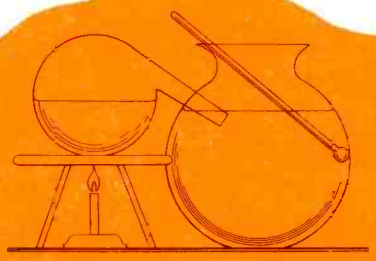
MAY, 1962 35 CENTS

PF REPORTER

including Electronic Servicing



EFFECTIVE USE of SERVICE CHEMICALS

- Track Down Those TV Signal Losses
- Report on the New York UHF Test
- An Approach to Custom Hi-Fi
- TV Tuner Troubleshooting Techniques
- Sure Cures for Repeat Tube Burnout

Outperforms them all!
Outsells them all!

JERROLD®

TRANSISTOR
POWERMATE PREAMPLIFIER

BY FAR THE BEST antenna preamplifier in the business—that's POWERMATE! On black-and-white, and where it *really counts*—on color TV—POWERMATE's superiority shows up across the country.

The better VSWR (impedance match), flat response, ultra-high gain, special broad-band neutralizing transformer, and better power-supply filtering—all add up to an outstanding product. No polarity problems . . . no call-backs . . . transistor protected from lightning-coupled surges . . . remote a-c power supply feeds 2 sets.

Step up to POWERMATE, and step up to a tremendous new profit opportunity. See your Jerrold distributor now.

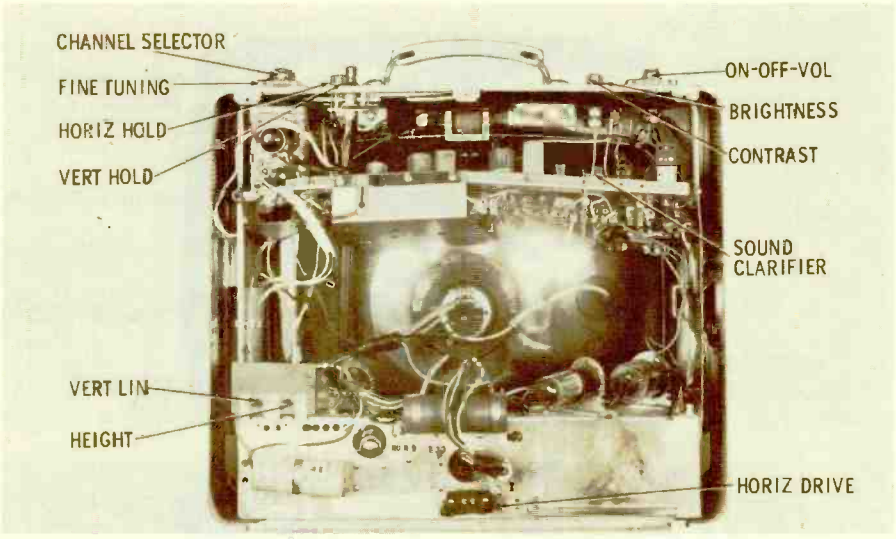
Model APM-101 $39.95 *list, complete*

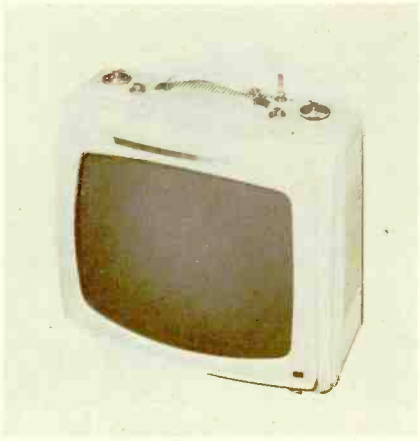
JERROLD ELECTRONICS CORPORATION

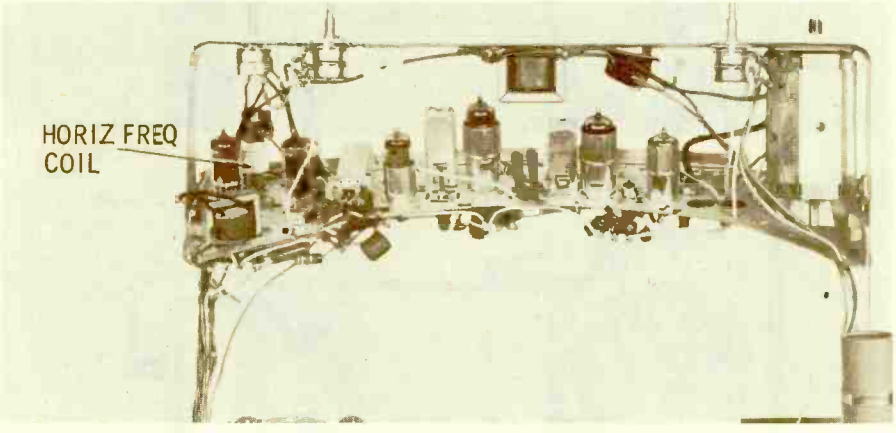
Distributor Sales Division, Dept. IDS-228, Philadelphia 32, Pa.

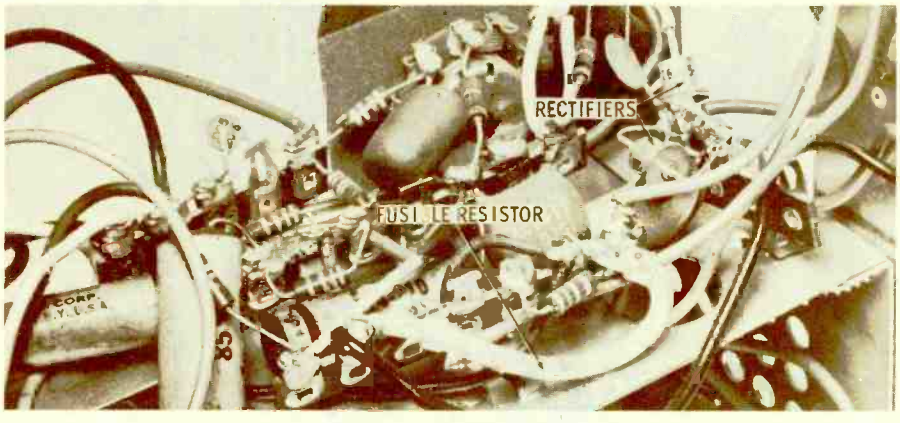
Jerrold Electronics (Canada) Ltd., Toronto • Export: CBS International, New York 22, N. Y.

Olympic









Olympic Model 9TX11 Chassis LX

Among Olympic's 1962 line of 19" portable television is the Model 9TX11, shown here. This 114° chassis has 14 series-filament tubes, including the 19XP4 CRT. A 3BZ6 serves as the first IF amplifier, and a high-gain 3EJ7/-XF184 is used as the second. The video detector is a 1N64 crystal diode (or, in some cases, a 1N60). An 8GN8 pentode-triode is used as the video output and sound IF amplifier.

The LX chassis is a slim "double-decker" type, contoured to fit closely around the bell of the picture tube. Operational controls, such as brightness, contrast, channel selector, fine tuning, on-off-volume, vertical hold, and horizontal hold, are all top-mounted. The vertical linearity and height controls are on the bottom left side of the chassis. These two controls can be adjusted through two holes in the rear cover. A *sound clarifier* coil (quadrature-circuit adjustment in the 4.5-mc sound detector) is made accessible by a plastic extension shaft which protrudes through the rear cover.

A pair of silicon rectifiers are connected as a doubler to supply the low voltage; a 5.5-ohm fusible resistor is used for overload protection. Normal "hot-chassis" servicing precautions are necessary.

The 6CG7 oscillator, 12DQ6B output, 12AX4GTA damper, and 1G3GT HV rectifier make up the tube complement for the horizontal section. A soldered-in dual diode is used in the AFC circuit. The horizontal drive adjustment is a trimmer capacitor in the grid circuit of the 12DQ6B. To reach this trimmer, you must first remove the rear cover from the receiver. The trimmer's physical location is hard to spot; you'll find it directly to the right of the AC interlock (see the photo).

The correct focus-anode potential for the picture tube can be chosen by connecting the lead from pin 4 to one of three slip-on terminal points near the rear apron of the chassis.

For chassis disassembly, remove the following items: The operating knobs, six rear-cover screws, the rear cover, three bottom and two top chassis bolts, the picture-tube socket, the yoke plug, and the speaker and CRT-anode leads.

PF REPORTER for May, 1962, Vol. 12 No. 5. PF REPORTER is published monthly by Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 6, Indiana. Second-class postage paid at Indianapolis, Indiana. 1, 2 & 3 year subscription prices: U.S.A., its possessions, and Canada: $4.00, $7.00, $9.00. All other countries: $5.00, $9.00, $12.00. Current single issues 35c each; back issues 50c each.

Setchell-Carlson Model 19P68R TV Chassis C-219; AM Radio Chassis AM-2

This metal-cabinet set is the first 19" portable television introduced by Setchell-Carlson. The CRT, a 19BRP4, uses 114° deflection. The chassis shown is equipped with an AM tuner, but other models incorporate this TV chassis alone.

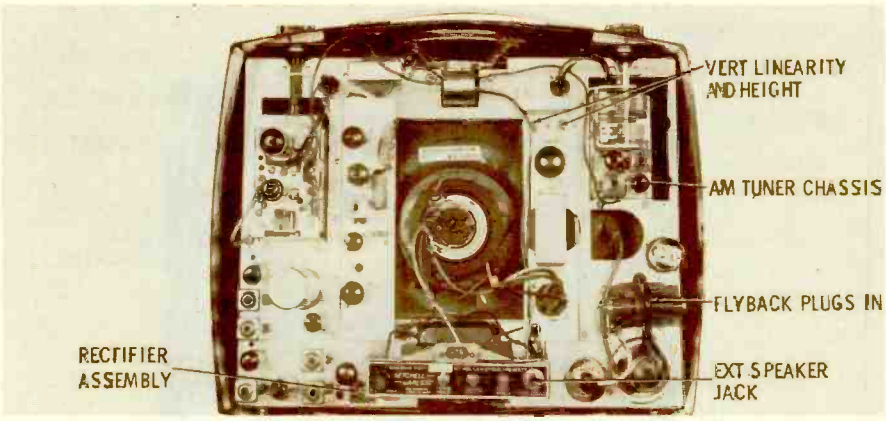
The radio-tuner chassis uses a 6BE6 as the converter, a 6BA6 for the IF amplifier, and a 1N60 diode as the detector. B+ and filament voltages for the tuner are obtained from a socket on the TV chassis. A DPST switch, operated by turning the contrast control, is used to change from TV to radio operation. In the radio position, filament voltage is connected to the tuner tubes, the 6BN8 AF amplifier, and the 6BQ5 audio output tube. The TV audio path to the volume control is also disconnected by a section of this switch.

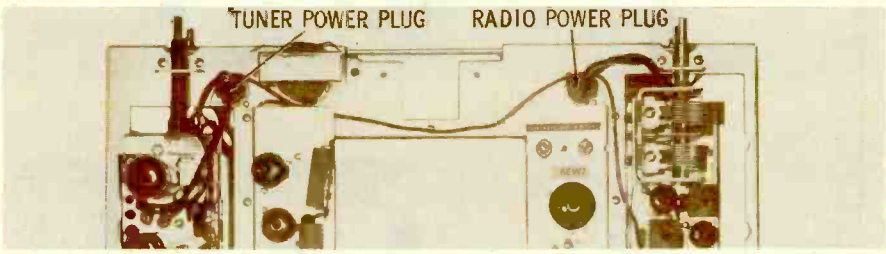
The operating controls located on the cabinet top include the channel selector, fine tuning, contrast, on-off-volume, and radio tuning. The brightness, horizontal hold, and vertical hold controls can be adjusted from the rear of the cabinet. The vertical linearity and height potentiometers (labeled TOP-HEIGHT-BTM) are mounted on the right-hand side of the chassis and are accessible through ventilation holes in the rear cover.

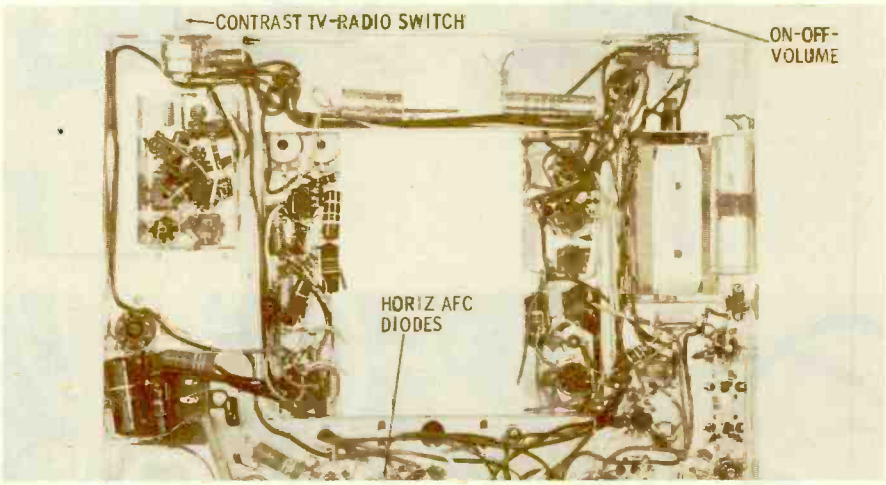
Pulling the chassis for servicing requires the removal of all operating knobs, six screws from the rear cover, and two screws from the bottom of the cabinet. The CRT, yoke and anode leads are then unplugged to release the chassis.

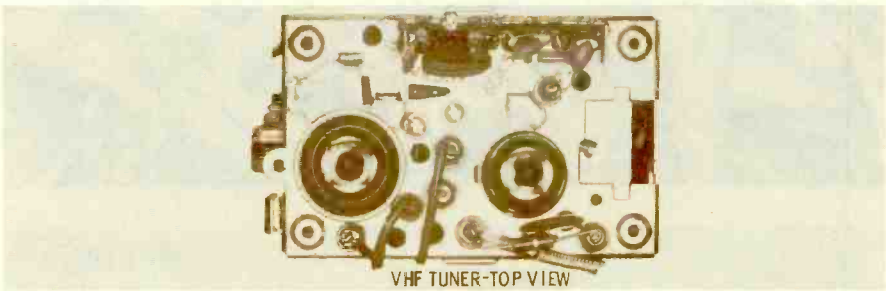
The LV supply circuit uses a power transformer and two silicon rectifiers wired as a voltage doubler. The rectifiers are soldered into a 5-prong connector which plugs into the chassis near the rear apron. A 2-ohm, 10-watt fusible resistor in series with a 3-ampere line fuse protects the transformer primary circuit from overload. A wire-link fuse, connected in the filament-winding ground circuit, safeguards the 6.3-volt supply.

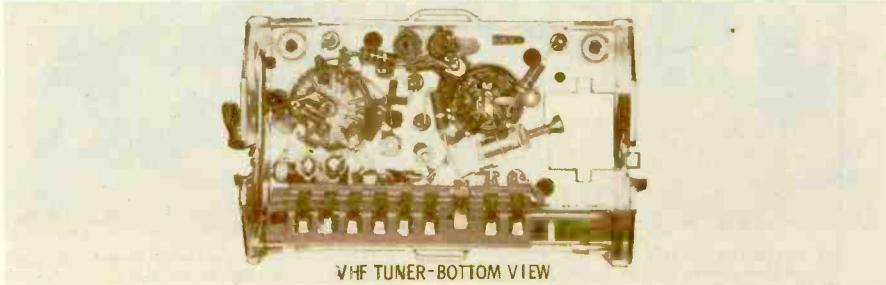
Unlike many previous Setchell-Carlson models, this receiver has a *Guided Grid* turret-type tuner with a 6GK5 RF amplifier and a 6CG8A mixer-oscillator. The individual oscillator slugs are easily accessible for adjustment after removal of the channel-selector and fine-tuning knobs. The tuner B+ and filament supply voltages are obtained through a plug and socket arrangement.



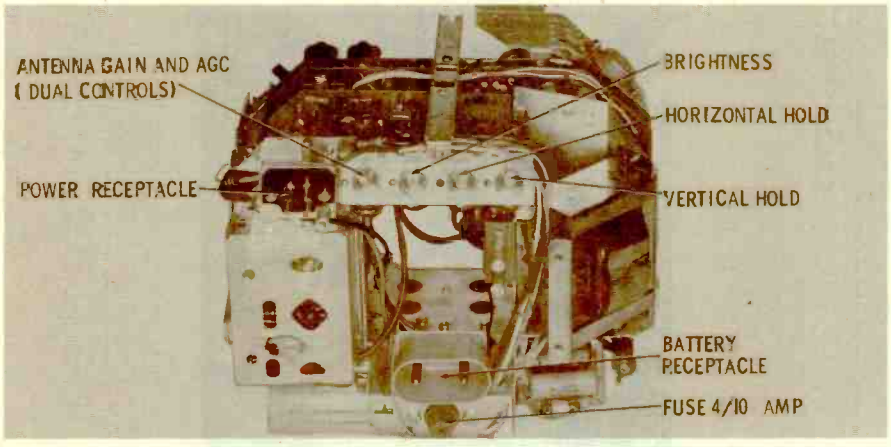


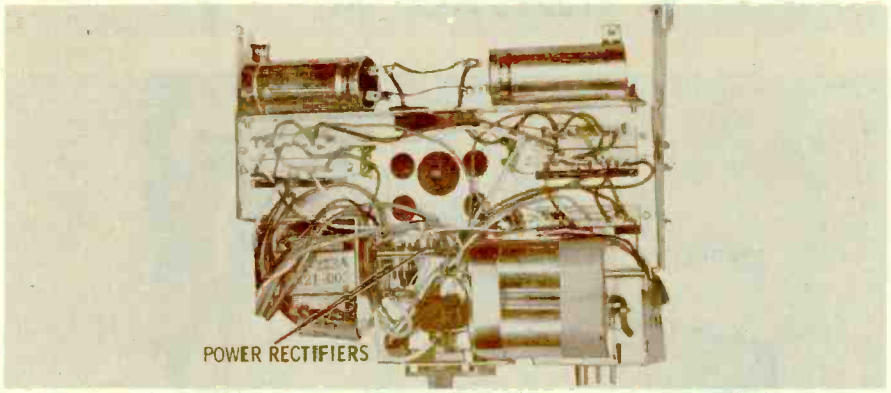


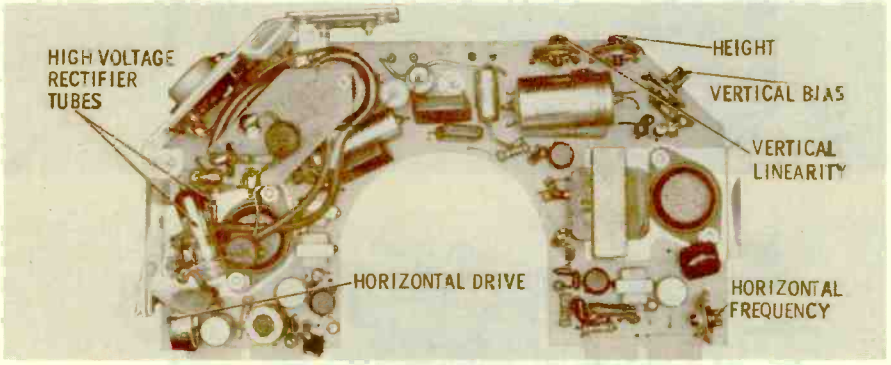

VHF TUNER-TOP VIEW

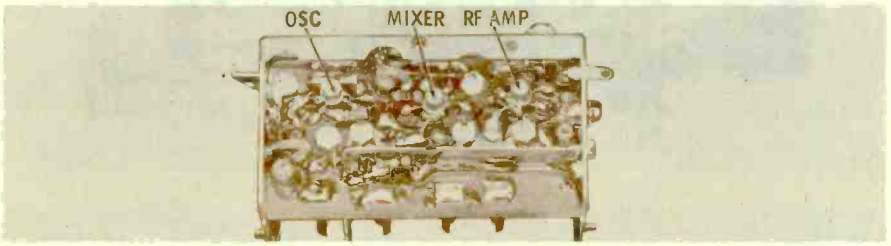

VHF TUNER-BOTTOM VIEW

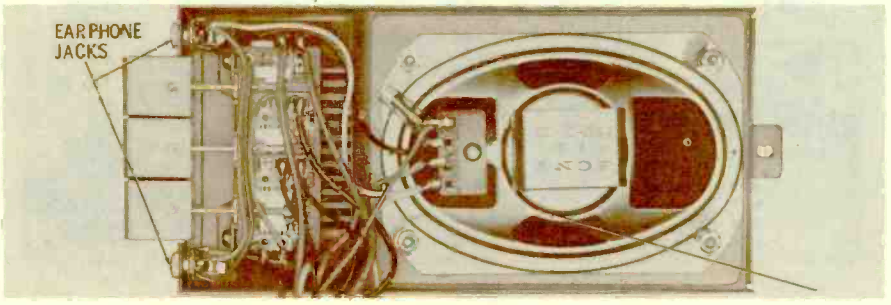
Sony

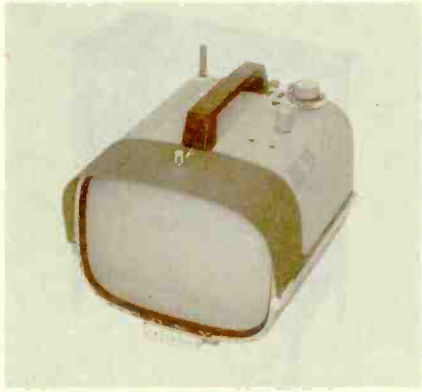












Sony Model 8-301W

Completely portable, Sony's new transistorized 8" television set has small dimensions all around—8¼" x 7" x 9".

Operating controls (brightness, horizontal and vertical hold, channel selector, fine tuning, and an ANTENNA GAIN-AGC dual control) are located on top at the rear of the cabinet. Vertical linearity and height adjustments can be made with a small screwdriver through two holes in the cabinet top. The contrast and horizontal-frequency controls are located on the bottom right side, while on the left side is the horizontal drive control. Before any of these last three controls can be adjusted, an ornamental strip of metal must be slipped off the side of the cabinet.

The receiver can be operated from either 12 volts DC or 117 volts AC, selected by pressing the AC or the DC push button. The 12-volt input can be obtained from a rechargeable battery pack available for the unit, or from a 12-volt automobile system using the cigarette-lighter power cord supplied with the set.

The chassis can be disassembled in the following manner: Remove the six operating knobs; remove six metal screws on the rear; slide the two metal ornamental strips from the cabinet sides; remove one metal screw from each side and the one remaining on the cabinet bottom. The chassis, with the front-panel and picture-tube assembly, can then be removed from the front.

The majority of the components, including most of the 23 transistors and 18 diodes, are mounted on three printed-circuit boards. These boards, being of the snap-in type, may be removed for inspection, servicing or repair. Along with the transistor and diode complement, Sony uses three vacuum tubes. Two 1DK1's, arranged in a voltage-doubler circuit, develop the 6 kv anode voltage for the 210HB4, 90° picture tube.

AC power is rectified by means of a power transformer and four silicon rectifiers arranged in a bridge circuit. The power-transformer primary is protected with a 4/10-amp fuse, and the manufacturer packs two spare fuses with each set. Besides supplying power for TV operation, this circuit also can be used to recharge the lead-acid battery pack when necessary. To prevent possible damage to the battery, Sony's instructions for recharging should be followed carefully; it's important to make sure the set owner understands this procedure.

Westinghouse Model H-K4120U Chassis V-2417-6

Six console models, three table models, and one consolette are included in the line of Westinghouse 23" receivers using the V-2417 chassis and a 114°, 23FP4A picture tube. Physical chassis design closely follows that used in the 1961 line, with a single large printed-circuit board.

UHF-equipped models use a 13-position VHF turret tuner (including a UHF-IF adapter strip) and a continuous-type UHF tuner. Sets which are shipped as VHF only models may be converted to receive a particular UHF channel simply by the addition of a strip.

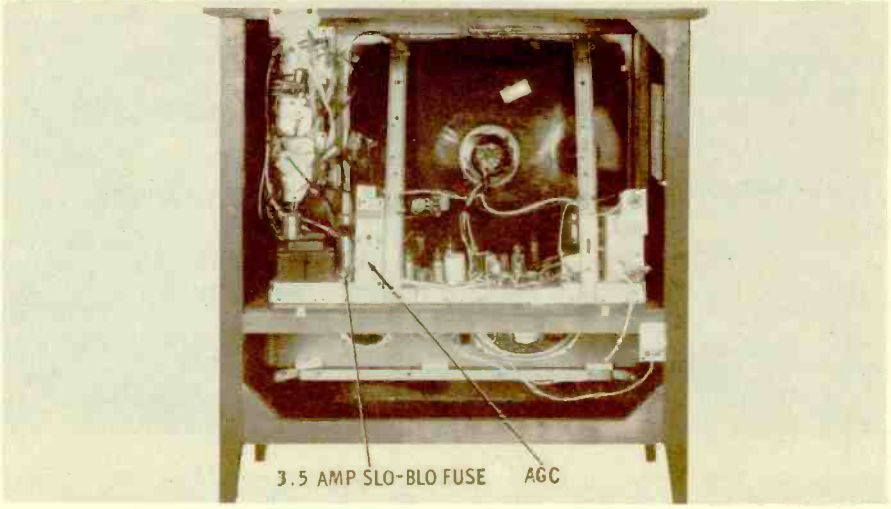
All the normal operating controls are mounted on the front-panel escutcheon. Vertical height and linearity controls are accessible through the hollow shafts of the horizontal and vertical hold controls. A tone control (concentric with the on-off-volume assembly) is included in the model shown, but is omitted in some versions.

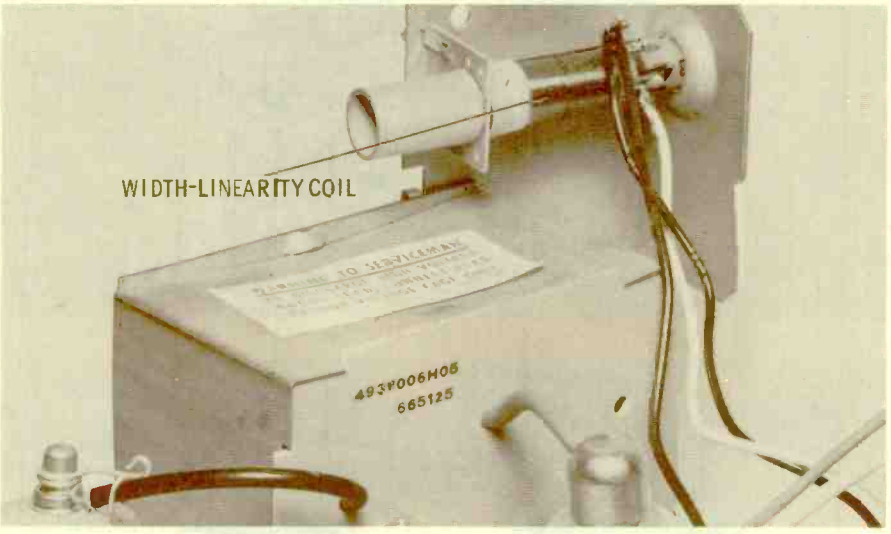
The AGC level can be adjusted from the rear. A 6AU6 keyed-AGC tube operates in a conventional circuit, except that the keying pulse is coupled to the plate in an unusual way. A two-conductor 5" cable (one lead connected to the flyback, the other to the keying-tube plate) functions as the coupling capacitor. The top-chassis photograph shows this "different" arrangement.

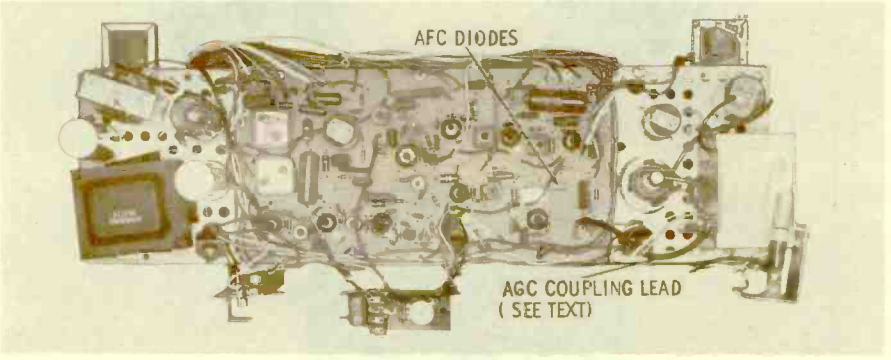
Circuit protection for the 3DG4 low-voltage supply is provided by a 3.5-amp slow-blow fuse in the power-transformer primary. A #24 wire-link fuse, located on the underside of the chassis, protects the 6.3-volt filament circuit.

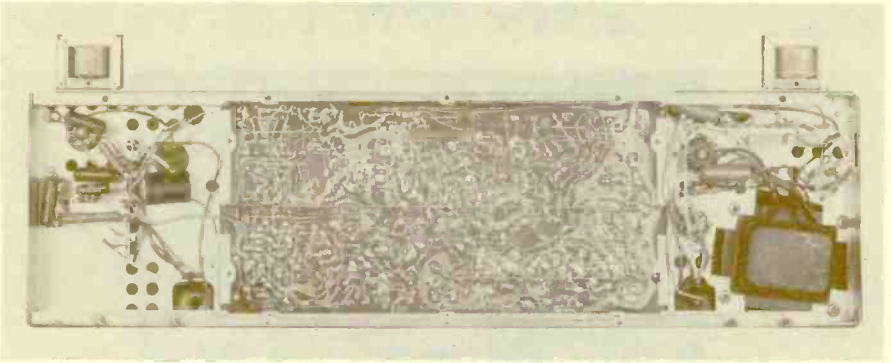
A dual-purpose coil (width and horizontal linearity) is mounted on top of the flyback cage. The width adjustment is the rear slug, while the front slug varies the linearity of the horizontal sweep. Two capacitors (75 and 100 mmf), connected in series from plate to cathode of the damper, provide further width adjustment. A jumper across one of the capacitors will alter the horizontal size; shorting the smaller-value unit will deliver maximum width.

To pull the chassis, you must remove the operating knobs, the rear cover (held by five screws). the tuner-control panel assembly (another five screws), five chassis bolts (from the bottom), and the speaker leads. You may then remove the chassis and picture tube as one unit.









See PHOTOFACT Set 501, Folder 1

See PHOTOFACT Set 501, Folder 1

Mfr: Admiral **Chassis No. 15G1B**

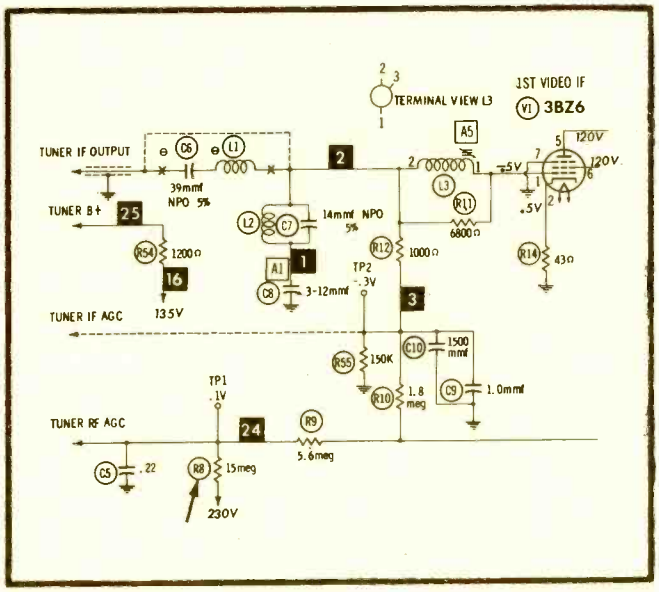
Card No: AD 15G1B-1

Section Affected: Pix.

Symptoms: Snow in picture.

Cause: Open delay resistor in RF branch of AGC line.

What To Do: Replace R8 (15 meg).



Mfr: Admiral **Chassis No. 15G1B**

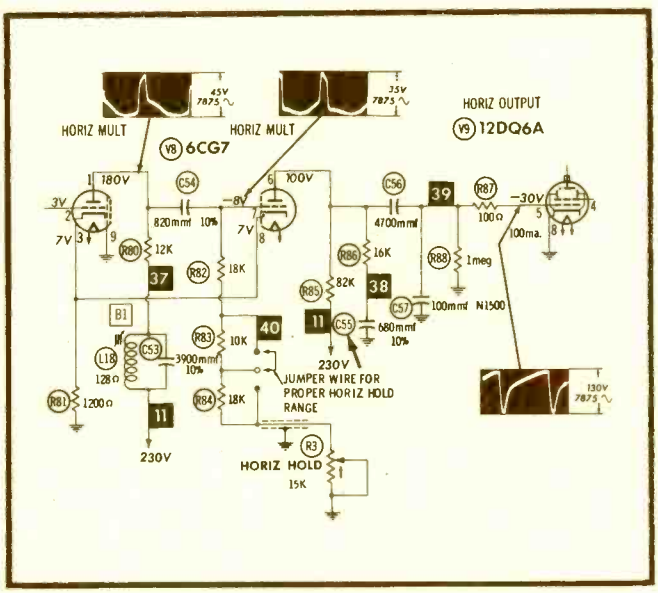
Card No: AD 15G1B-2

Section Affected: Raster.

Symptoms: No raster; no high voltage.

Cause: Shorted waveshaping capacitor at output of horizontal multivibrator.

What To Do: Replace C55 (680 mmf).



Mfr: Admiral **Chassis No. 15G1B**

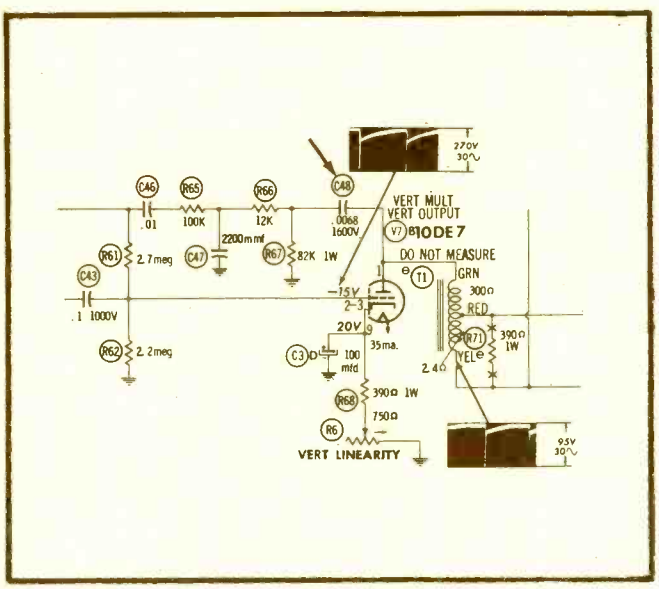
Card No: AD 15G1B-3

Section Affected: Raster.

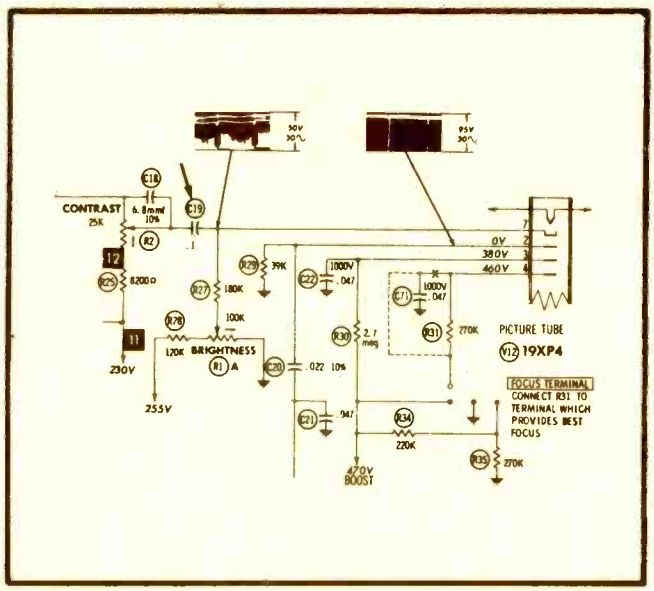
Symptoms: Picture rolls vertically; then vertical sweep collapses to thin white line.

Cause: Shorted feedback capacitor in vertical multivibrator.

What To Do: Replace C48 (.0068 mfd—1600V).



See PHOTOFACT Set 501, Folder 1



See PHOTOFACT Set 501, Folder 1

Mfr: Admiral **Chassis No. 15G1B**

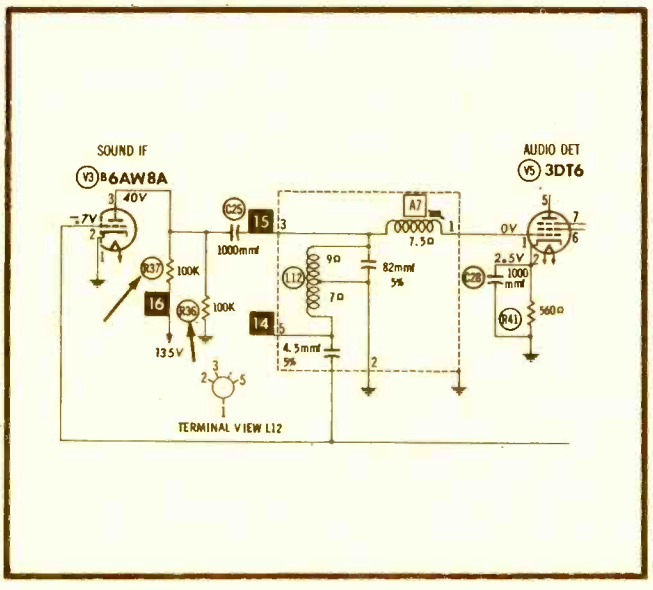
Card No: AD 15G1B-4

Section Affected: Raster.

Symptoms: No brightness; CRT cathode voltage is highly positive at all settings of brightness control.

Cause: Shorted coupling capacitor between video output stage and CRT.

What To Do: Replace C19 (.1 mfd).



Mfr: Admiral **Chassis No. 15G1B**

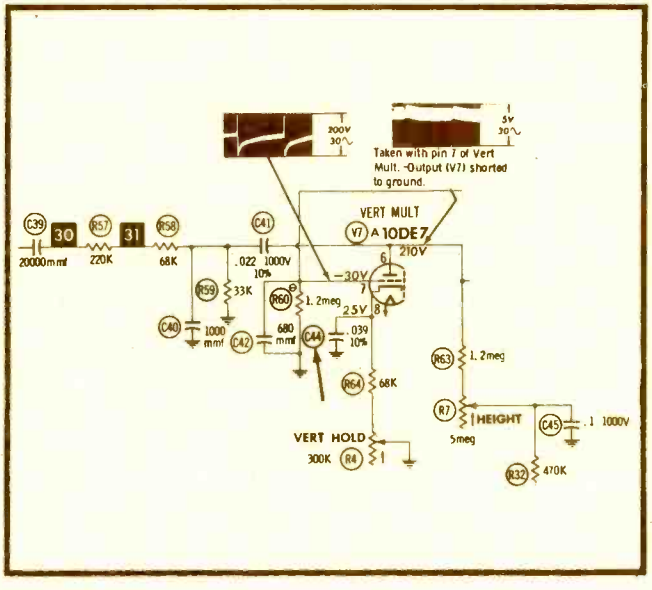
Card No: AD 15G1B-5

Section Affected: Sound.

Symptoms: Weak sound. Incorrect voltage on plate (pin 3) of V3B (6AW8A)

Cause: Voltage-divider resistors in plate circuit of sound IF stage have changed value.

What To Do: Replace R36 and R37 (both 100K).



Mfr: Admiral **Chassis No. 15G1B**

Card No: AD 15G1B-6

Section Affected: Raster.

Symptoms: Vertical sweep collapses intermittently.

Cause: Cathode-bypass capacitor in vertical multivibrator intermittently opens.

What To Do: Replace C44 (.039 mfd).

