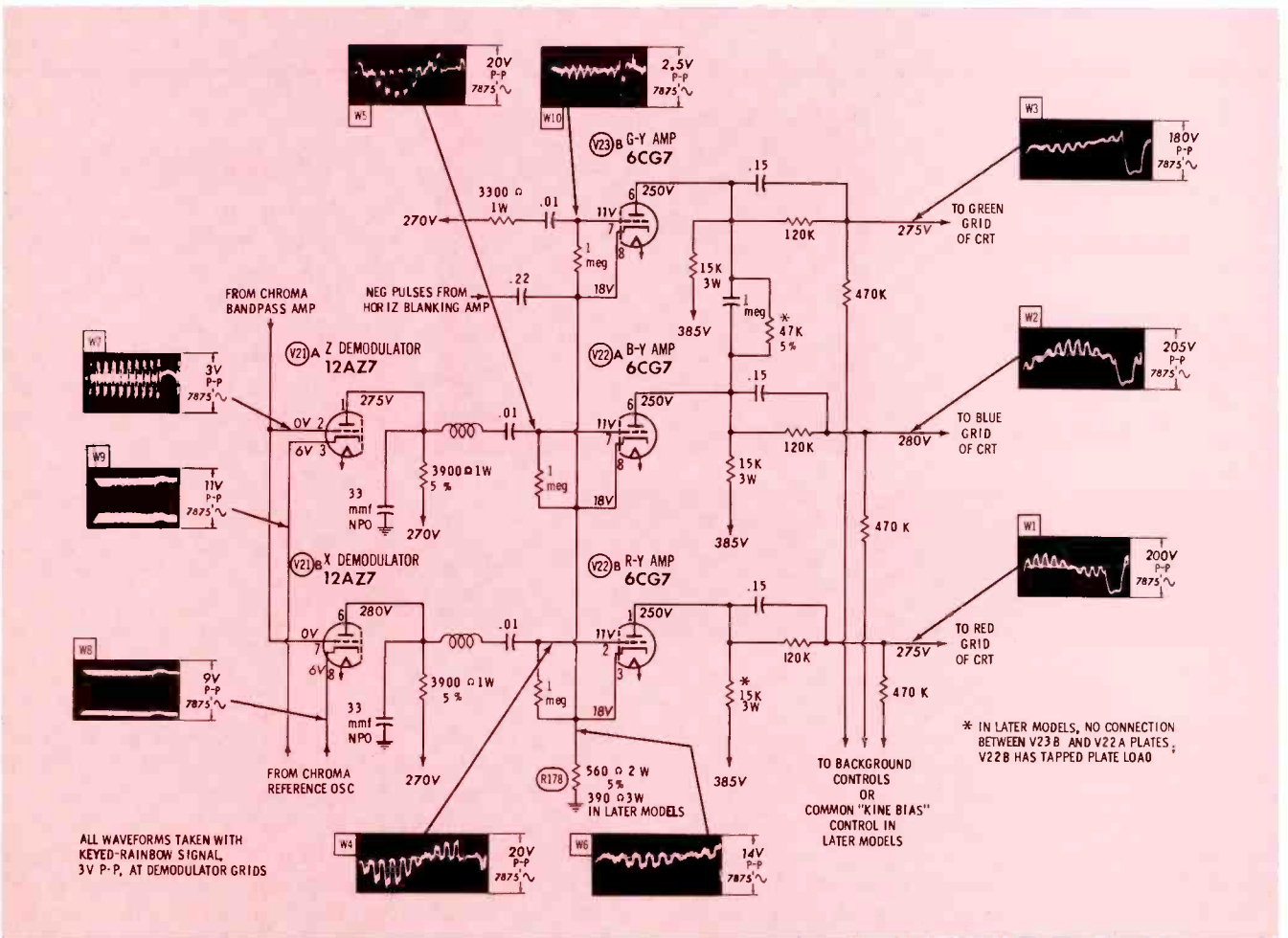


Fig. 1. Chroma demodulators and color-difference amplifiers of typical color TV (RCA Chassis CTC9).

more about the nature of typical test signals, because inaccurate color rendition is usually due to either *wrong proportions* or *incorrect timing* of signal inputs to the three guns of the color CRT.

Remember that each of the three outputs from the color-TV camera (red, green, and blue) is split in two before being transmitted. The portions corresponding to the relative brightness of different colors go to make up the equivalent of a black-and-white video signal. The remaining portions, called color-difference signals, are combined in specified amounts and then transmitted as chroma information.

At the receiver, the color demodulators must unscramble the chroma signal back into its original color-difference components; then these must be blended with each other and the video signal to recover the original colors. This final *matrixing* operation is done in the picture tube, by applying the video signal to the cathodes of all three electron guns and feeding separate color-difference signals to the individual control grids. The difference-signal voltages, by aiding or opposing the video-signal voltage in varying proportions, make the three guns conduct in the proper ratios to reproduce different hues.

Troubles which cause incorrect color mixing can develop in either the cathode or grid circuits of the picture tube. As a rule, faulty cathode operation is easily spotted by noting abnormal reactions to gray-scale tracking adjustments; therefore, it is not usually necessary to analyze the cathode-signal waveforms in great detail. On the other hand, close attention to both the amplitude and the waveshape of the grid signals will often provide the key to locating trouble in the related circuits (Fig. 1).

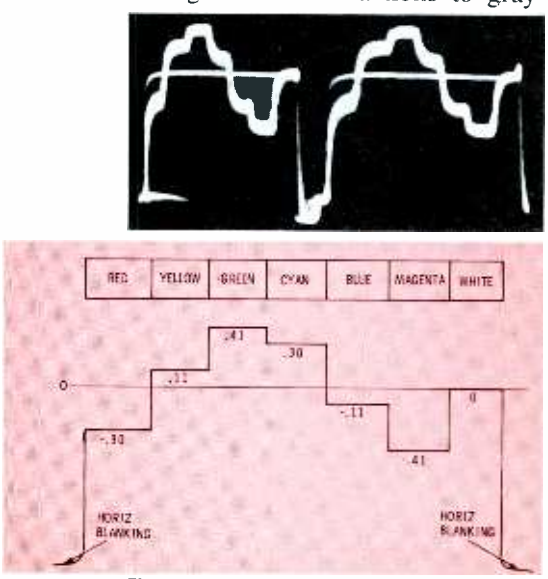


Fig. 2. Actual and theoretical G-Y waveforms of NTSC color-bar pattern.

A color-bar pattern is the best signal source for scope checks, because it provides a standard waveshape in which many important details can be readily identified. For example, the signals derived from an NTSC bar generator form "stair-step" patterns that show how the grid voltages fluctuate as various fully-saturated colors are transmitted. As demonstrated in Fig. 2, the waveform actually observed at the green grid bears a reasonably close resemblance to a graph of G-Y voltage based on mathematical color-difference formulas.

Note that the voltage is at a relatively low level during the first (red) bar, keeping the green gun cut off. The voltage rises above the zero reference line during the second bar, since the green gun (as well as the red gun) must conduct to produce yellow on the screen. The most positive point on the G-Y waveform naturally occurs during the third, or green, bar; if you scope the other two CRT grids, you'll find them both cut off by negative swings of voltage during this interval. The fourth bar (cyan) also requires some conduction of the green gun, so the signal level on the grid remains high. However, the blue bar causes a drop in grid voltage which interrupts the green beam. Magenta (the complement of green) accounts for the most negative signal peak in the bar presentation. During the white bar, no color-difference signals are produced, so the G-Y output is zero.

The other two grid signals can be similarly analyzed to find out which of the grid circuits is responsible for poor color mixing. Look for errors in overall waveform amplitude, or serious discrepancies in the relative amplitude of different signal elements; also see if any waveform "zigs" where it should "zag."

Keyed Rainbow Patterns

Obtaining color-difference signals from a keyed rainbow generator makes it even easier to troubleshoot many matrixing faults. Although this type of generator doesn't supply the exact proportions of cathode and grid signals needed for presenting saturated color bars, it furnishes adequate color-difference signals for testing purposes. It also has the advantage of giving a very accurate indication of phase relationships between these signals. When the keyed-rainbow waveforms display proper phasing and correct amplitudes, it can generally be assumed that the grid circuits are able to do their part in accurately mixing all colors.

To make the most of keyed-rainbow signals, it's important to remember these basic facts about the generator that produces them: The RF output frequency is exactly 15,750 cps below that of the 3.58-mc chroma subcarrier. This slightly offset frequency gives the same effect as a 360° change in chroma

• *Please turn to page 93*

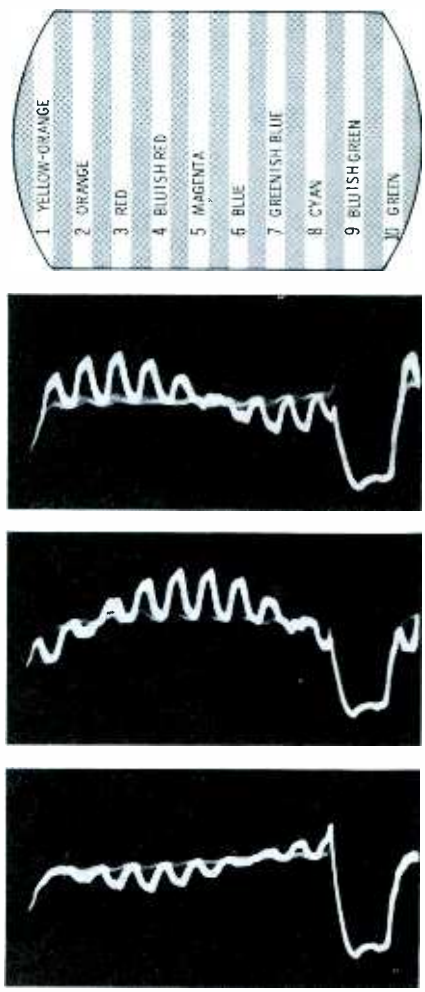


Fig. 3. Keyed rainbow with red, blue, and green grid inputs (W1, W2, W3).

OBJECTIVE PURE WHITE

One of the skills which a color-TV technician most urgently needs to develop is a well-practiced ability to make setup adjustments—static and dynamic convergence, purity, and gray-scale tracking. It's embarrassing, and sometimes frustrating, to be hesitant about what to do when you have a convergence job to perform in front of a customer. On the other hand, it's very satisfying to move controls and magnets with confidence, and know for sure which adjustment you should make next.

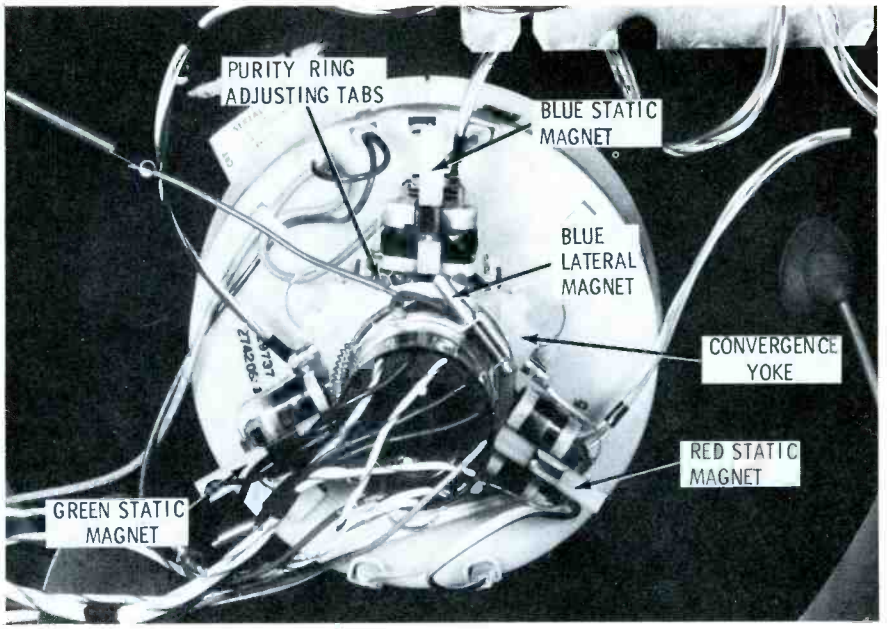


Fig. 1. Purity adjustments and convergence yoke are located on CRT neck.

You'll find frequent occasions to display your color-setup capabilities. A partial (and, in some cases, complete) convergence check is *always* necessary on new-set installations. It's also advisable after repair operations are completed, since a poorly converged screen can result from nothing more than circuits drifting out of adjustment — especially in older receivers.

Before you touch the setup controls, though, it's a wise move to stop and ponder the symptoms that appear on the screen. If you attempt setup before correcting other troubles, you can easily go off on a tangent and make conditions worse. To keep this from occurring, let's review a few of the symptoms and possible causes of incorrect purity and misconvergence. Then we'll discuss receiver procedures in detail.

Defining the Symptoms

If a limited area of the CRT screen shows background tinting, even without a picture present, one or more of the primary color fields —red, green, or blue—is contaminated. Before reaching for the static or dynamic convergence assemblies, try degaussing the receiver. This demagnetizing action, in the majority of cases, will result in a pure white screen; if it fails to do so, proceed to try the complete purity adjustment covered in this article.

A deep, overall tint of any one color is not normally caused by a defect in purity or convergence; instead, it normally stems from a defect or misadjustment in the color demodulators, the CRT circuits, or even the chroma reference oscillator.

Color fringing on a black-and-white picture indicates convergence troubles, and the main thing to look for at this time is the extent or degree of fringing. You must also take into account the age of the set, how long since it was last converged, and other information you may obtain from the set owner. Evaluating this information will help you determine if you should attempt reconvergence in the home, or if you should pull the set.

In cases where fringing affects the entire screen, and touching up the static-convergence magnets will not cure it, you most likely have circuit troubles, and repair will be necessary before proper convergence can be obtained. This is a shop job, and even if your shop is equipped with a color test jig, it's best to pull the entire receiver. True, the defect could be in one of the circuits on the

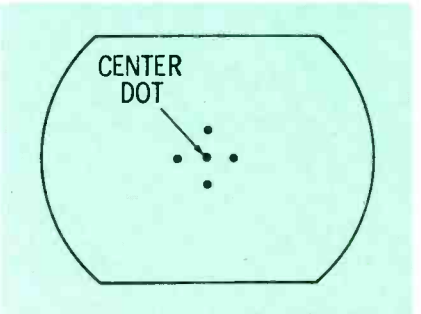


Fig. 2. Observe center dot while performing static convergence of beams.

STEP	PATTERN REF.	CONTROL NAME CHASSIS CTC 10, 11, 12	CONTROL NAME CHASSIS 29JC20 27KC20	FUNCTION (Beam Displacement)	USE TO CONVERGE (or straighten)	REMARKS
			Vertical Convergence			
1	Fig. 2					Perform Center Dot Static Convergence
2		R-G Master Tilt	R-G Vert Lines Top	Red and Green Vert Bars At Top of Screen	Red and Green Vert Bars, Pattern Area A-B	Touch Up Both Controls For Best Convergence, Pattern Area A-D
3		R-G Master Amp	R-G Vert Lines B't'm	Red and Green Vert Bars At Bottom of Screen	Red and Green Vert Bars, Pattern Area C-D	
4	Fig. 3	R-G Diff Tilt	R-G Horiz Lines Top	Red and Green Horiz Bars At Top of Screen	Red and Green Horiz Bars, Pattern Area A-B	Touch Up Both Controls For Best Convergence, Pattern Area A-D
5		R-G Diff Amp	R-G Horiz Lines B't'm	Red and Green Horiz Bars At Bottom of Screen	Red and Green Horiz Bars, Pattern Area C-D	
6		Blue Tilt	Blue Horiz Lines Top	Blue Horiz Bars At Top of Screen	Blue Horiz Bars with Red-Green Horiz Bars, Pattern Area A-B	Touch Up Both Controls For Best Convergence, Pattern Area A-D
7		Blue Amp	Blue Horiz Lines B't'm	Blue Horiz Bars At Bottom of Screen	Blue Horiz Bars with Red-Green Horiz Bars, Pattern Area A-B	
8	Fig. 2					Perform Center Dot Static Convergence
			Horizontal Convergence			
9	Fig. 4	B-1	Blue Horiz Lines Right Side	Blue Horiz Bars at Right Side of Screen	Make Blue Horiz Bar Straight, Pattern Area A-B	Touch Up Both Controls To Produce Straight Blue Line, Pattern Area A-D
10		B-2	Blue Horiz Lines Left Side	Blue Horiz Bars at Left Side of Screen	Make Blue Horiz Bar Straight, Pattern Area C-D	
11	Fig. 5	R/G-1	R-G Vert Lines Right Side	Red and Green Vert Bars At Right Side of Screen	Red and Green Vert Bars, Pattern Area A-B	
12		R/G-2	R-G Horiz Lines Right Side	Red and Green Horiz Bars At Right Side of Screen	Red and Green Horiz Bars, Pattern Area C-D	Use Control as in Step 9 To Converge Blue Bar With Red-Green on Right Side
13	Fig. 6	R/G-3	R-G Vert Lines Left Side	Red and Green Vert Bars At Left Side of Screen	Red and Green Vert Bars, Pattern Area A-B	
14		R/G-4	R-G Horiz Lines Left Side	Red and Green Horiz Bars At Left Side of Screen	Red and Green Horiz Bars, Pattern Area C-D	Use Control as in Step 10 To Converge Blue Bar With Red-Green on Left Side

chassis proper, but it could just as easily be in the convergence panel or the convergence yoke.

When fringing is only minor, chances are the convergence circuits are operating normally and all that's needed is a touch-up job. Before you perform this, try substituting new tubes in the horizontal and vertical circuits; then check the screen to see if fringing has decreased. Changes in sweep-circuit waveforms will often cause a small shift in convergence—perhaps back to normal.

During the touch-up job just mentioned, make sure an appropriate movement is evident on the CRT each time you adjust one of the controls on the convergence panel. If any of them fail to respond, check the connecting wires to the convergence yoke, and make a visual check for loose or broken connections on the panel; these quick checks might keep you from unnecessarily pulling the set.

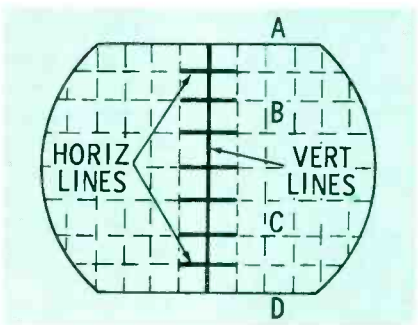


Fig. 3. Check for vertical dynamic convergence in this area of crosshatch.

Black and White Setup

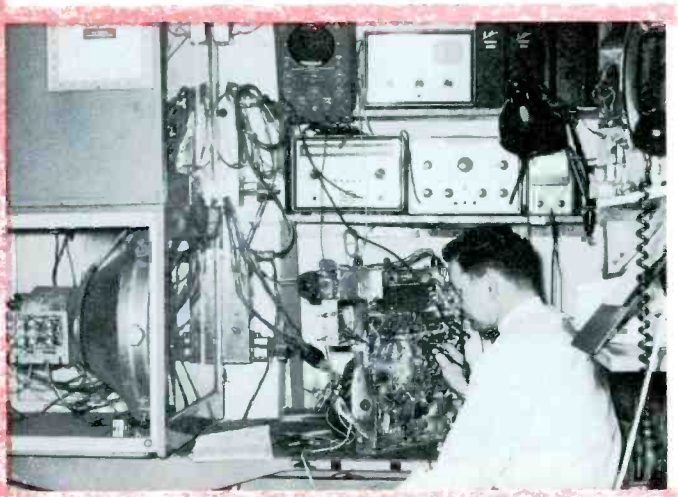
Perhaps you're not too familiar with the purpose or physical location of the different assemblies mounted on the CRT and used for purity and convergence adjustments. The physical arrangement is shown in Fig. 1; the purpose of the components in this photo will become

• *Please turn to page 88*

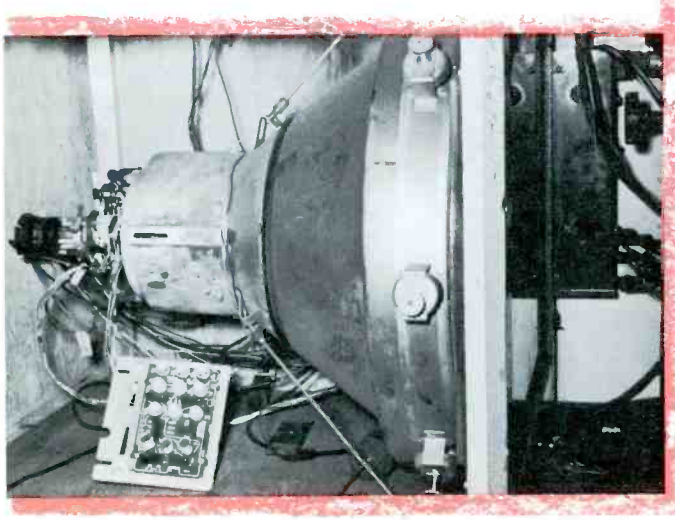
Meet a Color TV Specialist

How does a shop which specializes in color servicing appear—inside? What type of special equipment and test setups are required? What are some of the convenient little gimmicks used in color shop servicing? To find the answers to these questions (and others), we visited a color specialist who, in addition to servicing other electronic equipment, operates a profitable color-TV business.

Meet Leon Howland, of Indianapolis, Indiana. Leon has been actively engaged in home television repair since he first opened his shop in the spring of 1955, and active in color servicing since 1956. Prior to that he was a TV troubleshooter with a large electronics corporation. When questioned about color he readily admits, "I believe color is now being accepted by the public, and servicemen should keep abreast of its popularity."

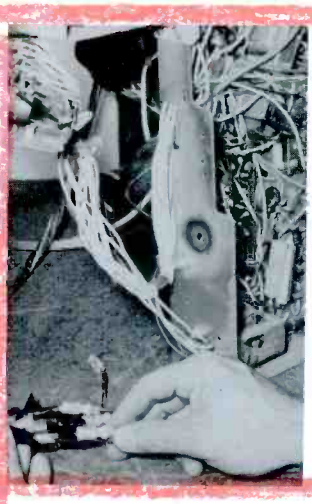


Shown here is the color-service bench. Leon says this is a good workable setup, although the room area is small. Notice the position of the test equipment, neatly arranged on wooden shelves where it can be easily connected to any point on the color chassis. You'll see two color-CRT jigs in this photo, one stacked on top of the other. The upper one is used to "cook out" color chassis, after they are repaired.



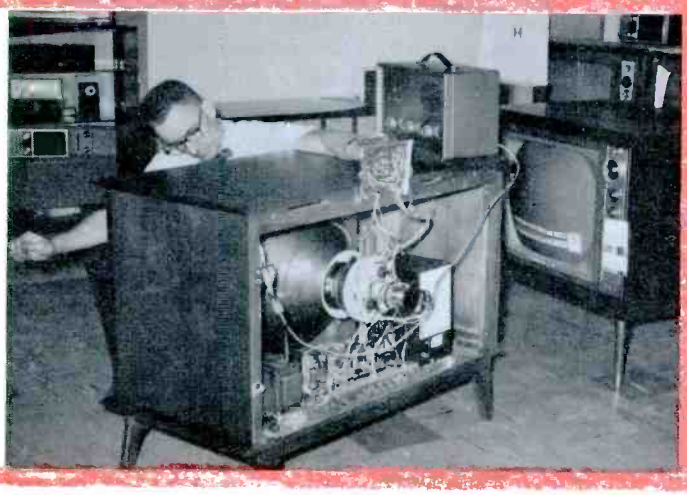
Cables for connecting the picture tube, the deflection and convergence yokes, and the CRT high voltage extend through a junction box to the front of the CRT-jig cabinet. The convergence yoke is installed on the neck of the test CRT. The convergence control panel (this type is used in late model receivers) is used to check convergence-current action quickly, without the panel from the set. Each control can be turned while the technician watches the CRT screen for the proper change in CRT beam displacement.

Leon explained what the technician is doing in these two photos. "On this special color jig, we can fire up any RCA color chassis, from the CTC5 through the CTC11, by merely changing the yokes. We've made our own adapters (one is shown connected to the yoke) which enable us to use our permanent test-extensions. To service a Zenith set, we need only to install its yoke on our CRT and connect the chassis."

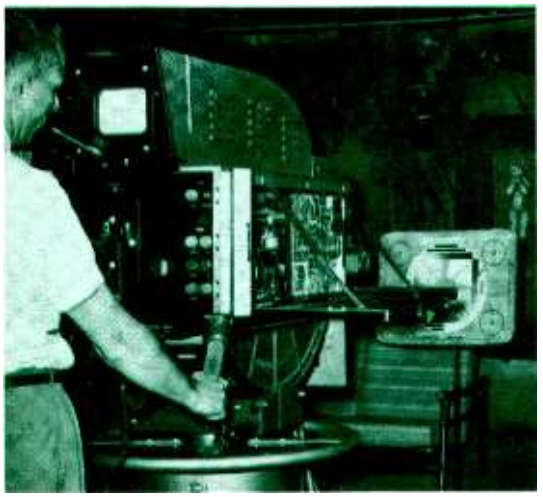


This display shows some ready-made aids for color servicing. A short clip lead, a resistor (in series with an electrolytic), and a detector probe (on the small terminal board) are all needed to perform chroma-bandpass alignment. The large 1500-ohm, 100-watt resistor is used to load the B+ supply, if horizontal sweep is disabled during alignment. The resistor is mounted on a wooden board because it runs "mighty hot" when connected. The anode cable has an alligator clip to facilitate connection to recent-model chassis.

The stock shelves shown here contain many replacement components for use in color chassis. Among them are two 3.58-mc crystals (chroma reference oscillator), a couple of plate coils for the same circuit, a thermal circuit-breaker, and a line thermistor (used in some color sets). Also, Leon mentioned he keeps one or two spares for any component which has a history of repeat failure in a particular color chassis. This special stock supply is located next to the color-test setup—there's real convenience!



