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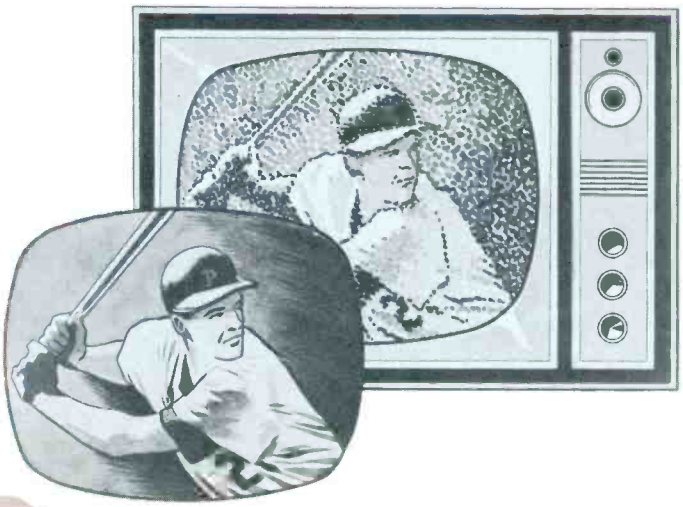

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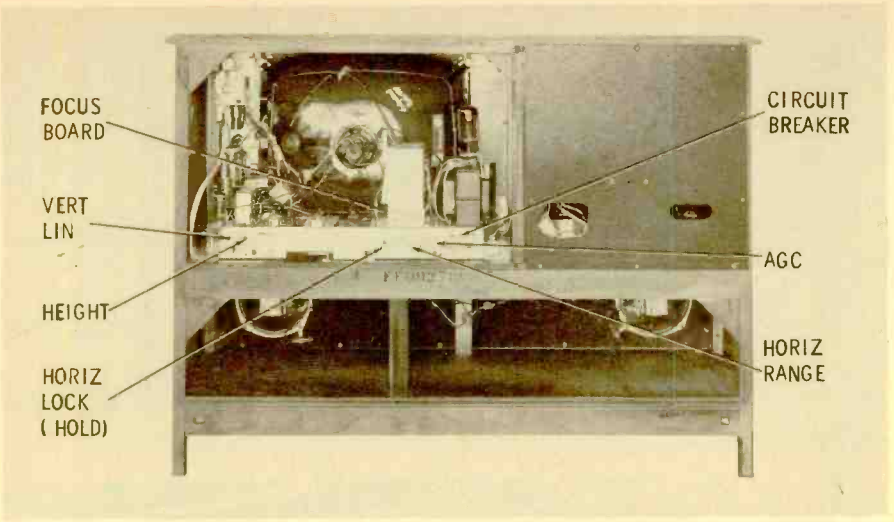
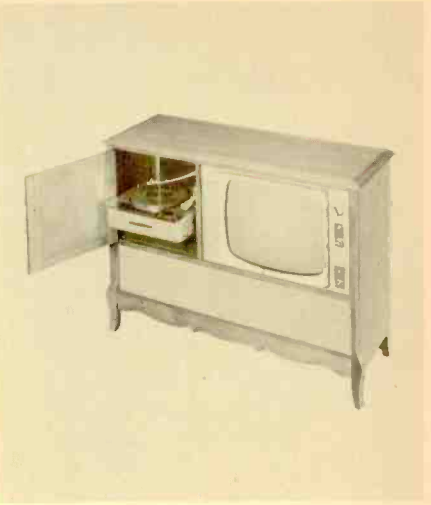
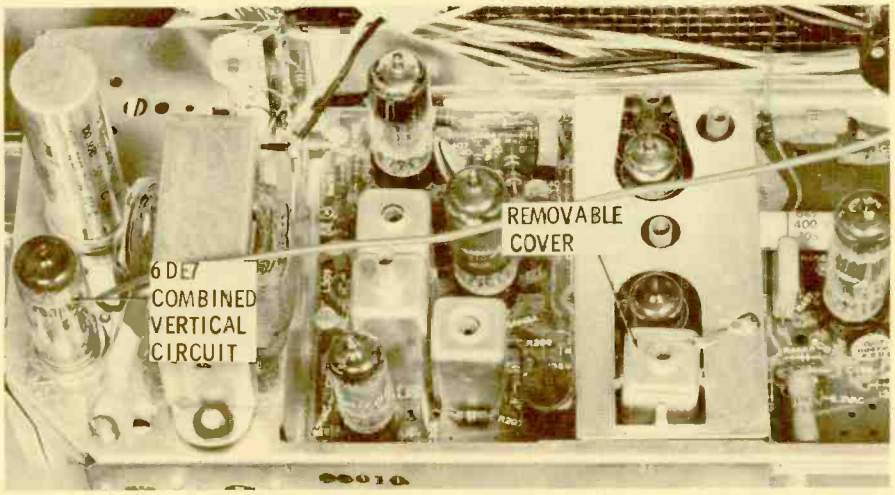
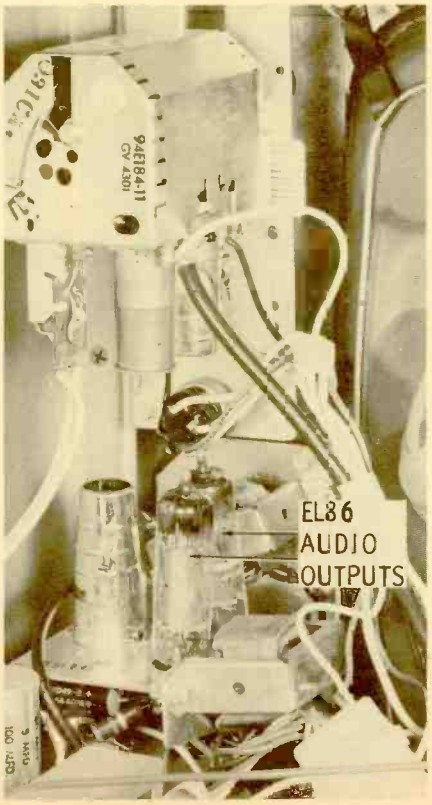