See PHOTOFACT Set 513, Folder 2

Mfr: RCA **Chassis No. KCS130A**

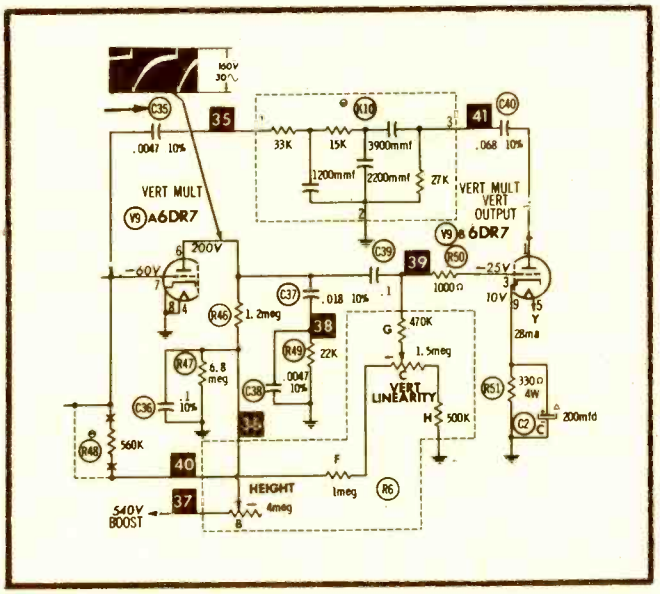
Card No: RCA 130-1

Section Affected: Raster.

Symptoms: No vertical sweep; insufficient negative voltage on grid (pin 7) of V9A (6DR7); incorrect waveform at plate (pin 6) of V9A.

Cause: Open feedback capacitor in vertical multivibrator.

What To Do: Replace C35 (.0047 mfd).



Mfr: RCA **Chassis No. KCS130A**

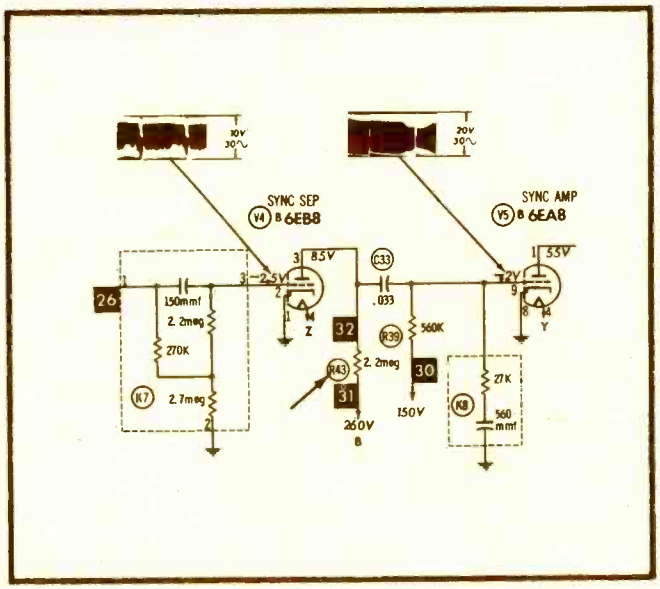
Card No: RCA 130-2

Section Affected: Sync.

Symptoms: Poor vertical and horizontal hold. Incorrect voltage on plate (pin 3) of V4B (6EB8).

Cause: Plate-load resistor has changed value.

What To Do: Replace R43 (2.2 meg).



Mfr: RCA **Chassis No. KCS130A**

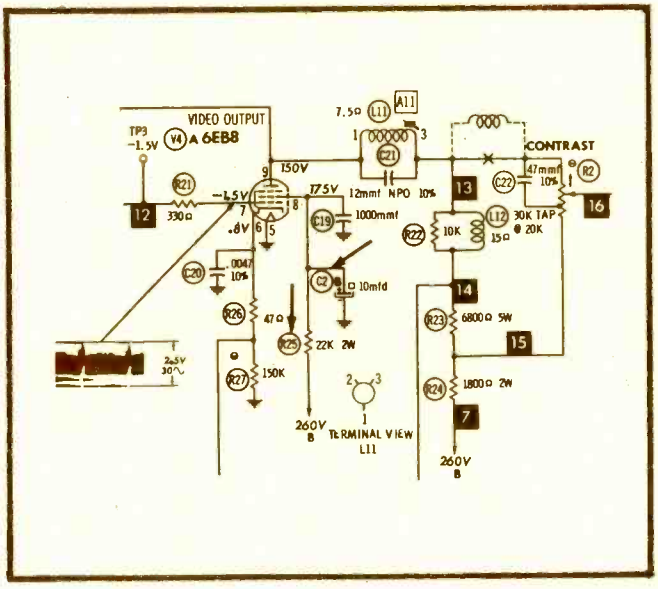
Card No: RCA 130-3

Section Affected: Pix.

Symptoms: Weak picture; flashes on CRT screen; overheated screen resistor in video output stage; erratic voltage readings on V4A (6EB8).

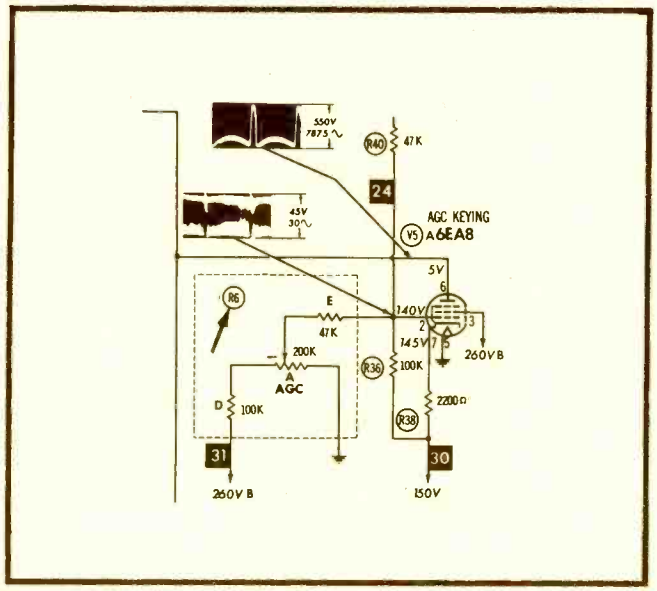
Cause: Leaky screen-bypass capacitor in video output stage.

What To Do: Replace R25 (22K—2W) and C2 (150-10-200 mfd—400-400-350V).



See PHOTOFACT Set 513, Folder 2

See PHOTOFACT Set 513, Folder 2



See PHOTOFACT Set 513, Folder 2

Mfr: RCA **Chassis No. KCS130A**

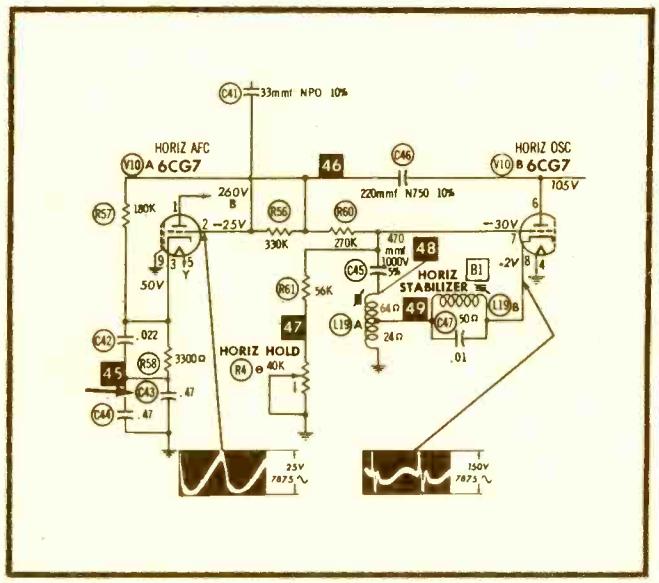
Card No: RCA 130-4

Section Affected: Pix.

Symptoms: Video overloading. No AGC voltage on RF amplifier or first video IF. Positive voltage on grid (pin 2) of V5A (6EA8) much lower than normal.

Cause: AGC control shorted internally to ground.

What To Do: Replace R6A (200K).



Mfr: RCA **Chassis No. KCS130A**

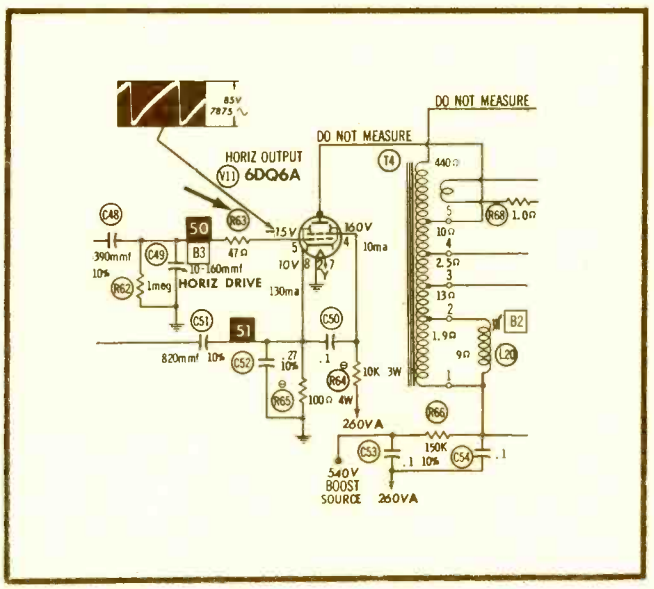
Card No: RCA 130-5

Section Affected: Sync.

Symptoms: Erratic horizontal hold. Scope waveforms observed in horizontal AFC stage are unstable.

Cause: Open capacitor in horizontal AFC circuit.

What To Do: Replace C43 (.47 mfd).



Mfr: RCA **Chassis No. KCS130A**

Card No: RCA 130-6

Section Affected: Raster.

Symptoms: Raster flashes on and off. Intermittent changes in voltage on control grid (pin 5) of V11 (6DQ6A).

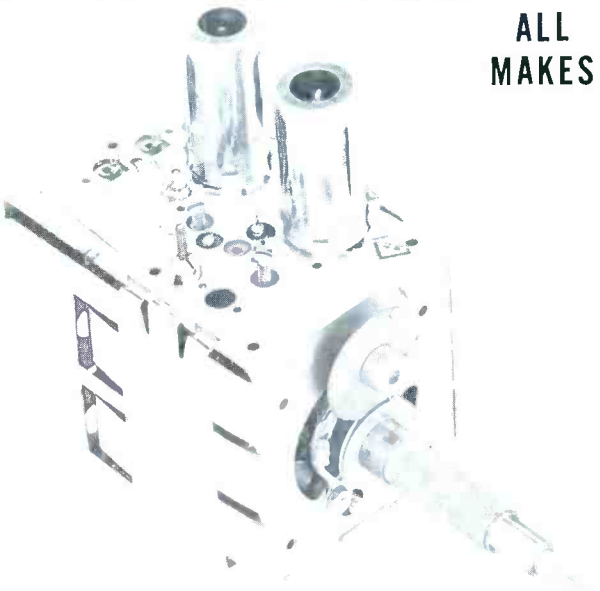
Cause: Horizontal-output grid resistor overheats and opens intermittently.

What To Do: Replace R63 (47 ohms).

Tarzian offers

FAST, DEPENDABLE TUNER REPAIR SERVICE

ALL MAKES



ONLY $8.50 INCLUDING

ALL PARTS and LABOR

24-HOUR SERVICE 6-MONTH WARRANTY

Tuners Repaired on Approved, Open Accounts

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

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

Tarzian-made tuners received one day will be fixed and shipped out the next. Cost is only $8.50 and $15 for UV combinations. That includes ALL parts (except tubes which are furnished at our cost) and labor, and a 6-month guarantee against defective workmanship and parts failure due to normal usage. Replacements available at low cost on tuners beyond practical repair.

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

SERVICE MANAGER • TUNER DIVISION • DEPT. 3A

SARKES TARZIAN INC

east hillside drive • bloomington, indiana
edison 2-7251

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM-FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT and SHISH-KABOB GRILLES

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

New Heavy Duty RFI Suppression Kit For Mobile Radio

RADIO HAMS, fleet owners, and CB operators can now enjoy clearer, more readable, less tiring mobile communications at longer effective ranges.

Sprague's new Type SK-1 SUPPRESSIKIT provides effective R-F Interference suppression—at moderate cost—up through 400 megacycles. Designed for easy installation on automobile, truck, or boat engines with either 6-volt or 12-volt generators, the Suppressikit makes possible high frequency interference control by means of Sprague's new, extended range, Thru-pass® capacitors.

The components in the SK-1 Suppressikit are neatly marked and packaged, complete with easy-to-follow installation instructions. All capacitors are especially designed for quick, simple installation.

The generator capacitor is a heavy-duty unit rated at 60 amperes, and will operate at temperatures to 125°C (257°F). This means you'll have no trouble with an SK-1 installation in the terrific temperatures found "under the hood" on a hot summer's day. There's no chance of generator failures from capacitor "short outs," as with general purpose capacitors. The Thru-pass capacitors for use on voltage regulators are also rated at a full 60 amperes.

The Deluxe Suppressikit is furnished complete with an 8-foot shielded lead on the generator capacitor which can be trimmed to necessary length for any car or small truck, preventing R-F radiation from armature and field leads.

Containing only 5 easy-to-install capacitors, the Deluxe Suppressikit is truly a "do-it-yourself" kit. The net price of $17.85 is a little higher than that of many thrown-to-gether kits, but it saves you so much time and aggravation it's well worth the slight extra cost.

If the SK-1 Suppressikit is not available at your Sprague Electronic Parts Distributor, send your order to Sprague Products Company, 105 Marshall St., North Adams, Mass.

Sprague TWIST-LOK® Capacitors give you 2 tremendous advantages over all other twist-prong electrolytics

1

The right size, the right rating, for EVERY replacement job

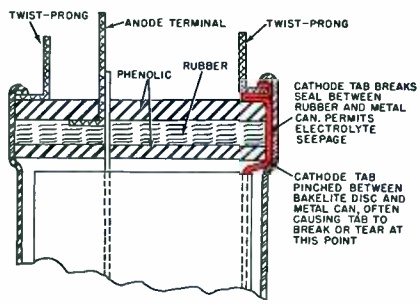
No need to compromise or improvise...the TWIST-LOK Line includes over 1690 different capacitors . . . It's the industry's most complete selection of twist-prong type capacitors, bar none!

2

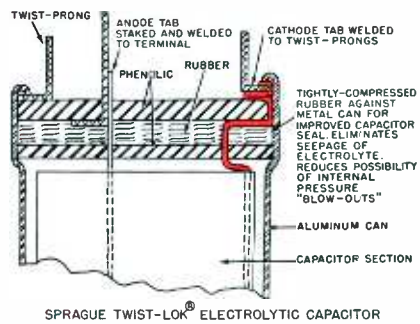
Exclusive, improved cover design for greater dependability

Type TVL Twist-Lok Capacitors are now more dependable than ever! Sprague's new cover design provides a truly leak-proof seal and permits capacitors to withstand higher ripple currents.

Compare internal construction of TWIST-LOK to ordinary 'Lytic!



ORDINARY ELECTROLYTIC CAPACITOR



SPRAGUE TWIST-LOK® ELECTROLYTIC CAPACITOR

Complete listings are shown in handy Wall Catalog C-457. Get your copy from any Sprague Distributor, or write to Sprague Products Company, 105 Marshall St., North Adams, Mass.

WORLD'S LARGEST
MANUFACTURER OF CAPACITORS

SPRAGUE®
THE MARK OF RELIABILITY

publisher
Howard W. Sams

general manager
Mal Parks, Jr.

editor
Verne M. Ray

managing editor
Forest H. Belt

ass't. managing editor
Thomas A. Lesh

associate editors
James F. Galloway
George F. Corne

consulting editors
William E. Burke
Joe A. Groves
C. P. Oliphant

art director
Anthony M. Andreone

advertising & editorial assistants
Ruth E. Bastin
Georgeanna Caldwell
Paula Haffner

production manager
Robert N. Rippy

circulation fulfillment
Pat Tidd, Mgr.
Constance Bland, Ass't.
Katherine Smith, Ass't.

photography
Robert W. Reed

advertising sales offices

midwestern
John Groce, advertising sales manager
PF REPORTER
2201 East 46th Street, Indianapolis 6, Ind.
CLifford 3-6441

eastern
Charles Horner
Howard W. Sams & Co., Inc.
3 West 57th Street,
New York, N. Y.
MUrray Hill 8-6350

western
The Maurice A. Kimball Co., Inc.
2550 Beverly Blvd., Los Angeles 57, Calif.
Dunkirk 8-6178; and 580 Market Street,
Room 400, San Francisco 4, Calif. Exbrook 2-3365

Address all correspondence to PF REPORTER, 2201 East 46th Street, Indianapolis 6, Indiana

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

PF REPORTER

including Electronic Servicing

VOLUME 12, No. 5 MAY, 1962

CONTENTS

ABOUT THE COVER

"Carbon tet" was good enough for the radio repairman of prewar days, but the modern electronics service shop has dozens of special-purpose chemicals to choose from. For some ideas on using these to make your work easier, turn to page 30.

Dear Editor:

I would like to compliment you on your very fine magazine. You still publish articles dealing with service problems on radio, TV, record players, and tape recorders — the things that are of interest to me and countless others. A great many magazines have dropped radio-TV servicing and devote almost all their space to industrial electronics and communications. For this reason, I am dropping some magazines I have subscribed to for years.

I like your service articles very much and hope you continue to give us more of the same.

CLYDE M. FRENCH

St. Joseph, Mo.

Many forward-looking TV shops are devoting some attention to sidelines such as communications, and we are filling an increased demand for articles in these areas. But we still look on consumer electronics as "home base."—Ed.

Dear Editor:

A few weeks ago, I returned to you an application for a trial subscription. I was to have received the November issue with the option to cancel for free.

When I received three issues at once, I was just a little miffed. I immediately sent you a card cancelling my subscription.

That was earlier this week. Since that time, I have had the opportunity to do some detailed reading in these magazines. Therefore, I now request that you *cancel* my *cancellation*.

HARRY R. ELLIOTT

Seattle, Wash.

With pleasure!—Ed.

Dear Editor:

Would it be possible for you to send me a parts list for the two-way test set shown on page 43 of your December, 1961 issue? Also, is it possible to use other diodes in place of the ones listed?

W. F. SOVINSKY

Kent, Ohio

Although we have not prepared such a list, we did provide additional data on the diodes and switches in our February "Letters" column. Except for some questions about these specific components, several readers have reported success in building the test set from standard parts.

If the evidence of interest in this project continues to run high, we are thinking of publishing modifications of the test-set design to expand its usefulness. At the same time, we could provide further data on parts. All we need now is sufficient reader response to indicate their feelings one way or the other.—Ed.

Dear Editor:

I enjoyed Allan Lytel's article on selective calling in the February issue. Upon studying the schematics, I have found that you have taken care in labeling all parts with the exception of T1 in the decoder unit. Exactly what type of transformer is it?

RONALD R. MCDONALD, SR.

(address not given)

Mr. Lytel did not supply us with exact data on this transformer, but we do know that the decoder unit was made by Secode Corp. of San Francisco.—Ed.

Dear Editor:

I have a Ravenswood Model C242149 (B20PTS) television set, and can't find service data anyplace. I wonder if you could help me?

RICHARD HOGAN

(address not given)

Sorry, but we have no information on this set at the present time.

We also regret that we were unable to send you and Mr. McDonald personal replies to your letters, but neither of you included a return address. To insure receiving an answer, return addresses should be included right on the letters—envelopes sometimes become lost in the shuffle.—Ed.

Dear Editor:

Your "TV Service Charge Survey" in the December issue was indeed a worthwhile and interesting article. I shall carry a copy in my tube caddy for the "education" of the few customers who complain about high service charges.

Some further explanation of the average home-call and bench charges would be of interest. What is usually included in these charges in the way of labor? Also, what maximum figure do most shops set, beyond which they cease to charge on "dog" cases?

JESS "OZZIE" OSBORNE

Ozzitronix TV
Marion, Ohio

The amount of labor seems to be roughly proportional to the charge, with extra services providing a "professional" touch that commands a higher fee.

According to the survey, a basic flat-rate bench fee of more than approximately $10 usually includes free pickup and delivery of the set. This simply indicates that some shops like to quote a "blanket" charge, while others prefer to itemize their fees in greater detail.

A fair proportion of shops have some means of limiting the maximum charge on "dogs." A few of them tack an extra $5 or so onto the basic flat-rate bench fee to help make up for extra time spent. Others, who charge by the hour for bench work, apply a lower hourly rate after the first hour or two has passed without resulting in a completed repair. Several other shops have a ceiling of $15 to $20 for the labor charge on bench work— ". . . for fairness to customers," they explain.—Ed.

Dear Editor:

We have a new customer for you—Mr. John Morley, who recently became as-

ALL-NEW

ATR® TUBE-TYPE and TRANSISTOR-POWERED Karadio®

"the oldest name in auto radio"

with Excellent Tone, Sensitivity, and Volume!

- HAND WIRED — NO PRINTED CIRCUITRY
- FINGER-TIP TONE CONTROL
- EQUIVALENT 8 TUBE PERFORMANCE
- AUTOMATIC VOLUME CONTROL

TUBE-OPERATED

UNIVERSAL Karadio

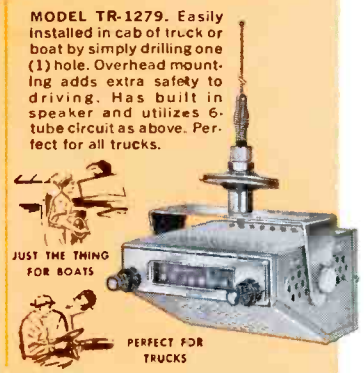
$39.95 LIST PRICE

MODEL 600 SERIES. Easily installed in-dash or under-dash. Amplifier/power supply chassis may be separated from tuner chassis for installation flexibility and easy servicing. Utilizes 6-tube superheterodyne circuit (two dual purpose tubes) with 8-tube performance . . . pulls in those distant stations with good tone and volume. Supplied with separate 5" x 7" speaker.

TRUCK Karadio

$59.95 LIST PRICE

MODEL TR-1279. Easily installed in cab of truck or boat by simply drilling one (1) hole. Overhead mounting adds extra safety to driving. Has built in speaker and utilizes 6-tube circuit as above. Perfect for all trucks.



UNIVERSAL Karadio

$44.95 LIST PRICE

MODEL TR/K-1279 SERIES. Easily installed in-dash or under-dash. Has self-container speaker and 6-tube superheterodyne circuit with 8-tube performance . . . pulls in those distant stations with good tone and volume.

TRANSISTOR-POWERED

UNIVERSAL Karadio

$39.95 LIST PRICE

MODEL 400 SERIES. Easily installed in-dash or under-dash. Superheterodyne circuit utilizing 4 tubes (two dual purpose tubes) together with two transistors . . . pulls in those distant stations with good tone and volume. Supplied with separate 5" x 7" speaker.

FULL CUSTOM Karadio

$49.95 LIST PRICE

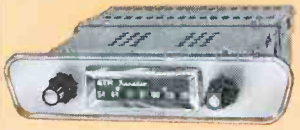
UTILIZES MODEL 400 SERIES designed specifically for 1960-61-62 Ford and Falcon cars. Blends perfectly with dashboard same as original equipment. Supplied with 6" x 9" speaker.

FULL CUSTOM Karadio

$49.95 LIST PRICE

UTILIZES MODEL 400 SERIES designed specifically for 1961 and 1962 Chevrolet. Blends perfectly with dashboard same as original equipment. Supplied with 6" x 9" speaker.

Customized Karadio



Illustrates ATR CUSTOMIZED Karadio utilizing Model 600 Series and deluxe trim plate mounting for Falcon. Many model CUSTOMIZED Karadios are available in Model 600 series, 400 series, or TR/K-1279 series permitting maximum installation flexibility.

as low as **$45.95** Complete LIST PRICE

to fit most Import Cars \ Compact U.S. Cars and Standard U.S. Cars & Trucks

READ and COMPARE!

Read why ATR KARADIOS provide the highest value and performance at the lowest cost, giving utmost customer satisfaction!

ATR UNIVERSAL Karadio 400 SERIES. Transistor-Powered	4 Tubes	2 Transistors	RF Stage	Tone Control
Brand A Transistor-Powered	2 Tubes	2 Transistors	None	None
Brand B Transistor-Powered	3 Tubes	2 Transistors	None	None
Brand C Transistor-Powered	3 Tubes	2 Transistors	None	None

The above UNIVERSAL type sets being compared are all Transistor-Powered types having suggested selling price $39.95. Note the extra value of the ATR KARADIO providing extra RF stage and variable tone control providing top performance, and maximum distance reception. In addition ATR KARADIO is supplied with a separate 5" x 7" speaker giving high fidelity tone, and maximum volume.

ATR

QUALITY PRODUCTS SINCE 1931

ATR ELECTRONICS, INC.

300 E. 4th St.
St. Paul 1, Minn.

SEE YOUR ATR KARADIO DISTRIBUTOR OR WRITE FACTORY FOR COMPLETE INFORMATION.

FRANCHISE TERRITORIES AVAILABLE FOR AUTO RADIO SPECIALISTS. ACT NOW!

WE'RE IN BOOTH E-121 — SEE US!!!!

sociated with us. Believe it or not, he had never seen a PF REPORTER until we showed him our copies. His immediate reaction was, "The best TV magazine I ever read. I wish I had known about this long ago."

May we say, in closing, that any small measure of success we may have achieved in the electronics field would have been considerably less if we had not had PF REPORTER and PHOTOFACTS to guide us.

CHRIS H. BAKER

Newtown Square, Pa.

Thanks for the double kindness of telling a friend, and us too, that you like our magazine. This way, we're all happy.—Ed.

Dear Editor:

In reference to Leroy Becwar's letter in the December issue, I have found that a small piece of Masonite covered with thin plastic (the type used by salesmen in their loose-leaf promotion books) will protect service schematics on the bench —without the added risk of broken glass. A dry rag will wipe off marks made with a crayon or china-marking pencil. If the plastic is fastened down with masking tape on three sides, leaving an open end, the schematics can be slipped in and out of the holder with very little trouble.

RAY MCCASKER

Bristol, Conn.

Dear Editor:

"Servicing Sync and Sound" in your September, 1960 issue was very good. I noticed that it was the last of seven articles; could you please inform me as to what issues carried the previous six installments? I would like very much to acquire the others.

W. A. FRAZIER

Cayucos, Calif.

The complete list of article titles and issues appeared in January, 1962, on page 17. This item drew so many requests for these back issues that we are now completely sold out of three different numbers —December, 1959; January, 1960; and May, 1960. However, we can still supply copies of the others, including September, 1959; March, July, and September, 1960, at the usual back-number price of 50c. —Ed.

Dear Editor:

We have a problem a little different from what most people are asking you.

We seem to be having difficulty in finding good TV repairmen for our TV-appliances stores in Potter, Sidney, and Gering, Nebraska. We would like to hire a good man—handicapped or not, it doesn't matter.

If you know anyone who may be interested, please have them write us.

HOFROCK BROS.

Box 6

Potter, Nebr.

This sounds familiar, since we've heard it before; it seems to be a common problem, and we'd like to help in some way. If it would be in the interests of our readers, we might even consider a classified column to help spread the word of shops who need help, technicians who want jobs, shops for sale, or other similar items. Any other readers have suggestions? —Ed.

ONLY WINEGARD MAKES ELECTRONIC TV ANTENNAS WITH TUBES!

Work Perfectly in Areas Where Transistors Fail!

Why Winegard Makes BOTH Tube and Transistor Electronic TV Antennas!

In December, 1960, Winegard introduced the first electronic TV antenna—the Powertron—a tube model that created an immediate reaction in the industry. Winegard had a transistor model ready for introduction within a few months. Later, competitive antenna amplifiers appeared, all of which were transistorized. But Winegard continues to make tube type Powertrons as well as transistor models, for very important reasons. *In fact,* more Winegard Powertrons have been sold than all *competitive* antenna amplifiers and so-called electronic antennas combined!

There are two types of signal area where electronic antennas can do wonders in improving TV and FM:

1. **Fringe areas:** where the nearest TV or FM stations are a considerable distance from the set.
2. **Mixed signal areas:** where some TV or FM stations are far away and weak, but other stations are strong because of being located fairly close.

The type of signal area is *extremely* important in determining your selection of tube versus transistor.

Transistors currently available, while they are very satisfactory for weak signals, often cause cross modulation interference when signal input is in excess of 20,000 microvolts. (It is possible to design a circuit that will prevent overloading transistors, but at too great a sacrifice in gain and noise figure.)

Because tube type electronic antennas will take many times more signal input than transistors without overloading, *there are areas where only Winegard tube type Powertrons can be used successfully.*

Both transistors and tubes have individual advantages. Transistors, for example, are small, use little power, and have a very long expected life. Tubes have the high gain and low noise characteristics of transistors, but do not normally overload.

Only Winegard gives you both! Get the facts, write for technical bulletin today or ask your distributor.

POWERTRON OUTFEATURES AND OUTPERFORMS ORDINARY ANTENNAS

- **POWERTRON CAPTURES MORE SIGNAL** than any other all-channel antenna ever made. Patented design, electro-lens director system, dual "TAPERED T" driven elements.
- **POWERTRON'S THE ONLY TRUE ELECTRONIC ANTENNA.** Only the Winegard Powertron is built with the amplifier as part of the driven element—not an "add-on" attachment.
- **POWERTRON ELIMINATES ALL SIGNAL LOSS** that normally occurs between the driven element and the amplifier due to transmission and coupling mismatch.
- **POWERTRON BOOSTS WEAK SIGNALS UP OUT OF THE SNOW** far better than any other antenna or antenna-amplifier combination made.
- **FOR VIVID COLOR, HIGH DEFINITION BLACK AND WHITE AND LONG DISTANCE RECEPTION,** nothing can compare to the Powertron.

POWERTRON IS 100% CORROSION-PROOFED—
ANTENNA IS GOLD ANODIZED, ALL HARDWARE IRRIDIZED, AMPLIFIER HOUSING OF HIGH IMPACT PLASTIC

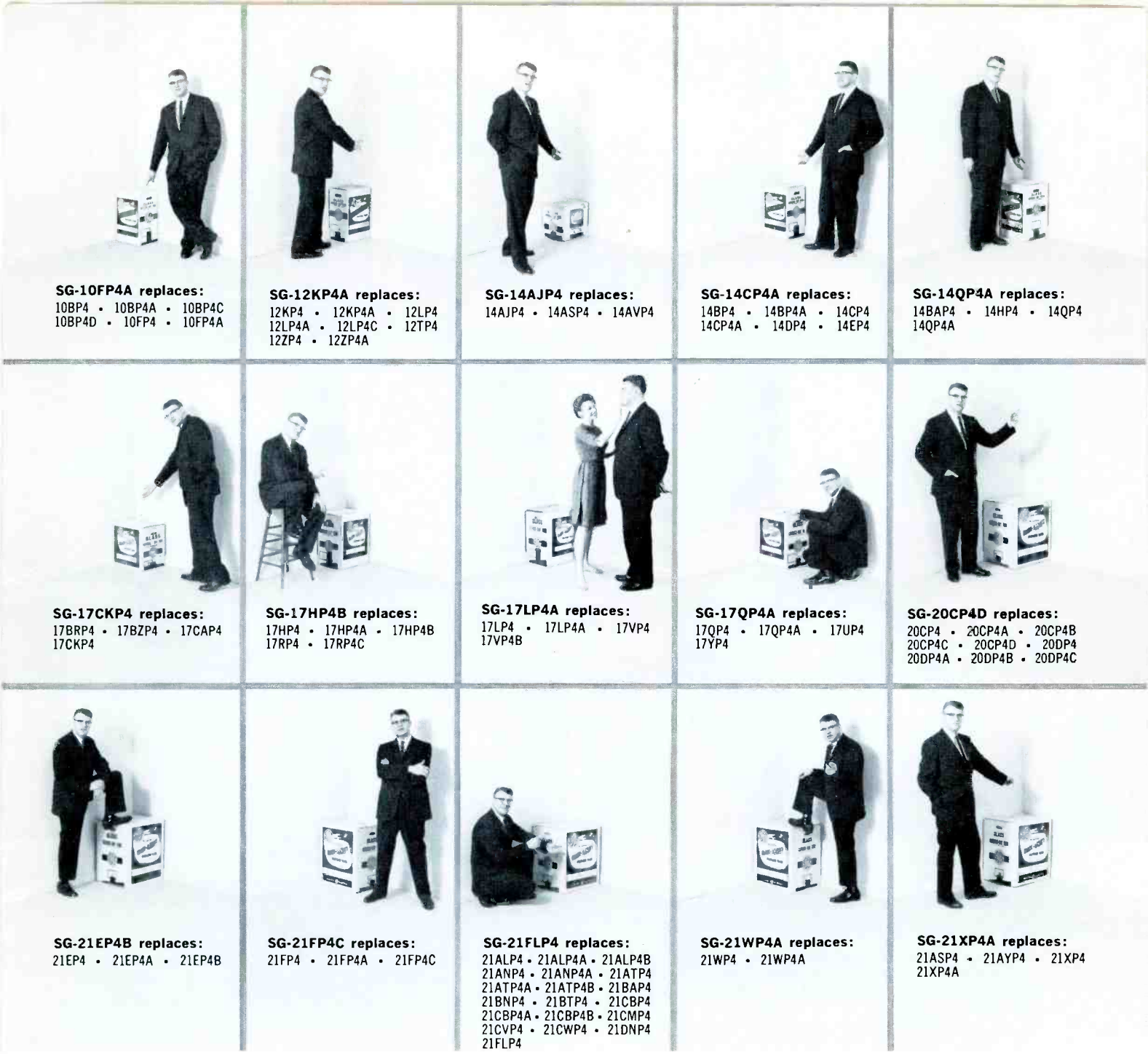
POWERTRON HAS COMPLETELY AC POWER SUPPLY
No shock Hazard!

Winegard

ANTENNA SYSTEMS

3009-5 Kirkwood Street • Burlington, Iowa

Originators of Gold Anodized TV and FM antennas — makers of the World Famous Color Captor TV antenna.



SG-10FP4A replaces:
10BP4 • 10BP4A • 10BP4C
10BP4D • 10FP4 • 10FP4A

SG-12KP4A replaces:
12KP4 • 12KP4A • 12LP4
12LP4A • 12LP4C • 12TP4
12ZP4 • 12ZP4A

SG-14AJP4 replaces:
14AJP4 • 14ASP4 • 14AVP4

SG-14CP4A replaces:
14BP4 • 14BP4A • 14CP4
14CP4A • 14DP4 • 14EP4

SG-14QP4A replaces:
14BAP4 • 14HP4 • 14QP4
14QP4A

SG-17CKP4 replaces:
17BRP4 • 17BZP4 • 17CAP4
17CKP4

SG-17HP4B replaces:
17HP4 • 17HP4A • 17HP4B
17RP4 • 17RP4C

SG-17LP4A replaces:
17LP4 • 17LP4A • 17VP4
17VP4B

SG-17QP4A replaces:
17QP4 • 17QP4A • 17UP4
17YP4

SG-20CP4D replaces:
20CP4 • 20CP4A • 20CP4B
20CP4C • 20CP4D • 20DP4
20DP4A • 20DP4B • 20DP4C

SG-21EP4B replaces:
21EP4 • 21EP4A • 21EP4B

SG-21FP4C replaces:
21FP4 • 21FP4A • 21FP4C

SG-21FLP4 replaces:
21ALP4 • 21ALP4A • 21ALP4B
21ANP4 • 21ANP4A • 21ATP4
21ATP4A • 21ATP4B • 21BAP4
21BNP4 • 21BTP4 • 21CBP4
21CBP4A • 21CBP4B • 21CMP4
21CVP4 • 21CWP4 • 21DNP4
21FLP4

SG-21WP4A replaces:
21WP4 • 21WP4A

SG-21XP4A replaces:
21ASP4 • 21AYP4 • 21XP4
21XP4A

G.E. reporter, Roland Kempton, shows 30 "universal" picture tubes

30 *SERVICE-DESIGNED "SG"*

ALUMINIZED TUBES FEATURE NEW STRAIGHT GUN, REQUIRE NO ION TRAP

Each of these Service-Designed "SG" tubes features General Electric's new straight line high-resolution gun. This means you don't have to install an ion trap. Save time. Less chance of call-back. Replace either bent gun or straight gun tubes and give your customers the best picture their sets can deliver.

Pick a number from 10BP4 to 27RP4 . . . or any of 167 tube types in between (see above). From just 30 G-E Service-Designed "SG" picture tubes choose a replacement. Chances are, you'll have it right in your shop, because now it makes sense to carry a minimum inventory for commonly replaced picture tubes. These picture tubes move! . . . give you a big advantage in prompt availability, faster customer service, fewer emergency pick-ups, simpler ordering.

SG-14WP4 replaces:
14NP4 • 14NP4A • 14RP4
14RP4A • 14SP4 • 14WP4
14ZP4

SG-16KP4A replaces:
16KP4 • 16KP4A • 16QP4
16RP4 • 16RP4A • 16TP4
16UP4 • 16XP4

SG-17BP4B replaces:
17AP4 • 17BP4 • 17BP4A
17BP4B • 17BP4C • 17JP4

SG-17BJP4 replaces:
17ATP4 • 17ATP4A • 17AVP4
17AVP4A • 17BJP4, 17BUP4
17CBP4 • 17CLP4

SG-17BWP4 replaces:
17BVP4 • 17BWP4 • 17CSP4

SG-20HP4D replaces:
20HP4 • 20HP4A • 20HP4B
20HP4C • 20HP4D • 20LP4
20MP4

SG-21ACP4A replaces:
21ACP4 • 21ACP4A • 21AMP4
21AMP4A • 21AMP23A • 21AQP4
21AQP4A • 21BSP4 • 21CUP4

SG-21AUP4B replaces:
21AUP4 • 21AUP4A • 21AUP4B
21AVP4 • 21AVP4A • 21AVP4B
21BDP4

SG-21AWP4 replaces:
21AWP4

SG-21DEP4A replaces:
21CZP4 • 21DAP4 • 21DEP4
21DEP4A

SG-21YP4A replaces:
21AFP4 • 21BCP4 • 21YP4
21YP4A

SG-21ZP4B replaces:
21ZP4 • 21ZP4A • 21ZP4B

SG-24AEP4 replaces:
24AEP4 • 24ANP4 • 24DP4
24DP4A • 24YP4 • 24ZP4

SG-24CP4A replaces:
24ADP4 • 24CP4 • 24CP4A
24QP4 • 24TP4 • 24VP4
24VP4A • 24XP4

SG-27RP4 replaces:
27EP4 • 27GP4 • 27NP4
27RP4

picture tubes replace 169 types

In addition to the unique straight gun design, each of these Service-Designed picture tubes is aluminized and employs General Electric's high temperature phosphor screen. They provide the bright, clear pictures your customers want—up to 40 percent brighter. Get your new interchangeability chart, plus full details on General Electric Service-Designed "SG" picture tubes from your General Electric tube distributor.

General Electric Company, Distributor Sales, Electronic Components Division, Room 1709A, Owensboro, Kentucky.

Tubes listed contain all new material and parts in reused envelope.

Progress Is Our Most Important Product

GENERAL ELECTRIC

STANDOFF!

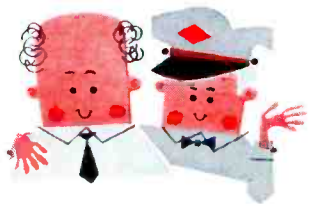
Most people think Standoff means "keep your distance" ■ Any good Service technician knows a Standoff as a gidget to hold the lead-in away from the house ■ So...?

Just this. Philco talks your language, Mr. Serviceman. We practically eat and sleep parts and service day in, day out—just like you! We know your problems intimately. We know that unless you make a profit, this Philco operation can never make a profit, either. Everything we offer must be of value to you.

This Standoff, for instance. It has been tested for heat . . . for cold. It is hot galvanized to be rust resistant, tested for tensile strength, for shear . . . dozens of individual tests and inspections. It's typical of the pains that are taken to insure the quality of every part Philco makes or sells.