Leon also sells color television sets. Here we see his service manager, Owen Crew, making predelivery convergence adjustments to a new color receiver. He points out, "Prior to delivering a color set, we check its performance thoroughly, making any necessary convergence and operating adjustments in the shop. Usually all that's needed later, when we set the receiver in the customer's home, is degaussing and quick operational checks. Naturally, a few receivers still require touch-up in the customer's home."



A LOOK INSIDE A COLOR TV STATION

Considerable effort goes into reproducing shows in natural color . . . by *Charles Guion*

Did you ever wonder what a television studio crew has to do to produce a live color picture? Just to think about it, you might imagine the engineer merely goes to the control panel and turns on a handful of switches, proceeds into the studio and lights up the set where the show will be televised, aims the camera in the general direction of the set, and awaits further instructions from the producer. On the surface, this is true—as far as it goes.

But just what switches does he turn on, and what are their functions and purposes? The first switch will probably turn on the tube filaments in the color camera. Next, the engineer will fire up the flag generator, the colorplexer, the color-bar generator, the color monitor, the black-and-white studio monitor, and the audio racks.

To help explain some of the equipment used in reproducing a color scene, let's take a brief look at the process used in color televising.

The Camera

The color camera is actually three separate cameras within a single housing. It contains three separate *image orthicons* (similar to those used in black-and-white cameras), three video preamplifiers, and — until recent years — three separate camera cables.

"Handful" of switches are important to color TV, but are only the beginning.

However, the camera uses only one lens for all three orthicons. They are positioned so that, through the use of prisms and mirrors, the same scene strikes all three tubes. A color filter is placed in front of each tube. Each filter corresponds to one of the three basic colors used in the present color-TV system—red, blue, or green.

With the camera aimed in the direction of the scene to be televised, the orthicon with the green filter in front of it produces a signal voltage corresponding to the amount of green in the scene. In a like manner, the orthicons with the red and blue filters develop voltages in proportion to the amount of red and blue.

Colorplexer

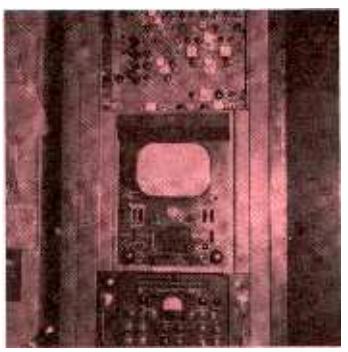
The three color-signal voltages are then applied to the *colorplexer*. This unit, approximately 15″ deep and 20″ high, is usually mounted in a standard 19″ equipment rack. The colorplexer contains the circuits which form a composite color signal by matrixing, or "cross-mixing," the green, red, and blue signal voltages from the color camera.

The colorplexer produces three output voltages: the luminance (Y) signal, and two chrominance signals (I and Q). These latter two are applied to a pair of balanced modulators within the colorplexer and combined with a 3.58-mc subcarrier. The balanced modulators suppress the carrier, so the modulators produce only the sidebands. The output signals from the modulators are 90° out of phase. When they are added (in another stage of the colorplexer), they produce a signal with an amplitude and phase which varies in accordance with the color saturation and hue in the scene being scanned. The I and Q signals are then added to the luminance signal, still within the colorplexer, and sent through switching relays and stabilizing amplifiers to the transmitter.

Preparing the Camera

Let's assume the camera chain has now been on for approximately thirty minutes. While the camera has been warming up, the studio engineer has been performing various routine tasks, such as checking the program log for upcoming color programs and shows that are to be put on television tape.

He now switches on the camera B+, places a *resolution chart* in front of the camera, and (using a light meter) makes sure the chart is illuminated sufficiently. Next, at the control console, he makes sure the regulated power supplies are adjusted, and sets the focus current to



Colorplexer, monitor, and control board —a maze of tubes, controls, and knobs.

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RCA Electron Tube Division, Commercial Engineering, Dept. X-33-R
415 South Fifth Street, Harrison, New Jersey

Please! Rush more information on the new RCA Mark VIII 2-way Citizens' Band Radio.

Name_____

Address_____

City_____ Zone____ State____

*Maximum plate input power to final radio-frequency amplifier stages as defined by FCC regulations

**Optional list price

RCA **The Most Trusted Name in Electronics**

the required value. Having taken care of these items, he is now ready to "set up" the color camera.

Beam Adjustments

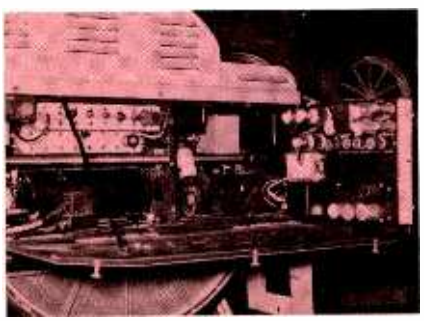
With the camera lens covered, the engineer adjusts the green channel first, since the red and blue are registered with respect to the green. The beam current is first increased until the dot can be seen on the camera monitor. The green channel is then aligned by turning the focus control back and forth, meanwhile adjusting the two alignment controls until the focus dot remains stationary. The same procedure is then followed with the red and blue channels. The basic adjustments are similar to those of a black-and-white camera, except that three separate orthicons must be set up.

Now, with the green lens uncapped, the camera is positioned so that the resolution chart is centered in the camera's viewfinder monitor and the control-room monitor. The beam current is increased until the highlights (bright areas) of the chart are just on the verge of blooming. A test switch reduces the image on the viewfinder, and the target voltage is set to a point where the chart is barely visible; when the test switch is released, the picture of the chart is visible again. The same procedure is followed with the other two channels — the red and blue.

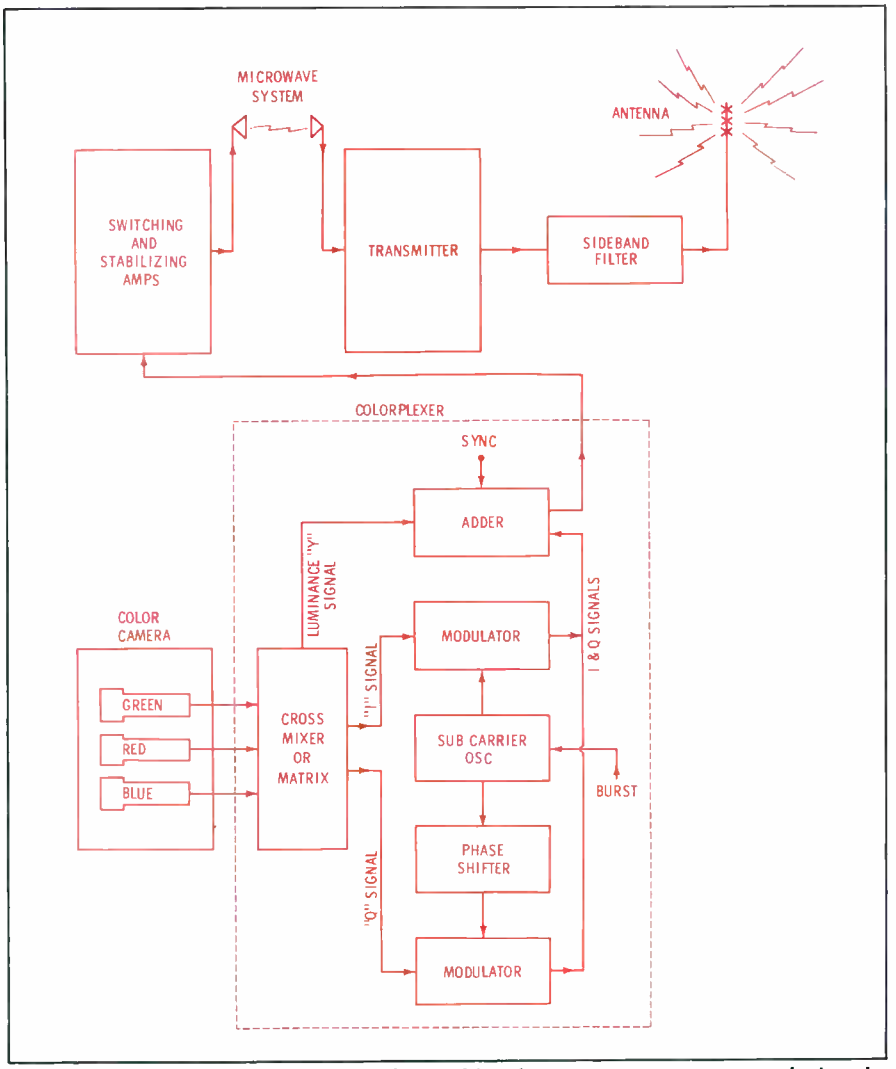
Registration

The resolution chart is now replaced by a registration chart. The engineer carefully checks the green channel for proper aspect ratio and adjusts the necessary controls.

Adjustment of the *gain* and *pedestal* controls to the prescribed levels in all three channels is necessary, before actual registration of the red and blue channels on the green can begin. By setting these controls, the engineer is attempting to achieve a good black and white picture, well focused, from each of the color channels in the camera.



Color camera with side panels down to reveal setup and maintenance controls.



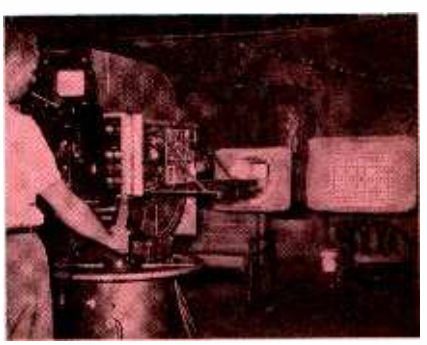
Simplified block diagram shows relationships between components and signals.

Registration of the color cameras — similar to convergence in the color receiver — is one of the most intriguing, fascinating, and sometimes frustrating operations in the entire setup procedure. The procedure is briefly this: The red-green button on the processing amplifier is depressed, enabling the engineer to see two pictures on the camera monitor. The green channel is left strictly alone, and the red vertical centering control is turned to separate the two pictures of the chart. Thus, the engineer can check the height of the red channel image with respect to the green; they should be equal at the top and the bottom. When they are the same, he brings the displaced signals back together.

Next, the vertical lines of the chart must be checked to make sure that they are parallel in the two rasters. To do this, the horizontal centering control of the red channel is turned just enough to offset the red-camera image. If the vertical lines are not quite parallel, the engineer can take care of this little problem with the *skew* control located on the camera.

Width is also checked, using this displacement technique; and even image displacement at the extreme left and right sides indicates equal widths. The chart images can now

• *Please turn to page 100*



Engineer uses resolution and registration charts to adjust color-TV camera.

NOW *EVERYONE* CAN QUICKLY
Set up and Service Color TV

1 PATTERN DISPLAY STANDARD
Shows correct pattern and color in window viewer for visual guide

2 PATTERN SELECTOR
Produces each pattern individually for quick, easy convergence

3 AUTOMATIC DECONVERGENCE
Simplifies static and dynamic convergence. No digging into set

4 COLOR SELECTOR
Produces each color one at a time for accurate color set-up

5 COLOR GUN KILLER
Automatically enables the technician to actuate any combination of the 3 guns

6 DEMODULATOR ALIGNMENT
Makes alignment extremely simple, without going into the color set

New! B&K Model 850 COLOR GENERATOR

Most Complete, Most Versatile, Portable Instrument for Use in the Home and in the Shop
Makes Color TV Set-up and Service Easier, Faster than ever!

Now every service technician can be ready to set-up and service color TV with amazing new ease and speed! New advanced design simplifies the entire operation, saves time and work in every installation. Eliminates difficult steps in digging into the color TV set. Gives you new confidence in handling color.

Produces Patterns, Burst, and Colors Individually—Provides dot pattern, crosshatch, vertical lines, horizontal lines, burst signal, and individual colors—one at a time—on the instrument panel as well as on the TV color set—for fastest, easiest check. Unique window-viewer on front of the instrument panel shows you each pattern and color as it should be—gives you an exclusive display standard to use as a sure guide for quick, visual comparison.

Provides Accurate, Individual Color Display—Produces Green, Cyan, Blue, B—Y, Q, Magenta, R—Y, Red, I, Yellow, and Burst—one at a time. All colors are crystal-controlled and are produced by a precision delay-line for maximum accuracy. Each color is individually switch-selected—no chance of error.

Provides Accurate NTSC-Type Signal—Color phase angles are maintained in accordance with NTSC specifications.

Makes Convergence and Linearity Adjustments Easy—Highly stable crystal-controlled system with vertical and horizontal sync pulses, assures the ultimate in line and dot stability.

Simplifies Demodulator Alignment—The type of color display produced by this instrument provides the ultimate in simplicity for precise demodulator alignment.

Provides Automatic Deconvergence—Eliminates the necessity for continual static convergence adjustments. The instrument automatically deconverges a white into a color dot trio without digging into the color set to misadjust the convergence magnets. It also deconverges a white horizontal or vertical line into red, green and blue parallel lines. This greatly simplifies dynamic convergence adjustments.

Provides Exclusive Color Gun Killer—Front-panel switch control makes it easy to disable any combination of the three color guns. Eliminates continuous adjustment of the background or screen controls, or connection of a shorting clip inside the receiver. The switch also selects the individual grids of the color tube and connects to a front-panel jack to simplify demodulator alignment.

Provides Switch-Selected R.F. Signals—Factory-tuned, for channels 3, 4, and 5—for open channel use in your area.

Model 850 also includes other features that make it invaluable for home and shop use. Net, **$199.95**

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DOLLAR & SENSE Servicing

by Wayne Lemons

Interpreting Your Inventory

How much is your inventory really worth? If you were forced to close out your business tomorrow, could you get 20c on the dollar?

Maybe you're overstocked on obsolete items. For example, if you're still stocking as many 6SN7's or 6BQ7's as you were two or three years ago, you should get a rag and wipe them off, for they have been collecting dust sitting there undisturbed. Take a look at your shelves. If you're not on top of the inventory-control problem, you'll find a lot of boxes that are showing their age—a dead giveaway that some of your money tied up in parts is slowly but surely dissolving into the air.

What can you do about this very real problem of inventory obsolescence? Unfortunately, there is no one pat answer, but even the smallest shop can take some highly effective stopgap measures. By far the most profitable of these is some sort of *simple, daily* inventory data sheet. This need not be elaborate; in fact, it should not be. Elaborate inventory controls are successful only for large companies—in small businesses they dig too deeply into the owner's productive time. Fortunately, even simple systems that take no longer than 15 or 20 minutes per day result in invaluable data relative to what you should or should not buy.

Fig. 1 shows a simple daily sheet you can use. All the information on it comes from your daily sales tickets. It does double duty as a "want list" for reordering stock; also, by simply placing a check after the items listed, you can keep a record of parts ordered. This information, if you have a busy shop, can be transferred to a weekly tally sheet—or you may want to transfer the information only once each month onto a record chart something like that in Fig. 2. The monthly record then becomes your standard of buying; you rely on it, rather than on what you "feel" you need. For example, you may think you should stock ten 1X2's because this type seems like a good mover. A look at your monthly record, however, shows that you sold only ten 1X2's for the whole year. Obviously, then, since you never sold more than two in any month, two 1X2's should be an ample stock. You can use the money that would be tied up in eight more to provide you with some ready cash for improvements, to buy test equipment, or to purchase other, faster moving items for resale.

(Incidentally, many shops make up their monthly tube records using tube price lists furnished by the manufacturer—simply making tally marks alongside the tubes used. This saves you the trouble of having to list all tubes separately. The method you use is, of course, a personal preference.)

You will note that other, larger items are also listed in the monthly record: speakers, transformers, yokes, and the like. A great deal of money-saving information comes from keeping track of these comparatively expensive parts. In Fig. 2, for example, the record shows that only one 6" speaker was sold during the year. Thus, it would be folly for this shop owner to have more than one 6" speaker in stock. Actually, it is unlikely that even one should be stocked unless the shop happened to be in some remote area where two or three days would be required to obtain a replacement.

For the small shop in particular, it usually is not profitable to take the time necessary to list small items costing less than $1, such as resistors and capacitors, on the record sheets. These are best kept in marked bins and reordered when the supply is low. These items usually

DAILY RECORD

DATE	PART	No. USED	DATE	PART	No. USED
7/9/61	5U4	III	7/10/61	4CB6	I
	6CB6	IIIIII		12BY7	I
	6AU6	I		6CB6	II
	1B3	I		6T8	I
	6A55	I		6AV6	I
	6AQ5	I		6BQ5	II
	3CB6	I		5U4	I
	5U8	II		5CG8	I
	12L6	I		6BQ7	I
	12BE6	I		6AX4	III
	Silicon Rect	II		17BQ6	I
	14S Vert Output XFMR	I		21AUP4A	I
	6" x 9" SPKR	I		4" SPKR	I
	100 MFD 150V	I		Y66 YOKE	I
	2-Set Coupler	I		80MFD 450V	I
				10MFD 150V	I

Fig. 1. Information from sales tickets is logged in a daily record sheet.

Find it and Fix it in ½ the time!

EASILY SOLVES "TOUGH DOGS"... INTERMITTENTS ... ANY TV TROUBLE

B&K MODEL 1076 TELEVISION ANALYST
BLACK & WHITE AND COLOR

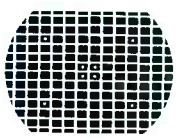
By Easy Point-to-Point Signal Injection, You see the Trouble on the TV Screen and Correct it—Twice as Fast and Easy!

Simplified technique stops lost hours never recovered on **"tough dogs", intermittents,** and **general TV trouble-shooting.** This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half ... service more TV sets in less time ... satisfy more customers ... and make more money.

With the Analyst, you inject your own TV signals at any time, at any point, while you watch the generated test pattern on the picture tube of the television set itself. This makes it quick and easy to *isolate, pinpoint, and correct* TV trouble *in any stage throughout the video, audio, r.f., i.f., sync and sweep sections* of black & white and color television sets—*including intermittents.* No external scope or waveform interpretation is needed. Checks any and all circuits—solves any performance problem. Gives you today's most valuable instrument in TV servicing—*proved by thousands of professional servicemen everywhere.*

Available on Budget Terms. As low as $30.00 down. Net, $299.95

SIMPLIFIES COLOR TV SERVICING, TOO



Enables you to troubleshoot and signal trace color circuits in color TV sets, or facilitate installation.

Generates white dot, crosshatch and color bar patterns on the TV screen for color TV convergence adjustments.

Generates full color rainbow display and color bar pattern to test color sync circuits, check range of hue control, align color demodulators. Demonstrates to customers correct color values.

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere

Model 960 Transistor Radio Analyst

Model 360 V O Matic Automatic VOM

Model 375 Dynamatic Automatic VTVM

Model 700 Dyna-Quik Tube Tester

Model 440 CRT Rejuvenator Tester

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do not become obsolete; even if they did, they would hardly be a major factor in inventory control.

How to Reduce Your Stock

If you find that you are overstocked, what can you do about it? First, the obvious answer is not to reorder when you sell one of the surplus parts. Second, in the case of tubes, you may be able to substitute one type for another. (Turn to a tube substitution manual for help.) Larger components sometimes may be put to use as substitutes for others, but be sure that the time involved in making the substitution doesn't offset any profit gained by it. Third, if you are overstocked on items that may be sold across the counter, you should consider running a sale. Capital tied up in slow-moving merchandise is costing you money. Often it is better to break even, or sometimes take a slight loss, so you can put that money into other items that have faster turnover. Fourth, sometimes distributors have something like a "five-for-one" deal where they will give you full net price on an obsolete tube for every five of some other type you buy. Take advantage of these deals to get your money into fresh and fast-moving stock. Always try to maintain the money you have tied up in inventory at about the same level, if possible. Money in inventory is not like "money in the bank." The real value of your inventory is what you can turn it into —in the form of sales. In reality, a part sitting on the shelf has no

Test your tubes free? Sure, and how about waxing my car free?

value at all unless it can be sold. Basic as this obviously is, many technicians develop a false sense of prosperity when they take their physical inventory at the end of the year—counting each obsolete item at its full net price.

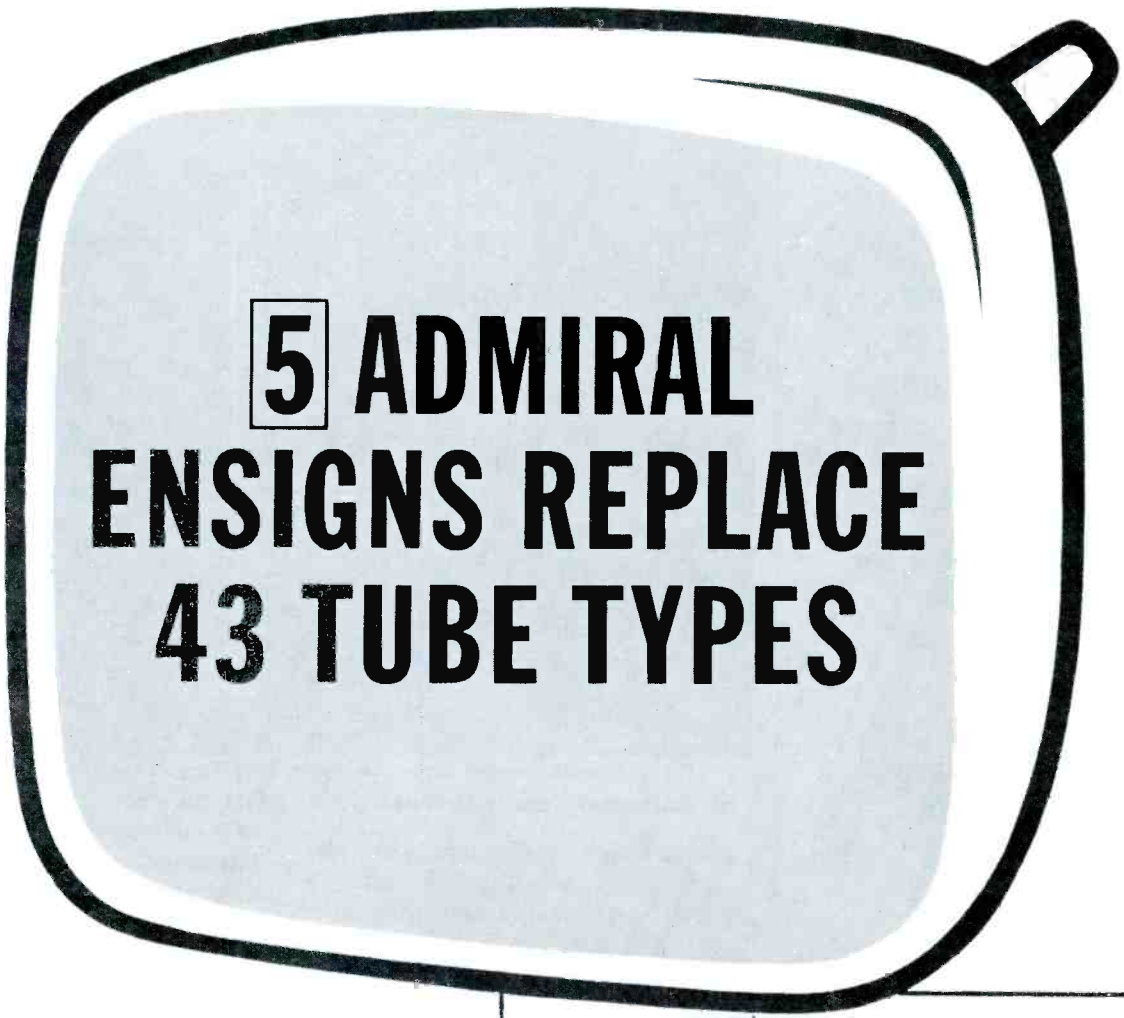
Where Should You Expand Inventory?

The admonition to maintain your inventory at a generally constant level is always wise unless you have a surplus of capital, or unless you can be reasonably sure that increasing your inventory will increase your profits. You might, for example, decide to take on transistor radios as a sales sideline. You should decide just how much money you are willing to spend. If you cannot spend enough money to put in a good selection of radios and to promote them through advertising, then you should forget about the whole thing. You might just as well put the money into a savings and loan association—you'd very likely make more money with a lot less effort. Or you'd be smarter to put it into some other item, such as a piece of test equipment, to speed up your work.

You must expand your tube inventory as new tubes come out; but by a careful check of your inventory records, you can usually do this without affecting your overall cost of inventory. You simply maintain a smaller stock of tubes that are being superseded by new types. For example, as you must buy more 6FQ7's, you can reduce your stock of 6CG7's. Likewise, you can buy fewer 6U8's as you stock up on 6EA8's and 6GH8's. You can keep up with new tube developments by studying articles on new set designs, and by checking the *Stock Guide for TV Tubes* which periodically appears in PF REPORTER.

Also remember that some tubes are used more in some areas than in others. For example, one make of set may be much more prevalent in your area than any other. This will help to determine what tubes you should stock, as well as other parts and components. It would be foolish, for instance, to stock 6BN8's if no sets sold in your area use them, or 6AF4's if you have no UHF tuners to service.

REDUCE INVENTORY! INCREASE SALES!



5 ADMIRAL ENSIGNS REPLACE 43 TUBE TYPES

You save space, save dollars— make more dollar profit per sale!

...with the Admiral ENSIGN "Big 5" as your basic tube inventory. Less stock, more sales—and you make more profit! That's sweet music! Every Admiral ENSIGN tube is of fine/precision quality manufacture. All materials and parts used in the manufacture of these tubes are *new* except for the envelopes, which prior to reuse, have been inspected and tested to the same standard as new envelopes.

Call your ADMIRAL DISTRIBUTOR tomorrow... start cutting inventory cost, pocketing new profits right away!

