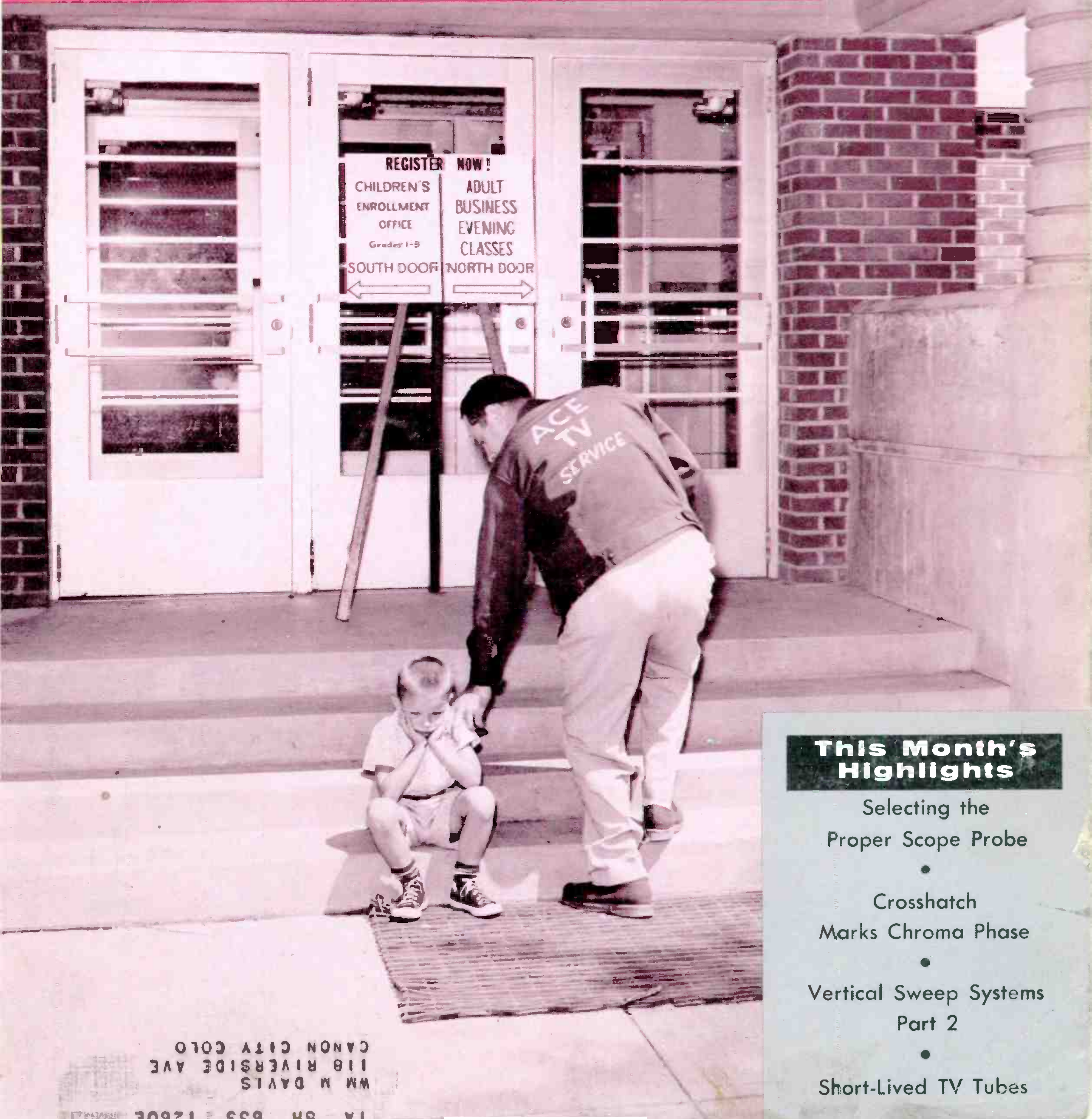
SEPTEMBER, 1959 35 CENTS

# PF REPORTER

PHOTOFACT

including **Electronic Servicing**




**This Month's Highlights**

Selecting the Proper Scope Probe

•

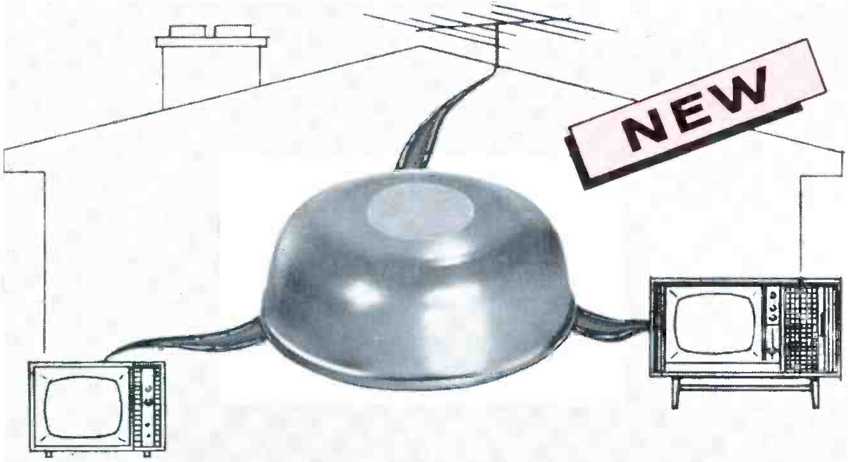
Crosshatch Marks Chroma Phase

•

Vertical Sweep Systems Part 2

•

Short-Lived TV Tubes





## Walsco 2-Set TV-FM Couplers

A Walsco Exclusive . . . both these couplers can be mounted on wall or mast before attaching leads. Standard Model for strong signal areas; Low Loss Model for fringe areas.

No. 1600 Standard.................. List $2.50
1602 Low Loss.................. 3.50

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New precision tool with accurate dial for stripping each wire size. Clips all wires from 12 to 26 gauge. Ground cutting edges, insulated grip.
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### WALSCO LONG NECK OILER

Reach all those hard-to-get oil cups, etc. All plastic container and nozzle; telescoping extension reaches 7 inches. Contains high quality all-purpose oil.
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Specially designed to remove and insert "C" washers and retaining rings on tuners, control shafts, etc. High grade steel, nickel plated.
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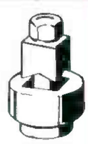

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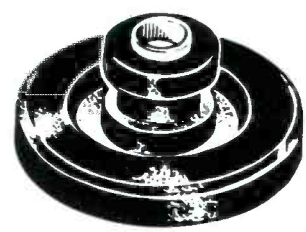

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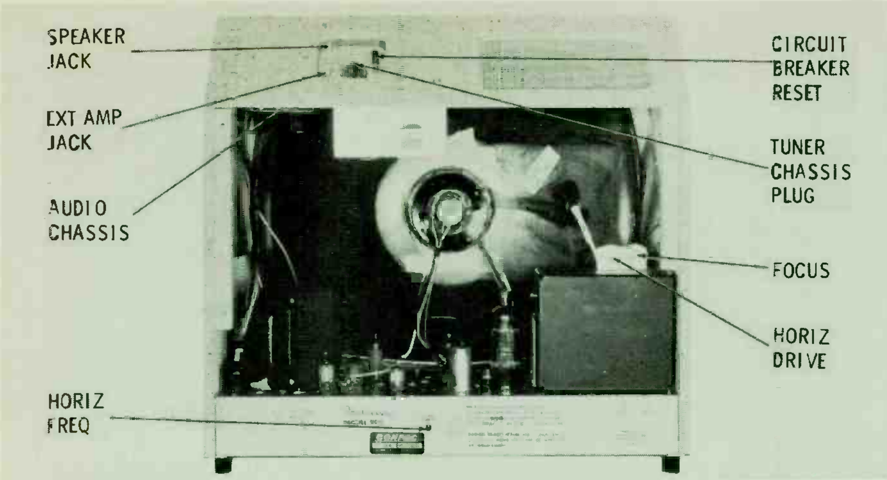
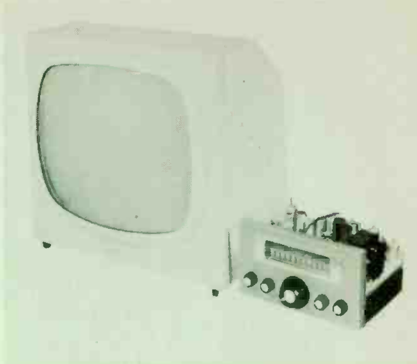
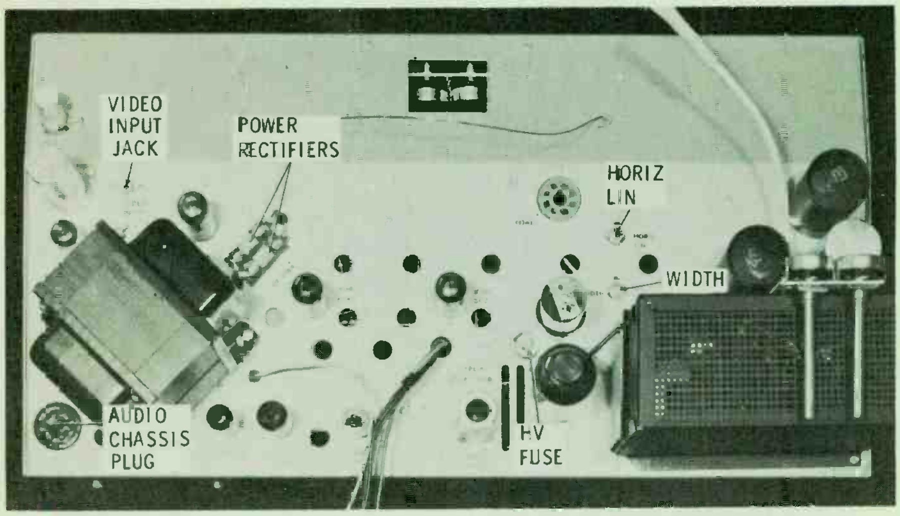
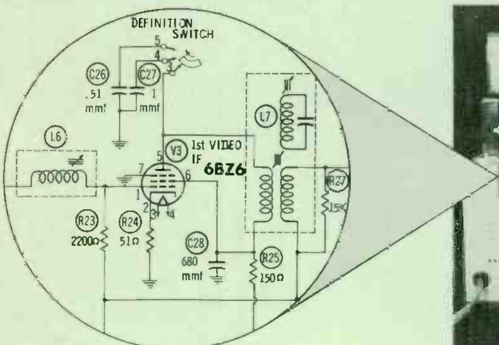
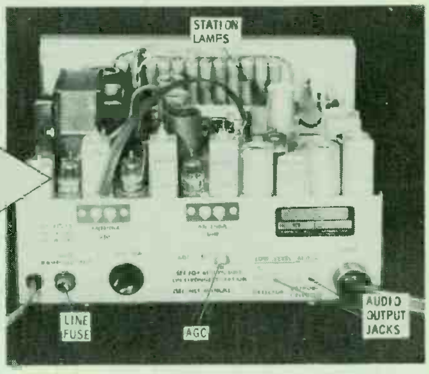
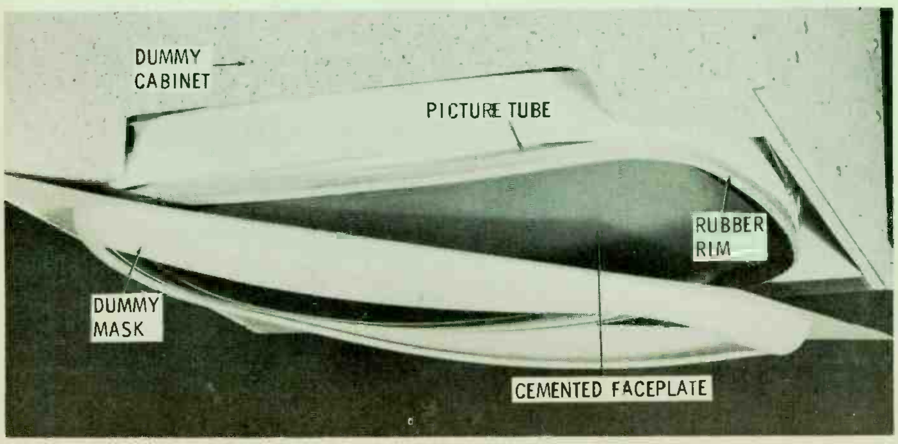





## Fleetwood Model 900 with tuner Chassis 870

You may find this custom receiver installed in a bookcase, wall, or just about anywhere in a customer's home. The tuner chassis, including RF, IF, and sync stages, can be located in a remote position from the picture tube and sweep chassis. The complete outfit has a complement of 25 tubes in the tuner, audio, and sweep chassis, plus a 21ERP4 110° CRT.

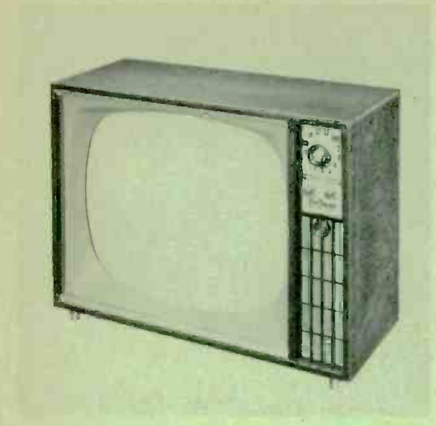
Taking a peek at the back of the Model 900 chassis (shown here mounted in a utility cabinet), you can see it's horizontally-mounted and transformer-powered. A two-tube audio chassis, incorporating an AF amplifier and output stage, is positioned under a sloping section at the top of the cabinet. This subchassis includes a 6-volt relay and switch that automatically applies power to the main sweep chassis whenever the tuner is energized. The drive adjustment shown on the rear of the cabinet is a 50K-ohm pot located in the output plate circuit of the horizontal multivibrator.

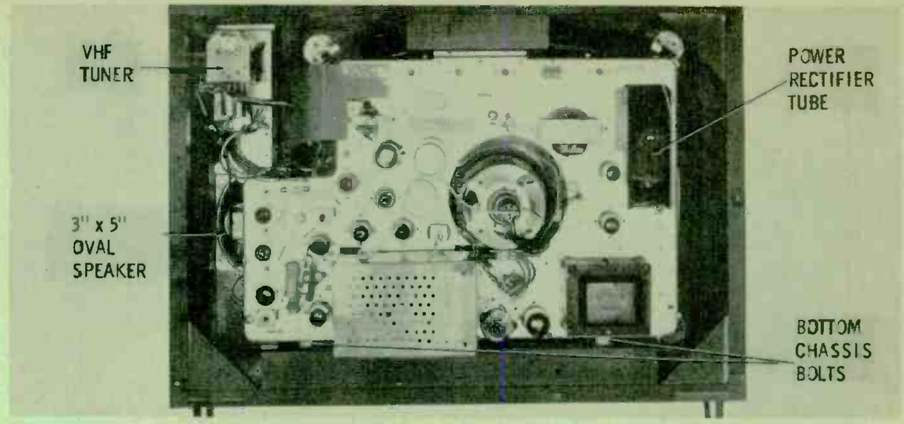
You'll also find several features on the "topside" of this chassis. For example, horizontal linearity and width coils are located behind the high-voltage cage, and a .3-amp slow-blow fuse mounts right next to the 6CD6 horizontal output tube. A pair of plug-in silicon rectifiers positioned near the power transformer are used to develop 300 volts B+.

On the front of the tuner chassis, you'll find one of the control knobs labeled DEFINITION. This should be set to give the most pleasing picture to the customer. Rotating the knob in one direction produces a softer tone, while picture elements appear much sharper at the other end of rotation. From the circuit diagram, you'll note that this control is a 3-position switch located in the plate circuit of the first video-IF amplifier. Capacitor C26 or C27 is switched across the tuned primary, and thereby varies the extent of high-frequency response.

Before making a call to fix this set, check your caddy for #44 dial lamps. The tuner uses 14 of these little rascals across the channel-indicating panel. Two audio-output jacks can be found on the rear apron of the tuner—one for a low-level output straight from the detector, and the other from a cathode-follower stage which includes the volume control.

Don't try to pry the safety glass from the front of the picture tube on this receiver. The front protective glass is sealed to the surface of the tube, and this *laminated integral panel* should not require cleaning.






## Hoffman Model K1331 Chassis 344

This receiver is one of a *Spanette* line featuring a 21" 110° picture tube housed in a cabinet only 10⅞" deep. It's basically a table model, but is light enough to double for a large-screen portable. To remove the safety glass for cleaning, merely take out the Phillips-head screws holding the top retaining strip, tilt the glass outward at the top, and lift the glass up and out.

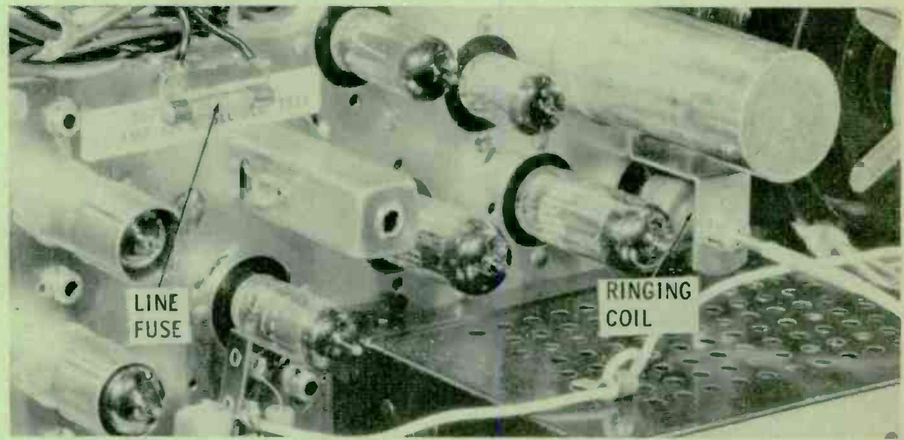
With the cabinet back removed, you'll find a transformer-powered, vertically-mounted hand-wired chassis. Notice, too, that a single 5U4 rectifier fits snugly in a chassis cutout on the right side. This tube, as well as the others, however, is in easy reach from the back. The *Hot Rod* tuner, employing 6CY5 and 6CG8 tubes, is positioned with the operating controls and the speaker on a narrow vertical panel at the opposite side of the cabinet. This panel is not attached to the main chassis, but is separately mounted to the cabinet. It need not be removed to work on the wiring side of the chassis; the pan can be pivoted outward and the panel left in place for many repairs.

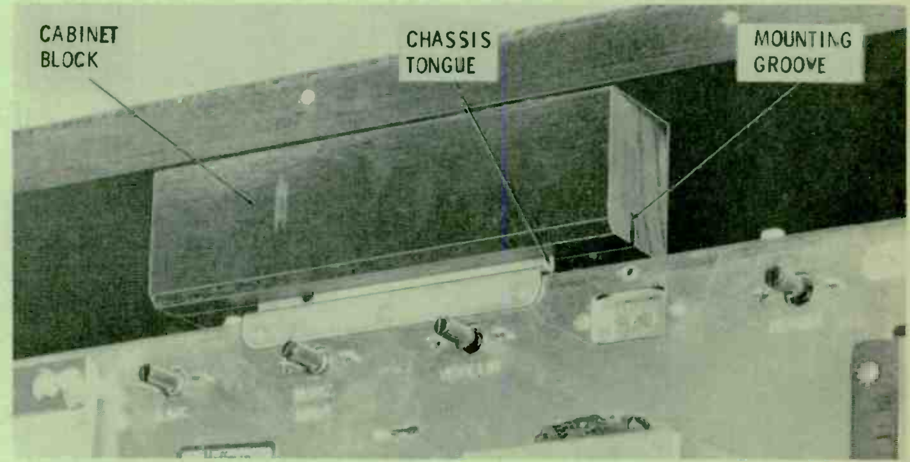
Taking a closer look at the chassis, you'll see that the ringing coil for the horizontal multivibrator, and a pigtail line fuse, are located at the left and above the high-voltage cage. The 3.2-amp fuse is a slow-blow type in the primary circuit of the power transformer. About the latest tube types you'll run across in this chassis are a 6DT5 in the vertical output stage and a 6DA4 in the damper circuit.

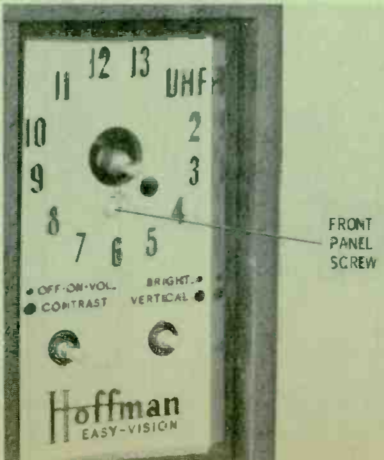
If it's necessary to pull the chassis for bench service, you'll find that the main pan has only a tongue-and-groove fitting at the top of the cabinet near the service adjustments, and a couple of bolts at the bottom. Service adjustments across the top of the pan include AGC, horizontal drive, vertical linearity, and height.

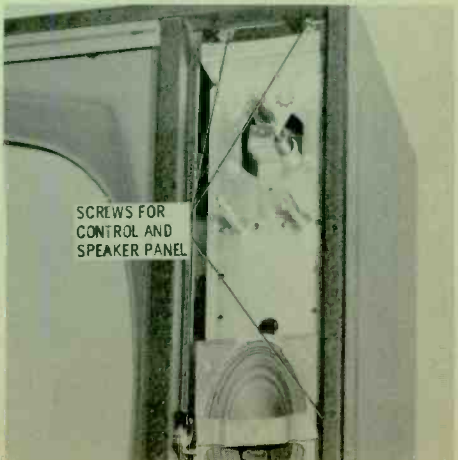
To remove the panel incorporating the tuner, front controls, and speaker, you must first remove the push-on type knobs from the front and the Phillips-head screw pointed out in the photo.

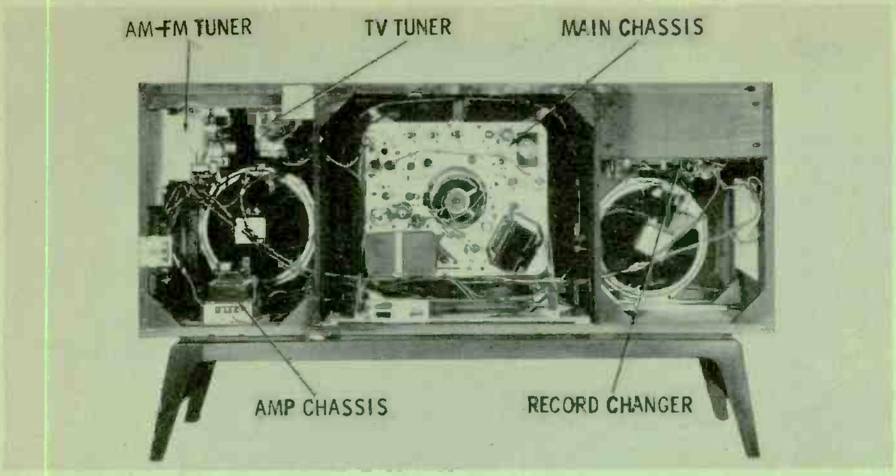
After taking off the front decorative section, remove four Phillips-head screws under strips of tape at the top and bottom of the panel. This will free the panel, and the entire chassis can be removed by disconnecting the picture tube socket, yoke plug, and high-voltage lead.

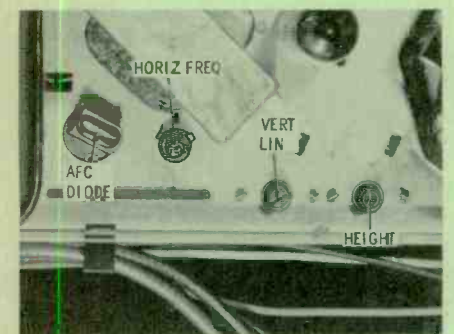


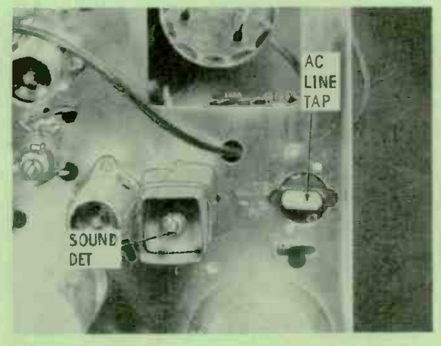



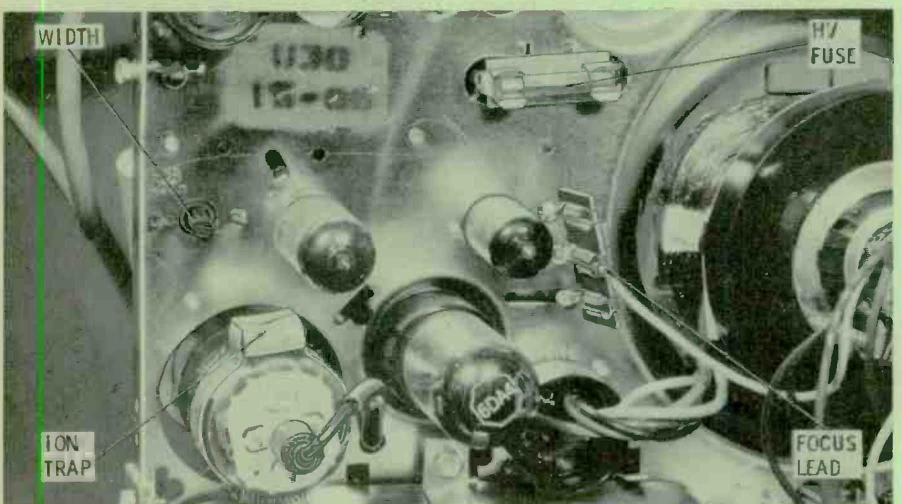



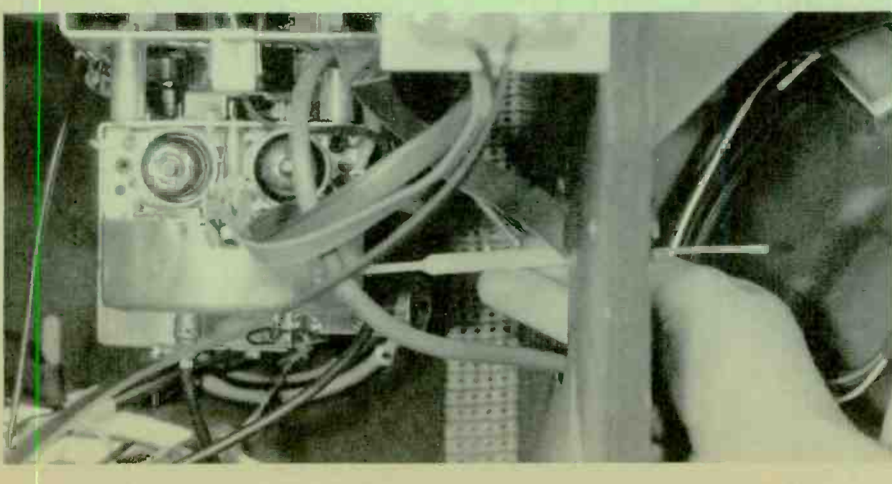





## Magnavox Model IU 354R TV Chassis U30-15-00

This combination includes a 24" TV receiver, AM-FM radio, and stereo automatic phonograph. The 24AHP4 110° picture tube is featured in the center of the all wood cabinet, while sliding panel doors on the top expose the operating controls on the right and a record-changer compartment on the left.

You can see the layout of the combination from the rear cabinet view. The stereo reproduction system consists of six separate speakers—a 12" woofer and two 5" units on each side of the cabinet. In addition to the main TV chassis (designated as the 30-series), the instrument also employs an AM-FM tuner chassis 59-00 and an audio-amplifier chassis 196-00.

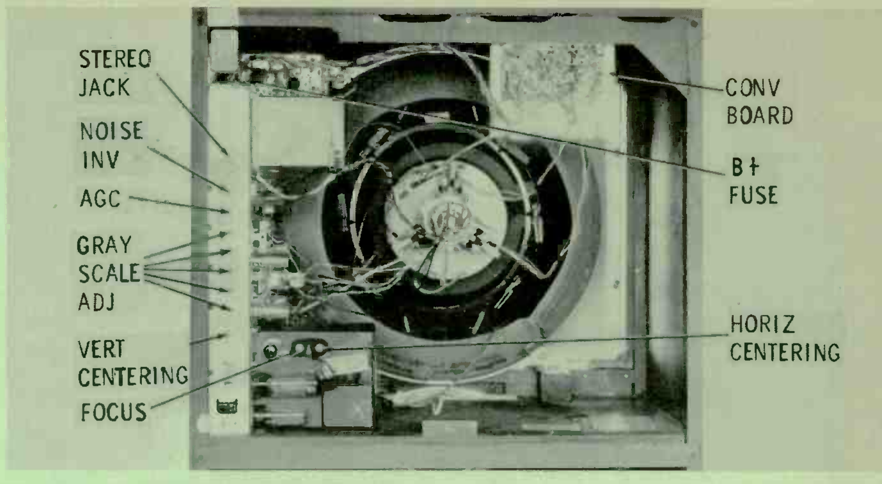
You'll find most of the TV service adjustments in a close group between the high-voltage cage and the power transformer at the bottom of the vertically-mounted chassis. The AFC dual-diode is a plug-in unit that feeds a special component combination network on the wiring side of the chassis.

You might take note of the AC line tap pointed out below the 5U4 rectifier. This small device is a special shorting plug located in the primary circuit of the power transformer to compensate for high line voltage. It has "117V" marked on one side and "127V" marked on the other. Under normal line conditions, the 117V mark should be up. If line voltage is higher than normal, the plug should be reversed in its socket.

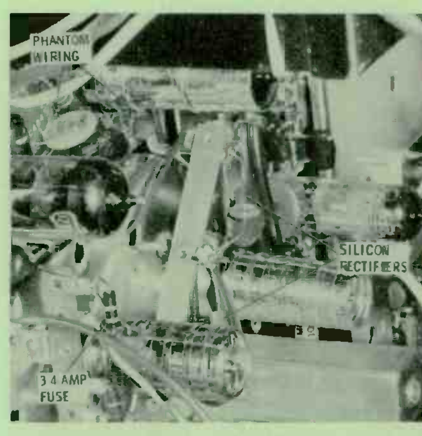
The clip-in fuse is a ¼-amp slow-blow type which protects the flyback system. The 6DQ6A horizontal-output tube is also located in this area of the chassis. Around the glass envelope of this tube, you'll note an ion trap magnet which serves to counteract Barkhausen oscillation. Speaking of tubes, a 6BF6 serves as half of a vertical multivibrator and as a diode clamper for both AGC and blanking. The AGC-keyer and sound-IF stages employ EF94's, which are merely foreign-made 6AU6's. You might also care to know that a 6V6GT is used as a voltage regulator for the power supply.

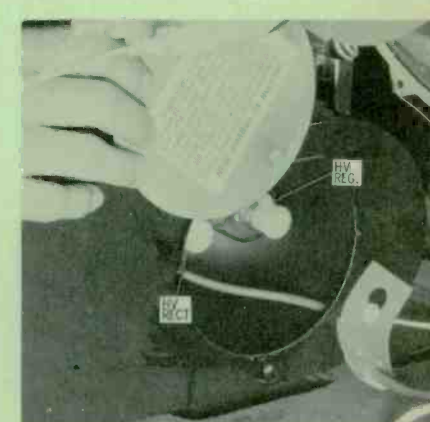
The VHF-UHF tuner, located some distance from the TV chassis, makes use of three tubes—a 6BN4 RF amplifier, 6CG8 converter, and 6AF4A UHF oscillator. Access to the VHF oscillator adjustments is provided for as illustrated in the photo.

## RCA Model 210CK855 Chassis CTC9A



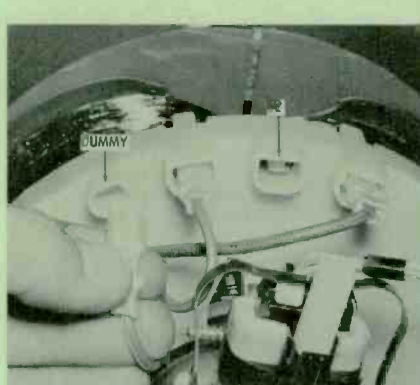

This color console employs a 21CYP22 picture tube, VHF tuner, and 6" x 9" PM speaker. The color tube and safety glass can be cleaned from the front by first prying the top and bottom trim strips off, starting at the ends with a small screwdriver or soldering aid. This will expose two glass retainers at both the top and bottom. Remove the retainers by sliding them to the right, and the glass may then be lifted out.