Admiral Model ST19J169 Chassis 15H1

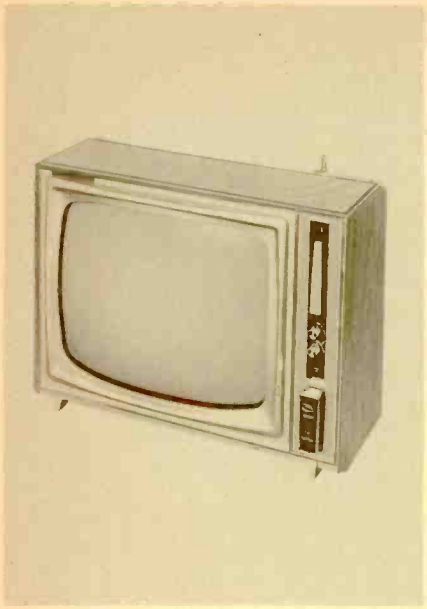
Forming a combination stereo phono and TV, this 19", 114° model uses a 19XP4 picture tube and separate safety glass. (You can clean the glass and tube by removing the chassis and CRT.) Operational controls for contrast, brightness, and vertical hold are located on the side of the cabinet; the channel selector, fine tuning, off-on-balance, volume, tone, and stereo-TV switch are mounted on the front.

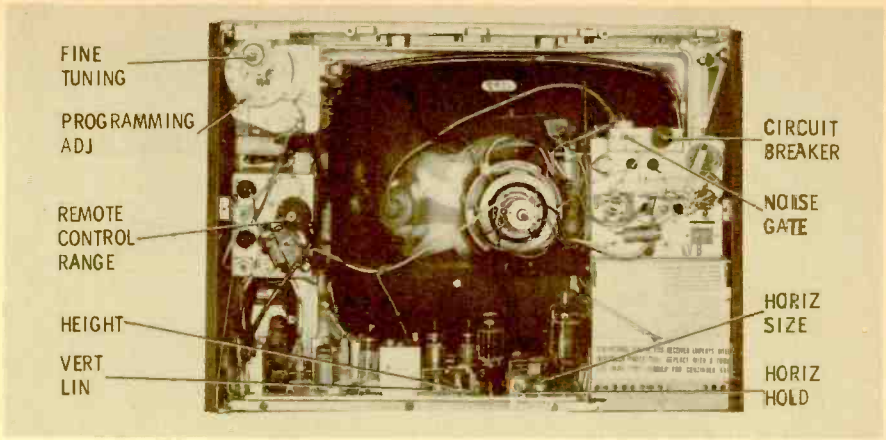
Setup controls for the 17-tube chassis are well marked and grouped on the rear apron. Warning notices are pasted over the recessed adjustments for horizontal range and AGC to discourage the "do-it-yourselfer." A terminal board to the left of the cage provides a choice of boost, ground, and B+ potentials for best focus. Removal of six chassis bolts, and two others holding the top of the mask, permits the chassis and CRT to be slipped out the front of the cabinet.

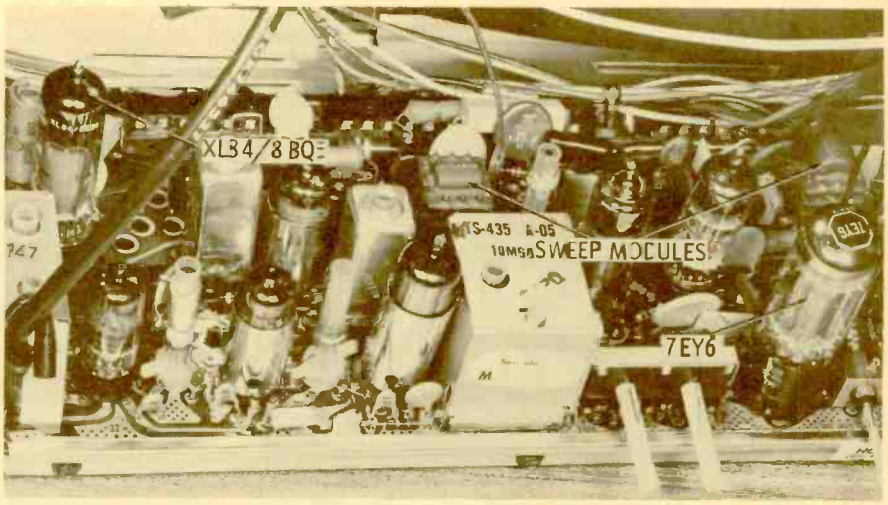
One large, recessed printed board contains most of the circuits. As in preceding models, the foil pattern, test points, and tube types are identified on the top of the board. The shielded portion of the board contains the two video IF stages and the video detector circuit. The 1N87 diode used in the latter can be reached by removing the cover of the final IF transformer. The conventionally-wired stage at the far left is the 6DE7 vertical circuit.