Look to Philco for Sales helps, Training aids, Programs, to help keep you the expert in your field. And look to Philco for parts that replace quickly and stay replaced. This means Quality! Your profits will follow as day follows night—and so will ours!

Standoffs, anyone?



YOUR PHILCO DISTRIBUTOR has a complete selection of Philco tubes, Philco and universal capacitors, batteries, parts and accessories . . . for every service need. See him today!

PARTS & SERVICE OPERATIONS

PHILCO®

A SUBSIDIARY OF *Ford Motor Company*

The Electronic Scanner

Program to Increase Recognition of Servicemen

"The new 'Key to Trusted Service' program from **RCA** will provide distributors with every major element needed to dramatize the important role of service dealers in the community," according to Harold S. Stamm, manager of the company's Advertising and Sales Promotion Division. Backing up the program will be national television and magazine advertising. Symbol of the program is a 14" statuette for counters or display shelves.

Antenna Manufacturer's Sales Up in 1961

"Sales of **Winegard** TV antenna amplifiers and accessories in 1961 were up 55% over 1960," reports John Winegard, company president. A new factory was completed in 1961 and is currently devoted to manufacture of amplifiers, boosters, and electronic accessories. Mr. Winegard also stated that sales for the first two months of 1962 were up 51% over 1961.

New Distribution Headquarters in Wisconsin

New facilities will house all sales, administrative and stocking operations of the Distributor Division of **Centralab.** The expanded warehousing facilities will permit shipment of distributor orders on a same-day (24-hour) basis. The new plant is located in suburban Menomonee Falls, close to the company's Milwaukee facilities.

High-Reliability Transistor Tested

Delco Radio has recently succeeded in manufacturing power transistors with 99.997% reliability for the MINUTEMAN missile. A test set, which automatically tests eight parameters of a transistor in eight seconds and records the results obtained, was built in conjunction with the development program.

Globe Electronics Merged with GC

GC Electronics is making a bid for its share of the amateur and Citizen's band radio market through the acquisition of **Globe Electronics Corp.** The first product of the new division is an amateur-radio transmitter, model HG-303, already available through distribution channels. The Los Angeles plant will serve as the warehousing facility for the Globe line.

Capacitor-Plant Expansion Planned

An estimated $3 million expansion is planned for **GE's** Electronic Specialty Capacitor plant at Irmo, S. C. Half the expenditure is for a 40% increase in manufacturing and research space, and the other half is for new equipment. The need for the expansion was brought about by the increased demand for standard foil and solid "Tantalytic" capacitors.

Developed in the field

to pay off in performance down the road

NEW CB-3A littlefone®

dual conversion,
8-channel citizens band

TRANSMITTER/RECEIVER

$159.95 (S-meter optional extra)

During a recent seven-month period, the Hallicrafters Company conducted a most unusual field test of its CB-3 citizens band transmitter. Through every conceivable condition of terrain, and weather, with almost completely continuous operation, the CB-3 was punished unmercifully and methodically . . . evaluated from every angle with the engineer's fine needle. Our purpose was not to prove something but to learn something. And in learning, to IMprove. Result: the new CB-3A "Littlefone"—solid and versatile expression of Hallicrafters' dedication to "THE NEW IDEAS IN COMMUNICATIONS."

EXTREME CONDITIONS WERE THE RULE

Early in July, 1961, test vehicles equipped with CB-3's were dispatched from Chicago northward into Wisconsin and Minnesota. A limited geographic area was picked, with no pre-planned route. Each short range destination was a "target of opportunity"—chosen to take advantage of the *worst possible conditions* as they occurred.

On D-day the temperature was 95°, and it ranged down to —20° before the test was completed. Identical and controlled transmission tests were conducted in both hilly and flat terrain, in cities and woodlands.

The CB-3 was operated on a continuous basis for periods ranging from four to twelve hours. More than 30,000 miles of mobile operation in the test vehicle were logged, plus unrecorded periods in trucks, boats—even an airplane.

TESTS WERE VARIED AND THOROUGH

All tests were conducted on both an objective and competitive basis. At various times, standard equipment of the five most popular transceivers were employed in the same or directly comparable situations. Relative range, modulation, channel interference and heterodyne were measured.

Base units also were interchanged, and four different basic antenna systems rotated both in base and mobile installations. In all, more than 150 antenna installation modifications were made.

WHAT WE FOUND OUT

Range and speech quality were exceptional. The CB-3 under "normal" conditions (average of hilly and flat terrain, moderate weather conditions) produced 10-2 copy at 20 miles . . . up to 40 miles in the lake region of Wisconsin . . . as low as 8 miles in the lead and zinc mining regions southwest.

Average performance over the entire seven-month period was a *minimum of 7%* and a *maximum of 12% greater range* of intelligible speech than the five other units tested.

In the major metropolitan areas visited, some adjacent-channel interference was experienced on all units during peak traffic periods.

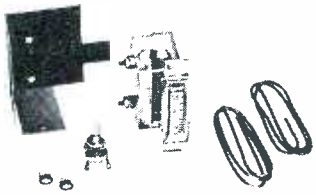
Reliability: in over 1,600 hours of operation, not a single major failure was experienced. Total parts replacement—two panel bulbs, one vibrator, two tubes. No visible deterioration of automotive electrical system. A microphone cord was broken due to carelessness.

Antennas: Major deterrent to good communications was observed to be faulty antenna installation throughout the test areas. Of more than 90 existing base stations co-operating in the tests, most were using improper or unmatched antennas. Range was increased (all brands) from *a minimum of 50% to 70%* with corrective measures.

General observations: Mechanical design and exclusive drop-down chassis construction of the CB-3 permitted far easier access for crystal changing and removal of unit for base use.

External S-meter was required during tests; observers with technical background felt a need for S-meter provision in the CB-3.

Eight-channel flexibility and crystal controlled operation on both transmit and receive functions were distinctly superior to competitive systems, particularly in mobile and heavily populated areas.



Hallicrafters S-meter kit,
optional at $8.95

Result—the new CB-3A with field-tested improvements!

- 8-channel, crystal-controlled convenience
- Maximum adjacent-channel rejection without loss of sensitivity through new type dual conversion.
- Removable panels for S-meter, future accessories.
- Built-in accessory jack (external speaker, etc.)
- FCC Type-Accepted.

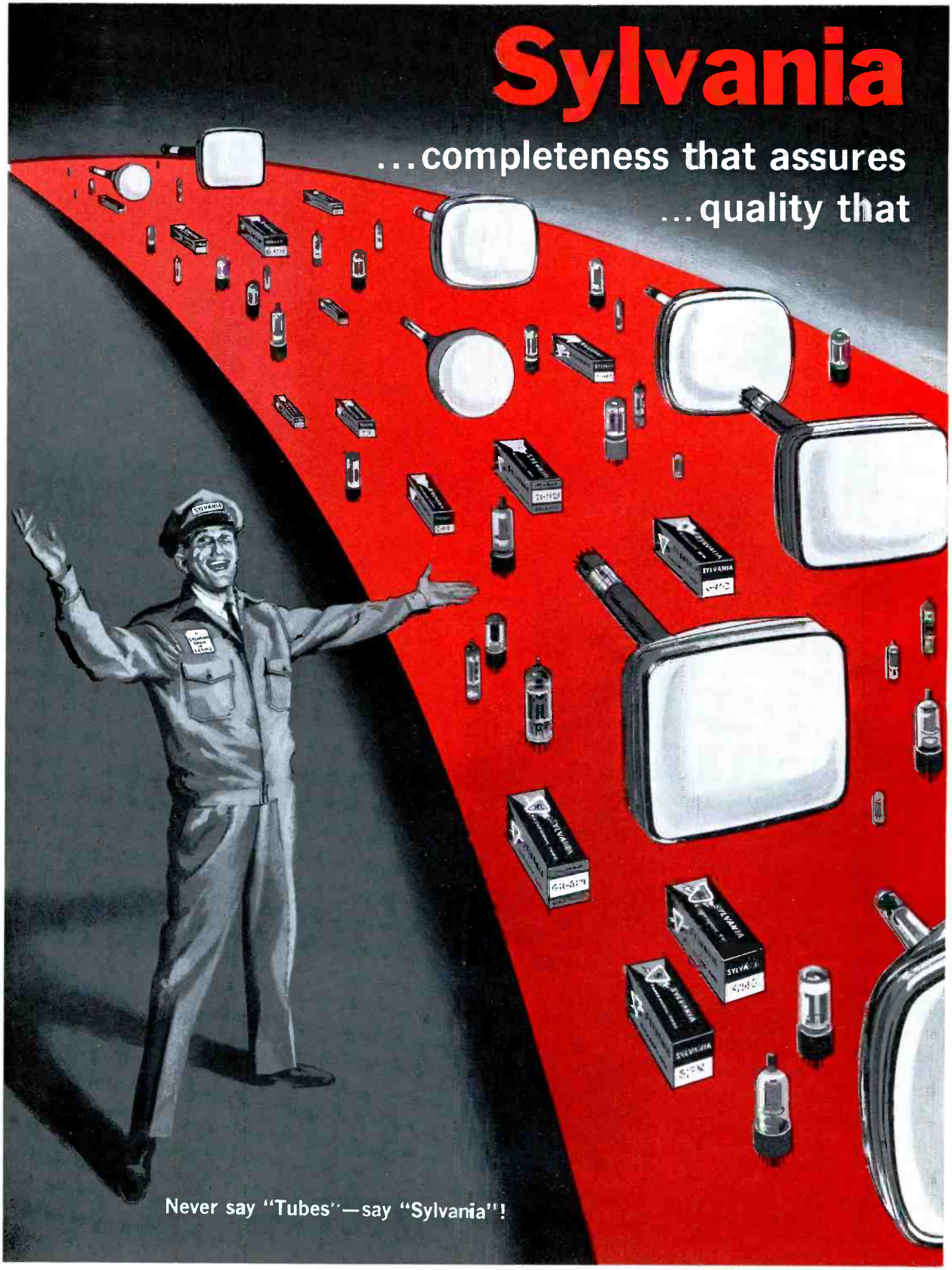
Transmitter: 100% modulation on positive peaks; output amp. adjustable for maximum legal input; matches 50 ohm antenna systems; series-tuned 2nd harmonic trap for excellent TV suppression.

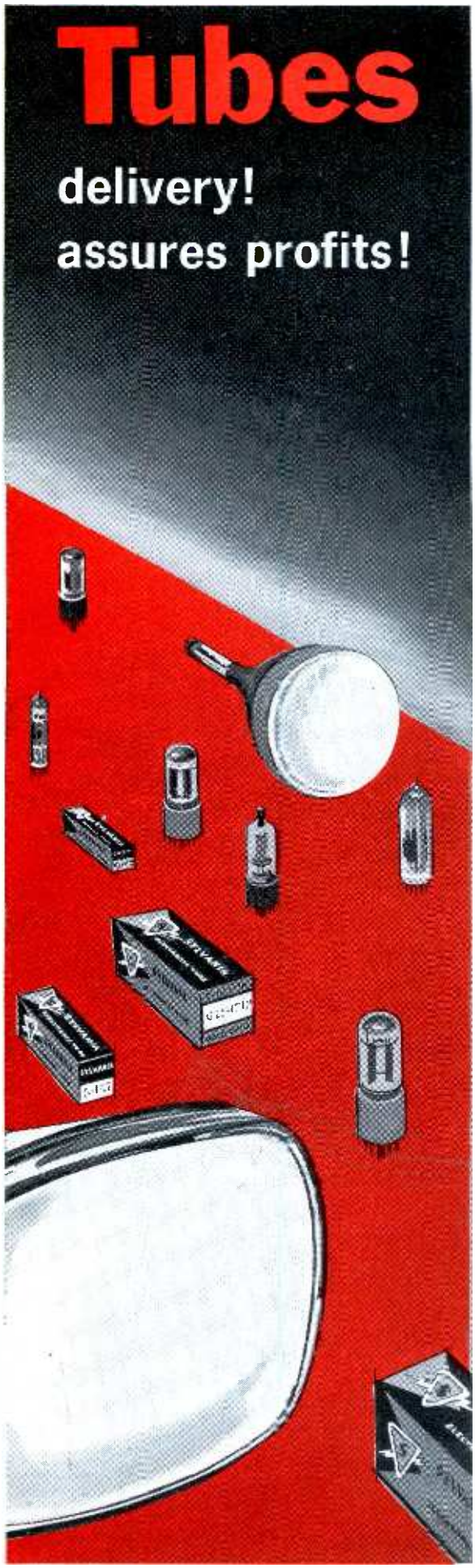
Receiver: Dual conversion—adjacent channel rejection 40 db. minimum; sensitivity less than 1 microvolt for 10 db. signal to noise ratio; 6 kc. selectivity; electronic squelch operates on less than 6 db. change; audio output over 2 watts.

the new ideas
in communications
are born at . . .

hallicrafters

Dealers: A limited number of Authorized Hallicrafters Dealerships are available. See your Hallicrafters distributor, or write to: The Hallicrafters Co., 5th and Kostner Aves., Chicago 24, Ill.





SILVER SCREEN 85 PICTURE TUBES

Sylvania was a pioneer in the manufacture of commercially produced picture tubes. That kind of experience builds profit protection into every 1962 SILVER SCREEN 85—top performance, maximum assurance against callback. And, when you specify Sylvania for that replacement job, you are sure to get delivery... because SYLVANIA has the *comprehensive* line . . . SYLVANIA DISTRIBUTORS are wherever there is TV!

Bonded Shield · anti-reflection Bonded Shield · non-Bonded Shield · single and multiple branded · long and short necks · metal and glass envelopes · 50° to 114° deflection · magnetic and electrostatic focus · ion trap and non-ion trap types · rectangular and round faceplates · 2.35-v to 6.3-v and 450-mA to 600-mA heaters · 5″ (50°-70°) and 8″ (90°-114°) universal bench-test tubes.

Plus "universal" 17-, 21- and 24-inch picture tubes!

Plus color TV picture tubes!

SYLVANIA RECEIVING TUBES

...for Color TV... Sylvania continues to prove its capabilities... in the production of tubes especially for color TV replacement. Since your customers are buying "performance"—not technical data—tubes at SYLVANIA are performance-tested continuously in actual color TV sets. Go with quality—go with Sylvania tubes for color TV: 6BK4 · 1V2 · 3A3 · 6DQ5 · 6CB5A · 6AU4GTA · 6CG7 · 6AW8 · 12BY7 · 6AQ5 · 6AV5 · 6EM7.

...for Black & White TV... Sophisticated manufacturing techniques and processes have made Sylvania a preferred supplier of tubes for TV. Developments such as Sarong Cathode and Strap Frame Grid *plus* extensive automation in production assure that replacement tubes are... in every way... as good as the original.

...for TV Tuners... Sylvania-originated, the 6GK5 brings new advances to the state of the electron tube art. This new tube type, as manufactured by Sylvania, features Strap Frame Grid constructions and high Gm, provides high gain and low noise in rf amplifier-service in TV front-ends. When replacing a 6GK5, specify *Sylvania*—universally accepted by manufacturers of TV sets. Sylvania 6GK5 also replaces the popular 6FQ5, 6FQ5A and the 6FY5.

...for AM-FM Radio... Whether servicing an AC-DC table radio, a fine Hi-Fi tuner or one of the latest Multiplex units, make Sylvania your number one choice. Take, for examples of outstanding quality, the new 17C9 and 6JK8. Both are Sylvania-originated and provide superior performance in standard tuner and in multiplex circuitry.

...for Hi-Fi and Phono... One of the pioneers in tubes for audio amplifier service, Sylvania has led with old faithfuls like the 6L6, 6V6 and 6AQ5 and the new high-performance Sylvania 6GM5 and Sylvania 7591. Automated production techniques and final test procedures maintain precision, assure high quality. A Sylvania replacement tube is the best way to make old equipment perform like new again. Electronic Tubes Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

Sylvania Tubes—available wherever there is TV!

SYLVANIA

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

Shop Talk by Allan F. Kinckiner

TV TUNER TROUBLESHOOTING TECHNIQUES

Defective tuners are among the least welcome service jobs in the average TV shop. Many servicemen hesitate to approach "front-end" work because of special conditions which make tuner repair different from other phases of TV servicing. A thorough analysis of these factors will provide valuable help in dealing more effectively with tuner problems.

The special points to consider in servicing tuners can be itemized as follows:

1. TV tuners are capable of developing mechanical as well as electronic troubles. Tarnished or dirty contacts, slight wear in fine - tuning assemblies, and faulty detent mechanisms can all cause noisy or intermittent operation. These defects are not always obvious, and can be difficult to find and correct.
2. Many components used in tuners are more critical than those used in other sections of receivers, and special parts such as temperature-compensating and feed-through capacitors are extensively used. Therefore, extra care is required in obtaining exact replacements.
3. Tuners usually have more parts per cubic inch than any other section of a TV chassis, and their compactness leaves little space for using servicing tools. Almost every tuner has some areas that are practically inaccessible for replacing parts, or even for testing.
4. No other section of a receiver has a more critical lead-dress problem than the tuner. More often than not, moving a component or wire — even very slightly—will affect the sensitivity, selectivity, or oscillator frequency to some degree.

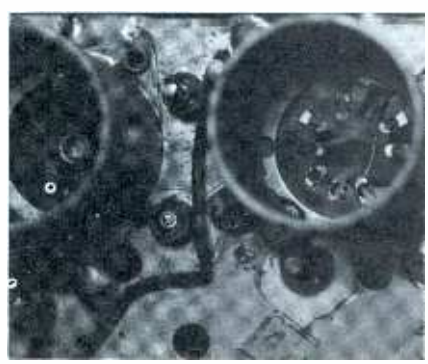
Although these four special characteristics restrict the extent of repairs that can be performed on a tuner without requiring realignment or complete disassembly, they by no means prohibit all repairs. Many troubles occur in noncritical areas, and the serviceman can accomplish a great deal if he knows when it is safe to proceed with work.

The RF-amplifier section requires the greatest caution. Signal circuits in this area are tuned to TV channel frequencies in the range from 54 to 216 mc, with bandpass as close as possible to the 6-mc width of one channel. Moving a lead or component in a tuned circuit changes the alignment of the RF stage, resulting in a loss of picture or sound quality, or in interference. However, if care is taken not to disturb the resonant circuits, certain components such as dropping resistors and decoupling or bypass capacitors can be replaced without causing trouble. Incidentally, don't overlook the capacitive or inductive effect of the leads that join these parts to the signal circuits!

Since the oscillator circuit operates at even higher frequencies than the RF section, it is also very sensitive to changes in lead dress. But the consequences of a frequency shift are less severe, because the oscillator is simply tuned to a single frequency and its output does not affect the bandwidth of the RF signal. Mistuning can make it difficult

• *Please turn to page 88*

(A) Crack caused "intermittent."



(B) Socket disintegrating from heat.

Fig. 1. Damaged tuner-tube sockets.

Fig. 2. Top-mounted socket is good replacement. Note pin-8 ground strap.

RCA COLOR PARTS AND DISPLAY RACK STOCK No. 11A1014

• Convenient • Compact

Because of the ideal size of this rack, it lends itself very well to mounting on the service work bench.

126 ESSENTIAL COLOR PARTS FOR SERVICING RCA COLOR CHASSIS TYPES CTC 10 & CTC 11

A complete color service center.

SEE YOUR RCA DISTRIBUTOR NOW!

PARTS & ACCESSORIES

new

RCA COLOR TEST JIG

#11A1015

A **must** for any serviceman now servicing or planning to service Color TV receivers ■ Make a one man service call out of a costly two man cabinet pulling job ■ Eliminate possibility of damage to the customer's set when transporting to and from his home ■ Eliminate the need to reconverge the customer's set when the chassis is returned ■ Professional Appearance—Finish matches that of RCA Test Equipment ■ Partial Assembly—Safety glass and kine mask assembled at factory ■ Components Kit furnished with Test Jig includes all necessary components, hardware and Instructions for installation of an RCA Tri-Color Kinescope ■ Convergence control panel supplied provides dynamic as well as static convergence for the CTC-10 and CTC-11 chassis ■ Instructions included with test jig provides data for utilization with CTC-4, 5, 7 and 9 chassis and lists extension cables required ■

CONTENTS OF PARTS KIT SUPPLIED WITH TEST JIG

Description	Quantity	Stock No.
Cushion—Plastic, for kinescope mounting	2	105033
Shield—Plastic, for anode contact	1	105034
Lead—Anode lead	1	105539
Resistor—Fixed Comp. 56K± 10%, 2W	1	—
Spring—For anode resistor	1	105028
Yoke—Deflection yoke	1	109457
Convergence assembly	1	—
Ring—Purity magnet	1	79604
Magnet—Blue beam lateral	1	103172
Clamp—For convergence cable	1	—
Screw—For mounting convergence assem.	3	—
Lead—Ground lead	1	—
Clip—For ground lead	1	—
Tool kaddy	1	—

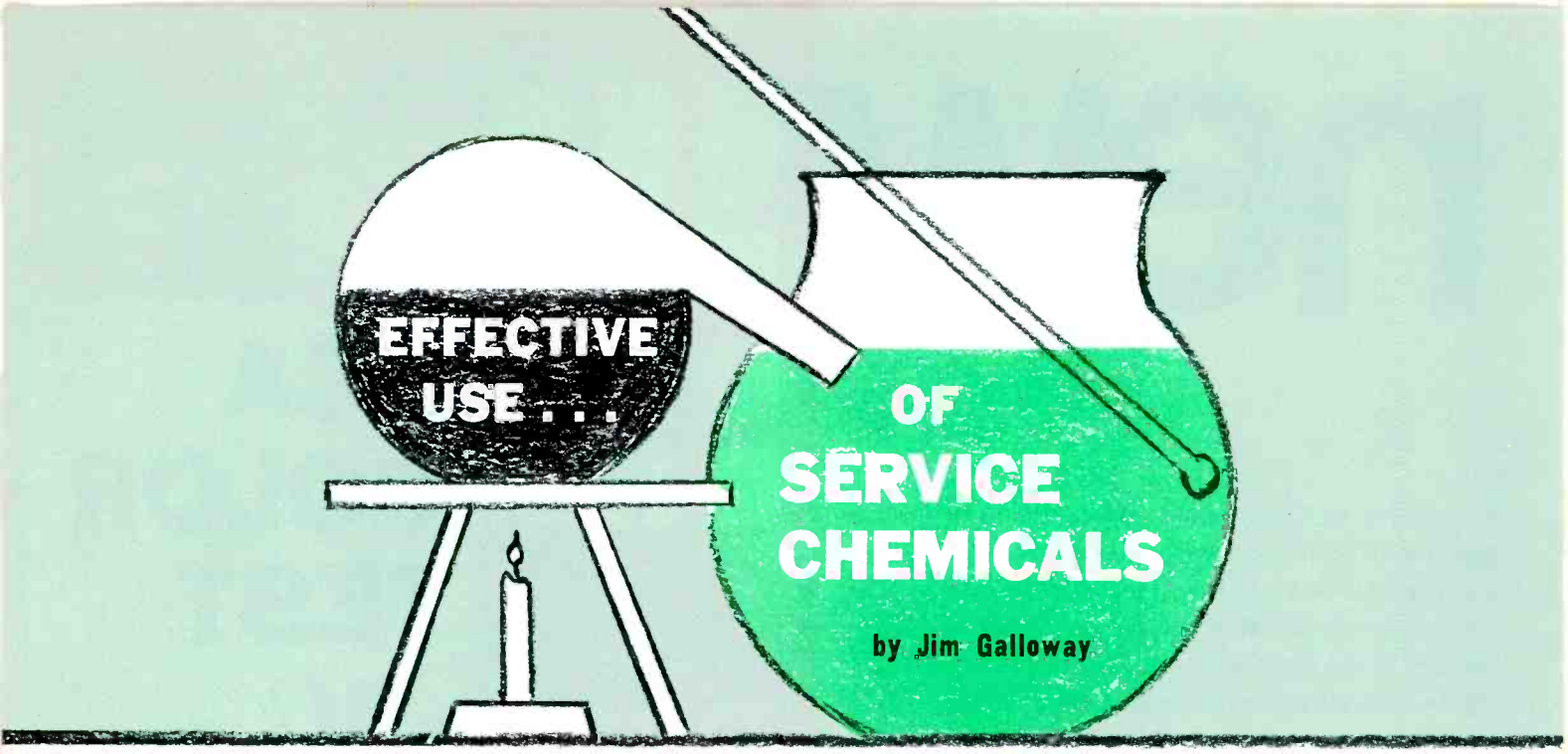
see your RCA distributor for details

RCA parts & accessories / camden, n. j.

act now for the color season

RCA The Most Trusted Name in Color Television

RADIO CORPORATION OF AMERICA



Are chemicals a problem to you? Here's how to find the correct solution.

Many new types of electronic servicing chemicals have recently appeared on the market, creating some confusion among servicemen as to the proper usage of these products. Among the questions being asked are: "What are the best chemicals to use for various purposes?" "Is a tuner cleaner good for switches in general, or should its use be restricted to tuners only?" and "Are general-purpose cleaners as good as the special-purpose types?" Such questions can best be answered by describing the most important characteristics of the servicing chemicals now available.

Contact Cleaners

In the past, when symptoms indicated dirty contacts, technicians usually reached for a bottle of carbon tetrachloride and a small brush. This certainly solved the dirty-contact problem, for "carbon tet" was one of the best solvents available; but it didn't do anything to provide for future contact protection. Besides washing away dirt, it removed any oxide coating that might have been present, leaving the contact surface vulnerable to corrosion and tarnishing. Inside of a few months, the contact resistance would increase again, and a callback would usually result.

Another disadvantage to "carbon tet" was its toxic nature. Anyone using this solvent was cautioned to provide adequate ventilation in order to avoid inhaling the fumes and to avoid physical contact with the solution. As an alternative, other solvents were tried, such as watch-cleaning solutions and even lighter fluid. However, while these were not quite so dangerous, neither did they provide future corrosion protection; thus, their use as servicing aids was short-lived.

Several years ago, special contact cleaners began to appear in quantity. First came solutions in bottles with brush or eye-dropper applicators. More recently, since the advent of aerosol spray cans, cleaners and lubricants have been supplied in spray containers. The main advantage gained from this packaging is that the pressurized stream aids in washing away the dirt or residue removed by the solution.

The usual propellant found in these bombs is Freon (the same gas used in refrigerators and air conditioners). This low-cost propellant is chemically inert, is nontoxic, and evaporates completely. Some cleaners contain solvents which damage plastic, so the spray should not be activated until the nozzle is pointed directly at the area to be saturated. Recently, manufacturers have included extension tubes in order to permit the stream of cleaner to be directed to a specific small area. This allows the spray to contact only the desired area and thereby eliminates waste. It also gives added protection against accidentally splattering an area that should not be sprayed.

Brush and eye-dropper applicators, of course, have certain advantages. Besides being relatively less expensive, they allow a greater amount of cleaner to be applied to a specific area. Then too, there is less danger of getting the cleaning solutions on surfaces which might possibly be damaged.

Cleaners come in a variety of forms for many different purposes, ranging from general-purpose to highly-specialized types. All contain one or more solvents to perform the primary function of cleaning. Many of the manufacturers we queried during the preparaton of this article specified "chlorinated hydrocarbon" as their principal solvent. There are a number of solutions under this general classification—carbon tetrachloride, trichloroethane, perchloroethylene, and many others. All of these are good solvents; some are more or less toxic; some are harmful to plastic and others are not. Occasionally other solvents are used, such as kerosene and toluene.

All-Purpose Cleaners

If removal of dirt, grime and corrosion from contacts or controls is

desired, there are several products specifically designed for this and nothing more. They contain no lubricants or protective coatings. Such a cleaner might be desirable where considerable dirt has accumulated; after the dirt and tarnish has been removed, the serviceman might wish to follow up with some type of protective coating. One manufacturer provides a kit containing both a solvent and a protective lubricant; each is applied to the contacts separately.

Tuner Cleaners

Dirty tuner contacts account for a large amount of TV servicing. Hence, special cleaners have been developed for the silver-plated contacts usually associated with tuners. Silver, while being one of the best conductors available, is also extremely susceptible to tarnish and corrosion. After a modern tuner cleaner removes the tarnish, dirt, and corrosion, it dries, leaving a film (usually silicone oil) on the contact surface. Microscopically thin, the film does not appreciably increase the resistance of the contact, even though silicone oil is nonconductive.

While general-purpose cleaners will do a good job of cleaning tuner contacts, a special cleaner will provide longer-lasting protection and help minimize tuner callbacks.

Control Cleaners

Solutions for cleaning potentiometers and rheostats must not only provide a solvent for washing away eroded carbon particles, but must leave behind a low-friction sliding surface to reduce contact skipping —the prime cause of noisy controls. Again, silicone oil is the lubricant most often used. Some manufacturers state that their product softens the carbon and redistributes it to cover bare spots.

Lubricants

Lubricants have been greatly refined for use in electronics servicing. Formerly, all that was available to the technician were light oils, intended for anything from a sewing machine to a hay baler. Recognizing the need for special lubricants, manufacturers developed

Please turn to page 85

Manufacturers	Tuner & Contact Cleaner	Control Cleaner	Non-Lubricating Cleaner	Lubricant	HV Insulator	Sealer
Channel Master	Contact Shield 6 oz. Spray $1.65	Contact Shield 6 oz. Spray $1.65	Contact Shield 6 oz. Spray $1.65			
Chemical Electronic Engineering Co.	Hush 6 oz. Spray $2.25	Ever-Quiet 6 oz. Spray $1.59				Plastic Sealer 16 oz. Spray $1.95
Chemtronics	Tun O Lub 8 oz. Spray $1.98	Trol Aid 8 oz. Spray $1.98		Chem Oil 8 oz. Spray $1.79	No Arc 8 oz. Spray $2.79	Kleer Spray 16 oz. Spray $1.39
Chem Spray	Jetkleen 6 oz. Spray $ .98	Jetkleen 6 oz. Spray $ .98	Quikleen 6 oz. Spray $ .98			
Colman	Rid Ox 8 oz. Spray $1.89	Lube-A-Trol 8 oz. Spray $1.89	Kleenall 16 oz. Spray $1.89	Lubra-King 2 oz. Brush $ .48	HV Putty 2 oz. Hand $ .69	
Electronic Chemical Corp.	Tuner-Tonic 6 oz. Spray $3.25	No Noise 6 oz. Spray $2.25		EC 44 6 oz. Spray $3.50		
G-C	De-Ox-Id 6 oz. Spray $2.33	Super Contact Cleaner 6 oz. Spray $1.80	Dry Cleaner 16 oz. Spray $2.10	Grafoline 4 oz. Brush $ .48	Hi Volt Resin Spray $1.83	Print Kote 6 oz. Spray $2.42
Injectorall	Tuner Cleaner 3 oz. Spray $ .89		Contact Cleaner 6 oz. Spray $1.79	Spot 3 oz. Spray $ .90	Hi Volt Spray $1.29	
Krylon	Contact Cleaner 6 oz. Spray $ .98	Contact Cleaner 6 oz. Spray $ .98				Crystal Clear 6 oz. Spray $ .98
Quietrole	Quietrole 6 oz. Spray $2.79	Quietrole 2 oz. Dropper $1.69				
Sargent-Gerke	Tuner Cleaner 16.4 oz. Spray $2.45①		Gear & Parts Cleaner 16.4 oz. Spray $1.98①	Squeak Stopper 16.4 oz. Spray $1.79①	Red Insulator 16.4 oz. Spray $2.15①	
Standard-Kollsman	Contacare 8 oz. Dropper $1.25②					
Walsco	Contacteen 6 oz. Spray $ .98	No-Ox 6 oz. Spray $2.33		Tunerlub 1¾ oz. Tube $ .53	Liquid Tape 2 oz. Brush $ .99	Acry Spray 16 oz. Spray $1.50

① List Price ② Cleaner and Lubricant applied separately (kit)

AUDIO FACTS
by
Stuart N. Soll

an approach to CUSTOM HI-FI

As the popularity of high-fidelity music increases, more and more listeners are becoming aware of the advantages of carefully planned sound-reproducing systems. The selection and installation of a system cannot always be successfully accomplished by the user, and he is likely to call for the services of an experienced technician—whose job is to supply the components, consult in the planning, and handle the actual installation.

The first step in planning the system is to establish its basic requirements. There are many points to consider, as you can see from the system diagram in Fig. 1.

An important question to be decided is: "What features are desired in the system?" The simplest setup consists merely of an amplifier, a record changer, and a speaker system. A good many listeners prefer to start this way, leaving provisions for future expansion.

Choosing the Components

You can be a great help to your customer when it comes to picking the components for his high-fidelity system. However, you must understand the requirements of the system from the listener's standpoint, as well as technically. Components must be chosen to match each other electrically, and to fit well into their physical surroundings. Only by becoming familiar with specifications and types of equipment can you offer the expert advice expected of you.

Amplifiers

The present and future power requirements of the amplifier should be determined first. The majority of the systems you are likely to handle will be stereo, and the amplifiers will be rated in power per channel. A rating of 20 watts per channel is adequate for a listening area of average to large size. Table I offers suggested amplifier ratings for various-sized listening areas. To use the chart, multiply the length times the width times the ceiling height of each room; total these, and you have the volume of the listening area. Of course, several speakers may be needed to adequately cover a given area.

Power amplifiers require input voltages from .5 to 1 volt for best performance. Distortion should not exceed 2%, and many units boast figures as low as .1%. If necessary, it is better to sacrifice some frequency response in favor of low distortion. While slightly limited response will almost never be noticed, distortion produces listener fatigue—a common downfall of high-fidelity sound systems. Some amplifiers are reputed to have response far beyond the normal range of hearing, but many experts recommend limiting the upper range to 20 kc to prevent damage to speakers from high-frequency oscillations (among other reasons). The bass response should extend to 20 cps for average listening.

Changers vs. Turntables

In most hi-fi systems, phonograph records serve as the main program source, although many listeners like to include tape recordings and FM broadcasts. The record fan has the choice of playing them on either a turntable or a record changer.

A turntable generally offers better performance than a changer, but not without some sacrifices. Turntables must be operated manually, playing only one record at a time. On the other hand, the *wow* and *flutter* characteristics of turntables are usually superior.

Wow is a variation in the speed at which the record is rotating, and

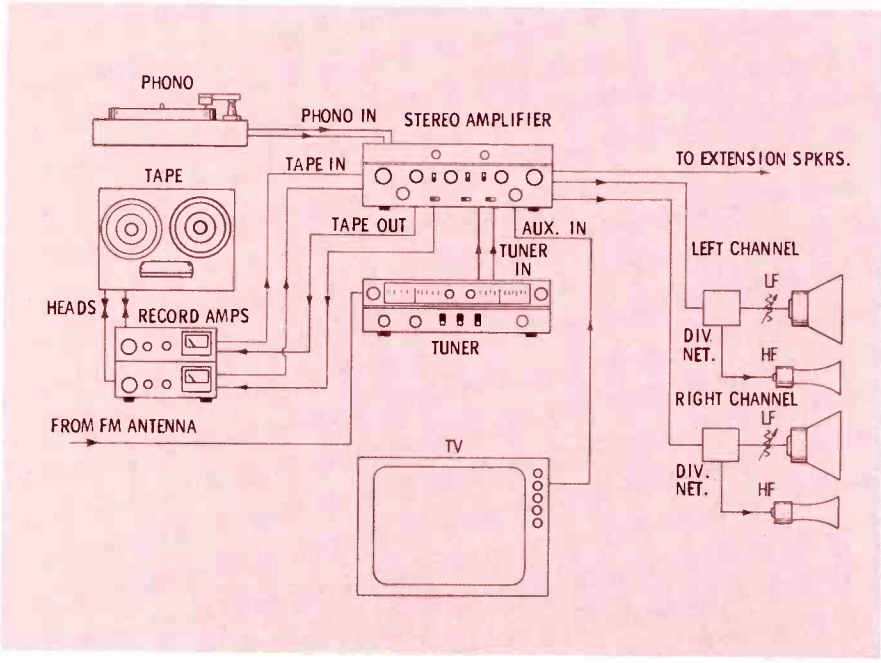


Fig. 1. This typical custom hi-fi system is one of many possible arrangements.

Table I — Amplifier Output for Various Room Volumes

Volume, cu. ft.	Watts/channel
4,000	7
20,000	15
35,000	20
50,000	30
80,000	40

produces a sound best described by its name—a periodic dragging of the tone. Wow can be detected by the unaided ear in almost every case. Flutter is a similar variation which is most noticeable as distortion in sustained stringed-instrument notes or high singing voices. Opinions vary as to the maximum acceptable wow and flutter, although .25% is usually the specified standard.

Pickups

Magnetic pickups have wide frequency response, light tracking pressure, and low distortion, but they are quite susceptible to magnetically-induced hum. Their low output (from 1 to 50 mv) must be preamplified to provide enough signal to drive the power amplifier.

Crystal and ceramic pickups are usually less expensive, and are not so susceptible to induced hum. The best of these produce very low distortion, with outputs as high as .5 volt—some of them need no preamp. Some ceramic pickups have been designed to track at low pressures, with good compliance.

The stereo versions of these pickups have outputs about the same or slightly lower—the more important specification being channel separation. An accepted figure has been 25-30 db, although manufacturers are attempting to improve this; some units have more than 35 db of separation.

Tape Recorders

A customer can have anything ranging from a complete stereo recording system to a simple monophonic playback transport. One tape system gaining in popularity is four-track stereo, and you can be sure that some custom installations will include a unit of this type.

For custom use, the size, external appearance, and input-output provisions of a tape unit are important. For playback only, the machine need have nothing more than the transport mechanism and heads, with connecting leads to the main preamplifier. For recording, a special preamp (Fig. 1) is required. It contains the microphone preamplifier as well as the essential bias and erase oscillators.

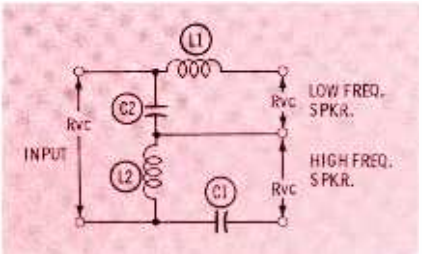


Fig. 2. Typical crossover network for separating low and high frequencies.

Tuners

Tuners are used in a good many installations to take advantage of the high-fidelity programming on FM. Their function is to pick up and detect the signal, and provide an audio output of from .1 to 1 volt. Many tuners now include stereo decoding (multiplex) circuits for developing the "left" and "right" signals of stereo broadcasts. Other tuners provide a direct output from the FM detector (without deemphasis) for application to a stereo adapter, which in turn recreates the stereo signals.

Combination units include the tuner and preamplifier—and sometimes the power amplifier—on the same chassis. In this case, various inputs are provided for connecting, switching and controlling other equipment. Tuners are available with meters or other tuning indicators, automatic tuning circuits, flywheel tuning, variable bandwidth, lights to indicate the presence of a stereo broadcast, and many other features.

Preamplifiers

Due to the low output from tape heads and phono pickups, preamplifiers must provide large voltage gains with a minimum of noise. Controls are included to adjust the sound to suit the listener's taste and the acoustical characteristics of the listening room. Equalizing networks are added to compensate for various phonograph recording curves.

Frequency response and distortion figures should equal or excel those for power amplifiers; the hum level is very important. Hum and noise should be 80 to 90 db below the output level. It is important that the preamp furnish sufficient gain at each input to supply the .5 to 1 volt required by the power amplifier.

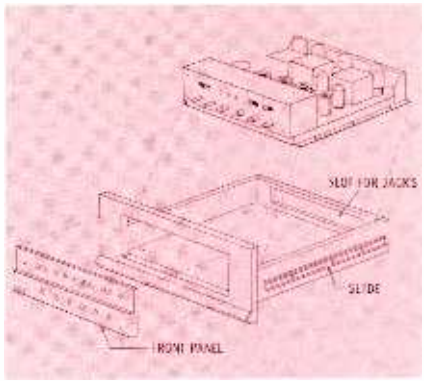


Fig. 3. Slide-out drawer is one method of mounting an amplifier in a cabinet.