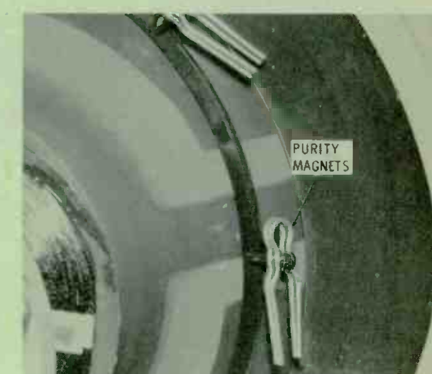



The chassis is of conventional style, but mounts vertically along one side of the cabinet. The AGC control has been moved to the rear apron of the chassis, and no adjustment is provided for horizontal drive. The B+ fuse located on the top edge of the chassis near the tuner is a 3.5-amp "C" type. Newcomers to the tube lineup for RCA color sets include four 6EA8's and one 6EW6.

Although isolated from the line by a power transformer, the chassis employs two silicon rectifiers in the low-voltage supply. The pigtail fuse positioned directly in front of these is a ¾-amp unit protecting the sweep and high-voltage circuits. The main chassis incorporates five separate printed boards; an additional board is used for the convergence panel. Each board features the new *Phantom Wiring*, which identifies each part and maps all connections on the component side for ease in circuit tracing.



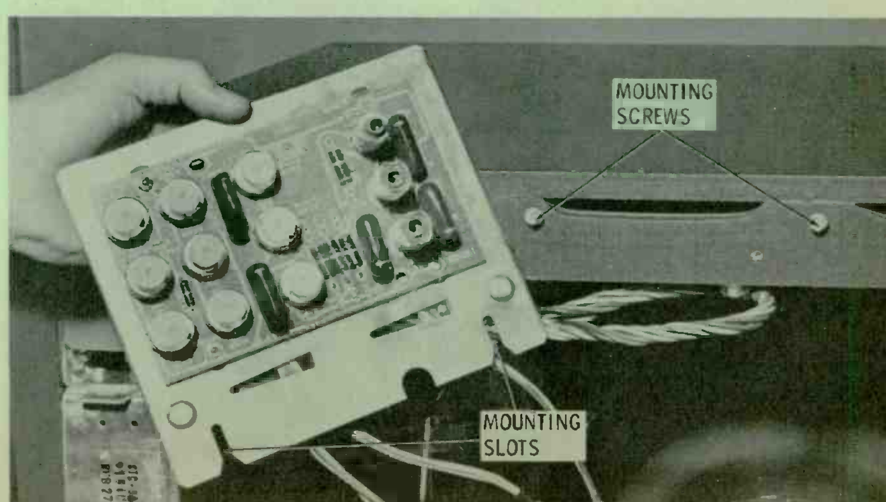




You can reach the two tubes in the regulated high-voltage supply by removing one screw from the side of the cage and sliding the round panel door upward as shown. You'll find the horizontal linearity control in the cage, while the high-voltage adjustment and horizontal-waveform coil are positioned on the chassis in front of the cage.

You might note that the width adjustment on this receiver consists of a lead-and-plug arrangement on the yoke assembly. To increase width, remove the lead plugged into the dummy terminal on the left and insert it into the terminal identified as No. 2.

The hairpin clips attached to a plastic ring on the bell of the picture tube a few inches from the yoke are edge-purity magnets. Maximum correction is obtained with the open ends 180° apart. Neutral position is with both magnets in perfect alignment with each other.

For convenience, the dynamic-convergence adjustments are located on a separate panel which can be removed from the inside of the cabinet and positioned on the two mounting screws pointed out in the photo.

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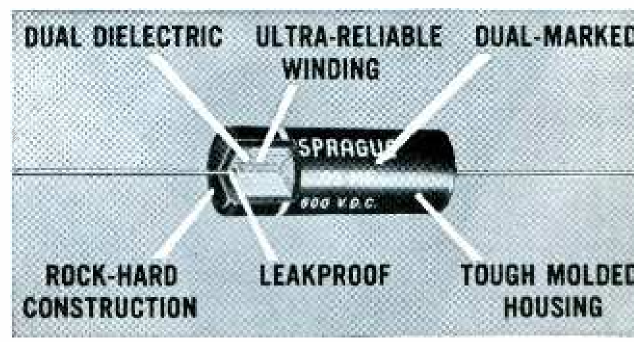



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***including Electronic Servicing***

*VOLUME 9, No. 9* *SEPTEMBER, 1959*


## CONTENTS



### ABOUT THE COVER

Hi-ho, hi-ho, it's back to school we go . . . although Junior seems a little reluctant. Daddy's older and wiser, of course, and realizes the value of a good education. As a matter of fact, he's on his way to register, too—for an adult class that will better equip him to handle his servicing business.

As you can see from the later photo at right, Dad has been able to get his offspring to take the first step, although we have our doubts as to what his attendance record will be like.


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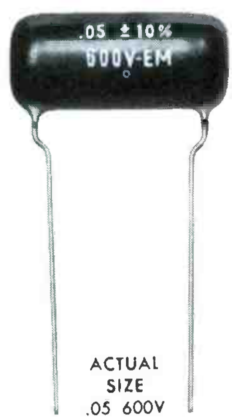


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TEXARKANA—Lavender Radio & TV Supply, Inc.

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CULVER CITY—Electronic Trading Post
ENCINO—I. F. A. Associates
GLENDALE—Western Electronic Supply Corp.
INGLEWOOD—Grossman & Reynolds
LA MESA—La Mesa TV Supply Co.
LONG BEACH—Electronic Supply Co.
Kiesub Corporation
Mission Electronics Supply
Scott Radio Supply Inc.
LOS ANGELES—Atlas Radio & TV Parts Co.
Hamilton Electronics Supply Co.
Radio TV Supply Co.
Shelley Radio Co. Inc.
ONTARIO—Pomona Valley Electronics
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Norcal Electronics
SAN DIEGO—Radio Parts Co.
SAN FRANCISCO—Edisco Electronic Dist. Co.
SAN JOSE—United Radio & TV Supply Co.
SANTA ANA—Hurley Electronics
SANTA MONICA—S. M. Radio
SUNNYVALE—Sunnyvale Electronics, Inc.
VAN NUYS—Capitol Electronics
Thrifty Electronic Supply Co.
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CLEARWATER—Thurow Distributors, Inc.
COCOA—Thurow Distributors, Inc.
DAYTONA BEACH—Thurow Distributors, Inc.
FT. LAUDERDALE—Thurow Distributors, Inc.
Vance Baldwin, Inc.
FT. MYERS—Thurow Distributors, Inc.
FORT PIERCE—McNees Radio Supply, Inc.
JACKSONVILLE—Peard Electronics Supply Co.
Thurow Distributors, Inc.
LAKELAND—Thurow Distributors, Inc.
MIAMI—East Coast Radio & TV Co.
Herman Radio Supply Co.
Thurow Distributors, Inc.
Vance Baldwin, Inc.
ORLANDO—Radio Accessories Co.
Thurow Distributors, Inc.
PANAMA CITY—Thurow Distributors, Inc.
PENSACOLA—Thurow Distributors, Inc.
SARASOTA—Radio Accessories Co.
ST. PETERSBURG—Thurow Distributors, Inc.
TALLAHASSEE—Peard Electronics Supply Co.
Thurow Distributors, Inc.
TAMPA—Radio Accessories Co.
Thurow Distributors, Inc.
WEST PALM BEACH—Thurow Distributors, Inc.

GEORGIA
ATLANTA—Southeastern Radio Parts Co.
AUGUSTA—Prestwood Electronics Co., Inc.
MACON—Peard Electronics Supply Co.
SAVANNAH—Kings Appliance & Electronics

ILLINOIS
CHICAGO—Nationwide Radio Co.
Stolz-Wicks, Inc.
Walker-Jimieson, Inc.
MATTOON—Mattoon Radio & TV Supply Co.
PEORIA—Klaus Radio & Elec. Co.
ROCKFORD—J. & M. Radio & TV Supply

INDIANA
HAMMOND—Nationwide Radio Corp.
SOUTH BEND—Colfax Co., Inc.

KENTUCKY
LOUISVILLE—R & K Dist. Co.

LOUISIANA
LAFAYETTE—Lafayette Radio Equipment, Inc.
NEW ORLEANS—Bell Radio Supply Co.
Crescent Radio Supply, Inc.

MARYLAND
BALTIMORE—Kann-Ellert Electronics, Inc.
Revacto of Maryland, Inc.
COLLEGE PARK—Rucker Electronic Prods. Co.
HAGERSTOWN—Stoddard Supply Co.
SILVER SPRINGS—Rucker Electronic Prods. Co.

MASSACHUSETTS
BOSTON—O'Donnell Electronics Supply Co.
Yankee Electronics
LAWRENCE—Alco Electronics Mfg. Co.
LOWELL—Frank P. McCartin, Inc.
PEABODY—Tee-Vee Supply Co.

MICHIGAN
DEARBORN—Westside Radio Supply
MUSKEGON—Mutual Radio Supply Co.

NEW JERSEY
BERGENFIELD—County Dist. Co.
BLOOMFIELD—Variety Electronics Corp.
CAMDEN—General Radio Supply Co., Inc.
LONG BRANCH—Vi-Van Electronics, Inc.
UNION CITY—Pyramid Supply Co.

NEW MEXICO
ALBUQUERQUE—Tele-Radio Supply Co.
SANTA FE—A-1 Communications Supply Co.

NEW YORK
ALBANY—Boyere Electronic-Radio Dist. Corp.
BROOKLYN—Bay Electronics Distributors
Sam Buchman Dist. Co.
FLUSHING—Bay Electronics Distributors
NEWARK—Top Distributing Co.
SYRACUSE—Goldcrest Electronic Supply Co.
WHITE PLAINS—Melville Radio Corp.

NORTH CAROLINA
CHARLOTTE—Dixie Radio Supply Co., Inc.
GASTONIA—Dixie Radio Supply Co., Inc.
GOLDSBORO—Womack Electronics, Inc.
HICKORY—Industrial Electronics

OHIO
AKRON—Main TV Supply Co.
CLEVELAND—Radio & Electronics Parts Corp.
COLUMBUS—Ace Radio Supply, Inc.
DAYTON—The Stotts-Friedman Co.
TOLEDO—Lifetime Electronics

OKLAHOMA
MUSKOGEE—Sooner Radio & TV Supply
OKLAHOMA CITY—Radio Supply, Inc.

PENNSYLVANIA
ALLENTOWN—A. A. Peters, Inc.
BETHLEHEM—Buss Radio Elec. Supply
ELKINS PARK—A. G. Radio Parts Co.
HARRISBURG—D. & H. Distributing Co., Inc.
Electronic Wholesalers Inc.
Radio Distributing Co.
JOHNSTOWN—Cambria Equipment Co., Inc.
LANCASTER—George D. Barbey Co., Inc.
LEBANON—George D. Barbey Co., Inc.
NEW KENSINGTON—R. P. C. Electronics Co.
PHILADELPHIA—A. G. Radio Parts Co.
Almo Radio Co.
Raymond Rosen & Co., Inc.
POTTSTOWN—George D. Barbey Co., Inc.
POTTSVILLE—Moyer Electronic Supply Co.
READING—A. G. Radio Parts Co.
George D. Barbey Co., Inc.
ROCHESTER—Radio Parts Co.
SCRANTON—Fred P. Purcell
STATE COLLEGE—Alvo Electronics Dists., Inc.
UNIONTOWN—Radio Parts Co., Inc.
WEST YORK—York TV Supply Co.
WILLIAMSPORT—Alvo Electronics Dists., Inc.
Electric Appliance Dists., Inc.
YORK—Wholesale Radio Parts Co., Inc.

SOUTH CAROLINA
ANDERSON—Dixie Radio Supply, Inc.
COLUMBIA—Dixie Radio Supply, Inc.
FLORENCE—Dixie Radio Supply, Inc.
GREENVILLE—Dixie Radio Supply, Inc.
SPARTANSBURG—Dixie Radio Supply, Inc.

TEXAS
ABILENE—Radio Communications Supply Co.
AUSTIN—Standard Radio Supply
DALLAS—All-State Distributing Co.
FORT WORTH—Electronic Equipment Co., Inc.
United Electronic Supply Co.
HOUSTON—Angie Radio & TV Supply Co.
City Electronic Supply
LUBBOCK—Amarillo Hardware Co.
PORT ARTHUR—Diehl Radio & TV Supply
SAN ANTONIO—Olsen Radio Supply
Perry Shankle Co.
Radio & TV Parts Co.
WICHITA FALLS—Gose Radio Supply

UTAH
SALT LAKE CITY—Flint Distributing Co.
Strevell-Paterson Hardware Co.

VIRGINIA
ARLINGTON—Rucker Electronic Prods. Co.
DANVILLE—Womack Radio Supply Co., Inc.
FALLS CHURCH—Television Craftsmen Wholesalers
LYNCHBURG—Eastern Electric Co.
NORFOLK—Southern Television Corp.
RICHMOND—E. A. Holsten, Inc.
ROANOKE—Dixie Appliance Co.
E. A. Holsten, Inc.

WEST VIRGINIA
WHEELING—Radio Parts Co.

WISCONSIN
FOND DU LAC—Harris Radio Corp.
KENOSHA—Chester Electronics Supply Co.
MILWAUKEE—A & F Electro Mart
Marsh Radio Supply Co.

HAWAII
HONOLULU—Radio Television Corp.

*DuPont Trademark

**ARCO ELECTRONICS INC. 64 White Street, New York 13, New York**

# GET BEHIND THE

# SYLVANIA

# $2. Combination

## America's biggest magazines deliver this business-building offer to over 100 million readers!


Look for this ad in these leading national magazines.

On June 20th Sylvania launched the dramatic combination coupon offer appearing in America's biggest weekly magazine, *TV Guide*, and America's biggest monthly magazine, *Reader's Digest*—plus *Sunday* and *Parade* newspaper supplement magazines.

*Your Service* shares the spotlight with top-quality Sylvania picture tubes and receiving tubes in a three-point program to make your customer's old TV set *better than when it was new.*

Month after month, more set owners will be saving the $2.00 coupon. Many will attach it to the back of their TV set so it's there for you to see.

You can identify yourself with this program by featuring Silver Screen 85 and Sylvania receiving tubes. Get behind the biggest, most practical, business-building offer ever made to the Service industry.

# Letters to the EDITOR

*Dear Editor:*

Since we have to stand for TV advertising as a necessary evil, the FCC should not permit TV stations to increase their audio power while transmitting commercials, as they often seem to do.

THOMAS LANE

Los Angeles, Calif.

*Actually, they are not increasing their RF carrier output; the FCC sees to it that this is rigidly held to a certain maximum value. Here's what is probably happening: During certain types of program material — for example, old movies — somewhat less than 100% modulation may be impressed on the sound carrier. The modulation level suddenly jumps up to virtually 100% when a commercial comes along, thus giving the effect of a power increase. As far as we know, there are no regulations to prohibit this sort of operation. Unfortunately, too, there seems to be nothing you can do about the fact that an announcer's strident voice is much more irritating than an equally loud musical score or occasional POW! of a six-shooter.—Ed.*

*Dear Editor:*

We have a Schaub radio which has two tubes, a UCH71 and a UEL71. We would like to restore it, but are having trouble finding tube replacements or interchanges. Could you be of any help?

GENE'S TV & RADIO

Eldridge, Iowa

*None of our reference sources list any American tubes which bear even a remote resemblance to either of these two European types. Their basic specifications, determined from the type numbers, will give you some idea of what you're up against.*

*Both tubes are dual-section units with 8-pin miniature sockets and 100-ma heaters. The UCH71 is a heptode-triode, probably being used as a converter and IF stage. The UEL71 is a combination of a tetrode and a power pentode, presumably employed in a two-stage audio section.*

*I doubt if these tubes are being regularly imported into the United States, but you might be able to order them from Europe. This is just about your only alternative other than extensively rebuilding the radio. We're sorry to break the bad news, but this sort of situation often arises when you're dealing with older-model or seldom-imported foreign equipment.—Ed.*

*Dear Editor:*

I have just finished reading the item about the tip saver for miniature soldering irons (page 36, May issue). It's a good idea; however, I notice that Mr. Farmer used a double-pole, double-throw switch in the circuit. Wouldn't it work equally well with only a single-pole, single-throw unit, as shown in the attached diagram?

JOHN FRENO, JR.

Brooklyn, N. Y.

*Yep.—Ed.*

*Dear Editor:*

Is there a practical way to cut down tube-caddy inventory of similar tube types (for example, the 6BK7, 6BQ7A, 6BZ8, 6BC8, 6BS8, etc.)?

R. G. MALCOM

Tulsa, Okla.

*The experts say not. Top servicemen are trying to maintain as complete a tube stock as possible, even though this means using TWO caddies—one with common types to bring into the house, the other with rarer types to leave in the truck.*

*The trouble with cutting down on tube inventory is that substitute types are different enough from the originals to be ineffective as permanent replacements in a great percentage of cases. They sometimes fail to give sure-fire results in substitution tests, and they give very little insurance against callbacks.*

*But, as we all know, the problems of maintaining a really complete tube stock have become just about insurmountable. You're bound to be caught short every now and then, and a substitute tube is far better than none in such cases. For this reason, we periodically present features such as our Tube Substitution Guide. The substitutes we recommend are intended to be temporary, however. When you must install any tube other than the original type (or its improved version), it's good business to go back and install the right type as soon as practical.—Ed.*

*Dear Editor:*

With the advent of hi-fi, I am getting into difficulty with the portable radio fans on the question of frequency response and tone quality. What can we expect from these $80 transistorized jobs?

C. E. LIVINGWAY

New Baltimore, Mich.

*Even though these radios are quite expensive, they have room for only a small speaker (usually from 2½" to 3½" in diameter). In addition, the power output available for driving the speaker is on the order of milliwatts. These limitations prevent you from getting any semblance of high fidelity out of a compact transistorized portable.*

*Actually, this isn't what they are designed to do. Essentially, they are a "go anywhere" type of radio, intended to provide the user with music of a sort as well as sports and news programs when away from a source of AC power. When used as such, they are excellent; however, it's unreasonable to compare them with high-fidelity sound equipment.—Ed.*

*Dear Editor:*

In Figs. 7 and 8 of the "P's and Q's of Transistors" article (page 62 of the July issue), there seems to be a mix-up in the

• *Please turn to page 22*


**Really dresses up your service work**

Reliable Tung-Sol tubes add real class to every service job — radio, tv, or hi-fi. Made to set manufacturers most exacting specifications, Tung-Sol Tubes are best for all replacements. Reduce your callbacks to new lows and keep your profitable new business rolling in high style. Tung-Sol Electric Inc., Newark 4, N. J.

*Tell your jobber you'd rather have*

# TUNG-SOL®

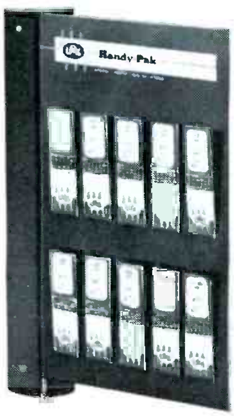
*Blue Chip Quality* TUBES • TRANSISTORS • DIODES

IRC CARBON COMPOSITION RESISTOR HANDY-PAKS ARE TAKING AMERICA BY STORM!

# NOW this exciting IRC HANDY-

# is ready to keep

## NEW! RESIST-O-PANEL



Easy-to-select, easy-to-inventory swing panel takes no bench space at all!

Wonderful space saver! Visible resistor stock on handy swing panel attaches to wall . . . can be used singly or in sets. All-metal—7″ wide x 12¼″ high—slotted to hold Handy-Paks—wall brackets included. Contains the 10 most popular resistor values, with room for 10 more Handy-Paks on back of panel. FREE with any of 4 popular assortments.

| | | Dealer Net |
|---|---|---|
| **Assortment #64** | 60 ½-watt, 10% resistors, 10 values | $7.20 |
| **Assortment #68** | 40 1 -watt, 10% resistors, 10 values | 7.20 |
| **Assortment #72** | 60 ½-watt, 5% resistors, 10 values | 14.40 |
| **Assortment #76** | 40 1 -watt, 5% resistors, 10 values | 14.40 |

## NEW! RESIST-O-ROUND

Unique revolving stock kit keeps IRC Handy-Paks at your fingertips!

Instant visual inventory within easy reach . . . in minimum bench space. Two tiers of Handy-Paks spin at the flick of a finger for fast, easy selection. This revolutionary metal kit is only 7″ diameter, 6¼″ high. Includes the 20 most popular resistor values. FREE with any of 4 assortments.

| | | Dealer Net |
|---|---|---|
| **Assortment #65** | 120 ½-watt, 10% resistors, 20 values | $14.40 |
| **Assortment #69** | 80 1 -watt, 10% resistors, 20 values | 14.40 |
| **Assortment #73** | 120 ½-watt, 5% resistors, 20 values | 28.80 |
| **Assortment #77** | 80 1 -watt, 5% resistors, 20 values | 28.80 |

## MORE IRC HANDY-PAK STOCKERS FAVORED BY SERVICEMEN EVERYWHERE

Included FREE with any of 5 Handy-Pak stock assortments.

### IRC RESIST-O-PEDIA

Attractive hardback binder has 3-ring "fingered" inserts for Handy-Paks. Indexed stock saves searching . . . speeds servicing. Identification always visible. 9″ x 8¼″ x 2⅞″. Five popular assortments.

| Assort. No. | No. of Resistors | Wattage | No. of Values | Tolerance | Dealer Net |
|---|---|---|---|---|---|
| **44** | 462 | ½ | 77 | 10% | $55.44 |
| **48** | 308 | 1 | 77 | 10% | 55.44 |
| **51** | 195 | 2 | 65 | 10% | 46.80 |
| **59** | 462 | ½ | 77 | 5% | 110.88 |
| **63** | 308 | 1 | 77 | 5% | 110.88 |

FREE with any of 4 assortments.

### IRC RESIST-O-CHEST

Ends "cigar box confusion". All-metal covered file in 10 Handy-Pak assortments. Compact 5⅝″ x 3⅜″ x 6¼″ size . . . takes little bench space. Identification clearly visible.

| Assort. No. | No. of Resistors | Wattage | No. of Values | Tolerance | Dealer Net |
|---|---|---|---|---|---|
| **42** | 204 | ½ | 34 | 10% | $24.48 |
| **43** | 462 | ½ | 77 | 10% | 55.44 |
| **46** | 136 | 1 | 34 | 10% | 24.48 |
| **47** | 308 | 1 | 77 | 10% | 55.44 |
| **49** | 102 | 2 | 34 | 10% | 24.48 |
| **50** | 195 | 2 | 65 | 10% | 46.80 |
| **57** | 204 | ½ | 34 | 5% | 48.96 |
| **58** | 462 | ½ | 77 | 5% | 110.88 |
| **61** | 136 | 1 | 34 | 5% | 48.96 |
| **62** | 308 | 1 | 77 | 5% | 110.88 |

Included FREE with any of these 10 assortments.

### IRC RESIST-O-CADDY

Ideal for in-home servicing. Plastic pouch folds to 6¾″ x 3⅞″ x 1½″ . . . fits in tube caddy or tool chest. Individual Handy-Pak pockets.

| Assort. No. | No. of Resistors | Wattage | No. of Values | Tolerance | Dealer Net |
|---|---|---|---|---|---|
| **41** | 120 | ½ | 20 | 10% | $14.40 |
| **45** | 80 | 1 | 20 | 10% | 14.40 |
| **56** | 120 | ½ | 20 | 5% | 28.80 |
| **60** | 80 | 1 | 20 | 5% | 28.80 |

quartet of brand new

# PAK* RESISTOR KITS

## your resistor stocks at your fingertips

*Patent Pending

NEW!

## RESIST-O-BIN


Easy-to-use IRC Handy-Pak Stocker with 36 identified compartments!

Just what busy servicemen need for compact, convenient stocking of Handy-Paks. 36 compartments in recessed tiers are identified for easy access to resistors . . . and quick, accurate inventory. All-metal—6¾" wide x 4¼" deep x 4½" high. FREE with any of 4 assortments.

| | | Dealer Net |
|---|---|---|
| **Assortment #66** | 204 ½-watt, 10% resistors, 34 values | $24.48 |
| **Assortment #70** | 136 1 -watt, 10% resistors, 34 values | 24.48 |
| **Assortment #74** | 204 ½-watt, 5% resistors, 34 values | 48.96 |
| **Assortment #78** | 136 1 -watt, 5% resistors, 34 values | 48.96 |

NEW!

## RESIST-O-RACK


Orderly, neat IRC Handy-Pak file for complete stocks of resistors!

The perfect answer to maintaining an orderly, complete inventory of Handy-Paks. Individual compartments separate stock by resistance values . . . with identification always visible. Metal rack is 11¾" wide x 5½" deep x 8" high. Key-hole slotted for wall mounting, if desired. FREE with any of 4 assortments.

| | | Dealer Net |
|---|---|---|
| **Assortment #67** | 462 ½-watt, 10% resistors, 77 values | $55.44 |
| **Assortment #71** | 308 1 -watt, 10% resistors, 77 values | 55.44 |
| **Assortment #75** | 462 ½-watt, 5% resistors, 77 values | 110.88 |
| **Assortment #79** | 308 1 -watt, 5% resistors, 77 values | 110.88 |


## 3 TYPES

½ watt, 1 watt and 2 watts*

10% tolerance **72¢ ea.**
5% tolerance $1.44 each
Dealer Net

Each IRC Handy-Pak contains several carbon composition resistors of one type and resistance value . . . to save you unnecessary shopping. Three types include: 6 ½-watt resistors; 4 1-watt resistors; 3 2-watt resistors.

*2-watt Handy-Paks available in 10% tolerance only.

## IRC HANDY-PAKS

**Smartest idea yet for packaging carbon composition resistors!**

Servicemen from coast to coast praise IRC Handy-Paks as the neatest, most compact, most convenient resistor package in the industry. Resistance value and power rating are clearly visible on every Handy-Pak. They're handier to use . . . open at either end; close to hold remaining resistors. IRC Handy-Paks keep leads straight; resistors are always factory-clean.

## Choose the Handy-Pak deal that suits you best!

**Order today from your IRC Distributor!**

IRC ®

**INTERNATIONAL RESISTANCE CO.**
414 N. 13th St., Philadelphia 8, Pa.
In Canada: International Resistance Co., Ltd.
Toronto, Licensee

# SELL THE ANTENNA LINE THAT HELPS YOU SELL!


## Cash in on . . .

# Winegard's

## . . . the Industry's Greatest

**SEE** the big-name TV stars such as ★ Ward Bond of "Wagon Train" ★ Walter Brennan of "The Real McCoy's" and other TV stars promoting Winegard Color'Ceptors!

**SEE** Winegard's advertising in a non-stop, big-space schedule in LIFE, Better Homes & Gardens, others, *ALL YEAR LONG!*


**GET FREE PROFIT-MAKING SALES AIDS**

*GET* Winegard's new "PROMOTION BUCKS"! Given to you free with every Color'Ceptor you buy. You use them for getting *your own choice* of the finest sales promotion aids anyone has ever offered — knock-out sales helps that hitch your business to the giant national sweep of *Winegard's BIG TV SHOW TIME!*

*Sell the Winegard Color'Ceptor, the only antenna that's GUARANTEED to give your customers the BEST reception — In the rare event, a customer of yours is not satisfied — Winegard will refund the list price of the antenna and YOU KEEP YOUR FULL PROFIT.*

*Talk to your Distributor or send coupon for the whole story.*

***FEATURE THE LEADER AND BE ONE!***


**SEND THIS COUPON TODAY!**

WINEGARD CO.
3009-9 Scotten, Burlington, Iowa

☐ RUSH full color brochure showing Winegard's new antenna dealer sales aids . . . and tell me how I can get them free!

☐ Send literature on Winegard's complete line of FM and TV antennas.

FIRM NAME________________

ADDRESS________________

________________

# Winegard Co.

3009-9 Scotten, Burlington, Iowa

OUT WHERE THE SALES BEGIN
As Advertised in
LIFE
Year-round big-space national advertising featuring big name TV stars.
factory-authorized
ANTENNA SPECIALISTS
SALES—INSTALLATION
Winegard
TELEVISION ANTENNAS
Special window decals.
BEST RECEPTION
Winegard
GOLD TV & FM
ANTENNAS
DEALER'S NAME & ADDRESS GO HERE
Giant 6 foot 3-color metal road sign imprinted with your name.
Color'Ceptor full-color mailing piece and full-color postcards for your direct mail program.
Unlimited 50-50 co-op on local newspaper and radio advertising.
For best TV reception Winegard Gold Antennas
Big gold balloons for the kiddies.
BIG TV SHOW TIME!
All-Out Antenna Profit Drive!
Antenna check-up sheets.
INSIDE YOUR STORE
GET THE MOST POWERFUL RECEPTION ... GUARANTEED!
GOLD
Winegard
COLOR'CEPTOR TV ANTENNA
Colorful window streamers.
"Antenna Specialists" Shirt Emblems.
MAKES EVERYTHING Look Better
Winegard
ANTENNAS
Attractive silk wall banners.
New Color'Ceptor display with gold anodized mast.
Let us install a
Winegard
GOLD ANTENNA
Winegard
LIFE
Gold anodized sample to hand out on service calls.
Winegard
GOLD TV and FM
ANTENNAS
FOR BEST RECEPTION
Illuminated plastic window sign.
OUTSIDE YOUR STORE
WE RECOMMEND
Winegard
GOLD TV and FM
ANTENNAS
FOR BEST RECEPTION
Eye-catching metal flange sign.
FOR BEST RECEPTION
TV FM
Winegard
GOLD
ANTENNAS
Special truck decals.
WE RECOMMEND
Winegard
GOLD TV and FM
ANTENNAS
FOR BEST RECEPTION
DEALER NAME
Hanging store front sign imprinted with your name.
ALL THESE SALES AIDS FREE—Ask Your Distributor

## LETTERS

*(Continued from page 16)*

transistor symbols — or is it in the "NPN" and "PNP" labels on the schematics?

LYNN D. PEPPERMAN
General Electric Co.
Utica, N. Y.

*In the second part of each figure, the arrow symbol for the emitter of the transistor was inadvertently turned end for end when the schematics were drawn. All the labels and voltage readings on these illustrations are correct.—Ed.*

*Dear Editor:*

The mixed-up *Video Speed Servicing* in the June issue was an unexpected help to me. I was working on an Admiral Model C21-E2 with an intermittent video overload and loss of sync. While taking a break after a long bench session, I happened to glance at Speed Servicing; noticing the error, I decided to unscramble the cards. The words on the ZE 15B20-5 card seemed familiar, and it dawned on me that here was the same trouble I had in the Admiral. I resoldered the ground connection on its horizontal output transformer, and my problem was solved.

If it hadn't been for the mix-up, I probably would not have noticed the similarity in symptoms; so I would have wasted a good deal of time checking in the wrong places. To the editor I say, "May you edit for a long time to come."

EDWARD W. ATKINSON
Detroit, Mich.

*Wish the publisher felt the same way. In case you missed out, we're still offering corrected reprints for those who request them. Also, Volume 3 of "Video Speed Servicing" is now available from your distributor.—Ed.*

*Dear Editor:*

As an ardent reader of and subscriber to PF REPORTER, I have been meaning for some time to write and thank you for giving TV servicemen such a wonderful magazine. I find it good not only for filling in the gaps left open by the TV servicing course I took, but also for keeping up to date on the newest things in electronics. It certainly is worth every penny of the subscription cost — and much more. You perform a real service for the industry, and I (for one) surely do appreciate it.

TONY ACAR
Tulsa, Okla.

*Dear Editor:*

We appreciate your putting the proper PHOTOFACT Folder number on each *Video Speed Servicing* sheet, since we catalog all information about a particular TV or radio chassis under the good old "PF" number.

JUNIUS D. DEBONIS
East Hartford, Conn.