BE WISE... STANDARDIZE ON

ADMIRAL ENSIGN

ENSIGN **17BJP4** REPLACES	17ATP4, 17AVP4A, 17ATP4A, 17BUP4, 17CLP4, 17AVP4, 17CBP4
ENSIGN **21AMP4A** REPLACES	21ACP4, 21AQP4, 21ACP4A, 21AQP4A, 21BSP4, 21AMP4, 21CUP4
ENSIGN **21CBP4A** REPLACES	21FLP4, 21ATP4, 21CBP4B, 21ALP4, 21ATP4A, 21CMP4, 21ALP4A, 21ATP4B, 21CVP4, 21ALP4B, 21BAP4, 21CWP4, 21ANP4, 21BNP4, 21DNP4, 21ANP4A, 21BTP4, 21CBP4
ENSIGN **24CP4A** REPLACES	24ADP4, 24ATP4, 24CP4, 24VP4, 24XP4, 24QP4, 24VP4A
ENSIGN **24AEP4** REPLACES	24DP4A, 24ANP4, 24YP4, 24ZP4

REPLACEMENT PICTURE TUBES—ALWAYS FINE/PRECISION QUALITY

PART USED	MONTHLY RECORD JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL 1961
0Z4	1	2	0	0	3	4	2	3	0	1	0	0	16
1B3	11	10	6	9	7	3	9	12	6	1	5	4	83
1G3	4	2	3	4	1	2	2	0	1	4	4	3	30
1R5	0	0	0	0	1	0	1	0	0	0	0	0	2
1U5	0	0	0	0	1	0	0	1	0	0	0	0	2
1X2	2	1	1	1	0	0	0	1	1	0	2	1	10
2BN4	0	0	0	0	1	1	0	0	0	1	1	0	4
2CW4	0	0	0	0	1	0	0	1	1	0	0	2	5
2CY5	1	0	1	1	0	0	0	1	2	0	0	1	7
3A3	1	0	0	0	1	0	0	0	1	0	1	0	4
3AL5	0	0	1	0	0	0	0	0	0	1	0	0	2
3AU6	2	0	1	1	2	1	0	0	0	0	2	0	9
3AV6	1	0	0	0	0	1	0	0	0	0	2	0	4
3BN6	0	0	0	1	2	0	2	0	0	0	0	1	6
3BU8	0	0	0	2	0	0	0	0	1	0	0	3	6
3BZ6	5	3	2	6	4	8	4	3	1	7	10	9	62
Spkrs. 4"	1	0	2	0	3	3	0	2	4	0	0	1	16
Spkrs. 5"	2	2	0	0	0	0	2	0	0	1	0	1	8
Spkrs. 6"	0	0	0	0	0	0	0	1	0	0	0	0	1
Spkrs. 4" x 5"	0	0	1	0	0	0	0	0	1	0	0	0	2
Spkrs. 5" x 7"	0	0	0	0	2	0	0	1	0	0	1	0	4
Spkrs. 6" x 9"	0	0	0	2	0	3	4	1	0	0	2	0	12
Vert. Output XFMR	1	0	0	0	1	0	2	2	0	0	0	1	7

Fig. 2. Monthly record shows long-term inventory needs for various parts.

Let Salesman Figure Inventory?

Some shops have a favorite salesman do their inventory; he looks over the merchandise and brings it back up to the normal level. If the salesman is honest (and most are and have to be), this can save the shop owner a lot of time. But even the most honest salesman cannot protect you from creeping obsolescence unless he is really on the ball. *You* must still maintain your own inventory records if you are to stay on top of your business. You must know just how many of each item you should stock. You should have this information so that, even if the salesman does your inventory, your stocks will reflect the changing trends in sales.

Also, if you do choose to have a salesman do your inventory, you can nearly always demand and get his agreement to replace slow-selling tubes with others that will move. Don't be afraid to ask for favors when you are extending him the privilege of an "automatic" order.

Summary

Inventory control can be simple or complex. For the small shop, keep it simple, but *keep* it! It will give you data that you can use to eliminate under- or overstocking, and can even help you to evaluate future sales trends. It can be the difference between making and losing money. ▲

New TRANSISTOR RADIO ANALYST

makes it Easy and Profitable to Service all Transistor Radios

B&K Model 960

TRANSISTOR RADIO ANALYST

with Exclusive DYNA-TRACE Single-Point Probe—and Built-in Metered Power Supply and VTVM

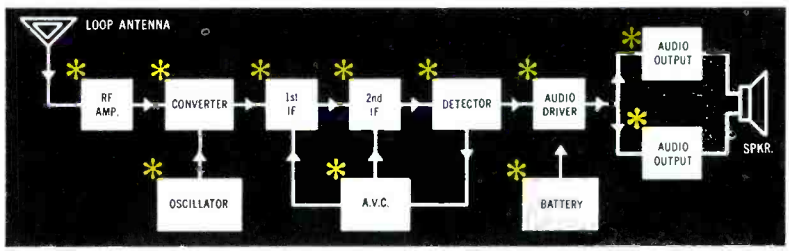
Complete Transistor Radio Service Shop in One Instrument

Signal-Generator, Power Supply, Milliammeter, VTVM, Battery Tester, Ohmmeter, and Both In-Circuit and Out-of-Circuit Transistor Tester—All in One

Also Speeds Servicing of Tube-Type Radios

Check all circuits - Pinpoint any trouble ... in minutes

Now you *can profit* from transistor radio servicing! This amazing new B&K "960" ANALYST gives you *everything* in *one* complete easy-to-use instrument. Makes transistor radio servicing *quick and easy*. Nothing else is needed except the transistor radios themselves waiting to be serviced. Brings you new customers for service, parts, and batteries. Makes this new business *yours*.



EASILY TROUBLE-SHOOT ANY STAGE BY UNIQUE POINT-TO-POINT SIGNAL INJECTION

The ANALYST gives you a complete signal-generating source for point-to-point signal injection. Easily enables you to trouble-shoot any transistor radio—check all circuits stage-by-stage—isolate and pinpoint the exact trouble in minutes.

Supplies modulated signals, with adjustable control, to check r.f., i.f., converter, and detector. Supplies audio signal to check audio driver and audio output. Provides unmodulated signal to test local oscillator. Provides separate audio low-impedance output for signal injection into loudspeaker voice coils to check speaker performance.

BUILT-IN METERED POWER SUPPLY FOR EASY SERVICING

Makes it easy to operate radio under test, while you inject your own signals. Provides from 1 to 12 volts in 1½ volt steps. Supplies all bias taps that may be required.

SIMPLIFIES IN-CIRCUIT TRANSISTOR TEST WITH NEW DYNA-TRACE SINGLE-POINT PROBE

Unique single-point probe needs only the one contact to transistor under test. No longer are three wires required to connect to emitter, base, and collector. Gives fast, positive meter indication. Saves time. Makes trouble-shooting simple and easy.

BUILT-IN VTVM

Includes high-input-impedance vacuum-tube voltmeter, which is so necessary for transistor radio servicing.

TESTS ALL TRANSISTORS OUT-OF-CIRCUIT

Meter has "Good-Bad" scale for *both* leakage and beta. Also has direct-reading Beta scale, calibrated 0-150. Assures quick, accurate test. Also automatically determines whether transistor is NPN or PNP. Meter is protected against accidental overload and burn-out.

Model 960. Net, **$99.95**

Solve Every Service Problem and Profit with a Modern B&K Service Shop. See Your B&K Distributor or Write for Catalog AP20-R

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COLOR TV SERVICE CHARGE GUIDE

Service shops are in business to make money. Some that service color sets, succeed in making a reasonable profit, while others don't. We made an investigation of current color-TV service charges, and came up with some facts and figures which should interest all servicemen.

Color-TV servicing, like many other types, is priced in one of several ways: by the hour, on a flat rate per job, at a rate based on parts which are replaced, service contract, and a service-call charge plus any bench service needed. In addition, prices vary among individual shops, and differ in various areas of the country.

For example, prices are higher in thickly populated areas than in rural areas. Much of this can be attributed to greater overhead costs; some increase is dictated by the difference in labor costs in metropolitan centers. Western prices have a tendency to be higher than those in the East.

Color-TV calls and service are priced generally higher than for monochrome receivers. Partly, this is because more special test equipment is needed, and service charges must reflect this added cost. Another reason is the increased training and ability required of good color servicemen, thus raising their wage level.

Hourly rates are usually the basis for deciding by-the-part prices, although this method is used less than in former years. The time normally required to test and locate a defective part, plus the time needed to replace it, is determined; then the rate is computed from that. To these basic rates, most shops add a charge to cover disassembly, general cleaning, and adjustment.

Service calls usually cover the first half-hour of time in the home. Most shops then charge by the hour, for extra time needed. Some have come up with flat charges for standard jobs, such as a complete setup, where the time required is fairly well known in advance.

The accompanying chart reflects various methods of charging for color service. The prices shown are based on national averages, and may be more in some areas, or less in others. Your own service charges should be based on a realistic scale which takes into consideration your labor costs, overhead, and investment in special test instruments. With the chart as a guide, you can determine whether your charges are in line with the average. ▲

National Average Color-TV Service Charges

		for Color TV	for B-W TV
Hourly Rate		$ 5.25	$ 4.50
Home Service Call		6.25	4.25
Bench Charge—Min.		15.00	10.25
Bench Charge—Max.		27.50	21.50
Yearly Contract (incl. parts & CRT.)	1st yr.	72.00	55.00
	2nd yr.	120.00	75.00

Note: The lowest prices charged centered around the northeastern section of the country, and are about 25% lower than the averages shown above. The highest prices, about 25% above the averages, are concentrated in the West Coast area.

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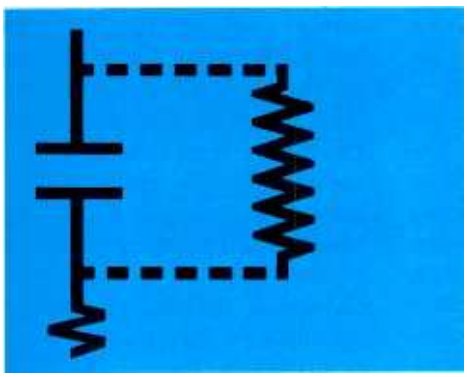
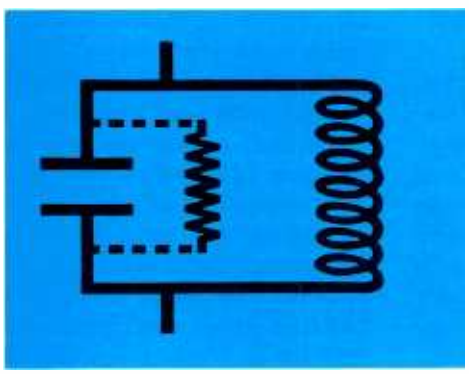
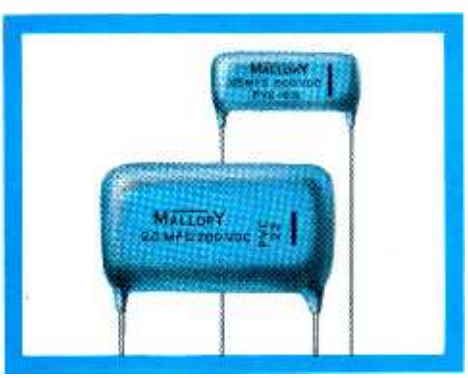
a division of P. R. Mallory & Co. Inc.

Moisture and microfarads







Humidity can cause serious troubles in capacitors used in many of the electronic circuits used today. Take a look at the equivalent circuit of a capacitor, and you can appreciate the source of these troubles. The D-C leakage path of a capacitor can be considered as a parallel resistance across the terminals. In a radio circuit, a capacitor with insulation resistance of as little as 25 megohms would give reasonable operation. But not in television and other sophisticated circuits.

Most television circuits have high impedance. Coupling, bypass and timing capacitors should have insulation resistance many times the circuit impedance. In a multivibrator circuit, for instance, capacitor leakage resistance alters the time constant of the timing network. In a ringing oscillator, frequency depends not only on inductance and capacitance, but also on the resistance of the capacitor leakage path.

What happens when ordinary capacitors are exposed to humidity? Sometimes there's an all-out failure. But even without a catastrophic short-out, a capacitor can begin to lose insulation resistance to the point where, in a television circuit, for instance, it's impossible to get the picture to lock in, verticals will be wavy, and the picture will bend at the top.

Our tip for the month: be sure of stable operation no matter how wet the weather, by using Mallory PVC capacitors. PVC stands for *plus value capacitor*. They're made with 100% Du Pont Mylar* dielectric. They contain no paper, no combinations of Mylar and paper, no substitutes for this most moisture-impervious of dielectrics.

PVC also stands for polyvinyl chloride . . . the flexible case on these new, blue capacitors that won't crack when you bend the leads. PVC's are exceptionally small for their ratings. You can squeeze 'em readily into crowded circuits. And they're even better in reliability, ruggedness and stability today than when we introduced them months ago.

Get Mallory PVC capacitors from your nearby Mallory distributor. He's the man to see for the best in capacitors, resistors, semiconductors, batteries . . . for *all* your component requirements.

* Reg. Trademark—E. I. du Pont de Nemours

How expensive are service calls?

Where can I get service?

answering customers' COLOR QUESTIONS

When will color be cheaper?

What does warranty cover?

Why are the faces purple?

How many stations can I get?

Be ready to stay one jump ahead of the anxious color-set owner . . .

Have you been stumped lately by inquisitive customers whose curiosity about color TV left you scratching your head for answers? If so, you're not alone; with the popularity of color TV growing by leaps and bounds, and with a large majority of TV stations transmitting either a little or a lot of color, this problem is cropping up among servicemen all over the country. To see what others are doing about it, let's peek in on a few scenes that have taken place at one or more shops in the past few months. These little bits of eavesdropping may prove very enlightening.

The scene is the color-TV showroom of a large midwestern TV dealer. Several color sets are sitting around the room, and even though the sun is bright outside, the light in the showroom is subdued. Two of the sets are playing—one, a table model, sitting on a decorative stand, and the other in a very fancy maple cabinet with doors.

A salesman and a customer are standing near the maple set, the customer with jacket unbuttoned and hand in pocket. The salesman has just extolled the virtues of this particular set, and the customer—with an all-wise look—continues the conversation something like this:

Customer: I'll agree, color-TV is much better than it used to be, but considering the price, I think I'll wait awhile. They're so expensive now, and later on they'll probably be as cheap as black-and-white.

Salesman: I appreciate your feelings, but actually, the price of color sets has been pretty well stabilized for several years. Since they are already being mass-produced, there's little likelihood of savings in that area. Color-TV sets are more expensive than black-and-white simply because there's more in them. It just takes more circuits to process the more complex color signal than it does to handle a black-and-white signal. In spite of this, you *can* purchase a color set—for instance, this table model in the metal cabinet—for less money than some black-and-white models.

Customer: Sure, but that's still close to $500, and I can buy a black-and-white set for one-third of that.

Salesman: But now you're talking about a portable, Mr. C, and the size of a color CRT alone dictates that a color set would not be easily portable. It is not likely that portable color sets will be a reality for several years, and when they are, the price will still be higher than that of a portable black-and-white TV, for the same reasons I mentioned before.

Customer: Okay, supposing I bought one? Could I use it on my screened-in patio in the summer time, like I do my black-and-white set?

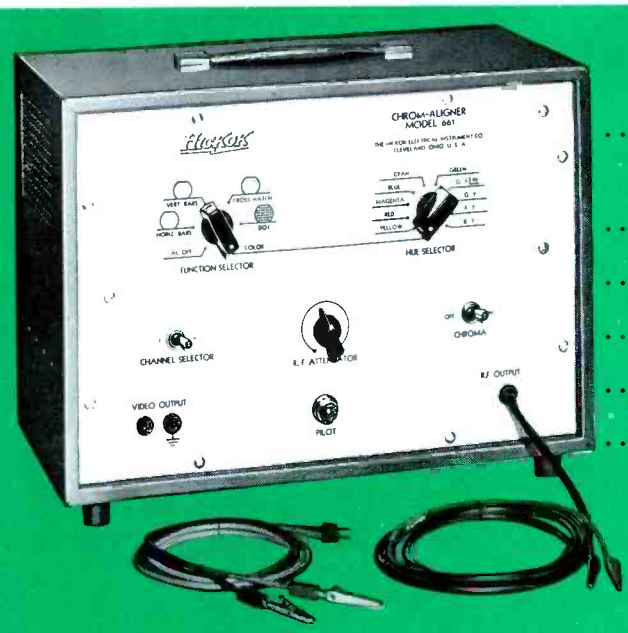
Salesman: You could, but it wouldn't be advisable unless you have shades. You see, bright daylight "washes out" the colors, and would rob you of some of the enjoyment and benefits of your color picture. (Turning on several overhead lights.) See? The colors were rather vivid on this set with the lighting lowered, but they appear a bit lifeless in the presence of bright light. (Turning the lights off again.)

Customer: Yes, I see now. It would be better in the living room. How about the antenna? Can I use the rabbit ears I've been using with my present set?

Salesman: Perhaps you can, but it wouldn't be wise for me to say for sure until we have a chance to use your particular antenna and actually see color shows from each of the stations you'll watch. Color sets require a more stable signal than monochrome sets, and faults (such as ghosts) which you can put up with on black-and-white will ruin your enjoyment of a color program. Occasionally, when stations are to be received from several directions, it is even necessary to install a rotator. In either case, you're sure to find the enjoyment you get from a color set worth the investment needed to get a proper picture.

Customer: What about service? I hear that will cost me more than for my black-and-white set.

Salesman: If and when your color set breaks down, the cost of repairs are usually a bit higher than with monochrome sets. A good color-TV serviceman will take more time to assure himself—and you—that the circuits in your color set are operating correctly. There is far more interaction among color circuits than is found in black-and-white sets, therefore they require special



- *6 NTSC Standard Colors*
- *Standard Alignment Signals*
- *Horizontal Bars*
- *Vertical Bars*
- *Crosshatch*
- *White Dots*

COLOR-APPROVED and NTSC for $200 less!

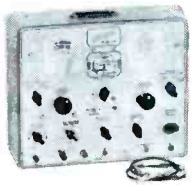
Model 661—NTSC Bar-Dot Generator—$349.50

Based on the same designs as Hickok's famous Model 656XC NTSC color bar generator, the NEW Model 661 is literally the answer for progressive service technicians who recognize the opportunities in color TV service but have been stopped by the cost of equipment. *The 661 is not a compromise—there are no short cuts—it's not "NTSC-like"; it is a complete instrument generating correct, 100% saturated, NTSC color signals complete with sync, blanking and burst at the right pedestal position and of the correct amplitude and phase, as well as demodulator alignment signals (R-Y, B-Y, —G-Y, G-Y 90°), plus dots and crosshatch.* In short, you can expect the same kind of performance standards from the new 661 that have established Hickok's reputation with leading Color TV manufacturers as COLOR-APPROVED.

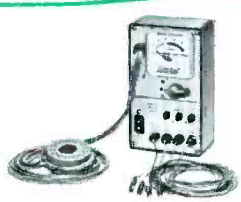
Compact, weighing just nine pounds, ideal for installation, convergence and in-the-home servicing, the new Model 661 provides everything needed for complete color service.

Ask your Hickok distributor to demonstrate the Model 661 for you . . . Write for our free booklet, "Why NTSC?" which explains why the NTSC standard tests are important. There is no obligation.

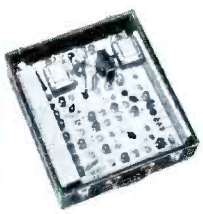
Equip your shop with these other Hickok Color-Approved *instruments to provide your customers with complete color TV service:*



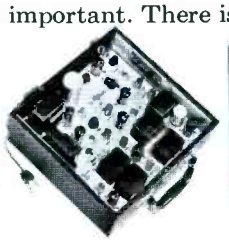
615
Sweep & Marker Generator



CR33
Color Picture Tube Tester



656XC
NTSC Color Bar Generator



660
White Dot-Bar Generator

675A
Wide-Band Oscilloscope

691
Marker Adder

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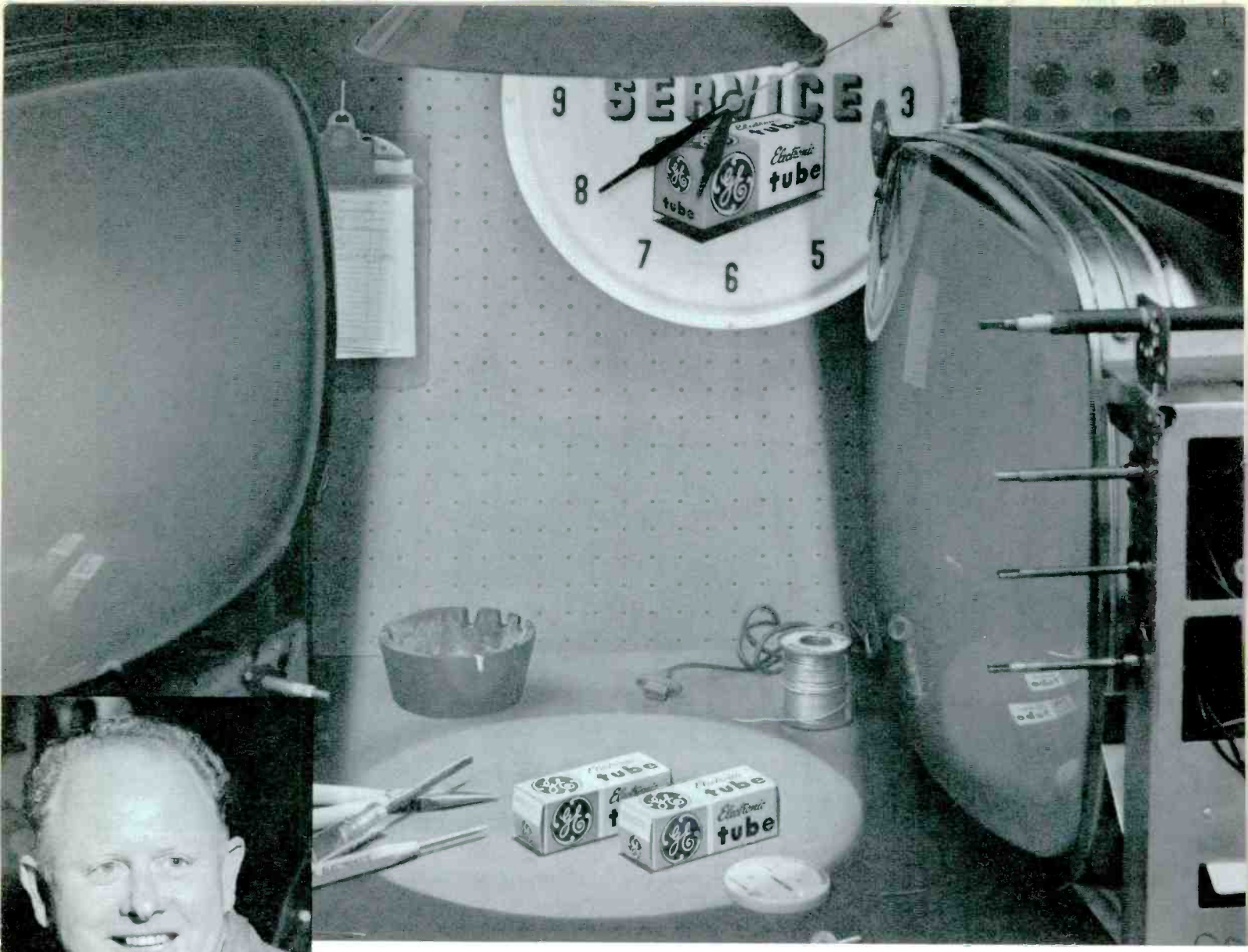

No callbacks tonight for Jim Liston, thanks to his in-warranty failure of less than 1% with G-E *SERVICE-DESIGNED* receiving tubes

"In this business, a reliable replacement tube can make you look like a hero . . . a callback due to in-warranty failure gives you a black eye, and wastes time and money. So, it's real simple, why I use G-E SERVICE-DESIGNED tubes in almost everything that comes into the shop. I can't afford callbacks."

Jim Liston is the owner of SOUTH CITY TV, South San Francisco, Calif. G-E SERVICE-DESIGNED "universal" replacement tubes help protect his profits—and his reputation. Here are just a few of their typical high-reliability features: **(1) Rhenium-tungsten heaters** increase tube reliability up to 4½ times. **(2) Three- and five-ply plate material** provides uniform heat conduction and radiation. **(3) Straight-sided bulbs** give more uniform heat dissipation. **(4) Tapered pins** prevent socket damage; save time. **(5) Tubes are interchangeable in all sets.** General Electric Company, Distributor Sales, Electronic Components Division, Room 1743A, Owensboro, Kentucky.

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GENERAL ELECTRIC

care in servicing. However, the experience of recent years seems to indicate that color sets are built more soundly, since they must be precision instruments to handle color signals properly, and as a result, need less service.

Customer: But you still aren't telling me how much color-TV service is going to cost me.

Salesman: You can budget your service costs very accurately through the purchase of a service contract. For a specified amount, you can be assured of replacement of parts which become defective within the first year, and of any adjustment that become necessary.

Customer: Doesn't the warranty take care of that?

Salesman: The warranty provides for replacement of a defective color picture tube within one year's time, but you would normally have to pay for any service involved. Under a service contract, however, even the labor for replacing any of these parts is covered.

Customer: What happens after the first year? What do I do about service then?

Salesman: Many service establishments offer second- and third-year service contracts, at very reasonable cost. Our company offers a second-year service contract which covers all parts, all labor, *and* the color CRT. Some shops don't include the picture tube in second- or third-year contracts, and of course the price is somewhat less. Still another contract plan covers all labor, but you pay for parts at regular prices.

Customer: How do I know I can get competent service? Are there very many people who know how to fix color sets?