Speakers

Finally, let us consider speaker systems, often overlooked in system planning. High-fidelity speakers are available in different sizes. Woofers (large direct-radiator speakers with diameters of 12" through 18") are used for the lower frequencies, since great amounts of air must be moved. The mid-frequencies (2 to 5 kc) can be faithfully reproduced by 8" speakers or by certain types of horns. For the high audio frequencies, small hard-coned speakers or horn units (tweeters) are used. When speakers of different ranges are used in a system, it is necessary to employ a crossover network (Fig. 2). This separates the audio signals, assuring that each speaker receives the proper range of frequencies.

Complete speaker systems are available in a variety of sizes, styles, finishes, power capabilities, and prices. They contain all the necessary speakers, networks, and in some cases, speaker "brilliance" controls. For most custom installations, it is wise to choose ready-made speaker systems that ade-

• *Please turn to page 88*

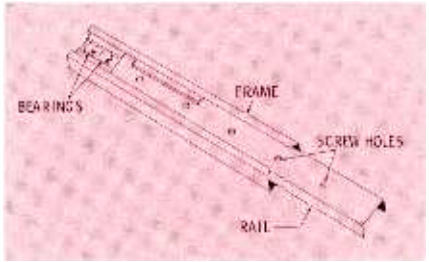


Fig. 4. This type of slide can be installed under shelf holding component.

REPORT ON THE NEW YORK UHF TEST!

The FCC's experiment may change the future course of TV broadcasting.

. . . by Thomas A. Lesh

The most carefully-watched TV station now on the air is WUHF (channel 31) in New York City, being operated by the Federal Communications Commission to permit extensive field testing of UHF reception in the nation's most heavily built-up metropolitan area. The transmitter location (Empire State Building) and the effective radiated power (1 megawatt maximum) have been chosen to furnish the closest possible comparison with New York's existing VHF stations. The FCC has contracted to have receivers temporarily installed at 5000 sites selected by the Census Bureau, and additional tests are being carried on independently by several organizations. Financing for the project comes from a $2 million Congressional appropriation. Full-scale operation began last December 1, with completion of the tests scheduled for later this year.

The official results are being awaited with intense interest, because success in this experiment could set off a large-scale expansion of UHF broadcasting. Servicemen in most parts of the country, who have assumed that UHF is a dead issue, may find it coming vigorously back to life.

Official tests at receiving sites include measurements with UHF-VHF field-strength meter.

Why a Special Test?

The FCC is convinced that UHF *must* be revitalized if this country is to have a fully adequate TV system. The 12 VHF channels fall short of accommodating all the TV stations which could be economically supported. The 70 additional channels in the UHF band are more than enough to take care of the need, but first it is necessary to help UHF overcome the competitive disadvantages which have stunted its growth up to now. (Only about 90 stations, plus a scattering of small translators, now occupy the UHF band.) After several years of frustrated attempts to solve the dilemma of nearly saturated VHF bands and almost vacant UHF channels, the FCC has launched an all-out drive to see if UHF can be made to work. Careful field testing is a major part of this effort.

None of the previously-existing UHF operations meet *all* of the conditions necessary for a thorough test (including direct comparison with both high- and low-channel VHF); so the FCC decided to build a station made to order for the purpose.

Test Results to Date

Since the daily progress of the tests is not being publicized, only a few preliminary results are now known. But as far as we've been able to learn, the general trend of the experiment is encouraging — UHF seems to compare favorably with VHF in metropolitan New York. Here are some specific observations:

The high power used on channel 31 is helping to minimize "shadowing" of the signal by hills and large buildings. In fact, this trouble may be scarcely worse on UHF than on VHF, although the different wavelengths cause some variation in the shadowing patterns. Some difficult VHF-reception spots in New York City can receive channel 31 better, and vice versa; a few locations are still "blind" to all channels.

There has been some apprehension that turning loose a strong UHF signal in the steel-and-stone canyons of Manhattan would cause intolerable ghosts due to multipath reception. Actually, this condition appears to have been overrated as a source of trouble. Ghosts are slightly more numerous on channel 31, but less severe than on channels 2 and 7. Multiple images *on both UHF and VHF* are often traced to direct signal pickup on the tuner leads, and this problem can be alleviated by better shielding of receivers.

In addition to field-strength tests, signals are monitored on TV sets to check picture quality.

Indoor UHF antennas, consisting of a "fan dipole" or "bow tie" with reflector, have given good results in about half of the known cases. Only a small minority have failed to obtain at least an acceptable picture. On the other hand, conventional rabbit ears do poorly on channel 31. Some experimenters have tried homemade "baby rabbit" antennas with elements only a few inches long, and these have often worked well.

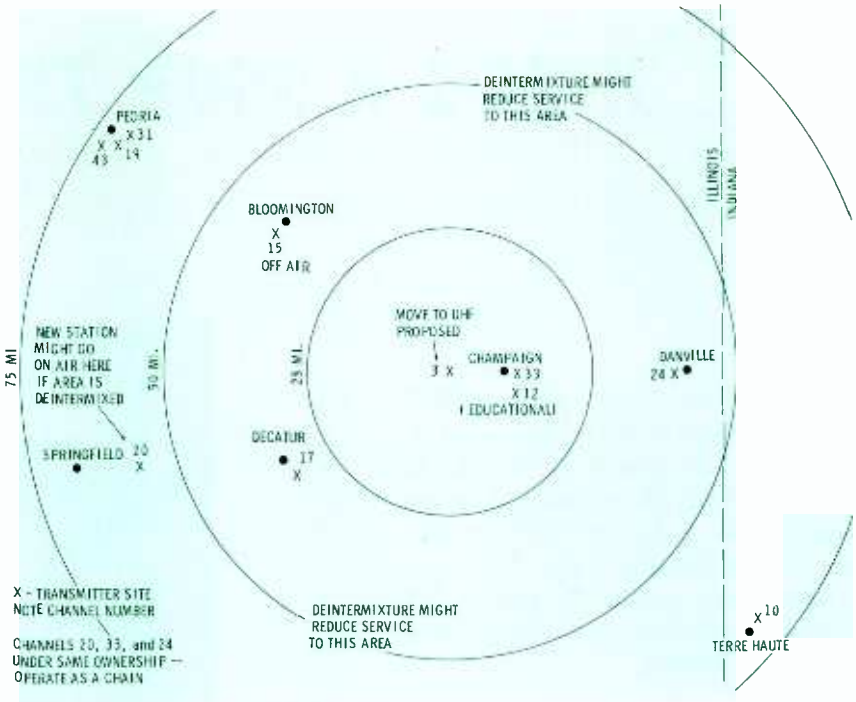
UHF waves show signs of being better than VHF for penetrating into difficult indoor reception spots, like basement apartments and steel-frame buildings. One possible explanation is that window openings are approximately two wavelengths wide at UHF, but less than one wavelength on channels 2-13.

The WUHF transmitting antenna, 1330′ above ground, affords line-of-sight reception over an estimated range of 40 miles. Beyond this distance, initial observations indicate that UHF reception deteriorates faster than VHF. This was expected, considering that even the high-band VHF channels 7-13 have a shorter range than the low-band channels 2-6. There may always be an inherent difference between UHF and VHF ranges, but this can be pared down by improving UHF receiving-antenna installations and tuner designs.

What's Holding UHF Back?

If the initial test results are really as promising as they seem, why hasn't the TV industry already solved the UHF problem without government action? This question is difficult to answer, because the problem is complex and deep-rooted. The best way to explain the situation is to probe deeply into the background of UHF.

There's no doubt that the public acceptance of UHF has been poor. As a matter of fact, publicity about the channel-31 test has caused many people to voice protests that UHF is unsatisfactory and shouldn't be encouraged. (They've seen it in operation somewhere — they *know!*) Furthermore, any proposal to shift a VHF station to the ultra-high band draws quick and vehement opposition. Is UHF as bad as all this? Let's summarize the factors which have worked against it:

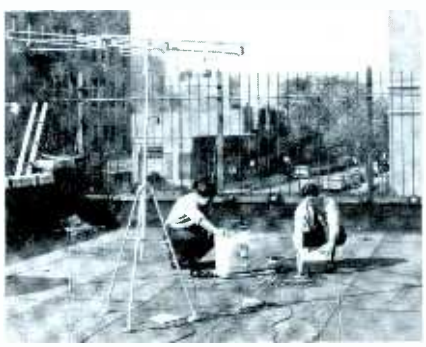


Besides the New York experiment, the FCC has tried several other means to encourage UHF broadcasting. These have stirred up a great deal of controversy. Probably the least popular technique is "deintermixture" — the separation of UHF and VHF stations into different geographical areas to promote more equal competition. Single VHF stations already operating in established UHF areas would be shifted to UHF channels. This map illustrates a typical case involving channel 3 in Champaign, Ill. Local opposition has effectively stalled most deintermixture proceedings.

Technical Problems

UHF got off to a bad start in 1953 because it was an untried medium, with peculiar operating conditions not yet properly understood by broadcasters, dealers, or consumers. Early low-power stations had nightmarish problems with signals being blocked by hills, buildings, and even woods. As a result, station coverage was much spottier than anticipated, and difficult outside-antenna installations were often necessary, even within sight of the transmitter. In addition, the tuners had a considerably higher noise figure than VHF types, and the UHF oscillator tubes employed for the first several years had an annoying habit of giving up after only a few months.

Broadcasters soon learned that increasing power, and going to the lowest-numbered channel available, considerably improved their service; but this discovery was made too late to save most of the early UHF stations from starving to death. However, even the improved transmitting setups put out less RF power than most installations on channels 7-13. Lacking the extra kilowatts needed to make up for the relatively great RF losses between transmitter output and receiver input, the medium-power UHF stations had a definitely shorter range than competing VHF stations. In addition, "shadowing" still made it difficult to receive good pictures in some locations.



Reception on local VHF channels is compared with results obtained on channel 31.

Economic Problems

Even a slight competitive edge of VHF over UHF is enough to create trouble for the latter in America's TV system, which has not developed along the lines mapped out by the FCC in its 1952 table of channel assignments. Most viewers outside of metropolitan areas, seeking a wider choice of programs, have gone to great effort to receive fringe-area VHF signals from extreme distances. To the FCC's surprise, they have shown a strong preference for these over local UHF service. Many people who spend over $200 for a

• *Please turn to page 95*

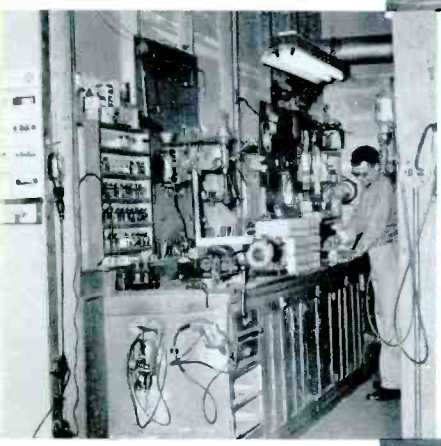
HERE'S A SHOP THAT SPECIALIZES

United Radio Service began in 1936 with one small bench in the corner of an auto-repair garage in Peoria. In 1946, Mr. Fred Degenford, the owner and founder, moved the business into its present location. Over the years, it has become one of the largest and most diversified service establishments in central Illinois.

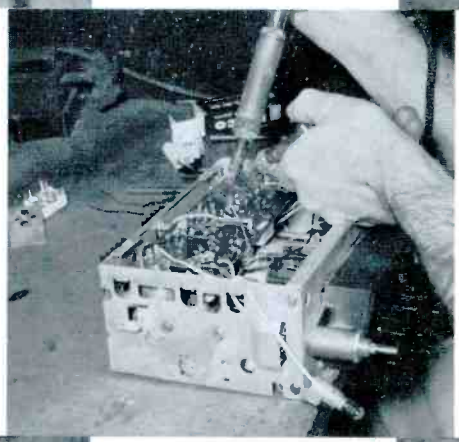
← The large service crew is pictured here, from left to right: Mr. Degenford, Raymond Crowe, Froilan Lopez, Jim Short, Art Smith, Harry Boler, John Karpowitz, Gilbert Mooberry, Charles Court, Meriel Goodyear, and shop foreman Bob Umholtz. They represent United's many departments — auto radio, television, radio-phono, automotive test equipment, commercial sound, and antenna repair.

Auto radios are serviced quickly and easily in this spacious drive-in shop. In-the-car trouble-shooting, removal for service, reinstallation of finished jobs, and installation of several brands of new auto radios take place in this area. United also handles installation and warranty repairs for a large number of new- and used-car dealers. →

Floor man Ray Crowe → "crawls under" in preparation for removing the radio for bench repairs. Jobs are completed right in the car whenever possible. A well-stocked parts department, handled by Harry Boler, speeds repairs. This job was finished while the customer waited, a common thing with United. Fast service has resulted in a fine reputation and much repeat business.



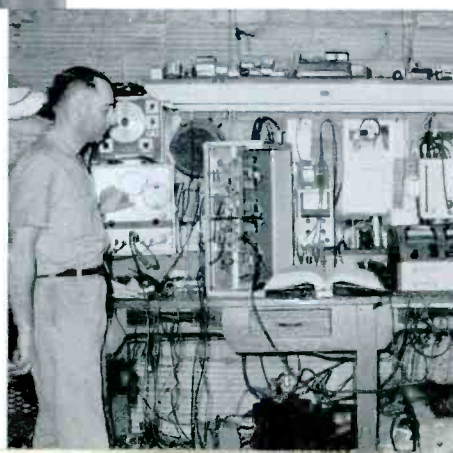
← In this area, tools and equipment, hardware, and accessories are stored. The bench provides space for auto-radio operations. United handles a large volume of installation work, in addition to repairs. Broken antennas, rear-seat speakers, extension leads — in short, all types of auto-radio jobs— are taken care of in this department.



← Here, a car radio which needed more than simple repairs gets its turn at the service bench. Fast, careful service, coupled with years of experience, helps United Radio maintain its enviable reputation. All kinds of auto-radio devices find their way across this bench: garage-door opener transmitters, auto record players, and automatic headlight dimmers are a few.

A steady flow of cars → through the drive-in facility keeps the auto-radio department busy. As one car leaves, another takes its place. On the day we were there, a line formed outside the door, waiting for service. In this picture, Ray Crowe directs a satisfied customer through the rear door, confident that he will return with his next service problem.

In the automotive test- → equipment department, shop foreman Bob Umholtz uses a master calibrator to check a combination instrument. United Radio is an authorized repair station for most of the major brands of this equipment, and does a large volume of this work. Auto-repair garages throughout central Illinois send their defective units here for repair.



in EVERYTHING

← TV technician Jim Short does an alignment job on a color TV set. United has been selling and servicing color sets since their first appearance on the market, making them somewhat expert at this business. With a very complete test-equipment setup, they can handle almost any kind of electronics repair job. Many local shops call on United for help when they want advice on how to repair a tough-dog set.

← Record players, tape recorders, and many other complicated home entertainment devices are promptly repaired by technician Lopez. Onto his bench flow the many small items which round out the over-all service picture at United Radio, a shop that truly specializes in many, many things—and does a good job on all of them!

Transistor-radio repairs → are handled as routine, along with repairs on the usual tube-type sets. In this department, too, United Radio provides service for a number of stores that do not have their own repair facilities. In addition, many local service shops bring transistor equipment to United for service.

Antenna specialist Gil → Mooberry and helper John Karpowitz prepare for a routine antenna installation. Peoria was a pioneer UHF area, and now has three stations in operation. The specially-equipped truck contains all the materials and tools necessary to put up and repair antennas. Some Peoria customers still use towers to receive distant VHF stations.

← Dispatcher Leonard Armstrong locates one of the men who is out on service calls in a radio-equipped truck. The two-way radio system speeds service to United's customers, and eliminates much backtracking by the servicemen. Also, by means of radio in his car and in the cars of his key personnel, Mr. Degenford can keep track of the operation wherever he is.

← United covers a total service area which exceeds a radius of 40 miles. The service trucks are supplemented by using the automobiles of some of the men. All vehicles used for the business are radio-equipped. The two-way radio transmitter is located about two miles from the shop, in a more advantageous location, and remote-controlled from the office.

With a calibrated → standard, a piece of automotive test equipment is adjusted for accuracy, following major repairs. A complete set of calibrators and standards makes United the best-equipped shop in the area for servicing this type of equipment. Many items are brought here for service, such as tachometers, tune-up oscilloscopes, combustion meters, battery chargers, and associated instruments.

Garage-door openers → have become an important part of United Radio's business. New transistorized transmitters are replacing the older tube-equipped types. Formerly, the transmitter was a vibrator-controlled device mounted under the car hood; the new ones fit in a shirt pocket. On the ladder, Mr. Degenford puts the finishing touch (a quick alignment) to a garage-door receiver.

In 1953, when the Peoria UHF stations began to go on the air, Mr. Degenford added a sales department. In 1954, he moved the salesroom into this much larger building. At the same time, he expanded the line to include high fidelity, records, and prerecorded tapes, as well as radio and television sets. The salesroom is in a separate building from the shop, but is located directly across the alley, making for easy access from one to the other.

Now, United Radio has one of the nicest showrooms in Peoria, and Mr. Degenford is one of the largest dealers in the area. He handles both monochrome and color television receivers. TV and radio set sales, combined with auto-radio and commercial sound sales, make up approximately 45% of the gross income. United carried a small quantity of white goods for a short time, but now concentrates entirely on electronics.

At the modern sales counter, sales manager Harold Mathis sells a transistor radio to a customer. United boasts a very complete stock of radios, batteries, phonographs, tape recorders, prerecorded tapes, and accessories for almost any electronic device. A very complete battery inventory keeps owners of portable radios happy. The sales counter and shelves are arranged for tasteful display of the merchandise.

Here is "the boss" writing up a completed sale at the sales counter. A self-service tube tester permits customers to sell themselves tubes, and a needle-cartridge assortment adds more over-the-counter sales. A very progressive approach to selling, centered on attractive displays of many items, has produced a steadily increasing volume of sales. United's customers come back year after year.

The hi-fi showroom was built above the main showroom in 1954. It permits the sales staff to demonstrate actual equipment in operation — no guesswork for their customers. The system of switches in the background allows the salesman to exhibit the playing qualities of any combination of speakers, amplifiers, turntables, changers, and even tape decks. The room is sound-treated. Not seen are couches for more listening comfort.

For years, United has sold and installed PA systems, intercoms, and allied sound equipment. More recently, they've increased and expanded until they are one of the larger sound dealers in the area. In this photo, their full-time sound engineer, Meriel Goodyear, pulls a transistorized amplifier out of East Peoria High School's language laboratory. This installation was one of the first language laboratories in downstate Illinois.

Installing and maintaining commercial sound equipment (and high-fidelity systems) now comprises at least 25% of the service activity at United Radio. Here, sound engineer Goodyear makes adjustments to a complete background music-paging-intercom system console. Systems such as these have been sold and installed over an 11-county area, and provide a source of continuing income, as well as the initial sale and installation.

Here is a sound console which serves a large department store in one of Peoria's suburban shopping centers. Most servicing jobs are taken care of by the technicians, but occasionally engineer Goodyear has to solve some applications problem. This is just another example of the thorough work which has made United Radio Service one of the leaders in their locality.

NEW, MODERN, PORTABLE . . . FOR THE MAN ON THE GO . . .

as easy to use as a voltmeter

3.58
COLOR BURST

- **A new 3 inch Extended View Portable Scope with New Features and Performance Unmatched by even the most Costly 5 inch Oscilloscopes**

NEW

SENCORE PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

Lowest priced Wide Band 3 inch Scope anywhere. All hand wired.

Only 124.50 net

Here it is, the scope that technicians, engineers and servicemen from coast to coast have been demanding. A portable wide band scope that can be used on the job anywhere, yet has the highest laboratory specifications for shop or lab. Cumbersome color TV sets, remote audio and organ installations and computers are just a few of the jobs that make owning a scope of this type so essential. Why consider a narrow band scope, when for only a few dollars more, this professional wide band sensitive scope equips you for any job.

• The PS120 provides features never before offered. Only two major controls make the PS120 as easy to use as a voltmeter. Even its smart good looks were designed for functional efficiency. New forward thrust design, creating its own shadow mask, and full width calibrated graph increase sharpness of wave form patterns. A permanent chromed steel carrying handle instead of untidy leather strap and a concealed compartment under panel for leads, jacks and AC line cord make the PS120 the first truly portable scope combining neatness with top efficiency.

• Electrical specifications and operational ease will surpass your fondest expectations. Imagine a wide band scope that accurately reproduces any waveform from 20 cycles to 12 megacycles. And the PS120 is as sensitive as narrow band scopes . . all the way. Vertical amplifier sensitivity is .035 volts RMS. The PS120 has no narrow band positions which cause other scopes to register erroneous waveforms unexpectably. Another Sencore first is the Automatic Range Indication on Vertical Input Control which enables the direct reading of peak-to-peak voltages. Simply adjust to one inch height and read P-to-P volts present. Standby position on power switch, another first, adds hours of life to CRT and other tubes. A sensitive wide band oscilloscope like the PS120 has become an absolute necessity for trouble shooting Color TV and other modern circuits and no other scope is as fast or easy to use.

S P E C I F I C A T I O N S

WIDE FREQUENCY RESPONSE:
Vertical Amplifier—flat within ½ DB from 20 cycles to 5.5 MC, down —3 DB at 7.5 MC, usable up to 12 MC.
Horizontal Amplifier—flat within —3 DB from 45 cycles to 330 KC, flat within —6 DB from 20 cycles to 500 KC.

HIGH DEFLECTION SENSITIVITY:

		RMS	P/P
Vertical Amplifier—	Vert. input cable	.035V/IN.	0.1V/IN.
	Aux. vert. jack	.035V/IN.	0.1V/IN.
	Through Lo-Cap probe	.35V/IN.	1.0V/IN.
Horizontal Amplifier—		.51V/IN.	1.44V/IN.

HIGH INPUT RESISTANCE AND LOW CAPACITY:

Vert. input cable	2.7 Meg. shunted by approx. 99 MMF
Aux. vert. input jack	2.7 Meg. shunted by approx. 25 MMF
Through Lo-Cap probe	27 Meg. shunted by 9 MMF
Horiz. input jack	330 K to 4 Meg.

HORIZONTAL SWEEP OSCILLATOR:

Frequency range—	4 ranges, 15 cycles—150 KC
Sync Range—	15 cycles to 8 MC-usable to 12 MC

MAXIMUM AC INPUT VOLTAGE:

Vertical input cable—	1000 VPP (in presence of 600 VDC)
Aux. vert. jack—	
Lo-Cap probe—	
Horiz. input jack—	approx. 15 VPP (in presence of 400 VDC)

POWER REQUIREMENTS:

Voltage—	105-125 volts, 50-60 cycle
Power consumption—	On pos. 32 watts
	Stby. pos. 10 watts

SIZE: 7" wide x 9" high x 11¼" deep—weight 12 lbs.

The PS120 is a must for color TV servicing. For example, with its extended vertical amplifier frequency response, 3.58 MC signals can be seen individually.

SENCORE
ADDISON 2, ILLINOIS

DOLLAR & SENSE Servicing

by Ernest Tricomi

HOW TO EXTEND CREDIT . . . WITHOUT GOING BROKE!

Traditionally, service dealers avoid extending credit to customers whenever possible. Under most conditions, this is sound thinking. A COD business has the advantage of simplicity; the work is done, the customer pays, and the cash is available to pay for labor, parts and overhead. If you have average business ability, a COD operation is clear sailing, and you can plan where you're going every step of the way.

As soon as you extend credit, you begin to complicate things. Your *receivables* (what people owe you) may not be paid for 60 to 90 days, on the average—yet you must lay out cash for labor, and your *payables* (what you owe people) bear EOM (end-of-month) or 30-day terms. This means you must set aside working capital to use during the period between the due dates of payables and the anticipated dates of receivables.

In addition, of course, you have the added problem of bad debts. Most people are basically honest. This is a forthright statement of fact, but there are two catchwords in the statement—"most" and "basically." When we say *most* people are honest, it follows that *some* people are dishonest. When we say *basically* honest, we mean that people's actions do not always measure up to their intentions.

If a customer, through inability or downright dishonesty, fails to pay an invoice, you can do one of two things—follow up with a vigorous (and expensive) collection effort, or write off the amount as a bad debt and forget it. Either way, you lose. It's a well known fact that collecting small sums of money frequently costs more than the amount eventually collected.

So, it's fairly obvious that COD operations are better for the small service shop, under usual conditions.

Service on Credit

Even if you're having smooth sailing in your service business, there are two small specks on the horizon—and you'd better get out your binoculars and examine them closely.

One of these is the "Fix now, pay later" service shops. They offer 30- and 60-day terms for service calls, "plus a small carrying charge." These firms operate a full-time credit department, with clerical help, collectors, and legal assistance when necessary. A few of these shops are "fast-buck" operations which sometimes claim "no charge for service labor." Inevitably, the cost of service by a "pay later" shop must be higher than COD shops would charge for a comparable job.

In spite of this, "pay later" shops are growing in size and number, particularly in the larger cities. These shops unquestionably will have an appeal to a misguided segment of anyone's customer list, and could offer serious competition to the established, conventional service shop.

The other speck on the horizon, growing fast, is the large department store. In addition to operating service departments for products sold by the store, some offer service on any product to their customers, to be paid for through their regular credit accounts. Department stores have a reputation for fair dealing and reasonable prices, which makes the department store a very strong competitor of the small service shop.

With a typical department store, a television or radio service call often costs more than the amount charged by a local shop. However, a wait of two or three days is sometimes necessary, and service is not available on weekends or after five o'clock in the evening. Also, some department stores stipulate that the product must be less than 10 years old.

In spite of these restrictions, the privilege of charging the call is a very great attraction for many people in today's credit-card society. Department stores can and do advertise rings around the average service shop, so that eventually even the small shop's competitive price advantage could be swallowed up by the sheer weight of the department store's superior promotional facilities.

What to Do About It?

You *can* offer credit to a limited segment of your customer list, and at the same time protect yourself against losses due to bad debts. Here are some suggestions which have been tried by various shops, and which offer the service shop a means for competing in the field of credit.

Central Charge Plan

Many communities have set up, usually through the facilities of a local bank, a central charge-plan association subscribed to by the merchants of the community. These associations act as the middleman between the merchant and the credit customer. A merchant sells a product (or service) to the customer, who then produces a membership card, charge plate or other charge-plan identification device. She signs the invoice just as she would sign any credit-card slip. The merchant then presents the signed invoice to the charge-plan association and receives 95% of the face amount. The other 5% is retained by the association to cover the cost of clerical help, bad debts, overhead, and profit. Accounts are usually balanced monthly, at which time the merchant receives payment.

Can you afford to guess

AT SWEEP, SYNC OR HIGH VOLTAGE TROUBLES?

WHEN IT'S SO EASY TO WALK THE TROUBLE RIGHT OUT OF CIRCUITS..... THESE TIME CONSUMING STEP BY STEP.....

SYNC. CIR. & H. SYNC. DISCRIM.	VERT. OSC.	VERT. OUTPUT	VERT. OUTPUT XFORMER	VERT. DEFLEC. YOKE
HORIZ. OSC.	HORIZ. OUTPUT	HORIZ. FLYBACK XFORMER	2nd ANODE VOLTAGE CIRCUIT	HORIZ. DEFLEC. YOKE

PUSH BUTTON TESTING . . .
for Color and Black and White

NEW, IMPROVED SENCORE
SWEEP CIRCUIT ANALYZER
MODEL SS117

How many times do you ask, "Why do I take so long finding that sweep trouble?" How often have you wondered whether weak horizontal sync was caused by defective sync circuit, horizontal oscillator, or sync discriminator? Can you quickly isolate inadequate width or low 2nd anode voltage to the oscillator, output, flyback transformer, or yoke? How many times have you changed a good yoke by mistake?

The SS117 will pinpoint troubles like these in minutes with tried and proven signal injection, plus yoke substitution for dynamic in-circuit tests. Error proof push button testing enables you to make all tests from the top of the chassis without removal from cabinet for maximum speed and profit on every job.

Here are the checks the SS117 makes . . .

- Horizontal Oscillator: Checked by substituting 15,750 variable output universal oscillator from SS117. Signal can be injected at any spot from horizontal output grid to horizontal oscillator to determine defective component.
- Horizontal Output Stage: Checked by reliable cathode current and screen voltage checks made with adapter socket and two push buttons,
- Horizontal Output Transformer: Checked for power transfer in circuit and read as good or bad on meter.
- Horizontal Deflection Yoke: Checked by direct substitution with adjustable universal yoke on SS117.
- Vertical Oscillator: Checked by substituting 60 cycle synchronized oscillator.
- Vertical Output Transformer: By simple signal injection for full height on picture tube.
- Vertical Deflection Yoke: By signal substitution for full height on picture tube.
- Sync Stages: Checked by synchronizing triggered horizontal SS117 oscillator from any stage. If oscillator synchronizes, sync is O.K.
- 2nd Anode Voltage: A new dynamic check using simulated picture tube load. C.R.T. does not need to be operating for current tests. No interpretations—read direct from 0 to 30 KV.
- External Circuit Measurements: By applying from 0 to 1000 volts AC or DC to external meter jacks. Meter will read DC or peak-to-peak volts. 0 to 300 milliamp scale also provided for measuring horizontal fuse current.
- New features include: Large 0 to 300 microamp meter for minimum circuit loading; all-steel carrying case with full mirror in adjustable cover; two 115 volt AC outlets in cable compartment.

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

Model SS117 Dealer Net **$89.50**

Sencore Sam says . . . How can you miss . . .

EACH PACKAGED UNIT CONTAINS:
- An Easy to Follow Instruction Book Especially Prepared and Edited by H. W. Sams.
- A complete 33 RPM, 10 inch Permanent Record on "How to Simplify Sweep Circuit Trouble Shooting."

SEE YOUR AUTHORIZED SENCORE DISTRIBUTOR

SENCORE

ADDISON, ILLINOIS

Since collections are handled by the association, the paper work usually connected with a credit system is cut to the bare minimum. No additional clerical help is required; in fact, the consolidation of transactions actually helps to cut down on paper work.

While most charge plans confine their merchant memberships to those stores selling tangible goods, the plan has been tried in recent months with service businesses as well. The major difficulty, as explained by a banker, is the nature of the service business.

A customer may refuse to pay for services if the product again fails after a few days, even though the failure may be caused by some entirely different condition. The time lag between the service call and the time she is required to pay gives the hypercritical customer an excuse that she would not have had with a COD call.

Also, as with most credit privileges, customers sometimes tend to go overboard. The serviceman may be called in to fix one product, then asked to fix others "while you're here," and the bill grows too large to be paid comfortably. Since part of the agreement between the merchant and the charge-plan association stipulates that there shall be no loss to the merchant for uncollectible items, there is some natural reluctance to add service shops to the list of member merchants.

Those service shops that have been admitted to charge-plan membership, and energetically promote the service, enjoy a growth which occasionally exceeds 25%. Since credit customers of department stores are frequently charge-plan members as well, this is an excellent way for the service shop to meet the competition from department stores.

Membership in a charge plan must be promoted extensively by the service shop in order to get results. To help with promotion, charge-plan associations usually circulate a bulletin about once a year, listing the merchandise and services offered to their customer membership. In addition, window decals and other material help advertise the plan to passersby, regular customers, and the general public.

As a bonus, membership in a charge plan sponsored by a local bank or businessman's association carries with it the implied recommendation of the association. This kind of endorsement, even if it is only implied, is valuable to any small business, and is particularly helpful in the service business.

Finance Companies

One way to "have your cake and eat it too" is to handle your credit customers through a finance company. Large repair bills can be financed on the installment plan over a period of time—up to a year in most cases.

There are several advantages of using this method. Finance companies make a full-time business of handling charge accounts. They can make the credit investigations necessary to reduce losses, and they have the machinery for handling and processing applications for loans and credit. If collections are slow, they have facilities for following up and collecting past-due accounts. They can do it at lower cost than can the service-shop owner.

Another advantage of this method is that the serviceman receives his money almost immediately. In this way, valuable operating capital is not tied up in accounts receivable. The cost of keeping track of charge accounts and collecting past-due accounts, and losses from those never collected, are all eliminated. His money is there ready to work for him at all times.

Financing Repairs

A simpler way to handle credit is to let the finance company take care of the entire matter. They will furnish the service shop with the necessary customer application forms, which can be filled out easily. They even furnish charts which show the finance charges for a particular repair-bill amount, and what the monthly payments will be. This simplifies the job for the service-shop manager. His serviceman can take care of the entire operation—taking a credit statement and filling out the loan application—right in the customer's home, if necessary. This saves loads of time (some customers suddenly find enough money to pay the bill anyway).

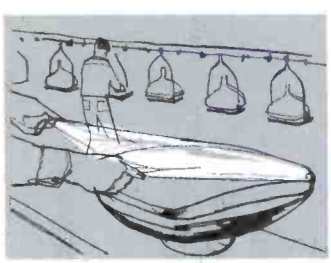
The finance company processes

• *Please turn to page 47*

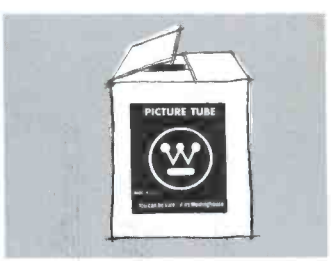
There's NEW POWER in Westinghouse tubes!

NEW PROFITS TOO, TURN PAGE FOR DETAILS

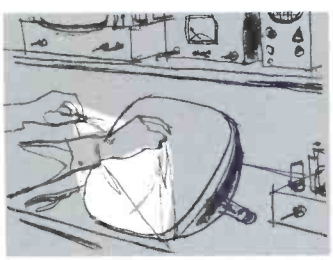
PEEL OFF THE MOST EXCITING IDEA IN PICTURE TUBE PROTECTION!



Glas-Gard Film, the industry's biggest selling plus, goes on at the factory. It's a sales story no other tube can match. Make the most of it. Here's what it does:



Glas-Gard, a tough film, protects the tube from being scratched in shipment, shields it from the chemical action sometimes caused by packing materials.



Glas-Gard keeps the tube factory-fresh to the moment of installation. For more on innovations offered in the 1962 Westinghouse Marketing Program, turn page.

Westinghouse

The New Westinghouse MARKETING CONCEPT for electronic tubes

which has recently been inaugurated takes on new elements, greater vitality, more benefits in 1962. It is based on sound business principles and a mutually profitable manufacturer-distributor relationship. Some of the major features and services of the new marketing concept are:

1. Outstanding Products.

As the culmination of an intensified product development program over the last several years, Westinghouse offers new products and highest quality products in all types: power tubes, cathode ray, and entertainment tubes.

2. Highest profit margins.

Westinghouse tube production facilities have no peer in craftsmanship and manufacturing skill. This results in exceptionally fine product quality—and, together with competitive product cost ratios—affords the highest distributor profit margins on a continuing basis. This is the basic value distributors will find in the Westinghouse franchise.

3. New packaging.

The bold, modern design of Westinghouse tube cartons has tremendous visual impact. Worked out in black, gold and white, it symbolizes the advanced engineering and careful quality control that produced the fine tube inside.

4. The ultimate in financing plans.

Here, at last, is a plan that recognizes the distributor's independence as well as his need for support. With it, a financially responsible distributor can buy Westinghouse tubes on a flexible line of credit, get the help he wants—and still keep control of all his business affairs.

5. Expert marketing counsel.

To help solve distributor problems related to distribution patterns, inventory problems, promotion and merchandising, Westinghouse offers the services of a team of experienced marketing executives. A key member of this team is our advertising agency, McCann-Erickson, Inc., with its nation-wide facilities.

6. Exclusive financial counsel.

For problems in credit control, cash flow, inventory turnover and operating ratios, Westinghouse offers the counsel of financial experts. Their services are available—on request—to all Westinghouse franchise distributors. These fiscal "trouble shooters" are full-time Westinghouse corporate officials based in offices all over the country.

7. Merchandising innovations.

Westinghouse is constantly creating new ways to package and merchandise electronic tubes. For example, new Glas-Gard Film that provides scratch protection for picture tubes.

8. New Profit Sharing Program.

Now—you share in the profits! With the new Westinghouse Profit Sharing Plan you get a bonus on every tube you sell. Each tube comes with a Golden Profitab good for many valuable gifts.

There's **NEW POWER** in Westinghouse tubes!

Distributors who are interested in this new business concept, and who would like to find out about obtaining a Westinghouse franchise are invited to write: F. H. O'Kelley, Jr., Manager, Distributor Product Sales, Westinghouse Electric Corporation, Elmira, N. Y. *You can be sure... if it's* **Westinghouse**

How to Extend Credit

(Continued from page 42)

the loan application, and when the loan is approved, sends a check for the full amount of the repair bill to the service shop. Sometimes the set is not even delivered until the loan is processed and okayed. The finance charges, of course, have been included in the loan, and the customer pays the cost of "charging it." The service shop has the money for the job almost as quickly as on a COD basis.

Discounting

Another way of handling credit is occasionally used by a service company that maintains its own customer charge accounts. Should the manager of the service organization become hard-pressed for capital because collections are slow, he can usually find a bank or a finance company who will take over a block (or all) of his charge accounts, provided they are not all past-due accounts. The price the finance company will pay for the accounts is based on their face amount and age.

This system, known as *discounting,* provides the shop owner with the ready cash he needs, and relieves him of the responsibility of collecting. However, he has sold his receivables at a much lower price than they originally represented to him. Unless his profit margin is very high (and whose is?), he has settled for no profit, or even a loss in many cases.

Promissory Notes

Even if you have a COD policy, you will occasionally run into a customer who expresses "surprise" that you require payment on completion of the work. You can protect yourself against this tactic by having a promissory note printed on the back of your invoices—the legal phraseology is available on ready-made forms at any commercial stationer. If you prefer, your lawyer can advise you on preparation of a suitable promissory note. Be sure you include a statement that the work was satisfactorily accomplished, and a place for the customer's signature. This becomes the basis for any future action you may have to bring against the customer.

Funny thing about this method, though—you rarely have to use it. When you produce the invoice and promissory note for the customer's signature, he or she usually will suddenly "remember" that there's some money in the drawer upstairs!

Receivables Insurance

If you have an extensive self-administered credit business, you may want to look into the possibility of insuring your accounts receivable against credit losses. For an annual premium, all your charge accounts can be protected from losses due to bad debts. The premium is based on a rate per $100 of receivables. This rate is adjusted upward or downward, depending on the following factors:

Location. The economy of your community will have a direct bearing on your rates. Prosperous communities, with a record of good employment, have lower rates than depressed communities.

Type of business. Manufacturers and wholesale businesses command a lower rate than businesses dealing with the general public. Due to the nature of their customer list, some types of businesses are not considered acceptable risks for this type of insurance.

Record of performance. The firm's own management record is also a factor in determining the insurance rate. Previous credit experiences, sound business practice, the nature of uncollectible accounts, and the owner's personal record are important considerations.

Condition of premises. Since collections must be supported by records, the storage and handling of records is one condition stipulated in the receivables insurance policy.

Policies differ somewhat as to exemptions, cancellations, restrictions on customers, and other provisions. Your insurance agent can give you details.

What About You?

A COD business is good business—as long as the press of competition does not force a change. When it does, however, the shop that keeps its head above water is the one which is flexible enough to recognize the change and use it to advantage. The suggestions above show how others are relieving their credit problems. One of these may work for you! ▲

TRACK DOWN THOSE TV SIGNAL LOSSES

How signals are attenuated by lead-in runs... *by Jack Beever*

Every so often you will be called upon to troubleshoot a TV set with a snowy picture. The most common cause of this symptom is inadequate signal at the input terminals of the set. The snow develops because the signal is insufficient to override the receiver noise generated in the tuner circuits. Smears caused by ghosting can also be attributed to signal losses either in the set or on the transmission line, or to reflected waves within the line. There are two primary antenna-system conditions which contribute to signal losses: (1) faulty installation, and (2) gradual deterioration.