*This is just one of several features we've recently added to VSS to make it more useful. By the way, have you noticed that component numbers referred to in the Speed Servicing sheets correspond to those listed in PHOTOFACT?—Ed.*

# COMMON TV TROUBLES AND THEIR CAUSES

| POSSIBLE DEFECT LOCATION → / SYMPTOM ↓ | TUNER | VIDEO IF | VIDEO DET & AMPS | SOUND IF | FM DET | AUDIO | AGC | CRT CIRCUITS | CRT COMPONENTS | SYNC SYSTEM | VERT DEFL. SYSTEM | HORIZ DEFL. SYSTEM | LOW VOLTAGE POWER SUPPLY | HIGH VOLTAGE POWER SUPPLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOUND OK, NO RASTER | | | | | | | | ✓ | ✓ | | | ✓ | | ✓ |
| PIX OK, NO SOUND | | | | ✓ | ✓ | ✓ | | | | | | | | |
| SOUND OK NO PIX RASTER OK | | | ✓ | | | | | | | | | | | |
| NO {SOUND PIX RASTER | | | | | | | | | | | | | ✓ | |
| NO SOUND NO PIX RASTER OK | ✓ | ✓ | ✓ | | | | ✓ | | | | | | | |
| PIX OK DIST SOUND | | ✓ ALIGN | | ✓ | ✓ | ✓ | | | | | | | | |
| SOUND OK PIX DISTORTED | | ✓ ALIGN | ✓ | | | | ✓ | | | ✓ | ✓ | ✓ | | |
| PIX FOLDED OVER TOP OR BOTTOM | | | | | | | | | | | ✓ | | | |
| PIX NON-LINEAR VERT | | | | | | | | | | | ✓ | | | |
| PIX NON-LINEAR HORIZ | | | | | | | | | | | | ✓ | | |
| PIX FOLDED OVER HORIZ | | | | | | | | | | | | ✓ | | |
| HORIZ LINE | | | | | | | | | | | ✓ | | | |
| VERT KEYSTONING | | | | | | | | | ✓ | | | | | |
| HORIZ KEYSTONING | | | | | | | | | ✓ | | | | | |
| NO VERT SYNC | | | | | | | | | | ✓ | ✓ | | | |
| NO HORIZ SYNC | | | | | | | | | | ✓ | | ✓ | | |
| NO VERT OR HORIZ SYNC | | | | | | | | | | ✓ | | | | |
| SHADOWS ON EDGE OF RASTER | | | | | | | | ✓ | ✓ | | | | | |
| AUDIO BUZZ | | ✓ ALIGN | | ✓ | ✓ | | | | | | | | | |
| BEND OR HOOK IN PIX | ✓ | ✓ | ✓ | | | | ✓ | | | ✓ | | ✓ | | |
| BLOOMING | | | | | | | | ✓ | | | | | | ✓ |
| CORONA | | | | | | | | | | | | | | ✓ |
| HORIZ PULLING | | ✓ | | | | | ✓ | | | ✓ | | ✓ | | |
| INSUFFICIENT HEIGHT | | | | | | | | | | | ✓ | | ✓ | |
| INSUFFICIENT WIDTH | | | | | | | | | | | | ✓ | ✓ | |
| NEGATIVE PIX | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | | | | |
| WEAK PIX (LOW CONTRAST) | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | | | | |
| POOR FOCUS | | | | | | | | ✓ | ✓ | | | | | ✓ |
| PIX SNOWY | ✓ | | | | | | ✓ | | | | | | | |
| VERT RIPPLES IN PIX | | | | | | | | | ✓ | | | ✓ | | |
| PINCUSHION EFFECT | | | | | | | | | ✓ | | | | | |

Shop Talk

# Developing a MODUS OPERANDI

Television receivers, even though simplified to the point where they require only 13 tubes to produce both picture and sound, are still complex mechanisms. When something does go wrong with a television receiver, there are a host of circuits to consider; and it is the rare individual, no matter how experienced he may be, who can unfailingly put his finger on the trouble right away.

Is there an orderly troubleshooting process one can follow to save time and temper — a process that can be applied to all sets irrespective of the number of tubes they contain, the types of circuits they utilize, or the symptoms they display?

The answer to this question is an unqualified *yes,* and yet it is surprising how few servicemen (experienced or otherwise) consistently attack each servicing problem by following a systematic procedure. Most men, when you examine the way they operate, employ a fairly haphazard approach — perhaps using several proved shortcuts, but aside from these, generally improvising as they go along. If these men would add a systematic procedure to the experience which they possess, they would be pleasantly surprised at how much quicker they could proceed with their analysis and discover the trouble.

The goal of this article (and those to follow) is to establish a general *modus operandi,* or a servicing approach which can be applied in all instances to all types of receivers, irrespective of the symptoms they exhibit. As the procedure unfolds, it will be seen to be quite flexible, enabling you to modify the technique as required. At all times, however, the over-all approach will remain the same.

As a start, let's assume a defective set is called to your attention, either in the home or in the shop. What do you do first? Begin by obtaining as much information as you can from the owner of the set—even before turning it on. Find out what peculiar trouble symptoms resulted in the service call. Here are some important points to check:

When did the symptoms first appear? Did they develop gradually, or was the change abrupt?

Has the set ever acted this way before?

Does this trouble occur on all channels or only one?

Is there any particular time of day when this trouble occurs, or is it always present?

This is an indication of the type of information that will assist you in cutting down on service time. Once you know the history and background leading up to the trouble, the next step is to place the set in operation and note the symptoms firsthand.

Symptoms which may appear in any television receiver can be grouped into two categories—those readily identifiable by the type of picture and/or sound they produce, and those which do not give any initial clear-cut clue as to the location of the components causing them. Let us discuss the identifiable symptoms first, because the operating procedure we will develop in tracking down these troubles can then be expanded to include those that are more obscure.

An identifiable trouble is one which will enable the serviceman to proceed directly to either the defective component or the section of the receiver containing the component. For example, the picture may come through sharp and clear—but sound may be absent. In this case, there is obviously no reason to check through the RF or IF sections of the video system or the video amplifiers themselves. Attention should be concentrated on the sound system, from the take-off point to the loudspeaker. Another easily identifiable difficulty is the similar but opposite case where the sound comes through clearly, but no picture is obtained. A raster, however, is present. Here again, it is generally best to begin checking the circuits between the sound take-off point and the picture tube. Initially, there would be no reason to go into the RF or video IF stages.

Other easily identifiable symptoms are those which produce fairly characteristic picture distortions. In Fig. 1, for example, the picture is vertically keystoned, a condition generally attributed to one or more shorted turns in the vertical windings of the deflection yoke. A comparable difficulty in the horizon-

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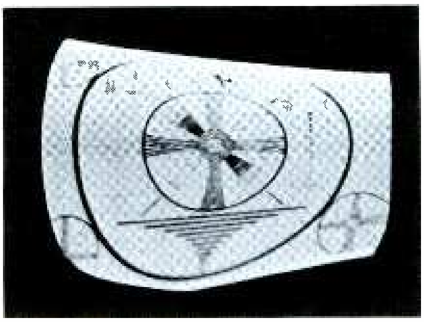

**Fig. 1. A raster with unequal sides is due to shorted vertical yoke windings.**

**Fig. 2. When raster width is nonlinear, suspect a shorted horizontal yoke.**

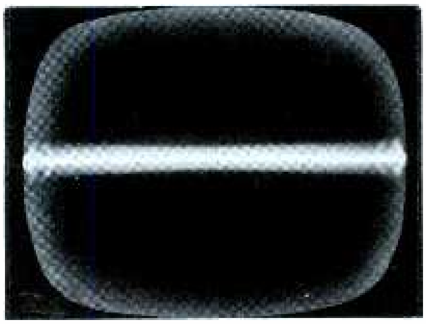

**Fig. 3. A thin horizontal line indicates trouble in the vertical sweep system.**

Servicing NEW DESIGNS

# Looking Over G.E.'s 1960 REMOTE-CONTROL UNIT

by Thomas A. Lesh

Remember when Studebaker first introduced an automatic shift for their cars? They must have thought enough different kinds of "----o-matics" and "Power----s" were already on the market, for they christened their product just plain "Studebaker Automatic Transmission."

General Electric apparently followed a similar line of reasoning in choosing a name for their new wireless remote control for TV sets. This unit, which is making its first appearance this fall in the U4 and M5 chassis, is called simply the "G-E Wireless Remote Control System."

While this new device has some characteristics in common with other types of wireless remote units, it also employs several design features not previously used in the TV field. Basic specifications of the G-E system are as follows:

*Medium of transmission:* Radio waves (RF).

*Operating frequency:* 322.7 kc, modulated by four different audio frequencies corresponding to the four push buttons on the transmitter case.

*Control functions and frequencies:* Receiver on-off, 405 cps; channel-selector, 375 cps; reduce volume, 345 cps; increase volume, 315 cps.

*Transmitter features:* One 2N319 PNP transistor operating as a self-modulating RF oscillator; 9-volt mercury battery.

*Receiver features:* Movable ferrite-core antenna; two tubes (6EW6 and 6EA8); self-contained half-wave B+ rectifier using a germanium diode; a total of six relays to perform control functions.

Since the control receivers used in other types of four-button wireless remote systems generally have from six to eight tubes, you may be wondering how the G-E receiver can operate with only two tubes. Here's the answer: It doesn't have a separate electronic circuit for each relay- control function, as do most other remote receivers. All control signals are fed through a single channel consisting of an RF amplifier, a common detector stage, and one audio amplifier. The different signals are separated from each other in the plate circuit of the final stage by means of a frequency-sensitive *reed relay*. In place of ordinary contacts, this unit has four flexible reeds which are mechanically resonant to the audio frequencies generated by the remote transmitter. Each incoming control signal produces an alternating magnetic field in the relay coil, thus causing one of the reeds to vibrate. When this occurs, the reed intermittently touches a stationary contact and completes a low-current circuit through the coil of another relay. The contacts of this secondary or "sensitive" relay then close, and the desired action is accomplished—turning the set on or off, changing channels, or varying the volume.

Fig. 1 is a schematic of one of the four identical reed circuits, and Fig. 2 is an interior view of the control receiver showing the location of all relays.

Let's trace out the circuits which connect the control receiver to the TV set, using the simplified schematic in Fig. 3 as a guide. When the *remote on-off* switch on the rear of the TV set is closed, power is supplied to the control receiver from the AC line through pins 2 and 5 of the octal plug. The remote system is then ready to use, regardless of whether the main power switch on the TV set is in the *on* or *off* position.

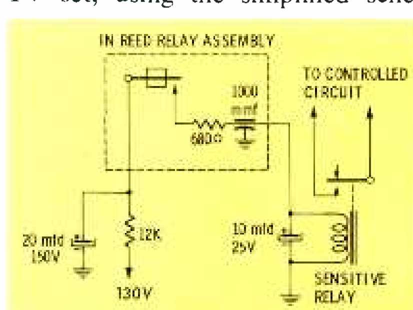


**Fig. 1. Incoming signal makes reed vibrate, thus applying power to relay.**

As shown on the schematic, one side of the TV power-transformer primary is connected through this local on-off switch to either pin 3 or pin 4 of the remote plug. One of these pins—it doesn't matter which one—must be tied to pin 2 of the plug in order to place the transformer across the AC line. The required connection is made through the on-off latching relay in the remote receiver. The contacts of this toggle-type unit are switched back and forth between two different resting positions, alternately making pin 3 and pin 4 "hot" with AC. To turn on the TV set, it is only necessary to line up the contacts in the local and remote sections of the transformer-primary circuit to provide continuity through one of the two possible AC-return paths.

As a safety feature, the latching relay is equipped with a thermal protector which automatically opens the relay-coil circuit in case of excessive current flow through the coil.

When the sensitive relay in the channel-selector circuit is actuated, its contacts complete the ground-return circuit of the power-tuning motor and thus cause it to rotate. It draws current from a special 24-volt winding on the TV power transformer, not shown in Fig. 3. The power-tuning mechanism is generally similar to the one in G-E's Chas-

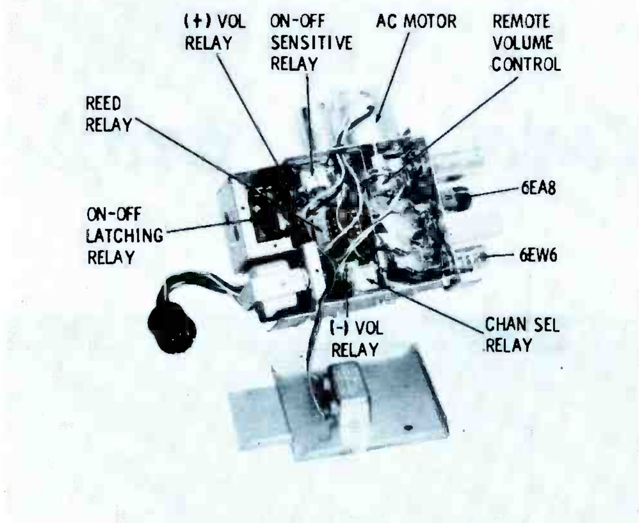


**Fig. 2. Remote-control receiver has two tubes, six relays, and remote volume control operated by a small motor.**

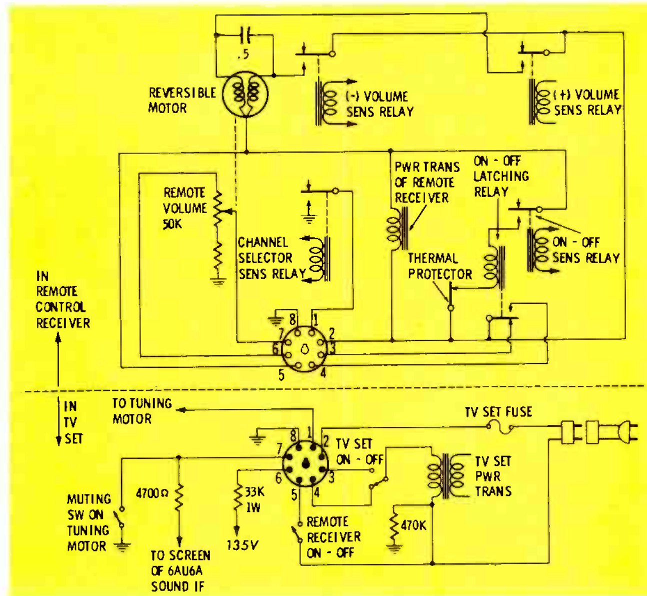


**Fig. 3. Circuits associated with octal plug which connects General Electric wireless remote receiver to TV set.**

sis U3, which was described in this column last May. However, the newer unit features a different arrangement for presetting the fine tuning, as well as a "trip-proof" switch to protect the tuning mechanism from damage which fine tuning is being adjusted.

When either the "plus" or "minus" volume relay is operated, one of the windings of a special reversible motor is connected across the AC line terminals via pins 2 and 5 of the remote plug. This motor turns the shaft of a potentiometer, which regulates the audio volume by varying the DC screen voltage of the sound IF tube. Since the G-E remote system uses RF transmission instead of acoustic waves, the control signal can be transmitted as long as necessary—and then cut off at any desired instant. This enables the user to adjust the remote volume control with a great deal of precision.

The motor turns the potentiometer all the way through its range in a matter of a few seconds. At the end of rotation, the slider strikes against a mechanical stop. This is sufficient to stall the motor; no clutches, limit switches, or similar devices are needed. In order to turn the control back in the opposite direction, the user must press the other volume button on the remote transmitter.

The control receiver is a relatively simple device as far as its electronic circuits are concerned. The plug-in antenna assembly functions as a tuned tank in the grid circuit of the 6EW6 RF amplifier. Output of this stage is coupled to the detector (triode section of the 6EA8) by a double-tuned transformer. Since the detector develops a high level of grid bias when a signal is present, the triode conducts only on positive half-cycles of the input signal. The resulting rectified output is coupled from the plate of the detector to the grid of the audio amplifier (6EA8 pentode section). Included in the RC coupling network is a sensitivity potentiometer which serves as a sort of "drive adjustment" for the audio stage.

The single transistorized stage in the transmitter (Fig. 4) is a common-emitter circuit including tuned elements for both RF and audio frequencies. An isolated tuned circuit, including the secondary windings of collector transformers T1 and T2, is resonant at 322.7 kc. A signal of this frequency is fed back to the transistor's base circuit through a tickler winding on T1, thus sustaining RF oscillation. The ferrite-core transformers T1 and T2 (long rods in Fig. 5) function also as a transmitting antenna.

The audio oscillator is a Hartley type; in Fig. 4, note that the emitter is returned through the battery circuit to an intermediate tap on the

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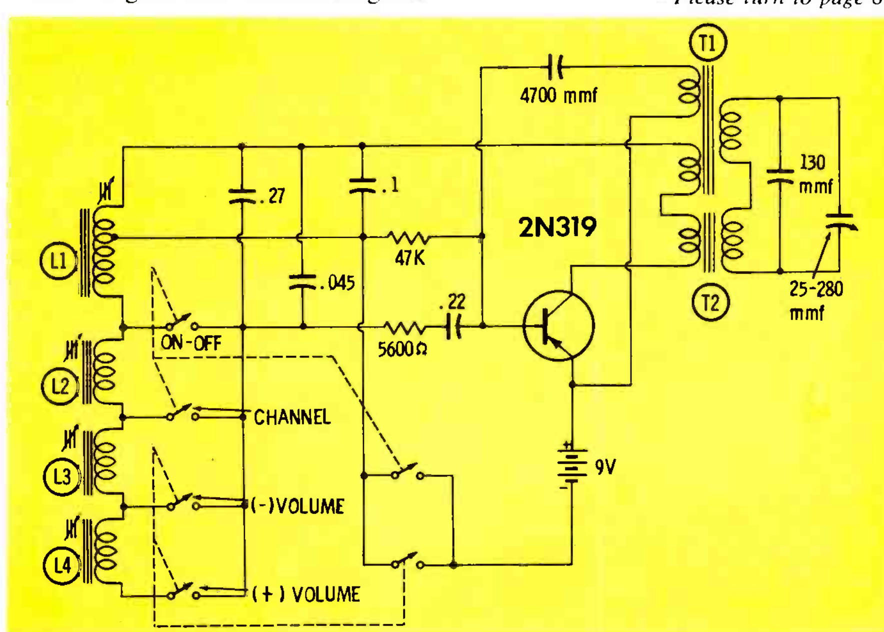
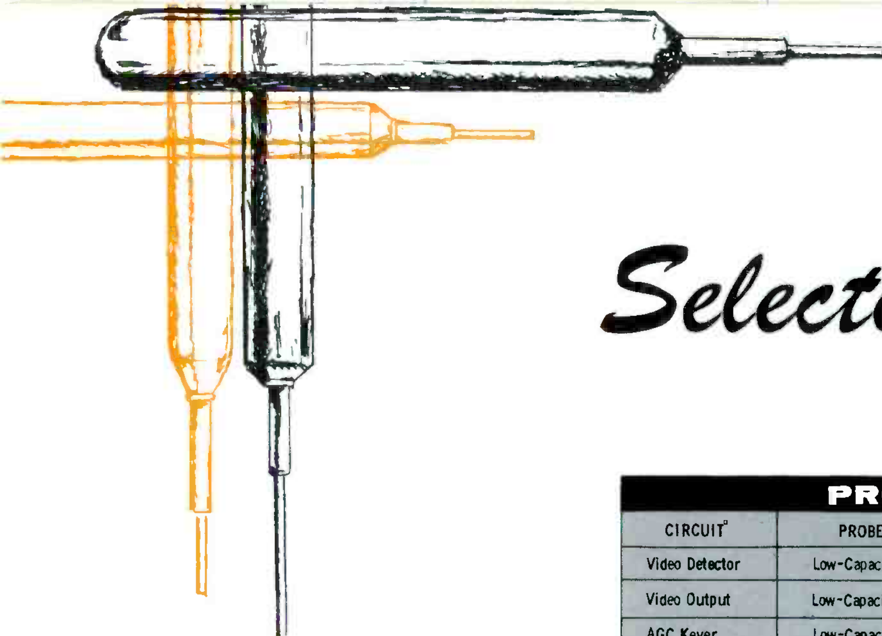



**Fig. 4. Transistor circuit in transmitter is combination RF and AF oscillator.**



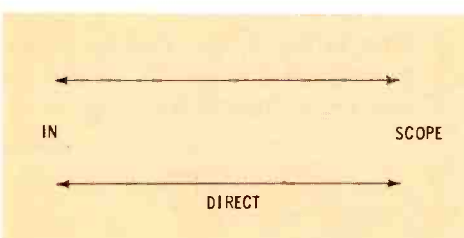
# Selecting the proper

*The scope is a valuable instrument in electronic service work, especially if it is used correctly. A large part of correct usage depends on the choice of accessory probes. Proper construction of probes is important, too; for example, every probe should be fitted with a coaxial lead no more than 3′ to 4′ in length. If you have trouble remembering which probe to use in various applications, the probe-usage chart given here will be a valuable asset.*

**PROBE USAGE CHART**

| CIRCUIT[1] | PROBE | WHY |
|---|---|---|
| Video Detector | Low-Capacity | To eliminate capacitive loading and the resultant signal distortion. |
| Video Output | Low-Capacity | as above |
| AGC Keyer | Low-Capacity | To prevent circuit loading and introduction of signal phase shift. |
| Sync. | Low-Capacity | To eliminate instability that might be introduced by probe loading. |
| Noise Inverter | Low-Capacity | To eliminate phase shift caused by capacitance of direct probe. |
| Vert. Output | Low Capacity | To divide signal and avoid scope being overdriven. |
| Vert. Oscillator | Low-Capacity | To prevent probe capacitance from shifting frequency. |
| Horiz. AFC | Low-Capacity | as above |
| Horiz Oscillator | Low-Capacity | To prevent circuit loading and oscillator detuning. |
| Horiz. Output | Low-Capacity | (grid only) To prevent circuit loading and reduced grid drive. |
| Low-Voltage | Direct | Low-impedance, low-frequency circuit best handled with direct probe. |
| Video IF | Demodulator | Detect IF signal and provide a response within scope's bandpass. |
| Tuner | Isolation | Reduce noise pickup and make marker pulse easier to see (alignment) |
| Video Detector | Isolation | as above |
| Color Sync. | Demodulator | (single ended type) To provide a signal within scope's bandpass. |

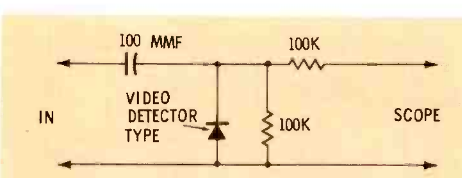
Caution 1. Never apply any of these probes to points in the circuit that have AC, DC, or pulse voltages in excess of the rating of the probe's input component.




DIRECT

## THE SIMPLEST PROBE

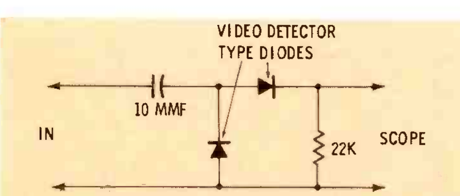
The DIRECT PROBE is the simplest of them all, and may be constructed in one of several different ways. It may consist solely of a piece of shielded cable with spade lugs on the scope end and alligator clips on the other—or, you may need co-axial or banana-plug connectors on the scope end. A dummy probe tip and a 10″ wire complete with alligator clip terminating the braided shield makes a very good direct probe.




100 KC TO 250 MC DEMODULATOR PROBE WITH NARROW-BAND OUTPUT

## 100-kc to 250-mc DEMODULATOR

This DEMODULATOR PROBE can be used at frequencies between 100 kc and 250 mc, and the demodulated output can be any frequency between 60 cps and about 8 kc. The unit is useful in signal-tracing video-IF stages and TV tuners, as well as in checking bandwidth in the chrominance sections of a color receiver.

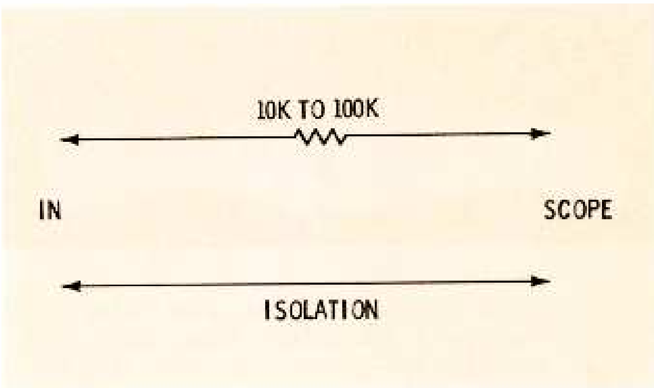


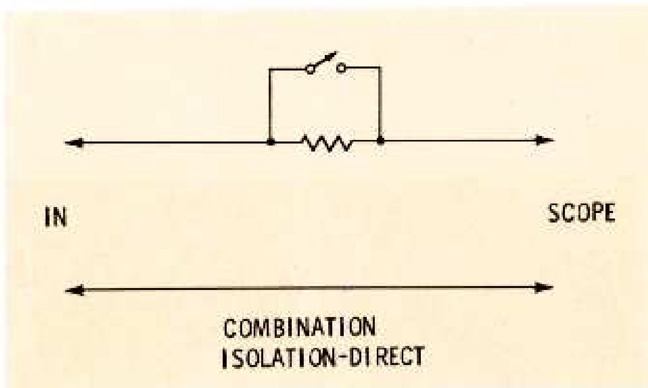

20-50 MC DEMODULATOR PROBE WITH WIDE - BAND OUTPUT

## 20-50-mc DOUBLER-TYPE PROBE

This DOUBLER-TYPE DEMODULATOR PROBE has a much narrower bandpass than the single-ended type, but it offers about twice the signal output. It is excellent for all forms of troubleshooting in video IF and other circuits in the 20- to 50-mc range.

# SCOPE PROBE




## ISOLATION PROBE

This is also a direct probe with a 10K to 100K resistor in series with the "hot" lead. It is usually specified for RF and IF sweep alignment. A VTVM probe of the "Uniprobe" type would permit both Direct and Isolation probes to be contained in a single unit. The desired probe type could then be obtained with a simple turn of the tip, or a flip of a switch.

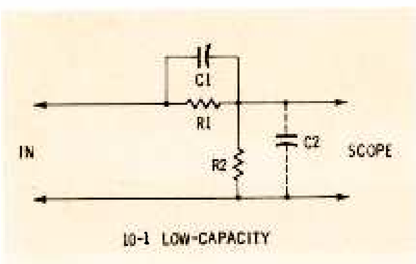
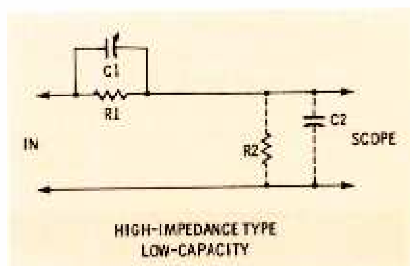



TABLE OF VALUES FOR LOW-CAPACITY PROBES

| SCOPE IMPEDANCE | R1 | C1 | R2 |
|---|---|---|---|
| 1 MEGOHM | 1 MEG | 3-13 MMF | 110K |
| 2 MEGOHMS | 2 MEG | 3-13 MMF | 220K |
| 3 MEGOHMS | 3 MEG | 5-20 MMF | 330K |

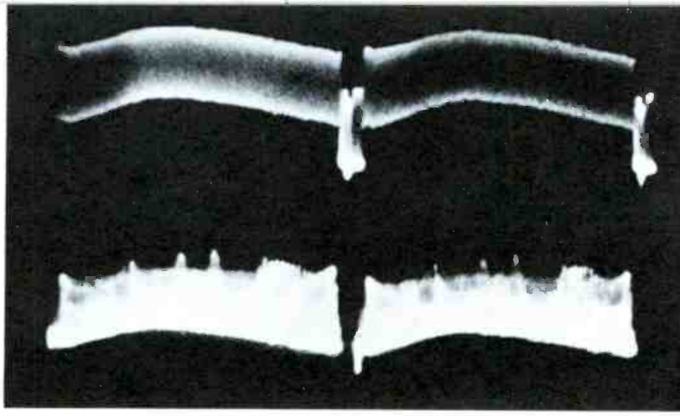



## THE MOST USEFUL PROBE

The Low-Capacity Probe (with 10:1 attenuation ratio) is the most important accessory you can have for your scope. Its design is such that the output signal is one-tenth of the input, and thus it offers only one-tenth as much circuit loading as a direct probe. This is desirable even at the expense of a 90% signal loss.

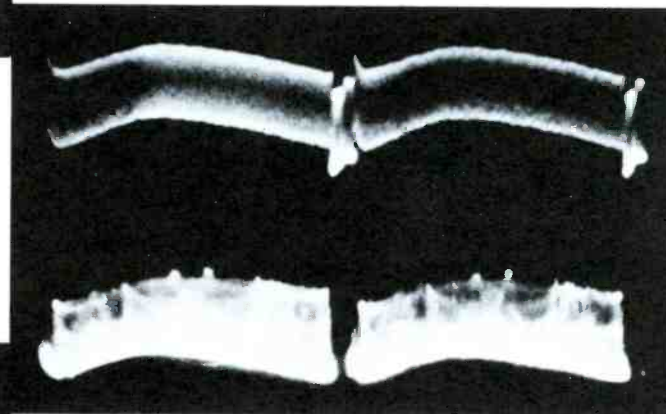
Low-capacity probes have two general configurations. The simpler design offers higher impedance and correspondingly less circuit loading, but may have an attenuation factor other than 10 to 1, making it more difficult to calculate peak-to-peak signal measurements.

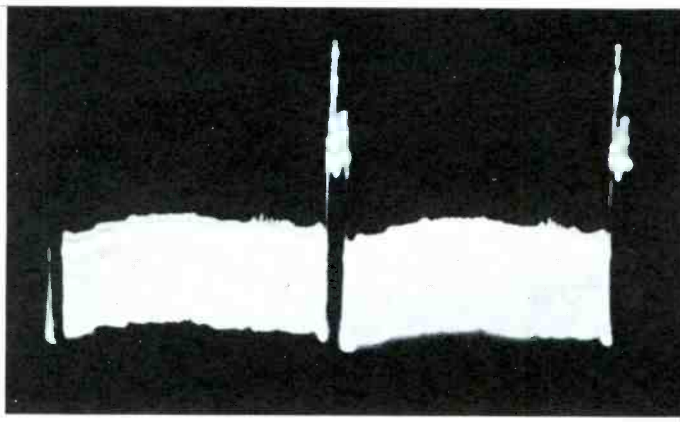
In either probe circuit, R1-C1 should equal R2-C2, and the value of R1 should be ten times that of R2. The combination of R2-C2 in the simpler circuit matches the impedance of the cable and scope. For the more elaborate probe, R2 always equals 1/9 of the scope's input resistance, and C2 is the total of the cable and scope input capacitances (no physical capacitor is used). The most common values for R1, C1, and R2 used in 10:1 probes are given in the table. Choose the values to match scope input impedance.



Vertical sync compression in this video-detector waveform was caused by circuit loading with a direct probe. Using this type of probe to monitor the video signal could cause you to erroneously assume there is trouble in the tuner or video-IF strip.

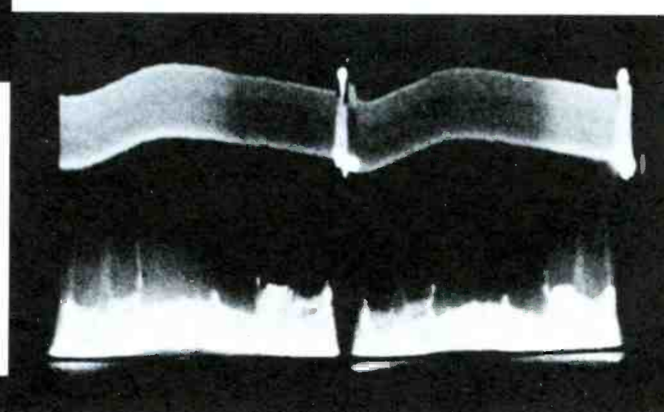
When a low-capacity probe is used to view the signal at the video detector, there is no circuit loading and you therefore get a true picture of tuner and IF operation.

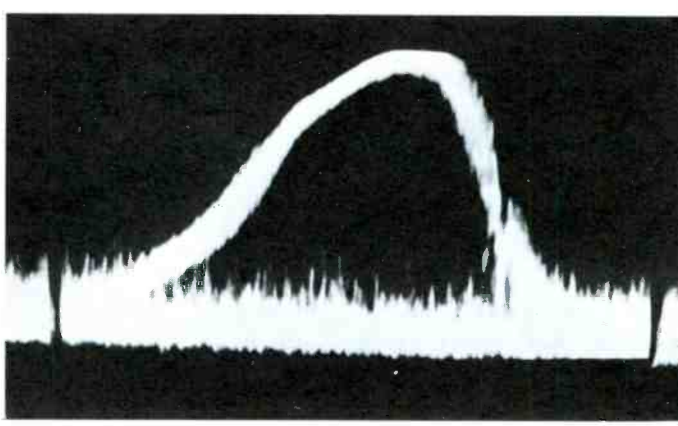




The detected IF signal, when using the single-ended demodulator probe, shows very prominent low-frequency response. High-frequency portions of the signal are greatly attenuated; thus, this type of probe is useful only when the modulating frequency is low.