Salesman: Admittedly, color sets are more complicated than black-and-white. Recognizing this, certain leaders in the electronic industry have developed training courses and sessions which are available—sometimes at cost, sometimes free—to service groups, and to distributors for local showing to service people. Additionally, many forward-looking distributors are supplying training clinics of their own to familiarize servicemen with color sets, circuitry, and up-to-date techniques for troubleshooting them. Many test equipment manufacturers are also offering local seminars stressing modern test equipment for servicing color sets. With all this effort being expended to train color servicemen, it is an unusual community that doesn't have at least one competent color-TV technician, and soon every shop will boast at least one color-TV serviceman.

. . . and so we step quietly out of the picture, leaving the color-TV salesman to consummate his sale, write up the order, and make arrangements for delivery. From the foregoing you can see, however, that simple factual answers are the best ammunition for combating doubts in the mind of a would-be color-TV customer.

Installing the Set

Mr. C bought the set. Deciding to go all the way, he picked the deluxe set in the French Provincial maple cabinet. The dealer's servicemen unpacked a new set from the crate, tested it thoroughly, let it "cook" a full day, and then delivered it to Mr. C's residence. Mr. C had decided to do without a new antenna system, so they had only to place the set in a corner of the living room, and connect the rabbit ears. With Mr. C as a very interested bystander (and occasional stumbling-block), one of the servicemen connected a dot-bar generator, demagnetized the set with a degaussing coil, and carefully touched up the convergence. Then, as the first color show began, Mr. C took over the operating controls of the new set. Let's listen:

Customer: I thought this show was in color. You said to turn up the color-control to get color, but it still doesn't work.

Serviceman: Perhaps you'd better recheck the fine-tuning control. To receive color, the tuner has to be carefully adjusted to the station frequency, at a point where the color part of the signal can get through.

Customer: Oh! There it is, but it sure looks gaudy; and how come the anouncer's face looks so purplish?

Serviceman: Well, the first thing to do is turn the COLOR TINT control down a little bit. If you overdo the color, it spoils the effect for you, while less color will give a nice

pastel cast to the picture.

Customer: Okay, it's not so gaudy, but I still don't approve of a pastel purple announcer.

Serviceman: That's where the HUE control comes in. As you rotate it back and forth you'll notice the announcer's face changes from purple to green. You'll find a point between these two extremes where his face becomes a nice, soft flesh tone. Again, you'll want to be sure the color control is not too high.

Customer: You're right, it does look very nice now! But why must I adjust for flesh tone? Can't I use some other color? What would I do if there is no person on the screen to use as a guide?

Serviceman: Flesh tone is, generally speaking, the only color you can really depend on always being the same; that's why it makes a good reference. However, you can come pretty close, using an outdoor scene, if you adjust the hue control for a light blue sky and green grass. Then, if necessary, you can touch up the adjustment when there are scenes that involve people.

Customer: Well, I understand all that, so what's next?

Serviceman: If you mean, what else do you have to do to get color, there's nothing. The other controls operate just exactly as with a monochrome set. With a black-and-white program on the air, simply adjust the HOLD controls, BRIGHTNESS, and CONTRAST exactly as on your old set. Then, when a color show comes on, you have simply to turn up the color control, adjust the hue, sit back, and enjoy yourself.

Customer: Now, I'll just set this little lamp on top, and we'll be in business.

Serviceman: You'll want to be careful, Mr. C, about placing things on top of the color set. In some cases, metallic objects such as that lamp will affect the picture. See the pink tinge you now have at the top of the screen? That is caused by a slight magnetic field surrounding the lamp. Bring it over here to our degaussing coil and perhaps we can demagnetize it.

Customer: Gee, I had no idea these color sets were so sensitive. Do I have to be this careful all the time?

Serviceman: Not necessarily, although if you suddenly notice some

Blue Beaver™
Types BBR/BR

Twist Prong
Types A, B, C & D

Electomite™
Type NLW

so you think you know electrolytics!

(TAKE THIS QUIZ...RATE YOURSELF)

1. (True or False) In normal servicing, all 3 usually mount under the chassis.

Ans: FALSE. Twist Prongs, almost by definition, mount through the chassis. And the NLW is often mounted on printed circuit boards.

2. (True or False) The range of ratings of the 3 basic electrolytic types are clearly separate and distinct.

Ans: FALSE. Blue Beaver ratings are 3 to 300 V, 1 to 2000 mfd. NLW ratings overlap Blue Beaver ratings in many of the lower values. And Twist Prongs, as you know, are available in practically every rating imaginable.

3. (True or False) Although all 3 types are listed in the CDE Service Selector, the NLW is really a "special".

Ans: FALSE. All 3 are standard, stocked in depth by CDE distributors. In fact, the NLW has become such a favorite with technicians over the years Distributors tell us it's one of their fastest movers!

4. (True or False) Twist Prongs and Blue Beavers are designed for entertainment electronic replacements. The NLW, on the other hand, is so expensive that it should only be used in missiles.

Ans: FALSE. The NLW is designed for entertainment as well as industrial replacements. Use it where space is important (it gives your fingers "wiggle room") and whenever an extra margin of reliability is important. The price difference between the Blue Beaver and the NLW is actually only a few pennies.

5. (True or False) If you had the right answer to all these questions, you are, without doubt, an outstanding person with intelligence and wit far beyond your station. You are a credit to yourself, your family and your country. You are also a successful technician in your community.

Ans: TRUE.

CORNELL-DUBILIER ELECTRONICS, DIV. OF FEDERAL PACIFIC ELECTRIC CO., 50 PARIS ST., NEWARK 1, N. J.

CDE CORNELL-DUBILIER

the line that collects dollars, not dust!

odd color effect in the picture, especially during black-and-white programs, check to make sure some magnetized object hasn't been placed near the set. Even moving the set to some other location will sometimes cause picture contamination, or color fringing. There, now the lamp doesn't affect the picture at all.

Customer: Yes, that's better, but what's this about moving the set? My wife will want to move it regularly, with the other furniture. Is there no way we can do it?

Serviceman: Yes, you can move it, but if there is any color contamination we may have to come out and, for a nominal charge, readjust the set to work properly in the new location.

Customer: Okay. If it's going to cost money, maybe we won't be moving furniture quite so often.

. . . and again we quietly withdraw and leave our installation technicians in full control of the situation. They have the answers to this customer's questions.

Servicing Color Sets

A few months later, Mr. C has settled into the routine of being a color-TV owner. But lately, the set doesn't seem to show as good a picture. So one bright morning, Mr. C picks up his phone and dials the number of his favorite service shop —those men who have always had the answers for him.

That afternoon, a neat, business-like serviceman is ushered into the presence of a somewhat sickly color set. Let's listen:

Customer: It's hard to say exactly what I think is wrong. The black except for those fringes around the edges of everyone in the picture, but on color it just doesn't look right. What do you think?

Serviceman: Well, Mr. C, your set is obviously ready for a "tune-up." You've had it several months now, and parts have had time to age, resulting in a need for slight realignment. I'll get a pattern generator from my truck, and give the set a good checking over.

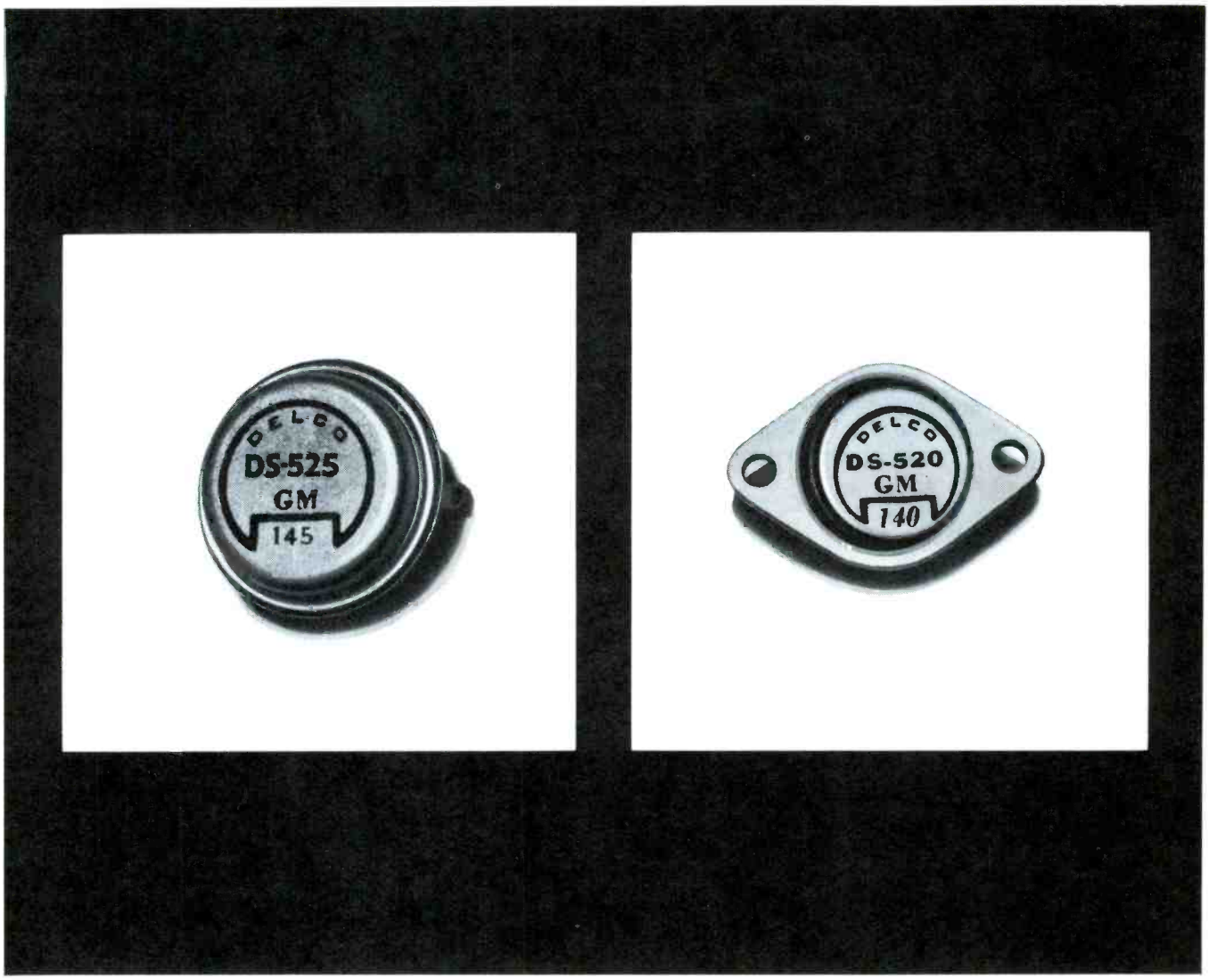
Customer: (when serviceman returns) How come you have to use special equipment?

Serviceman: I'll explain to you while I make some of the adjustments. Remember you mentioned the color slipping out of place? With this crosshatch pattern you see on the screen now, I can determine what sections of the picture need adjustment. For instance, up in this corner the red and green lines are both out of place. They should blend together with the blue line to make a white line, like it is in the center. With this pattern on the screen, I can see the result of my adjustments. There! Now we have white lines almost all over the screen, except for these little corners.

Customer: Why aren't the lines white all the way to the edges around the screen?

Serviceman: Manufacturing tolerances in the color picture tube and other circuits of the set make it well-nigh impossible to converge the lines all the way to the edge. However, when you're sitting at a correct viewing distance—say 12′ or 14′—none of the action in the picture takes place in these corners, and any slight misconvergence is not noticeable.

Customer: What causes the screen



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Now you can offer your customers inexpensive replacements for their Delco audio output transistor needs. The DS 520 and our new DS 525 can be used in place of the Delco DS 503 and DS 501 where low cost is a factor. Each of these low-priced transistors can produce 4 watts of output with top Delco reliability. They're ideal for the servicing of older car radios or for the experimenter or ham operator. The DS 520 and the new DS 525 will be a profitable addition to your basic line of Delco transistors: the DS 501 and DS 503 —to restore full power audio output in all Delco Radios; the DS 25 and DS 26 to cover small signal needs in Delco and just about every other auto radio or small portable on the market. How's that for a complete line of transistors? Oh, you need application and cross reference charts too? Look in the package. They come with all Delco transistors. All are available now through your United Delco electronics parts distributor.

Delco Radio automotive radio service parts and electro-mechanical devices are distributed nationally through **United Delco.**

DELCO RADIO, Division of General Motors, Kokomo, Indiana

United Delco

to have that bluish look on black-and-white programs?

Serviceman: That is a function of certain other controls. I can set it up for what appears to be a pure white. You watch and tell me when I have it right.

Customer: Well-l-l, that's pretty close, but it still seems a little brownish. Could you make it more black?

Serviceman: There, I'll crank a little more blue into the picture. How's that look?

Customer: That's better. How come you didn't set it up like that in the first place?

Serviceman: Well, everyone sees colors a little bit differently. The manufacturer provides these controls so we can make "custom" adjustments.

Customer: That reminds me—seems I have to adjust color controls several times an evening, to keep faces looking natural. What could be wrong with the set, to cause that?

Serviceman: Probably nothing is wrong with the set. Various shows are telecast under different lighting conditions; also, some of them are live, while others are on film or video tape. All these things cause very subtle changes in the color. The stations and networks try to keep their studio lighting as consistent as possible, but its a hard job, and they have to keep working at it. Consequently, as you change from station to station and program to program, you'll find you must occasionally change the settings of the two color controls on your set. Now, a color show is on the air, so let's see what the colors look like.

Customer: See the way those women in the picture have smeared lipstick? Can you do something to keep those colors from running together?

Serviceman: The trouble you see there is caused by ghosts, just like you had on black and white; the difference is, in color they are more noticeable. I'm sure we can clean up those ghosts, by putting up an antenna outside, or even in the attic. An attic antenna was installed for another customer of ours who lives only a few blocks away, and it works swell for them.

Customer: If I put up an antenna, could I get color shows from any other stations?

Serviceman: Yes, I can put up one of the latest-type antennas for you, and, in addition to helping clear up the ghost problems you have now, it will enable you to pick up color pictures from at least two other stations.

Customer: Won't that be pretty expensive? I've already got a lot of money tied up in this thing.

Serviceman: Not much at all, considering the added enjoyment you can get by receiving more programs in color. I think it would be a good investment.

Customer: Well, you may be right, I'll certainly give it some thought and let you know.

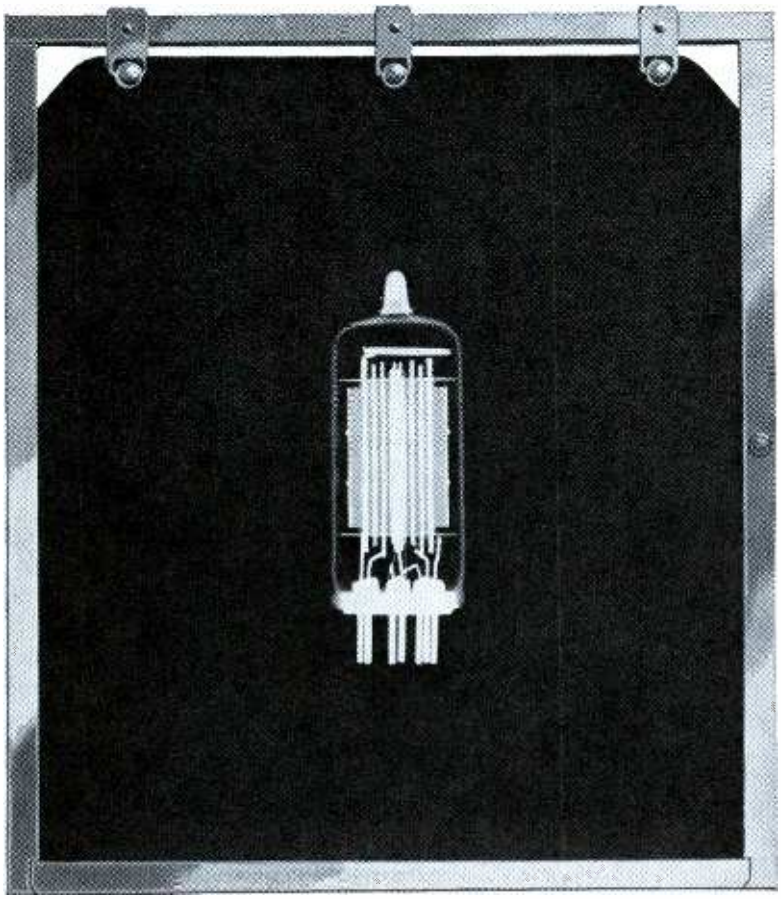
. . . and so we leave the scene. The serviceman will pack up his pattern generator, pick up his tools, collect his service charge and leave.

By the way, Mr. C *did* buy a rather elaborate antenna installation, resulting in a greatly improved color picture. Because these people knew the answers to his color-TV questions, Mr. C became one of that dealer's best boosters, and convinced several of his friends to purchase color sets there. ▲

NEW AUDIO AMPLIFIER TUBE SUPPLIES FULL-RANGE TONE FIDELITY IN RECEIVERS

NEWEST addition to Tung-Sol's family of fine audio amplifier tubes is the type 4GZ5 pentode. Thorough exposure to realistic combinations of operating and environmental hazards during development shows this tube will lead its class in television, radio and high-fidelity service. Even after accelerated life testing, the subject remains full of pep, providing large power output with remarkably low distortion over the full audio range from loud cry to subdued chortle.

Tung-Sol takes lavish parental care of this baby during its formative stages. Internal elements are welded and brazed on hospital-clean production lines after sterilization in bakeout ovens to prevent gas, leakage and spurious emission. Rigidized construction cures low-frequency rattles and other forms of tube distress. Alclad plates spread body heat evenly for efficient cooling.



FORMULA FOR GOODWILL

Customers will love the way this model tube makes stereo, radio and tv audio come alive. Foster good customer relations by adopting the 4GZ5 as your first choice in replacement tubes. Others in Tung-Sol's family of audio amplifiers are: 6CU5, 6BQ5, 12CU5, 6AQ5A, 6GK6.

TUNG-SOL®
AUDIO AMPLIFIER TUBES

TUNG-SOL ELECTRIC INC., NEWARK 4, N. J.

Sy says:

Microphones—Part II

Last column we discussed the carbon microphone. This time we will discuss the crystal microphone and its cousin, the ceramic microphone.

Both the crystal and ceramic microphone are less expensive than the dynamic microphone which we will discuss in the next issue.

The crystal microphone has a high output and a good frequency response. The crystal unit consists of slabs of "Rochelle Salts" which are assembled and mounted so that the diaphragm will apply stress to the "crystal element" in accordance with the sound waves. The bending of the crystal element creates voltages on its surfaces, which are picked off by electrodes. It is a "capacitance" device having a value usually between 600 and 1,500 MMF. It is therefore, a high impedance device whose impedance varies with frequency.

The very similar ceramic microphone has most of the characteristics of the crystal unit, though the output voltage is slightly less. The ceramic unit will, on the other hand, withstand temperature and humidity ranges which might damage a crystal microphone.

Since the ceramic and crystal microphones are both high impedance devices, they can be connected directly to the grid circuit of a vacuum tube. For this reason, they are very popular for public address work, home recording and similar applications. Crystal or ceramic microphones can replace a high impedance dynamic type in most applications, although the performance may be a little different in response, range and level due partly to basic design and partly to any mismatch that might occur.

Ceramic units are not susceptible to nearby magnetic hum fields such as those from the amplifier chassis and this might favor the substitution.

In "exchanging" units, it is always important to compare the stated levels, response ranges and recommended load impedances. Don't go too far afield.

The Astatic Corporation offers a number of crystal and ceramic microphones. The newest being a ceramic mobile microphone Model 511 for Citizen Band application. The Astatic 330 Series units, which are widely used for tape recording and mobile installations, are available in either crystal or ceramic. The famous Astatic D-104, used by Ham operators the world over, is also manufactured as ceramic or crystal.

How's Color TV Doing?

Is its growth curve really taking an upturn?

by Forest H. Belt

A real bonanza is gaining momentum in the world of electronics—or is it? Some feel it is one of the biggest events in the consumer electronics field during recent years, while others feel it is a misfit, doomed forever to mediocrity. This would-be "boom" is Color TV!

Color TV was introduced several years ago with a large splash, and then sort of shuttled off to one side in favor of other things. Color had to share the limelight with such wonders as transistors and space-age electronics, so it's no wonder the "boom" never really came about. Let's examine the facts surrounding this unusual subject, and draw our own conclusions—are we going along with color TV, or not?

Strange Effects

Color TV has had some marked effects on more than one segment of the electronics industry, and these effects bear directly on feelings, today. Color has affected the manufacturer, the consumer, the broadcaster, and the serviceman.

The Manufacturer

When color first came along, a number of manufacturers plunged into the field, only to hastily withdraw when customer acceptance wasn't up to expectations. For several years, color television moved very slowly, with only one manufacturer—RCA—carrying the ball. A couple of years ago, several manufacturers decided color had reached a degree of acceptance, so they made color sets available in their line.

Next, Zenith culminated an extensive research program with a color chassis all their own. However, even their set used the tricolor CRT made by RCA, since it was the only such tube being produced.

Now, with color business picking up, other tube manufacturers are planning color CRT's—but more about that later.

The Consumer

Why did the consumer reject color TV for so long? There are a number of theories which have been advanced: One has it that color was given such a build-up, and then proved so poor, that no one wanted to pay the price for such disappointing results. Another idea is that people were already becoming used to large screens, and couldn't be satisfied with the masked-down picture on a 15" CRT. Some say the public was prediscouraged by the false starts that took place before a compatible system was developed. Others feel it could be because there just wasn't anything to watch in color—so why bother with it? Thus, the faults of color rejection are laid at the feet of almost anyone who had any connection with it; the circumstances just didn't seem right.

Now, all these faults have been overcome—is there anything left to hold color back? Price? Programming? Service? The sets? We'll see . . .

The Broadcaster

How has color affected the broadcaster? He is the one who provides the color-TV programs. Color productions are costly, and someone must pay the bill. Will it be the

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manufacturer, or perhaps the consumer? No, not directly, anyway. The broadcaster (network or local) must find *sponsors* who are willing to invest in the medium as a method of effective advertising.

This being the case, no wonder color telecasting was slow developing. The reasoning goes something like this: If the consumer hasn't a color set—no matter what the reason — he can't derive any benefit from watching a color show, so there is no special incentive to watch it. Without viewers, the program makes a poor advertising medium. If the sponsor can't get his money's worth, he simply will not pay the price for color shows. With no color shows, what's the use of owning a color set? . . . and we're back where we started.

It has been the job of progressive broadcasters to find and convince equally progressive advertisers that color-TV could and would become one of the more important and effective advertising mediums. We'll discuss the results in a moment.

The Serviceman

What has color TV done to and for the serviceman—you? For the serviceman who resists change, color has been a nemesis—something to be shunned, ignored, and discouraged. For more forward - looking technicians, color has presented a technical challenge, a chance for increased knowledge and prestige, and (not least) an opportunity for greater income.

Some shop owners tried (and still do) the old tack, "Leave it alone, and maybe it'll go away." It hasn't, nor does it appear that it ever will. Like it or not, color TV is real, and is growing by leaps and bounds. As the growth continues, those who accept and master the challenge are bound to profit. This has been the case in other parts of the electronics industry, and it can happen to you!

What Now?

No one can deny the existence of color TV, so let's look into some of the plans industry has for the future. By knowing what to expect from color, perhaps you can decide how your future will be affected. We'll see what's in store for that all-important four—manufacturer, con-

It used to take 2 men to pull a color TV set into the shop...

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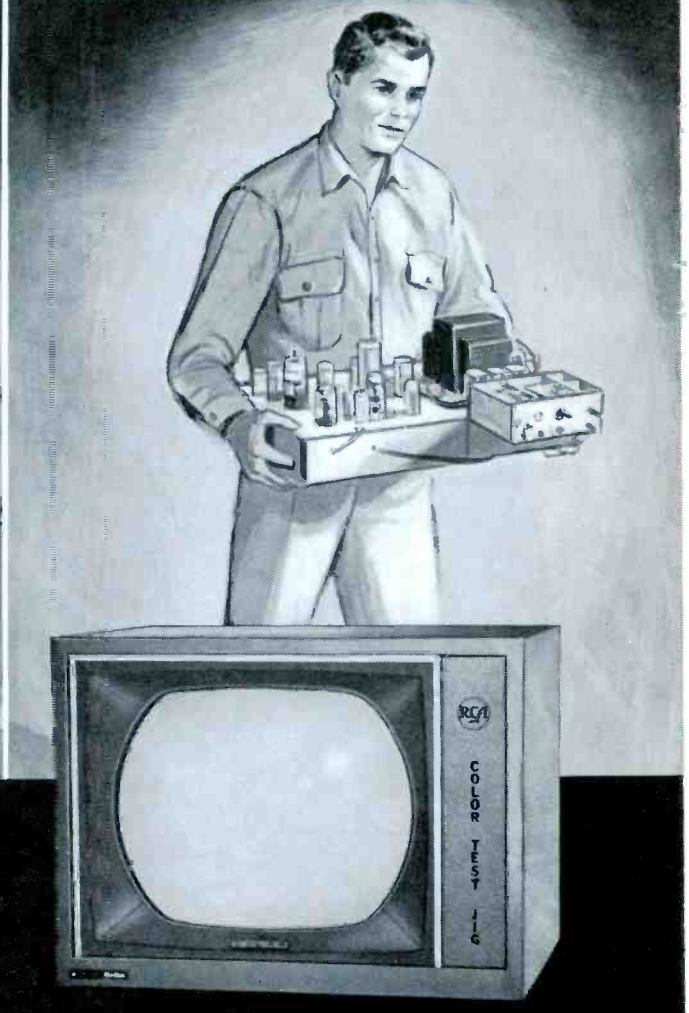

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STEP THREE. VISUAL SWEEP RESPONSE WITH ES-150.

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sumer, broadcaster, and serviceman.