Transmission-Line Facts

A lead-in doesn't have to be broken to cause trouble. There is quite a difference in the way a transmission line and a DC-carrying wire operate. A lead-in doesn't function like an ordinary wire which merely acts as a path for direct current flow. Currents in a transmission line alternate at hundreds of millions of cycles per second, and polarity reversals take place all along the pair. In a 16′ length (one wavelength at channel 2) the instantaneous polarity along the wire will reverse twice — the current within either conductor will be flowing in opposite directions at the same time. (See Fig. 1.) Obviously, this is not like DC conduction.

To understand this behavior, visualize the electrostatic and electromagnetic fields that exist around and between the conductors of the parallel-pair line. The line behaves as a kind of guide which transfers these

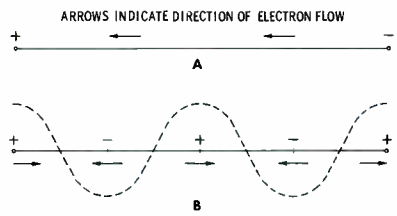


Fig. 1. (a) In a wire carrying DC or low-frequency AC, the electron flow is in the same direction along the wire. (b) An RF transmission line can have many reversals of current flow along its length at any instant in time.

fields along its length. As the fields travel, current within the wire flows in a pattern which helps to propagate the fields.

A certain amount of attenuation is inherent in a practical transmission line, and we must accept this loss. At VHF (channels 2 to 13) good-quality flat 300-ohm ribbon line will cause a loss of 1 or 2 db per hundred feet; this varies with frequency and depends, too, on the manufacturer. This means that as much as 22% of the signal can be lost in a 100′ lead-in — not too alarming, but this loss is computed

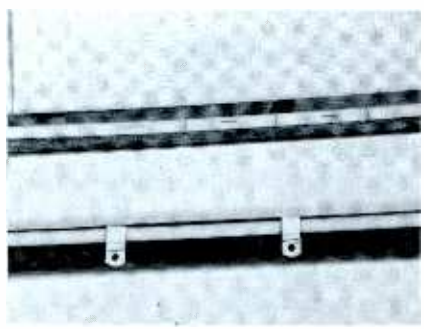


Fig. 2. Staples should be used in conjunction with clamps to cut losses.

with the line suspended in dry air, away from all disturbing influences.

It isn't practical to install antenna leads this way; we must fasten them to something, and whenever we do, the losses increase. Any nearby conductor or magnetic material will capture energy from the line, and will prevent that energy from reaching the terminal end. Proper installation techniques can keep these externally caused losses to a minimum.

Faulty Installation

Most TV-antenna installers spend much effort choosing the best or highest-gain antenna and the best receiver (one with a low noise figure). Unfortunately, they too often ignore what happens to the TV signals between the antenna and the receiver. There is a tendency to regard the transmission line as carrying all the antenna signal to the receiver input terminals—but this is not true. This writer has measured as high as 20-db losses in less than 45 feet of installed twin-lead. This means the set saw only 10% of the signal which was present at the antenna terminals. This lead was not broken or shorted; an ohmmeter indicated a perfectly good lead wire. The ohmmeter gave an insufficient test, since the lead was carrying VHF and UHF signals between 50 and 1000 mc.

The author was called to look at an installation where it had been necessary to run 80′ of twin-lead around the interior of a TV service shop. The line was attached to a plasterboard wall by means of plastic cable clamps; altogether a neat

"Now Pitching for New York, No. 33..."

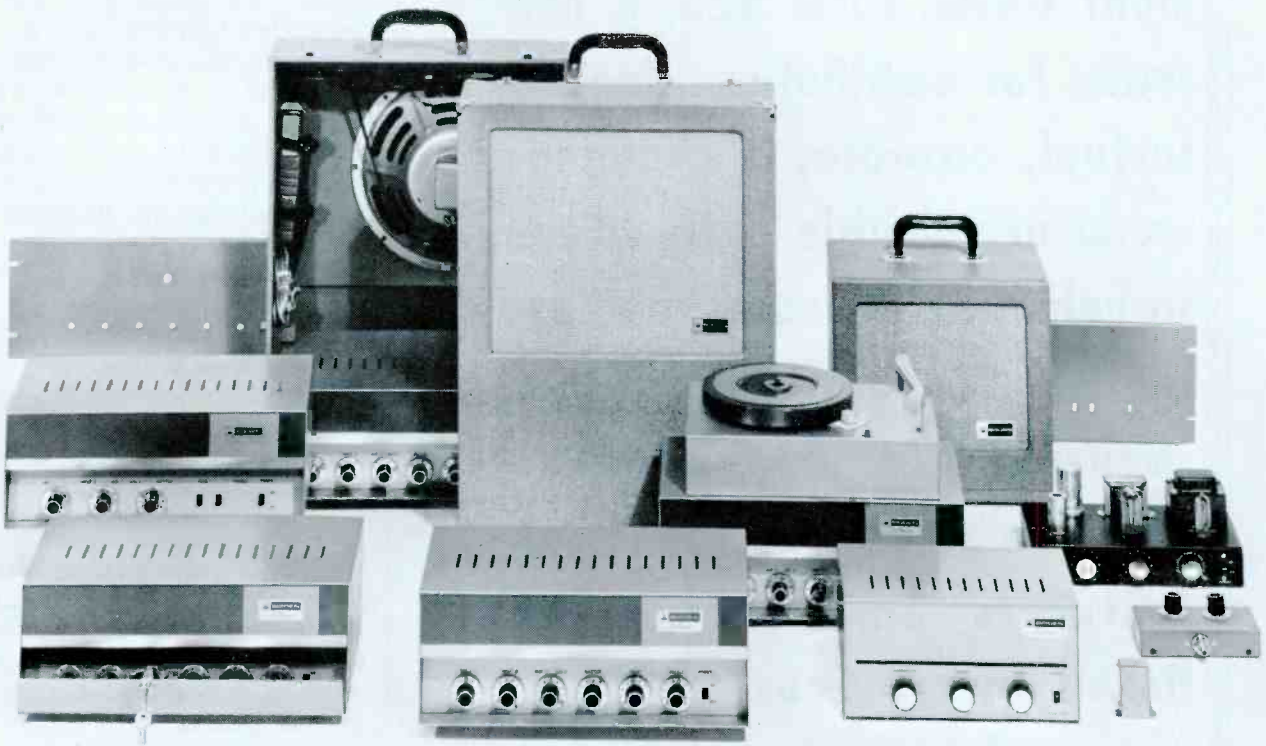
"The Savoy Lounge proudly presents..."

"My sermon for this morning deals with..."

"WILL THE OWNER OF CAR 7Z-463 PLEASE..."

"FLIGHT 702 NOW LOADING AT GATE..."

"10...9...8...7...6..."



the Sounds of the Sixties Sound Best thru New Bogen Challenger "CHB" P.A. Systems

Versatility. Whether you need P.A. to function above a stadium roar... or in the neighborhood recreation hall, there's a new CHB to fit your need. Ranging in power from 10 to 100 watts, CHB amplifiers are adaptable for indoor, outdoor, portable or mobile use. **Features and Accessories:** 4-speed phono, fastens to amplifier top • tamper-proof, front locking plate • continuous-duty circuitry • remote controller • circuit protection against accidental speaker-line shorting... and many more, previously featured in the exclusive BOGEN Flex-Pak line. **Reliability.** BOGEN's 30-year leadership in sound craftsmanship is your extra guarantee of rugged, dependable performance with minimum maintenance. In business, industry or government... most P.A. is by BOGEN—pioneer of the most significant developments in P.A. Write for CHB Catalog #311.

BOGEN-PRESTO

Desk PF-5, Paramus, N.J.—A Division of The Siegler Corporation

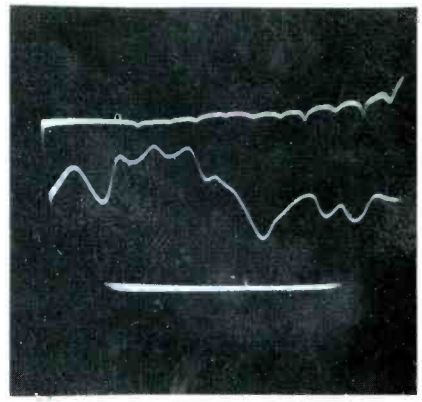


Fig. 3. Improperly stapled lead-in has response curve shown by lower trace.

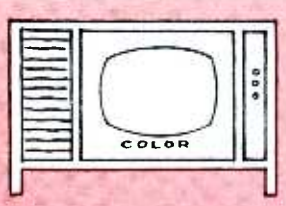
job, but the picture on the set at the end of the lead was full of snow. The same set displayed a snow-free picture at the point where the line came into the building. The total line loss was measured and found to be nearly 12 db, instead of the normal 1 db; this meant that less than one-fourth of the signal was reaching the set terminals. The losses were found to be due to the damp and conductive plaster board, which was absorbing the magnetic and electric fields.

The cure was simple; a strip of 1" x 2" lumber was nailed to the wall, and the line run on the top of this "furring strip." The dry wood caused considerably less attenuation, being more like the ideal dry-air environment.

Bad Habits

Let's note some more of the really bad installation practices commonly seen. The worst offender is the staple gun—a very handy gadget, but murderous to signals inside a twin-lead. The metallic staples are clamped tight across the lead-in, and each one can cause from ¼ to ¾ db of loss. Taking the median (½ db) as an example, it is easy to see that twelve staples may cause a 6-db loss—and 6 db is 50%! But this loss is only part of the story; the characteristics of the line are so changed that it no longer has a 300-ohm impedance. It turns into a kind of trap for certain unpredictable frequencies, causing them to be attenuated. We find that these losses cause the picture to be poorer on some channels than on others, and sometimes actually cause "ghosting" from line reflections.

Fig. 2 shows two sections of twin lead illustrating improper methods



FIX OVER 90% OF ALL TV COLOR TROUBLES WITH THIS SENSITIVE TUBE TESTER

THE NEW SENCORE MIGHTY MITE II

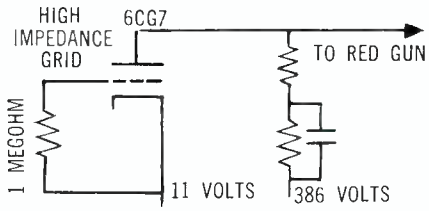
MODEL TC114

67.50

Thinking of buying equipment for color TV servicing? Here is the tester that you should place number one on your list. Why? Because this tester alone will help you repair over 90% of all color TV receivers. Faulty tubes cause over 90% of all color TV troubles because the majority of color tubes have high impedance grid circuits. To detect faults in these critical tubes, sensitive grid circuit checks are essential. The Mighty Mite checks for grid leakage as high as 100 megohms or as little as .5 microamps of current. Large expensive testers and the drug store type offering only 2 or 5 megohm leakage checks will pass these critical tubes as good. You can find these tubes in a jiffy with the famous Mighty Mite . . . give real service to your new customers with color receivers . . . and make more money too.

Typical high impedance circuits like these, need the Mighty Mite for accurate checks

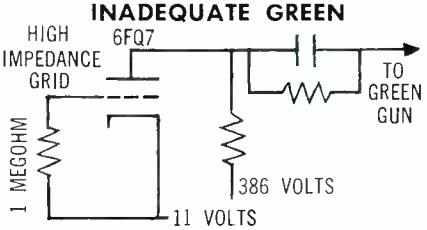
INADEQUATE RED



RCA & ADMIRAL R-Y AMPLIFIER

If this tube draws as little as 2 microamps of grid current, the bias is upset 2 volts causing reduced red signal. To correct this, you may go to all the trouble of readjusting the red gun when the Mighty Mite, with its high sensitivity grid check, would have indicated the tube bad, saving you this trouble.

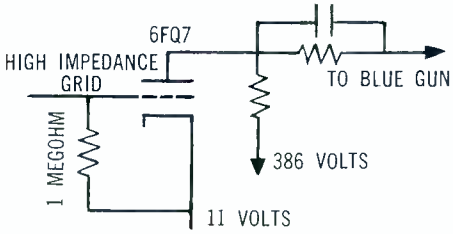
INADEQUATE GREEN



RCA & ADMIRAL G-Y AMPLIFIER

If this 6FQ7 tube starts to draw only 2 microamps of grid current, the tube bias will be upset 2 volts because of the high impedance one megohm grid resistor. An old fashioned tube tester, or drug store type that requires 25 microamps of current to indicate the tube as bad, would pass the troublesome tube as good.

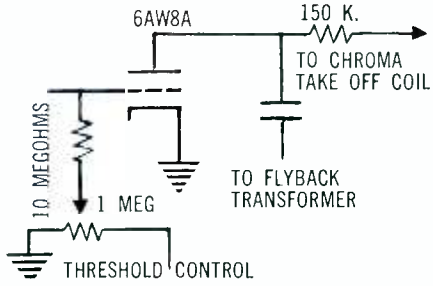
INADEQUATE BLUE



RCA & ADMIRAL G-Y AMPLIFIER

Conventional tube testers will not show this tube bad until it develops a change of 25 volts positive bias in circuit. The Mighty Mite will find it as soon as it starts to cause poor color mixing.

COLOR INTERFERENCE

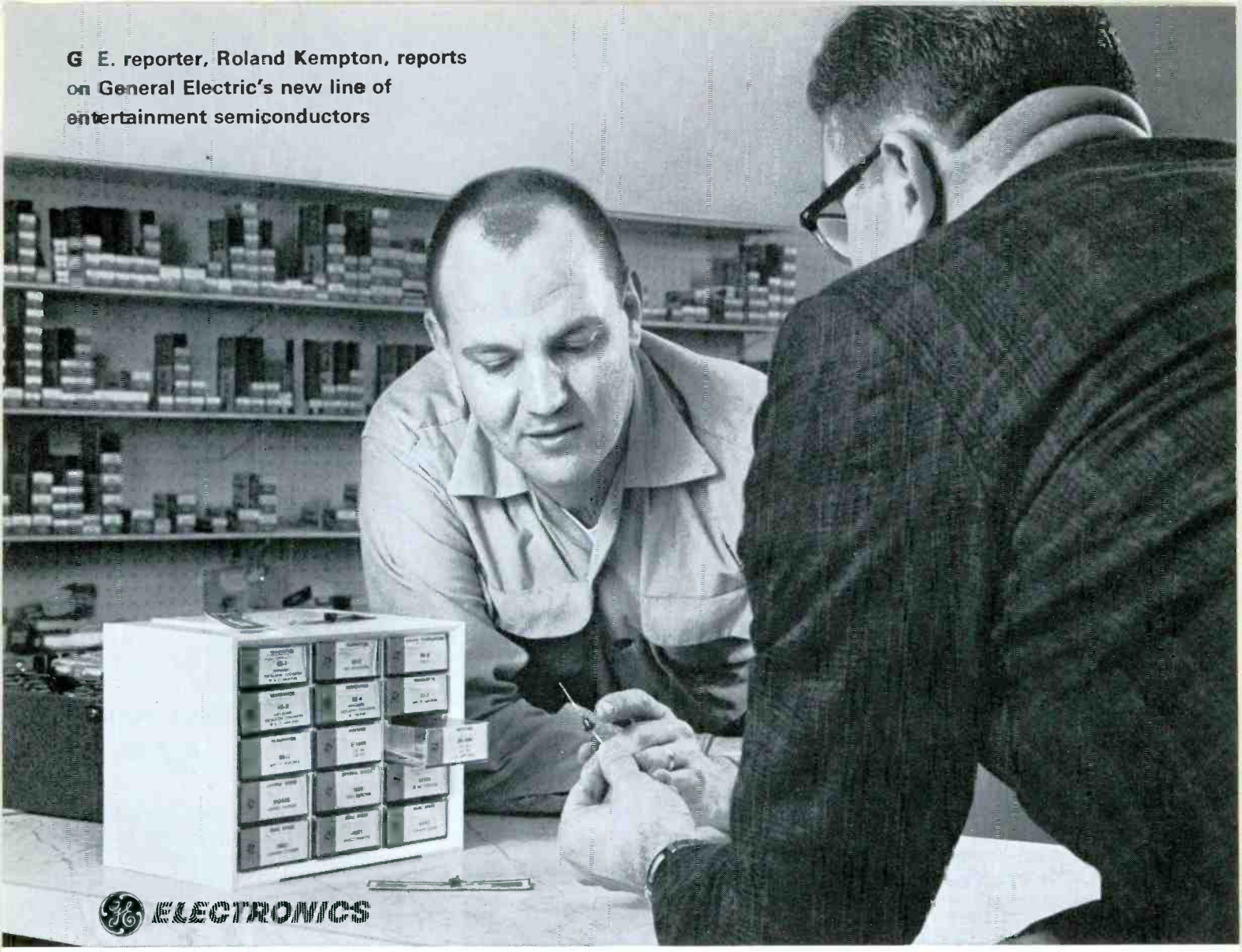


RCA & ADMIRAL COLOR KILLER

If the tube draws only 1 microamp of current through this 10 megohm grid resistor the bias will be upset 10 volts restricting operation of the color killer. Color signal will interfere with black and white programs. The Mighty Mite will locate this faulty tube in a hurry while old fashioned testers will pass it as good.

Checks them all, including the New RCA Novars, Nuvistors, Sylvania 10 Pin, GE Compactrons, and picture tubes too. A real money maker for servicing color, black and white, radio, Hi-Fi.

Available at Electronic Parts Distributors • Manufactured by Sencore, Inc., Addison, Ill.



Marvin Kleine figures he can fill 80% of his replacement needs from new G-E *SERVICE-DESIGNED* entertainment semiconductor kit

We gave Marvin Kleine, manager of ROGERS HORNSBY TV SERVICE, St. Louis, a preview of General Electric's new line of Service-Designed entertainment semiconductors. He saw several immediate advantages: "One of the main things in this business is *one time on the bench*—being able to put a set on the bench, check it out, fix it and get it out with a minimum of handling. These Service-Designed semiconductors will help because in about 80 percent of the cases I'll have the replacement right here in the shop. Should speed up our service and save a lot of shopping around for exact replacements. The blister-pack on cards makes a lot of sense, too, and I'm glad to see you've included interchangeability data. Saves us the trouble of looking it up."

If you still have to shop around for entertainment semiconductor replacements, it will pay you to check G.E.'s expanded new Service-Designed line, including:

GE-504 "Universal" Silicon TV Rectifier—a universal replacement for all silicon, germanium and selenium rectifiers used in TV receivers. It features a 45 amp. max. surge rating which eliminates the need for a limiting resistor as is necessary with ordinary silicon rectifiers. 750 ma DC output; 400 PIV.

8 "Universal" Transistor Types—including 2 power transistors for auto radios—Service-Designed to replace over 600 types used in original equipment.

4 Crystal Diodes—Service-Designed to replace approximately 98% of all diodes used in entertainment applications.

A Replacement Guide and Catalog of entertainment semiconductors is available at your G-E distributor. Ask for ETR-2982 or write to: General Electric Company, Distributor Sales, Electronic Components Division, Room 1710A, Owensboro, Kentucky.

Progress Is Our Most Important Product

GENERAL ELECTRIC

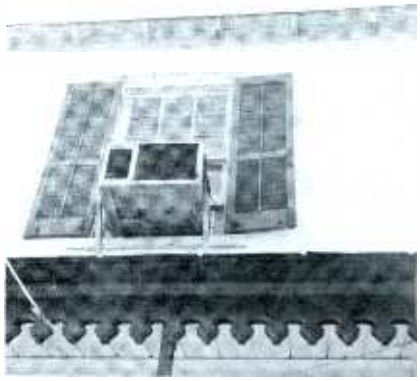


Fig. 4. Window frame pinching lead-in causes several db of TV signal loss.

(upper lead) and acceptable methods (lower lead) of using staples. Fig. 3 is a photo of an oscilloscope trace during a sweep-generator test of an improperly stapled section of line. The normal output on channels 7 through 13 is shown as the top line of the scope pattern. The lower, jagged line is what is left of the generator signal after squeezing past the staples.

Other common installation errors occur, such as running twin-lead through a hole drilled in a metal window frame, or worse yet, clamping it between the window and the frame. The writer has seen lead-in wires strapped to metal heating ducts, taped to water and gas pipes, and in one case, fastened to a steam pipe. A bundle of twin-lead, neatly tied into a sort of bow behind the set, is a common sight. Losses invariably result from this practice, since adjacent sections may be carrying out-of-phase currents, and the interaction can ruin the signal.

Outdoors, one often sees twin-lead draped over the edge of a roof,

"I don't think I'd take it there, Ed."

as in Fig 4, or tastefully tucked away behind a gutter or drain pipe. But in each case the error is the same; the installer has not *tried* to keep the transmission line in the ideal dry-air environment. When considering this environment problem, you should bear in mind that dry wood is the next best thing to dry air; next is dry masonry, then damp masonry, and worst, of course, is metallic material. Remember, also, that a small piece of metal in close proximity to the lead-in will be as harmful as a larger one at some distance. In general, it is well to keep twin lead at least four or five inches away from metal of any kind.

In some cases, it is practically impossible to avoid long lead-in runs near metallic surfaces. If sufficient signal is available and the internal loss can be tolerated, shielded twin lead may be used. Here, external losses are minimized by the design, but the inherent loss is substantial.

If neither type of loss can be tolerated, coaxial cable may be used. A larger size such as RG-11/U is usually recommended, since the losses are less. Because the line impedance is 75 ohms and unbalanced, matching transformers (baluns) must be used at each end. Such transformers are available for both indoor and outdoor mounting.

Gradual Deterioration

The weather extracts a heavy toll among antenna installations. Over a period of years, what was once a good installation will gradually deteriorate until the losses are more than can be tolerated.

The effect of the weather is even worse on an installation that was poor to begin with. Fig. 5 is a photo showing what remains of an installation which had to be replaced. The original job was done two years and eight months before the picture was taken, and new materials were used; the location was a non-industrial, suburban area.

The first mistake was in the choice of twin-lead. This was a cheap line with a polyethylene dielectric made from recovered (salvaged) material, "stretched out" with some kind of filler. It has become so brittle that, when bent, it breaks like glass. It cannot be cut

with a knife because it crumbles away like sugar. Where wind movement caused the insulation to crack, the bare conductors are exposed.

Since the site was only five miles from the TV transmitter, there was enough signal to override the snow in spite of the poor lead-in; the customer complained of smearing, especially during rainy weather. This is quite understandable in view of the short circuits the water must have caused in the transmission-line cracks. In actuality, a gradual degradation had been building up, but such slow attrition of picture quality is seldom noticed; it is only when sudden changes occur that people normally see it.

Observe the stand-off insulator in Fig. 5; originally, it was cadmium-plated steel, but after only 32 months it has rusted almost beyond recognition. The difference in price between it and a stainless steel stand-off is only pennies, but the man who did the original job has damaged something he can't restore —his reputation.

Note the way the twin-lead has pulled through the insulating bushing until it is pressed into the metal support ring of the stand-off. It is quite likely that conduction between the support and the lead took place when the wire was wet. This condition was the result of too large a loop between the antenna terminals and the mast stand-off, allowing the wind to whip the lead. The lead should have been supported on the boom itself, between the antenna terminals and the mast.

If this installation had been a fringe-area job, where every microvolt counts, the stand-off could not have been tolerated. Notice that the

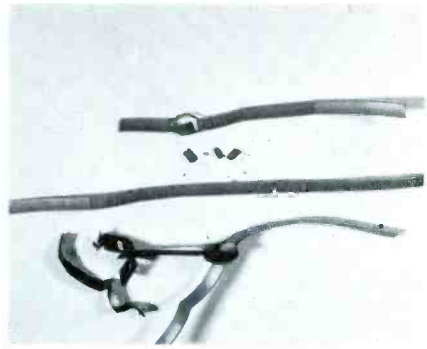


Fig. 5. The ravages of time are evident in these remains of an antenna job.

ring of metal supporting the bushing has been squeezed until the ring is closed. Such a closed ring becomes the shorted one-turn secondary of a transformer, with the lead-in line forming the primary. These shorted secondaries can cost a lot of signal.

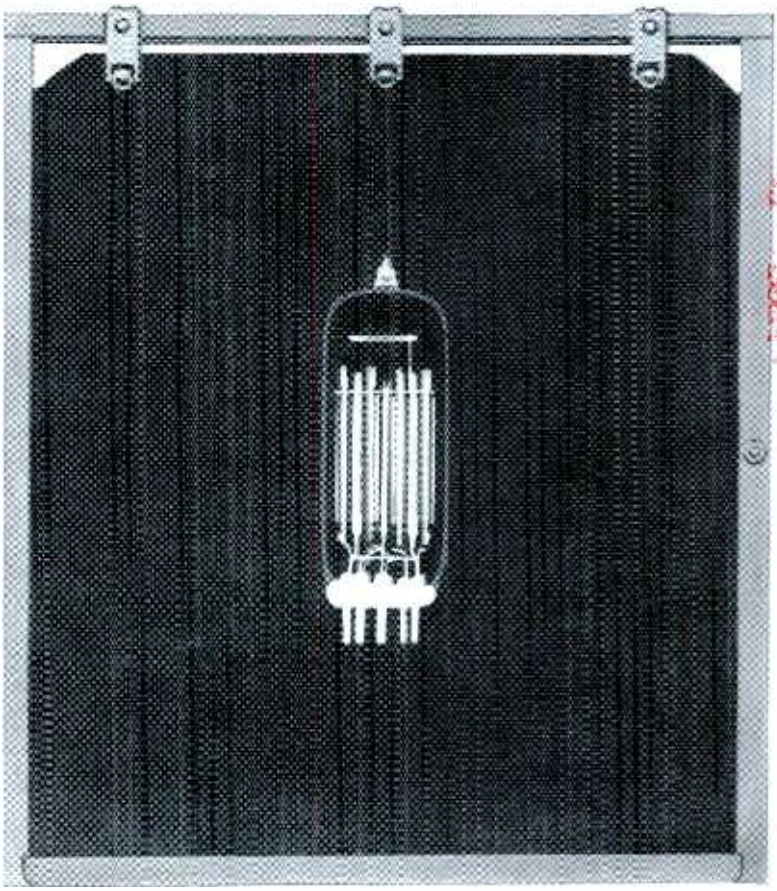
Trouble Indicators

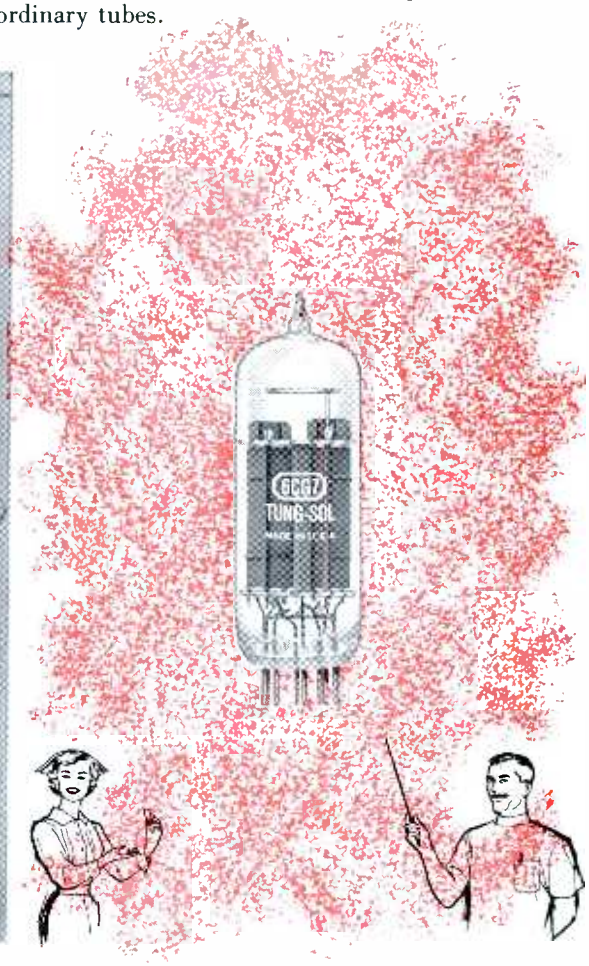
Most installation defects can be spotted by visual observation, but in cases where the installation is suspected of causing picture degradation, suspicions can be verified from picture symptoms. Smearing that varies with weather conditions, loss of color, intermittent loss of sync, and critical set adjustment may all be caused by lead-in trouble, especially if these symptoms occur only on one channel. Ringing (a condition in which a number of ghosts are seen very close to the main image, each ghost weaker than the next) usually indicates a bad mismatch in the line.

A final note: Remember, all snowy pictures aren't the fault of the set — many a serviceman has had to make two calls on an apparently defective set, later discovering that it was antenna trouble all along. ▲

Controlled heater explains greater life expectancy of Tung-Sol series-string tubes

Prognosis—*excellent!* Examination of Tung-Sol series-string TV tubes reveals advanced design of heater and cathode structure, making possible *controlled warm-up time.* This explains the good health and longevity of Tung-Sol series-string tubes. Tung-Sol was a pioneer producer of 600 ma series-string tubes. But, not content merely to be among the first, Tung-Sol expanded this group to cover many applications and then added 450 and 300 ma series-string tubes for sets of more sophisticated circuitry. Time has proved Tung-Sol's diagnosis to be correct; the series-string principle radically improves tube life expectancy while retaining youthful vigor. Consultants on TV service agree that the family of Tung-Sol series-string tubes are far more immune to malfunctions of all kinds. Sets equipped with Tung-Sol series-string tubes require fewer visits and less hospitalization than sets with ordinary tubes.





Rx FOR A HEALTHY TV SERVICE BUSINESS

To avoid sluggish customer attitude, low profit levels and other complications symptomatic of poor components selection, always rely on Tung-Sol. Choose from more than 100 Tung-Sol series-string tubes to fill your prescriptions.

the first name | to ask for when ordering

TUNG-SOL®
SERIES-STRING TUBES

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

QUICKER SERVICING
by George F. Corne

SURE CURES for REPEAT TUBE BURNOUT

Have you replaced the same tube in a set two or three times during a six-month period? Does your customer ask, "Why does the same tube always burn out?" There's a possibility the tube is not at fault; on the average, the normal lifetime of a tube will be at least one year and in many instances far longer. Abnormally short-lived tubes result when circuit defects cause their operating specifications to be exceeded. If the service history of a set indicates a repeat-burnout problem, don't swap trouble for trouble by just replacing the tube. It's a good policy to explain the problem to your customer and suggest the set be bench-serviced to prevent continued tube failure. In most cases the customer will agree; if not, suggest he give you a call when the set fails again. By that time, he'll more than likely be ready to let you get to the bottom of the problem.

Sometimes repeat tube burnouts are due to a peculiar defect in a certain model. For this reason, it's a good idea to note troubles that "strike twice in the same place," and take advantage of all field-service information on common faults in particular chassis. Then you can catch troubles before they cause a bothersome (and expensive) chain of tube failures. If you stumble on an advanced case without warning, you'll find more to it than meets the eye—as in the following examples.

Touching on Color

Tinted screen, loss of color—unable to repair with new tubes? If you're faced with this problem in certain color sets, look for unsuspected trouble in the color-difference amplifiers.

The partial schematic in Fig. 1 shows the demodulator and amplifier circuits used in the RCA CTC9 chassis. The CTC7 uses the same basic circuit, except 12BY7's serve as the amplifiers, and repeat trouble has been encountered with both chassis.

In one typical case involving a CTC9, the trouble was corrected

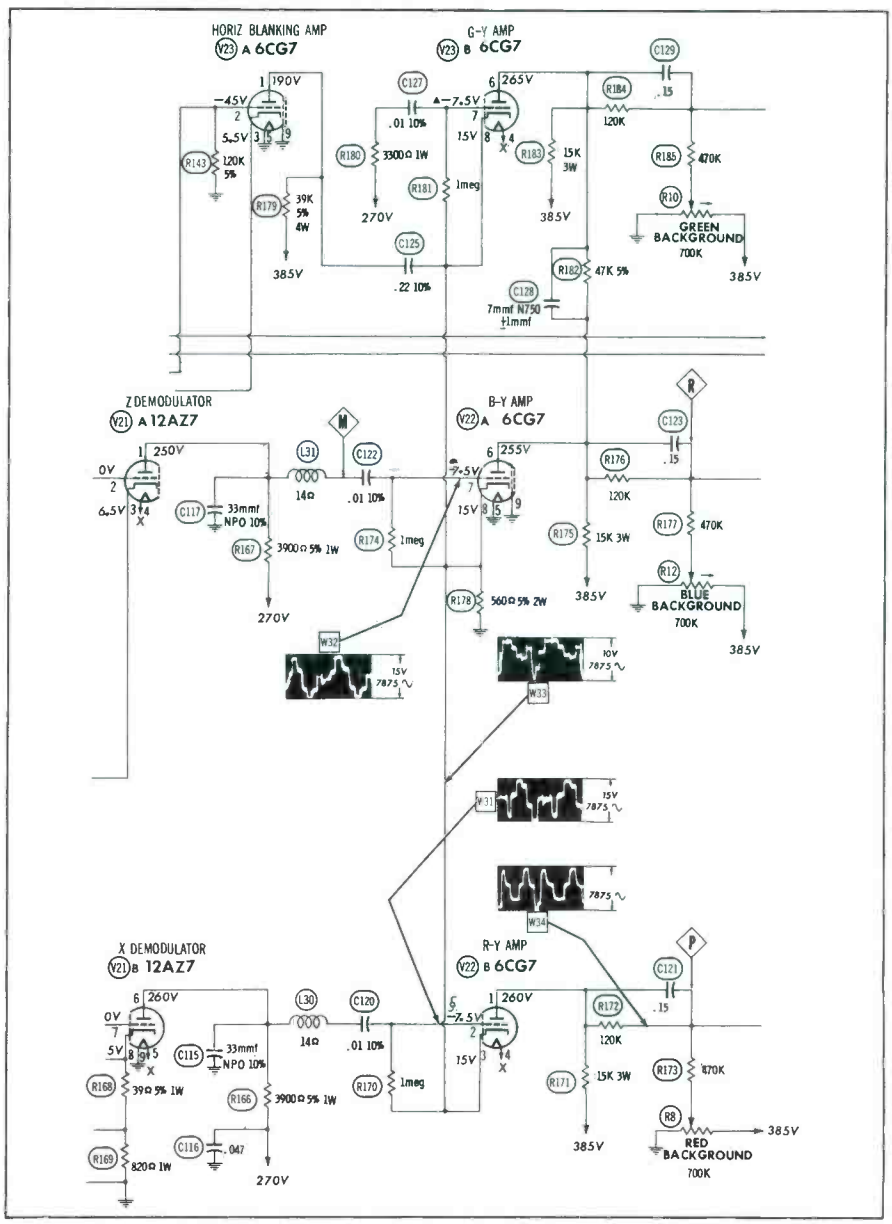


Fig. 1. Capacitor failures can cause burnout of V22 or V23 in RCA CTC9.

NOW! LEARN HOW TO SERVICE TRANSISTOR RADIOS

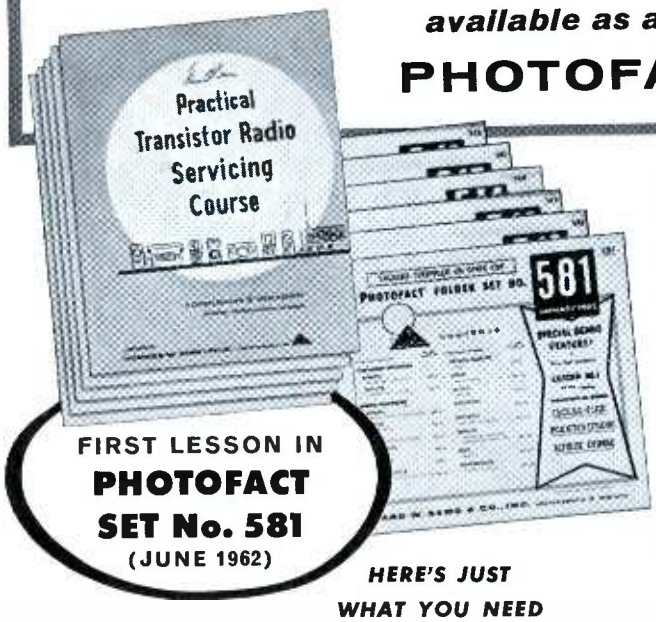
THE QUICKEST, EASIEST WAY SO YOU CAN EARN BIG PROFITS!

you'll get money-making know-how from the COMPLETE 16-LESSON

"PRACTICAL TRANSISTOR RADIO SERVICING COURSE"

available as an exclusive BONUS FEATURE for

PHOTOFACT® SUBSCRIBERS!



FIRST LESSON IN
PHOTOFACT SET No. 581
(JUNE 1962)

Here's the Course you get with your Photofact Subscription!

Lesson 1. Transistor Radio Components. Description of transistors, diodes and thermistors in transistor radio circuits, and other components used in miniature portables.

Lesson 2. Transistors in Operation. Biasing, loads, temperature effects, polarities, positive and negative grounds, heat dissipation.

Lesson 3. Measurements in Transistor Circuits. Voltage resistance, and current measurements in audio, RF and IF amplifiers, oscillators, detectors and other circuits.

Lesson 4. Transistor Circuit Checks. Reading schematics, using CircuiTrace®, measuring voltages and resistances.

Lesson 5. Transistor Radio Construction. Cabinets and case construction, chassis removal, care of plastics and use of solvents.

Lesson 6. Special Tools. Soldering devices, miniature tools used in assembly, disassembly, and repair of transistor radios.

Lesson 7. Troubleshooting Techniques. Preliminary tests, current and voltage checks, and signal-tracing techniques used in isolating troubles.

Lesson 8. Making Effective Use of Test Equipment. Test equipment needs and applications.

Lesson 9. Servicing Procedures. Where to start; step-by-step checks.

Lesson 10. Analyzing Troubles by Symptoms. Commonly-found problems, recognizing the symptoms, and locating defective components.

Lesson 11. Alignment and Adjustment. Step-by-step procedures plus time-saving hints.

Lesson 12. Improving Performance. Techniques for improving the operation of noisy and/or weak receivers.

Lesson 13. Repairing Printed-Boards. How to isolate printed-wiring defects and replace faulty components.

Lesson 14. Transistor Replacement. Selecting and installing suitable types.

Lesson 15. Auto Radios. Special requirements for servicing hybrid and all-transistor models.

Lesson 16. Replacement Parts. How to repair defective components; sources for replacements.

PLUS — to-the-point Questions & Answers to help you check your progress!

HERE'S JUST WHAT YOU NEED TO CASH IN ON THIS HUGE SERVICING MARKET!

Servicing small transistor radios can be a real headache and a financial loss to service technicians—UNLESS you have the knack of quickly locating and repairing troubles caused by faulty miniature components or defective printed boards.

The Howard W. Sams PRACTICAL TRANSISTOR RADIO SERVICING COURSE gives you the special knowledge and techniques you need to become an expert on transistor radios—so you can repair all types at a profit.

You get practical know-how, based on years of on-the-job experience. You get down-to-earth text on every phase of transistor radio servicing (see Lesson list at right), PLUS large pictorial photos showing you why, what and how.

The transistor radio servicing market is huge and growing, with millions of customers crying for service. There's big money to be made by those who know the shortcuts to quick, effective repair. The Sams PRACTICAL TRANSISTOR RADIO SERVICING COURSE can make you an expert, can give you the speedy know-how you need to earn big money consistently.

SUBSCRIBE TODAY—Get This Timely BONUS Course!

DON'T MISS A SINGLE ISSUE!

Subscribe today through your Sams Distributor to receive all PHOTOFACT Sets as issued each month. Beginning in June, 1962, you will start receiving the 16-lesson Practical Transistor Radio Servicing Course as a bonus with your subscription to PHOTOFACT—the world's finest tv-radio servicing data!

SUBSCRIBE TODAY!

Are You Enjoying the Benefits of Membership in "PEET"?

Join the thousands who have qualified and profited by membership in the "PEET" Program. If you now own a PHOTOFACT Library or plan to own one, you can apply for membership. It's the *only* program designed to build powerful public acceptance for you, which means increased business and profits. You get dozens of free promotional aids. Benefits cost you absolutely nothing if you qualify. Ask your Sams Distributor for the "PEET" details or mail coupon today.

AS SEEN in TV GUIDE

Powerful national advertising monthly in TV Guide now carries the "PEET" message to over 8,000,000 TV families, building dynamic support and demand for the services of "PEET" members. Now more than ever it pays to qualify as a "PEET" member!