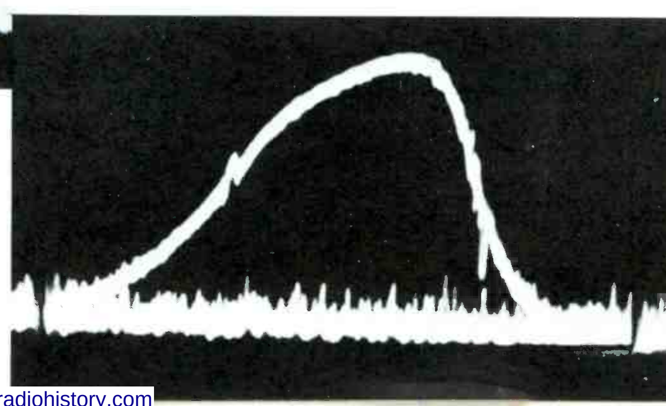
When using the doubler-type probe, the detected IF signal is very nearly identical to the video-detector output. Naturally, it is smaller by a degree, depending on the stage being examined. A small loss of high-frequency information is indicated by the lower relative amplitude of the horizontal sync pulses when compared to the vertical pulses.





A small marker pip or dip would be very difficult, if not impossible, to locate among the "grass" on this video-IF response curve. The grass is due to pickup of the 15,750-cps energy radiated by the horizontal-output and high-voltage circuits.

This video-IF curve has much less "grass" because an isolation probe was used. The series resistance in the probe is frequency-discriminating, and affects high frequencies without disturbing low frequencies.



## Dealer JOHN G. ALTMEYER Says...

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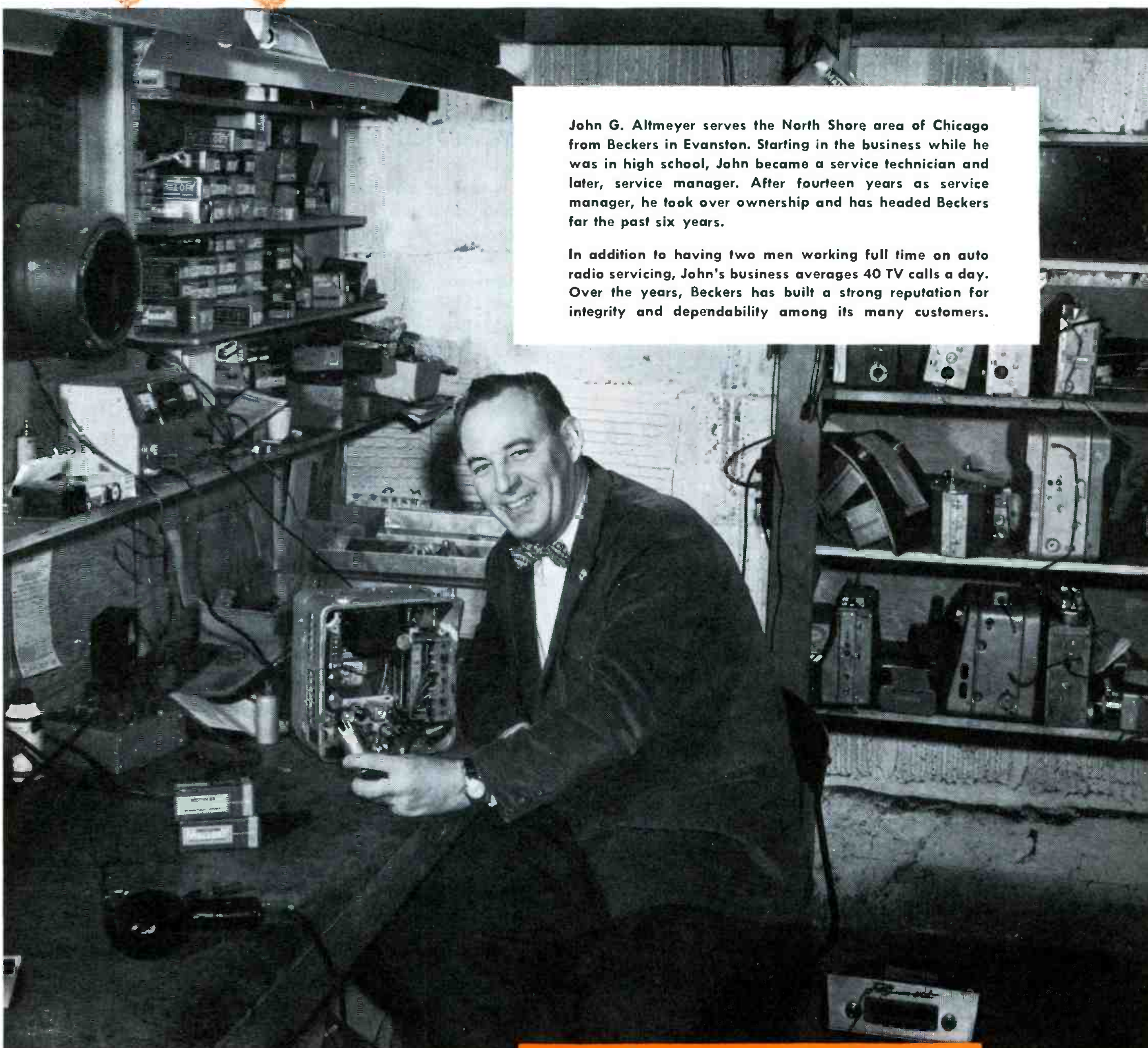

John G. Altmeyer serves the North Shore area of Chicago from Beckers in Evanston. Starting in the business while he was in high school, John became a service technician and later, service manager. After fourteen years as service manager, he took over ownership and has headed Beckers far the past six years.

In addition to having two men working full time on auto radio servicing, John's business averages 40 TV calls a day. Over the years, Beckers has built a strong reputation for integrity and dependability among its many customers.

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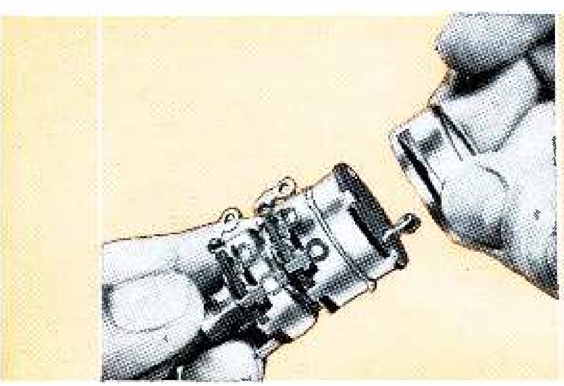

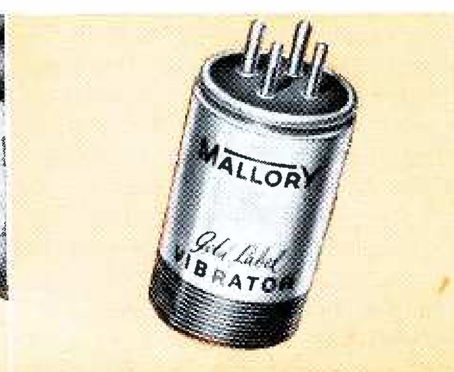


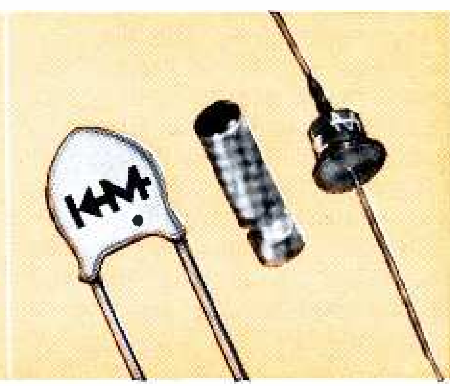

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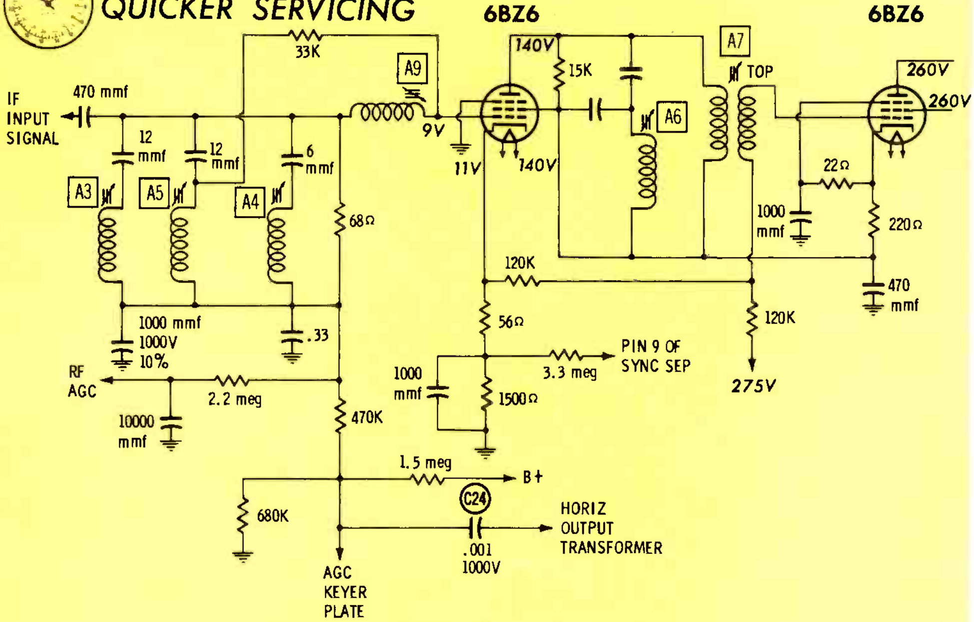


**Fig. 1. AGC-controlled first IF stage has positive voltage on its grid.**

# running down AGC TROUBLE

by Calvin C. Young

The customer's original complaint was "buzz in the sound and picture distortion." On the initial service call, tubes were substituted in the tuner, video-IF, video-amplifier and AGC stages. This reduced the trouble symptom, but there was still a tendency toward buzz on strong signals—even after the AGC and noise-inverter controls were adjusted.

Since the receiver wasn't performing perfectly, the customer agreed to a shop repair. In the shop, the initial step was to pull the service data from the file and study the AGC, tuner and video-IF circuits (see Fig. 1). The first thing that caught my eye was the positive voltage reading shown at the grid of the first video-IF stage. The mere fact that the control grid of an AGC-controlled IF stage was normally operating at a +9-volt level started me wondering about the sanity of the design engineer. However, I then noted that the cathode reading was +11 volts, and I realized that the stage was designed to operate at a reasonable bias level. Furthermore, I knew the set had worked normally (made the original installation and setup adjustment on this one myself), and the design had to be a workable one, so I pitched right into the problem.

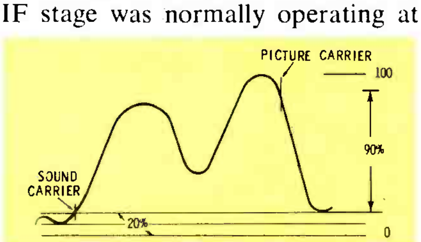


**Fig. 2. Distorted response curve noted in set with symptoms of AGC trouble.**

Even though tube substitution in the home had failed to shed any light on the problem, the tuner, video-IF, video-amplifier and AGC tubes were checked with the shop's tube tester for gas, leakage and Gm. The RF amplifier, 1st video IF, and video amplifier all checked defective (interelectrode leakage or gas) and were replaced. Naturally, this didn't repair the trouble; but at least it didn't leave symptoms in the circuit to camouflage the location of the real culprit.

Since this was one of those "just not quite right" type of troubles—where everything works, but not good enough—I felt the solution to the problem would involve more than just a bad capacitor or off-value resistor. Nevertheless, I made the usual standard checks of the AGC filters, video-detector crystal, video-bypass capacitors, and components associated with the keyer stage. This failed to produce even a hint as to the source of the trouble. Voltage checks in video-IF, video-amplifier and AGC-keyer stages also indicated that everything was working fine.

Finally, I even disassembled the tuner and made the usual checks for poor contacts and burnt or off-value resistors — still no results. I had made progress though, since I knew what the trouble wasn't. In fact, I now felt it was isolated to an alignment condition.

When the alignment equipment was warmed up and operating stably, the necessary connections were made to permit viewing the over-all IF response curve. What an unholy mess this revealed—a big dip in the center of the curve and very peaked response on the video carrier side as shown in Fig. 2. Just to make sure our equipment wasn't causing part of the curve deformity, I rechecked the instructions relative to dummy antenna, bias, isolation, etc. Everything was connected as specified. Now I was sure poor alignment was causing the trouble.

Not knowing whether the misalignment was caused by component aging, a defective component, or by "twiddling," I could only pitch in and hope for the best. When adjustment of the over-coupled transformer (detector input) and four stagger-tuned circuits (all of the tuned circuits except the traps) failed to completely restore the curve to normal, I suspected someone had been "twiddling." (Grid and plate circuits could change with tube replacements, but this is highly unlikely where traps are concerned.) Adjustment of the traps and a slight retouch of the previously-adjusted plate and grid coils finally brought

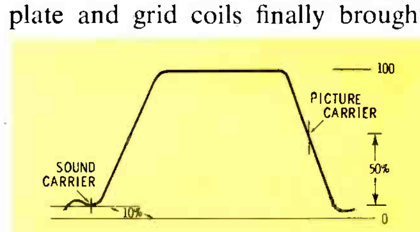


**Fig. 3. Normal curve has sound carrier at 10% and video carrier at 50% level.**


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the curve back to normal (see Fig. 3).

Just to be on the safe side, I also checked tuner alignment. Since the response curve was tilted on low-band channels, I made a few touch-up adjustments. The small amount of adjusting required on the tuner ruled out twiddling, so I reasoned that tube replacement had affected tuner alignment slightly.

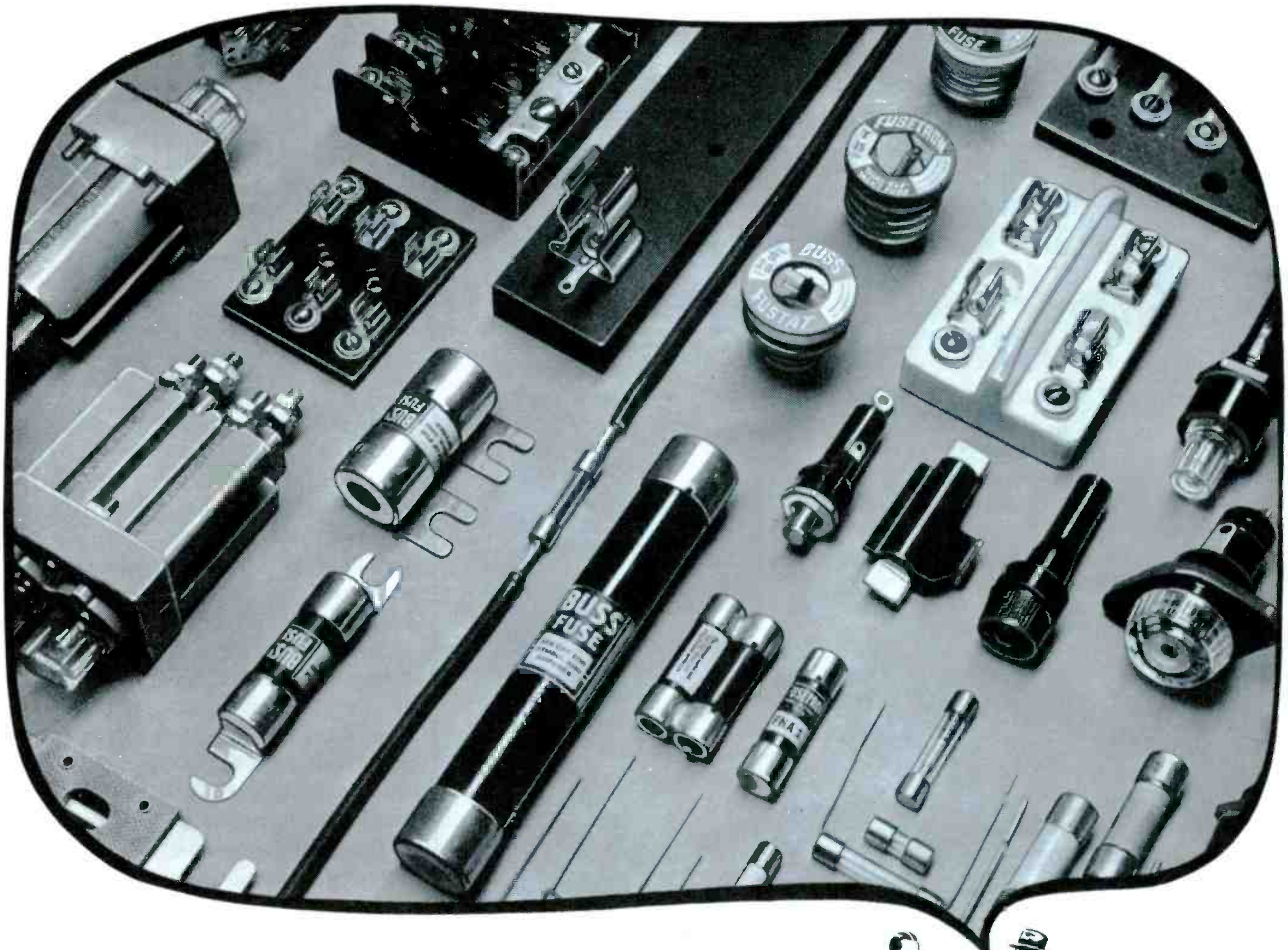
To test the repair, I then connected the set to the outside antenna system and tuned in the strongest local station. The AGC and fringe-lock controls now produced normal changes in picture and sound when they were adjusted; i.e., the AGC control range would white out the picture at one extreme, vary the degree of picture contrast in the center portion, and black out the picture at the other extreme setting. The fringe-lock control caused the picture to bend when adjusted toward the fringe position. The sound developed a trace of buzz at AGC-control settings which produced excessive contrast, which is the normal condition.

While we have just dealt with a case wherein alignment cured a very nasty AGC trouble, let's not get the idea that this will always be the case. The real story is not that the trouble was repaired, but how the serviceman went about locating its cause. If he hadn't checked things in an orderly and calculating manner, he might never have reached the conclusion that alignment was the source of his trouble.

For those who feel that the standard procedure of clamping the AGC line was overlooked, let's say briefly that this test wasn't tried since the voltage on the control grid of the first video-IF stage was positive. After the set was repaired, however, I did a little checking and found that, after disconnecting the coupling capacitor (C24 in Fig. 1) from the AGC-keyer plate, a negative voltage could be applied to the plate of the keyer tube to effectively clamp the AGC line. The voltage required was quite high, though; I used a 67.5-volt battery and a 1-meg potentiometer for the bias pack.

### Grille Cloth Installation

Installing a strip of one of the new plastic grille-cloth materials can make a very noticeable improve-

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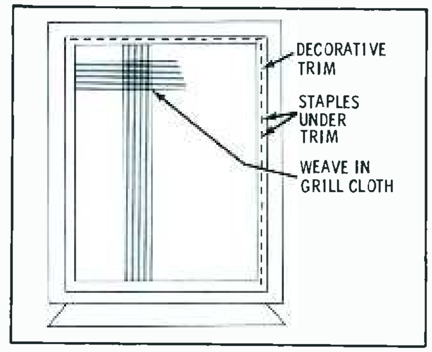


**Fig. 4. Use decorative trim to hide staples used for installing grille cloth.**

ment in the appearance of an older model TV, radio or hi-fi set. The actual installation is a relatively simple process, although it varies somewhat with the particular job. If speaker-board mounting permits, remove it, pull the cloth around all four sides, and staple it in place from the rear. Make sure to get the weave straight for appearance' sake. If the speaker board can't be removed, staple the cloth to the front at the outer edges, and install a narrow decorative trim strip to hide the staples as shown in Fig. 4.

One pitfall to avoid: think twice before you install light colored cloth over a light colored board. If you don't, the speakers will stick out like a sore thumb, as they do in Fig. 5. The remedy is simple; merely paint the speaker board with a flat black paint before installing the grille cloth.

### Battery Lives Forever

Old soldiers aren't the only things that never die; Sonotone's new rechargeable flashlight pack is reported to have a useful life of 15 to 20 years in normal service.

This battery pack (Fig. 6) should be a boon to the TV serviceman. If

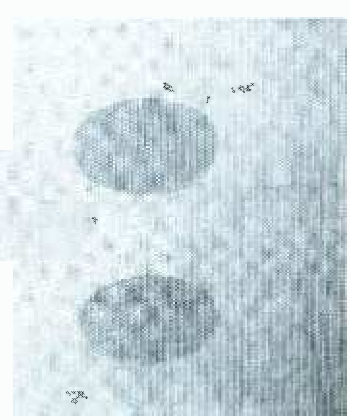

**Fig. 5. Paint speaker board black when installing a light-colored grille cloth.**

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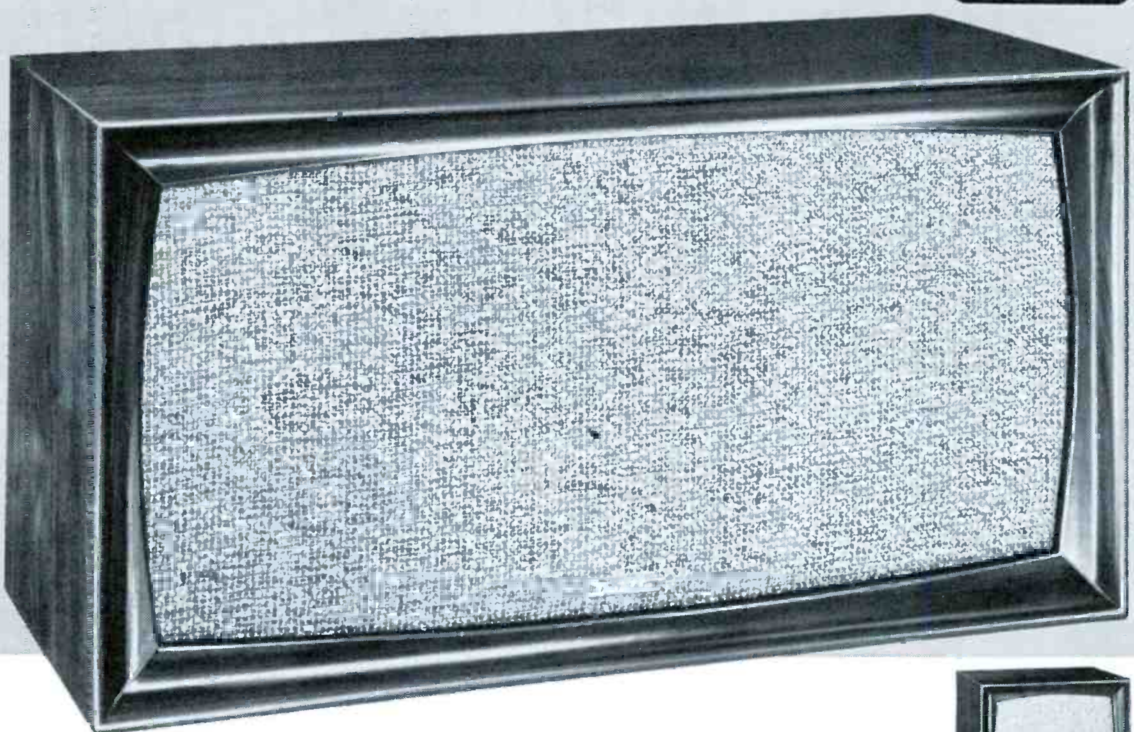

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Fig. 6. Sonotone rechargeable 3-volt pack compared to 2-cell flashlight.

you've ever been on a home call and needed your flashlight to locate the keyway on a 9-pin tube socket, only to find the batteries "shot," the rechargeable feature is sure to be of prime interest to you. With the new Sonotone battery, you just unscrew the cap, and insert the exposed male plug (Fig. 7) into the nearest AC outlet. In about 5 minutes or so, the battery will be recharged enough to complete the job. You could use this waiting time to clean the CRT screen or tuner contacts, or perform other small necessary jobs, thereby eliminating lost time.

To completely recharge the battery, leave it plugged into an AC outlet overnight. A six to eight hour charging period is usually sufficient to restore the battery to full charge, although longer charging periods won't damage it.

You dealers that feature walk-in sales items should be interested in stocking these rechargeable batteries for resale to your customers. As a matter of fact, you can sell them while making home calls without half trying. They are both shockproof and leakproof, and have a recommended consumer price of $7.95. ▲



Fig. 7. Simply plug the Sonotone battery into a 110-volt outlet to recharge it.

# DOLLAR & SENSE *Servicing*

by Thomas A. Lesh

**What—Me Sell?** If you shy away from the thought of performing a sales function, you have plenty of company. There aren't many good technical men who enjoy (or have the aptitude for) the aggressive, persuasive type of selling. In fact, TV-appliance stores frequently discourage their service employees from this kind of activity. If an outside technician sees an opportunity for sale of an appliance, he's often asked to pass along this lead to the regular sales force instead of handling it himself.

But this doesn't slam the door on *all* selling efforts by technical men. The low-pressure type of salesmanship, known as "suggestion," lends itself beautifully to use on service calls. Mr. C. W. Dunlap, a parts distributor in Stockton, Calif., has pointed this out very aptly in a newsletter he sends to his service-dealer customers:

"Your right foot and your left foot as you approach a customer's door enjoy a unique selling situation. You have no barrier to break down, nor must you resort to "fast talk" to gain your customer's attention. Quite to the contrary, the customer awaits your arrival. Your technical background and "know how" has been requested by the owner of a radio or TV set. This immediately places you in the role of the expert. Take one moment to analyze the situation.

1. You are called into the home as an expert because of your specialized knowledge.
2. Your customer will listen to what you suggest.
3. Pre-selling and promotion of a product by the brand-name manufacturer has already occurred, and the technician, by reminding his customers of the brand-name products he represents, has gained a unique selling situation. "Suggestion selling" calls for initiative, and it is a great profit power potential and a valuable assist for *increased profits.*"

Note one point: You have to take the intiative in order to reap the advantages of selling by suggestion.

$ & ¢

**Direct Mail — To Where?** The other morning, I took in my mail as usual. With a well-practiced gesture, I deftly dropped the supermarket coupons, "Occupant" items, etc., into the wastebasket; then I settled down to read the "real" mail. Among the envelopes was a neat white one addressed in a precise, old-fashioned hand. A letter from some dear old aunt back East? Nope —it turned out to be an elegantly-printed invitation to the grand opening of a new golf driving range!

This was somewhat of a letdown, but the important point is that the letter got through my hard-shelled defenses and captured my attention.

Now let's talk about *your* direct-mail advertisements. If I had received your latest mailing piece, would I have taken a look at it, or shooed it into the trash bin? That would have depended upon a split-second impression. The item would have had to look worthy of consideration, or I (in my role of a skeptical, ad-weary householder) wouldn't have bothered to rip open the envelope.

To coax the addressee into looking at the mail you send, put his name on the envelope and get it *right* to the best of your ability. Perhaps you'd like to add a real personal touch with handwritten addresses, as the driving-range owner did. If so, the writing should be done in a reasonably careful hand in order to get the desired effect. Some retired or shut-in person in your neighborhood would probably be glad to turn out a meticulous job, and the expense is small. You might even pay (or persuade) members of your family to help you out.

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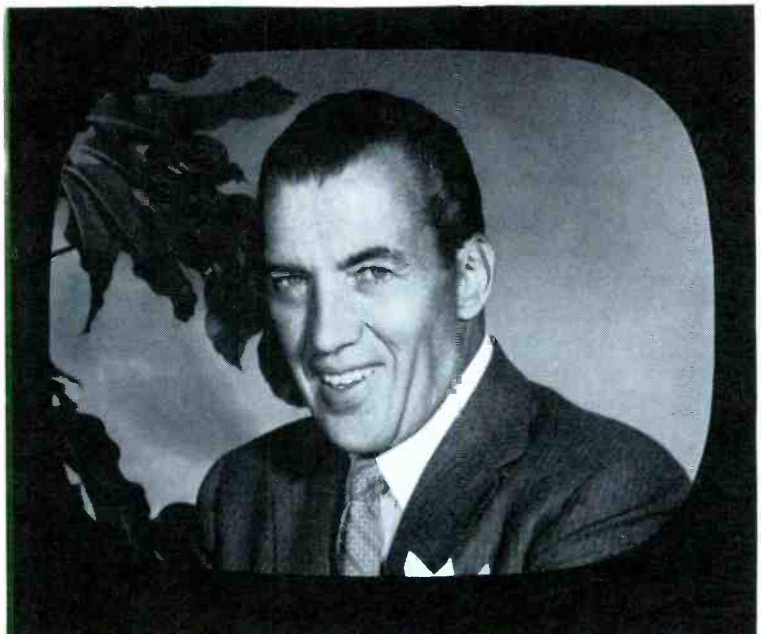

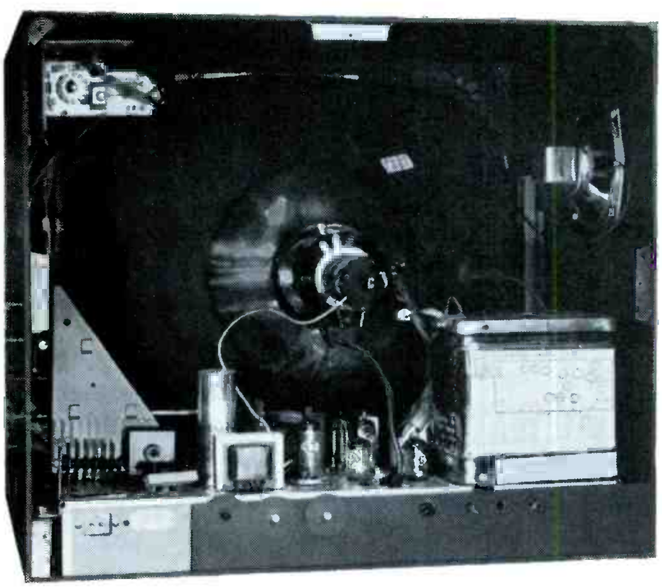

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# CROSSHATCH MARKS Chroma PHASE

## how a crosshatch signal can be used to determine chroma phase

*by Robert G Middleton*

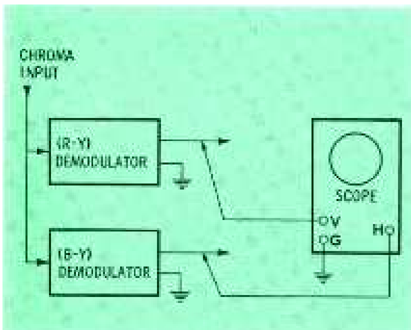


**Fig. 1. Scope connections used for check of quadrature transformer adjustment.**

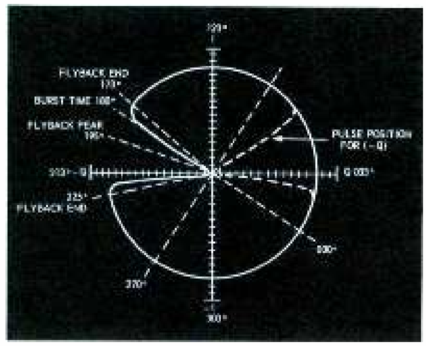


**Fig. 3. Correct pattern obtained at quadrature transformer of I-Q color set.**

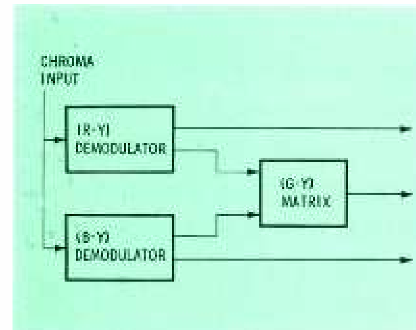


**Fig. 4. Block diagram showing how R-Y and B-Y demodulators drive G-Y matrix.**

Faithful color reproduction is possible only if the chrominance section of the receiver is properly aligned. Chrominance circuit alignment can be checked with even the inexpensive rainbow-type signal generator if the proper test procedure is employed. In making such a test, the rainbow signal is applied to the antenna-input terminals of the receiver, and the outputs from the R-Y and B-Y demodulators are fed to the vertical- and horizontal-input terminals of the scope as shown in Fig. 1.