The Manufacturer

To begin with, the two current manufacturers have plans for better-than-ever circuits, with greater stability, greater dependability, and easier, more economical servicing. Production is at an all time high, although it is being curtailed by one problem — there are not enough color CRT's to go around.

RCA is the only builder of the tricolor picture tube that is now being used in all color sets. Those companies who are building sets under license can produce only as many sets as their numerical allotment of picture tubes. Zenith, too, is hampered by this shortage of CRT's.

The "drouth" is expected to end soon. Rauland, a subsidiary of Zenith, is tooling for color CRT's and hopes to be in production soon. Sylvania plans soon to produce a color picture tube, similar to the 21″ round, shadow-mask, 70° tube being used now. National Video, on the other hand, is working on a 23″ rectangular 90° CRT; this will be the first major change in color CRT's since the introduction of the 21″ tube.

From overseas, a two-gun color CRT is being developed, which uses blue and red-orange phosphors. Exact plans for this tube, and its impact on the U.S. market, is not yet known. Time will tell.

Back home, there is discussion of a four-gun CRT, although no one has publicly committed themselves to produce or use it. The idea will be to use three guns for color, as is done now, and the beam from the fourth gun will fall on a regular black-and-white phosphor, to eliminate convergence problems for monochrome viewing. Once again, we'll see.

From all this you can see many things are in store for color TV. Other manufacturers are making plans for their own color chassis, and with more and improved CRT's available, this phase of color is well in hand.

The Consumer

Is the consumer going to buy color TV? All signs say, "Emphatically, yes." Even with the scarcity of CRT's slowing down some manufacturers, it now appears that sales for this year alone will reach between 400,000 and one-half million. Planners are predicting sales in 1963 of 750,000. That's a lot of color sets!

In most of the major populations areas of the country, giant color promotions are taking place daily and weekly. The push is on to sell, sell, sell; and it is proving quite effective. Color sets in the New York and Los Angeles areas are moving at an all-time-high rate. If efforts mean anything, color sets will soon be almost as common as monochrome receivers.

Of course, much will depend on the consumer. Will he continue to buy durable goods? Will he accept the fact that color—real, true-to-life color—is here? Will the price tag hold him back? Those who claim to "know" answer "Yes, Yes, No," to these questions, in that order.

There is still a selling job to be done for color. The manufacturer, the broadcaster, and the serviceman are all going to have to assist in building the confidence the consumer has so far failed to feel toward color TV. It is not a feat any one of them is likely to accomplish alone. All are taking steps in this direction — the manufacturer through service-training programs, the broadcaster through more and better programming, and the serviceman through an enlightened viewpoint on the matter of customer relations. All are contributing to their future and that of color TV.

The Broadcaster

The season of telecasting which just began marks a milestone in the development of color TV. This season, all three major networks will be telecasting programs in color. NBC leads the way with a record high in color programming—much of it in prime night-time spots. Not including specials, NBC has devoted 68% of its prime time to color telecasts. ABC has joined the color parade with at least 3 regular weekly telecasts, and a number of specials. CBS is still holding out, but has indicated they have plans for this season, too.

On a more local basis, nearly 400 stations are now able to pass network colorcasts on to their viewers, while 150 local stations are equipped to originate color shows.

The latter requires quite an investment, and bespeaks the fact that these stations are sold on color. More are sure to follow.

Broadcasters are making concerted attempts to overcome one of the major consumer objections to color—that of constantly changing colors from program to program. Color is telecast by one of three methods: film, video tape, and live. Each has its problems.

Film made especially for color TV is produced under special conditions, and normally presents few problems; the colors are good, and they stay that way. Older color films, adapted from movie films, are apt to have been less carefully produced, and may have certain color problems when rerun on TV.

Tape can be controlled rather closely, but trouble often occurs when parts of a show are taped at different times — sometimes even with different cameras. Cameras require extensive setup each time they're used, and it is very difficult to get them exactly the same two days in a row. Often, too, tape will be transferred to other tapes, and some quality is lost in the process. The "tape of a tape of a tape" may leave much to be desired in the way of quality when viewed on a color receiver.

Live shows are probably most difficult to handle, from a standpoint of color. Lighting is very important, and must be controlled very carefully. Indoors, this can be done, but outdoor live shows are subject to the whims of weather, clouds, and other uncontrollable variations (even the humidity is a problem).

Great strides have been made in broadcasting, and more are yet to come.

The Serviceman

Surely by now you're wondering what's in store for you? The answer is—plenty! Plenty of work, plenty of learning, and for those who handle it right, plenty of profit.

Set makers are bending backward to provide information on color theory, color circuits, and practical troubleshooting methods. Test-equipment manufacturers are developing special instruments to simplify the task of keeping all those color sets working, and a number of them are providing free training clinics to help the serviceman better understand the test procedures necessary with color.

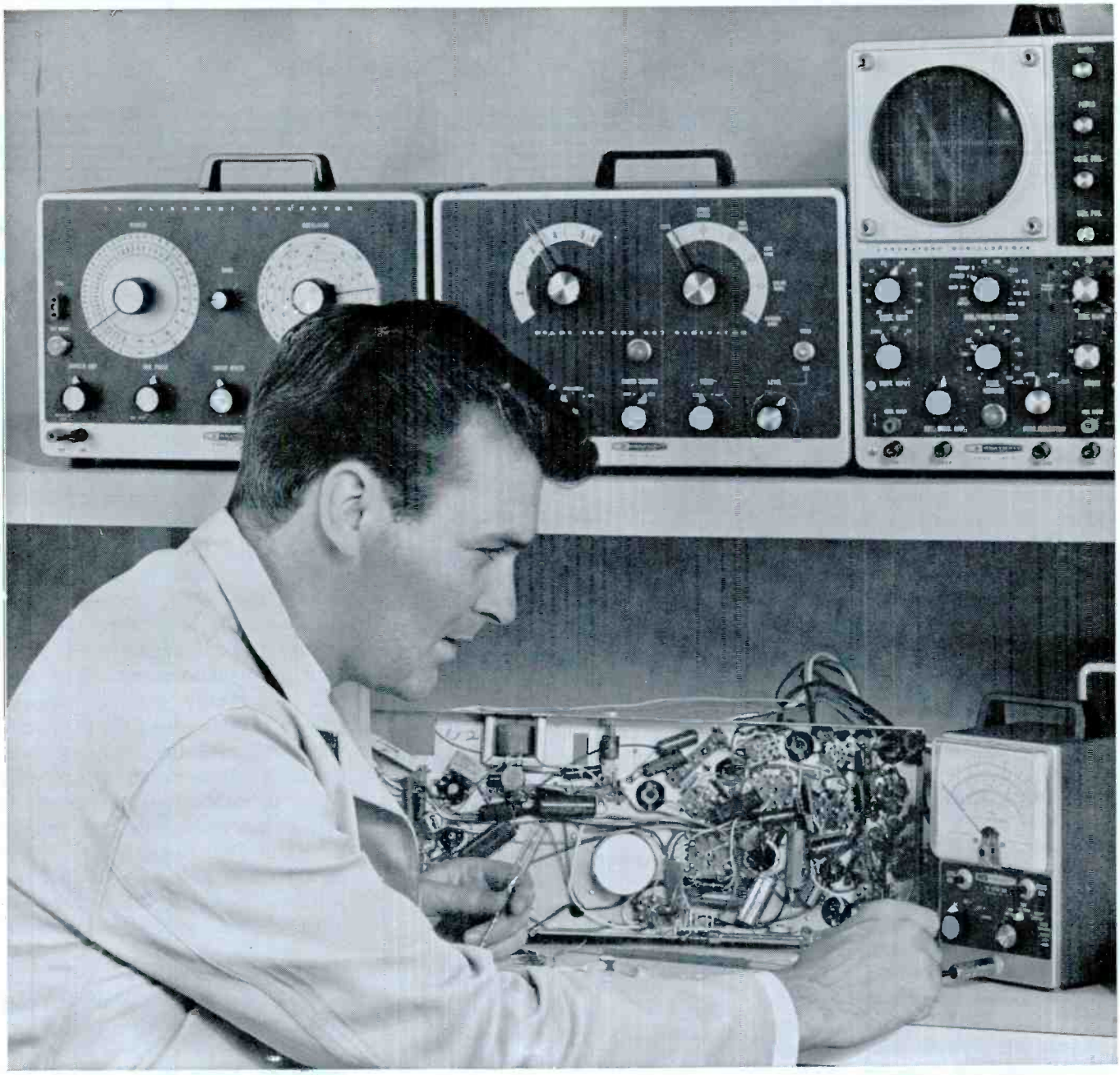
Other industry leaders are providing books, pamphlets, slide lectures, courses, and countless other aids, all aimed at helping the serviceman become a proficient color specialist.

Those servicemen who sell color-TV sets will be in on the spectacular rise in set sales that is anticipated. A boom in set sales is automatically followed by a boom in installations, and in sets which must be adjusted and regularly maintained. The opportunities are expected to abound.

Is It For You?

You're the only person who can answer this question. The opportunity has never been greater, and the means to carve yourself a slice of this melon are all around you.

You should be familiar with the trends, learn about the sets, study troubleshooting methods, and prepare to enter a new era in customer relations. We're launched on an era of Color TV, and I, for one, am going along. Are you? ▲



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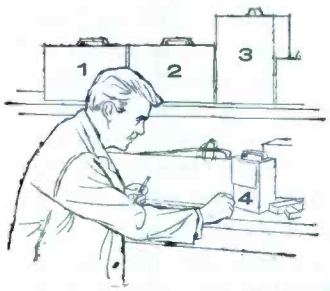

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CORONA

in the Cage and Out

A set that sizzles is cooking up trouble . . . by Stu Hoberman

Ask some technicians what to do about corona, and you may hear something like, "I simply spread dope over everything and hope for the best." Or perhaps, "There doesn't seem to be much you *can* do about it, except wait till the weather isn't so humid."

Feelings such as these are not really too surprising, because arcing and corona are the "plague" of the high-voltage cage. Some symptoms of corona are very difficult to understand; some are even difficult to spot. For example, a set was brought into a shop recently with a symptom of "wiggles all over the screen"—known to some old-timers as "waterfall effect," because the picture looks as if it is being seen through shimmering water. After much fruitless searching for sync trouble, or horizontal AFC trouble, the cause was finally traced to the high-voltage cage. There, with the shop darkened, a few spots of misty, blue "spray" could be seen sparkling between the flyback and the cage. This corona was radiating interference to the video circuits, causing the peculiar "waterfall" symptom. But what created this hard-to-locate phenomenon, anyway?

Corona (and arcing) generally occurs because the high voltage at some point has ionized the air gap between that point and ground. When air is the only insulator, moisture often contributes to the ionization. In television sets, however, high-voltage components are insulated with special dielectric materials, to supplement the safety afforded by physical separation. As a result, ionization — or corona discharge—can occur from deterioration of insulation, from improper repair techniques that damage insulation, or from actual breakdown of certain high-voltage components. The greater high voltage used in color sets makes them even more susceptible to corona than monochrome receivers.

Three Types

You should understand that there are three distinct types of high-voltage breakdown. The first is symptomized by a hissing, sizzling sound, and is often accompanied by the sickly-sweet odor of *ozone*. This type of corona can be spotted only in a darkened place, as a rule, and very often continues undetected for quite some time, since it seldom bothers set operation.

The second type of breakdown is that described at the beginning of the article. You can see it in the light (not too bright a light) as it "sprays" itself from the high-voltage point to the surrounding ground areas, sometimes taking more than one path. This type of corona is commonly very bothersome to the set viewer, often disables the set completely, and can be very damaging to components under some conditions.

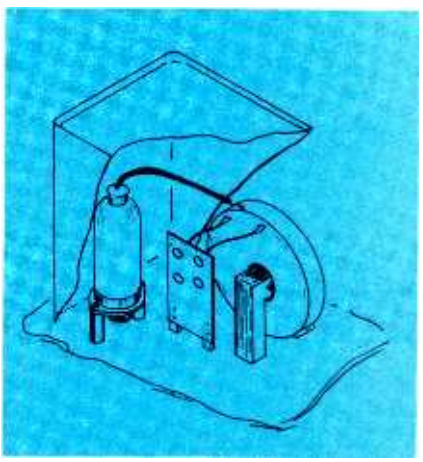

Fig. 1. Most common mounting for high-voltage sockets in older TV receivers.

The final, and worst, form of high-voltage breakdown is the loud cracking sound which occurs when high voltage completely breaks down the intervening insulation and air, and jumps viciously across the gap.

The important facts to remember about these three breakdowns are these: The latter type—the loud crack—occurs only when the high voltage is predominantly DC. The type of breakdown described second, the heavy corona, happens only in circuits where the high voltage is AC. The first type, the "unobtrusive" little corona spots, can occur in either type of circuit; it matters not whether the high voltage is AC or DC. But this type is the sneaky, easy-going one—the one you have to watch. Where it is, *the others are sure to follow.*

In the Cage

With these facts in mind, you can now identify the portion of the circuit which may cause a particular symptom. Since most corona and arcing problems appear inside the high-voltage cage, let's examine some of the possibilities for trouble.

One common symptom is that of DC arcing from the rectifier output to some nearby ground point. Modern tube sockets have done much to solve this problem in the immediate vicinity of the tube, but the filament leads still must be routed along the chassis, and must be wrapped around the core of the flyback transformer. If the insulation on the leads becomes aged or cracked, breakdown is likely to occur; the remedy is to replace the entire filament lead.

In sets without special sockets (see Fig. 1), arcing sometimes occurs from the socket terminals to the mounting hardware. An accumula-

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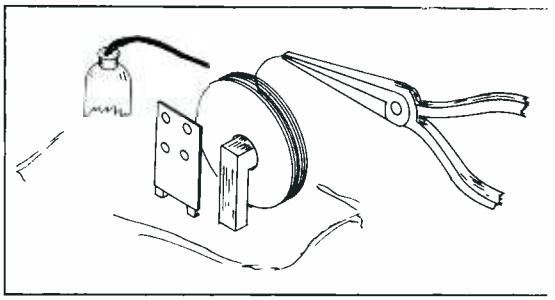

Fig. 2. Secondary winding of flyback transformer can sometimes be repaired.

tion of dirt or grease on the socket or its standoffs could furnish a path for first-stage corona, which would eventually build up to a complete arc-over.

Many times, the corona and arcing will result in carbonizing of the socket; this makes the condition worse, of course. Such carbonizing can be temporarily corrected by scraping the carbonized portion from the socket or supports, and coating the affected areas with corona dope. For a permanent cure, you must replace the socket and mounting.

Even more common than arcing in the cage is the problem of corona "spraying" from the flyback transformer to surrounding parts. This kind of corona (the damaging kind —remember?) can occur between any ground point and the high-voltage rectifier cap or lead, the windings of the flyback, the flyback terminals, or the horizontal output cap or lead. Extremely high-amplitude pulses of 15,750-cps energy exist all over these circuit components, just waiting for a break, a dust path, or a damp day to set them free.

Once the leakage point is located, it can sometimes be repaired simply by cleaning the surface with a good solvent, and then applying one or more coats of a good-quality corona dope. Evidence of this corona can be seen most plainly in a darkened room. A good method of detecting and locating breaks in the insulation of the flyback or the leads is to pass the blade of a screwdriver (well-insulated, for your own protection) over the suspected areas. Corona will become excessive around the blade when it is brought near the "weak spots"; even small breaks or pin-holes can be spotted by this method. Filling them with dope is easy.

If the flyback transformer be-

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- IF/Video output frequency continuously tunable from 50 Kc to 50 Mc
- Sweep-frequency bandwidth continuously adjustable from 50 Kc to 20 Mc on IF/Video and FM; 12 Mc on TV channels
- Output level—0.1 volt or more
- Attenuation range: TV channels, 60 db IF/Video, 70 db FM, 60 db
- Return-trace blanking
- Two adjustable bias voltages on front panel

$295.00* including all necessary cables.

RCA RF/VF/IF Marker Adder

Designed for use with a marker generator (such as RCA's WR-99A) and a sweep generator (such as RCA's WR-69A), this instrument is used for RF, IF, and VF sweep alignment in both color and black-and-white TV receivers. In visual alignment techniques, it eliminates distortion of sweep response pattern. Important features:

- Choice of four different marker shapes provided by front panel switch for different types of sweep-response curves and for positive and negative sweep traces
- Provides very high-Q markers of high-amplitude and narrow bandwidth
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comes defective as a result of the arcing problem just described, the defect will appear as an open circuit, in the secondary winding supplying the rectifier plate, or as shorted windings, which result in overheating of the unit. If a suitable replacement is not available, an emergency repair can be performed, as follows:

1. Unsolder the connections to the flyback transformer and remove it from the set.
2. Carefully remove the outer insulation to expose the first layer of windings. Unsolder the high-voltage lead.
3. Using a long-nose pliers, as shown in Fig. 2, carefully peel off the windings, layer by layer, until the break or short is uncovered. (To avoid impairing the efficiency of the transformer, do not remove an excessive amount of winding.)
4. Resolder the high-voltage lead and carefully tape it to the transformer with a good grade of plastic tape.
5. Using corona dope, paint the exposed windings evenly. Allow the dope to dry; then paint on a second coat before replacing the flyback in the receiver. However, it is wise to avoid excessive use of anti-corona preparations to eliminate arcing or corona.

Many high-voltage faults can be found by carefully inspecting the circuits for uneven or pointed solder connections, too-close component placement, or accumulated grease and dirt. Cleaning with a solvent and a touch-up with a soldering iron is often all that is needed to correct the trouble.

When soldering on or near the socket terminals of the high voltage rectifier, be sure the soldered connection is round and smooth and no solder peaks are formed as the iron is lifted from the joint. Wire terminations should be cut very close to prevent possible arcing. You must also be careful that the hot solder tip doesn't accidentally touch a wire, or the flyback, leaving behind a melted opening where corona can develop.

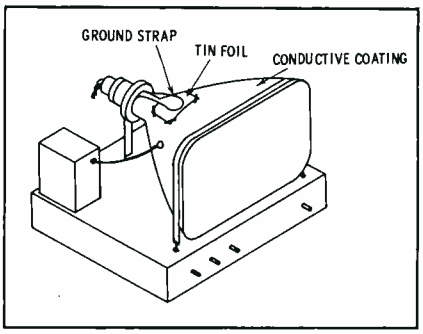

Fig. 3. Tin foil "patch" makes substitute for missing aquadag CRT coating.

Outside

Arcing and corona problems which develop outside the high voltage cage usually occur between the anode lead of the CRT and the chassis or mounting brackets, between the bell surface of the CRT and its grounding strap.

Arcing from the CRT anode lead is usually caused by deteriorated insulation, and is best remedied by complete lead replacement. This usually involves soldering inside the cage, where the precautions mentioned before should be taken.

Arcing from the anode socket to the CRT surface can result from an accumulation of grease and dirt. To correct this condition, remove the anode lead, being careful to discharge the CRT; then clean the area surrounding the anode socket with

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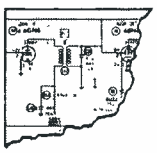

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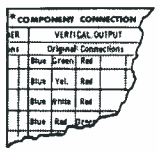

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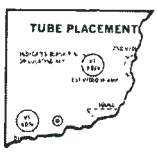
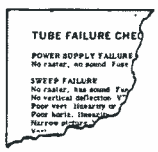
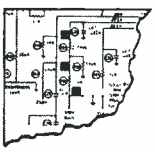


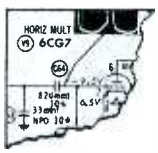
Tube Location Guide enables you to locate and replace proper tubes in seconds—a big time-saver on most repair jobs.



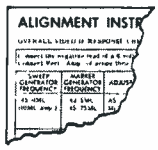
Tube Failure Check Charts spell out probable tubes responsible for failure—no need to waste time studying circuitry.



Clear Parts Symbols with values and associated information are shown plainly on the schematic—no time wasted in cross-reference "look-up."

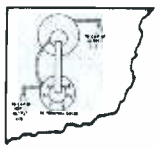


Waveform actual photos are shown on schematic for quick comparison of patterns on your scope. No time wasted in guesswork.



Unique Alignment System eliminates guessing; you get complete instructions with response curves, how to connect test equipment, proper adjustment sequence.

Full Photo Coverage of the actual equipment makes identification of all components and wiring easy—you can see everything.



Terminal Identification saves you time; transformer and coil terminals quickly identified by color code or basing diagram shown on schematic.

Auto Radio Removal instructions show you step-by-step procedure for removal of even the most complicated models—a big time-saver.

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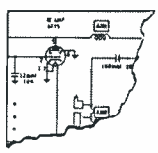

Alternate Tuner Data—separate schematics, alignment data and parts lists are provided—no time wasted interpreting various tuner versions.

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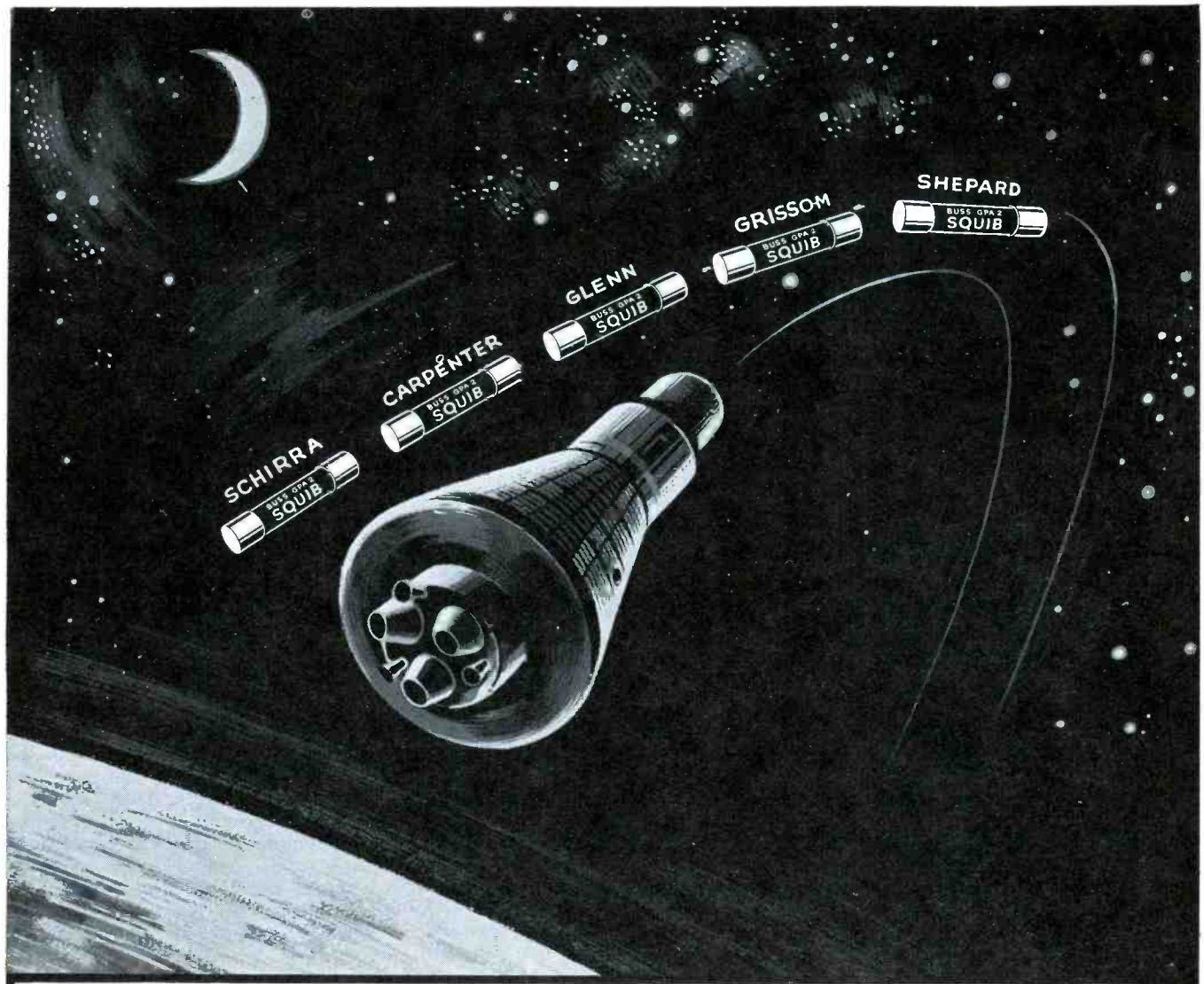
TABLE I

Symptom	Probable Cause	Remedy
	Inside the Cage	
Arcing from high-voltage rectifier socket to cage, chassis, or mounting hardware.	Accumulation of dirt on socket terminals, or on mounting hardware.	Clean socket terminals and mounting hardware with solvent; if necessary, apply corona dope.
	Solder or wire "peaks" on socket terminals causing arcing between these points and ground.	Cut leads close to terminals and smooth solder peaks with a hot iron.
	Socket mounting supports carbonized.	Scrape or sandpaper socket mountings to remove carbon; then clean with solvent, and paint with corona dope.
	Filament limiter resistor or anode bleeder resistor breaking down.	Replace with equivalent resistor.
Internal arcing in high-voltage rectifier tube.	Tube elements shorting.	Replace tube.
	Rectifier output shorting or arcing to ground.	Repair arcing as previously described.
Internal arcing or burning in flyback transformer.	Open or shorted secondary windings.	Repair transformer (as previously described) or replace with equivalent.
	Outside the Cage	
Arcing from filament winding to flyback core.	Insulation on filament lead deteriorated.	Replace lead with equivalent.
Corona between CRT external conductive coating and ground.	External conductive CRT coating worn away.	a. Tape tin-foil square to CRT beneath ground strap. b. Use commercial aquadag to replace coating.
Corona from anode socket to CRT surface.	Accumulation of dirt and grease.	Remove anode lead, discharge CRT; then use solvent to clean adjacent area.
Arcing from CRT anode lead to ground.	Lead insulation deteriorated.	Replace lead (and anode cap, if needed).

a suitable solvent, and replace the lead.