Howard W. Sams & Co., Inc., Dept. 7-E2
1724 E. 38th St., Indianapolis 6, Ind.

☐ **I would like to enter my subscription to Photofact, effective with Set No. 581**

My Distributor is: _____

☐ Send me details on how to become a "PEET" Member

Shop Name _____

Attn. _____

Address _____

City _____ Zone ____ State _____

when V22 was replaced, but the new tube soon began arcing. The chassis was finally pulled and taken in for shop service. When it was connected to the bench color setup and power was applied, visual inspection in the area of V22 showed overheating of cathode resistor R178. A resistance check in the grid circuit of V22B pinpointed a short in coupling capacitor C120. Plate-load resistor R166 in the X demodulator was damaged, but R171, the 2-watt plate resistor of V22B, was still in good shape. After C120, R178, and R166 were replaced, and a new 6CG7 was inserted, the set was fired up again. An operational check proved that color and gray-scale tracking were correct, so after approximately five hours on the check-out rack, the set was returned to the customer.

Here comes our repeat tube failure. After only a week, the set was returned to the shop with the same problem. Checking again in the area of V22, the bench man found another coupling capacitor (C122) shorted, and a damaged plate-load resistor R167 in the Z demodulator. An overdose of positive grid voltage was the obvious reason for failure of the new 6CG7. Two capacitors failing in rapid succession in closely associated circuits are something to wonder about. It so happened that the original C122 was rated at 400 volts; so were C120 and the G–Y grid capacitor C127. It was reasoned that such a low rating might lead to early breakdown in this circuit, causing subsequent tube failure along with component damage. In the past six months, a single shop reported 10 color chassis of the CTC7 and CTC9 series needing

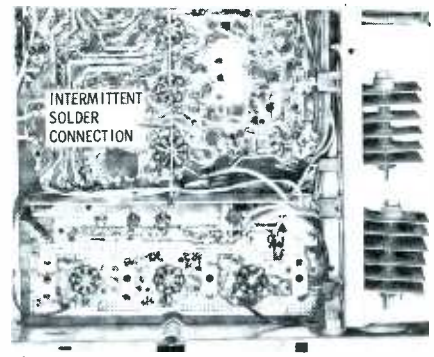


Fig. 2. Intermittent open connection at pin 5 damages filaments of 12BY7A.

shop service for the same circuit failure. Some chassis, it was found, are already equipped with 600-volt capacitors. As a result, this shop has adopted the habit of checking these coupling capacitors, and replacing them if necessary, regardless of the reason for bringing in a color set. This cure prevents tube burnouts, saves callback time, and provides an added service to the customer.

Filament Fault

Most technicians are now familiar with the peculiar defect that causes repeat burnout of 12BY7A video-output tubes in Westinghouse Chassis V-2342, -43, and -53. As explained in earlier issues of PF REPORTER, this condition can be traced to an intermittently open filament connection on the printed wiring board at pin 5 of the 12BY7A socket (see Fig. 2). But a complete repair may demand more than just resoldering the connection and plugging in a new tube. Other tubes and parts are sometimes damaged when this defect appears, and they will cause future trouble if not discovered and replaced. Here's one such case, reported by a serviceman who went the long way around

Find it and Fix it in ½ the time!

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

B&K MODEL 1076 **TELEVISION ANALYST**

BLACK & WHITE AND COLOR

Just As Easy to Use As a VOM!

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

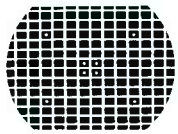
Simplified technique stops lost hours never recovered on **"tough dogs", intermittents,** and **general TV trouble-shooting.** This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half ... service more TV sets in less time ... satisfy more customers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

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

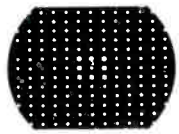
Available on Budget Terms. As low as $30.00 down.

Net, **$299.95**

SIMPLIFIES COLOR TV SERVICING, TOO



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



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

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

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

Model 960 Transistor Radio Analyst

Model 360 V O Matic Automatic VOM

Model 375 Dynamatic Automatic VTVM

Model 700 Dyna-Quik Tube Tester

Model 440 CRT Rejuvenator Tester

See Your B&K Distributor or Write for Catalog AP20-R

B&K

B & K MANUFACTURING CO.

Division of DYNASCAN CORPORATION

1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.

Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.

Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

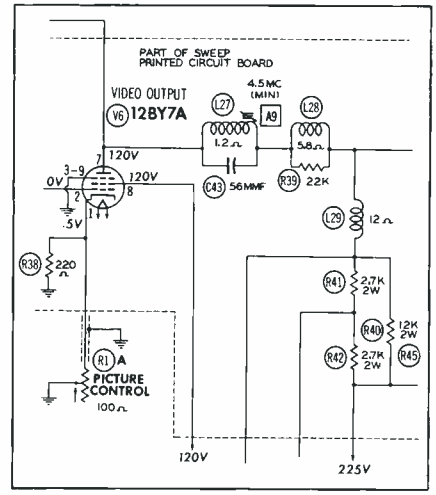


Fig. 3. If short occurs from heater to cathode, both R1A and R38 are burned.

to find the chronic filament trouble.

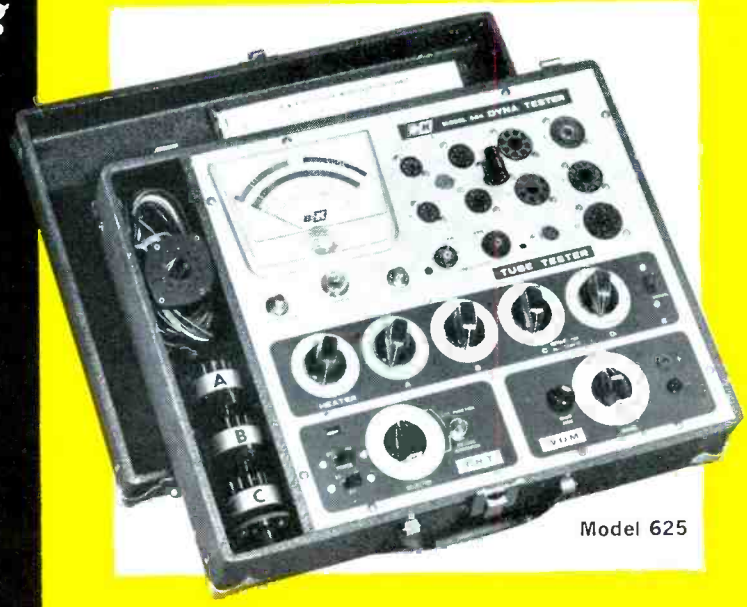
Two months after a Westinghouse set was bench-serviced for a tuner defect, the chassis was returned to the shop with a burnt picture (contrast) control R1 and cathode resistor R38 (see Fig. 3). The 12BY7A video output tube was checked and found to have interelement shorts. This was sufficient reason for understanding why R1 and R38 had been damaged. The scorched components were replaced, plate-load resistors and associated components were checked and found in good condition, and all tubes were checked. V14, V7, V10, and of course V6 (video output) needed replacement.

After an operational check was made, the set was returned to the customer; but it came back again in less than three months with the same components damaged (R1, R38) and another shorted 12BY7A video output tube. Ignoring R1 and R38 for the time being, the serviceman connected a clip lead from cathode to chassis ground and inserted a new 12BY7A. The tube filament lit with an unusual brightness and did not settle down to normal. When another new 12BY7A was inserted, it glowed no brighter than the other tubes. "Just a bad tube," the serviceman surmised, but a tester showed the first replacement to be good.

The set was fired up again, and the same problem came back; an intermittent condition appeared likely. Wiggling the tube proved this to be true, for the filament returned to normal. Inspecting the tube socket, the serviceman found a hairline

Again B&K Makes Servicing Easier... More Profitable!

NEW! 3-IN-1 DYNA-TESTER



Model 625

1 TUBE TESTER **2 VOM** **3 CRT**

Unique new B&K design now simplifies servicing in the home or in the shop. Combines Tube Tester, Volt-Ohm-Milliammeter, and Cathode Rejuvenator Tester in one compact, professional quality instrument—at low cost!

1 TUBE TESTER SECTION is fast and accurate. Tests the *newest* tube types as well as all of the *old* commonly used tubes in TV and radio sets. Tests the Nuvistors and Novars, the new 10-pin tubes and 12-pin Compactrons. Tests voltage regulators, thyratrons, auto radio hybrid tubes, European hi-fi tubes, and most industrial types. Checks for *all* shorts, grid emission, leakage and gas. Provides *adjustable* grid emission check with exceptional sensitivity to over 100 megohms. *Checks each section* of multi-section tubes separately. Checks tube quality and capability of cathode emission under current loads simulating actual operating conditions.

2 VOM SECTION provides the 7 most-used ranges for convenient TV testing:

3 DC Ranges: 0-10, 100, 1000 volts
3 AC Ranges: 0-10, 100, 1000 volts
1 Ohm Range: 3 kc center scale

3 CRT SECTION spots picture tube trouble and corrects it in a few minutes right in the home, without removing tube from set. Tests and rejuvenates picture tubes at correct filament voltage at 2, 6, and 8 volts. Checks for leakage, shorts, and emission. Removes inter-element shorts and leakage. Restores emission and brightness. (Checks and repairs color picture tubes with B&K Accessory C40 Adapter.)

Model 625 Dyna-Tester complete in handsome, lightweight, leatherette-covered carry-case. Size: 11¾" x 15" x 4½". Net, $139.95

See your B&K Distributor, or Write for Catalog AP20-R

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


Model 960 Transistor Radio Analyst


Model 360 V O Matic Automatic VOM


Model 375 Dynamatic Automatic VTVM


Model 1076 Television Analyst


Model 440 CRT Rejuvenator Tester

See Your B&K Distributor or Write for Catalog AP20-R

B&K MANUFACTURING CO.
Division of DYNASCAN CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

crack in the printed-wiring connection to pin 5. This terminal is normally connected to pin 4 in order to provide 6-volt operation, with both sections of the filament in parallel (Fig. 4), but the open connection was causing the full 600-ma current to flow through only half of the 12BY7A filament. Excessive heating of this section caused premature breakdown between elements in the tube. Overconduction in the cathode circuit damaged R1 and R38—but that's not all!

Remember those new tubes installed on the set's last trip to the bench? When they were checked once again, V14 was found weak, and both V7 and V10 were shorted—all ripe for replacement! In Fig. 4, note that all these tubes are between the hot side of the line and V6. With a heater-to-cathode short in the 12BY7A, the voltages across V14, V7, and V10 would rise, and the consequent overheating was evidently enough to cause early breakdown of these particular tubes.

While servicing sets with series filament circuits, take a few seconds to compare the filament brightness of similar tube types. If one is unusually bright, take an AC voltage measurement across it (referring to schematic information for the correct voltage) and assure yourself that it's normal.

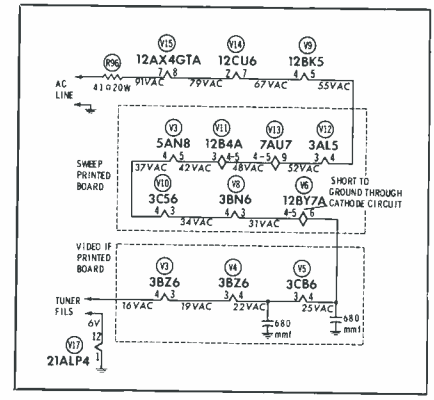


Fig. 4. Short in V6 increases voltage across each tube "higher" in string.

Other Known Trouble Spots

In many different makes and models of sets, certain stages have circuit features which make them especially prone to repeat tube burnout. A few extra precautions in servicing these stages will lengthen tube life.

High-Voltage Rectifier

Sometimes a dropping resistor is wired between the filament winding (on the high-voltage transformer) and the tube pin. An open resistor will cause complete loss of high voltage. If the resistor shorts, high voltage will be present, but increased filament voltage will shorten the life of the rectifier tube. If you have trouble keeping high-voltage rectifiers in a set, check the dropping resistor for correct value. A faulty resistor should be replaced only by the special type recommended in the service information—not by a general-purpose carbon resistor. Along with this, check horizontal circuit adjustments; if improperly set, they can also cause increased filament voltage.

RF Amplifiers

Tubes used in RF circuits, because of the close physical spacing of their internal elements, are inclined to develop internal shorts quicker than most. This sometimes causes only minor damage to the voltage-dropping resistors associated with the RF circuit, and the customer doesn't notice that his picture is becoming snowy or that some channels are received better than others. However, the life of new

The world's finest antenna rotor . . .

becomes the world's only wireless remote-control rotor system . . .

with this!

Now CDR gives you the world's first and only wireless antenna rotor remote control! The ultrasonic receiver plugs into and acts as a base for the control cabinet. The ultrasonic transmitter—the size of a pack of cigarettes—is effective from a favorite easy chair, rocker . . . anywhere in the room!

Here's why this exciting new product is important to you:

1. There's a bigger demand today than ever before for precise antenna directional control. Color TV, FM Stereo, and UHF black-and-white TV all contribute. Even strong-signal rural areas, where rotors were never used before, need them now!

2. More TV sets are being sold today with remote control tuning and volume control than ever before. The man who invests in remote control for his set will want it for his rotor, too!

3. Only famous CDR antenna rotor systems are built for remote control. The control cabinet of every CDR manually-operated system, heavy-duty or custom, comes with a wireless remote control adaptor built right in. Everything else is the same!

4. You can sell the basic rotor system today and make another sale on the remote control later. Installation is incredibly easy. Just plug in, and you're in business!

The CDR wireless remote control is further evidence of Cornell-Dubilier's continuing leadership in antenna rotor design. Get all the details. Ask your CDE Distributor or Representative. Convince yourself that in rotor systems, as in hundreds of component and subsystem categories, Cornell-Dubilier Can Do!

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

CDE CORNELL-DUBILIER

tubes can be seriously shortened by decreased bias or increased plate voltage, if a resistor has changed value. The cure for this one, you may say, is to replace the damaged resistor. True, but since you've already gone into the tuner to change this bad part, why not go a bit further? A visual inspection and a resistance check of the other resistors is your best means of minimizing chances for a callback. Check not only the resistors feeding the plates and screens, but also those located in the grid circuit—especially in cascode RF amplifiers! If you still need assurance that everything is normal, measure the current through the tube in question, and compare it with the operating specifications in any tube manual.

Thermal Switches

A delay switch located in the low-voltage supply of some recent-model sets (Fig. 5) permits tube filaments to reach operating temperature before B+ voltage is applied—thus providing extra tube protection. The easiest check on this thermal switch is merely to listen for a click about a minute after the set has been turned on. These thermal switches may stick in the closed position, thereby defeating their purpose—which is lengthening tube life.

Be Suspicious!

While bench service is being performed, take a few extra minutes to check all high-wattage resistors visually for signs of being burned or of having been hot. A resistance check may show they are within tolerance, but why take a chance? Replace them—they've been overworked at some time and could soon break down. Unless you're sure the cause

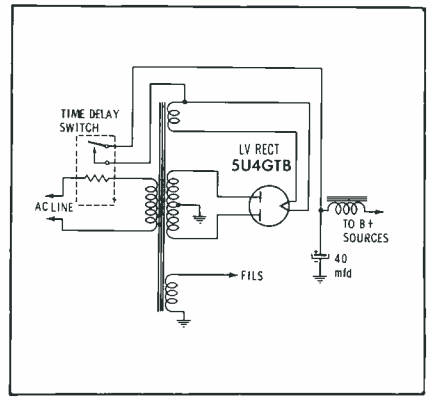


Fig. 5. Thermal switch protects tubes by delaying B+ till heaters warm up.

of their overheating was a shorted tube, you'll profit from looking for other causes of current overload—like shorted and leaky capacitors, or circuit leads accidentally touching each other. This small extra service is good for customer satisfaction, prevents callbacks (you may never know how many), and helps keep repeat tube failures at a minimum.

Instant Modernization

Many older tube testers, and some modern ones, are not equipped to test newer tube types such as *novars*, 10-pin miniatures, compactrons, and both 5- and 7-pin *nuvistors*. To modernize these instruments, Precision Apparatus

RCA–PIONEER OF COLOR TV–BRINGS YOU

ALL YOU NEED FOR COLOR-TV SERVICING

RCA Color-Bar/Dot/ Crosshatch Generator

Low-cost, lightweight, portable instrument that provides all essential Color-TV test patterns. Simple to operate: only 3 controls. RF output leads connect directly to antenna terminals of receiver; no external sync leads required. Crystal-controlled signals assure rock-steady patterns, free from "jitter" and "crawl." Extra-wide-range chroma control. Generates:

- **Color-bar pattern**: ten bars of color, including R-Y, B-Y, G-Y, I and Q signals spaced at 30° phase intervals for checking phase and matrixing, and for automatic frequency and phase alignment. Permits accurate alignment of the "X" and "Z" demodulators which are used extensively in RCA Victor and many other makes of color TV receivers
- **Crosshatch pattern**: a grid-like pattern of thin sharp lines for adjusting vertical and horizontal linearity, raster size, and overscan
- **Dot pattern**: a pattern of small sized dots facilitating accurate color convergence adjustments

$189.50* with output cables.

RCA 5-Inch Oscilloscope for Color-TV

A wideband scope excellent for checking colorburst signals and general troubleshooting of wideband color circuits and other electronic equipment. Muilt-scale calibrated graph screen makes measurement of peak-to-peak voltage as easy as with a VTVM.

- New 2-stage sync separator assures stable horizontal sweep lock-in on composite TV signals
- Dual bandwidth: 4.5 Mc at 0.053 volt rms/in. sensitivity. 1.5 Mc at 0.018 volt rms/in. sensitivity
- Continuously adjustable sweep frequency range: 10 cps to 100 Kc
- 3-to-1 voltage-calibrated, frequency-compensated step attentuator for "V" amplifier
- Simplified, semi-automatic voltage calibration for simultaneous voltage measurement and wave-shape display
- Vertical-polarity reversal switch for "upright" or "inverted" trace display

$249.50*, including direct/low capacitance probe and cable, ground cable, and insulated clip.

RCA Television FM Sweep Generator

Specifically designed for visual alignment and troubleshooting of color and black-and-white TV receivers, and FM receivers. The RCA WR-69A has pre-set switch positions for all VHF TV channels, FM broadcast band, and TV video, chrominance, and IF frequencies. The WR-69A has these important features:

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

$295.00* including all necessary cables.

RCA RF/VF/IF Marker Adder

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

- Choice of four different marker shapes provided by front panel switch for different types of sweep response curves and for positive and negative sweep traces
- Provides very high-Q markers of high-amplitude and narrow bandwidth
- Complete front panel control of marker shape, marker amplitude, marker polarity, sweep amplitude, and sweep-trace polarity

$74.50* complete with cables.

RCA Crystal-Calibrated Marker Generator

Supplies a fundamental frequency RF carrier of crystal accuracy for aligning and troubleshooting color and B&W TV receivers, FM receivers and other electronic equipment in the 19-260 Mc range. Combines functions of multiple-marker generator, rebroadcast transmitter, and heterodyne frequency meter.

- Highly stable output
- May be calibrated at 240 separate crystal check points—accurate calibration provided at 1-Mc and 10-Mc intervals
- Matched impedance pad-type attenuator and double shielding of the oscillator provide effective attenuation of all frequencies
- Most-used IF and RF frequencies are specially indicated on the dial scale
- Sound and picture carrier markers available simultaneously

$242.50* complete with output cable and phone tip.

RCA ELECTRON TUBE DIVISION, Harrison, N. J.

The Most Trusted Name in Electronics

*User Price (Optional)

Co., Inc., has introduced their Model G-140 Socket Adapter, priced at $12.95. An accompanying folder includes setup data for the most of these tube types. The instruction sheets furnish directions for using the adapter with Precision and Paco testers, and for developing setup information for other brands of testers.

The Model G-140 cable terminates in a standard 9-pin miniature plug. A stud on top of the plug furnishes a grid-cap connection for the standard tube tester.

Quick Substitution

Precision has also come out with a pair of component boxes for quick and easy parts substitution in electronic circuits. These units, the Model 1702 Resistance Substitution Box and the Model 1803 Condenser Substitution Box, are priced at $15.95 and $12.95, respectively.

The Model 1702 contains 36 different EIA resistance values, from 15 ohms to 10 megohms, all rated at 1 watt. The box can be used to experimentally determine a value for best circuit operation, or to temporarily replace a defective resistor while other circuit conditions are being checked. The unit is thus of value to professional servicemen, as well as experimenters, designers, and students.

The Model 1803 is constructed much the same as the resistance box. It provides 18 different capacitance values, from 100 mmf to .22 mfd. Capacitors of 5% accuracy, and rated at 500 volts DC, are used for values through 470 mmf, and the remainder are 10% types, rated at 600 volts.

Both units have innumerable applications in servicing electronic equipment, and are therefore worthwhile additions in any shop. ▲

Utah Thin-Drive Speaker: the first major breakthrough in speaker design in 25 years

A radically new kind of speaker has been designed by Utah Electronics Corporation. We call it the Thin-Drive Speaker.

Thinner in profile and lighter in weight, this new Thin-Drive Speaker is also far more powerful and faithful in sound reproduction than any speaker now being produced in comparable sizes.

A new magnetic material

The Thin-Drive Speaker design was made possible by using a newly discovered magnetic material called Lodex. Developed by General Electric, Lodex uses iron-cobalt in a lead matrix. Working with the General Electric people, we tested this material.

We soon determined that a wafer-thin Lodex magnet, radially magnetized and precision formed, was the ideal approach to small speaker construction and proceeded to develop the revolutionary Thin-Drive Speaker.

New thin silhouette

Look at the illustration on this page. This actual-size drawing of our 2" miniature speaker shows the full depth of the speaker. Notice there's no need for a bulky pot. The model illustrated has a total depth of only ½ inch. Thin-Drive Speakers in other sizes present equally dramatic reductions in overall depth.

New lightweight design

Reducing the bulky, conventional pot assembly to a one-piece part, gave us a featherweight speaker. Even though the total weight is less, Utah Thin-Drive Speakers provide far more drive per ounce.

Uniform performance

Sound fidelity of Utah Thin-Drive Speakers often exceeds that of original equipment. And with such a simple assembly, Utah can guarantee precision performance from speaker to speaker and from run to run.

This new Lodex radial magnet resists interference from stray magnetic fields, and it gives more stable operation over long periods of use than conventional speaker magnets. It has also proved to be highly resistant to changes in temperature and humidity.

Universal application

Obviously, such a superthin, lightweight high-performance speaker simplifies replacement problems. Select the proper diameter and impedance and you needn't worry about space or weight of the Thin-Drive Speaker.

The shape of future speakers?

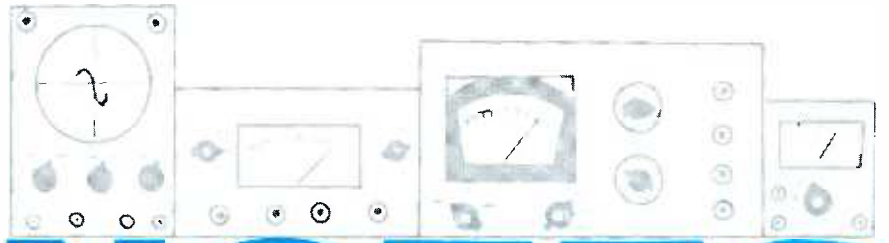
We at Utah believe that most replacement speakers will be built this new and better way a few years from now. Unquestionably, the new Utah Thin-Drive Speaker is an important advancement – perhaps the most important in 25 years.

utah ELECTRONICS CORP.

Write for details, specifications and prices.

UTAH ELECTRONICS CORP.

Huntington, Indiana



NOTES ON TEST EQUIPMENT

by Forest H. Belt

Compact Tube Tester

An up-to-date, low-cost tube tester has been introduced by Mercury Electronics Corp. of Mineola, New York. Their Model 1100 Tube Tester is shown in Fig. 1.

Specifications are:

1. *Power Requirements — 117 volts AC, 60 cps; autoformer power supply.*
2. *Tube Tests — quality test by emission method; shorts; leakage, sensitive to 2 megohms; special screen-grid shorts test.*
3. *Tubes Tested — standard receiving types, novar, compactron, 5-pin nuvistor, 10-pin noval; each section of multisection tubes tested separately.*
4. *Panel Meter — face size 3½"; 1-ma, 100-ohm movement;* GOOD-WEAK-BAD *scale; numerical value comparison scale.*
5. *Controls and Terminals — three rotary switches (X and Z connect pin elements, and Y is the heater switch);* SPEC-REG *switch W; neon shorts indicator;* QUALITY *switch for tests; grid- or plate-cap lead.*
6. *Other Features — Portable; contains 7- and 9-pin straighteners; tube setup chart in booklet.*
7. *Size, Weight, Price — 10¾" x 8¼" x 3¼"; approximately 3½ lbs. $39.50.*

The Model 1100 is compact, lightweight, and complete with lid and carrying handle. The etched panel makes settings easily read, and the markings are not likely to be rubbed off under heavy use.

Fig. 1. Small tube tester contains sockets for latest receiving types.

The first clockwise position of switch Y applies line power to an autoformer, which in turn supplies the heater voltages. A tap on the autoformer provides voltage for the bridge-type metering circuit, and also for the shorts-test circuit.

The shorts and leakage test is relatively simple, as shown in Fig. 2. Line voltage is placed in series with a neon bulb (shunted by a protective 1-megohm resistor), and applied through a capacitor to the elements to be tested. Shorts or leakage of 2 megohms or less will cause the bulb to light. If leakage is very slight, say 3 or 4 megohms, no indication appears. Each tube is automatically checked for shorts from the cathode to either adjacent element — the heater or grid. Special settings of the pin connections (with switch X or Z) permit shorts tests of the other elements. If a tube causes the neon light to show a cathode short, it is unsafe to make a quality test, as damage to the tester is likely to result.

To take care of various heater connections without using an extra switching arrangement, the Model 1100 uses 13 prewired sockets. Therefore, it is important that each tube be plugged into the socket designated in the tube chart. This prewiring simplifies the setting up of the tester, as well as the actual testing. As in all tube testers, it is important that switch settings be made before the tube is inserted in the test socket. If this precaution is not taken, you might burn out the tube heater, or even damage the tester itself. An accompanying instruction book stipulates the entire test procedure, step by step, and outlines the use of each special test.

The settings of switch W and the SPEC-REG switch are very important to the quality test. Since the latter picks the voltage applied to the elements for tesing, a wrong setting can give an erroneous reading. Switch W chooses the shunt resistance for the metering circuit. If this switch is not properly set, not only will the quality test be valueless, but it is very possible to damage the instrument. This stresses again the importance of reading the instruction manual, and using care in setting up the tester exactly according to the tube chart.

We examined a sample unit in our labs, testing a quantity of tubes from our stock of known "failures." Certain operational factors became evident from our analysis.

We performed a number of gas, grid-emission, leakage, and shorts tests on several tubes. For example, heater-cathode shorts were quickly determined; we merely set up the switches and inserted the tubes into their proper sockets. The tester automatically checked for shorts or leakage. Cathode-to-heater leakage was detected in most instances; however, some of our "borderline cases" defy even the more sensitive testers One 6U8 tube, which saw service as a mixer in a VHF tuner, has sufficient heater-cathode leakage (measured on a lab analyzer at 6 megohms) to create a hum bar in the picture, but the Model 1100 failed to detect it. This test supported the accuracy of the 2-megohm leakage sensitivity specified by the manufacturer. It is well to know the limitations of a test instrument as well as its capabilities.

When making shorts and leakage tests, we sometimes found it wise to leave a suspected tube in the socket for awhile, because certain defective tubes show gas or grid emission only after they become very hot. The Model 1100 is fairly sensitive to gassy tubes, and it located a few cases of grid emission. In some gas tests, we found that it was necessary to shade the neon bulb with one hand, since some tests caused only a faint glow — almost invisible under the lights in the lab. Of course, as you know, tubes can operate in many noncritical circuits even though they contain a certain amount of gas.

Shorts can very often be intermittent; therefore, it is a good practice to wait until the tube is quite warm, and then thump it slightly with a finger (or pencil eraser) to see if vibration might cause a momentary flash of the neon bulb. The Model 1100 is rather sensitive to tests of this sort, and spotted a number of intermittents for us.

A few tube types require very careful testing, and it is well to analyze how a tube will be used. For instance, a 6BN4 checked "good" on the tester, but in a set (RF amplifier in a VHF tuner) it produced snow. This condition very likely involves the spacing of elements inside the tube, affecting the Gm of the tube,

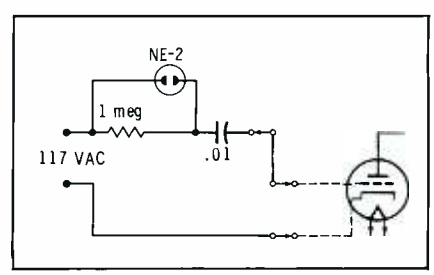


Fig. 2. Uncomplicated circuit checks interelement leakage to two megohms.

P. R. MALLORY & CO. Inc.
MALLORY

Tips for Technicians

Distributor Division, P. R. Mallory & Co. Inc.
P. O. Box 1558, Indianapolis 6, Indiana

Rectifier "packages" save time and space

When you're putting together a DC power supply, these little Mallory packaged rectifier circuits can spark a lot of time-saving, space-squeezing ideas.

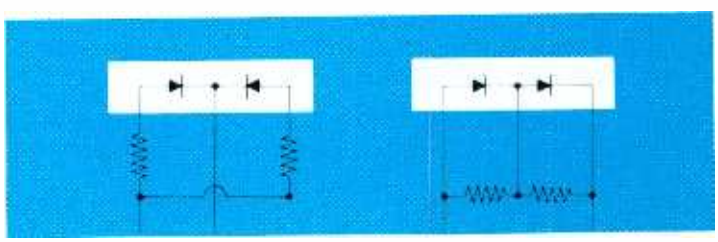
Each package is a complete rectifier circuit . . . bridge, doubler or center-tap . . . that does the job of two or four separate rectifiers. So you've only got *one* component to wire in place. The individual rectifier cells are factory-connected in the package.

You can get the exact rectifier you want in this compact form. And we mean compact. Less than ¾" by ½", and ¼" thick. Cold case design, too; you can mount 'em anywhere without worrying about case-to-ground shorts.

PRV ratings on all three types go as high as 600 volts. And there's plenty of current capacity. The FW full wave bridge models are rated 1.5 amps. DC at 50°C. ambient, 1.0 amp. at 100°C. Doubler Type VB and center tap Type CT are rated 0.75 amp. at 50°C., 0.5 amp. at 100°C.

If you need more current rating, you can parallel the two sides of the type CT package, using 0.5-ohm equalizing resistors in series with each leg. And you can get a high PRV unit at low cost by using a type VB double package as a series-connected half-wave rectifier, connecting a one-megohm resistor across each cell for voltage equalization.

As if all this weren't enough, you save money, too, because our packaged circuits cost less than individual rectifiers. Get them from your Mallory Franchised Distributor. He's a good man to call on for Mallory capacitors, switches, controls, batteries, resistors and vibrators . . . and for any other components you need.



but having little effect on its emission. In one TV set, we had a 6SN7 which had shifted the horizontal oscillator 'way off frequency. This tube showed normal emission, and no excessive gas or grid emission. Undoubtedly, it was suffering from some change in interelectrode structure, which an emission-type tester could not be expected to detect.

In tube-quality comparisons, the Model 1100 performed very satisfactorily. We tried a number of good tubes, weak tubes, *very* weak tubes, and a few borderline types. Each checked out exactly as on our lab tester, leading us to conclude that the test voltages and ranges of the Model 1100 were quite sufficient for the majority of tubes used in modern television sets.

All-Around Transistor Tester

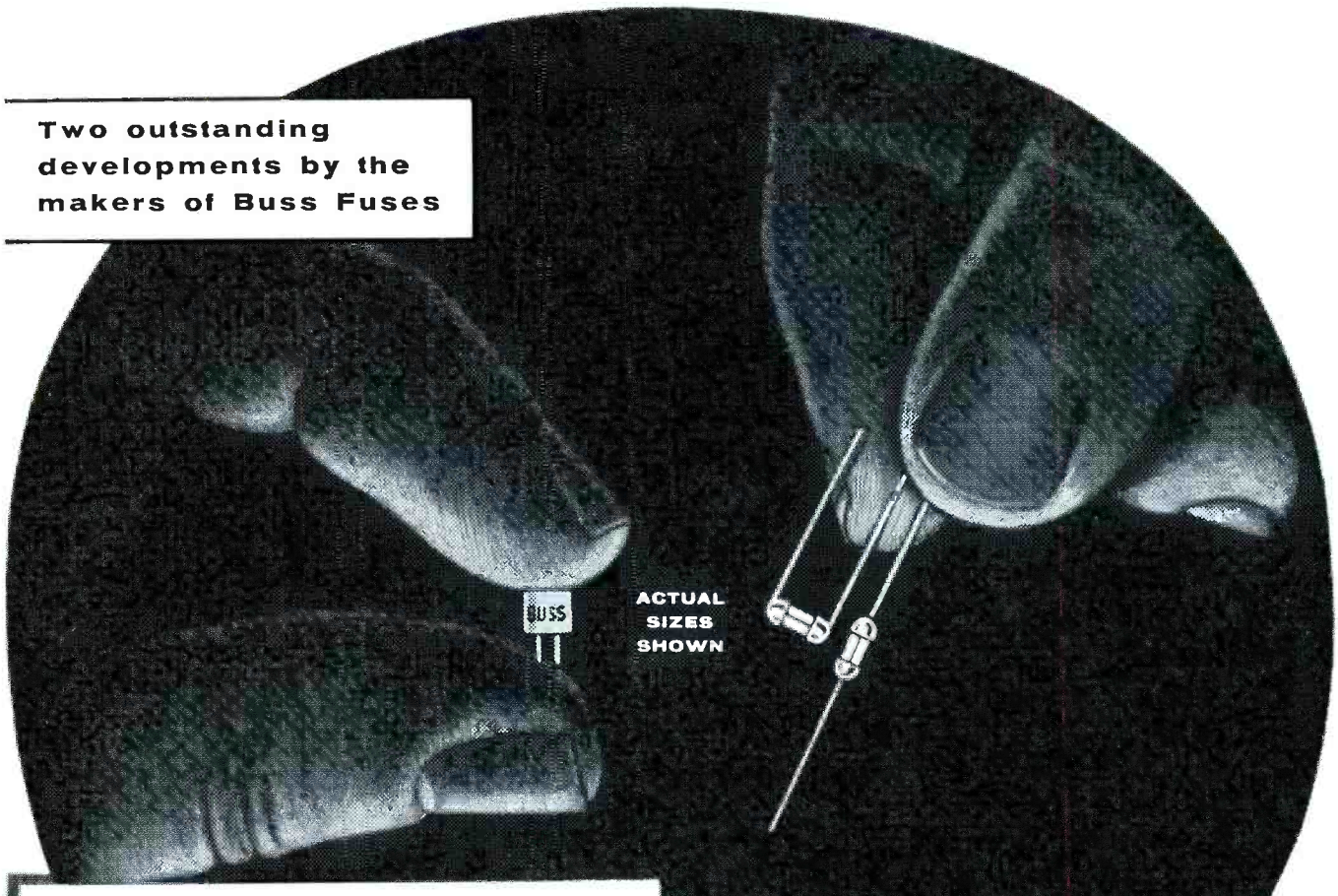
Transistor radios (both auto and portable sets) have firmly established their popularity; fewer and fewer tube models are being made. To aid the serviceman in troubleshooting transistor equipment, and to provide a means for evaluating the transistors, EICO has introduced the Model 680 Transistor and Circuit Tester, shown in Fig. 3.

Specifications are:

1. *Power Required — four size AA penlight cells, one size C cell.*
2. *DC Voltmeter — from 0 to 5 and 50 volts; 20,000 ohms per volt; accuracy 3% of full scale.*
3. *DC Milliammeter — from 0 to 50, 500ua, 5, 50, and 500 ma at 100 mv; accuracy 3% of full scale.*
4. *Ohmmeter — from 0 to Rx1, 100, and 10K; center-scale reading 12.*
5. *Transistor Tests — DC beta, simulated AC beta, Iceo, Icbo; tests leakage in both signal and power types.*
6. *Panel Meter — face size 3½"; 50 ua, 2000-ohm movement; clear plastic case.*
7. *Controls and Terminals — MODE switch, which chooses the function; TEST switch; RANGE switch; BETA-CALIBRATE control; three clip leads for transistor tests; standard transistor socket; VOM banana jacks.*
8. *Size, Weight, Price — 6¾" x 5¼" x 3"; 3 lbs; $25.95 (kit), $39.95 (wired).*

Fig. 3. Transistor tester can be used for checking circuit operation, also.

Two outstanding developments by the makers of Buss Fuses



TRON FUSES by BUSS

Give Design Engineers New Possibilities in Sub-Miniaturization

Tron fuses are so tiny they can easily be used—to protect miniaturized devices—or gigantic multi-circuit electronic devices—without sacrifice of space.

Tron fuses are extremely reliable under high shock and vibration conditions. They are not affected by atmospheric conditions.

Tell us your design problem and let our engineers help you select the right type Tron fuse for your application.

Bussmann Mfg. Division • *McGraw-Edison Co.* • **St. Louis 7, Mo.**

DESIGNED FOR SPACE-TIGHT APPLICATIONS

Prong type GMW TRON fuses

Diameter: .270 inch; Length of Body: ¼ inch

Fully insulated ceramic body isolates fusible element from effect of dust, corrosion, and moisture.

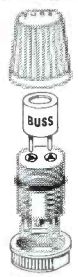
Transparent window permits visual inspection of fusible element.

Prong type contacts mount directly into printed circuit boards.

Available in ratings from 1/200 to 5 amps. for use on circuits of 125 volts or less where available fault current would not exceed 300 amps.

The holder for BUSS GMW fuses can be *mounted on panel*—or, terminals can be inserted thru holes in *printed circuit board* and soldered into circuit.

A knob for holder is available. It makes holder waterproof from front of panel.



Exploded view of GMW-HWA fuse & holder combination with AF knob.

Pigtail type GLN & GLX TRON fuses

Body size only .140 x .300 inches

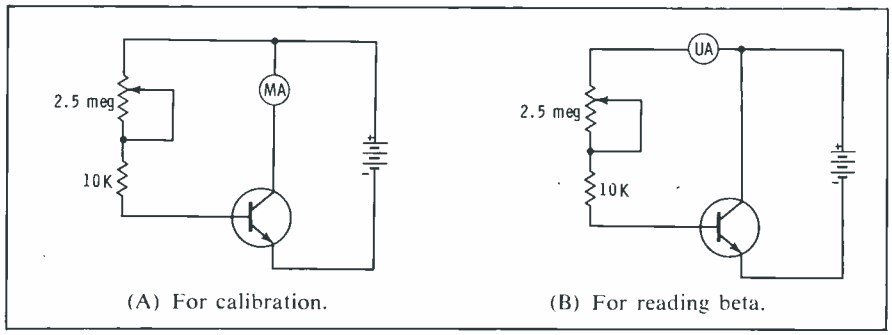
Fuse element is hermetically sealed. Fuses may be potted or encapsulated without danger of sealing material affecting operation.

Fuses are self-protecting and operate without exterior flash or venting. They may be teamed in one capsule or replacement unit with such components as resistors or condensers.

Made with axial pigtails, or with right angle pigtails.

Available in ratings from 1/20 to 5 amps. for use on circuits of 125 volts or less where available fault current is not over 50 amps.

BUSS—THE COMPLETE LINE OF FUSES AND FUSE MOUNTINGS OF UNQUESTIONED HIGH QUALITY.



(A) For calibration. (B) For reading beta.

Fig. 4. Model 680 tests beta of transistors by utilizing these circuits.

The Model 680 can be used for testing transistors (out of the circuit) as well as taking current, voltage and resistance readings in the circuits. The 5- and 50-volt ranges encompass most voltages encountered in transistor equipment. The 5-volt range facilitates reading DC voltages as small as 0.1 volt. With the 20,000-ohms-per-volt sensitivity of the 680, the loading effect on the 5-volt scale is in the order of 100K ohms; thus, low-impedance transistor circuits are not seriously affected.