A three-tube, conventionally-wired stereo amplifier chassis and a control panel are attached to the mask. The amplifier is equipped with EL86/6CW5 and 12AX7 tubes. Since the right channel of the stereo amplifier is used for TV sound, you'll want to be sure you have these tubes along if you're called to service a complaint of no sound.

Protective devices found in the transformer-powered chassis include a circuit breaker for B+, and a length of #26 fuse wire in the filament circuit. Not only does the open mounting of the 5U4GB rectifier make it easy to check the B+ source without removing the chassis, but it also keeps the heat generated by the stage away from critical circuits.







Motorola Model A19T2-3 Chassis WTS-435

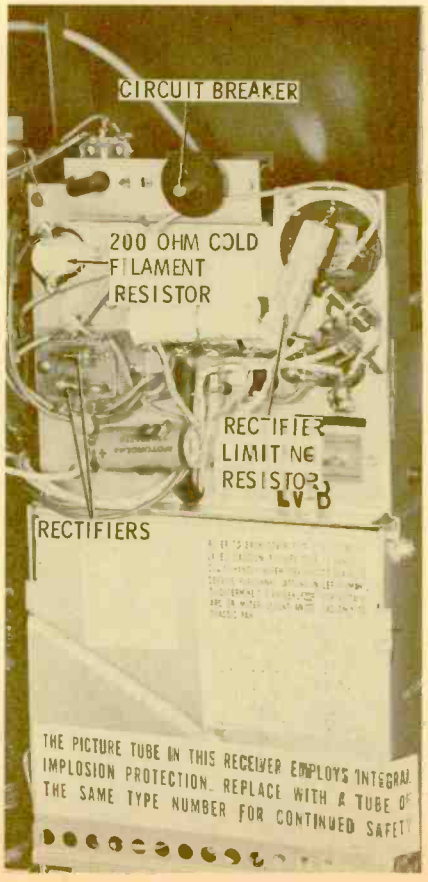
A 114°, 19AFP4 picture tube with a bonded, tinted safety shield is used in this series of 41 models. This particular chassis is a remote-controlled version of the basic TS-435 chassis. Operational controls are clustered to the right of the CRT, the long bar near the top serving to actuate the power tuning.

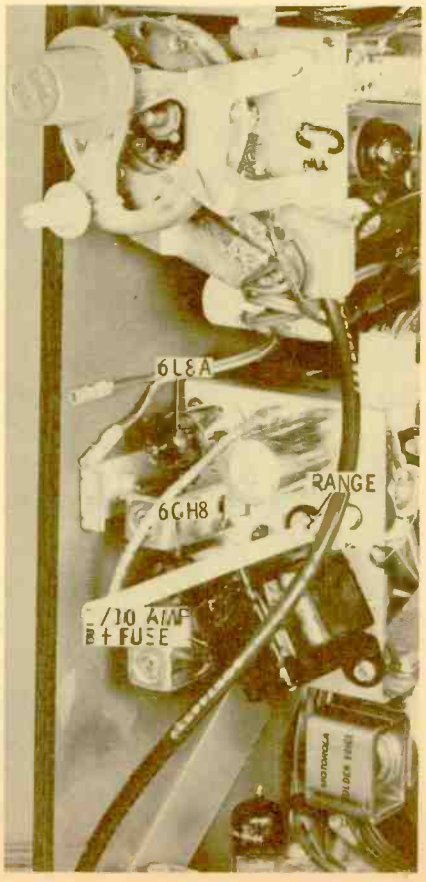
Setup adjustments for the 15-tube "hot" chassis are well identified and readily accessible. Notice the rear-mounted fine-tuning adjustment. A captive phenolic shaft is provided for making programming adjustments. Pushing the shaft in and turning it clockwise until a stop is reached sets the mechanism to receive a channel, while turning it counterclockwise allows the channel to be skipped. A switch mounted on the back of the set is also a part of the power-tuning circuit. In the SELECTED position, only programmed channels are received; in the ALL CHANNELS position, the tuner stops at each channel.

This is one of the chassis using modules in both sweep circuits. A plug-in printed board contains most of the circuits. You can reach the underside by turning the set on its side and removing a bottom cover. The 600-ma series filament circuit uses three new tubes — a 4ES8 RF amplifier, a 7EY6 vertical output, and an XL84/8BQ5 audio output.