Corona between the CRT surface and the ground strap (Fig. 3) results from erosion of the conductive external CRT coating (aquadag) or insufficient tension of the ground spring. As shown in Fig. 3, an emergency repair can be made by taping a sheet of tin foil to the CRT directly under the ground strap. Alternatively, commercial aquadag solutions are available, which can be painted on to replace any defective portion of the coating.

Table I is a summarized listing of high-voltage problems, together with probable causes and cures. By using this chart and applying your knowledge of the *facts* behind corona, no high-voltage fault will be able to "throw" you! ▲



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NOTES ON TEST EQUIPMENT

by Forest H. Belt

Extended Scope

Fig. 1. Extended-range oscilloscope will respond to frequencies beyond 7 mc.

Portability is one of the key features of SENCORE's new Model PS120 wide-band 3" oscilloscope. The unit, with its test probe, can be seen in Fig. 1.

Specifications are:

1. *Power Required—105-125 volts, 50-60 cps, 82 watts (10 watts "Standby").*
2. *Vertical Amplifier — Frequency response, within ±½ db from 20 cps to 6 mc, down 3 db at 7.5 mc; sensitivity, 35 mv rms for 1" deflection (350 mv rms through low-cap probe); input loading, 2.7 megohms shunted by 99 mmf, 27 megohms shunted by 9 mmf through low-cap probe, 2.7 megohms shunted by 27 mmf at auxiliary vertical input jack; maximum input voltage, 1,000 volts peak to peak in presence of 600 volts DC.*
3. *Horizontal Amplifier—Frequency response, within ±3 db from 45 cps to 330 kc, within ±6 db from 20 cps to 500 kc; sensitivity, .5 volts rms for 1" deflection; input loading, 40K-ohms to 200K-ohms shunted by 80 mmf; maximum input voltage, 15 volts peak to peak in presence of 400 volts DC.*
4. *Sweep Ranges—15 cps to 150 kc in five ranges; preset TV vertical and horizontal positions; adjustable automatic sync to 7.5 mc.*
5. *Cathode-Ray Tube — 3RP1, 3" face, green trace; covered by green graticule.*
6. *Controls and Terminals — Eight potentiometers:* INTENSITY, VERT POS, FOCUS, SYNC, HORIZ GAIN, HORIZ POS, VERTICAL INPUT *(gain), and* HORIZONTAL FREQUENCY *(vernier); two rotary switches:* VERTICAL INPUT *(multiplier) and* HORIZONTAL FREQUENCY; *two slide switches:* OFF-STBY-ON *and* VERTICAL INPUT SELECTOR *(both inside lower panel);* HORIZ INPUT *and* AUX VERT INPUT *pin jacks; pilot lamp; permanently connected cable with probe.*
7. *Size, Weight, Price — 8½" x 7" x 11"; 12 lbs.; $125.50.*

The Model PS120 provides the serviceman with a lightweight wide-band scope which he can use in both the shop and the home. The bandwidth of this unit is much wider than ordinarily found in a service-type scope, and enables the serviceman to see unusually detailed waveforms in both monochrome and color TV sets. The special probe, which is permanently connected to the unit, includes a detachable 10:1, low-capacitance tip for checking waveforms in sensitive circuits, such as horizontal oscillator-AFC circuits.

Fig. 2. Closeup of vertical attenuator showing multiplier reading in window.

The cabinet of the PS120, and the control-panel layout, represent something new in oscilloscope design. Two large concentric knob arrangements are used to control the vertical input voltage and the horizontal sweep frequency. Switches connected to the outer knobs serve for coarse voltage and frequency selection, while controls actuated by the inner knobs take care of fine adjustment. The four beam controls, which adjust the position of the display and the brightness and focus of the trace, are located in a row of controls spaced along the top edge of the control panel, just below the graticule. The synchronizing adjustment and the horizontal gain control are in the same row. None of these controls have knobs, but are fitted with black shafts which extend through the panel and serve the same purpose. The on-off switch (which also contains a standby position) is located in a lower compartment, one side of which provides space for storing the AC cord and the probe-and-cable assembly while the unit is being transported to or from a job.

The input sensitivity is controlled by turning the large knob on the left; a little window (Fig. 2) above the knob shows what multiplier to use with the calibrated control knob for measuring peak-to-peak voltages. There are four multiplier ranges: .1, 1, 10, 100. To use this arrangement, you first connect the probe to the point where the waveform is to be measured. Next, the vertical input coarse and fine controls are adjusted until the waveform display is 1" high on the graticule (which is ruled in 1" segments). By noting the setting of the control knob, and multiplying the setting by the figure shown in the little window, you can find the approximate peak-to-peak voltage of the waveform being picked up by the direct probe. If you're using the low-cap probe tip, you must also multiply the reading by 10, to allow for the 10:1 attenuation of the probe. The final result is the peak-to-peak voltage of the waveform being tested.

An auxiliary vertical input (connected through a switch inside the lower compartment) provides a means for using a direct probe for low-capacitance measurements, eliminating the 10:1 attenuation of the low-cap probe. The secret of this arrangement lies in the use of an unshielded lead, as short as possible. This introduces such problems as stray pickup, but these can be held to a minimum by careful routing of the lead during tests. Hand capacitance also affects this arrangement, and must be taken into consideration; the best means of eliminating this problem is to keep your hand away from the test lead or the circuit after making the connection.

The horizontal sawtooth frequency is controlled by the two large concentric knobs on the right of the panel. The output voltage is also available at the HORIZ

INPUT jack in the lower compartment; this makes an excellent source of sawtooth signal for other testing purposes.

When the horizontal frequency selector knob is in the EXT INPUT position, the HORIZ INPUT jack is connected to the horizontal amplifier, and any voltage applied to the jack will deflect the CRT beam horizontally. This is handy for special applications when other than sawtooth deflection is desired. The horizontal amplifier will handle external frequencies as high as 500 kc, although frequencies that high will be attenuated to about half the amplitude of frequencies in the 1,000-cps range. For horizontal deflection, however, this attenuation is of little importance, unless the source voltage is weak to begin with. As noted in the specifications, it takes .5 volt rms to sweep the beam at least 1".

The above-average frequency response of the PS120 is the result of careful design in the vertical amplifier. The input attenuator (Fig. 3) is thoroughly frequency compensated, which assures uniform respose over the entire range of peak-to-peak voltages to be measured. Other important steps are taken throughout the vertical amplifier to attain the extra bandwidth.

In Fig. 4, the first stage in the vertical amplifier is cathode follower V1A, which effectively prevents loading of the input attenuator by the rest of the amplifier. The output is frequency compensated and fed to a potentiometer (the fine vertical attenuator). From the slider of this control, the signal is fed to amplifier V1B, which has a very low-resistance plate load to broaden the bandwidth at this point.

A high-gain pentode, a 6GM6, is used in the next stage. In addition to an unbypassed cathode to insert a bit of degeneration, this circuit utilizes a peaking coil as part of the plate load; being a shunt coil, its effect is an extension of high-frequency response.

Final vertical amplifier V3 is a push-pull stage which drives the vertical deflection plates of the CRT. This is the stage where most of the peaking networks appear. Both series and shunt

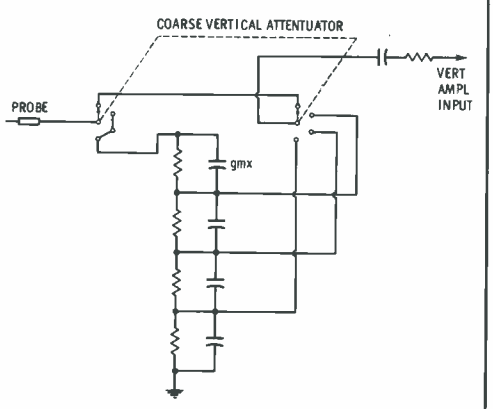


Fig. 3. Schematic showing compensation networks of vertical attenuator.

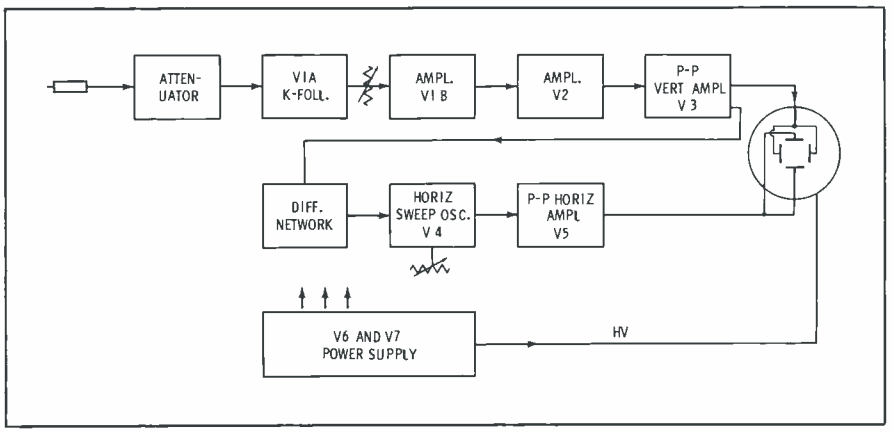


Fig. 4. Block diagram of PS120 scope.

peaking coils are used, to shape the response at both ends of the frequency spectrum. In addition, the cathodes are unbypassed, to smooth the overall response. This final stage is fed by a somewhat unbalanced phase-splitter arrangement in V2, which is compensated for in the design of the V3 stages. The result, however, is a balanced response for the entire amplifier.

A point worth mentioning is the use of low-value capacitors for coupling in the vertical amplifier. The PS120 vertical amplifier is AC-coupled throughout and the use of relatively small coupling capacitors minimizes the bounce often encountered when connecting a probe to a circuit. Using these low values demands that low-frequency response be restored in other sections of the amplifier, which has been done.

The horizontal sweep amplifier consists of a push-pull stage, AC-coupled to the CRT deflection plates. No special compensation is employed in this stage, except for a small amount of degeneration introduced by the unbypassed cathodes. As a result, the response is not nearly so broad as in the vertical amplifier, but bandwidth is not too important in the horizontal amplifier. This stage needs to pass without attenuation only the horizontal sweep frequencies of the scope; in this case, 150 kc is the maximum necessary bandwidth.

Horizontal sweep oscillator V4 is a cathode-coupled multivibrator, which feeds a sawtooth waveform to the horizontal amplifier. It is controlled by pulses from the output of the vertical amplifier, which synchronize the base line on the scope with the signal in the vertical amplifier. A differentiating network is inserted between the sync take-off point and the input to the multivibrator, to shape the synchronizing pulse into a spike that can more accurately control the sawtooth oscillator.

The power supply consists of a common full-wave rectifier, utilizing a 6V4 tube, and a 1V2 half-wave negative high-voltage circuit. The 6V4 develops approximately 340 volts DC of B+ for the scope stages, while the 1V2 develops minus 400 volts for the CRT.

We used the PS120 in our lab, for a number of different jobs. For one

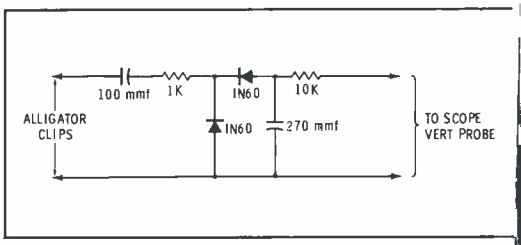


Fig. 5. Simple demodulator probe unit.

test, we checked waveforms all the way from the video detector of a color set to the CRT; we had nice, clean waveforms all the way. In using the PS120 for TV troubleshooting, we wished for an RF probe. So, we made up a small voltage-doubler demodulator probe similar to that shown in Fig. 5. By clipping this device into the IF circuits at various points, we used the PS120 for signal tracing all the way back to the tuner output. Of course, our indications were weak in the first IF stage, but they were sufficient to show that the stage was functioning.

Just to see how clean a waveform the PS120 would show, we used it as a waveform monitor for our color-TV transmitter. Chroma and horizontal waveforms showed up plainly, and the burst signal was easily spotted riding beside the horizontal pulse. For regular use in this application, however, a calibrated time-base would be very helpful.

Back in the lab, audio tests using square waves were a snap. The extended range of the PS120 is sufficient to test the most exacting audio or video amplifier. Our tests showed that rolloff began, for the instrument we used, around 6 mc. This is enough to satisfy the demands of any equipment likely to come into the average electronics service shop.

Not A Ripple

The Model EC-2, a DC Power Supply (Fig. 6) recently introduced by Electro Products Laboratories, is a well filtered, low-ripple unit housed in a small, portable case.

Specifications are:

1. *Power Requirements—105/125 volts, 50/60 cps.*
2. *DC Output — continuously variable from 0 to 16 volts; 5 amps, continuous; 10 amps, intermittent.*
3. *Regulation — 1.8 volt/amp, no-load to full-load.*
4. *AC Ripple—less than .5%, at rated load.*
5. *Panel Meter—single meter monitors both voltage and current; switch selects meter function.*
6. *Controls and Terminals—ON-OFF slide switch; pilot light; meter function slide switch; fuse holder; voltage control; two insulated binding posts.*
7. *Size, Weight, Price—10¾" x 4⅜" x 6½"; 9 lbs.; $39.95.*

The metal cabinet, designed for vertical use, has ventilation openings at the top, bottom, and both sides to provide heat dissipation when the unit is in operation. Provision is made for using the unit in a horizontal position by merely changing the rubber feet from the bottom to the left-hand panel. Access to the inside of the cabinet is by removing eight metal screws from one of the right-hand side panels. Fig. 7 shows the unit with the panel removed.

A carrying handle is included to make the unit easily portable. All operating controls are mounted on a gray panel and are clearly labelled. The output voltage binding posts, in addition to being color-coded (red and black), are labeled with positive and negative signs.

This power supply provides a well filtered DC source for servicing all types of low voltage electronic equipment, especially automobile radios, transistor radios, and Citizens-band transceivers. The output of the EC-2 (see schematic—Fig. 3) is smoothed by a pi-type network consisting of a dual 4000-mfd electrolytic capacitor and a heavy-duty filter choke. Two seleniums, wired as a full-wave bridge-type volt-

Fig. 6. Low-ripple DC supply can also be used for powering transistor radios.

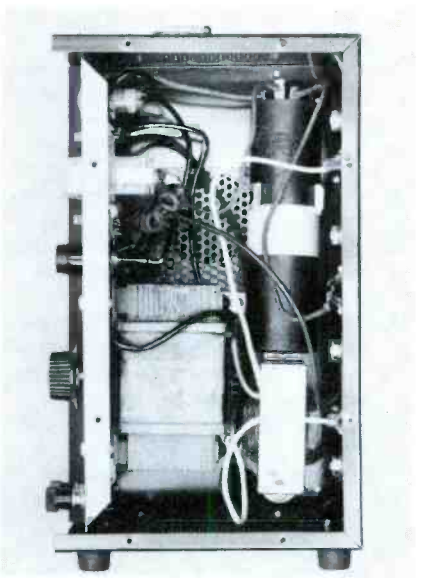


Fig. 7. Opened view of the Model EC-2.

age doubler, make up the rectifier circuit. Selenium rectifiers are used in this unit apparently because of their ability to withstand momentary overloads without being damaged. Thus, intermittent current as high as 10 amps can be drawn from the EC-2 without damaging the supply or its components.

The ON-OFF switch and a 3-amp fuse are in series with the primary winding of the power transformer. The output voltage is controlled by adjusting rotary contact assembly M1, which contacts the secondary winding of the power transformer, selecting a particular amount of the secondary AC voltage for the rectifier. This voltage is then rectified, filtered, and connected to the binding posts on the front panel.

The meter is used to measure either the voltage or the current of the supply. Current drawn by the load is developed across resistor R1 (approximately 13" of #20 copper wire) in the AMPS position of the selector switch; the meter is connected across R1, measuring the load current. In the VOLTS position, the switch connects the meter, in series with multiplier resistor R2, across the output terminals, and output voltage is indicated.

The EC-2 is designed to be used for battery charging in addition to its other applications. Before the instrument is used in this application, it is wise to remember certain important facts that apply to battery-charging in general.

For example, it is best to start with the voltage-control knob at minimum, and advance it slowly. The charging current is most important, while the voltage is relatively minor, so you should adjust the unit for proper charging current, and ignore the voltage. A maximum charging current of 5 amps seems best for a 6-volt battery and 3 amps for a 12-volt battery. Total charging time should not exceed 13 hours. Rely on the hydrometer to determine when the battery is fully charged, reading the specific gravity of all cells, not

just one. The difference in the reading of any two cells should be no more than 50 points (.050); if it is greater, a defective cell is indicated.

Incidentally, you shouldn't rely on hydrometer readings for batteries other than the lead-acid type. Alkaline batteries use other methods of indicating the charge even though the method of charging is similar.

Never make or break the battery connections while the charger (in this case, the EC-2) is delivering current to the battery. The battery generates highly explosive hydrogen gas while being charged, and a very small spark can explode the battery, spraying battery acid over a wide area.

We lab-tested the EC-2 using it in several different applications. First, it was used to supply operating voltage for several transistor radios. The voltage meter came in handy to set the exact operating voltage for each transistor radio. The current meter, however, is not sensitive enough to read transistor-radio drain current. During this test, we also checked the meter by measuring the actual output voltage with an accurate VTVM. Within the operating range of the EC-2 — 0 to 16 volts — the meter readings were very close to those obtained with the VTVM.

An important point we might mention here, in connection with using the EC-2 as a transistor radio power supply: The ripple output is so small, and well filtered, that we could detect no hum whatsoever from the output of any of the transistor radios.

Automobile radios—older 6-volt, 12-volt hybrid, and all-transistor types—were "fired-up" with the EC-2. One of the advantages of the two-function meter was noticed in these applications: Since the meter reads both voltage and current, we were able to spot one of the radios that had a leaky output transistor; the defective component caused an abnormally high input-current reading on the meter, while the voltage control had to be set much higher than usual to get a normal output-voltage reading. Thus, we used the EC-2 as a trouble-shooting device as well as for a power source. ▲

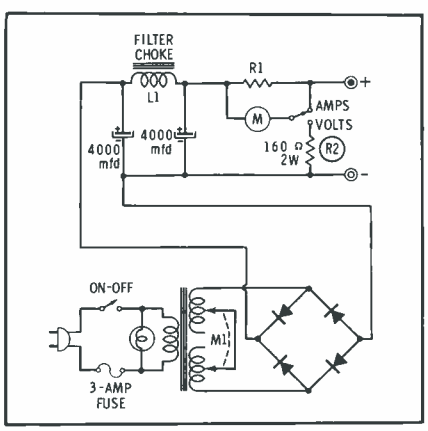
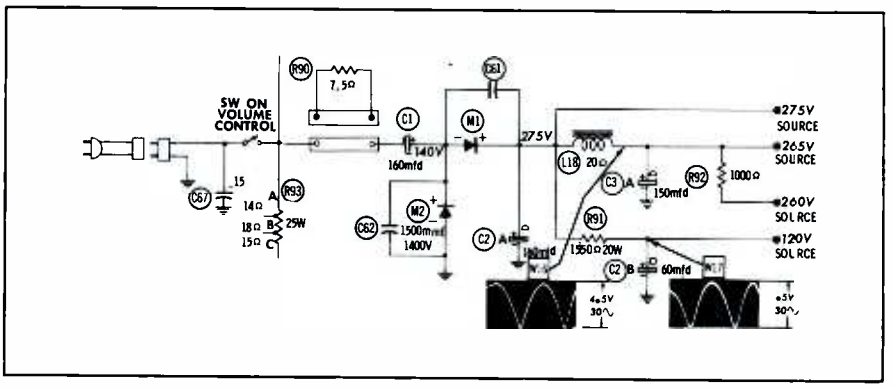


Fig. 8. Schematic showing straightforward circuit, special two-way meter.

THE TROUBLESHOOTER
answers your service problems



Smoker

I had a Westinghouse TV, Model H21K308 (covered in PHOTOFACT Folder 465-2), with an open 7.5-ohm fusible resistor. I replaced it with a 7.5-ohm universal type and got a perfect picture and sound. But, after five minutes or so the resistor started to overheat and smell—a thin trail of smoke rose from it.

The cathode current through the 12DQ6 horizontal output tube measured 110 ma and all of the B+ voltages were near normal. The current at the output of rectifier M1 was 325 ma. All tubes checked good and I found no short circuits.

I then replaced the fusible resistor with a 5-ohm, 7-watt unit and made another operational check of the set. Everything appeared normal, so I returned it to the customer. What should the B+ current consumption be for this receiver? What kind of resistor should be used in this application?

S. YANCIS

Wilkes-Barre, Pa.

The first thought that enters my mind

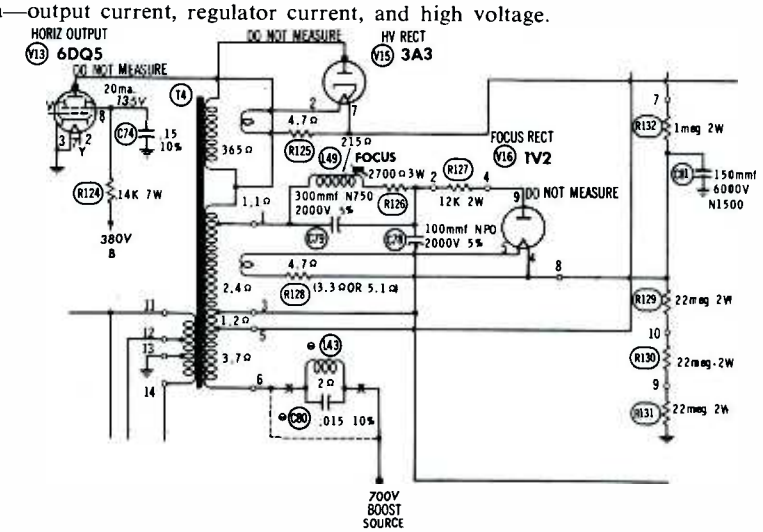
COLOR COUNTERMEASURES

Symptoms and tips from actual shop experience

Chassis: Zenith 29JC20

Symptoms: No raster, smoke rolls out of set.

Tip: If burnt odor is in the area of the flyback cage, remove the cover and visually inspect L49, R126, and R127 (focus circuit). If all three of these components appear burnt, you'll find it necessary also to replace the flyback transformer. Replacement of C79, C78 and the 1V2 focus rectifier will not cure this defect, although it's a good idea to replace these components—especially the tube. As final callback insurance, make adjustments to the horizontal circuits as described in the service data—output current, regulator current, and high voltage.



is: Did the new fusible resistor fail? You mentioned overheating, and smoke rising from the new resistor after a few minutes of operation, but failed to state the final results. This resistor runs pretty hot during normal operation, so the smoke you noticed could have resulted from the newness of the unit. Or, perhaps there was a small amount of oil from your hands—I've seen this happen a number of times.

The 325-ma reading you obtained at the output of rectifier M1 is probably normal for this receiver. The particular chassis analyzed for the PHOTOFACT *Folder drew a current of 310 ma. This information is usually listed directly on the schematic (at the output of the rectifier circuit); it was inadvertently left out of this Folder, but you'll find it in the parts list. The voltage rating of the rectifier is listed, along with the current through it.*

In regard to the wattage rating of the 7.5-ohm fusible resistor used in this set, it's most likely a 5-watt unit; most of them are. You mentioned replacing this resistor with a 5-ohm, 7-watt unit, and I don't believe this will cause any noticeable difference in the circuit—just make sure the unit is a fusible type.

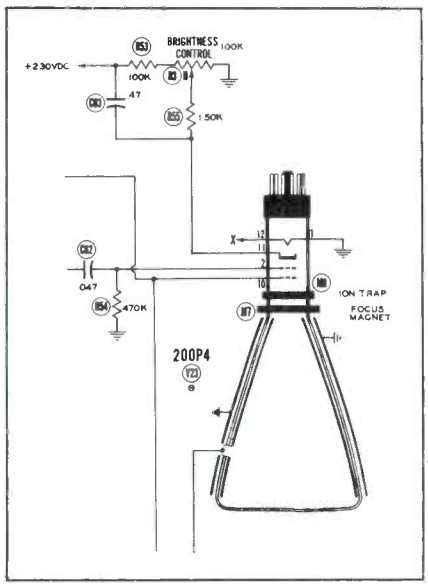
Dimly Lit

I have a problem with a Philco Model 51T2134. Referring to PHOTOFACT Folder 132-10, you do not state the amount of voltage applied to the second anode of the picture tube. In most sets, 14 kv, ± 2 kv, will work; in this one, I measure only 9 kv. This is enough voltage to fire my small 5" test tube perfectly, but the CRT in the set will give only a very faint light. On pin 11 (cathode) of the CRT, I measure 20 volts with the brightness control at maximum and 70 volts when it's set to minimum. I have substituted a yoke, and several capacitors and resistors in the high-voltage rectifier circuit; the only thing I have not tried is replacing the flyback. Do you think 9 kv is enough high voltage for this tube?

B. REED

Limaville, Ohio

The 20DP4 picture tube used in this



receiver normally requires about 16 kv. As a general rule, you can get a pretty good picture with as little as 12 kv, but I agree that 9 kv seems pretty low. However, the symptom you describe, and the voltage readings you are getting, are commonly caused by a leaky C63. I would suggest that you change it, and check the value of R53. If a dim raster is still a problem, I suggest you look for high-voltage or horizontal-circuit trouble, either of which can cause poor high voltage.