The quadrature transformer is driven by the subcarrier oscillator, and supplies 3.58-mc reference signals to the chroma demodulators as indicated in Fig. 2. The quadrature transformer is slug-tuned, and when correctly adjusted, supplies the chroma demodulators with 3.58-mc voltages which differ in phase by 90°.

To check the adjustment of the quadrature transformer, observe the pattern on the scope screen while adjusting the transformer slug. Correct adjustment is indicated by a perfectly circular pattern; incorrect adjustment by a slanting ellipse which cannot be made into a circle by adjusting the vertical and horizontal gain controls of the scope.

This test method also works well with an I-Q demodulator system. Output from the Q demodulator is applied to the horizontal-input terminals of the scope, and output from the I demodulator is applied to the vertical-input terminals. As before, correct quadrature - transformer adjustment is indicated by a circular pattern, as illustrated in Fig. 3.

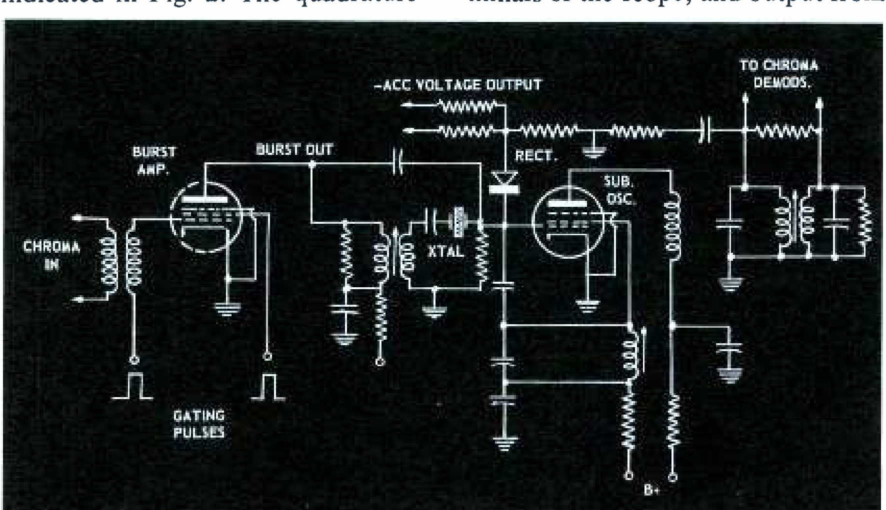


**Fig. 2. The quadrature transformer supplies the demodulator reference signals.**

### The G-Y Matrix

The R-Y and B-Y demodulators are followed by the G-Y matrix, as shown in Fig. 4. To test for proper matrixing with a rainbow signal, connect a scope to the output of any chroma channel, such as the B-Y demodulator indicated in Fig. 5. A sine-wave pattern should appear on the scope screen.

The pulse that appears on the sine-wave is a gating pulse. It marks the BY demodulator contributes the color-phasing control is correctly adjusted, this pulse appears at the bottom of the sine-wave, as shown in Fig. 5.

When the scope is connected at the output of the G-Y demodulator, the pulse should shift to the position illustrated in Fig. 6. The reason for this will be understood after looking at Fig. 7, which shows the basic phases of a rainbow signal. The G-Y matrix operates by mixing −(R-Y) and −(B-Y) voltages in a specific ratio. The burst occurs at −(B-Y), and maximum negative output from the B-Y demodulator contributes maximum positive output to the G-Y matrix. The G-Y matrix obtains a negative output from the R-Y


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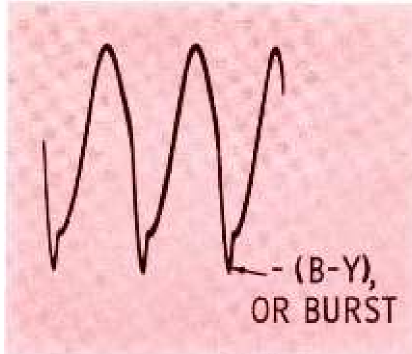


Fig. 5. Signal obtained when scope is connected to B-Y demodulator output.

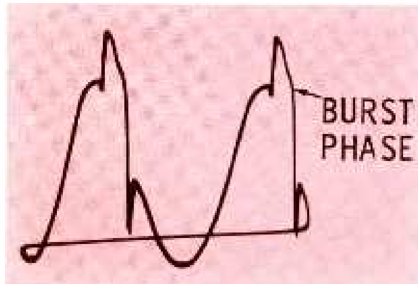


Fig. 6. Signal obtained when scope is connected to the output of G-Y matrix.

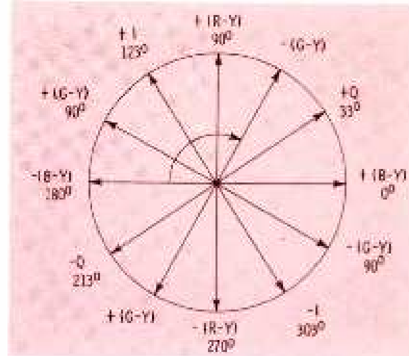


Fig. 7. Phases of a rainbow signal most often used in practical service work.

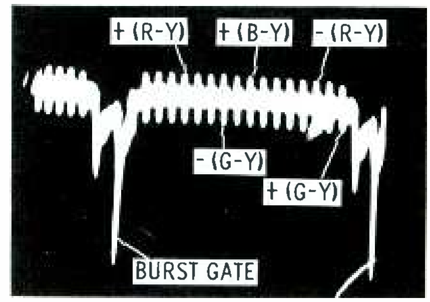


Fig. 8. Crosshatch pattern produces 17 pips along baseline for chroma check.

demodulator, which also contributes the the burst-phase pulse observed on the G-Y waveform.

### Using Crosshatch Markers

Since the burst pulse lacks pinpoint sharpness, it is somewhat of an indefinite phase indicator; thus, a more accurate means is required to check matrix operation. One method is to use a keyed rainbow generator. Since many shops have simple rainbow generators instead of the keyed variety, however, a crosshatch pattern can be used to mark chroma phases.

Some instruments provide a crystal-controlled unkeyed rainbow signal, as well as a crosshatch signal. By taking advantage of the rainbow signal that feeds through while operating the crosshatch function, a simultaneous crosshatch and rainbow pattern will be displayed on the picture-tube screen. Operating in this manner, you will observe that the vertical bars of the crosshatch signal appear along the base line of the pattern when the scope is connected to the output of a chroma demodulator. As shown in Fig. 8, the fifth pip provided by a sample generator is very close to R-Y, the eighth pip is very close to –(G-Y), the tenth marks B-Y, the fifteenth –(R-Y), and the seventeenth G-Y.

With the chroma gain control advanced, the pips appear along the sinewave output from the chroma demodulator, as seen in Fig. 9. As the color phasing control is rotated, the pips change positions or "slide" along the sine wave. Adjustment of the quadrature transformer also causes the pips to "slide." Thus, we have a ready means of checking the G-Y matrix; it is operating properly if we find the 17th pip at the positive G-Y peak (Fig. 9), and the eighth pip at the –(G-Y) peak. Appearance of these pips elsewhere than at the peaks of the sine wave (scope connected at the G-Y matrix output) is an indication of matrix trouble.

Many modern color receivers use R-Y and G-Y demodulators with a B-Y matrix. Principles of test are similar—the same sine-wave pattern, marked in the same manner, will be obtained whether the G-Y section is a demodulator or a matrix. ▲

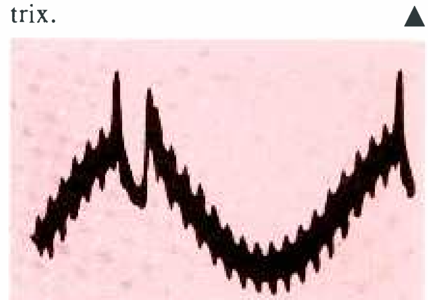

Fig. 9. Turning up chroma gain control produces marked sine-wave pattern.

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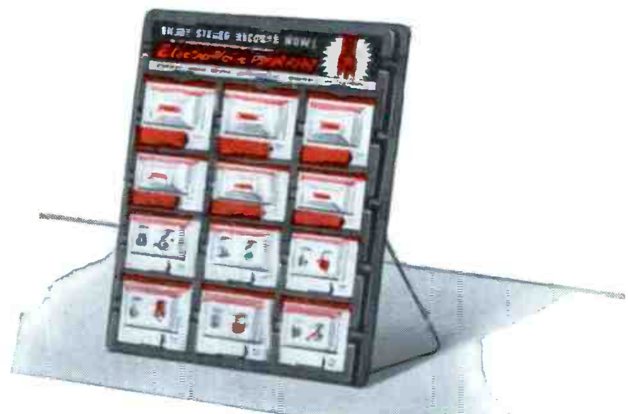

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# VERTICAL SWEEP SYSTEMS

***Part 2—Causes and cures for vertical bounce, poor interlace, and various types of sweep distortion***— by *Allan F. Kinckiner*

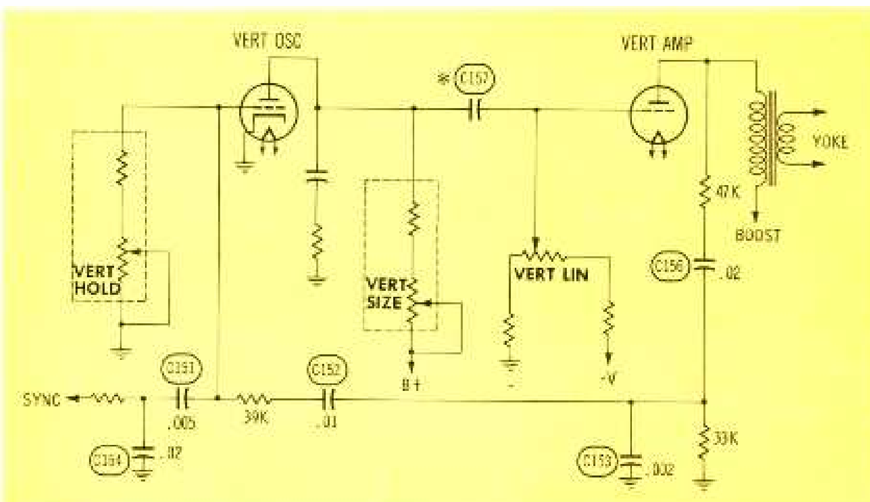


**Fig. 7. Replacing C157 cured vertical bounce in an RCA KCS100B portable.**

### Vertical Bounce and Jitter

Every experienced serviceman is familiar with the vertical bounce found in many of the early Admiral sets. This bounce may often be cured by replacing the vertical-output transformer. Sometimes shunting of the transformer primary with a .05-mfd capacitor does the trick.

Recently, I traced the source of vertical bounce in an RCA KCS47 to the installation of an unpotted blocking-oscillator transformer. This case was resolved by replacement of the unpotted unit with the potted type used in the original design.

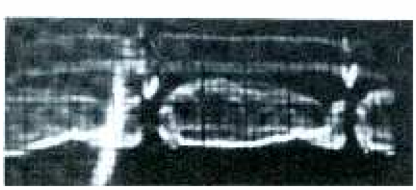

**Fig. 8. Inadequate AGC filtering can distort sync and cause vertical bounce.**

One of the earliest RCA's to use a rectangular glass picture tube developed bounce when someone failed to replace the vertical-oscillator tube shield. The bounce only occurred when the set was in the cabinet, and we nearly lost our minds before this simple omission was discovered.

In an RCA KSC100B, vertical bounce was due to a somewhat different defect. The customer brought in this small portable himself, complaining that it would not hold vertically after it warmed up. Previous experience on this model had taught the serviceman that capacitors C152, C153, and C156 (Fig. 7) were prone to defects. These parts were changed, and the set was wrapped in a blanket to build up heat for a test run. After about 20 minutes, the set developed a most disagreeable vertical bounce. C157, a .033-mfd unit, was temporarily replaced with a .047 unit because a .033 was not in stock. The set was again tested and operated perfectly.

The next day a .033-mfd capacitor was installed, but since the set had better linearity with a .047-mfd unit, a capacitor of that value was finally left in the set. A later job confirmed this observation, and it is now standard practice in our shop to use .047's in this application for all KCS100B's.

When an Admiral 22A2 exhibited vertical bounce, I first thought that it, too, was due to a change in vertical-output transformer characteristics; however, a new transformer did not help. After considerable testing, a waveform check at the video detector showed the pattern in Fig. 8. Note how the blanking level drops into the video area. This distortion was cured by increasing AGC filtering. (A 2-mfd capacitor was installed—negative end to the AGC line and positive end to chassis.) The improvement shown in Fig. 9 was equalled by the improvement in set performance.

Similar results have been obtained by the same means in RCA, Emerson, and other sets that employ

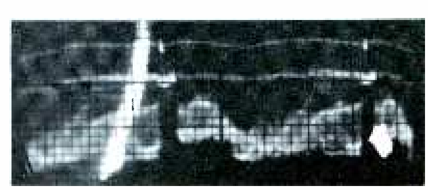

**Fig. 9. Improved video-output waveform after installing 2-mfd AGC filter.**

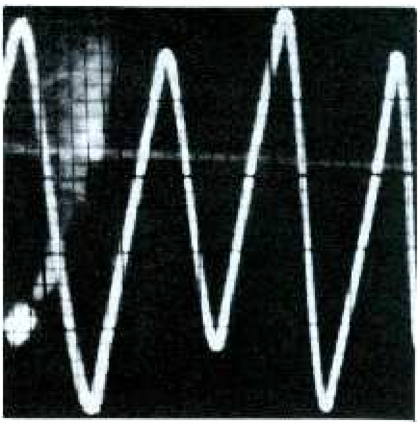

Fig. 10. Unbalanced ripple output of rectifier caused by defective 5U4 tube.

keyed AGC. Occasionally, the added filtering also rids the receiver of bends.

### Poor Vertical Interlace

In early model receivers using 10″ or 12″ picture tubes, less than good interlace was acceptable, since the spaces between scanning lines were not easily noticed. In late model receivers using 21″ and larger screens, there is more space between the lines. Should this be further compounded by line pairing, picture detail becomes seriously impaired.

Poor interlace presents itself in two conditions: a steady state where alternate fields are paired at all times, and a fluctuating state where alternate fields pair and interleave rapidly. Both types are difficult to correct, but some suggestions are offered here.

#### *Poor Interlace, Steady*

Line pairing is caused when the vertical oscillator is triggered one-half line too early. This type of defect is often due to insufficient high-frequency filtering in the integrator network, permitting the

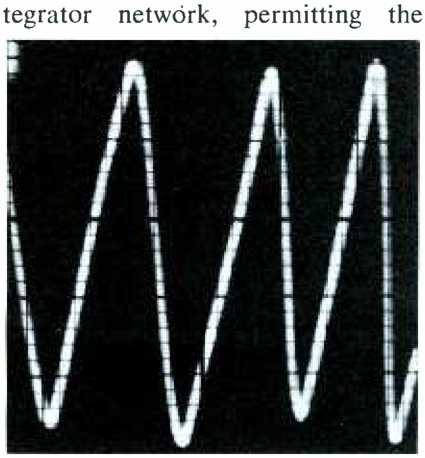

Fig. 11. Improved ripple waveform obtained when 5U4 tube was replaced.

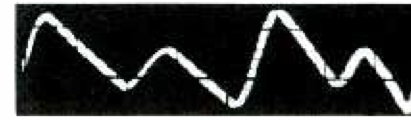

Fig. 12. Unequal ripple in Philco set caused by defective selenium rectifiers.

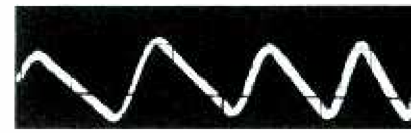

Fig. 13. Improved ripple waveform observed with new seleniums installed.

equalizing pulses to reach the oscillator grid. If the integrator is not defective, its action can be improved by adding a series resistor at the input and a small capacitor to ground at the output. Nominal values for these additions are 22K ohms and .005 mfd.

Another cause of poor interlace is the presence of horizontal pulses at the vertical-oscillator input, a condition due to poor lead dress, poor B+ decoupling, etc. Rerouting all wiring capable of causing such unwanted interstage coupling, plus increasing filter values on lines common to both sweep oscillator circuits may be the only solution.

#### *Poor Interlace, Fluctuating*

This is usually more objectionable than the steady type because it also adds a small amount of bounce to the picture. Receivers having troubles similar to that discussed in connection with Fig. 8 are often subject to fluctuating interlace. The cure is the same—increased AGC filtering, particularly on the bias line to the tuner. There are also numerous cases of fluctuating interlace caused by a poorly-balanced full-wave rectifier system. Fig. 10 shows unbalance at the output of a 5U4 rectifier tube with a weak section. Fig. 11 shows the improvement after the 5U4 was replaced. Figs. 12 and 13 were obtained at the same point

Fig. 14. Cathode signal when both B+ and bypass filters are in the same can.

Fig. 15. Normal signal at the output cathode restored by new bypass filter.

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Fig. 16. Vertical-sweep distortion when video signal reaches the output grid.

in a Philco set using two 5U4's. Fig. 12 was the result of one tube being weak; Fig. 13 was taken with two new tubes in the set. In both these cases, the B+ voltage drop was not sufficient to cause symptoms other than the fluctuating interlace.

### Distorted Sweep

While the poor linearity discussed at the beginning of the article can be classified as distorted sweep, this writer prefers to consider the following to be more truly representative of the term.

A DuMont RA340, after being serviced for other troubles, displayed a raster with two light horizontal stripes or bars. Close inspection revealed that they appeared to be the result of line bunching. The vertical section used a circuit similar to Fig. 4, except that the linearity control was in the cathode circuit of the amplifier and was bypassed with a 100-mfd, 50-volt electrolytic. Being an avid scope user, the serviceman used it to check this filter and observed the waveform in Fig. 14. The one he should have seen is shown in Fig. 15. Since the waveforms were taken with sweep at 30 cycles, he knew he should have only two peaks and not four. Checking further, he discovered that the cathode filter was housed in a can that also contained the high B+ filter. From this, he figured that coupling was taking place within the can. Replacing the cathode-bypass unit with a separate electrolytic of the correct value cured the condition. This symptom has also been found in Crosley and Emerson receivers using a vertical-amplifier cathode filter en-

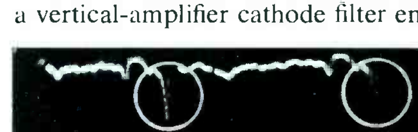


Fig. 17. Video feedback from picture tube causes distorted vertical sweep.

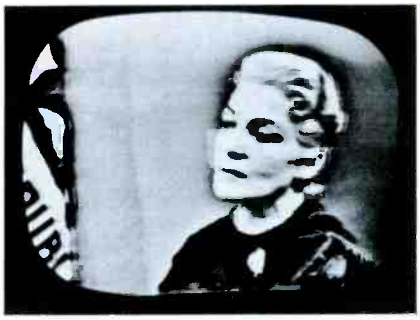


**Fig. 18. Clean picture after the retrace-blanking network had been modified.**

cased in the same can as the B+ input filter.

Another type of sweep distortion is caused by defects in the vertical-retrace blanking network. Usually, defects in this network cause all sorts of strange conditions, such as raster shading, etc. The picture on a Motorola TS-418 with a slightly weak picture tube appeared as shown in Fig. 16. This set uses a negative pulse from the sawtooth-peaking resistor for vertical-retrace blanking. Use of a scope showed that a small amount of video was being fed back to the grid of the vertical-output tube. Fig. 17 shows the waveform on the retrace-blanking line; the encircled pulses are for blanking, and the smaller signals are due to video pickup by the picture tube grid. The retrace-blanking pulse is taken off as shown in Fig 4, and thus signals fed back along this line will reach the grid of the vertical amplifier. By changing the retrace-elimination circuit to that shown in Fig. 18, the customer was spared the expense of picure tube replacement, and the picture came out as clear as that shown in Fig. 19.

This modification has been made in many different receivers (Muntz, Zenith, and Westinghouse to name a few), and in every case has worked out superbly. Only one bit of advice is needed: Be sure the pulse taken from the vertical transformer is a negative-going spike.

In conclusion, I'd like to point out that vertical-sweep troubles need not be your nemesis. Pattern your approach after the doctor who tries not to operate before he knows what's wrong; i.e., don't start changing parts indiscriminately just because they *might* be defective. Instead, take a little time to analyze the symptoms and make conclusive tests before you operate. You'll find the trouble more quickly, I'm sure, and your disposition will be better, too. ▲

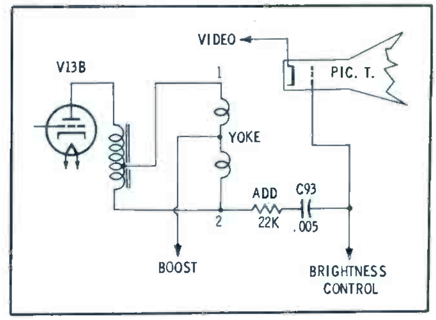



**Fig. 19. Modified retrace-blanking network used to cure sweep distortion.**


"I can't even get a test pattern."

# SHORT-LIVED TV TUBES

**by Allan F. Kinckiner**

While the life span of tubes used in TV receivers varies considerably, a *minimum* figure can be set up as a standard. Depending on the tube type and the use to which it is put, a TV tube may provide trouble-free performance for 3500 hours or more, but a minimum life-expectancy figure should be between 1500 and 2000 hours. This equals approximately one year of operation for the average set. Shorter tube life than this is considered as premature failure, and where a tube repeatedly fails in less than a year's time, a defective circuit component is most likely to be the cause.

Certain runs of tubes do fail in shorter time; however, these failures are most often due to open filaments or interelectrode shorts. It is a credit to the manufacturers that such defective runs are becoming scarcer. Other types of failures, such as lowered conduction and grid emission or gassy conditions, should definitely be considered symptomatic of circuit defects when they occur prematurely.

Premature failure is not always recognizable; tube appearance is an unreliable indicator (tubes that have been in a set several years often *look* better than others only a few months old). Then, too, you might replace a tube that another serviceman installed a few months previously. Even if you are one of those rare individuals who can translate all the code-dating systems, you would still fail to recognize a recently-installed tube if it had been in the other fellow's stock a long time.

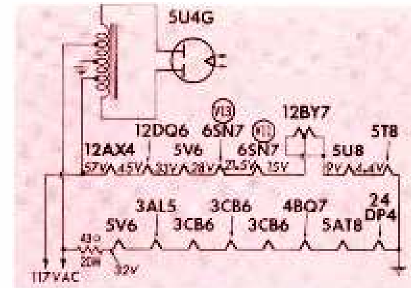
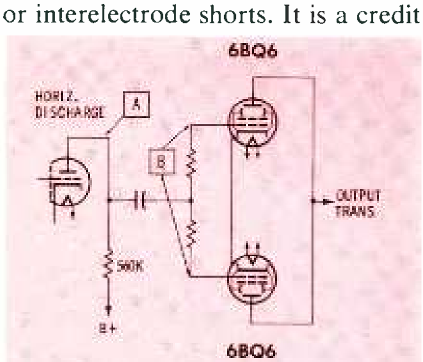



**Fig. 2. Filament-string hookup in the case of the short-lived damper tube.**

Customers can be helpful, but the frequent attitude of set owners is that the tube you just replaced is the same one the other man installed. When an itemized receipt or other evidence backs this contention, you have two alternatives. One is to replace the tube and attempt to get the customer's promise to call you the next time he needs service so you can follow up on the present job. (Leaving a piece of advertising literature with your phone number on it will induce the customer to keep this promise.) The other alternative is to suggest that the customer allow you to take the set in for a bench check; you'll be surprised at the number of times this suggestion will be accepted. More surprising is the number of times a customer himself will suggest a set be taken in, especially if he thinks he has had too much tube trouble lately. Most surprising is that a number of servicemen never make this suggestion, or belittle it when made by the set owner. Customer-serviceman relationships in such cases are discussed in some of the following instances of short-lived tubes.




| R=560K | | | | R=1 meg | | | |
|---|---|---|---|---|---|---|---|
| PT | SCOPE | DC | CRT HIGH VOLTS | PT | SCOPE | DC | CRT HIGH VOLTS |
| A | 325 | +70 | | A | 85 | +40 | |
| B | 115 | -5 | 12,500 | B | 75 | 0 | 8,000 |

**Fig. 1. Repeated burnout of the 6BQ6's was due to an off-value plate resistor.**

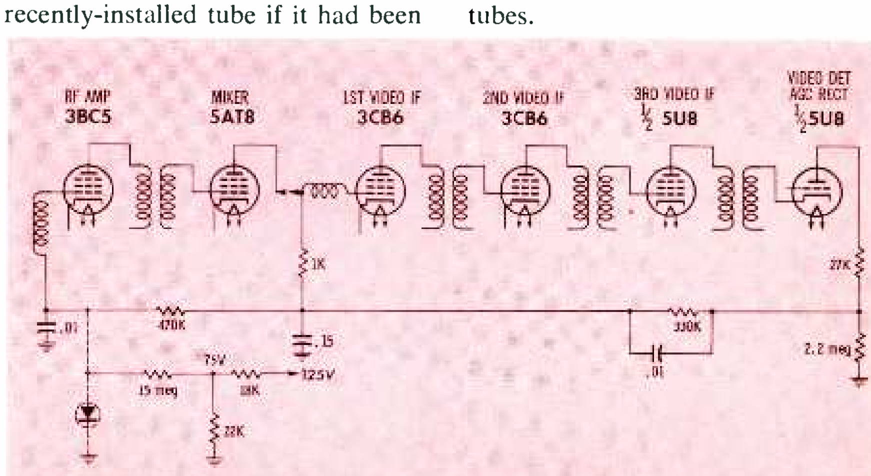



**Fig. 3. AGC delay voltage at the RF amplifier grid caused the tube to draw grid current when a clamp wasn't used.**

**The Case of the Narrow Raster**

The first set involved a Zenith 24G26 chassis belonging to one of our newer customers. The raster was narrow by about one inch on both sides. In the home, our man first tried a new 5U4 low-voltage rectifier without any result. Next, he replaced the two 6BQ6 horizontal-sweep amplifiers, and the width became fully adequate—so much so that he had to reduce the width-control setting (which was at maximum). Along about this time, the man of the house came in and told the serviceman that the set required a new pair of 6BQ6 tubes every six or seven months. He wondered if the previous servicemen were using inferior or old tubes. Our man assured him that such was not the case; the tubes just replaced were of good quality and reasonably recent date. Suspecting circuit troubles, the serviceman checked the 6SN7 horizontal oscillator-discharge tube. It also bore a recent code date, and the tube checker declared it to be in first class condition. The serviceman suggested taking the set to the shop for a complete bench check, and the customer readily agreed. He even expressed some enthusiasm over the idea. Here was a serviceman who didn't only change tubes; he tried to determine why the tubes required frequent replacing.

When he brought the set in, he related all the facts to the bench man, and started to hook up the set to demonstrate. He was abruptly stopped by the bench technician who, turning the set on its side, took a reading with the ohmmeter. Only then did he turn the set on, drawing a rough schematic like that in Fig. 1 as he waited for it to warm up. Using a voltmeter and scope, he obtained the figures shown in the table headed "R=1 MEG." The set was turned off, and after replacing the resistor shown in the schematic as 560K (the part he had first measured with the ohmmeter and found to read 1 megohm), the set was again turned on. Scope and voltmeter readings now became those shown in the table headed "R=560K."

Our outside serviceman was impressed with the differences in the readings, but wondered if noting them was really necessary. "Not necessary, but it explains the tube-failure mystery," the bench man explained. "I'd be afraid to let the set go back without being sure in my own mind that the discrepancies we found were wholly responsible for the trouble."

"Wouldn't a voltage check across the grid resistor be enough of a check?" the outside man asked.

"The voltage reading on the grid of the horizontal amplifier is the result of the oscillator signal, and since its shape is as important as its amplitude, I prefer to observe the signal with a scope," replied the bench man. "Besides—there's a lot of resistance in the dual 6BQ6 cathode return, and the voltage across the grid resistor only runs a few volts as compared with the 30 or more volts found in sets with low-value or no cathode resistor." The bench man further explained that he had found this condition about thirty times in the past year, which was why he had checked the resistor first. He admitted that the tables were merely for the other man's benefit.

After slight adjustments of the buzz control and quadrature coil, set operation was top-flight. When it was returned to the customer, the increased brightness was readily noted by him. But his crowning comment was, "You made the sound clearer, too!"

### The Case of the Troublesome 12AX4

An Emerson chassis #120286 was brought in at the customer's insistence because it had a habit of burning out the 12AX4 damper tube. The circuit in Fig. 2 shows that the set uses a power autotransformer with center tap grounded to the chassis. Tube filaments are series-connected in two strings between opposite sides of the power line and the chassis.

The serviceman suspected that pulse voltages at the 12AX4 cathode were responsible for the breakdowns but, before exploring this possibility, decided to take filament-voltage readings for all the tubes. Measurement across the 12AX4 filament was over 16 volts; all others were close to normal except those across the two 6SN7 tubes V11 and V13. They read only about four volts each. The 6SN7's both bore the same code date and were of the same make. Replacing them with new tubes restored correct filament voltages all around.

Tube filaments that change resistance with age have never been explained to my satisfaction, and I'm only one of many servicemen who have been puzzled by the condition. Even more puzzling in this instance is why all the surplus voltage appeared across the 12AX4 filament, rather than distributing itself across the entire filament string.

### The Case of the 12-Second Warm-Up

An Emerson chassis 120245D was brought in primarily because of a defective filter, but the set owner also complained about having to replace the RF amplifier every eight months or so, when the picture got too dark or would not hold sync. After replacement of the filter, the set was further checked, uncovering the fact that the AGC-controlled tubes were drawing grid current. Allowing the set to become stone cold, new tubes were installed in the RF and the first IF stages, but before turning the set on, a VTVM was connected across the AGC line. When the set was turned on, the meter swung violently positive. Quickly turning the set off, the meter polarity was reversed and the scale set at 60 volts. Now when the set was turned on, it was found that +20 volts was being applied to the grids of the AGC-controlled tubes. The voltage decreased slowly and fell to zero after about twelve seconds, when the regular AGC bias took over.

A study of the simplified circuit in Fig. 3 readily shows where the positive voltage comes from — the voltage divider formed by the 18K and the 22K resistors. It is counteracted in two ways — through DC conduction of the video detector and development of AGC voltage through rectification of the video signal.

It should be noted, though, that if any tube between the antenna and the video detector is slow in reaching its normal conduction level, the positive voltage will be impressed on the AGC-controlled stages even after they have reached full conduction. This condition can easily lead to a rapid lowering of tube transconductance, or give rise to grid emission and "gassy" operation.

The circuit is almost as old as those for AGC control, and is incorporated for the purpose of keeping bias on the RF stage slightly lower than IF bias. When it was used in earlier receivers, an unused diode section was available—either in a 6AT6, 6T8, or some similar type—for use as a clamp on this delay voltage. Diode sections are at a premium in later sets using -BN6 or -DT6 type audio demodulators, and thus the fact that AGC-controlled tubes are driven pretty hard on initial warm-ups is simply ignored.

We modified this circuit merely by adding a germanium diode as shown in Fig. 3. We used a 1N38, connecting the cathode to ground and the anode to the tuner AGC line. Semiconductors have other advantages; they don't have the warm-up time lag of tube-type diodes, they don't affect normal AGC action, and they have a tendency to flatten the vertical blanking pedestal in some sets. Where this latter improvement has been noted, vertical interlace was slightly better as a result.

### The Case of the Self-Service Addict

The frequent need for replacement of 6BQ7's and similar types used as cascode RF amplifiers has led many servicemen to believe such tubes are inherently short-lived. Actually, the short life span of these tubes stems from the same condition noted in the previous case. While their early failure has been noted in receivers of virtually every make, using every type of AGC, it is more prevalent and severe in receivers employing keyed AGC.

A typical case recently involved a Motorola TS-553 which had an extremely snowy picture even though it was located in a prime signal area. On removing the back cover in preparation for replacing the 6BC8 RF amplifier, the serviceman was surprised to find five old 6BC8's lying in the chassis pan. The customer explained that he had been replacing these tubes ever since another serviceman had fixed the set about a year after its purchase. Since the trouble always appeared in the same fashion, a snowy picture, the customer had been replacing the tube himself instead of calling in a professional. Pointing out that it was not normal for the set to be kicking out tubes so often, the serviceman easily obtained an okay to take the set in for a bench check.