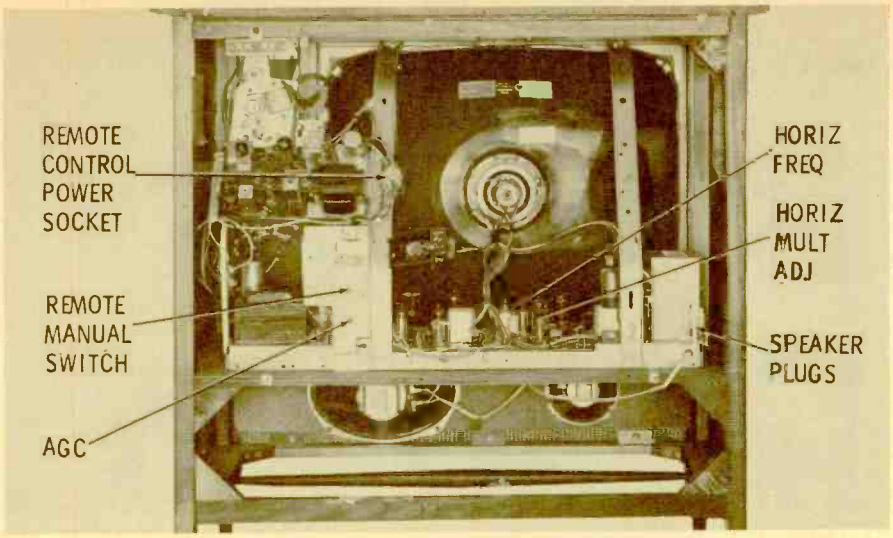
Above the cage, the silicon-rectifier, half-wave doubler power supply is protected by a circuit breaker and 5-ohm, 10-watt limiting resistor. Filament warm-up is controlled by a temperature-compensating resistor rated at 200 ohms cold, 6 ohms hot.

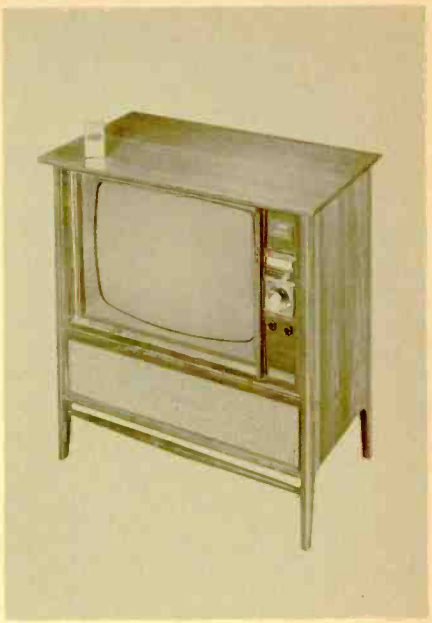
Two pentode-triode tubes are used in the remote control receiver — a 6GH8 and a 6U8A. The unit is rather unusual in that the triode section of the 6U8A serves as the B+ rectifier, and the range control is used as a variable voltage divider to supply AC to a dual-diode bias rectifier for the relay-control amplifier. A 1/10-amp, type-N fuse protects the AC supply feeding both these circuits.