Needed — Better Blanking

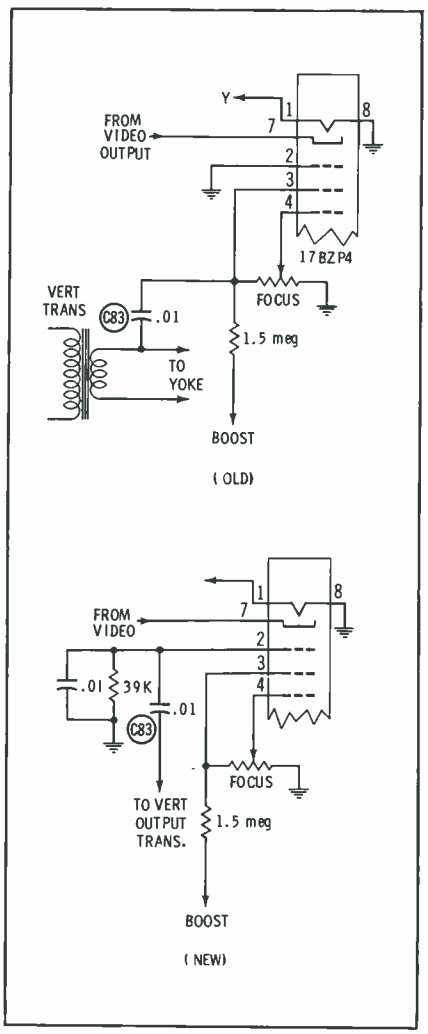
I want to eliminate vertical retrace lines in a Packard Bell TV, chassis V8-2 (covered in PHOTOFACT Folder 387-3). I would appreciate any help you could send my way.

W. CZERVINSKI

SKI's TV Service
Fairchild, Washington.

This set already has a retrace-blanking circuit. Negative 75-volt pulses are coupled from the vertical output transformer through C83 (.01 mfd) to the accelerating grid of the picture tube. Perhaps blanking would be improved if you were to modify the circuit to conform with later versions of the V8 chassis, such as the V8-7 covered in PHOTOFACT Folder 544-2.

The change (see schematic) involves transferring C83 from pin 3 to the control grid (pin 2). The existing ground connec-



tion to this grid should be broken, and a 39K resistor in parallel with .01-mfd capacitor inserted between pin 2 and ground.

This new arrangement should give more efficient blanking, since it applies vertical blanking pulses of approximately 35 volts peak to peak at the control grid. ▲

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(Signed) MAL PARKS, JR., Bus. Mgr.
Sworn to and subscribed before me this 3rd day of October, 1962
(Seal) Billie S. Paul, Notary Public

Objective: Pure White

(Continued from page 35)

evident as we describe the setup technique.

Purity checks are ordinarily made first, unless the convergence yoke or its magnets are known to be incorrectly positioned. To insure that each electron beam in the CRT will strike only the appropriate set of color dots on the screen, purity is adjusted by repositioning the deflection yoke and the purity rings. These rings are permanent magnets with projecting adjustment tabs; they look exactly like the centering rings used in monochrome receivers, even though they are not used for the same purpose. Rotating both rings at the same time moves the beams in a circular pattern on the screen, and spreading or closing the adjusting tabs causes radial movement of the beams. The purity rings are used to set the beam landing in the central area of the screen, while the yoke is used to set up correct purity on the outer edges of the CRT.

Some older receivers also had external edge-purity magnets (located around the perimeter of the CRT housing) to help remove color contamination on the outer edges of the tube; however, improvements in picture-tube tolerances have made these magnets unnecessary in newer sets.

Before attempting to adjust purity in a color receiver, give it and the color bar-dot generator a good 15 minutes to warm up; then degauss the receiver, and adjust operating controls for correct AGC, horizontal frequency, focus, vertical linearity, height, and centering (vertical and horizontal). If necessary, also make a rough adjustment of gray-scale tracking.

For the actual purity check, disable the green and blue guns —

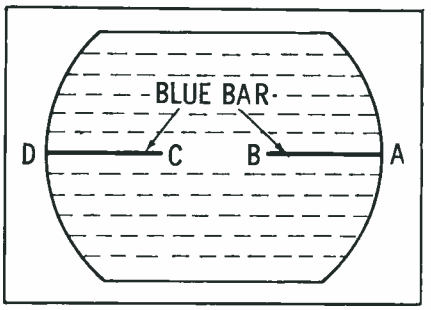


Fig. 4. Straightening the blue bar is first step of horizontal convergence.

either by turning down their screen controls, or by connecting the grid of each gun through a 100K resistor to chassis. Loosen the yoke-retaining clamp, and pull the yoke slightly rearward to scan only the center area of the screen. Now, adjust the purity ring to produce the purest (and brightest) red area in the center of the CRT. Slowly slide the yoke toward the bell of the tube, stopping at the point where the purest red field is evident over the entire screen. A more exact check of red purity can be obtained by looking through a magnifying glass or low-power microscope to see if the individual dots (especially near the edges of the screen) appear round. A circular area of illumination on a dot means that the beam is striking it correctly. Egg-shaped or oblong dots indicate that purity could stand some improvement—even though a good red field seems to be present on the screen. This check can also be made with the naked eye, if you look at the screen from an angle and focus on the dots in a single area.

If the red purity is good, proceed to activate the other two guns (one at a time) and check for a pure blue and green screen. When red is good, the other two colors will generally be just as good.

When purity is satisfactory—or in case the purity adjustments don't react as they should—the next step is to adjust four static-convergence components (blue lateral magnet, and red, blue, and green static magnets) so that the three CRT beams intersect at the center of the screen. Using the pattern from a dot generator, you should be able to make red, blue, and green dots coincide to form a white dot at this one point. Always remember to concentrate on the *center* dot, as shown in Fig. 2. (It's a good idea to circle this dot with a colored crayon or a grease pencil to facilitate the use of a mirror.)

When the red, blue and green magnet sleeves are slid inward or outward, the following actions should take place: The red and green dots should move diagonally in opposite directions on the screen, crossing through one another; and the blue dots should move up or

down, intersecting with the red and green dots. If one of the color dots at the center cannot be moved far enough to reach the crossover point, remove the corresponding magnet sleeve, rotate it 180°, and reinsert. Also, in case the center blue dot falls to one side of the red-green dot junction, use the blue lateral magnet to move it horizontally. This adjustment will also tend to shift the position of the other two dots, making it necessary to retouch the red and green static-magnet adjustments.

When the static adjustments have been completed, the twelve dynamic controls are used to refine the convergence over the entire screen. The labeling of these adjustments varies from one receiver to another, but the resultant actions on the beams follow consistent patterns.

It will help you to think of the dynamic adjustments as being grouped into several "clusters," each of which is intended to have a specific effect on a certain small area of the screen. Remember—it becomes confusing to watch the entire screen during these adjustments, when you should be concentrating on one particular area.

To help you learn to converge a color receiver without constantly referring to a service manual, we've prepared the dynamic - convergence chart shown at the beginning of this article. It will serve to acquaint you with the convergence controls, their effects on the particular CRT beams, and the area affected by each group of controls. The chart is self-explanatory, as are the reference patterns chosen to demonstrate the screen areas. Under the heading *Control Name,* you'll find the control labels as they actually appear on the convergence panels of specific late-model receivers.

Looking back to the convergence circuits used in the RCA CTC7 and CTC9 chassis, we find few differences except in the vertical convergence adjustments. The red and green circuits have *separate* controls marked TILT and AMP, instead of the R-G MASTER TILT, MASTER AMP, DIFF TILT, and DIFF AMP controls used in the newer chassis; for all general purposes, however, the vertical-convergence action is much the same. In older sets, merely use the RED TILT and GREEN TILT controls to converge the center vertical lines at the top and bottom of the screen. Then, adjust the RED AMP and GREEN AMP controls to converge the center vertical lines all the way from the top to the bottom of the screen. Vertical convergence of the blue beam on older sets is the same as in steps 6 and 7 on the chart.

Previous adjustments, *including* static convergence, should be periodically retouched during the procedure. In fact, the complete convergence procedure may need to be repeated at least once, and in stubborn cases, a number of times. Remember, though, one of the most important facts to learn about converging a color receiver is *when to stop.* When the screen appears to have good convergence to within approximately 1½" to 2" of the CRT edges, stop — that's close enough! In cases where you need to leave one beam misconverged in a small area to obtain maximum convergence over the largest possible area of the screen, sacrifice blue; it will not be as noticeable, from a distance, as would red or green.

If acceptable convergence is unobtainable, check to see that the convergence assemblies are in their correct physical location on the neck of the tube, and that the magnets are properly seated in their mount-

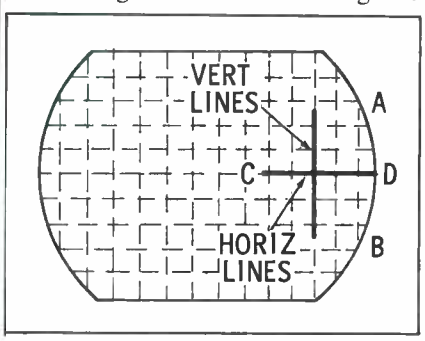


Fig. 5. Check convergence of both vertical and horizontal bars at right side.

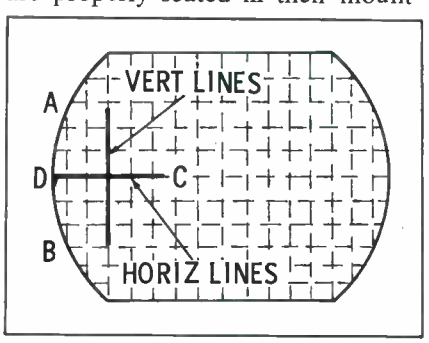


Fig. 6. Follow this pattern to adjust horizontal convergence at left side.

ings. Try relocating the convergence yoke; then reconverge.

Troubleshooting

If, during convergence, a control fails to produce the expected beam-shifting effect, a visual check of the convergence yoke and panel may locate the trouble. In case this fails, further troubleshooting in the vertical or horizontal convergence circuit is in order. By simple analysis of the action on the CRT, determine which convergence circuit is at fault—the vertical or horizontal. Are all three beams—red, green and blue—affected, or only one?

If it's all three, look for trouble in the vertical or horizontal sweep circuits, which supply currents to the convergence yoke. Troubleshoot by checking the input waveforms to the convergence assembly; these are shown in the service information covering the receiver.

If only one color beam fails to move when adjusted, chances are you'll locate a defect in the circuit pertaining to that particular color. Most likely suspects are a bad control, an open coil, or a broken connection on the convergence panel. (The majority of the convergence-circuit components are mounted on this panel.)

Gray-Scale Tracking

Gray-scale adjustments are rather simple in newer color sets, so we won't go through the complete adjustment sequence. Many technicians have their own procedure for gray-scale setup; some merely *feel* their way along until satisfactory reproduction is evident on the screen, while others follow the adjustments as stated in service information. No matter whether you "play it by ear" or "go by the book," keep in mind that the accelerating-grid controls (labeled SCREEN or G2) should be adjusted for the whitest possible highlight areas in a black-and-white picture at high brightness levels, whereas the other set of controls (variously marked DRIVE, GAIN, or BACKGROUND) need to be adjusted for true dark-gray tones in shadow areas. The end result you're after is to keep the raster free of color tinting throughout the brightness-con-

trol range. When you achieve this *final* setup, you'll have a good *black and white* picture on a *color* receiver.

Quicker Color Servicing

The Model CA-378 Kine-Color Circuit Analyzer, recently introduced by Antronic Corp. of Chicago, can be used to speed most color-TV servicing adjustments. By connecting the Analyzer between the color CRT and the chassis, the serviceman introduces a color-gun killer arrangement, a means for measuring the current in the circuit to any element of either color gun, and a way to measure the voltage between any CRT element and ground or between any two elements.

The color-gun killer is useful during convergence adjustments of a color set, as well as for controlling the guns during purity checks and gray-scale tracking adjustments. The panel switch (there is one for each gun) simply opens the lead from the chassis to the grid of the color gun, and grounds the corresponding CRT pin. Since the cathode remains at a positive potential, grounding the grid biases the gun enough to cut off that color.

Voltage tests for the Grid-3 pin and the heater "bias" are made at single pin jacks provided on the panel of the CA-378. One pin jack is connected to ground.

Cathode, control-grid, and screen-grid voltages and currents are brought to pin jacks on the front panel by a special switching arrangement that permits choosing one of the three color guns. This means that voltage and current can be measured in the circuit of any element of either color gun. In addition, voltage can be measured between the elements of any color gun. Complete instructions with the unit spell out how to make all measurements. ▲

Demodulator and Matrix

(Continued from page 33)

phase modulation during each horizontal scanning line; thus, the color circuits receive a signal that represents a continuous change in hue. This signal is alternately keyed on and off so the receiver will produce a series of bright vertical bars separated by dark strips. The chroma-signal phase advances by 30° with each succeeding color bar, resulting in the pattern diagrammed in Fig. 3. One of every 12 "keyed-on" intervals is overridden by a horizontal sync pulse, and the following bar serves as a reference burst signal. Since "burst phase" always corresponds to a greenish-yellow hue in a properly adjusted color set, the visible bars in a keyed-rainbow pattern normally progress from orange-yellow at the left end to green at the right.

If this sequence does not appear when the hue control is set near the middle of its range, the chroma-sync and demodulator - phasing adjustments should be checked as outlined in service data. The bars on the screen can serve as a fairly accurate indicator during this procedure, but more precise adjustments can be made by checking the effect on individual pips in the grid waveforms. These signals are best viewed with the aid of a low-capacitance probe at a scope-sweep rate of 7875 cps, and it's helpful to expand the trace horizontally (as in Fig. 3) for a better look at the series of pips corresponding to just one TV scanning line.

Note that all three waveforms include a wide, deep negative pulse for horizontal retrace blanking of the CRT. In addition, the "keyed-off" intervals between color bars form a convenient zero-reference line. The 10 active color-bar pips vary in height, setting up the proper combinations of grid voltages to produce the desired color sequence. For example, on the third pip following burst, the red-grid voltage (in W1) reaches its highest positive peak; the blue-grid voltage (in W2) stays down near the reference level; and the green-grid voltage (in W3) dips to a negative value. As a result, the color of the third bar on the screen is nearly pure red. On the

next pip, there is a little less red drive and a little more blue drive; thus, the fourth bar appears red with a definite bluish tinge.

During the sixth bar — when the input-signal phase has advanced 90° past the point of maximum red output — the voltage on the red grid remains at the background reference level (see W1). This and other "nulls" found in the three color-difference waveforms are the most reliable check points for setting up correct phase relationships in the chroma circuits. In a perfectly adjusted receiver, nulls should also appear at the third and ninth pips in W2 on the blue grid, and at the first and seventh pips in W3 on the green grid. Some leeway is permissible; for instance, W2 in Fig. 3 reaches a null somewhere between the second and third pips, but this slight displacement does not cause an obvious defect in the color-bar pattern on the screen of the test receiver.

If any greater phasing error is apparent in the waveforms, check to see if all the nulls are displaced

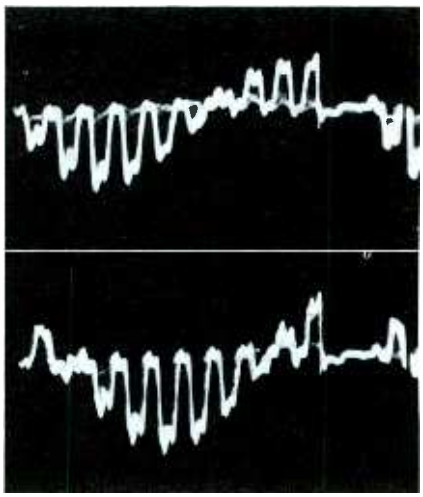


Fig. 4. Waveforms W4 and W5 applied to grids of R-Y and B-Y amplifiers.

equally in the same direction; if they are, they can usually be brought back to normal by readjusting the hue control or the burst-phase transformer. When only one or two nulls are out of place, the fault ordinarily lies in the demodulator-phasing adjustment or in one of the demodulator circuits.

Signal Amplitudes

Even when properly phased, the CRT-grid waveforms will produce correct color mixtures only if the ratio of their amplitudes is normal. The red and blue signals should generally have about the same peak-to-peak value, but that of the green signal is likely to be somewhat lower. (This point is illustrated by the waveforms in Fig. 3, which were taken without resetting the vertical gain controls on the scope.)

In circuits of the type shown in Fig. 1, attenuation of a CRT-grid signal is often due to low gain in one of the color-difference amplifiers — V23B, V22A, or V22B. If this trouble involves a change in the DC plate voltage of the amplifier, the error will also be passed along to the associated CRT grid through the DC coupling circuit — resulting in a tinted raster. However, the technician may cover up a mild case of this symptom by readjusting the drive or background controls, before he realizes that a trouble is present.

Signal measurements will clear away any doubt about the relative gain of the color-difference circuits.

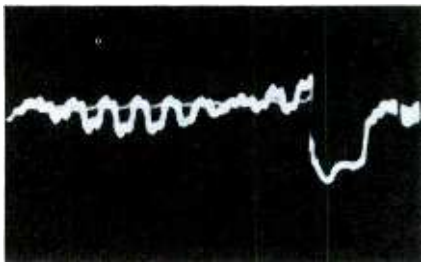


Fig. 5. W6 is developed across cathode resistor R178 in circuit of Fig. 1.

The overall peak-to-peak readings of the CRT-grid waveforms, *including* the horizontal blanking pulse, are valid indications of amplifier gain—since the pulse is fed into the common cathode circuit and amplified by all three color-difference stages.

If one or more of the CRT-grid inputs definitely seems weak, the next step in trouble isolation is to check the signals being fed to the R-Y and B-Y amplifier grids from the chroma demodulators. Both of these waveforms (W4 and W5—see Fig. 4) should have practically equal peak-to-peak values if the circuits ahead of the color-difference amplifiers are working properly.

The color-bar pips in W4 and W5 follow a pattern almost exactly opposite to those in W1 and W2, since the signals are inverted by the R-Y and B-Y amplifiers. However, the nulls are slightly displaced, indicating that the amplifiers introduce an approximate 20° phase shift in addition to a polarity reversal. The explanation of this slight phase alteration is tied in with the explanation of how an input signal is developed for the G-Y amplifier in the circuit of Fig. 1.

The cathodes of all three color-difference amplifiers are returned to ground through a common, unbypassed resistor R178. When W4 and W5 are applied to the red and blue amplifiers, replicas of both these signals are developed across the cathode resistor, and the resultant waveform (W6) is as shown in Fig. 5. This is a G-Y signal of the same polarity as W3. It is amplified by V23B, which operates as a cathode-driven, grounded-grid stage; however, it subtracts from the outputs of V22A and V22B.

This degenerative effect of the cathode circuit on the R-Y and B-Y signals is taken into account in the adjustment of demodulator phasing.

Aside from this point, the X and Z demodulators are basically designed to recover the red and blue color-difference components of the signal coming from the chroma bandpass amplifier. A brief review of this process will make it easier to pinpoint troubles that result in phase or amplitude distortion of the demodulator outputs.

Demodulator Operation

The basic idea of demodulation is to combine the received chroma signal with a locally-generated 3.58-mc signal in two different ways, to obtain a pair of waveforms from which the color-difference and matrixing circuits can reconstruct all hues. In most color receivers, the demodulators are respectively set up for maximum (or near-maximum) response to R-Y and B-Y phase modulation of the chroma signal. Since a 90° change in phase is what makes the difference between these two signal components, the desired waveforms can be recovered by feeding 3.58-mc reference signals approximately 90° out of phase to the two demodulators.

Reference signal W8—fed to the cathode of the X demodulator—is nearly 180° out of phase with the chroma signal at the grid, when the latter is modulated at R-Y phase. The negative peaks of this cathode signal then coincide with the positive peaks of the grid signal, and this conduction causes maximum output from the demodulator. When the phase of the chroma signal changes, the demodulator-plate current decreases — reaching a minimum when the grid and cathode signals are in phase.

In the filtered output signal (W4), note that the strongest negative pulse, corresponding to maximum plate current in the X demodulator, is the third (red-bar) pip. The X output crosses the zero-reference line (equivalent to no chroma modulation) at a point between the sixth and seventh pips. W5 reaches its maximum negative value at about this time, since W9 (at the cathode of the Z demodulator) lags W8 by nearly 90°. Therefore, blue is the dominant output in this portion of the color-bar signal.

G-Y modulation in W7 reduces the plate current of both demodulators to minimum, as indicated by the positive value of the tenth pip in both W4 and W5. The R-Y and B-Y amplifiers invert this pip, developing negative outputs which cut off the red and blue CRT guns. At the same time, a positive pulse is developed in the common cathode circuit and amplified in the G-Y stage without inversion—driving the green gun into conduction.

Summary

Every change in chroma phase causes the demodulators to conduct in different proportions. As long as the circuits between the demodulators and the CRT grids are in correct balance, all three grid voltages will be varied in the exact amounts necessary for accurate reproduction of all colors. When some hues are poorly represented, troubleshooting is a matter of checking for faults in the sections of the circuit known to affect these hues. Analyzing the phase and amplitude of pertinent test signals is an excellent short cut to pinning down the trouble. ▲

Service Aids

(Continued from page 24)

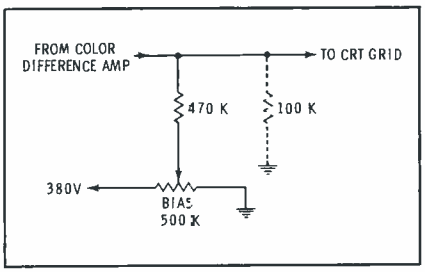


Fig. 1. 100K resistor disables CRT gun.

these are lined up to produce yellow, you can restore blue and converge it with the yellow lines.

Another time when you might want to disable guns is during in-the-home setup of color sync. Using a keyed-rainbow generator, you can remove two of the primary colors and adjust chroma phasing to remove all of the color from a certain bar in the pattern. (Exact instructions appear in service manuals.)

How does a 100K resistor disable a grid circuit? Fig. 1 gives the answer. By shunting from grid to ground, it alters the voltage division in the grid circuit so that the grid voltage is lowered. The decrease is enough to bias off the gun. A short from grid to ground would accomplish the same end, but would place too heavy a load on the circuit between B+ and the grid. At least one commercial unit disables the gun by disconnecting the grid from its divider network and grounding it. With the cathode highly positive, the grid is cut off, disabling the gun.

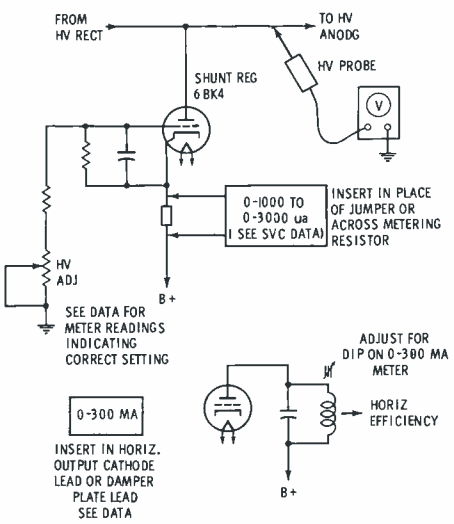


Fig. 2. Meters show the color-TV technician what's going on in HV circuits.

High-Voltage Accessories

In color TV, high voltage is not checked by just drawing a "zap" from the anode lead and estimating the strength of the arc. To maintain the voltage regulation necessary for proper sweep, focus, and convergence—and also to prevent overburdening the horizontal sweep system—a rather exacting procedure using meters is required to check the high-voltage system.

Fig. 2 shows a typical test setup. The high voltage is actually measured; a standard shop VOM or VTVM can be used, provided you also use a HV multiplier probe rated at 30 kv or more. Two curret meters indicate, respectively, the current drawn by the HV regulator cathode circuit and that drawn by the over-all horizontal sweep circuit. When the HV ADJUST pot is turned to adjust the anode voltage, both current meters must be monitored to see that regulator current is neither too high nor too low, and that the horizontal output and damper stages are not drawing excessive current.

A HORIZONTAL EFFICIENCY coil —same circuit location as the hori-

zontal linearity coil in black-and-white receivers—provides a means of "cooling down" the horizontal flyback current. Just as in some early monochrome receivers, sweep components will last a lot longer if the coil is tuned for a (minimum) dip in the milliammeter reading.

The low milliammeter range of a shop VOM can be used in place of a special current meter in some cases, but there are some instances where this introduces excessive resistance in the regulator circuit—thus lowering the readings. An ordinary meter may be used sometimes, if its shunting effect is allowed for; the set's service information will explain. However, it's a lot more convenient to have at least one special meter just for this purpose, so you can use two current meters at once to monitor all points involved in HV adjustment.

Bias Supplies

You may have heard that color-TV alignment often requires three or four separate clamping bias sources; perhaps you marveled at the statement, dismissed it as the complexity of color, and didn't even find out what the various bias sources were for. The color sets of a few years ago required four bias sources for video-IF alignment. Two of these replace the RF and IF AGC bias, respectively; two others substitute for fixed negative bias normally obtained from the horizontal sweep circuit. (Specifically, the grid of the horizontal blanking amplifier and the bottom of the brightness control). These bias sources become necessary because the instructions call for disabling of horizontal sweep during alignment, to get rid of interference on the alignment curve and permit easy use of the multimarker.

By the way, this brings up another service accessory — a 2000 - ohm, 100 - watt resistor (1500 - ohm for some chassis) which is wired across B+ to take the place of the horizontal circuitry as a load. Removing a load of that size from the B+ circuit, without substituting for it, could raise the B+ voltage enough to affect IF frequency response and the accuracy of alignment!

In some of the more recent models, the IF-AGC bus can be grounded to chassis, reducing the bias-pack requirements to three. In still others, no fixed bias is needed from the horizontal section, and one or two bias sources will suffice. None of the above-mentioned sets require a bias voltage greater than –15 volts at any of the points mentioned.

Test Extensions and Harness

Using test extensions with a color set produces the usual problems of cable capacitance—video smear in full color, possible cross-coupling effects between sweep leads (affecting convergence as well as sweep)—but these conditions can be taken into account during servicing. They can be somewhat alleviated by making extensions no longer than really necessary and by dressing leads of extension cables as far apart as practical (to discourage cross-talk). There's no question, however, that some type of extension setup is essential for servicing color receivers.