The set was hooked up in the shop, and as in the preceding case, the voltage on the tuner AGC line was monitored. In this set, the initial reading was over 50 volts, decreasing very slowly for the 20 seconds or so it took the AGC voltage to develop. The reason the voltage was higher in this set than in the Emerson is that the delay voltage is taken from a 250-volt source; the voltage remained positive longer because development of the negative bias depends on conduction of all the tubes from the RF stage to the video amplifier plus the horizontal section and the keyer. The cure was the same, however—adding a 1N38 diode to clamp the tuner AGC line.

### The Case of the Chain Reaction

An Admiral 19SZ4D receiver with RF and IF stages as shown in Fig. 4 was brought in with the following parts damaged: R13, R35, R37 and R23 all cooked to lower resistances than normal; the 6BZ7 RF amplifier shorted; and the 6CB6's and the 6DG6GT all weak. This extensive damage was all caused by the 6BZ7 shorting, resulting in a positive voltage being placed on the 6CB6's through the AGC line. This increased the current drawn by these tubes which, in turn, overheated resistors R35 and R37, and also weakened the 6DG6GT.

In all probability, the damage would have been limited to burned resistors R13 and R23 had there been a diode clamp on the tuner AGC line. Thus, the inclusion of a clamp, as suggested in the previous cases, will not only protect the RF tube from being driven too hard, but will also protect other tubes and their associated parts.

We use 1N38 diodes in this application for two reasons: First, the forward voltage rating of a 1N38 is 100 volts, which is about double the value of the delay voltage. Sec-

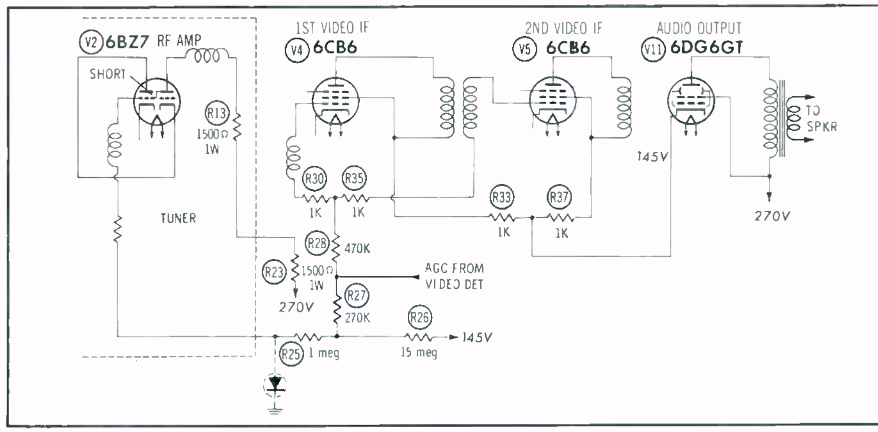



Fig. 4. A chain of failures could have been prevented with an AGC clamper.

ondly, 1N38's have the low-forward, high-reverse resistance qualities needed for this application.

There are other, more readily apparent reasons for short tube life than those in the cases presented. The most common is premature horizontal sweep-amplifier failure due to excessive screen grid voltage, resulting from decreased resistance in the screen-grid dropping resistor. In sync stages, tubes have been found to fail prematurely because of slight leakage in coupling capacitors. Early loss of transconductance in 6U8 and 6X8 tubes used in video amplifier stages has not yet been pinned down to any circuit fault or component defect.

In addition to developing new types, tube manufacturers are also constantly engaged in improving the quality of commonly-used older types. Improved versions must retain essentially the same characteristics as the prototype so they can be used as replacements. Generally, this requirement is upheld, but our last case concerns a six-year old receiver in which a recently-manufactured tube would not operate properly.

To the serviceman, this call appeared to be simply a matter of replacing a tube. The set was a Zenith 20J22 with varying vertical size. The picture would stretch well beyond the mask outline and then alternately shrink so that it was about an inch short at both top and bottom. Tapping the 6BL7 indicated it was the culprit, so the serviceman stuck in a replacement and proceeded to make the necessary height and linearity adjustments. To his surprise, he could not obtain vertical lock-in, even after trying two other 6BL7's of different brands. Driving to several parts distributors (which luckily were not too far away) he purchased 6BL7's of makes different than those he had already tried. On returning to the job, he was quite chagrined to find that not one of the new tubes would permit vertical lock-in to be achieved. He gave up and brought the set in.

He presented the set and the above information to the bench technician, along with the new 6BL7's, which now included six different brands. Before working on

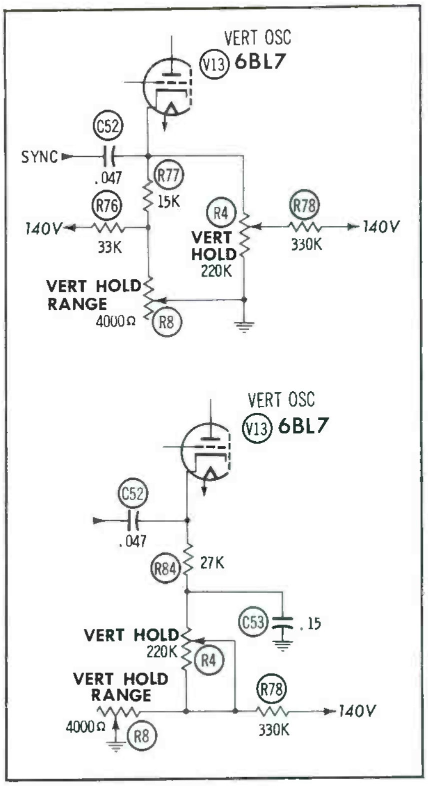



**Fig. 5. Alternate vertical-hold control circuits for the Zenith Chassis 20J22.**

the set, the bench man borrowed an old 6BL7 from one of the sets in the shop. Sure enough, the set worked perfectly. Delving into the circuit, he found that someone had previously replaced the 4000-ohm, vertical-hold range control with a 2000-ohm, 10-watt fixed resistor. The choice seemed logical enough, and because the set had worked, this type of repair could not be condemned. It also appeared logical that if a 4000-ohm control was now installed, vertical lock-in could be obtained with a new 6BL7 in use—but such was not the case. Further circuit checking turned up the fact that R78, a 330K-ohm unit, had increased in value. The bench man almost had apoplexy after the set still refused to hold vertically with the new resistor in place.

The PHOTOFACT folder indicated that two different circuits were used. The chassis under discussion contained the circuit in Fig. 5A. Since changeover to the alternate circuit shown in Fig. 5B seemed simple enough, the necessary work was done. Now the set would not only hold vertically, but it had that "snap into sync" characteristic so indicative of good vertical lock-in—and with each and every one of the six brands of tubes, too. ▲

# ELECTRONIC HEATER CIRCUITS

## . . . and how they work

by Melvin Whitmer

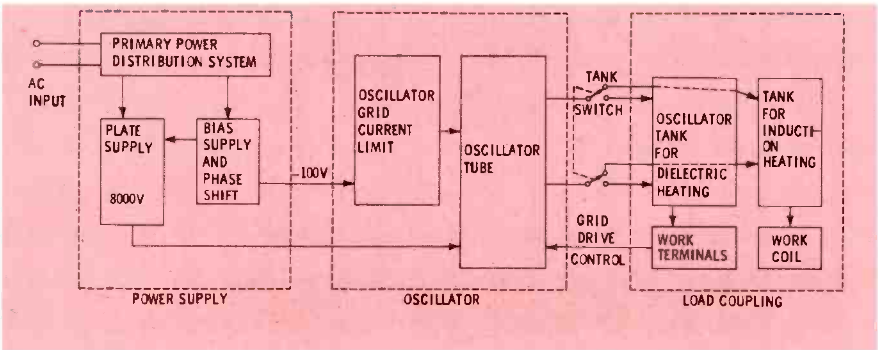



**Fig. 1. Typical heater has power supply, oscillator and load-coupling sections.**

In parts 15 and 16 of this series, dielectric and induction heating applications were described. You may recall a brief statement to the effect that the same heater may supply RF power for either of these applications. This versatility is made possible by simple changeover and load-coupling techniques.

The block diagram in Fig. 1 shows how few circuits are really involved in an electronic heater. Note that the primary power distribution system contains protective devices required to save the equipment from self destruction, and that the oscillator section contains filters to prevent harmonic and other spurious oscillations from being radiated. In addition, the load-coupling section quite often has facilities for controlling the amount of feedback.

### Primary Power

AC power distribution for a typical 5-kw electronic heater is shown in Fig. 2. Closing MAIN POWER switch S1 applies AC power through fuses F1 and F2 to the fan, which operates continuously. Closing FIL ON switch S2 supplies primary power to relay K1 and lamp DS1. After S2 is closed, the normally-open contacts of relay K1 close and supply power to filament transformer T1 and bias transformer T4. One secondary winding on transformer T1 couples power to thermal time-delay switch S4, while the others supply filament power to the various tubes. It takes five minutes for S4 to close; thus, tube filaments are permitted to reach operating temperature before

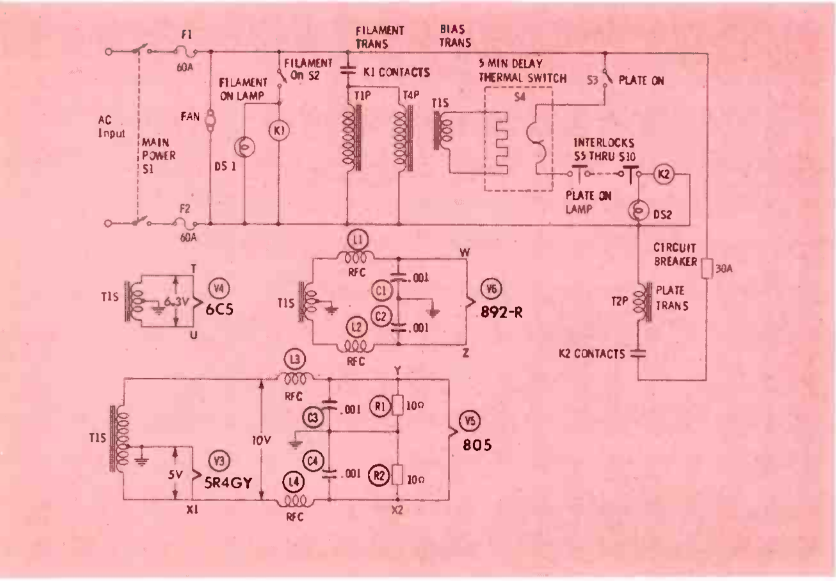



**Fig. 2. AC power distribution for a typical electronic heater.**

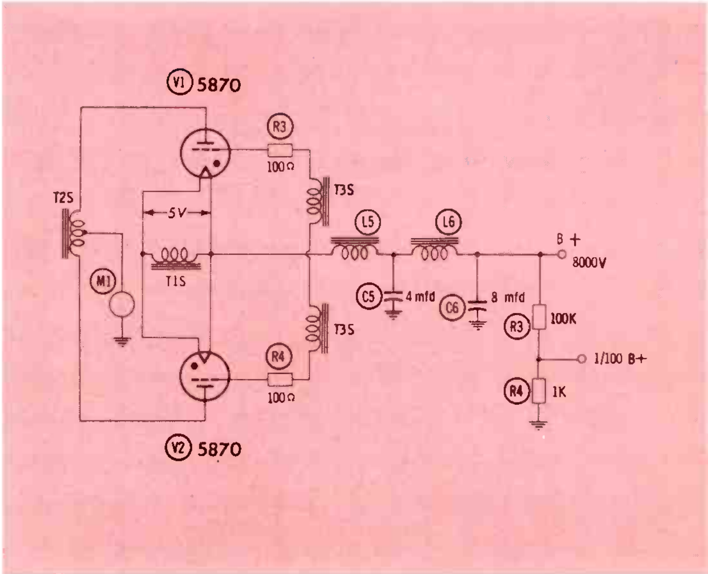



**Fig. 3. Power supply uses grid-controlled thyratrons.**

plate power is applied.

After the time-delay interval, actuating PLATE ON switch S3 will complete the primary power circuit for relay K2 and lamp DS2, provided all access doors are closed. Interlock switches S5 through S10 interrupt the primary power circuit for K2 when any one of the six access doors are opened, thereby eliminating shock hazards. When relay K2 energizes, its normally-open contacts close and supply power to plate transformer T2. Overload protection for the plate supply is provided by circuit breaker CB, which interrupts the T2P circuit when the plate transformer current exceeds 30 amps.

### Plate Supply

The plate supply section is shown in Fig. 3. Transformer T2 supplies high voltage for mercury-vapor thyratrons V1 and V2. These tubes provide an output voltage which is continuously variable from 0 to 8000 volts. Their respective currents are controlled by a phase-controlled AC voltage coupled through T3S to their grids. The phase-shift network consists of T3, P1 and C7, all of which are shown in Fig. 4. Phase can be varied from 0° to 174° by adjustment of potentiometer Pl. Fig. 5 shows how various resistance settings for Pl affect phase shift, thyratron conduction time, and output voltage. Conduction time is indicated by the shaded areas in the grid-plate voltage curves, which should help you visualize the control action. Output voltage is included only to indicate the reduction in voltage as phase shift is increased.

Referring again to Fig. 3, filter capacitor C5 charges to about 90% of the peak thyratron plate voltage with no load on the power supply. Power supply loading will decrease the value shown because output voltage is directly related to thyratron conduction time. For any given period of conduction, there is a corresponding value of available power. Since power is the product of voltage and current, an increase in current through the load must result in reduced output voltage.

### Oscillator Bias

Although oscillators generate self bias, large power oscillators are

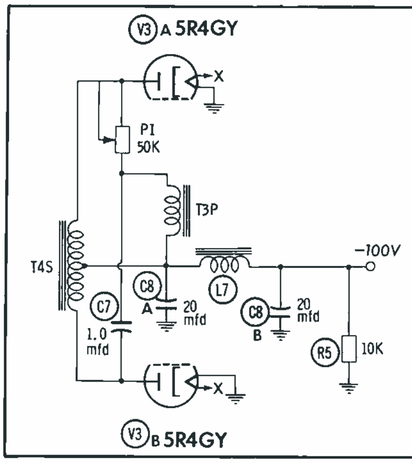



**Fig. 4. Bias supply includes phase-shift network for controlling the thyratrons.**

often protected by returning the control grid to a fixed negative voltage source. The normal operation of the oscillator remains unaffected because the fixed bias is much less than the self-generated bias. If oscillation ceases, however, the fixed bias limits oscillator plate current to a safe value. Transformer winding T4S (Fig. 4) supplies AC to bias rectifier V3 and the phase-shift circuit. The bias voltage of –100V is developed by the grounded-cathode (filament) rectifier and a pi-type filter located between the tap on T4S and ground. This voltage is applied to the oscillator grid through grid-current meter M2, R6, R7, R8, and radio-frequency choke L14 at the lower left in Fig. 6.

The bias voltage also acts as plate voltage (negative voltage to a cathode causes the same action as positive voltage to a plate) for current-control tube V4. Oscillator grid current through R6 develops bias for V4, and the plate current of V4 flows through R9 and develops bias for V5. The conduction level of V5 determines how much feedback signal will be applied to the grid of the power oscillator. Heavier conduction of V5 means less feedback and therefore less oscillator output power.

### Power Oscillator

The power-oscillator circuit shown in Fig. 6 may be converted from a dielectric to an induction heating application simply by changing the tank circuits. Two separate oscillator coils provide a Colpitts-connected high-frequency circuit for dielectric work, or an Armstrong-connected low-frequency circuit for

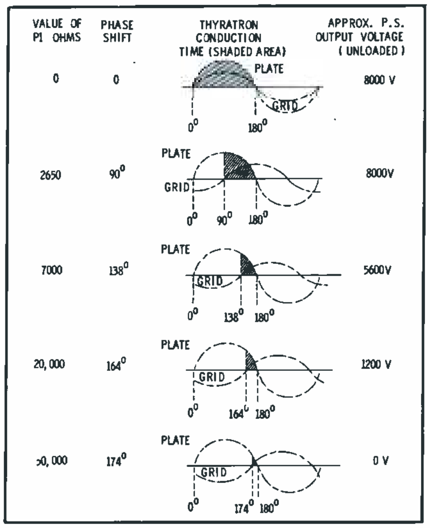



**Fig. 5. How grid-signal phase affects conduction time and output voltage.**

induction work. Copper connectors are bolted between the tube circuit and corresponding points on the desired oscillator coil. To change oscillator coils, the connectors are simply transferred from one oscillator coil to the other.

As an oscillator, this circuit differs from the local oscillator in a radio receiver and the variable-frequency oscillator in a transmitter in two respects. First, radio-frequency power is consumed by the load in large quantities. Second, tubes V4 and V5 limit the grid current. Neither of these features are encountered when the oscillator simply functions as an exact frequency source.

The first difference, that of power consumption, makes the oscillator change frequency. A normal frequency drift when changing from minimum to maximum load is 10% of the no-load oscillator frequency. Therefore, a dielectric heater operating at 27.3 mc wtihout a load may


" . . . I said somebody bring out Mrs. Adams' set . . . "

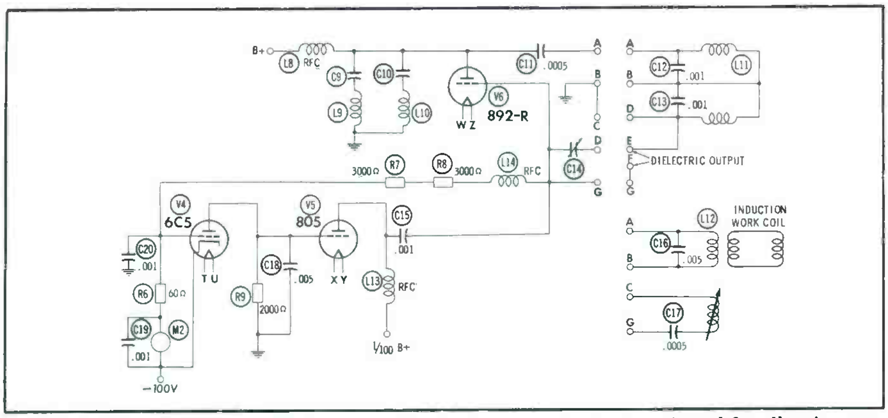



Fig. 6. This power oscillator circuit features automatic signal-feedback control and may be used for either dielectric or induction heating applications.



operate at 25 mc when loaded to capacity. For this reason, electronic heaters are usually operated within a shielded room or enclosure to prevent undesirable radiation.

The second difference, use of control tubes V4 and V5, guards against excessive grid current. When RF feedback drives the oscillator grid positive, it conducts to charge the feedback capacitor (C14 or C17). As the RF signal swings negative, capacitor discharge current flows through R8, R7 and R6. Voltage developed across R6 forms the input signal for V4, driving this tube toward cutoff. If the RF feedback voltage causes oscillator grid current of 165 ma or more to flow, the resultant voltage across R6 drives V4 to cutoff. This, in turn, removes the bias from V5 so that the next positive RF swing at the grid of V6 is clamped by the conduction of V5. Grid current for V6 is thus limited to a safe level.

#### Load Coupling

Any one of the four capacitors in the Colpitts oscillator network may be replaced by the work in a dielectric-heating application. Substituting the work for capacitor C11 provides increased coupling when the dielectric constant of the work is low. Thus, the tank circuit receives a greater push when the work is consuming the greatest amount of power. Using output terminals instead of tank capacitor C12 or C13 removes the DC plate voltage from one side of the output terminals, but does not provide compensation for changes in the dielectric constant of the work. The oscillator frequency changes more when the work replaces one of the tank capacitors than it does when the work replaces either of the output coupling capacitors. Replacing C14 with the work provides increased coupling for a material with a low dielectric constant. The regular output terminals shown in Fig. 6 have less DC voltage across them than plate-coupling capacitor C11. Making the grid-coupling capacitor C14 variable widens the dielectric-heating applications of the circuit because oscillator grid drive can be adjusted to compensate for different work properties.

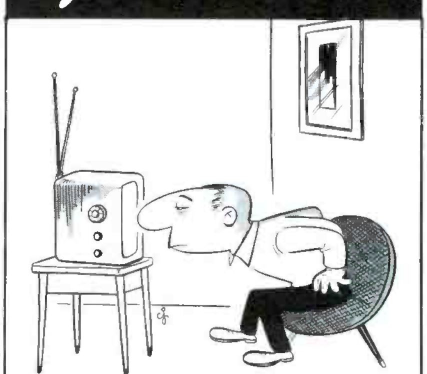
Load coupling for induction heating must be based on generating a magnetic field around the work. Thus, a portion of the tank coil or a coupling loop must be used. Using an extension of the tank coil is usually difficult because of mechanical problems, in addition to maintaining the proper tank coil inductance. The most satisfactory method of coupling power to the load is through a low-impedance link. The link eliminates the above problems and permits low-impedance power transmission over considerable distances. Several applications described in the August issue used link coupling to facilitate impedance matching.

### Harmonic Suppression

Lead inductance and stray capacitance are often large enough (due to the physical size and spacing between components) to resonate at points near the second harmonic of the power oscillator. The resultant spurious radiation not only wastes power, but also interferes with various radio services. To counteract this radiation, lumped elements that resonate at the same frequency are connected from the oscillator plate to ground. Two such networks (called suppressors) are shown in Fig. 6. The network of C9 and L9 passes one spurious frequency to ground, while C10 and L10 pass the second harmonic to ground.

This concludes the coverage on electronic heating units. In the next installment, we'll deal with open and closed loop recorders. A discussion on the three most popular types of electro-mechanical pen positioners will be included, along with service hints and typical troubles. ▲

*Guess Who ?*



is too cheap to buy a new picture tube.

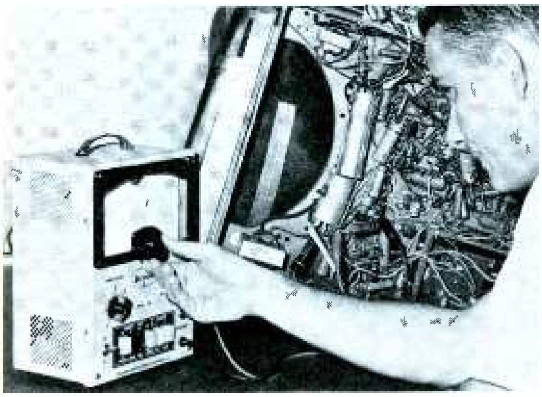


Fig. 1. Jackson's capacitance checker uses bridge circuit and tuning-eye tube.

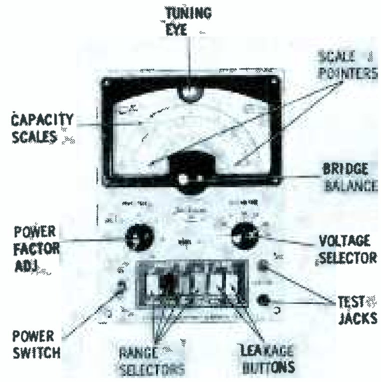



Fig. 2. Front-panel features of the Model 591. Push buttons are color-coded.

# An "Eye" for Capacitors

When troubleshooting at the bench, why do we often suspect a capacitor is causing the trouble? Isn't it because we've been able to readily check the other components with tube tester and ohmmeter, saving the capacitors for last because we feel that they are difficult to test? Thus, the innocent looking capacitor often gives us our toughest "dogs," and we're prone to suspect it on every job that defies us longer than average.

I have emphasized this point to call your attention to the instrument being used in Fig. 1. Manufactured by the Jackson Electrical Instrument Co. of Dayton, Ohio, the Model 591 Capacitor Tester fulfills a wide range of applications, including tests for shorted, leaky, open, intermittent, value and power factor conditions.

*Specifications are:*

1. *Power Requirements—117 volts, 60 cps; power consumption approximately 20 watts; transformer provides line isolation.*
2. *Capacitance Measurement—7 individual scales for 4 overlapping ranges covering from approximately 10 mmf to 1000 mfd; special scale for values above 30 mfd; open, shorted, or intermittent conditions automatically indicated by tuning eye; push-button range selector and test leads provided.*
3. *Leakage Tests — measurements for both polarized and non-polarized capacitors made under 7 different working voltages up to 500 volts; special low-voltage range for transistor-circuit capacitors; conditions indicated by tuning eye; capacitor automatically discharged by releasing push buttons.*
4. *PF Check — power factor measurement for all electrolytic capacitors from .1 to 1000 mfd; tuning-eye indications provided by setting of separate 0 to 60% control on front panel.*
5. *Size and Weight—10" x 7½" x 5"; 10 lbs.*

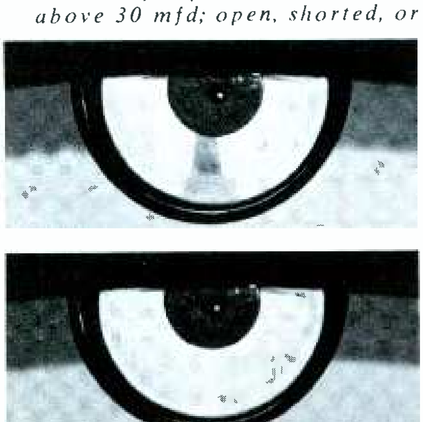


Fig. 3. Appearance of the indicating "eye" in open and closed positions.

Examining and using the Model 591 on the bench, I checked a large quantity of capacitors ranging in value from 10 mmf to 350 mfd—those found in typical radio and television applications. I was most impressed by the simple, straightforward indications I was able to obtain. Since the unit is not designed for any kind of in-circuit testing, the results left no doubt as to the condition of each capacitor.

The instrument employs an impedance-bridge circuit which balances a known standard against the unknown with proper setting of a potentiometer on the front panel. A 6E5 tuning-eye tube serves as a bridge detector and indicating device for all tests. As pointed out in Fig. 2, the front panel also features a voltage selector for leakage tests, and a power factor control to determine the percentage directly.

The range-selector buttons are color-coded (green, red, black, and grey) to match corresponding arcs on the capacity scales. The bridge balance control has a rotation of only about 300°, but with two scale pointers attached to its shaft, its effective scale length is increased considerably. The dual pointers move in a windmill-like fashion — the longer one indicating capacity on the outer scale arc, and the shorter on the two inner arcs. A complete test takes only two steps — one for leakage and one for measurement of capacitance.

When testing paper and mica capacitors, I first turned the instrument on and allowed it to warm up. Then, I connected the questionable component across the test jacks. Incidentally, the instruction manual mentions the fact that small-value mica capacitors must be connected directly to the test jacks in order to obtain an accurate reading. This, of course, eliminates any stray capacity introduced by the two test leads. Through actual trial and error, I found that the test leads seem to have little effect on units with values above 200 mmf, but a great deal on those below.

Getting back to the procedure, I next set the voltage selector to a position as high as possible without exceeding the rated value of the capacitor under test. (If the value of a paper type is above 1 mfd, however, the selector should be set to its 200 volt position.) To test for leakage, I pressed the leakage button labeled PAPER-MICA and took note of the eye tube at the top of the front panel. If the eye opens as pictured in Fig. 3A, the capacitor passes the test; if it remains closed as in Fig. 3B, the unit has excessive leakage and should therefore be discarded. For some capacitors, especially those of higher value, I found that it may be necessary to hold the leakage button in for 15 seconds or so before evaluating the test results.

Following instructions, I continued with the second step of the procedure and pressed one of the range-selector buttons covering the approximate value of the capacitor under test. Watching the tuning eye, I rotated the bridge balance knob until I obtained a circuit balance which produced the widest eye opening. I was then able to read capacity value on the scale corresponding to the range I had selected. If the capacitor is open, circuit balance will only occur at the far left end of the scale. With a shorted unit, on the other hand, a balanced indication will occur only at the far right end of the scale. These areas are labeled OPEN and SHORT, respectively. I also noted in this test that intermittent capacitors will show either open, shorted, or excessive change in capacity whenever they are tapped or slightly heated.

Electrolytic capacitors are tested in much the same manner; however, in the value range from .1 to 1000 mfd, the control marked POWER FACTOR is connected in the bridge circuit and must be adjusted in conjunction with the balance knob to obtain the widest eye opening. If a balance cannot be obtained at any setting of this control, the component undoubtedly has a power factor higher than 60% and should therefore be rejected. In testing electrolytics for leakage, I noticed in some cases that I had to wait for a minute or so before their plates would form sufficiently to produce an opening of the eye.

## A New VTVM

The piece of equipment shown in Fig. 4 is a Model VT-10 vacuum tube voltmeter by Arkay of Richmond Hill, New York. Housed in a black plastic case and featuring a wide-angle scale, it comes in either kit or factory-wired form with two test leads plus a DC probe and cable.

*Specifications are:*

1. *Power Requirements—105/120 volts AC, 60 cps; power consumption about 7 watts; 1.5-volt battery supplied.*
2. *DC Voltmeter—ranges 0 to 3, 15, 75, 150, 300, 750, and 1500 volts; zero center-scale ranges 0 to 1.5, 7.5, 37.5, 75, 150, 375, and 750 volts; input resistance 11 megohms; both + and — positions on function switch; balance control provided for zero and center-scale adjustments; 1 megohm isolation provided in DC probe.*
3. *AC Voltmeter—rms ranges 0 to 3, 15, 75, 150, 300, 750, and 1500 volts; peak-to-peak ranges 0 to 8, 40, 200, 400, 800, and 2000 volts; peak-to-peak scales in red.*
4. *Ohmmeter—0 to 1000 megohms in 7 ranges of R x 1, 10, 100, 1K, 10K, 100K, and 1 meg; center-scale value 10; circuit powered by self-contained 1.5-volt battery; zero and ohms-adjust controls provided on panel.*
5. *DB Meter—3 ranges from −10 db to +58 db on AC voltage ranges of 15, 150, and 1500 volts; direct-scale reading from −10 db to +18 db; zero db=6 milliwatts across 500-ohm line.*
6. *Panel Meter—6", 400-ma movement with burnout protection; accuracy within 2%.*
7. *Size and Weight — 7¾" x 6½" x 4½"; 3½ lbs.*

Examining one of the factory-assembled units in the lab recently, I found it possessed all the versatility one could want for radio and TV troubleshooting. Since the manufacturer made no direct mention of the instrument's accuracy,

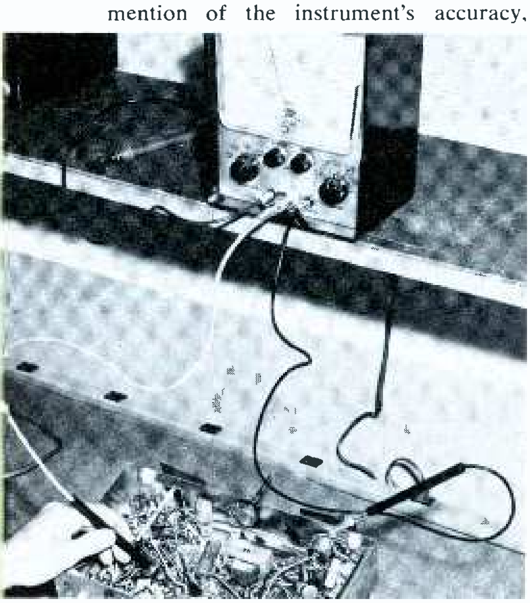


**Fig. 4. Model VT-10 AC-powered VTVM is designed for both lab and bench use.**

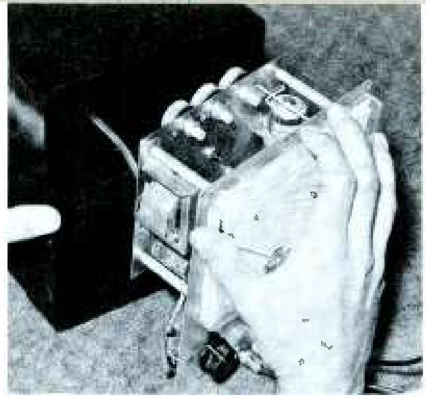


Fig. 5. Arkay meter slips out of its case after removal of four panel screws.

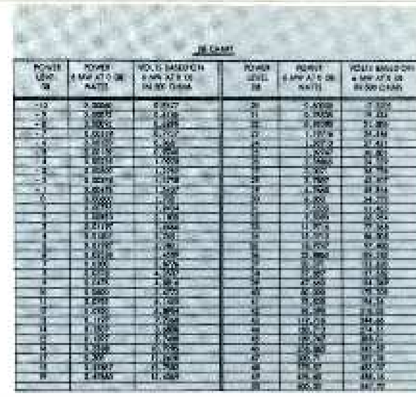


Fig. 6. The chart in the Arkay manual lists db levels in both watts and volts.

however, I thought that I might check out this all-important characteristic against our laboratory standards.