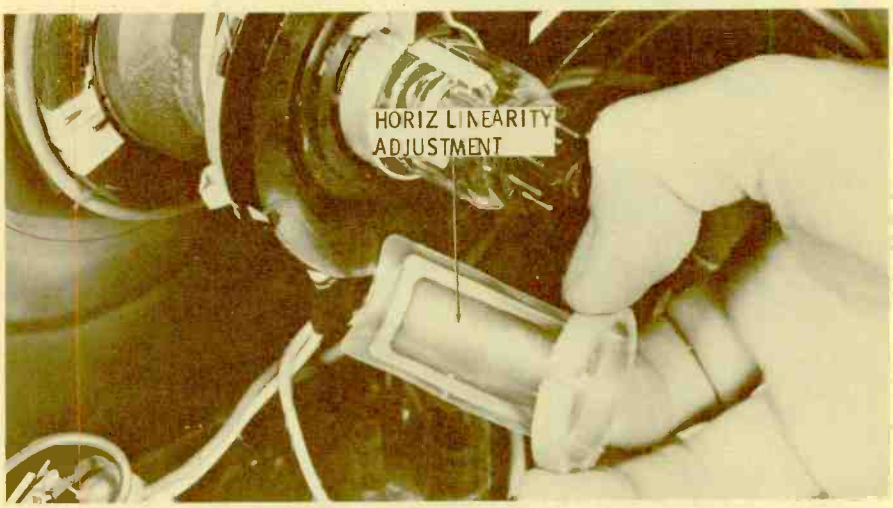


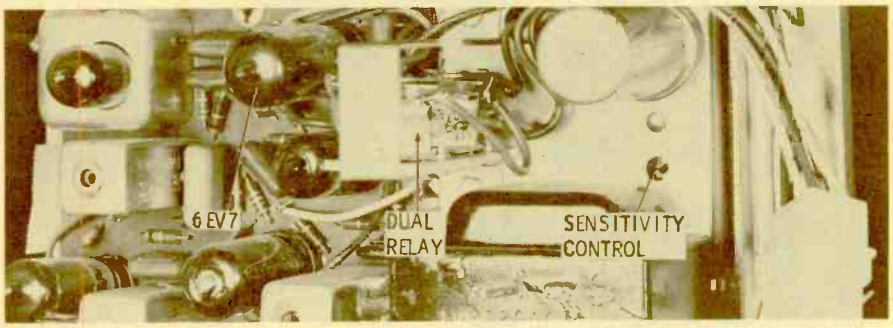


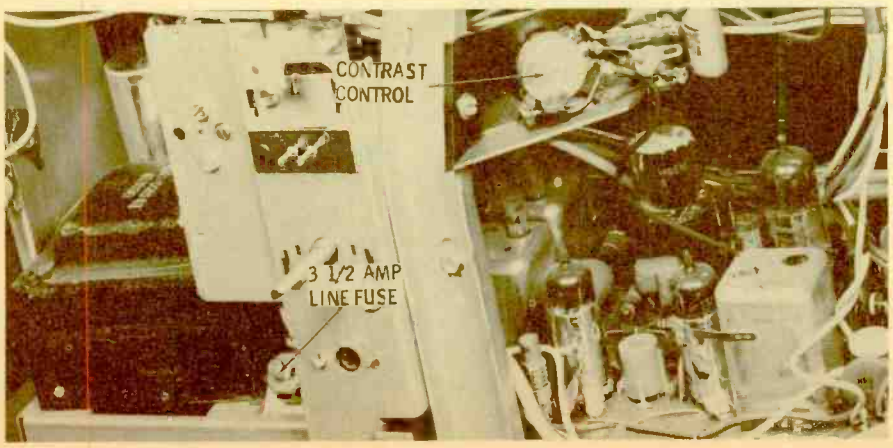
Westinghouse











Westinghouse Model H-K4150 Chassis V-2411-6

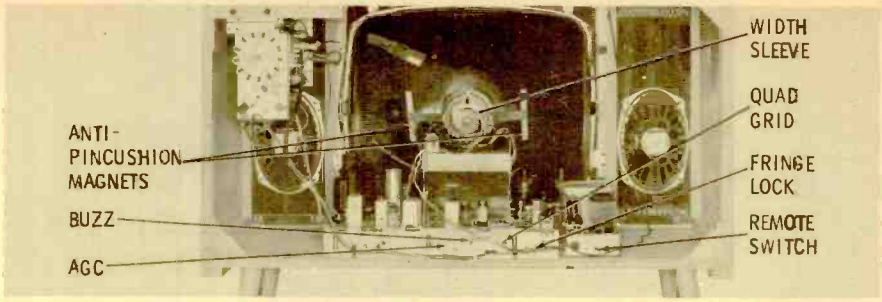
This *American Contemporary* is one of 45 models using the same basic chassis. All of these sets use a 114°, 23FP4 picture tube and a separate safety glass. A trim strip along the top edge of the glass holds it in place. Touch-up oscillator adjustments can be made after removing the channel-selector and *Memory Tuning* knobs, the escutcheon, and the channel indicator. The *Memory Tuning* adjustment is for setting up the fine tuning cams. Height and vertical linearity adjustments are accessible through the hollow shafts of the horizontal and vertical hold controls.

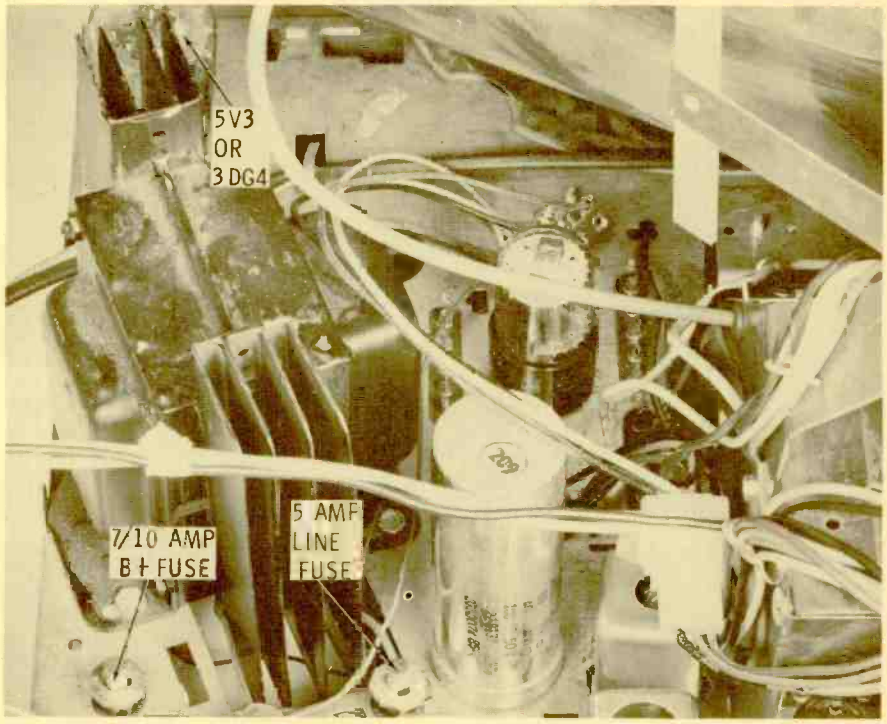
Chassis layout conforms to the patterns previously established by Westinghouse. The tuner in some versions is equipped with a 6EA5 RF amplifier. The newest tube types used in the main chassis include a 6EB8 video output-sync separator and 6EM7 combined vertical multivibrator-output. The rear-mounted AGC control has a recessed adjustment slot.