The ohmmeter can measure most resistances encountered in transistorized equipment, but care must be exercised if it is used for measuring forward and back resistances in transistors. The reason for this is that the R x 10K scale uses 7.5 volts, which might exceed the ratings and damage the transistor. It is far safer to use the transistor-testing function of the instrument, and use the ohmmeter only for measuring circuit resistances and checking continuity.

There are enough DC current ranges in the Model 680 to measure almost any electron flow in a transistor radio. It is not often that an instrument of this type uses so sensitive a meter. With the 50-ua scale, such tiny currents as those found in base circuits can be read. There are also correct scales for measuring the current drain of almost any transistor receiver. (Many servicemen use this measurement as a clue to certain circuit or component faults.)

Several transistor tests are performed by the Model 680. It checks leakage between the collector and base (Icbo) and between the collector and emitter (Iceo). There should be very little (if any) current flow between the collector and the base of a transistor. Of course, current normally flows from the emitter to the collector, but the Iceo test is performed with the base element open, to measure the leakage with no bias applied.

If the transistor shows little or no leakage, it is safe to proceed with gain tests (beta). The 680 tests the gain by inserting the meter in the collector circuit of the transistor (as in Fig. 4A), and connecting the BETA-CAL potentiometer so it controls the base bias. The control is adjusted until the collector current is 1 ma, as read on the meter scale. When the TEST switch is placed in the READ position, the meter is switched into the base circuit (see Fig. 4B), and the base current can be read on the meter. Since beta is the ratio of collector current to base current, a reciprocal scale automatically computes this ratio so that beta can be read directly.

Simulated AC beta is measured by taking base-current readings at two different values of collector current; the beta is then calculated by dividing the difference between the base currents into the difference between the collector currents. In the lab, we connected a 2N137 transistor to the tester, to see how this test works. We left the MODE switch on VOM while we were making the connections, to prevent accidental damage to either the meter or the transistor. Switching momentarily to the NPN mode, we got no reading, confirming that the unit was a PNP type. We made the usual 1-ma beta test, and found the beta reading to be 75. At the same time, we noted the base current, 13 ua or .013 ma. Next, we recalibrated, this time at 3 ma collector current; the base current was 39 ua this time. Finding the collector-current difference (2 ma) and dividing it by the base-current change (.026 ma) gave us a *simulated AC beta* of 77.

This comparison pointed out two important facts: The beta value as read on the Model 680 is somewhat relative, for any particular transistor type. Secondly, a linear base-collector curve will cause a transistor to produce similar readings for either type of beta test. To test this theory, a 2N1086 was checked. It gave us a DC beta reading of 55, with simulated AC beta of 37; and we found that the Ib\|c curve was not linear.

We learned other characteristics of the Model 680 from the tests. An unknown transistor can be evaluated with no advance knowledge of its type or character. The type can be identified from the action of the gain tests; the incorrect switch position will usually result in no reading at all.

A combined test is proabably the most useful with transistors for which you have no published data. If DC beta and simulated AC beta measurements provide similar values, the transistor is linear, and very likely to be okay. However, nonlinear transistors still function very well in some circuits, providing the leakage is not too high.

The Model 680 is a versatile instrument. After isolating a suspected fault to a particular stage, you can use it to test the circuit components, including the transistor. Not a bad combination, at all.

YOU CAN PAY YOUR CHILD'S COLLEGE TUITION WITH A FREE SIGNET SOUND CATALOG

Why not?...Hundreds of other electronic technicians around the country who sell SIGNET SOUND in their spare time can now afford to do and buy things they felt they couldn't afford before. All they needed to start was their free SIGNET SOUND Catalog. ■ Here's how easily you can get started: ■ First, look around your neighborhood at all the possible prospects that could use complete sound reproduction packages and components contained in the SIGNET SOUND Series of STROMBERG-CARLSON® Communication Products: churches, meeting halls, sports and social clubs, bowling alleys, taverns and restaurants. Then write for your free SIGNET SOUND Catalog. Steady, extra income will be yours in no time at all. ■ Selling SIGNET SOUND won't take up a lot of your time. There's no inventory for you to stock. There's no special knowledge or background necessary to make a sale, and the installation of SIGNET SOUND is a cinch! Everything you need to make one extra income sale after another is contained right in your SIGNET SOUND Catalog! ■ Write for details and your free SIGNET SOUND Catalog now! You'll also receive a valuable booklet that tells how easy sound equipment is to install. Write to: General Dynamics/Electronics-Rochester, Box F, 1405 N. Goodman St., Rochester 1, N.Y.

GD

GENERAL DYNAMICS | ELECTRONICS—ROCHESTER

Easy Reading

A new approach to simplified meter readings is offered in a new VTVM by B & K Mfg. Co. Known as the Model 375 Automatic Vacuum-Tube Voltmeter (Fig. 5), it eliminates the need for multiplying scale divisions to obtain the correct meter reading.

Specifications are:

1. *Power Requirements — 117 volts, 50-60 cps; one 1½-volt battery.*
2. *DC Voltmeter — from 0 to 1.5, 5, 15, 50, 150, 500, and 1500 volts DC; accuracy ±3% of full scale.*
3. *AC Voltmeter — from 0 to 1.5, 5, 15, 50, 150, 500, and 1500 volts rms; frequency response, 30 cps to 2 mc, ±3db.*
4. *Peak-to-Peak Voltage — from 0 to 1.5, 5, 15, 50, 150, 500 and 1500 volts peak to peak; frequency response 30 cps to 2 mc, ±3db.*
5. *Milliammeter — from 0 to 5, 50, and 500 ma DC.*
6. *Ohmmeter — from 0 to Rx1, 10, 100, 1000, 10K, 100K, and 1 megohm.*
7. *Input Resistance — 11 megohms on all DC ranges.*
8. *Panel Meter — 4" face size, 100-ua movement; illuminated scale card changes with range; anti-parallax mirror; iridescent knife-edge pointer.*
9. *Controls and Terminals — RANGE switch; SELECTOR switch (includes on-off function); OHMS and ZERO adjust potentiometers; probe-input jack; ground jack for pin plug; separate pin jacks for DC current.*
10. *Size, Weight, Price — 10¾" x 6¾" x 4"; 8 lbs; $89.95.*

The stand furnished with the Model 375 puts it in position for easy reading and also permits easy carrying when it is necessary to move the unit. The illuminated scale, which lights when the meter is turned on with the SELECTOR switch, enables the operator to read the instrument under almost any conditions of shop lighting.

In VTVM design, it is often very difficult to make a decision as to what voltage scales should be used. This is because certain common voltages are rather standard, such as the 117 volts AC line voltage, or the 6 or 18 volts

Fig. 5. Stand allows the Model 375 to be read from almost any desired angle.

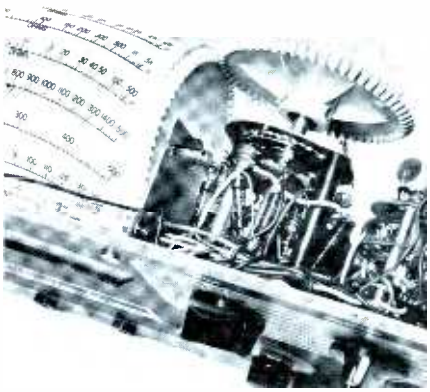


Fig. 6. Turning the range switch also chooses correct scale automatically.

usually found in auto radios. The designer tries to find a happy medium which will cause the majority of these values to be indicated at a point somewhere between ⅓-scale and ⅔-scale; then, if the voltage is a bit high, or a bit low, it is not necessary to choose another scale for the exact value.

The Model 375 meets this requirement rather well. Line voltage can be read on the 150-volt AC scale at just above ⅔ scale; auto-radio voltages fall at points approximately ⅓ from either end of the 15-volt DC scale.

Modern transistor receivers use very small voltages, and low meter ranges enable the technician to detect the slight changes which indicate trouble in these circuits. In the lab, we used the 375 for transistor measurements, and found the 1.5- and 15-volt ranges most useful. Also, since the very small changes are so important, the anti-parallax mirror assumes a vital role in taking these measurements.

An unusual feature of this instrument is its rotating scale card (Fig. 6). A large plastic gear on the rear of the RANGE switch drives a drum upon which is printed the meter scale for each range of the instrument. As the switch is turned, the proper scale card is moved into position behind the window. Two Allen-type set screws hold the plastic gear on the round switch shaft.

The Model 375 has the bridge circuit commonly used in VTVM's. A 12AU7 serves as the bridge amplifier, and a 6AL5 is the rectifier for AC measurements. A tube has a better frequency characteristic than the semiconductor meter rectifiers used in some instruments, and the frequency response of this unit is thus improved. A 65 ma selenium rectifier provides the operating voltages from the power transformer, in an ungrounded circuit which furnishes both positive and negative voltages.

The ohmmeter circuit receives its actuating voltage from the 1½-volt battery. The low voltage at the leads of the ohmmeter render it safe for most measurements, even in semiconductor circuits — or for checking the resistances of semiconductors themselves. However, the instrument is capable of furnishing as high as 150 ma (on the R x1 scale), and the serviceman should be certain this would not exceed the rating of the device being measured. If any doubt exists, use a higher ohms range, as the current diminishes as higher ranges are chosen.

The calibration potentiometers, used for keeping the instrument accurate, are accessible without removing the cabinet, as you can see in Fig. 7. It is very important that you refrain from tampering with these adjustments unless you have accurate standards for testing the results. Calibration is simple, provided you have accurately-known voltages available to apply to the instrument. The DC CALIBRATE is adjusted by first zeroing the meter with the front-panel ZERO control, while touching the probe tip to the GROUND jack; the RANGE switch should be set for 1.5 volts. Next, an *accurate* 1.5-volt DC source should be connected to the probe (and ground lead), and the DC CALIBRATE control adjusted for an exact full-scale reading.

AC calibration is a three-step procedure, beginning with an adjustment of the front-panel ZERO potentiometer. The meter is zeroed with the SELECTOR switch on +DC and the RANGE switch at 1.5 volts AC. Then the switches are set as if to measure 1.5 volts *peak to peak*, and the AC ZERO potentiometer is adjusted for an exact zero reading (with the probe still grounded, of course). Lastly, the SELECTOR switch is set to AC RMS and the RANGE switch to 15 volts. With an *accurate* source of 15 volts rms connected to the probe tip (be sure the probe slide switch is set for AC meas-

Fig. 7. Calibration potentiometers can be reached without removing the cabinet.

urements), the AC CALIBRATE control is adjusted for an exact full-scale reading. In the lab, we found no difficulty in calibrating the instrument for very accurate readings.

The peak-to-peak feature of the VTVM is very helpful to the technician who does not own a scope. Many of the complex waveforms in television-receiver sweep and sync circuits cannot be accurately determined by an rms-reading voltmeter. A peak-to-peak instrument will measure the actual value of the waveform, no matter what its shape, while a simpler rms meter will measure only the *effective* value of the voltage. The Model 375 will read most peak to peak voltages very accurately on ranges above the 5-volt scale, but a slight inherent inaccuracy is found in measurements of less than 5 volts peak to peak. For this reason, the instruction booklet includes a correction chart to be applied to readings below approximately 4.5 volts peak to peak. This assures maximum accuracy in certain critical measurements.

Our lab examination of the Model 375 convinced us that the instrument is accurate, dependable, and easy to use. ▲

Let's cut out these ANYTIME ANYPLACE service calls!"

THE TROUBLESHOOTER

answers your service problems

Ultra-High Voltage

A flyback lead on an RCA CTC7 color set was arcing to ground. Changing the lead did no good, so I installed a new transformer—but the arcing still continued. High voltage was 30 kv! Installing a new 6BK4 regulator tube accomplished nothing. After a short time, a fan-shaped pattern appeared on the CRT. Then came a loss of focus and the CRT went dark. Do you think the picture tube is gone?

J. SUSLA

Montrose, Pa.

There are several different versions of the CTC7 chassis, with major differences in the high-voltage circuitry. Not knowing the chassis suffix of your set, or which PHOTOFACT *Folder you are using, I can give you only a general troubleshooting procedure.*

The 30 kv is 'way too much high voltage. First you had better check the regulator circuit—which appears inoperative—for any component failure. Try replacing the capacitor located between grid and cathode of the 6BK4. Also check the 56-mmf capacitor located in the focus circuit, as this is a common offender. Another component that might be at fault is the horizontal linearity coil. It would be advisable to change all horizontal-sweep tubes to eliminate the possibility of a defective one.

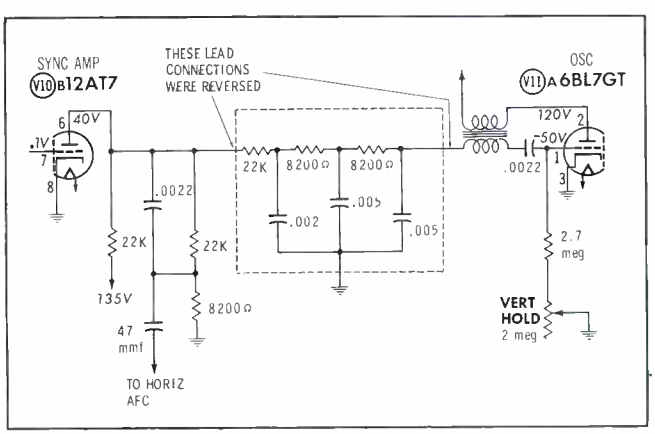
Recheck all lead connections made when the new flyback was installed, and make sure each connection has a good smooth solder joint.

You will probably need to make horizontal and high-voltage adjustments. All adjustments should be made with meters connected as stated in the PHOTOFACT *Folder; you shouldn't guess at readings in color sets!*

It's doubtful if the picture tube is defective; the fan-shaped raster was probably just a result of defects in the high-voltage circuit.

A Backward Serviceman Was Here

I recently wrote you, explaining my problem—a loss of horizontal sync in a Muntz Chassis 17B4 (covered in PHOTOFACT Folder 163-8). Before receiving your answer, I found the trouble—and it was simple. Someone had previously reversed the lead connections of the printed-circuit vertical integrator! With the plate of the sync amplifier connected to the output end of the integrator, the horizontal sync pulses were being shunted straight to ground through a .005-mfd capacitor.



I would have spent less time on this one if I had not ignored the clue offered by the unusually broad vertical-hold range.

ELMER E. SHUE

Towson, Md.

This shows the importance of connecting multiple-lead components "by the numbers."

Add Sweep Fuse

I would like to fuse the horizontal output circuit in an Emerson Model 1100. What size fuse should I use? Where should it be connected?

C. ORTH

Baltimore, Md.

The correct fuse size for the 6BQ6-6AX4 circuit is .5 amp. The fuse should be connected in series with the damper plate choke.

Jumpy Auto Radio

A Model 6BF radio (covered in PHOTOFACT Folder 331-8), installed in a 1956 Mercury, shifts frequency for no apparent reason. The customer states that the trouble has been happening for a long time. On the bench, with a battery eliminator as a power source, the radio does not falter—but when I put it back in the car, the trouble is soon back.

The shifting is just great enough to lose the station. A slight touch-up brings it back, but then the tuning shifts in the opposite direction—to where it was in the first place. Rapping on the dashboard will sometimes bring the radio back to normal, but sometimes it will not. It may operate for a long time without trouble, and then may shift every few minutes.

JOHN L. WOOD

Long Beach, Calif.

A common fault in these radios, leading to the symptom you describe, is a shifting of the permeability tuning mechanism. Since you can affect the trouble by jarring the radio, check to make sure the core adjustments of oscillator coil L4 are sealed with cement; also examine the clutch in the tuning mechanism for slippage. In addition, be sure the dial mechanism is free at all points, because a slight binding is sometimes responsible for erratic frequency shifts.

Another possible culprit is a thermally-caused defect in oscillator trimmer A5 or in fixed oscillator capacitor C7. If you can make the trouble appear by heating either of these capacitors, replace whichever part is defective.

Flashing the Field

On page 92 of your premium book, *The Troubleshooter's Handbook*, the instructions for flashing the field of a generator are OK if you are referring to Ford-built cars or to aircraft. They have the grounded end of the field inside the generator, and the field current is fed from the regulator through the field lead. On most other cars, the field is connected to the hot brush in the generator. and the regulator acts as a variable resistor to ground for controlling generator output; therefore, the procedure you recommended would not work. If you connected the battery and field leads together, you would cause current to flow through the field windings in the reverse direction. Then the field would be flashed so that its polarity would be opposite to that of the system.

To flash the field on most cars (other than Ford products), you should disconnect the generator lead at the regulator and momentarily touch this lead to the battery lead; then reconnect the generator lead and check the generator for proper operation —voltage, current output, and so forth.

W. H. URQUHART, JR.

Orlando, Fla.

We had a rather one-sided view of this situation at the time the original item was written—the entire staff drove Fords!

Endless Search

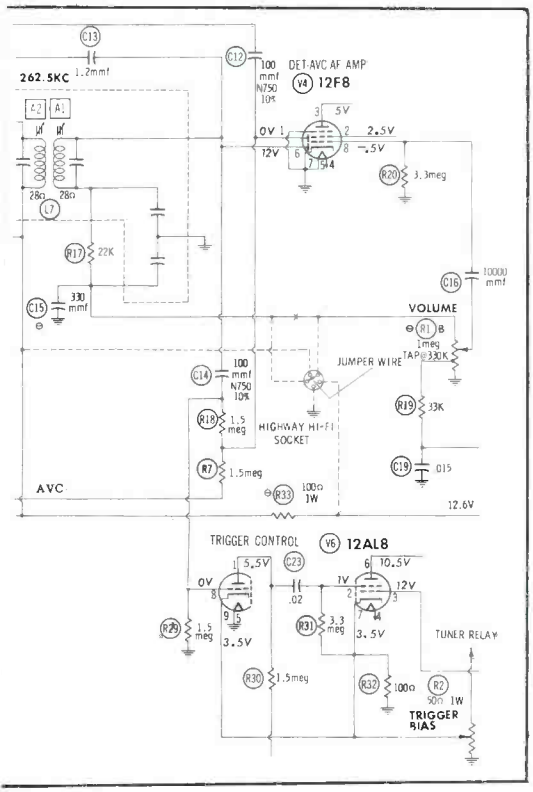
A Mopar Model 919 auto radio (covered in PHOTOFACT FOLDER 379-10) had low sensitivity, and the search tuner would not stop on any station. I replaced the 12BL6 RF amplifier, 12K5 audio driver, and 12AL8 search tube, changed several components in the search circuit, and readjusted the TRIGGER BIAS control. The radio now works normally on the bench, or in the car at idling speed, but the search-tuning trouble reappears when the car is driven. Intermittent weak sound has also developed.

FRANK'S RADIO AND TV
Highland, Ind.

To stop the search tuner, the relay-control section of the 12AL8 must be driven into cutoff by a trigger pulse. This is more difficult when the car is in motion, because the operating voltages on pins 3 and 6 of the 12AL8 are relatively high as a result of the increased output voltage from the car's electrical system. Once started, the tuner may run continuously if the input pulses are weak, or if the 12AL8 circuit has marginal sensitivity. Resetting the TRIGGER BIAS *control, using a greater supply voltage (say 16 volts) may give you a clue to the trouble.*

The faulty tuning and the erratic volume may both be due to the same cause; if so, the defect is in the detector or some preceding circuit. C12, C14, and the 12F8 are the most likely suspects. Also check for a high-resistance or loose jumper connection in the HIGHWAY HI-FI *socket.*

The radio could be suffering from "double trouble." If you can make the intermittent condition appear while the set is on the bench, signal tracing will help you isolate the cause. You might also go back and recheck the search circuit, replacing R29, R31 and C23 if you haven't already done so.



Custom Hi-Fi

(Continued from page 33)

quately meet appearance and size requirements as well as electrical specifications. This saves cabinet construction and is often less expensive than assembling speaker systems. In some installations, however, it will be necessary to construct an enclosure or enclosures.

Installing the Equipment

The installation may be arranged in a variety of ways. Components can be placed on shelves, or in equipment cabinets. Many customers prefer to have their equipment built into a wall of their listening room, or in cabinetry which simulates this effect. Occasionally, you will encounter a customer who already has cabinetwork in which the sound system is to be installed.

The initial factors, of course, must be space considerations and the styling preferences of your customer. Beyond that, the limits are few and the possibilities many. A television set may be included in the system, and remote speakers and controls can be installed at convenient locations throughout the home.

Cabinets

The majority of installations will require cabinetry, either commercially-available or specially-built units. If you plan to do the cabinet work yourself, and are equipped to do so, well and good. However, many installers find it better to have their cabinets constructed by a professional cabinetmaker. There are many firms who specialize in custom furniture, and many already have experience in building custom hi-fi cabinets. Contact several to determine their charges and their capabilities. The chances are good you will find a cabinetmaker or two with whom you can arrange for any custom woodwork.

Mounting Amplifiers and Tuners

In the simplest layout, the amplifier and tuner, with their cases in place, are arranged on open shelves. A great variety of ready-made cabinets and shelves are available for this type of installation, or they can be built to order. A shelf arrangement is flexible, but often poses the problem of wire

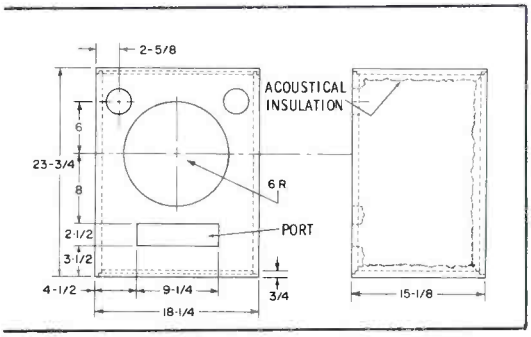


Fig. 5. Dimensions of bass-reflex enclosure for 12" woofer, two tweeters.

and cable concealment. This can be overcome by routing wires neatly along the back edge of a shelf, out of sight; a staple gun will tack them in place. Or, possibly, books or knick-knacks can be placed on the shelf to hide unsightly cables. Many attractive arrangements are possible this way, and the components are readily accessible for service and adjustment.

In cabinet installations, the components can be mounted behind panels or on slide-out shelves or drawers. Fig. 3 shows such a drawer for mounting an amplifier. In this case, the slides are on the sides of the drawer, and the rails mount on the inside walls of the cabinet. The front panel is cut out to accept the amplifier control shafts and switches. You'll notice a slot in the rear panel for input, output, and power cables.

A similar system could use a sliding shelf without the side and rear panels; the slides would be mounted on the underside. This would necessitate a supporting structure beneath the shelf, on which to mount the slide rails. A slide such as shown in Fig. 4 will serve the purpose quite well.

Tuners, preamps, and control units can all be mounted in this manner. Be sure to leave enough slack in the connecting cables for the drawers or shelves to be pulled out. Also, it is very important to allow plenty of room in each compartment for air circulation.

Record Changers and Turntables

A record changer can be mounted in a drawer, in much the same way as was described above, or it can be placed on a base and left out in the open on a shelf. In either instance, be sure you leave room for reaching the operating controls, and for loading and unloading records.

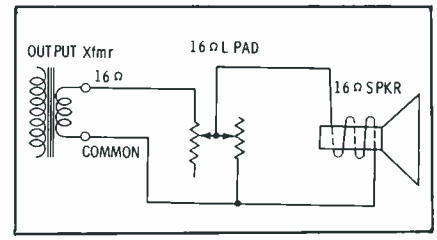


Fig. 6. Volume of extension speaker can be adjusted with an L-pad control.

The manufacturer will usually be able to provide a mounting board or a base which fits the changer; if not, a template accompanying each unit can be used by the installer or cabinetmaker to construct a mounting board. The properly-cut mounting board can then be used in a drawer, on a shelf, or integrated in a custom-built base.

Turntables are best mounted on a solid surface, free from movement and vibration. They should be leveled when installed and rechecked after a few months' use. Since a turntable is manually operated, it should be in a clear location and at a convenient height. The stylus pressure of the pickup arm should be measured and adjusted according to the specifications for the cartridge. The average pressure for magnetic pickups is from 4 to 8 grams; that for ceramic pickups is similar, provided the cartridge is used in a good-quality arm. There are a few cartridges on the market that track properly at pressures as light as 1 or 2 grams.

Tape Recorders

Because of their weight, and because of motor vibration, tape recorders must be sturdily mounted. Drawer installations are practical and popular. However, be sure to use heavy-duty slides and supporting hardware for the drawer.

If a portable unit is used, provide an easy means for convenient connecting and disconnecting. One way is to use a multicontact connector for the audio and control lines, and a separate connector for the power cable.

Speakers and Speaker Systems

Whether it is an adapted cabinet compartment, a commercially-available enclosure, or a custom-built box, the speaker enclosure must be designed for the speaker. An acoustical match is essential for proper reproduction. The reason lies in the inability of the relatively

small speaker cone to move the enormous quantity of air in the listening room; the enclosure serves as a coupler between the speaker and the air mass.

A typical bass-reflex enclosure, intended to house a 12″ speaker and two 3″ or 4″ tweeters, is shown in Fig. 5. In general, the area of the rectangular port should be equal to about half of the cone area of the large speaker. This will provide proper loading and bass-frequency reinforcement — hence the name *bass-reflex*. If the separate high-frequency speakers are omitted, the smaller openings may be left out, or covered with ⅝″ or ¾″ plywood screwed down tight.

Enclosures should be constructed of a good-grade ¾″ plywood and reinforced to prevent vibration. The sides should be covered with 1″ acoustical insulation. The crossover network can be securely mounted on the inside bottom surface. For convenience, a terminal strip can be mounted on the cabinet, and the speaker wires soldered to it.

Where extension speakers are used, each should have an individual level control, such as the L-pad in Fig. 6. It should be chosen to match the impedance and the power rating of the speaker system. Extension speakers can be mounted in standard wall baffles or in flush-mounted wall or ceiling baffles.

If more than three or four extension speakers are used, a booster amplifier is recommended. This will take the load off the main amplifier, solve impedance - matching problems, and provide adequate power to drive all the speakers to full output, if this should become necessary.

In systems employing two or more speakers, the cones of all speakers should be in phase — all must move in the same direction at the same time. This can be checked in several ways.

If the speaker cones are visible, your ohmmeter or a flashlight cell connected momentarily across the voice coils will cause the cones to move slightly. If you note the polarity which causes all the cones to move in the same direction, the speaker leads can be connected to the amplifier in parallel.

In systems with crossover net-

works, a microphone, amplifier and voltmeter can be used. Connect the microphone to the input, and an audio voltmeter to the output of the test amplifier. Place the microphone in front of the speakers, and feed a signal at the crossover frequency into the system amplifier. Now, connect the speakers so as to produce maximum output on the meter. A commercial device is available which uses two small transducers to check all the speakers in a system for proper phase.

General

Be sure that all wiring carrying low signal levels is well shielded and all chassis are grounded together; record changer and turntable motor frames should be grounded. Tape-head and phono-pickup leads must not be any longer than absolutely necessary. To avoid ground loops, be sure each chassis is grounded to another at only one place.

All components should be mounted so they receive adequate air circulation. Remember that these units will dissipate considerable heat over extended periods of use. High-power amplifiers should be located away from the other components if possible; they can often be mounted completely out of sight.

In many locations, FM tuners require good outside antennas for proper reception. This is especially important if stereo-FM broadcasts are to be utilized. If the system includes a television set, a broadband TV antenna usually serves as well for FM. The transmission line should be run to a convenient point and terminated in a junction box.

Be sure to place the television set at proper viewing level. By picking up the signal at the 4.5-mc detector in the set, the TV sound can be fed through one of the inputs of the main amplifier or preamplifier. A switch can be installed to feed the TV sound either to the main amplifier or through the sound system of the TV set. This permits TV viewing while extension speakers are carrying music to listeners at the other locations.

With reasonable care, and through wise choice of components, you can be the custom hi-fi expert in *your* locality. And you'll find it a satisfying and profitable arrangement. ▲

Chemicals

(Continued from page 31)

many types for use by service technicians. Silicone oil is one of the best because it can be applied in such a thin coat that electrical contact can be maintained through the film. Graphite solutions also are used extensively in service shops.

There are many things in a TV set that require lubrication. For instance, tuner shafts should be lightly lubricated at all points where they enter and leave bushings or bearings. Motorized tuners require frequent oiling to keep their shafts from binding. Sometimes, when a shaft is dry, it creates static, which can cause a noisy or intermittent picture.

Lubricants are even more important to a shop which repairs record changers and tape recorders. Several products, ranging from light oil to heavy grease, are required for keeping both rotating and sliding mechanical parts in smooth working order.

Insulators

Another common TV complaint is high-voltage arcing. Dust accumulates over a period of years, and under the high operating temperatures in the high-voltage circuits, the flyback transformer may develop leakage paths across its windings. The dust, the heat, and a little moisture provide the conditions necessary for corona and arcing to occur. Yokes, too, are often victims of this trouble. Until certam insulating chemicals were developed, the usual cure for an arcing transformer or yoke was to replace it with a new one.

"The brain has been repaired and is now computing the service charge."

Several chemicals now available to the serviceman can be applied as insulation between transformer windings and cores. Some of these are applied with brushes; some are sprayed on; some are even applied by hand, like putty. Most insulating chemicals are more likely to cover the component evenly if applied in several thin coats rather than one thick coat, so several applications are advisable to obtain the fullest benefits of the liquid insulator.

Freeze Sprays

For many servicemen, the most difficult service problem is trying to find the cause of an intermittent trouble. The secret to curing these troubles lies in causing them to occur when the proper test equipment is connected to pinpoint the faulty component. Many an intermittent is caused by some component developing an open or short after heating to operating temperature. An ideal answer to the problem, then, is to cool suspected parts—one at a time. When the troublesome component is cooled, the equipment resumes normal operation. Test equipment, connected into the faulty circuit, will usually give a more positive indication than mere observation of the symptom.

There are aerosol products ready-made for this purpose, utilizing a liquid under high pressure. The jet action of the nozzle vaporizes the liquid, and its low temperature thoroughly chills any component on which it is sprayed.

Sealers

Other products of value around the service shop are acrylic and silicone-resin sprays. After a printed-circuit board has been repaired or soldered, it should be sprayed with some type of sealer to prevent shorts from developing. Some technicians like to spray all components and solder joints involved in repairs to any chassis. For instance, the underchassis side of a high-fidelity amplifier kit could be coated with a sealer after the wiring has been completed and checked.

Glass Cleaners

Two items which can go a long way toward building good will among customers are glass cleaner and plastic cleaner. The serviceman who carries a can of glass cleaner in his caddy is able to make a special point of cleaning picture - tube screens and masks. Many customers will be amazed at how dirty a picture tube can get in as little as six months of service; cleaning the tube can increase brightness and focus to a point where a customer will think the set has actually been repaired. Around the shop, these cleaners will brighten store fronts, service-truck windows, display counters, and service mirrors.

Furniture Polishes

While not normally considered an electronic servicing chemical, this is another sales and reputation booster for both the service dealer and the

technician. No customer likes to see TV cabinets which have a coating of dust or grime. The progressive dealer keeps the sets on his sales floor well polished; this imparts a new appearance and creates the impression that the dealer moves a lot of sets. A dirty set, however, might make the customer feel that there must be something wrong with it—"That set must have been here a long time; maybe it's last year's model."

The serviceman on the job can do a lot to build his reputation if he takes a few minutes to shine up the customer's set. This extra touch contributes to over-all customer satisfaction.

Use Chemicals Whenever Possible

Many servicemen make it a habit to spray tuners and controls, whether noisy operation was the primary complaint or not. Likewise, they correct any arcing, clean CRT screens, and perform other small services without waiting for customers to request them. All these little "extra touches" create good will which more than offsets the slight cost of the chemicals.

Although you may not sell as many replacement components when you employ chemicals for preventive maintenance, your profits will improve because satisfied customers will keep coming back to you. It's a good policy to keep servicing chemicals around and use them often. ▲

"I took all the tubes down to the drugstore and they tested okay—but on the way home I dropped them".

TV Tuners

(Continued from page 26)

to tune in stations at the correct dial setting, but is not likely to degrade the picture.

The mixer-plate circuit operates at much lower frequencies, in the 20-or 40-mc IF band, and it is relatively easy to maintain the fairly critical bandpass of this circuit. Nevertheless, this gives the serviceman no license for haphazard probing or rewiring in the mixer section.

Troubles in the filament and B+ supply circuits can be serviced with little worry about causing misadjustments, providing nearby circuitry is undisturbed; so can mechanical defects, if the serviceman uses common sense in tracking down the cause of the malfunction. In fact, most troubles outside the RF amplifier can be handled without seriously affecting the performance of the tuner. Time and money can often be saved — and valuable experience gained—by investigating a tuner-service problem before giving up and sending the unit away to be repaired.

Common Troubles

What are you likely to find wrong when you examine a faulty tuner? The most prevalent complaint (snowy picture) is caused, 99 times in a hundred, by defects in the antenna or RF section. Fortunately, the more critical parts of this circuit are not often involved. The chief causes of snowy pictures are open balun or antenna coils, weak RF-amplifier tubes, and incorrect DC voltages in the RF-stage (either insufficient B+ voltage or excessive grid bias). Voltage troubles are often due to faulty plate-circuit resistors or to AGC defects outside the tuner!

The next most common tuner trouble is intermittent operation caused by poor switch contacts. Most cases are easily corrected by lubricating switch contacts, or (in turret tuners) by polishing all movable and stationary contacts.

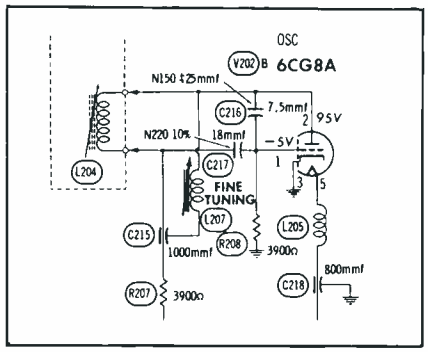
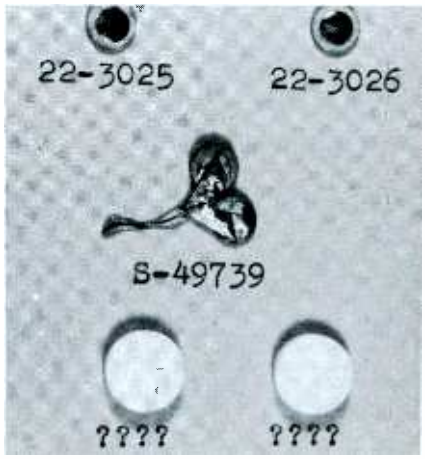
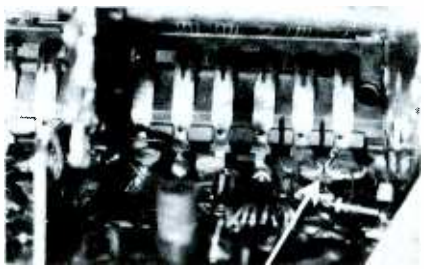


Fig. 3. Capacitor breakdowns can disable oscillator or shift its frequency.



(A) Replacement units (see text).



(B) Location in tuner chassis.

Fig. 4. Disc capacitors in oscillator.

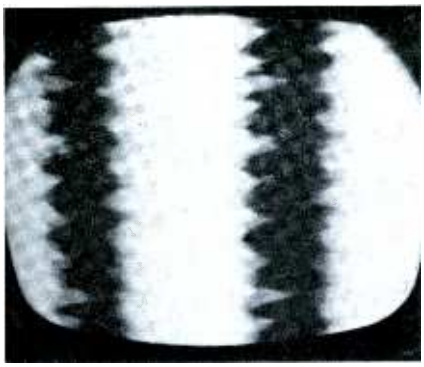


Fig. 5. Cause of this "Indian blanket" pattern was traced to local oscillator.

The third most common trouble is defective operation of the fine-tuning control. Some cases, resulting from mechanical wear of the fine tuning assembly, cause noisy or intermittent operation. At other times, the control is inoperative or sluggish in response, due to slippage between parts in the fine-tuning mechanism. This condition often results from excessive wear— a consequence of having to adjust the fine tuning every time channels are changed. The only way to correct this trouble so that it will not recur is to repair the slippage and adjust the oscillator slugs so that the fine-tuning control can be left in the same position on every channel.

On one RCA in which the fine-tuning control was linked to the tuning shaft by a dial cord, the control was inoperative because of a broken cord. After restringing the cord, I found that each of the four receivable stations required readjustment of the fine tuning. Proper alignment of the oscillator slugs resulted in a repair that has already stood up for over two years. Previously, according to the set owner, the cord required replacing about every six months.

Typical Bench Repairs

In the following cases, the accent will be on the actual repair of faults, because more time is generally spent in this process than in locating defects. Tuner troubleshooting is generally a fairly straightforward, uncomplicated procedure involving inspection, voltage and resistance readings, and — occasionally — checking the frequency response or alignment.

Damaged Tube Sockets

Cracked sockets (Fig. 1A) have been noted in several switch tuners.

In one case, shown in Fig. 1B, the socket wafer was not only cracked, but had dried out and disintegrated from the heat of the tube. Socket replacement can be made easier if the new socket is of the top-mounting saddle type shown in Fig. 2. It is fairly easy to solder this type of socket right to the top surface of the tuner. In replacing a socket for a CL8 mixer/oscillator tube, much subsequent trouble can be avoided if a 1/16" strip of copper foil is attached to terminal 8 of the socket before installation. The foil is brought out to the top side, as illustrated in Fig. 2, and soldered to the tuner chassis as close as possible to the socket. This connection is a very critical ground, and is very hard to attach to the inner side of the tuner body because the desired ground point is almost inaccessible.

Inoperative Oscillator

Virtually all tuners use oscillator circuits similar to that shown in Fig. 3, including a triode oscillator tube. Oscillation is generated by feedback through tube interelectrode capacitance, as well as through capacitors in the grid-plate circuit (C216 and C217 in this illustration).

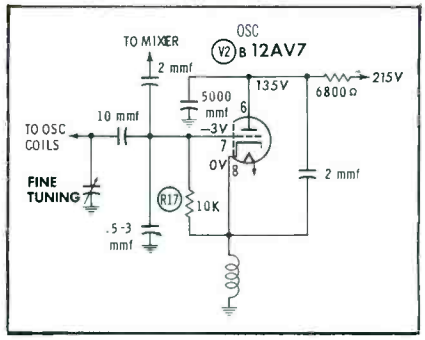


Fig. 6. Increase in value of resistor R17 produced strange visual symptom.

A Zenith 17A30, using the Fig. 3 circuit, had an intermittently dead oscillator. Sometimes the set would receive perfect picture and sound until a different channel was selected. Finding it impossible to tune in the other station, the set owner would turn back to the original channel, only to discover that this signal had also disappeared. With the help of a tube-socket test adapter, I found that all voltages on the mixer-oscillator tube were correct; also, the set operated perfectly on the bench without a trace of the previously-noted trouble. However, the results were different when I removed the tuner shield and several channel strips so that tube voltages could be read at the socket. A lack of negative voltage on the oscillator grid showed that the oscillator was inoperative.

According to service notes, C216 and C217 were special units having specific negative temperature coefficients. C217, an 18-mmf disc, had a N220 characteristic, and C216 was a 7.5-mmf, N150 type. I ordered replacements for both capacitors from the manufacturer's distributor, specifying part number 22-3025 for C217 and 22-3026 for C216. The service manager at the distributor tipped me off to the fact that these two capacitors were avail-

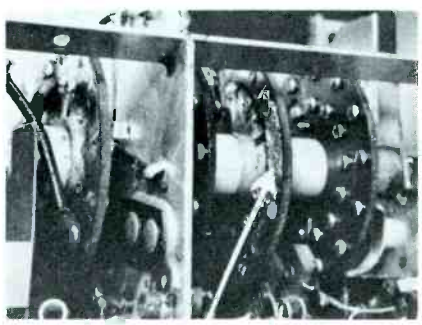


Fig. 7. Resoldering riveted contacts on tuner wafer corrects weak picture.

able in one assembly (part number S-47939), which he suggested might be easier to install. Fig. 4A shows the two discs, the suggested dual replacement, and two aspirin tablets to furnish a size comparison. (I found I didn't need the aspirin on this job.) The arrow in Fig. 4B indicates the location of the discs in the tuner chassis.