My first step was to recalibrate the meter by following instructions in the manual. I found the calibration adjustments located across the top chassis frame as pictured in Fig. 5. After calibrating the DC function using standards for 12, 60 and 120 volts, I made what is called a "diode adjustment" to balance out any contact potential introduced by the 6AL5 or 12AU7 tubes employed in the VTVM circuit. For the AC calibration, I used a recommended 75-volt standard, and also two others at 100 and 140 volts.

On completing the calibration, I measured a number of known AC and DC voltages as well as several precision resistors. My findings were favorable. I made spot checks at 1, 10, and 100 marks on the ohms scale for all resistance ranges and found that the readings were only off a hair from the lowest value to the highest. To me this meant that the ohmmeter accuracy was satisfactory for many laboratory applications and certainly adequate for the service bench.

Voltage-wise, I found the AC accuracy within ±5% and DC readings within ±3% of full-scale deflection. Actually, the few DC checks I made were closer than this rating indicates, but to be conservative, I'm quoting this percentage since it is generally accepted by the industry and is more than required for practical servicing applications.

Another function of a VTVM often ignored by the service technician, is its capability of expressing power loss and gain in terms of decibels. Since the meter is provided with a special db scale, I thought you might be interested in its "whys and whatfors."

Decibel indications have a relationship to the response of the human ear; i.e., a db ratio is roughly proportional to an increase or decrease in loudness or acoustical power as detected by a listener. Db values (based on power levels) may also be added or subtracted algebraically, and are therefore simple terms to use when expressing audio gain or loss.

In looking over the manual for the Model VT-10, I found a full page db chart which is reproduced in Fig. 6. This chart involves three factors: In the first column, db power level; in the second, corresponding power in watts; and in the third, an equivalent voltage value. When using this chart and/or the db scale of the meter, you must remember that all values and readings are accurate only if the load impedance you are working with matches that at which the instrument has been calibrated. In this instance, zero db equals 6 milliwatts of power measured across a 500-ohm load.

Using this function in a practical application, I tested an AF amplifier by using an audio oscillator as a signal source, and compared the input and output power levels in decibels. To take measurements across the input and output loads, I set the meter up to read AC voltage and balanced the pointer to zero on the db scale.

Provided my load impedances were 500 ohms, I could read directly any db level from −10 to +18 with the range switch in the 15-volt position. With the range switch in the 150-volt position, 20 db must be added to the reading indicated by the pointer. In this case, the range was from +10 db to +38 db. In the 1500-volt position, 40 db is added to make the range +30 db to +58 db.

I noted in this experiment, however, that as long as both input and output load impedances are equal, they need not have a value of 500 ohms to obtain an accurate indication of gain or loss. The individual db readings taken across input and output will not be a true representation of power, but their difference represents the change in power.

# Dynamic Transistor Tester

Seco Mfg. Co., Minneapolis, Minn., has developed a new transistor checker that operates on a dynamic testing principle employing a pulse signal generator. Shown in Fig. 7, the Model 100 is a lightweight portable instrument and is completely self-powered.

*Specifications are:*

1. *Power Requirements — one self-contained 1.5-volt battery, universal replacements available.*
2. *Transistor Tests — checks* PNP *and* NPN *types in or out of circuit for opens, shorts, and gain; neon indicating lamp on front panel; special* GO-NO GO *quick check and gain-comparison test provided.*
3. *Panel Features —* ON-OFF *switch for*

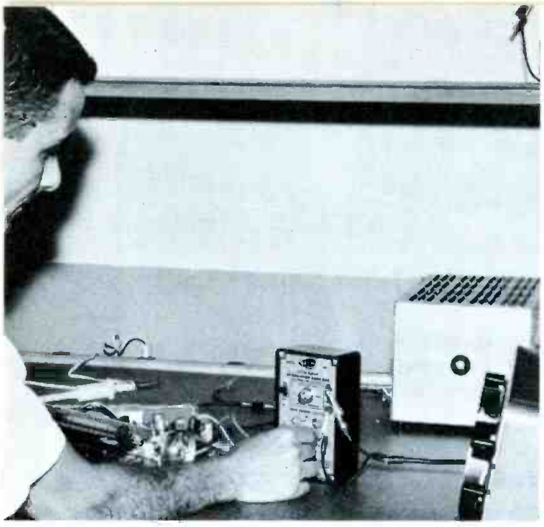


Fig. 7. Scope is used with Seco 100 to view the transistor-developed signal.

*neon lamp; output jacks for voltmeter or scope indications; base current control and test selector switch;* PNP-OFF-NPN *selector switch; one 4-element transistor socket plus separate emitter, base, and collector test leads.*

4. *Size and Weight—6¼" x 3¾" x 2"; 1¼ lbs.*

When I used the Seco Model 100 to test a number of known good and bad transistors, I immediately wanted to find out what made it tick. The instrument does not measure current or resistance on a meter, but indicates the condition of a transistor by placing it in a current-amplifying circuit. Its output is then evaluated by the glow of a built-in neon bulb, or by monitoring the output with an AC voltmeter or oscilloscope. Special output jacks are provided on the front panel for this purpose.

So that you will better understand its theory of operation, I have shown a schematic of the tester in Fig. 8. The transistor under test is connected as a grounded-emitter stage in a pulse generator circuit. This network functions as a simple blocking oscillator, driving the transistor into saturation and thereby generating a pulse signal with a repetition rate of approximately 150 to 12,000 cps.

A single 1.5-volt cell supplies operating bias for the transistor, while correct polarity is selected by the PNP-OFF-NPN switch located on the front panel. The 5K-ohm pot shown in the schematic permits the operator to vary base current and thereby establish a conduction range for the transistor. I found that the higher you set this control before the transistor cuts out, the higher the representative gain will be. You'll find this feature useful when comparing operating characteristics of like or unlike transistors.

When a satisfactorily operating transistor is connected to the tester, the AC signal developed in the primary winding of the transformer is stepped up in the secondary to fire the NE51 indicator. Brightness of the neon glow will be directly proportional to the amplitude of the output signal. When using the output jacks to monitor the signal, the lamp switch should be placed in its off position to prevent any limiting or clipping

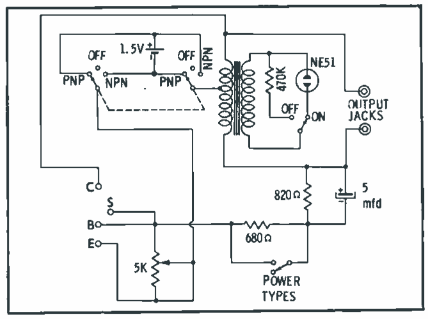



**Fig. 8. Dynamic testing circuit used in Seco Model 100 transistor checker.**

action by the bulb itself. With this switch in its off position, a 470K-ohm resistor loads the secondary of the transformer.

The switch shunting the 680-ohm resistor in the base network is used to change the amount of feedback present in the test circuit. Thus, the instrument can be set up to test a wide range of transistors from small signal types to power units. With this switch in its POWER TYPES position and the resistor in the circuit to reduce feedback, power transistors can be tested at currents up to 50 ma or more. To give you an idea of the actual test procedures involved, here are the motions I went through to test several different transistors in our lab.

For a straightforward "go-no go" indication, I first adjusted the base current control to its zero mark and turned on the neon lamp switch. Next, I pushed the slide-type selector switch to either its PNP or NPN position, depending on the type I was testing. I noted, however, that if you couldn't determine the type and switch setting, no damage would occur to the transistor or the instruments as long as the base current knob pointed to "0". This proved very interesting; if the bulb didn't glow after connecting the transistor and placing the switch in one position, I merely switched it to the other, got an indication, and thus identified the type automatically. Of course, if the unit under test is defective, the bulb will not glow in either position.

In each test I either inserted the transistor into the panel socket or attached the coded clip leads to the proper elements. Once the transistor is connected to the tester, its condition is indicated immediately by the glow of the neon bulb. The bulb will glow if the transistor is functioning in the oscillator circuit, which means it isn't open, shorted, or excessively weak. At this point, you may also increase the base current control, which is calibrated from 0 to 100, until a point is reached where the glow of the neon can no longer be detected. This is the drop-out or cut-off point of the transistor in the oscillator circuit, and the reading on the control may be used to indicate relative gain.

When monitoring the output of the Model 100 with a scope, I found that a normal signal generally produced a pattern like that pictured in Fig. 9A. This particular example was obtained using an NPN type 2N172 transistor. The pulse frequency was about 450 cps, and the

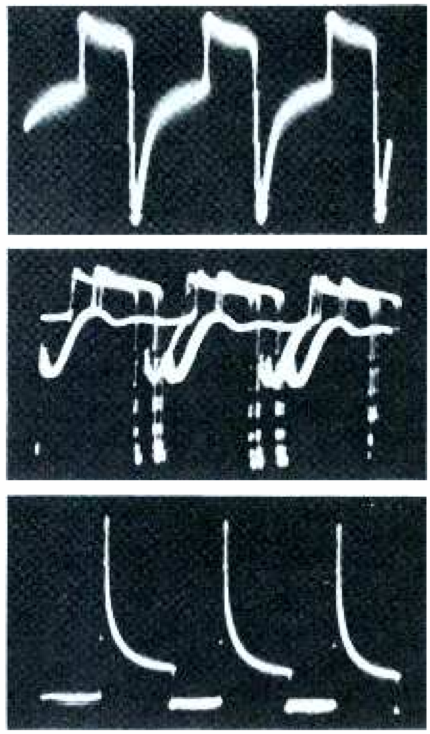


**Fig. 9. Scope waveforms obtained at the output jacks of the Seco tester.**

signal had an amplitude of 6 volts peak-to-peak. With the lamp switch turned on, this same output became distorted as shown in Fig. 9B. Here, I noted some clipping and a few unusual oscillations.

Checking a 2N44, which is a PNP type, I found the polarity of the signal reverses from that obtained with an NPN unit (see Fig. 9C). The pulse frequency was about the same, but the amplitude tripled. I could also reverse scope-lead connections and the pattern would revert back to the polarity of Fig. 9A. When I tested a CK721 known to be defective, I found it would not light the neon bulb nor produce any indication on the scope. Trying to out-fox the instrument, I also checked a 2N35 unit which had a good gain characteristic but excessive leakage. As it turned out, however, I couldn't fool the tester; an output just couldn't be obtained.

One of the most important test features of the Model 100 is its ability to check transistors in-circuit. This is a real timesaver, especially since so many transistors are now soldered to printed wiring boards. The impedance of the circuitry in most transistorized equipment is such that the tester is capable of generating a signal — provided, of course, the transistor itself is operative.

When troubleshooting portable radios, I found it's best to advance the volume control to maximum in order to minimize base circuit loading for an in-circuit test. To increase the instrument's utility, I noted that an external battery connected in series with the collector circuit would provide a higher operating potential for certain in-circuit test requirements. In addition, a 500-ohm control may be placed across the output jacks to extend the current range of the unit when checking power-type transistors. ▲

# TIPS for TECHS

### Soldering Gun Repairs Knobs

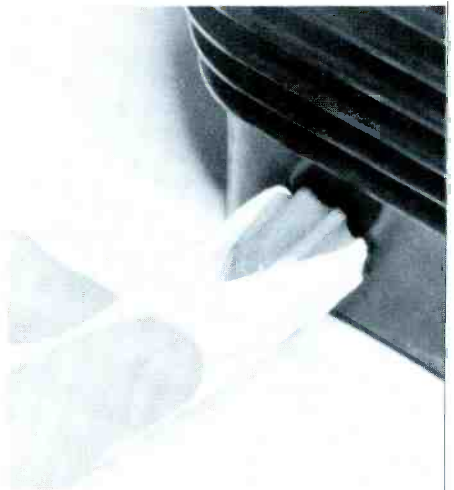
Ever pull the knob off the front of a set and have the metal insert either fall to the floor or stay on the control shaft? If you cement it back in place, you have to wait quite a while for the cement to set. Next time you encounter this trouble, use the tip of your soldering gun to fuse some plastic around the insert to hold it in place.

### Handy Tool Bag

If those sets of interchangeable screwdriver bits or socket-wrench tips aren't kept together in a case, you probably have to paw around among the other tools in your box to find the one you need. You can keep all of these tools "rounded up" by putting them in a plastic or leather tobacco pouch of the type available at stores for a few cents.

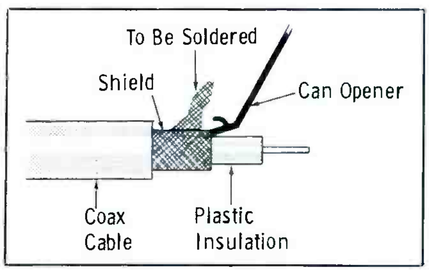
### Tube Removal Time-Saver

When a tube caddy is jam-packed with tubes in their cartons, it's not easy to take hold of the one you need and lift it out. In fact, it's possible to waste several minutes trying to fish out the tube you want. You can lick this problem by carrying a nailfile in your tube kit. Bend over one end of the file at a 90° angle so that you can slip it under the end flap of a carton to lift it out. Keep your "nail-file tube lifter" wedged in between cartons when it isn't in use.



### Handkerchief Frees Knob

If you ever encounter a stubborn radio or TV knob that just won't come loose no matter how hard you tug away at it, don't damage the set's cabinet by trying to pry the knob loose with a screwdriver. Instead, take a piece of cloth or a handkerchief, slip one edge down behind the knob, and pull outward. This will usually do the trick.




### Opener Used As Heat Shunt

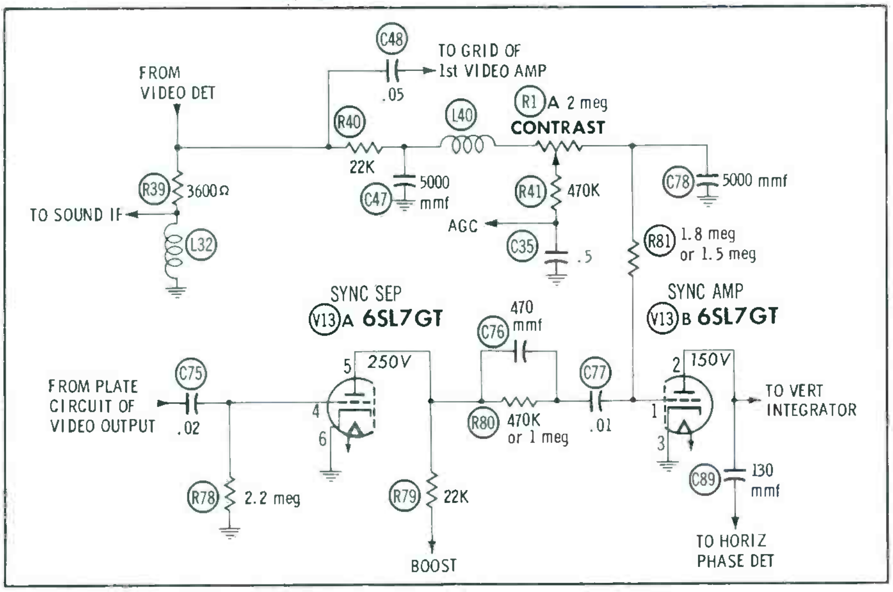
When you're soldering or tinning a braided shield on a piece of coax cable, the heat from the iron causes melting of the plastic insulation underneath. To prevent this, place the pointed end of a puncture-type can opener under the braid as shown. The opener will absorb most of the excess heat and thereby prevent melting of the underlying insulation.

### A Sponge Will Do The Trick

What TV serviceman hasn't carried a heavy TV chassis and felt the discomfort of its sharp edges? Gloves make the task a bit easier, but a couple of those rectangular-shaped plastic kitchen sponges work even better. Next time you have a chassis to carry, try using them to pad the edges. You'll want them in your tool kit not only for this purpose, but also for padding a CRT when the chassis is rested on its side and for cleaning the tube face.

# THE TROUBLESHOOTER

## ANSWERS YOUR SERVICE PROBLEMS




### A Lot of Pull

Several of my regular customers own General Electric Model 16C113 receivers. As these sets age, they have an increasing tendency to develop horizontal pulling when the contrast control is advanced. In one particular set, horizontal sync is completely lost at maximum contrast. I would appreciate any advice you can offer to help me eliminate this symptom.

E. J. STREBLER

St. Louis, Mo.

*Horizontal pulling in this model is usually caused by some malfunction which interferes with normal operation of the sync stages. The grid of the sync amplifier is connected to the AGC system through the contrast control (see schematic); therefore, trouble in the sync section will affect AGC and vice versa. Resetting the contrast control will naturally produce a change in the observed symptoms.*

*Begin this repair job by installing new tubes in all tuner, IF, video, and sync sockets to eliminate the possibility of sync-signal distortion due to gas or leakage in tubes. In a set this old, you'd also be smart to replace tubular capacitors C35, C48, C75, and C77, which frequently become leaky and cause sync trouble.*

*If these efforts don't bring the pulling to a halt, check tube-pin voltages in the video and sync stages. Keep in mind that all grid voltages should measure slightly* *negative with respect to the associated cathodes when no input signal is present. To prevent random noise from entering the receiver and causing inaccurate readings, short the VHF antenna terminals together.*

*The pulling symptom should yield to the above treatment. If not, check the output waveform of the video detector at a scope sweep frequency of 30 cps. If the sync pulses in this signal have a mashed-down appearance at high settings of the contrast control, RF or IF overloading is indicated; on the other hand, a clean waveform at the detector means the preceding stages are working normally, and you can confine your trouble search to the video and sync circuits.*

### TV Through Hi-Fi?

Is it practical to connect a TV set to an external hi-fi amplifier and speaker system to obtain better sound quality?

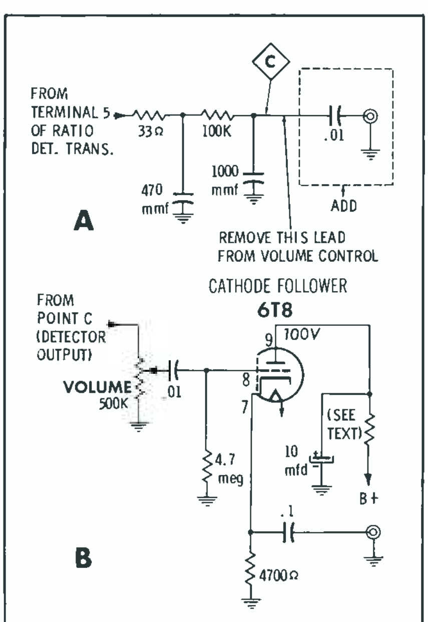
FRED W. BROWN

Los Angeles, Calif.

*If it has a power transformer, a TV may safely be connected to an external audio amplifier with a minimum of trouble. If the connecting lead is going to be short (not over 6' of shielded cable), you can use the simple arrangement shown in part A of the schematic. Install a phono jack at the rear of the TV chassis; then unsolder the lead from the top of the volume control and run it to the center terminal of the jack by way of a .01-mfd coupling capacitor.*

*This high-impedance connection won't be satisfactory if the TV and hi-fi units are some distance apart. However, a long interconnecting lead can be used if you rewire the first audio amplifier of the TV set to convert it to a cathode follower. A suitable circuit is given in part B of the schematic. Try different values of resistance in the plate circuit, then finally install whatever value is necessary to deliver 100 volts at the plate of the 6T8.*

*Don't disable the audio output circuit of the set if it is an essential part of the B+ supply network (tube acting as a dropping resistor between the high and low B+ lines). The output stage may be isolated from the first audio amplifier by removal of the coupling capacitor, and you can silence the TV set's speaker by replacing it with a dummy load consisting of three 10-ohm, ½-watt resistors in parallel. If you don't want to leave the audio output tube operating, you'll have to subsitute a power resistor for it. This will require some figuring or experimentation to determine the resistance value which will establish the correct voltage level on the 135-volt B+ line.*




### Frybacks

I have had to replace the flyback transformer in a Magnavox 107 Series receiver several times during the past few years. The transformer gets warm enough to melt the wax, and I've also had trouble with corona discharge. By placing sheets of polystyrene between the flyback and the chassis, I eliminated a great deal of the corona—but not the overheating. All components in the circuit seem to check normal. Could the high-voltage circuit be drawing too much current for some reason?

C. D. MAYSENT

Harlan, Iowa

*Repeated flyback failure, when not accompanied by severe arcing, is generally the result of excessive current through the transformer. As a rule, the high-voltage rectifier circuit is not at fault. More probable causes of this condition are improper drive signal to the grid of* *the horizontal output tube, incorrect screen voltage on this tube, or misadjustment of the width and linearity controls. When these slugs are properly adjusted, the cathode current of the 6CD6 output tube should not exceed approximately 120 ma.*

### Sound Bars

I am working on a Packard-Bell Chassis 98D1 which has a beautiful picture (resolution better than 325 lines) until the fine-tuning control is adjusted for clear sound; then the picture is full of interference and barely usable.

ORVIL L. PAYNE

Santa Rosa, Calif.

*There are only two things which cause sound bars and related interference patterns in the TV picture. One is lack of decoupling between the audio output stage and the rest of the receiver, while the other is incorrect alignment of the RF, IF or video circuits.*

*In the former case, bridging new units across the filter and decoupling capacitors in the audio output circuit will quickly reveal the culprit. Should you suspect misalignment, the first adjustments to check are the sound traps—one in the video amplifier (tuned to 4.5 mc), and another in the IF strip, usually adjusted for minimum response at 41.25 mc. In case these traps seem to be working properly, but you still cannot remove the sound bars from the picture, then you will probably have to perform further alignment of the video IF and possibly the tuner.*

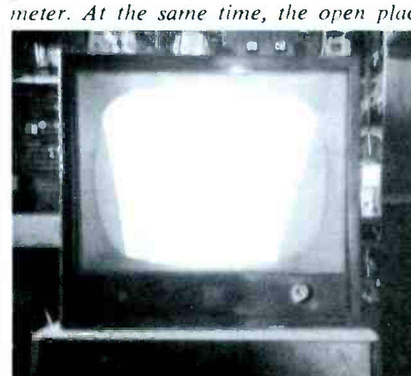
### "Pleated" Raster

The enclosed photograph is of an Arvin Model 21-551TM. The combined keystone and foldover effect was caused by an open high-voltage winding on the horizontal-output transformer.

ROBERT E. REDD

Union Furnace, Ohio

*It's a wonder you had any raster at all! According to the usual behavior of open circuits, you should have no input to the high-voltage rectifier and thus no screen brightness. Evidently, however, the gap in the transformer winding is narrow enough that the high-voltage pulses can arc across it and still reach the plate of the rectifier. This could happen even though the winding might give an "open" indication on an ohmmeter. At the same time, the open place*



*in the winding would probably cause enough detuning of the flyback circuit to produce the weird "pleated" effect in the raster.*

### Vertical Roll

An Olympic Chassis DD, used in a weak-signal area, has had poor vertical hold from the time it was installed. I have checked all components and voltages from the sync take-off point to the vertical output stage, but all check normal.

JOHN SCHLECHT

Baker, Mont.

*If anyone ever needed a scope, you need one now! The key to your whole problem is the waveform at the output of the integrator. This should be viewed with the vertical output tube removed from its socket, and clean 60-cps pulses with an amplitude of about 5 volts p-p should appear. Unfortunately, the signal in your area may be so weak that you are not obtaining a good, noise-free vertical sync waveform of adequate height. In that case, make sure that the sync stages are all working at peak efficiency. You might increase stage gain or noise immunity by making slight changes in component values. If you attempt this, keep checking your results with the scope to see if the desired improvement is being produced; also consider whether or not the proposed changes would cause shortened tube life or circuit instability.*

*In case your integrated pulse waveform looks normal, the most likely trouble is that the natural frequency of the vertical oscillator is either too fast or too slow. For a quick check of this possibility, see if the oscillator tends to fall into sync at one end of the hold control range.*

### Behind Bars

A Motorola Chassis TS-52 has a number of vertical bars in the picture; the darkest ones are toward the left side of the screen. The set has shown the same symptoms to a slight degree since the date of purchase, but the bars have recently become strong enough to be objectionable. They change in intensity from day to day, and the defect is much more noticeable after two or three hours of operation. Various minor repairs in the past have temporarily reduced the bar effect but never completely cured it.

We suspect CRT cathode modulation of an intermittent thermal nature, and we wonder if a slight circuit change might not be in order—for example, connecting a bypass capacitor from the center arm of the brightness control to ground.

OSCAR VAN KAN

Cleveland, Ohio

Five or six vertical black lines appear in the left half of the raster on an Admiral Chassis 18Y4B. New horizontal sweep tubes and yoke-circuit capacitors have not helped matters, nor have I been able to eliminate the lines by putting a magnet on the horizontal output tube. Since I can remove the lines by pulling the 6AW8 video output tube or bypassing the cathode of the picture tube, I suspect trouble in this area. However, I've been unable to eliminate the lines by rerouting the picture-tube base leads or shielding them with aluminum foil grounded to chassis.

"DURK" DURKIN

New York, N. Y.

*Apparently, you're both experiencing the same trouble. The electron beam of the CRT is evidently being modulated by an unwanted signal originating in the horizontal sweep system. To confirm this suspicion, check the waveform on the driven element (cathode or grid) of the picture tube, using a scope sweep frequency of 7,875 cps. The video signal input will have a "wrinkled" or "roller coaster" appearance if it contains enough horizontal sweep energy to produce noticeable bars in the picture. When a sweep signal is mixed with the video in this way, it is usually entering the tuner or IF strip by means of radiation from some horizontal sweep component. Judging from the patterns you describe, I doubt if your trouble is Barkhausen effect (radiation from the horizontal output tube); but there are several other possible sources of stray signals for you to check. Make sure the outer aquadag coating on the picture tube is grounded to chassis. In addition, you might try shielding the yoke and its leads. Also consider the pos-*

*sibility of parasitic oscillation in the horizontal output or damper circuit. The most commonly-used remedy for the latter condition is to insert low-value resistors (under 100 ohms) in series with the various signal leads to the output and damper tubes. Connect the resistors directly to the socket pins and attach the leads to the outer ends of the resistors.*

### Grip of Death

Here is a hint regarding failure of 6CD6GA horizontal output tubes in General Electric Model 21C225 and similar sets. The tube is held in its socket by a spring-steel retainer having two jutting prongs. They grip the old-type 6CD6G tubes at the top of the Bakelite base; however, the design of the newer-type 6CD6GA is such that the retainer contacts the glass envelope directly opposite the lower supporting disc for the tube elements. The high pulse voltages within the tube eat pinholes through the glass where the prongs touch it, thereby admitting air into the tube. The retaining device is easily removed, being held in place by only a single #8 x ¼" sheet-metal screw.

JOHN H. BLOODGOOD

Anaheim, Calif.

*Be on guard for this kind of trouble whenever "modernized" tube types seem to be suffering from a high failure rate. The 6BQ6GTB, 5U4GB, 1G3GT, 6L6GC, and similar tubes can be substituted for older types in most cases with no trouble; however, some design peculiarity of a certain chassis occasionally results in a bothersome problem involving nothing more than an improper physical clearance between parts.*

### Broadcast Interference

Would you give some practical solutions to various cases of interference with radio reception due to TV oscillations, stoker motors, heat blowers, electric razors, mixers, etc? This is a problem that everyone is up against to some degree, but I can't find sufficient information about what can be done with unwanted frequencies arriving at the radio —through the air, from the power line, or both. It's often impossible to correct the interference at its source.

JOHN J. HANCOCK

Keokuk, Iowa

*The radio interference you describe is still one of servicing's nastiest problems. Most sources of interference radiate harmonics or noise pulses that cover the same frequency range as the standard broadcast band, so "wave traps" are powerless to filter out the objectionable signals.*

*If the spurious radiation is principally being fed in through the power line, as is often the case with household appliances, you're relatively well off. A line filter, inserted between the receiver and the AC line plug, will often reduce the interference to a bearable level.*

*Airborne interference is most efficiently attacked by increasing the radio's sensitivity to desired signals, or by improving its selectivity. An amazing improvement can often be made by adjusting the receiver for proper tracking—not in the sense of bringing in all stations at the correct places on the dial, but in the manner described in "Tracking Superhets" in our December, 1957 issue. If you make sure that the difference frequency between the RF and oscillator signals is always precisely equal to the center frequency of the IF, then the desired signals will receive more IF gain and will be better able to override noise.*

*Reception of a particular "favorite station" can be cleaned up to some degree by replacement of the standard radio antenna with a high-Q, ferrite-core antenna. This unit can be adjusted for peak antenna sensitivity in the desired portion of the broadcast band, with a resulting increase in signal-to-noise ratio.*

*Some desperate cases have been improved by installation of an outside radio antenna, as far removed as possible from interference sources. This may have to be connected to the receiver by a shielded cable to avoid picking up unwanted radiation on the lead-in. Unfortunately, an outside antenna isn't much help if the interference is coming from a neighbor's TV set and radiating from a roof antenna. In this instance, about your only recourse is to visit the owner of the offending TV receiver and politely seek to correct the cause of any excessive radiation.*

## G.E. 1960 REMOTE UNIT

*(Continued from page 27)*

basic oscillator coil L1. Incremental coils L2, L3 and L4 can be switched in series with L1 to provide more inductance and thus tune the oscillator to various lower frequencies. The transmitter's push buttons operate the coil switches as indicated in the schematic; at the same time, they close a battery switch and energize the transistor circuit.

### Servicing

For a quick operational check of the transmitter, key it while holding it within several feet of an ordinary AM radio tuned to 640 kc. (In recent models, this corresponds to the *Conelrad* marking near the low end of the dial.) Since 640 is approximately the second harmonic of the 322.7-kc transmitter frequency, the control signals will normally be heard on the radio as a "do-re-mi-fa" series of audio tones. If you suspect that the transmitter's output is weak, remove the back of the case and check the base-emitter voltage of the transistor. (Proper test points are indicated in Fig. 5.) You should get a DC reading of -1.5 to -2 volts whenever you press one of the buttons; any lesser reading means insufficient output.

If necessary, the control receiver can be serviced without being connected to the TV set. Merely apply 117 volts AC between pins 2 and 5 of the octal plug, and observe the operation of various relays as indicators of system performance. It's advisable to keep the receiver in an "upright" position (with tubes sideways!) to insure free operation of the relays.

Two test points are provided outside the case of the receiver (near the 6EA8) to simplify alignment and testing. One of them, 2″ above the antenna jack, is connected through a 5000-mmf capacitor to the plate of the audio amplifier. When this point is monitored with a VTVM (set on a low AC scale), a reading of about 15 volts rms should be obtained between test point and ground when the transmitter is held near the receiver and keyed.

If this reading seems abnormal, try moving the meter lead to the amplifier-grid test point on the other side of the 6EA8 socket. When the transmitter is keyed, you should obtain an AC reading of about 1 volt rms—or a DC indication of as much as -2 volts. Exact values of voltage will depend upon several factors such as the sensitivity-control setting.

The grid of the detector (pin 9 of the 6EA8) is an excellent place to check for the presence of an input signal; unfortunately, you have to take off the side panel of the receiver to reach it. This point is a fraction of a volt negative with respect to ground, until a signal arrives from the transmitter; then the voltage should shift to some value from -5 to -12 volts, depending on the strength of the input signal.

If a signal from a normally-operating transmitter does not produce the expected voltage shift at the input side of the detector, then trouble probably exists in the antenna, RF amplifier, or power supply of the receiver. Realignment might even be needed.

### Adjustments

The General Electric remote unit, like most other electronic equipment, is not likely to need realignment for at least several years. However, it may be necessary to check the adjustment of the receiver antenna and the sensitivity control from time to time. Being RF-operated, the remote system is subject to some interference due to radiation of horizontal-sweep energy. This effect has been minimized by choosing an operating frequency midway between harmonics of the horizontal-oscillator frequency; even so, the remote- receiver antenna sometimes must be relocated to insure minimum pickup of sweep interference. The procedure is as follows: (1) Throw the horizontal oscillator out of sync in order to produce maximum interference; (2) use a VTVM to monitor the AC voltage at the audio-output test point; and (3) orient the antenna for a *minimum* reading.

While you're at it, check the sensitivity-control setting. With the horizontal oscillator still out of sync, turn the control until the VTVM reads 3 volts rms. The sensitivity of the receiver should then be high enough to permit normal operation of all relays, but not sufficiently high to let interfering signals cause spurious triggering. In locations where

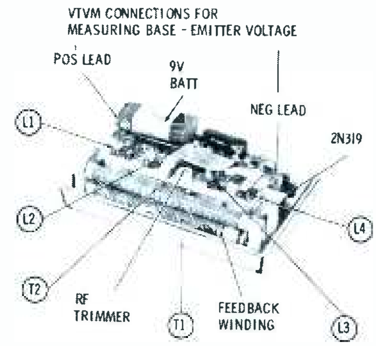



**Fig. 5. Remove back of case for access to all coils, battery and transistor.**

considerable RF noise is present, you may have to cut down the sensitivity of the remote receiver. Although this will reduce the effective operating range of the transmitter, it will increase the reliability of the system.