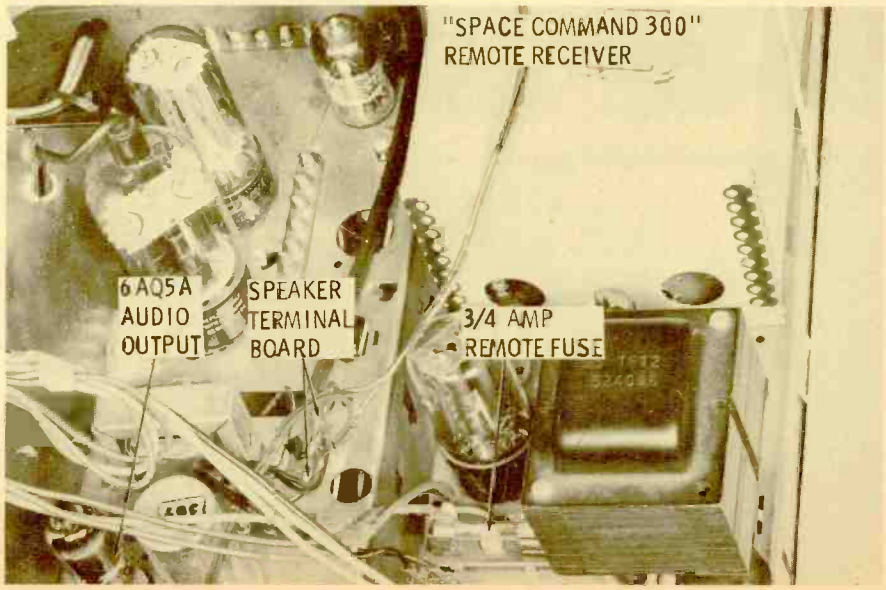
A horizontal linearity sleeve, consisting of a single loop of foil covered by a plastic coating, is held in place between the yoke and the bottom of the CRT neck by the yoke clamp. Moving the sleeve in and out of the yoke permits the linearity to be adjusted in much the same way as width sleeves control raster width.

Another new tube in this remote-control model is the twin-triode 6EV7 used as a relay-control amplifier. The four-tube remote-control chassis has its own power transformer. A sensitivity control, which regulates the bias on the relay-control tube, provides a means of selecting the amount of signal required to operate the unit.

The transformer-powered chassis has a 3½-amp, type-N fuse in series with the AC line. A length of #24 fuse wire, located under the chassis, protects the filaments. Attached to the channel brace you'll find a tapped control coupled to the contrast knob by a long shaft. Contrast controls are often mounted in this manner to reduce stray capacitance and improve video-amplifier response.







Zenith Model F3344E Chassis 16E24Q

Space Command 300 identifies the type of remote tuning unit found in this series of 23" sets using Chassis 16E24Q. A 90°, 23ZP4 picture tube with a bonded safety shield is used in these models. A very similar chassis (16F24Q) in the highest-priced series uses a 92°, AR23-ANP4/23ATP4 CRT with an anti-reflection bonded safety shield.

The 16-tube, conventionally-wired chassis has rear-mounted controls for AGC, buzz, quadrature grid, and fringe lock adjustments. A metallic sleeve is inserted between the yoke and CRT neck to vary the width, while two anti-pincushion magnets are provided to compensate for horizontal compression.

All operational controls except on-off-volume and the power tuning push bar are located behind a tilt-down door below the picture tube. Recessed setup adjustments for focus, vertical size, and vertical linearity are also located behind the door. All controls are well labeled for easy identification.

Power-supply circuits for the two chassis vary slightly. This one has a special power transformer and a rectifier socket which is wired for use with either a 3DG4 or a 5V3 rectifier; thus, the tubes can be used interchangeably. Circuit protection is provided by a 5-amp, type-N fuse in series with the AC line, a 7/10-amp, type-N fuse in series with B+, and a 1" length of #24 copper wire in the filament circuit.

The Space Command 300 remote control used with this 16E24Q chassis is one of the same types used in previous years. It has its own power supply which is protected by a 3/4-amp slow-blow fuse. Chassis 16F24Q incorporates a more elaborate remote unit called *Stratosphere Control 1000,* which performs additional functions but operates on the same basic principle as the 300. Another thing you'll find in the 16F24Q chassis is an empty 6AQ5A socket. It's all wired and ready to have a tube and speaker installed for shop service, so you won't have to pull the stereo amplifier chassis which normally handles the TV sound.