The necessary hookup includes the following: CRT base extension, HV extension, yoke leads, and convergence-yoke extension. CRT bases are the same (with 14 pins) on all

color sets, so one cable will take care of all. You'll need two basic types of heavy-duty HV leads—one for the older-style CRT's and another for the new sulfide tubes introduced last year.

Yokes are now standardized to connect to a bundle of four plug-in, color-coded leads—yellow and yellow/black for the vertical windings, red and blue for the horizontal. Special extensions are available for these. In addition, you'll find octal-plug yoke cables for some older sets.

The convergence plug in most sets is also octal. Notable exceptions are Zeniths, which use a square 9-pin plug, RCA Chassis CTC5, which has a 12-pin plug, and RCA CTC 4 which has a 6-prong plug.

Screen Inspectors

It seems you're always craning your neck to see the reflection of a color-TV screen, or squinting directly at the screen itself during set-up. Make it easy on yourself with a couple of optical accessories. One is a *good, large* mirror—one that will let you see the entire screen clearly while you're manipulating the yoke and purity magnets from behind the set. Another is a magnifying glass or pocket-size microscope that gives about 10-power magnification. It will let you look at a small sample of the phosphor dots on the screen to see if the beams are landing in the correct area of each dot.

Additional Aids

Countless other accessories are available to simplify the job of the color-TV technician. Color-CRT brighteners let him extend the life of weakening picture tubes. Special tools make it easier to adjust concentric controls, and other special alignment points. Some chassis even require special cheaters for the high-voltage interlock.

Special servicing aids are for a purpose—they are time-savers. The serviceman who has built his reputation for better, quicker service must make use of aids such as these to enable him to handle the increasing demands on his time. And better use of his time will help him build his reputation for better, quicker service. It just works that way! ▲

Color TV Station

(Continued from page 40)

be brought back together with the centering controls. With any luck at all, registration of the red and green channels is complete.

The same routine is followed in registering the blue channel over the green. Finally, the engineer looks at all three—the red and blue channels "supered" over the green. If registration is correct, only one chart will be seen.

Shooting

Now it's time for the engineer to look at the scene to be televised. First, he'll light the set. Many types of lights are used—spots and floods of all descriptions and power, from a single-candlepower light to a 5-kw monster mounted on wheels. "Lazy boys"—lights on scissors-like mountings—are pulled down, spotlights are zeroed in, and a dash of top light is added to highlight a good hairdo (and also add depth to the set). A basically flat light, between 250 and 500 foot-candles, is usually sufficient to light a set. The good engineer never uses more light than is necessary to get the desired results.

The engineer has now checked and rechecked the beam and target settings of the three orthicons, the three focus controls, and the pedestal and gain of each channel for the same output. Now it's time for him to take a look at the scene and make his final adjustments.

The equipment has now been on for probably two or three hours. The burst flag generator is working properly, sending keying pulses to the colorplexer to control the injection of the 3.58-mc burst into the composite signal. The colorplexer and the color monitor have been adjusted and balanced to the engineer's satisfaction, using signals from the bar generator. Now, he can switch the colorplexer from the bar generator to the camera. (It's embarrassing to have the switcher operator place the color signal on the air, only to see the color bars on the air monitor, instead of the desired stage scene. They are pretty, though.)

On the Air

With the test charts out of the way, the cameraman dollies the camera back to a position from which he can get a good shot of the entire set to be televised. He then mechanically focuses the camera with the control handle. The camera controller (at the main control panel) makes any final adjustments necessary. The only adjustments left to be checked are the master gain, the iris control on the camera, and the master pedestal control, which maintains the proper blanking level in the three color channels. The controller may have to touch up the individual shading, both horizontal and vertical, as well as individual gain adjustments of the separate channels; often, he ends up painting, electronically, his own desired picture.

Once he is satisfied with the color-camera output, the engineer places the shield over the channel controls; only the master pedestal and gain controls are left for adjustment during the televising of the show. This eliminates the possibility of upsetting the registration or focus of one channel by turning the wrong knob.

All Done

After the show is over, and the studio lights are killed, the camera B+ is shut off; but filaments are left on so the camera will not cool down too quickly. Later all equipment is shut down, the camera is dollied back to its storage position, and the camera cables are coiled near the camera.

If there is any time left in the engineer's day, he'll do some maintenance on the camera or its associated equipment. There are always tubes to be checked and lenses, prisms, and mirrors to be cleaned. Blower motors need periodic lubrication. Many periodic checks are required so the gear will be ready to perform its duties at the desired time.

Finally, the last tube has cooled, the maintenance logs have been filled out, and the live-color shows for the day have been "put to bed." The color-TV studio engineer can feel the satisfaction of a job well done, but he must also face the disquieting feeling of knowing it all has to be done over again tomorrow. ▲

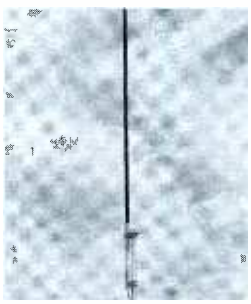
PRODUCT report

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

Transistor Protector (42T)

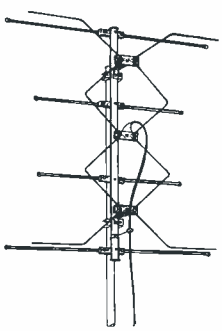
Littelfuse has developed a small device to protect transistors from both current and voltage overload. Known as "Transistor Protector," the unit can be mounted in printed-circuit boards or used with conventional-type wiring. The small cylindrical-shaped body houses a plug-in "Microfuse." The unit is presently available in the 20- to 200-volt range and for currents in the .05- to 1-amp range. Littelfuse expects to extend the line to other values at a later date.

Base-Station Antenna (43T)



Taxi operators, police and fire departments, and commercial car fleets represent excellent markets for the new "Beacon" line of omnidirectional base-station antennas by **Mark Products.** Designed for use in the 150- and 450-mc ranges, these units have low VSWR and high strength-to-weight ratios. List prices range from $75.00 for the eight-foot Model 4506 to $175.00 for the 16-foot Model 4585. Longest unit in the line is the 21-foot Model 1506, priced at $150.00.

UHF Antenna (44T)



This new antenna by **Antennacraft** features all-aluminum, rust-proof construction and an anodized finish. It uses a multiresonant collinear reflector system and provides 37% more gain than previous chicken - wire - type antennas. Two models are available: SA-1483, for channels 14 to 83; SA-7083, peaked for channels 70 to 83. Each model, shipped preassembled, carries a price of $10.95.

Wire Caddy (45T)

A combination container and reel, for shipping, holding, and dispensing certain types of wire, has been developed by **South River Metal Products Co., Inc.** This novel package is available with 300-ohm twin lead-in wire for antenna installation purposes. Each "Wire Caddy" (Model WC shown here) contains 1000 feet of wire. South River plans to furnish aluminum and steel guy wire, coaxial cable, and other products in the new type of package.

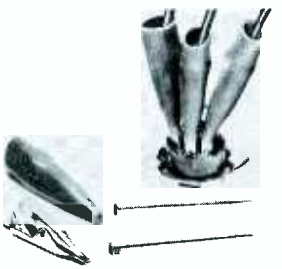
New Microphone (46T)

"Big Mike" Mark 1, introduced by **Communications, Inc.,** Wilton, Conn., is primarily for use with CB transceivers or amateur transmitters. It has a built-in transistor amplifier, with adjustable controls for output level and tone. The mike is constructed of anodized aluminum. Power for the amplifier is obtained from a small, long-lasting mercury cell. Net price of the unit is $29.95.

Antenna Coupler (47T)

A new special auto-antenna coupler has been introduced by **B & K Mfg. Corp.** Designated the CBC-1, the coupler permits the use of a single antenna for both CB and regular AM auto radios. Featuring an extremely low insertion loss — less than .3 db between transceiver and antenna — the coupler is recommended for use with any mobile CB antenna. Net price of the unit is $8.95.

Clip Leads (48T)

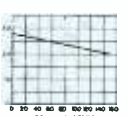


The contact end of this tiny clip lead, new from **Mueller Electric,** is no larger than a pin head. The miniature size of this "Micro-gator" makes possible the connection of clip leads to the smallest terminals used in electronic equipment. Clips are available in both steel and copper. Various colored insulators, for use in multiple-lead applications, are also available.

Speaker Horn (49T)

Model 1R-9 is a new two-way speaker or paging horn available from **Progress Webster.** The unit can be used with Webster intercom systems, Models W1-60 or W1-65. Especially suitable for areas of high noise level, the unit can be mounted on a wall or ceiling, indoors or out. The adjustable bracket provides directional flexibility. Power output is 7.5 watts. List price is $24.50.

DC Supply (50T)



The Model EC-3 transistor power supply, introduced by **Electro,** carries a full-year warranty. It has outputs of from 0 to 20 volts (adjustable) and delivers 150 ma at 20 volts. Also included is an adjustable bias tap for voltages of 0 to 6 volts. Sliding a handy switch connects the meter to read voltage or current. The unit, completely wired, sells for $19.95.

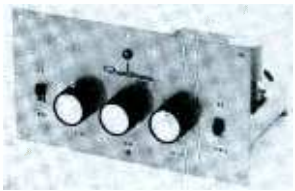
Phonograph Aid (51T)

This new package from **Duotone** contains a turntable level indicator and needle cleaning brush. The level is 3" long and comes equipped with a handy pocket clip. The tiny brush may be used to remove dirt and grit from the needle tip. This complete package is available for immediate delivery and carries a suggested list price, for both items, of $1.49.

Connectors (52T)

A new line of audio connectors—for microphones, tape recorders, amplifiers, and other electronic applications — has been announced by **Switchcraft, Inc**. Four new models are available: A3F, a female cord plug; A3M, a male cord plug; B3M, a panel-mount receptacle; and C3M, a wall-mount receptacle. In addition to three circuit contacts, each connector has a grounding contactor.

Stereo Amplifier (53T)



This low-priced stereo amplifier is now available from **Qualitone Industries, Inc.** Designated "Little Giant," this unit can be used for stereo conversion of portable phonographs or as a stereo tape recorder amplifier. Outputs (1½ watts per channel) are for 8-ohm speakers. Inputs to the amplifier can be from either a crystal or ceramic cartridge. This Model 26-01 retails for $19.95.

Phonograph Accessory (54T)

A new "Disk-Whisk" kit, to clean records while they play, has been introduced by **Robins Industries.** The kit contains a pad and brush which, when attached to the tone arm, cleans the record grooves and deposits an antistatic coating on the record surface to prevent future dust gathering. The special antistatic fluid is included in the kit. List price is $4.00. Refill kits (fluid and roller) are available for $2.00.

Tube Tester (55T)

A new self-service tube tester, Model 203-LB, has just been introduced by **Mercury Electronics Corp.** The unit will test all tube types, including nuvistors, novars, compactrons, and new 10-pin tubes. In addition, it has provisions for testing vibrators, batteries, fuses, and pilot lights. New easy-to-read flip-type tube charts for the tester will be made available periodically. The unit is priced at $254.50.

Recording Tape (56T)

"Scotch" brand 290 is an extra-long-play magnetic tape introduced by **Minnesota Mining and Manufacturing Co.** The tape is available in 600-foot lengths on 3¼" reels. Each reel provides a full hour of recording time on two tracks at 3¾ ips. List price is $2.95 per reel.

Degaussing Coil (57T)

New from **Stancor** is this DGC-100 "Merchandiser," containing a total of five degaussing coils. Each features a convenient in-line power switch, and rugged construction. Easy-to-use instructions are packed with each unit. Dealer net price for each degaussing coil is $12.75.

INDEX TO ADVERTISERS

November, 1962

Latest Jackson Tube Test Data

MODEL 648				
Tube Type	Fil.	D.	E.	Plate Test
1AD2◆	1.4		5	80X2
	Connect Top Cap To Octal Socket Pin 8			
6GL7	6.3	A238	AC56	41X2
		A234	A17	20V
6HZ8	6.3	A128	679	47XZ
		A124	A35	37XZ
6J11◆	6.3	A878	C569*	45VX
	Nor. 5 Switch In 5 Position			
	"	A839	C124*	45VX
22BH29	25	126	5	14W
SUPPLEMENTS LATEST ROLL CHART 648-26				

MODEL 598								
Tube Type	A.	B	C	Fil. Cont.	D	E	F.	G.
1AD2◆								
6GL7	6.3	8Y		7	5	42		47
		8			2	1		16
6HZ8	6.3	4		5	9	7	8Y	46
		4Y			3	22		68
6J11◆								
22BH29								
SUPPLEMENTS LATEST ROLL CHART 598-5								

MODEL 658								
Tube Type	Sec.	Heater	Circuit H-K	Circuit P-G	Plate	Grid Test	Heater Current	
1AD2◆	D	1.2J		5	27U	VX		
Connect Top Cap To Octal Socket Pin 8								
6GL7	T	6.4K	238	ac56	19Q	10XY*		
	T	"	234	a17	17R	80VY*		
6HZ8	P	6.4L	128	679	26Q	25VY*		
	T	"	124	a33	17R	10XY*		
6J11◆	P	6.4J	870	c568	60S	5WY*		
	P	"	834	c129	60S	5WY*		
22BH29	D	22.M	124	5	19U	V	A30.K	Z450
SUPPLEMENTS LATEST ROLL CHART 658-5								

CATALOG AND LITERATURE SERVICE

ANTENNAS & ACCESSORIES

1T. *JERROLD ELECTRONICS*—Brochure describing how Jerrold's TX-FM coupler utilizes a TV antenna to provide FM signal to FM tuners.

2T. *JFD*—Brochures on LPV log periodic TV antenna, FM stereo antenna; also catalog showing complete line of TV/FM indoor and outdoor antennas and antenna accessories.

3T. *TACO*—Sheet giving specifications and performance information on Taco's T-Bird Electra antenna. *See ad 2nd cover.*

AUDIO & HI-FI

4T. *ATLAS SOUND*—Catalog No. 562 listing specifications on microphones and loudspeakers for public address, commercial, and industrial use. *See ad page 86.*

5T. *EICO*—New 32-page catalog of kits and wired equipment for stereo and monophonic hi-fi, test equipment, Citizens-band transceivers, ham gear, and transistor radios. Also "Stereo Hi-Fi Guide" and "Short Course for Novice License." *See ad page 93.*

6T. *QUAM-NICHOLS*—Catalog sheet listing specifications and prices on complete line of wall baffles. *See ad page 71.*

COMMUNICATIONS

7T. *CADRE*—16-page booklet "Businessman's Guide to Citizens Band Two-Way Radio." *See ad page 95.*

8T. *COMMUNICATIONS COMPANY, INC.*—Descriptive literature on VHF and UHF two-way radio communications equipment for airport vehicles and towers.

9T. *E. F. JOHNSON CO*—Brochures describing complete CB equipment line, new Messenger "202" transceiver, and specifications on selective-calling system for CB equipment.

10T. *MIRATEL ELECTRONICS*—Brochures containing information on Citizens-band equipment and CB Club membership.

COMPONENTS

11T. *ADMIRAL (SALES DIVISION)*—1963 catalog listing parts and accessories, service and business aids, complete cross-reference on needles and cartridges, and complete antenna line.

12T. *BUSSMANN*—Bulletin SFH-8 giving information on new GMW-HWA subminiature fuse-and-holder combination for use on panels or printed-circuit boards. *See ad page 77.*

13T. *CENTRALAB*—Catalog No. 220, handy 6" x 9" 20-page catalog listing price and other information on more than 1,815 controls, switches, ceramic capacitors, and other electronic components. *See ad page 83.*

14T. *LITTELFUSE*—Illustrated dealer-serviceman fuse and holder catalog (No. L-562) showing prices and specifications. *See ad 4th cover.*

15T. *SONOTONE*—Sheet listing new dry-cell batteries for use with transistor radios, flashlights, photo units, and toys. Specification sheet No. SAH-58. *See ad page 44.*

16T. *SPRAGUE*—Chart C-457 (designed to hang on wall) showing all popular TV-radio-hi-fi replacement components. *See ad page 10.*

SERVICE AIDS

17T. *CASTLE*—Leaflet describing fast overhaul service on television tuners of all makes and models; also illustrated lists describing universal and original-equipment tuners. *See ad page 72.*

18T. *ELECTRONIC CHEMICAL CORP.*—Catalog and brochure listing electronic chemical line, including new formula EC-44 for lubricating and cleaning electrical contacts.

19T. *MINNEAPOLIS SPEAKER CO.*—Brochure describing new "Mini-Speaker" specifications and applications.

20T. *PRECISION TUNER*—Information on repair and alignment service available for any TV tuner. *See ad page 76.*

21T. *SWING-O-LITE INC.*—Two brochures listing information on "The Inspector" and "Hi-Mag" lamps for servicing or office use. *See ad page 88.*

SPECIAL EQUIPMENT & SERVICES

22T. *ACME*—Illustrated catalog sheet 24-B01 giving specifications and listing applications for magnetic amplifiers designed for control uses; includes units with capacities from 5 to 1000 watts and voltage ranges from 24 to 160 volts. *See ad page 103.*

23T. *CINE-SONIC SOUND, INC.*—Sheet listing cartridge tape repeaters for background music. Catalog of tape cartridges from the Largest Library of Music.

24T. *R-COLUMBIA PRODUCTS CO. INC.*—Brochures No. 61 and 62, describing 7-oz dynamic headphones for language laboratories and stereo listening. *See ad page 58.*

25T. *TERADO CORP.*—Catalog sheet 5978 showing Dual Continental and Continental inverters. *See ad page 98.*

26T. *TRANSVISION ELECTRONICS*—12-page catalog listing black-and-white TV kits and wired chassis for custom installation; also catalog of color-TV kits.

27T. *VOLKSWAGEN*—60-page illustrated booklet, "The Owner's Viewpoint," describing how various business enterprises use VW trucks in their operations; also booklet giving complete specifications on VW truck line. *See ad page 21.*

TECHNICAL PUBLICATIONS

28T. *HOWARD W. SAMS*—Literature describing all current publications on radio, TV, communications, audio and hi-fi, and industrial electronics, including brand-new Fall-Winter 1962 Book Catalog and descriptive flyer on 1962 Test Equipment Annual. *See ads pages 75, 84.*

TEST EQUIPMENT

29T. *B & K*—Catalog AP20-R, giving data and information on Model 850 *Color Analyst*, Model 960 *Transistor Radio Analyst*, Model 1076 *Television Analyst*, *Dynamatic 375 VTVM*, *V O Matic 360*, new Model 625 3-in-1 *Dyna-Tester*, Models 600 and 700 *Dyna-Quik* tube testers, Models 440 and 420 CRT Tester-Reactivators, and Model 1070 Dyna-Sweep Circuit Analyzer. *See ads pages 41, 43, 45, 49 and 60.*

30T. *HICKOK*—Four-page brochure describing new Hickok Model 661 Chrom-Aligner NTSC Standard Color Bar Generator. *See ad page 53.*

31T. *MERCURY*—Literature describing regular and self-service tube testers, component substitutor, CRT tester, and other service equipment. *See ad page 85.*

32T. *PRECISION*—7" x 10" two-color catalog containing specifications and prices of their complete test equipment line. *See ads pages 66-67.*

33T. *RCA*—Pocket catalog covering complete line of test equipment; includes all color-TV instruments. *See ad page 73.*

34T. *SECO*—Brochure describing new transistorized power supply, designed for high-powered transistorized equipment. *See ad page 89.*

35T. *SENCORE*—Complete literature on the CA-122 color circuit analyzer and the PS-120 wide-band scope. *See ads pages 25-28.*

36T. *TRIPLETT*—Catalog No. 44-T containing specifications of new test equipment.

TOOLS

37T. *BERNS*—Data on 3-in-1 picture-tube repair tools, on Audio Pin-Plug Crimper that lets you make pin-plug and ground connections for shielded cable without soldering, and on *ION* adjustable beam bender. *See ads pages 92, 100.*

38T. *ENTERPRISE DEVELOPMENT CORP.*—Literature from Endeco on improved desoldering and resoldering techniques for use on PC boards.

39T. *ONEIDA ELECTRONIC MFG. CO.*—Three brochures describing service chemicals, soldering-gun attachments, high-voltage caps (for color TV's) and other hard-to-find servicing accessories. *See ad page 102.*

40T. *UNGAR*—Eight page, fully illustrated four-color catalog describing "Imperial" soldering iron and complete line of interchangeable Imperial components.

TUBES & TRANSISTORS

41T. *AMPEREX*—16-page semiconductor handbook and 34-page tube reference book. *See ad page 15.*

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Tools and tubes are your bread and butter on home service calls. That's why, in addition to the finest electron tubes, RCA also provides you with special service-designed tool chests and tube caddies to increase your efficiency on every call. These valuable service aids . . .

- Save your time
- Simplify your job
- Organize your work
- Help you find the tool or tube you need readily and quickly
- Help assure that you have what you need when you need it—with nothing inadvertently left behind in the shop.

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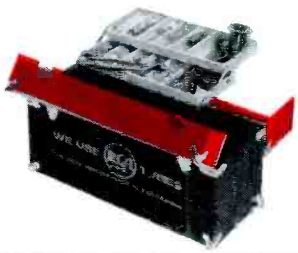
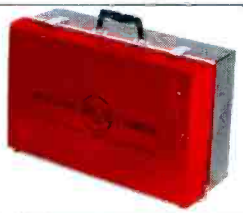


NEW SERVICE-SPECIAL TOOL CHEST
(1A1280) Ample room for all basic tools, with a special compartment to hold your RCA WV-38A V-O-M or RCA Power Line Monitor.

RCA "QUICK CALL" TUBE CADDY
(1A1002) A handy tube caddy that holds 162 of the tube types you use most frequently on TV service calls.

RCA "TREASURE CHEST" TUBE CADDY
(1A1001) RCA's famous full-size caddy —holds over 260 receiving tubes.



RCA LITEWEIGHT TUBE CADDY
(1A1241) This lightweight, compact caddy holds up to 210 receiving tubes. Custom molded of plastic, its finish resists marring and staining, cleans with soap and water.

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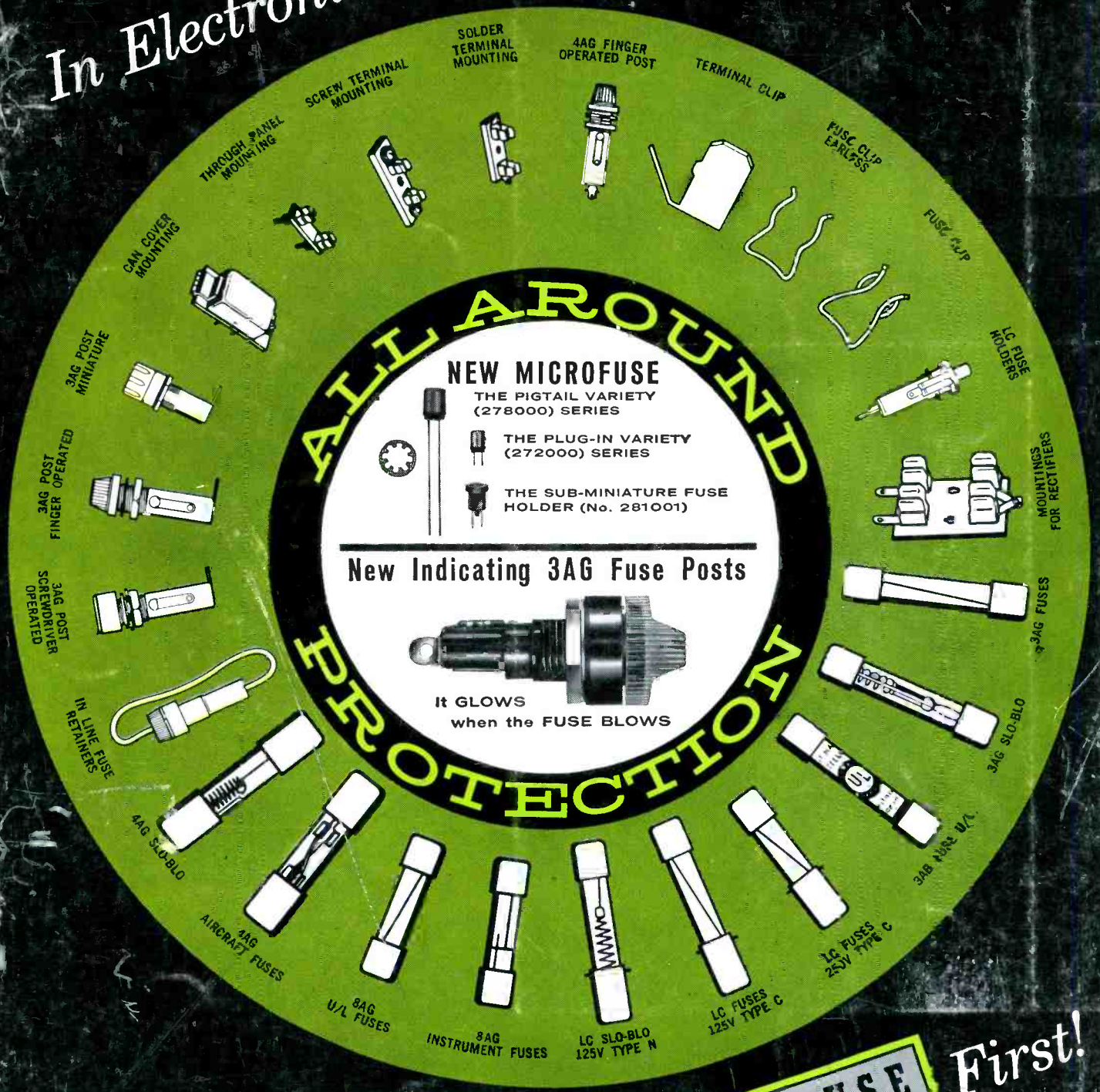

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