Further alignment of the receiver consists of adjusting the double-tuned RF output transformer and touching up the antenna trimmer. If a known good remote transmitter is not available, an ordinary RF signal generator (tuned to 322.7 kc and modulated with audio) makes a satisfactory signal source.

If a transmitter must be aligned, use a normally-operating receiver as an indicator; the job is much easier that way. The RF trimmer (Fig. 5) is adjusted for maximum AC voltage at the audio-output test point, and the reed relay is used as an indicator while the slugs in the audio coils are being retuned. Watch the shortest reed when adjusting the highest-frequency coil—and so on down the line. When you're on the right frequency, the reed will vibrate and energize its associated relay.

It's unlikely that two receivers using this same remote-tuning system will be installed close enough together to produce mutual interference; but if they ever do, provisions have been made for solving the problem by tuning one of the systems to a different frequency. The RF circuits have been designed for satisfactory operation at either 291.2 or 354.2 kc, should the need arise. (These particular frequencies are specified because they are subject to minimum interference from horizontal sweep.) Retuning is done just like regular alignment—adjust the receiver first, then the transmitter. ▲

## Shop Talk

*(Continued from page 25)*

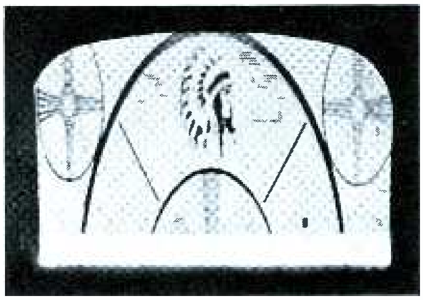


**Fig. 4. Vertical foldover indicates that vertical yoke current is nonlinear.**

tal windings will produce the distorted image shown in Fig. 2. When either of these two illustrations are encountered, your first action should be to change the yoke. No series of grueling tests are needed.

In Fig. 3, the complete absence of any vertical deflection (resulting in a brilliant, thin horizontal line) indicates that the trouble is in the vertical deflection system. Consequently, that section of the receiver is the place to look. Another type of trouble in the vertical system might lead to the distorted indication shown in Fig. 4. The picture is folded over at the bottom, indicating that vertical sweep is not linear. This trouble is generally caused by some defect in the vertical output stage, although the oscillator circuit is at fault on occasion. The final illustration, Fig. 5, illustrates a severe loss of horizontal synchronization. This symptom, known as the "Christmas-tree effect," produces a completely jumbled picture; its cause is highly erratic operation of the horizontal oscillator.

The foregoing symptoms are fairly specific in their origin, and should guide any reasonably experienced service technician directly to the stage or section where the trouble is being developed. There are quite a number of other trouble indicators

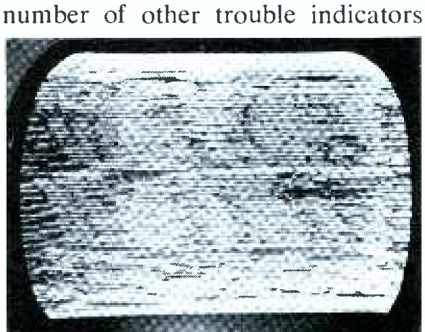
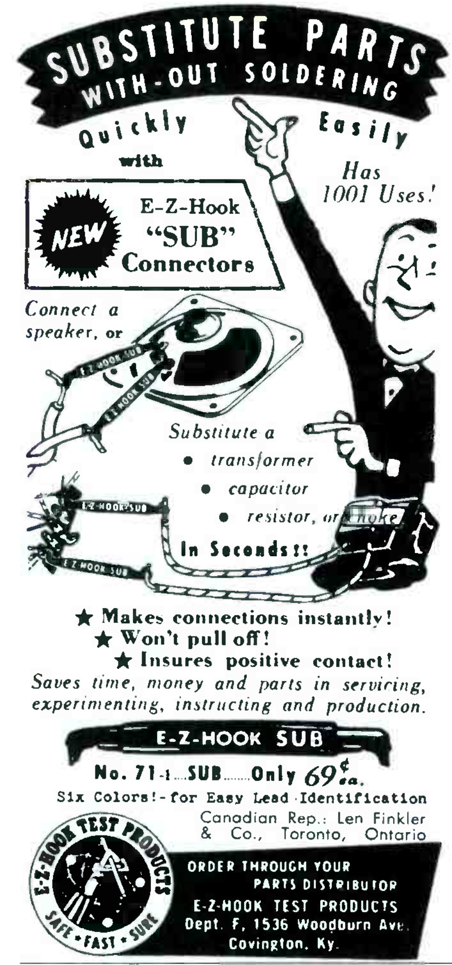


**Fig. 5. Severe sync loss with ragged edges is called "Christmas-tree effect."**

which fall into the same category; the most common are listed in Table 1. Possible sources of trouble have been broken down into 13 categories, which encompass every section of a television receiver, including the deflection components mounted on (and associated with) the picture tube. A check in the latter column does not necessarily mean that a component is defective, although it can be. Much more likely, it means the component (yoke, ion trap, focus magnet, etc.) is out of position and should be repositioned. In similar fashion, a check in the "FM Detector" column more often indicates a need for readjustment of the input transformer rather than for changing any component.

In the chart, all possible stages in which a defect can produce the indicated symptom have been checked. However, it stands to reason that the trouble would normally be found in only one stage, not in all those checked.

Once a trouble has been narrowed down to a certain section of the receiver, the next step is to





check the tubes in that section. It may be desirable, after the defect has been located and the set is operating normally again, to check all the tubes as "callback insurance." With the quick-test checkers now available, this can be done in 15 minutes or less. From a systematic point of view, it is seldom desirable to check all the tubes as the first step; it is better to wait until the defect has been localized and corrected.

An important feature of tube testing is the ability of the test instrument to reveal gas and high-resistance leakages. These are subtle defects that can play all sorts of havoc with receiver operation, and experience has demonstrated repeatedly that you will have less trouble with a tube possessing weak emission than one with gas or leakage.

There is one situation where the initial step might be to check all the tubes—when a receiver is brought into the shop and none of the tubes light up. This is a fairly common trouble, particularly since many receivers now being designed have all the tube filaments connected in series. Under these circumstances, checking the tubes to locate the one with the open filament would be a logical step; however, when all the tubes are lit, your best bet is to localize the trouble before testing them.

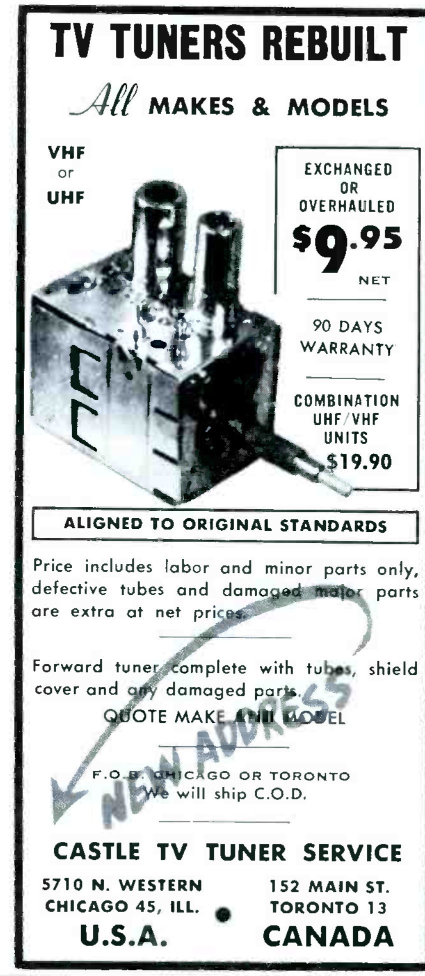
To summarize, here's a brief recap of the troubleshooting approach thus far:

1. Find out all you can about set behavior from the set user before any service work is done.

2. From the way the set operates, determine the section of the receiver where the defective component is likely to be located.

3. After the section in question has been located, check tubes in this section as a first step.

The systematic approach to troubleshooting can do more than just lead you to the defective section in a receiver. It can also help you find out which stage in the section is not functioning normally, and sometimes it even permits you to locate the exact component which is causing trouble. The next article in this series will take you a step farther in the technique of "analyzing trouble analysis." ▲




## $100.00 CASH REWARD

*. . . to the first serviceman who reports the location of any of the following stolen receivers:*

AMC, serial 6210857; Emerson, serial 151428; GE, serial 179594 and 284055; Motorola, serial 627880; Muntz, serial 31238; Olympic, serial R454175 and R473427; Philco, serial nos. DD98415, 188687, SR11019, F3044, S.O.H. 68747, A.D. 58146, A.D. 84616, and A.C. 40544; RCA, serial nos. 919673, 1801877, B5388102, 1837008, 1786520, 4613730, 1786697, 180076, 902650, 894108, A88460, and A4657299; Sentinal, serial 10793; Sylvania, serial nos. 537309-183-4334 and 537309-124-4108.

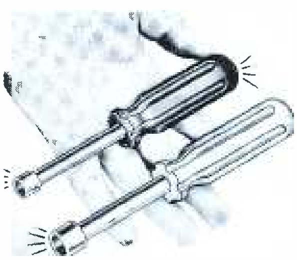
*These receivers were stolen from various service dealers in the Indianapolis area. Investigation indicates they are being disposed of in several large midwestern cities.*

Contact by phone or wire, Carl C. Schmidt, Inspector of Detectives, Indianapolis Police Dept., Indianapolis, Ind.

# PRODUCT report

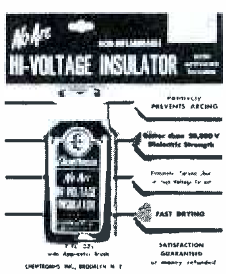
*For further information on any of the following items, circle the associated number on the Catalog & Literature Card.*

### Hex Drivers (41H)



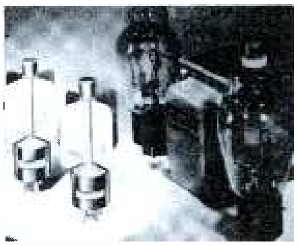
Extra-hard tempered sockets discourage "rounding out," and color-coded handles indicate socket size, in two new series of Vaco hex nut drivers. The *Chrome-Tone* line, with chrome-finished solid shafts drilled 1½" deep, comprises 13 different tools in standard, "stubby," and "extra small" sizes. The 18 nut drivers in the deluxe *Gold-Tone* line are equipped with gold-colored, hollow shafts.

### Insulating Dope (42H)



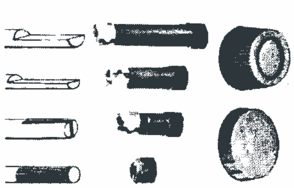

A nonflammable, clear fluid—Chemtronics *No-Arc Hi-Voltage Insulator*—can be brushed onto yokes, horizontal output transformers, and other components to repair damaged insulation or to serve as corona dope. It dries quickly to form a coating with a dielectric strength on the order of 20 kv. A 2-oz. bottle, with brush attached inside cap, has a net price of 89c.

### High-Voltage Silicon Diodes (43H)



A pair of International Rectifier Corp. Type ST-7 silicon rectifiers can replace two Type 866 mercury - vapor rectifier tubes and their filament transformer for broadcast and communications radio applications where PIV does not exceed 6,400 volts. The silicon diodes and their cooling fins are mounted on tube bases to permit plug-in installation.

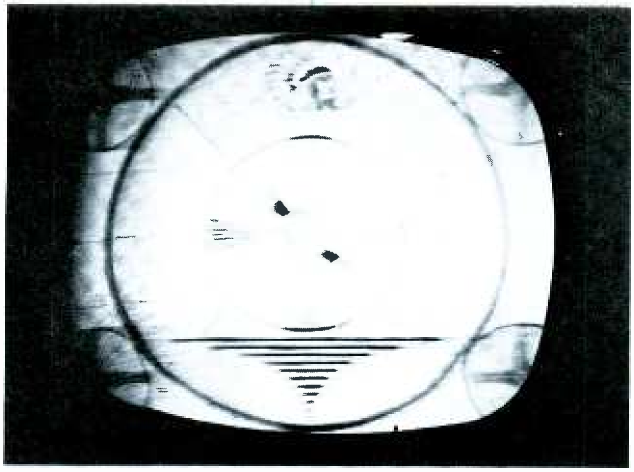
### Knob Stems (44H)



Flatted shafts of ¼", 3/16" and .202" diameter, in addition to ¼" slotted and knurled shafts, can be fitted with Colman universal-type knobs by use of *Radio Knob Stems* as a coupling device. The selection of stems includes a total of 13 different types having various lengths.

### Crystal Mike (45H)

A clip-on desk stand and a lavalier cord are furnished with the American Microphone Model X-206 portable tape-recorder microphone. Its response pattern is omnidirectional, frequency response is 65 to 10,000 cps, output level is –55 db, over-all length is 5 11/16", and list price is $7.95.



# COMING IN OCTOBER

## Curing Brightness and Contrast Problems

The quality of a TV picture depends on accurate control of CRT phosphor illumination. You'll like the refreshing treatment of this subject, describing troubles that rob sets of that extra *oomph*.

## Isolating Color TV Troubles by Symptoms

If you want to be proficient in locating and correcting color TV circuit troubles, you must know which section to suspect when confronted with a specific set of conditions. With the information included in this article, you'll take one giant step forward in the servicing profession.

## Stock Guide for TV Tubes

A completely revised list of the 200 most popular TV tubes, with usage figures to guide you with regard to your inventory requirements. Of particular interest is that, for the first time, the chart will also include a suggested stock list for a typical tube-caddy inventory of 350 tubes.

*Other helpful and informative articles include:*

**Why Test Tubes in the Home?**
**Using a Scope for TV Troubleshooting**
**Previews of New Sets**
**Video Speed Servicing**
**Notes on Test Equipment**
**How to Choose and Use Microphones—Part 2**
**Servicing Medical Amplifiers**

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### Two-Set Couplers (46H)

Two new Walsco antenna couplers are designed to be mounted on the mast (or wall) before the leads are attached. Connections are protected from the weather by a snap-on cap. The *Standard* coupler (No. 1600; $2.50) is a resistive divider for use in areas where moderate RF power loss can be tolerated. The *Ultra Low* Loss unit (No. 1602; $3.50) is recommended for fringe areas.

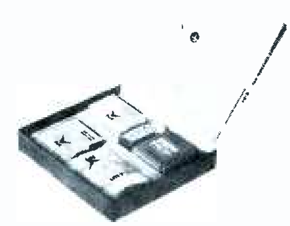
### Stereo Stylus-Cartridge Combination (47H)

The standard version of the Sonotone Model 10T unitized stylus-cartridge assembly has both 0.7- and 3-mil sapphire tips, is designed to mount in a snap-in bracket, and has plug-in leads. Output is ½ volt, frequency response is 20-15,000 cps, tracking pressure is 6 to 8 gm., and compliance is 1.5 x $10^{-6}$ cm/dyne. Price is $6.45 complete with mounting hardware.

### Palm-Size Meters (48H)

Two new members of the "Little Triplett' line of hand-sized test instruments are the Model 307 AC ammeter (shown) and the Model 308 *Lo-Ohmmeter*. The former, used for measuring 60-cps current, has four ranges from 0-1 to 0-25 amps; the latter, for such jobs as motor testing and tracing shorts in wiring, accurately measures resistances as low as .1 ohm or as high as 5,000 ohms.

### Tape Recorder Accessories (49H)

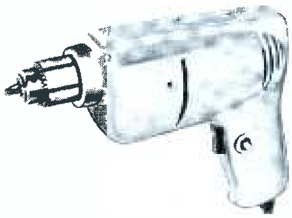


The following items are contained in the V-M No. K-82 *Tape Editing Kit*: T-131 *Junior Tape Splicer*, T-132 *Klenz-A-Tape* cloth (for cleaning and lubricating tape), T-134 *Self-Timing Leader Tape* (marked at one-second intervals), T-136 *Recording Head Cleaner*, and a 150" x ½" roll of splicing tape. Inside the cover are adhesive reel labels and a "Guide to Better Tape Programming" booklet.

### Bidirectional PA Speaker (50H)

The two-way sound-dispersion pattern of the Atlas TW-9 speaker enclosure enables it to "cover" long narrow areas such as corridors from a central location. This enclosure is designed for 8" cone-type speakers and comes equipped with a mounting plate which permits attachment to either a plain wall surface or an electrical outlet box. The case is finished in beige enamel.

**Power Tools** (51H)



Two new portable power tools have been announced by Drake Electric. A ¼" drill, Model D74, operates at 2,000 rpm and draws 2.6 amps. Weight is 3¼ lbs. Its two-part aluminum housing is designed to provide easy accessibility to the motor for maintenance. Another item, the Model D58 jigsaw, is suggested for work on hi-fi cabinetry.

**Tubular Capacitors** (52H)

Sprague *Difilm Black Beauty* capacitors have a dual dielectric—both paper and *Mylar* polyester film—and are impregnated with a synthetic hydrocarbon which solidifies after being injected. The humidity-resistant molded phenolic case is black with red markings. A TK-1 kit of 20 units (in five often-used values) is $14.46.

**Record Player Adjustment Kit** (53H)


Two phono servicing aids are packaged together in the Clevite "Walco" *Balanced Sound Kit* (list price $2.50). One tool is a leveling gauge which indicates any variations from a true level condition when laid on a turntable, and the other device is the *Microgram Stylus Pressure Gauge,* a balance scale calibrated in 1-gm. steps.

**Fringe-Area TV Antenna** (54H)

The new Winegard Model SCL-4 *Super Color 'Ceptor* TV antenna ($38.95 list) has higher gain than the standard Model CL-4. The two driven elements, which have been redesigned into a modified folded-dipole configuration, are pre-assembled to the boom and "fold out" into operating position. The boom is reinforced with a short parallel brace and dual "wrap-around" mast clamps.

**Filament Dropping Resistor** (55H)

A 41-ohm fixed resistor, designed as an exact replacement for General Electric part RRW-148, has been added to the Clarostat P25K line of 25-watt wire-wound resistors. This new P25K-41 unit is suitable for use as a voltagt dropping resistor in the filament circuit of certain models of TV sets.

**Mobile Radio Base Station** (56H)

An AC-powered base-station unit has been introduced for use with COMCO 580/582 *Fleetcom* Series VHF mobile radio gear (described in this column in December, 1958). Its transmitter receiver chassis is directly interchangeable with that of the DC-operated mobile unit. The base station, designed for desk mounting, weighs 30 lbs., measures 15¼" x 11½" x 10", and costs about $450.

# INDEX TO ADVERTISERS

**September, 1959**



## Latest Jackson Tube Test Data

| TUBE TYPE | FIL. | MODEL 648 CIRCUIT D. | E. | PLATE TEST | SEC. | MODEL 49 A. | B. | C. | D. | CATH. SHORTS | E. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6AM6 | 6.3 | AC1236 | C457* | 32WY | P | 6.3 | 3 | X | 1567 | 2 | 30 |
| EF91 | | | | | | | | | | | |
| 6BL8 | 6.3 | A125 | C389* | 75WZ | P | 6.3 | 4 | X | 236 | 7 | 30 |
| ECF80 | | 127 | A46 | 25V | T | 6.3 | 4 | – | 19 | 8 | 5 |
| 6BM8 | 6.3 | 125 | AC389 | 33Z | P | 6.3 | 4 | - | 367 | 2 | 4 |
| ECL82 | | A127 | AC46 | 45XZ | T | 6.3 | 4 | X | 19 | 8 | 32 |
| 6DC8 | 6.3 | A125 | B348* | 73WZ | P | 6.3 | 4 | X | 1269 | 3 | 30 |
| EBF89 | | 123 | 7 | 80X | D | 6.3 | 4 | – | 7X. | 3 | 62 |
| | | 123 | 9 | 80X | D | 6.3 | 4 | – | 8X. | 3 | 62 |

| TUBE TYPE | SEC. | HEATER | MODEL 658 CIRCUIT H-K | P-G | PLATE | GRID TEST | HEATER CURRENT |
|---|---|---|---|---|---|---|---|
| 6AM6 | P | 6.4J | 1267 | b345 | 25Q | 15WY. | A10.6H-Z300 |
| EF91 | | | | | | | |
| 6BL8 | P | 6.4J | 129 | ab358 | 37R | 15WY. | |
| ECF80 | T | 6.4J | 127 | a46 | 24S | 15WY. | |
| 6BM8 | P | 6.4K | 125 | ac389 | 72R | 60VW. | |
| ECL82 | T | 6.4K | 127 | ac46 | 40S | 10XY. | |
| 6DC8 | P | 6.4J | 1236 | ab458 | 45R | 15WY. | |
| EBF89 | D | 6.4J | 123 | 7 | 75U | X | |
| | D | 6.4J | 123 | 9 | 75U | X | |

Latest Chart Form 648-21, 49-5, 658-1

# CATALOG AND LITERATURE SERVICE

### ANTENNA SYSTEMS

1H. *BLONDER-TONGUE*—"Master TV systems Bidder's Guide," compiled from a series of catalog sheets and specification folders. *See ad page 38.*

2H. *JERROLD*—Free subscription to *Technical Reporter,* which keeps you up-to-date on equipment for multiple antenna systems.

3H. *SOUTH RIVER* — Illustrated material with information on the "free-opening" chimney mount banding. *See ad page 56.*

4H. *TACO*—Revised price list and catalog sheets on antennas, accessories, and FM promotion kit. *See ad page 78.*

### AUDIO & HI-FI

5H. *ARKAY*—Literature including specifications for the new Harting MS-5 stereo tape deck, dual-track *record playpack. See ad page 64.*

6H. *ASTATIC*—Catalog 33-3 listing microphones, cartridges, and other radio equipment. Includes list prices. *See ad page 9.*

7H. *ELECTRO-VOICE* — Bulletin No. 255, "How to Choose and Place Stereo Sound Equipment for the Home," explains what you should know about stereo. *See ad page 47.*

8H. *RCA*—"Microphone-Select-a-Guide," with information to help you choose the right unit for any job. *See ads page 58 and 3rd cover.*

9H. *TURNER*—New microphone catalog plus specification sheets with descriptions, specifications, and prices on various microphones in company's line.

### CAPACITORS

10H. *CORNELL-DUBILIER* — Bulletins on the *Treasure Chest* twins and the new service bench capacitor kits. *See ad page 61.*

11H. *SPRAGUE*—M-773 *Difilm* Mylar-paper capacitor catalog sheet. *See ad page 10.*

### CARTRIDGES & NEEDLES

12H *SONOTONE*—Cartridge reference chart, cartridge replacement manual, hi-fi products catalog, and rechargeable flashlight battery flyer. *See ad page 70.*

### COMPONENTS (MISC.)

13H. *CENTRALAB* — New 24-page catalog listing over 1700 composition and wire-wound controls, ceramic capacitors, switches, and packaged circuits available through distributors. *See ad page 69.*

14H. *RADIART*—1959 Vibrator Replacement Supplement.

### FUSES

15H. *BUSSMANN*—Completely new television fuse chart describing proper fuses to use, how they are mounted, and which circuits they protect. *See ad page 37.*

### SEMICONDUCTORS

16H. *PYRAMID* — Specification sheet on the S1-500 silicon power rectifier for radio and TV replacements. *See ad page 67.*

17H. *RAYTHEON*—16-page "Transistor Entertainment Equipment Guide," providing interchangeability data for transistor radios. *See ad page 23.*

18H. *SYLVANIA*—20-page booklet with up-to-date information on line of semiconductor diodes, including characteristics and interchangeability; also a replacement guide, form no. SD-10. *See ads pages 14-15, 50, 65.*

### SERVICE AIDS

19H. *BULLDOG*—Catalog #EH-100 describes *Electrostrip* multiple AC outlet assembly. *See ad page 66.*

20H. *CLAROSTAT* — Form 755259 describes 225-watt, power-resistor decade box with ranges from 1 to 999,999 ohms in 1-ohm steps. *See ad page 41.*

21H. *E-Z-HOOK*—Convenient reference sheet titled, "How to Build the Five Most Useful Scope Probes," with schematics, mechanical component layouts, etc. *See ad page 84.*

22H. *SERVICE INSTRUMENTS* — 4-page brochure on all company's time-saver instruments. *See ads pages 77, 79, 81, 83.*

23H. *YEATS*—Data sheets on appliance dollies, hand trucks, and padded appliance covers. *See ad page 87.*

### SPECIAL EQUIPMENT

24H. *ATR* — New KARADIO catalog sheet describing auto radios for both imported and small U.S. cars. *See ad page 16.*

25H. *MONITORADIO* — Catalog page describing two new tunable FM communications receivers for the 30-50 mc and 152-174 mc bands.

### TECHNICAL PUBLICATIONS

26H. *CBS*—The latest issue of *Tech Tips* by Bud Tomer, entitled "How to Test Transistors." *See ad page 43.*

27H. *GERNSBACK*—Descriptive literature on Gernsbeck Library books. *See ad page 56.*

28H. *HOWARD W. SAMS*—Descriptive literature on all Howard W. Sams publications covering servicing of radio, TV, hi-fi, etc. Includes data on latest books, "Television Antenna Handbook," "101 Ways to Use Your Signal Generator," the new revised edition of "PHOTOFACT Television Course," Volume 3 of "Video Speed Servicing," and Volume 2 of "Electronics Reference Data Handbook." *See ads pages 40, 51, 71.*

### TEST EQUIPMENT

29H. *B & K*—Bulletin ST21-R gives helpful information on new point-to-point signal-injection technique with Model 1075 *TV Analyst;* other bulletins describe *Dyna-Quik* Models 500B, 650, and automatic 675 portable dynamic mutual-conductance tube and transistor tester, plus Model 400 CRT cathode-rejuvenator tester. *See ad page 31.*

30H. *DOSS*—Information on the latest in test equipment, including the *Pioneer* 250 Horizontal Systems *Quantalyst. See ad page 42.*

31H. *EICO*—20-page 1959 2-color catalog describes 65 models of professional test instruments, hi-fi, and "ham" gear in both kit and factory-wired form. Shows how to save 50%. Also, 4-page 2-color stereo hi-fi guide. *See ad page 60.*

32H. *JACKSON*—Data sheets describing Models 598 and 658 low-cost dynamic tube testers. *See ads pages 63, 88.*

33H. *RCA*—Pocket-sized folders on the WV-38A(K) volt-ohm-milliammeter and WO-33A(K) super-portable oscilloscope kits. *See ads page 58 and 3rd cover.*

34H. *SECO* — Literature describing the new Model 100 dynamic transistor checker and Model 78 grid-circuit and tube-merit tester; also 8-page 2-color folder on company's other equipment, plus servicing information. *See ad page 74.*

35H. *VIS-U-ALL* — Tube-testing equipment catalog describing new quick-type portable and caddy tube testers and CRT tester-rejuvenator. *See ad page 71.*

36H. *WINSTON*—Flyers describing complete line of instruments, including an AGC circuit analyzer, intermittent condition analyzer, induced waveform analyzer, rainbow generator, dot generator, sweep circuit analyzer, and audio system analyzer.

### TOOLS

37H. *BERNS*—Data on the 3-in-1 picture tube repair tool that crimps pin and element lead to make a solid electrical connection; can also be used as screwdriver and channel selector. *See ad page 72.*

38H. *HUNTER* — Catalog on subminiature tools for printed board work, etc. *See ad page 78.*

39H. *XCELITE*—Catalog sheet on the latest in servicing tools. *See ad page 71.*

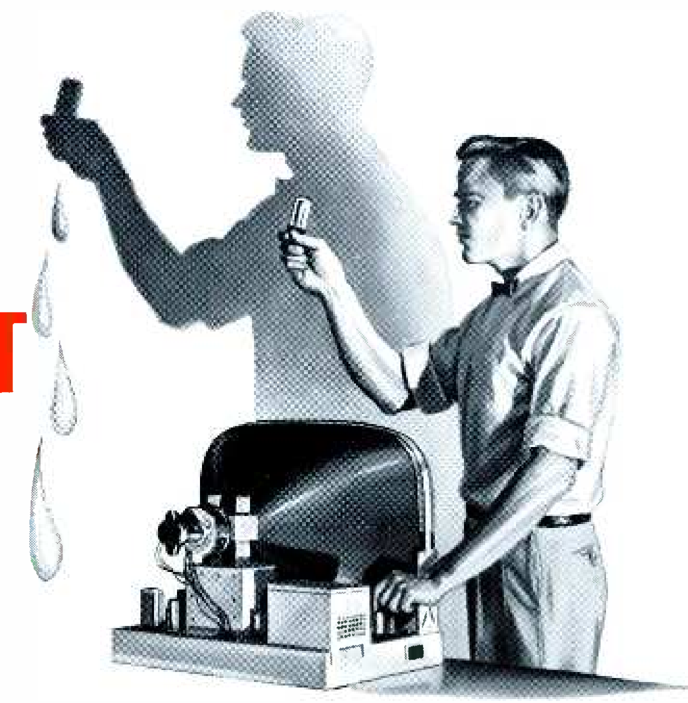
### TUBES

40H. *TUNG-SOL*—Pocket price list for approximately 1000 receiving and picture tube types; also, order form and catalog sheet for newly-published "Tube Base Connections" and "Tube Characteristics" books. *See ad page 17.*

How to keep your profits from going to the "dogs"!

Another way RCA helps you improve your business

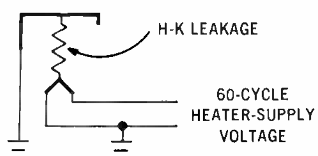
# STOP PROFIT LEAKS!



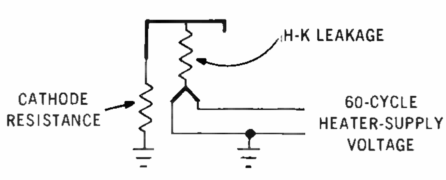
## Review these important facts about heater-cathode leakage

Did that TV set come back? Same symptoms—60-cycle hum bars? You diagnosed the trouble correctly—a leaky tube.

Here's why a leaky tube can cause *you* a lot of trouble.



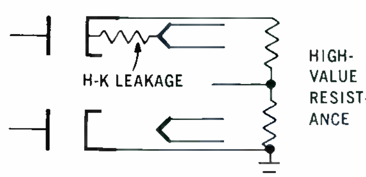

H-K leakage provides a path for 60-cycle current to flow from the heater to the cathode. If there is no resistance or impedance in the cathode circuit, this leakage current usually causes no difficulty.



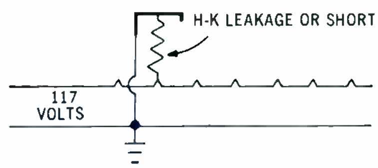

When there is resistance in the cathode circuit, the H-K leakage current develops a 60-cycle voltage across the cathode resistor. This voltage may produce visible and/or audible 60-cycle "hum".

H-K leakage in the RF, IF, or video stages of a TV receiver can produce 60-cycle horizontal pulling and "hum" bars.

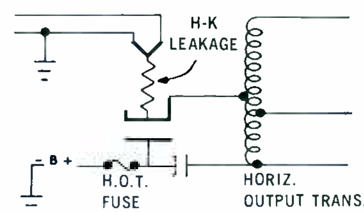
H-K leakage in the sync-separator tube or in the horizontal AFC, oscillator, or output tubes can produce 60-cycle horizontal pulling without "hum" bars.




In detector, discriminator, and AFC stages, which usually have relatively high values of resistance in the cathode circuit, even a slight amount of H-K leakage current can easily cause visible and/or audible 60-cycle "hum" symptoms.




An H-K short circuit, or low-resistance leakage, in a series-string tube, short-circuits part of the heater circuit. The resulting higher voltage across the remaining heaters may cause heater burnout.




H-K leakage in a damper tube which has its heater grounded may cause the H.O.T. fuse to blow.

RCA tubes help you beat these problems—drastically reduce heater-cathode leakage and shorts through such improvements as precise control of heater coatings to eliminate "thin spots"...better heater stem lead arrangements...new cathode materials and structures. Avoid callbacks caused by tubes that develop H-K leakage problems and keep your profits from "leaking" too. Remember to always ask your distributor for *RCA TUBES!*

**RADIO CORPORATION OF AMERICA**

***Electron Tube Division*** ***Harrison, N. J.***