See PHOTOFACT Set 495, Folder 2

See PHOTOFACT Set 495, Folder 2

Mfr: Andrea **Chassis No. VS 323-1**

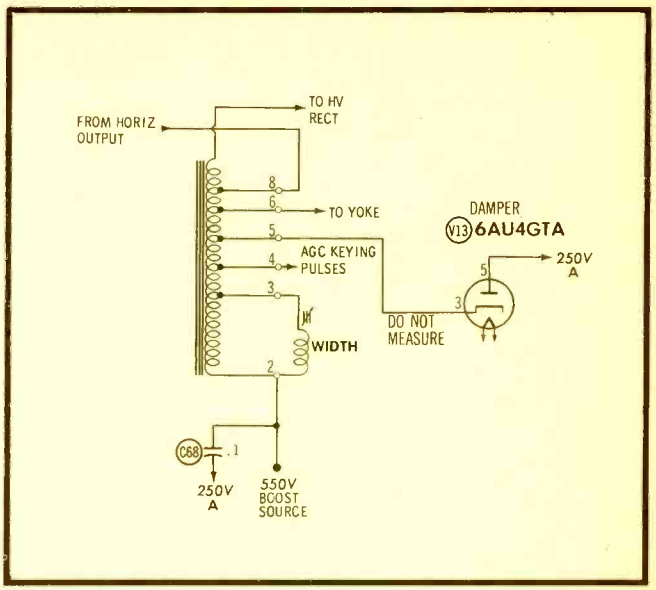
Card No: AN VS 323-1-1

Section Affected: Raster.

Symptoms: No raster; no boost voltage.

Cause: Shorted boost capacitor.

What To Do: Replace C68 (.1 mfd).



Mfr: Andrea **Chassis No. VS 323-1**

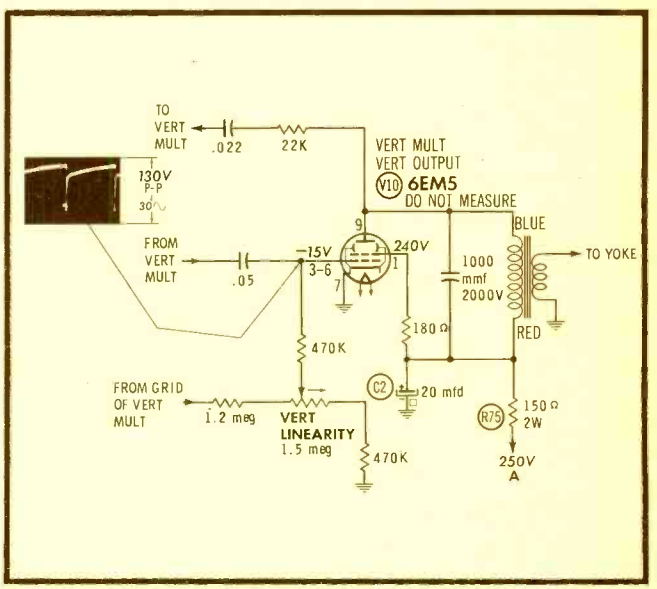
Card No: AN VS 323-1-2

Section Affected: Raster.

Symptoms: Insufficient height; incorrect voltage at screen grid (pin 1) of vertical output tube (V10).

Cause: Leaky decoupling capacitor in B+ return circuit of vertical output stage.

What To Do: Replace C2 (20 mfd); check R75 (150 ohms—2W).



Mfr: Andrea **Chassis No. VS 323-1**

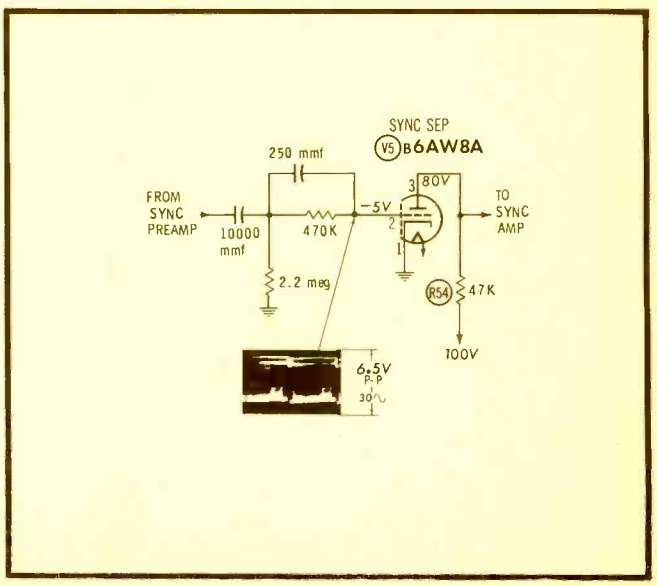
Card No: AN VS 323-1-3

Section Affected: Sync.

Symptoms: Unstable horizontal and vertical sync. Incorrect voltage on plate (pin 3) of sync separator (V5B).

Cause: Plate-load resistor of sync separator has changed in value.

What To Do: Replace R54 (47K).