Oscillator troubles often follow a pattern similar to the case just discussed. Sometimes the oscillator will not operate at all, but occasionally it will start and then quit for no apparent reason. The trouble can usually be traced to the feedback capacitors. Instead of stalling the oscillator, a defective C216 may just cause it to shift frequency. One pretty good indication that the oscillator is, or has been, inoperative is a blistered or discolored plate resistor.

An unusual symptom (Fig. 5) of local-oscillator trouble once occurred in a Motorola TS-221. I finally pinned the blame on R17 in Fig. 6, normally a 10K-ohm unit, which had climbed in value to about 60K ohms.

Weak Picture

Weak but snow-free pictures are usually associated with defects in the video amplifier. However, this condition can also be due to defective tubes in two of the preceding stages. A weak final video IF tube is quite often the culprit, and in one Philco, I even traced the trouble to a 12AZ7 oscillator-mixer tube. The defect in this tube did not register on a tube tester, and was caught only after extensive IF signal-tracing. The fault was not steady; the picture came on with very good contrast, but dropped off about 10% (as scoped) after half an hour, and continued to fall off at a slightly accelerating rate after that. Since the oscillator grid voltage did not de-

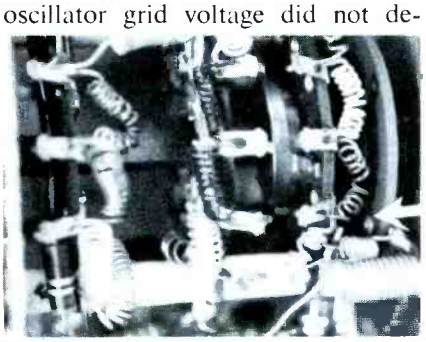


Fig. 8. Aquadag applied around rivet cures intermittent fine-tuning defect.

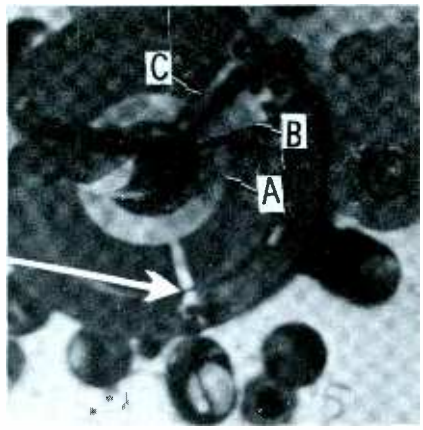


Fig. 9. Mechanical wear on the stator disabled fine tuning on low channels.

crease along with the contrast, I surmised that the trouble resulted from some obscure fault in the mixer section of the 12AZ7.

A weak picture with snow has been a frequent trouble symptom in tuners similar to that shown in Fig. 7. These tuners have incremental inductances which are mounted on one side of rotating discs, and connected to plated rivets on the opposite side. The rivets make contact with stationary wipers. The arrow in Fig. 7 points to an inductance strip which has to be resoldered in many of these tuners to bring their sensitivity up to normal. A different fault, in which one of these tuners received channel 10 on the channel-9 position of the station selector, was corrected by resoldering the inductance strip on the oscillator wafer. Incidentally, resoldering only the rivet-to-strip connection for the affected channel usually isn't enough; it's also necessary to resolder both adjacent rivets.

Intermittent Fine Tuning (High Channels)

The type of tuner which was shown in Fig. 1B has one fairly common fault which causes erratic fine tuning on the high band only.

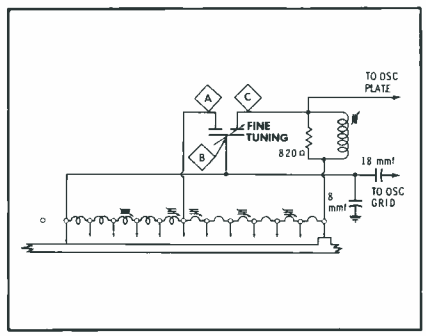


Fig. 10. Lettered points show the electrical location of stator segments.

Fig. 11. RF plate trimmer (left) and fine-tuning disc (right) were arcing.

The fine-tuning assembly in these units consists of a section of a disc, rotating parallel to a carbon deposit (printed on a stationary wafer), forming a variable capacitor. The point of the arrow in Fig. 8 touches the rivet which connects the printed carbon plate to the oscillator inductance. Trouble in these tuners arises when, for some reason, the rivet connection deteriorates. The repair is very simple: Shake a bottle of aquadag tube-coat solution very thoroughly, pick up a drop of the aquadag on the end of a toothpick, and apply it to the rivet and printed area at the spot indicated by the arrow.

Intermittent Fine Tuning (Low Channels)

Fig. 9 is a view of the stationary fine-tuning plate used in Sylvania Chassis 1-521. The tuner was partially disassembled to obtain a close-up photo of this part. An insulating material (which looks like cambric coated with silicone grease) is placed next to the stationary disc, separating it from a second disc that has an egg-shaped printed circuit on it. The letters designating various printed areas on the stationary disc correspond to similar letters on the schematic diagram of the oscillator circuit (Fig. 10).

In one of these tuners, low-band fine tuning was disrupted by an open "A" section on the stationary disc (note arrow in Fig. 9). Just as in the case last discussed, a successful repair was very simple; I bridged the break in the printed circuit by soldering in a narrow strip of copper foil. Next, since the wear obviously resulted from rubbing by the rotating disc insulator, I insured a permanent repair by cementing the insulator to the stationary disc. This eliminated the rubbing without affecting operation of the fine-tuning assembly in any way.

Arcing Strikes Twice

An older-model Admiral receiver, using a Standard Coil T-series tuner, developed picture flashing after about half an hour of normal operation. I caught the fault more by luck than by logic. Here's what happened: I turned out the light over the bench for a better look at a scope trace, and when I accidentally glanced down into the tuner, I detected a faint arcing in the fine-tuning assembly. On close inspection, it became obvious that someone had previously oiled the rotor with what looked like heavy mineral oil. Scrubbing off the residue of this oil with a toothbrush dipped in carbon tetrachloride disclosed that the arc was occurring at the edge of the fine-tuning disc. A small spot had become pitted, as shown at the right in Fig. 11.

Replacing the fine-tuning disc and its mount, I turned the set on and allowed it to run. After it had worked normally for another hour or so, I was jolted when the picture started flashing again. I had been lucky to discover one fault with the lights out, and wondered if I could possibly have similar luck a second time. With the lights

out, I was once more able to detect arcing—this time at the base of the RF-amplifier plate trimmer (Fig. 11, left). Replacing this part took care of the trouble.

Brain Twister

Ordinary troubleshooting occasionally fails to pinpoint a tuner trouble. One such case involved a Silvertone receiver in which the picture intermittently became twisted as shown in Fig. 12A. The symptom would be present for varying lengths of time, sometimes remaining for as long as five minutes. During one of these intervals, I scoped the video-detector output signal, and the distortion evident here (Fig. 12B) proved that the trouble was in signal circuits ahead of the detector. A diode demodulator probe on the scope further localized the distortion to the tuner. With the shield removed from the tuner, I discovered that the twisting could be created or cleared up by exerting slight pressure with a plastic rod on the second switch wafer from the front. The trouble source was a poor solder connection at the ground end of the mixer grid coil. One resoldered connection eliminated the fault for good.

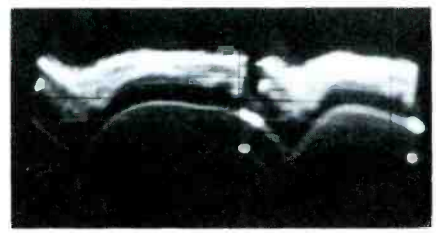
Troubleshooting Techniques

Physical inspection, aided by *delicate* probing with a thin insulated rod, is useful for locating many electrical as well as mechanical faults in tuners — for instance, shorted or open coils, burned resistors, and cracked feedthrough capacitors. If no defects are visible, a VTVM is the most useful instrument for further troubleshooting. The ohmmeter function is especially helpful in evaluating the condition of antenna coils and various resistors. DC voltage readings, especially at tube grids, also give significant clues to many different troubles.

Sometimes a defective tuner is in such poor shape that replacement is more practical than repair. This is especially true when lightning damage has burned more than just the antenna coils, when switch wafers are broken, or when short circuits have caused fires.

Frequency-response problems should be suspected only after other possibilities have been pretty thoroughly checked. RF-alignment troubles seldom develop on their own account, but are more often the result of careless handling. Conversely, gentle treatment of tuners will help you avoid the need for alignment, and will allow you to repair many of these units just as easily as any other part of a TV set. ▲

(A) Intermittent twist in picture.



(B) Video-detector output waveform.

Fig. 12. An unusual tuner trouble.

New York UHF Test

(Continued from page 35)

VHF antenna system hesitate to add $30 to $60 so they can receive a nearby UHF station. As a result, the originally-proposed local viewing areas have given way to a system of far-flung regional TV markets. In most instances, a single market includes several fair-sized cities served by the same cluster of stations. This arrangement has been developed to the point where the 12 VHF channels are almost, but not quite, enough for a national three-network service that relies heavily on fringe-area reception. More stations are eagerly sought — and UHF is the only practical answer known at present.

A UHF station, even if it had no problem in promoting receiver conversions, would have a hard time competing in a regional market unless its coverage area were fully as large as that served by VHF competitors. The plain economic fact is that the choicest network affiliations go to the stations with the biggest audiences. Without network programming, a station has a slim chance of success under the best technical conditions; this factor alone explains why most UHF's have been frozen out.

Even if the New York test is a resounding success, it will not clear away the economic roadblocks by itself. Additional actions have been proposed to help equalize competition between VHF and UHF.

Other FCC Efforts

In 1958, the TV Allocation Study Organization (TASO) was asked to perform a nationwide survey of existing UHF operations. This study showed that UHF was still unable to match the performance of VHF, although it had been improved technically and was able to provide reasonably satisfactory service.

Deintermixture

About the same time, seeing that UHF did well in markets where it was left to itself, the FCC proposed a policy of *deintermixture*. The 1952 channel assignments would be amended to lessen direct competition between UHF and VHF stations, thus enabling more broadcasters to stay on the air.

The 1952 plan had given many medium-sized cities only one or two VHF channels, supplemented by a few UHF's. In a small percentage of these cities, one or two UHF outlets managed to survive. At the same time, a larger city 75 miles away might be limited to two TV services (both VHF) because a third service on a UHF channel could not get a toehold in the market.

Thus, the FCC suggested taking lone VHF channels away from certain cities where UHF was already established, and moving them to nearby cities which had no UHF receivers but needed more stations. It was reasoned that no hardship would be imposed on people in the existing UHF market, since their sets were already converted.

Nevertheless, deintermixture has been under such strenuous attack that it has been fought to a standstill. Opposition comes not only from VHF stations faced with a shift to UHF, but also from residents of areas scheduled to lose VHF service. There is a prevailing belief that UHF is a "second-class" service, with reduced coverage and more difficult installation, and this arouses angry feelings that areas proposed

for all-UHF service are being discriminated against.

The technical and economic problems of deintermixture are quite serious, as illustrated by the case of WCIA (channel 3) in Champaign, Ill. As shown on the map accompanying this article, WCIA is the only commercial VHF station serving central Illinois. The most heavily-populated part of its market is also served by channel 17 in Decatur, and by channel 20 in Springfield (which operates UHF "satellites" or repeaters in both Champaign and Danville). To the northwest, the WCIA fringe area overlaps the coverage of three strong UHF stations in Peoria.

If WCIA were shifted to UHF, it might maintain substantially the same east-west coverage by building a satellite station near Springfield, or by using very high power. Peoria stations would have less competition from WCIA, but the thinly-populated areas both north and south of Champaign might face a curtailment of service.

VHF Drop-Ins

Another piecemeal attempt to ease the allocations squeeze has been to add extra VHF channel assignments wherever they can be "shoehorned in" without producing co-channel interference. This has been done successfully in such places as Albany, N. Y., but has made only a small dent in the demand for more stations. The FCC is going at this procedure in a very gingerly fashion, not wanting to degrade VHF service by adding too many substandard assignments. Most of the additional stations would have to use reduced power or directional antennas, which would put them in a poor competitive situation. Their only advantage would be that an ordinary VHF receiver could pick up their signals.

Test crews are checking indoor reception in thousands of homes selected by Census Bureau.

All-Channel Sets

Conversely, UHF stations would have a greater acceptance if their broadcasts could be picked up on all receivers. As things stand, a UHF tuner is an optional accessory, costing about $30, and requested by only about 6% of new-set buyers last year. Bills now before Congress would require that an all-channel tuner be included in every TV set shipped in interstate commerce.

Spectrum Reform

Depending on technical progress and on the outcome of the New York test, all TV broadcasting might someday be shifted to the UHF band—leaving VHF open for reassignment to communications or other services. FCC Commissioner Robert E. Lee strongly advocates this idea, many engineers are reported to be in favor of it, and Rep. Emanuel Celler (D., N.Y.) has submitted a House bill this year pro-

posing that a UHF shift be accomplished over the next six years.

An expanded system within the present 12 VHF channels might eventually be possible by using radical new modulation techniques to permit channel-splitting. Using earth satellites as TV relay transmitters might even help the situation — someday. But the FCC is seeking a down-to-earth solution that can be put into effect as soon as possible, and is convinced that such a solution must include rescuing the UHF band from its present disuse.

Present Washington Situation

Strong opposition from all sides has stalled FCC plans for deintermixture or all-UHF television. However, one piece of legislation to aid UHF—the proposal for mandatory all-channel set production—appears to have a good chance of passage by Congress this year. The FCC is unanimously behind this measure, industry organizations such as the National Association of Broadcasters (NAB) and National Appliance and Radio-TV Dealers' Association (NARDA) have issued statements in favor of it, many Congressmen have testified for the proposal in committee hearings, and President Kennedy has sent a message to Congress stating his opinion that the all-channel plan is "the most economical and practical method of broadening the range of programs available."

The only major source of organized opposition is the Electronic Industries Association (EIA), representing set manufacturers. The EIA has protested that all-channel tuners alone would not solve the problem, and has proposed a free-enterprise alternative — a joint industry and government effort to overcome indifference to UHF and to work on problems which hinder its success. Results of the New York test are cited as providing facts needed to produce better results with UHF transmissions.

Another EIA proposal, now under consideration by Congressional committees, would encourage quick expansion of UHF by licensing all VHF broadcasters to telecast simultaneously on UHF channels (with either duplicate or separate programming).

What UHF Is Doing Now

As mentioned before, free competition has reduced UHF service to isolated pockets, reaching only about 6% of the American people. Let's examine the conditions under which UHF is able to stand on its own feet; this will give us some idea of what must be done to establish it in other localities having a less healthful climate for growth.

"UHF Islands"

Of the cities with populations large enough to support several TV stations, only a few are completely without VHF service other than extreme-fringe reception. These have developed into flourishing all-UHF markets, each with three or four stations serving a territory as large as 100 miles or more in diameter.

The Scranton-Wilkes-Barre area in northeastern Pennsylvania is the only such market in the East, and the only one anywhere in which all the local stations are taking advantage of the 1 megawatt or more of effective radiated power permitted on UHF. The high power is reported to be a great help in hurdling the rugged hills typical of this region.

Four "island" cities are in the Midwest — South Bend and Fort Wayne, Indiana; Youngstown, Ohio, and Peoria, Illinois. Since there are few hills, and most of the desired coverage area is within a 50-mile radius, a moderate ERP (100 to 500 kw) has been found adequate for most stations in these cities.

Fresno, in the middle of California is another UHF center. VHF channel 12 was formerly assigned here, but the licensee agreed to switch to channel 30 in a deintermixture proceeding.

Two-UHF Markets

Several other cities support two UHF stations apiece. There is generally more encroachment by either local or fringe VHF, but the U's stay in operation because they are firmly entrenched or aggressively promoted. Among these secondary locations are Bakersfield, Calif.; Evansville, Ind.; Lexington, Ky.; Springfield, Mass.; Harrisburg, Pa.; Yakima, Wash.; and Madison, Wis.

Home-Town Stations

Single UHF's operate as the only local TV service in about two dozen small and medium-sized cities, competing well enough with fringe VHF signals to continue operating. When the 1952 allocation plan was put into effect, it was thought that such stations would form the backbone of the nation's TV system; but an extensive "hometown" service has not yet materialized.

Single "Holdouts"

Special conditions in several localities have enabled individual UHF stations to operate in competition with one or more VHF outlets, although at more or less of a disadvantage. A few examples are channel 38 in St. Petersburg, Fla., channel 26 in Knoxville, Tenn., and channel 35 in Erie, Pa.

An encouraging new try at UHF began last fall in Louisville, Ky., which has had only two VHF stations since an earlier UHF attempt failed several years ago. A new station on channel 32 obtained a network affiliation, actively promoted itself among dealers and the public, and has already become well established.

Educational Stations

A scattering of noncommercial stations occupy the UHF band in such cities as Detroit, Atlanta, Philadelphia, and Oklahoma City. Many of these stations, like the airborne MPATI system described last October in PF REPORTER, are used mainly to beam programs to schools.

UHF Translators

Dozens of 10- to 100-watt UHF repeater stations are in service in remote areas, mostly out West, to extend the coverage of conventional VHF stations. These units also have VHF competition, as described in the August, 1961 PF REPORTER, but they have found a niche in certain places where they do a better job than VHF.

Conclusion

The small band of existing UHF stations, all but forgotten until recently, form a solid nucleus from which UHF broadcasting can grow as fast as it is able. The final results of this year's experiment in New York will focus attention on the technical problems most critically in need of solutions, and will thus guide future industry research and FCC allocations policies. ▲

PRODUCT report

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

Indoor Antenna (43N)

Printed in silver on low-gloss flexible plastic, the "Brite Site" TV antenna by **RCA** can be pinned to the back of a sofa or drapery, or placed flat under a rug. The device is also designed for the FM band and can be thumbtacked to the rear of a hi-fi console. The antenna measures five feet in length and has a suggested list price of $3.95.

Capacitance Checker (44N)

A low-voltage bridge for testing electrolytic capacitors in transistorized circuits characterizes the **Jackson** Model 691 capacitance checker. The unit uses color-coded push-buttons which match the color of each capacitance scale. Its four ranges test capacitors from 10 mmf to 1000 mfd. Leakage and power-factor tests can also be performed by the checker, which has a net price of $69.95.

Telephone System (45N)

Private communication between a master switchboard and an unlimited number of desk- or wall-mounted remote stations is provided by the **Bogen** "Attend-A-Phone" system. "Expansion boards" allow the addition of 21 remote stations at any time. Specially designed for motels, bowling alleys, and hospitals, the system may also be used, with an adapter, for paging through separate amplifiers and loudspeakers.

Pocket Screwdriver (46N)

A ⅛" x 2" beryllium-copper round blade is a feature of **Xcelite's** new pocket-size screwdriver. The tool, which is non-sparking and nonmagnetic, is 4¼" in over-all length and has a black plastic handle. Designed to be useful in electronic assembly and service work, the screwdriver (Cat. #BR181) has a pocket clip and lists for $1.50.

Transformers (47N)

Two series of miniature top-tuning IF transformers have been added to the **Stancor** line. The first series (part numbers RTC-9284 to RTC-9295) includes 262 and 455 kc input and output IF units, and 4.5-mc input, interstage, and ratio detector cans. All are mounted by snap fasteners attached to the shields. The second series includes units with the same applications, but with ground lugs, designed for use on printed-circuit boards. Part numbers for these are RTC-9266 to RTC-9307.

Transistor Kit (48N)

Ten transistors which replace better than 95% of all transistors used in miniature radios are contained in a kit (#10NPD) sold by **Semitronics Corp.** Packed in a reusable pocket-size plastic box, the kit contains an assortment of PNP, NPN, and diode types. An interchangeability and replacement guide is included with every kit for quick reference.

Indoor Antenna (49N)

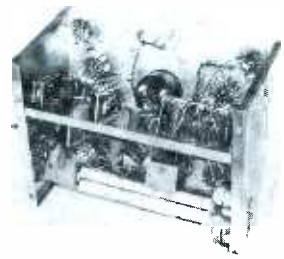
A patented "Diamond Phasing Loop" characterizes the "Focus" indoor antenna by **RMS Electronics.** When used for low-band reception, the dipole arms are fully extended to bring the loops into operation. These increase the effective length of the dipole to a complete half wave on channel 2. For high-band performance, the loops act as a quarter-wave phasing stub which causes a reversal of the out-of-phase current. List price is $14.95.

Component-Lead Bender (50N)

Particularly applicable to mounting components on printed - circuit boards, **Electronic Aids'** new lead bender accepts resistors, capacitors, diodes and other two-lead components. The tool is graduated in 32nds of an inch and forms a 90° bend on each lead. It is easily clamp-mounted on a workbench.

Transistor Tester (51N)

AC beta, DC beta, leakage, and other transistor characteristics can be measured by the **RD Instruments (Div. of Hickok)** Model 1880 tester. Setup characteristics for over 1550 transistor types are contained on a roll chart. Tests on unlisted types can be set up using the transistor manufacturer's specification sheets. Revised roll charts are available every six months on a subscription basis.



In addition to germanium or silicon transistors, the unit tests zener diodes. The panel meter is calibrated to read beta in ranges of 0-50 and 0-150 directly, and the range can be extended to 300 by using a calibration point and doubling the indicated value. The Model 1880 has an over-all accuracy of ±3%.

Column Speaker (52N)

The addition of the CS-3 to its existing line of sound columns was announced recently by **University.** Designed to handle 25 watts of program material, frequency response of the unit is 150-10,000 cps. 22° vertical and 120° horizontal dispersion permit placement of the sound pattern to cover a particular area. Measuring 48" x 7½" x 8¾", the CS-3 sells for $89.95 dealer net.

Fuse Puller (53N)

Slim-line design makes it easy to use the new **Bussmann** fuse puller in tight hard-to-get-at places. The new tool is bright yellow in color and is molded of chemical - resistant nylon. The puller is designed so that one end can be used for long fuses and the other end fits short ones.

Flybacks (54N)

Several new flybacks have been added to the **Merit** line. HVO-191 replaces Hoffman 782011; HVO-192 replaces Airline, Bradford, Coronado 53X390; HVO-195 replaces Motorola 24K754273; HVO-196 replaces Zenith S-46564; HVO-197 replaces Silvertone, Warwick 80-153, HVO-198 replaces Motorola 24D65410A01, HVO-201 replaces Admiral 79D8304, and HVO-203 replaces Philco 32-8830-1, 32-8830-3.

FM Tuner (55N)

A new FM stereo tuner kit, the "Citation" III-X by **Harman-Kardon,** contains a single control for mono, stereo and stereo SCA-filter operation. The latter position is used to filter out stray noises when background music is being broadcast by multiplex. The front panel also includes an AFC control. A solid-state carrier-suppression detector system, consisting of four diodes in a ring configuration, suppresses the reinserted carrier. Price of the kit is $219.95. Factory wired, the unit is $299.95.

DC Power Supplies (56N)

Two new DC supplies, Models EC-1 and EC-2, are available from **Electro Products.** Both models measure 10¾" x 4¾" x 6½" and can be operated in either vertical or horizontal positions. The EC-1 is rated at 12 volts at 5 amperes. The EC-2 has an adjustable output of 0-11 volts, at 5 amperes, and features a combination voltmeter-ammeter. Ripple for both units is .5%. Prices are $29.95 for the EC-1 and $39.95 for the EC-2.

Drive-Belt Kit (57N)

A supply of rubber-belt material and "Rubr-Weld" fluid are contained in the "Make-A-Belt" kit by **Techni-Parts Corp.** Using the old tape-recorder or phono drive belt as a guide, the serviceman cuts a length of the special belt material to size, threads it around the pulleys, then fuses the ends together with the fluid. The fusing process takes 30 seconds and no heat is required. Each kit contains enough material to make six to eight belts and has a net price of $2.97.

Illuminated Magnifier (58N)

Interchangeable lenses are available for the **Luxo Lamp** Model LFM-1, allowing the operator to increase the magnification from the normal 3-diopter rating to 7 or 11 diopters. The lamp is adjustable to any position and stays put through the use of spring-balance design techniques. Price of the LFM-1 with the "C" bracket (as shown) is $44.50. Auxiliary lenses are $9.50 and $11.00.

Stereo Preamp (59N)

Both the INPUT and MODE selector switches have seven positions for various operating combinations on the **EICO** ST84 stereo preamplifier. Frequency response of the unit is 5-25,000 cps ±0.3 db, and harmonic distortion from 20-20,000 cps is 0.06% at 2 volts output. Tube complement is five 12AX7/ECC83's and one 6X4. Measuring 5½" x 15⅞" x 8¾", the preamp sells for $59.95 in kit form or $89.95 wired.

Soldering Equipment (60N)

A variable temperature control is featured in a soldering "center" from **CBC Electronics.** The kit consists of a 25-watt soldering iron, a continuity checker, and a convenience outlet box. The variable temperature feature is especially suited for work on printed-circuit boards. The model SK-1 has a 6-volt, 25-watt iron and nets at $37.95, while the SK-2 uses a 110-volt iron and nets at $31.85.

INDEX TO ADVERTISERS

CATALOG AND LITERATURE SERVICE

May, 1962

ANTENNAS & ACCESSORIES

1N. JFD—Descriptive and promotional literature plus sales aids for new *Transis-Tennas;* also complete set of specifications for outdoor and indoor TV antennas and accessories, including exact-replacement antenna data.

2N. WINEGARD — Sheet answering questions most frequently asked about FM reception. *See ad page 17.*

AUDIO & HI-FI

3N. BOGEN-PRESTO—6-page catalog, No. 311, describing the *Challenger* CHB series of PA systems and amplifiers; also describes PA-system accessories. *See ad page 49.*

4N. CINE-SONIC — Brochure describing background-music tape recorders; catalog of background-music tapes available (hundreds of listings). *See ad page 64.*

5N. EICO—New 32-page catalog of kits and wired equipment for stereo and monophonic hi-fi, test equipment, Citizens-band transceivers, ham gear, and transistor radios. Also, "Stereo Hi-Fi Guide," and "Short Course for Novice License." *See ads pages 81, 91.*

6N. FISHER — 1962 Fisher Handbook; *StrataKit* folder and sample page of *StrataKit* manual; brochure on Model 300 Multiplex Generator. *See ad page 82.*

7N. HARMAN-KARDON — Folders on *Award* and *Citation* equipment; also folder describing PA equipment.

8N. PACOTRONICS—Flyer describing complete line of hi-fi equipment; also sheet describing MX100 Multiplex Adapter.

9N. QUAM-NICHOLS—Sound-system catalog listing specifications on PA speakers and related products. *See ad page 88.*

10N. SONOTONE—Release describing equipment shown at the 1962 Electronics Parts Distributors Show in Chicago, May 21-24. *See ads pages 70, 89.*

11N. UNIVERSITY—12-page catalog describing PA loudspeakers; also 4-page brochure giving information on F-107 transistorized mobile siren and PA system, and 20-page catalog containing complete list of hi-fi speakers and systems.

COMMUNICATIONS

12N. CADRE—Bulletins on Model 500, 5-watt CB transceiver; Model CP12 rechargeable battery pack and case for Model 500 *Sigalert* alarm system; also brochure on home and business intercom systems. *See ad page 16.*

13N. COMCO—Catalog sheets and price lists for Models 580 and 680 two-way VHF-FM radio communications equipment providing 25- to 100-watt outputs in the HF and VHF bands; also information on available dealerships. *See ad page 94.*

COMPONENTS

14N. BUSSMANN — Literature describing fuse and holder combination that indicates open circuits. Fuse has a red-tipped pin that can be seen through transparent knob when fuse opens. *See ad page 71.*

15N. CLAROSTAT—Catalog of components for radio, TV, and sound servicing; also industrial-component catalog. *See ad page 27.*

16N. RCA—Form TK310, "RCA Color Parts and Accessories for Installation and Service," listing replacement parts and service aids for all RCA color TV receivers. Also Form TK-292, 28-page "TV Knob Directory," listing part numbers for all knobs used on 1955 through 1962 RCA TV receivers. *See ads pages 28-29.*

17N. SPRAGUE — Electrolytic-capacitor replacement manual K-105 listing replacements for all radio and TV sets. *See ad page 12.*

18N. STANCOR—Bulletins 608, 609, 610, and 611 listing such components as top-tuned IF's, FM multiplex inductors, microminiature transistor IF's, etc. *See ad page 96.*

RECEIVERS

19N. SONY — Catalog describing complete line of radio and television receivers; also information on CB transceivers.

SERVICE AIDS

20N. BERNS—Data on 3-in-1 picture-tube repair tools, on *Audio Pin-Plug Crimper* that lets you make pin-plug and ground connections for shielded cable without soldering, and on *ION* adjustable beam bender. *See ad page 98.*

21N. CASTLE—Leaflet describing fast overhaul service on television tuners of all makes and models. *See ad page 95.*

22N. ELECTRONIC CHEMICAL CORP. — Catalog sheet describing *No Noise* line of servicing chemicals; gives specifications and prices. *See ad page 82.*

23N. MERCURY TUNER—Information sheet describing immediate tuner-exchange service, 24- to 48-hour tuner repairs, and additional services; states prices and announces new seven-month warranty.

24N. PRECISION TUNER—Information on repair and alignment service available for any TV tuner. *See ad page 54.*

SPECIAL EQUIPMENT

25N. ACME—Release giving information on new line of rack-mounted regulated magnetic power supplies. *See ad page 100.*

26N. CBC — Catalog sheets describing hi-fi cables, electrical-outlet boxes, TV servicing accessories, and soldering kits. *See ad page 98.*

27N. CHEMTRONICS—Information concerning No. 900 *Jet Spare*, an emergency method of inflating flat tires. *See ad page 58.*

28N. ELECTRO—Catalog PS-562 describing filtered variable-output DC power supplies for all types of low-voltage applications. *See ad page 78.*

29N. EMCEE—Literature on VHF translators for extending TV coverage into difficult reception areas; planning package to aid in establishing a translator station; reprint of FCC rules covering translators. *See ad page 80.*

30N. GREYHOUND—Brochure giving information on and rates for Greyhound Package Express.

31N. TERADO — Catalog sheets describing complete line of converters, battery chargers, and relays. *See ad page 98.*

TECHNICAL PUBLICATIONS

32N. CHRISTY TRADES SCHOOL—Literature on various correspondence courses, including one on radio and television servicing.

33N. HOWARD W. SAMS—Literature describing all current publications on radio, TV, communications, audio and hi-fi, and industrial electronics, including 1962 Book Catalog and descriptive flyer on 1962 Test Equipment Annual. *See ads pages 47, 57, 92.*

34N. MOTOROLA TRAINING INSTITUTE —Literature describing two-way radio correspondence course which is available to qualified electronic technicians.

TEST EQUIPMENT

35N. B & K — Catalog AP18-R, giving data and information on Model 960 *Transistor Radio Analyst*, Model 1076 *Television Analyst*, *Dynamic 375 VTVM*, *V O Matic* 360, Models 600 and 700 *Dyna-Quik* tube testers, Models 440 and 420 CRT Cathode Rejuvenator Testers, Model 1070 *Dyna-Sweep* Circuit Analyzer, and B & K *Service Shop*. *See ads pages 59, 61, 62.*

36N. DON BOSCO — Literature describing seven new accessories for the *Stethotracer*, including microwave demodulator, vibration pickup, telephone pickup, etc. *See ad page 101.*

37N. MERCURY ELECTRONICS — New catalog giving specifications on Model 1000, 1100, and 1200 Tube Testers, Model 201 Self-Service Tube Tester, Model 500 Component Substitutor, Model 300A Combination Tester, and Model 800 CRT-Tester-Reactivator. *See ad page 97.*

38N. SENCORE—New booklet, "How to Use the SS117 Sweep Circuit Troubleshooter," plus brochure on complete line of *time-saver* instruments. *See ads pages 39, 41, 51, 86.*

TOOLS

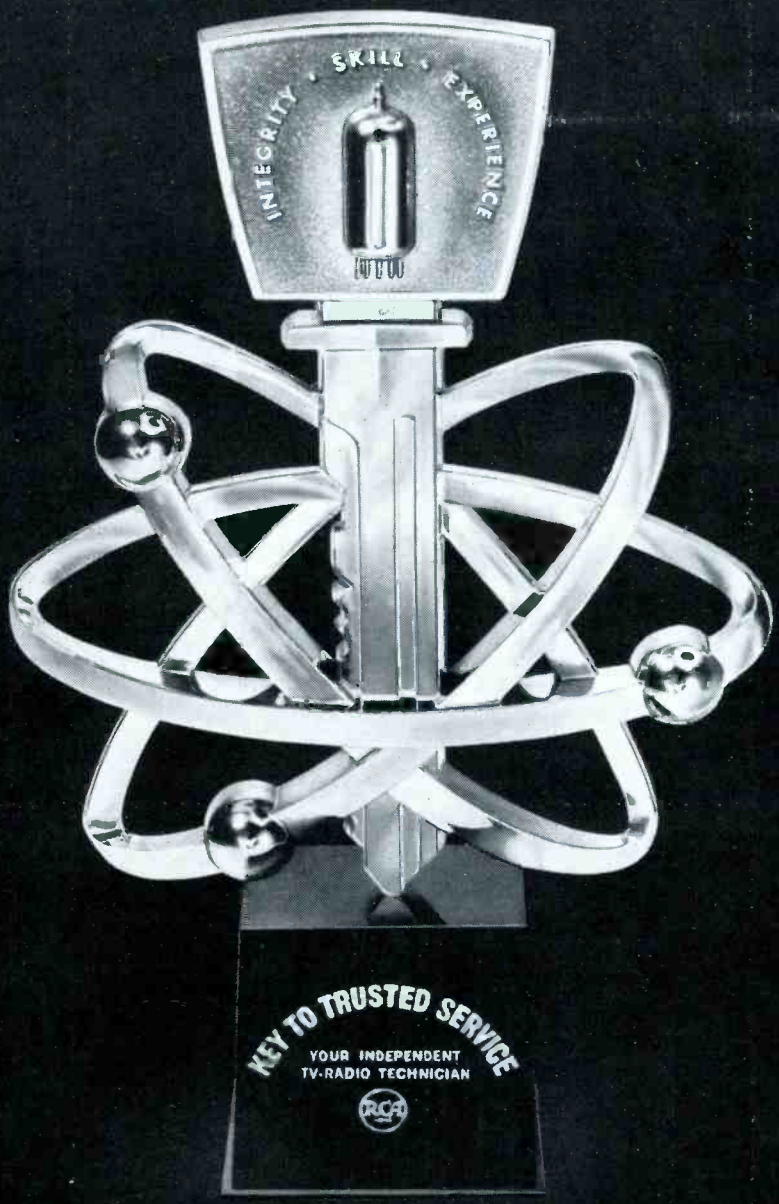
39N. CHAMPION DE ARMENT—Literature describing *Channellock* pliers and No. 46 *HeatSorb* clamp, a heat sink for electronic use. *See ad page 72.*

40N. EVERSOLE INDUSTRIES — Sheets describing and listing prices on *DeSod* desoldering tools for removing and replacing parts on printed-circuit boards. *See ad page 54.*

41N. VACO—Literature on new line of *Bull Drivers;* also catalog sheets describing 4-piece screwdriver set and solderless-terminal kit. *See ad page 77.*

TUBES

42N. SYLVANIA—"Six Miles of Sylvania Craftsmanship," a 28-page booklet describing picture-tube manufacture. *See ad pages 24-25.*



RCA's Key to Trusted Service...

YOUR KEY TO MORE AND BETTER BUSINESS

Each day you see more and more of these *Key to Trusted Service* symbols displayed in radio-TV-HiFi service shops all over the country.

This symbol is the focal point of a major RCA promotional program to identify and "boost" outstanding service dealers in each community.

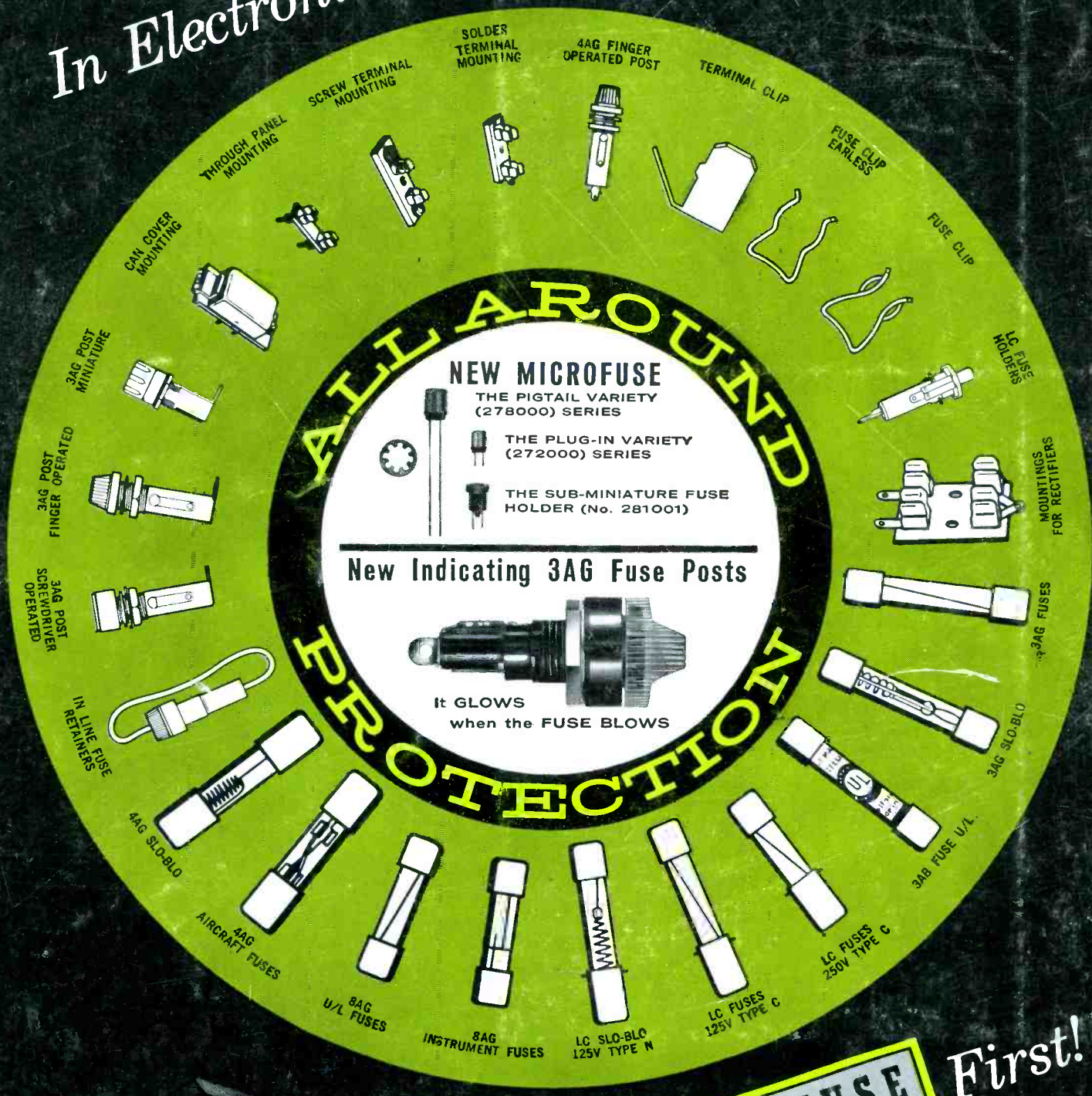
During April, RCA is advertising nationally on Walt Disney's "Wonderful World of Color"—urging consumers to look for and patronize service shops displaying the key statuette.

Your Authorized RCA Tube Distributor has all the facts on how you can become a KEY service technician in your community. Call him today.

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.

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

In Electronic Circuits . . .



It's LITTELFUSE First!

DES PLAINES, ILLINOIS