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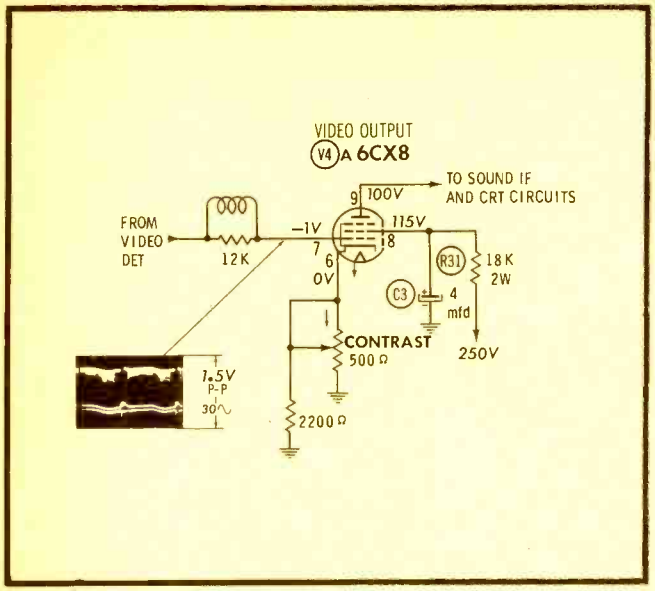
See PHOTOFACT Set 495, Folder 2



See PHOTOFACT Set 495, Folder 2

Mfr: Andrea **Chassis No. VS 323-1**

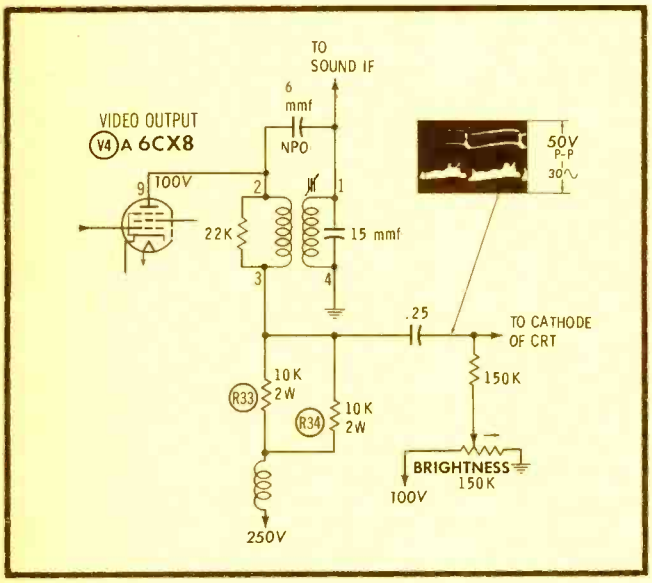
Card No: AN VS 323-1-4

Section Affected: Pix.

Symptoms: Picture disappears after short period of operation. Voltage on screen grid (pin 8) of video output tube (V4A) may not be correct.

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

What To Do: Replace C3 (4 mfd—450V). Check R31 (18K—2W).



Mfr: Andrea **Chassis No. VS 323-1**

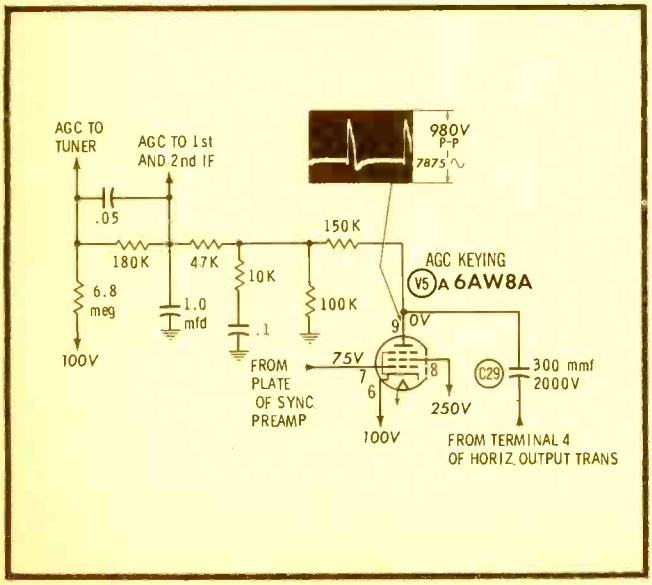
Card No: AN VS 323-1-5

Section Affected: Pix.

Symptoms: Picture weak and smeared. Voltage at plate (pin 9) of video output tube (V4A) is higher than normal.

Cause: Decrease in value of plate-load resistors in video output circuit.

What To Do: Replace R33 and R34 (each 10K—2W).



Mfr: Andrea **Chassis No. VS 323-1**

Card No: AN VS 323-1-6

Section Affected: Pix.

Symptoms: Overloading (excessive contrast). Voltage on plate (pin 9) of AGC keying tube (V5A) may be positive.

Cause: Leaky coupling capacitor between plate of AGC keying tube and horizontal output transformer.

What To Do: Replace C29 (300 mmf — 2000V, 10%).

See PHOTOFACT Set 503, Folder 1

See PHOTOFACT Set 503, Folder 1

Mfr: DuMont **Chassis No.** 120600A

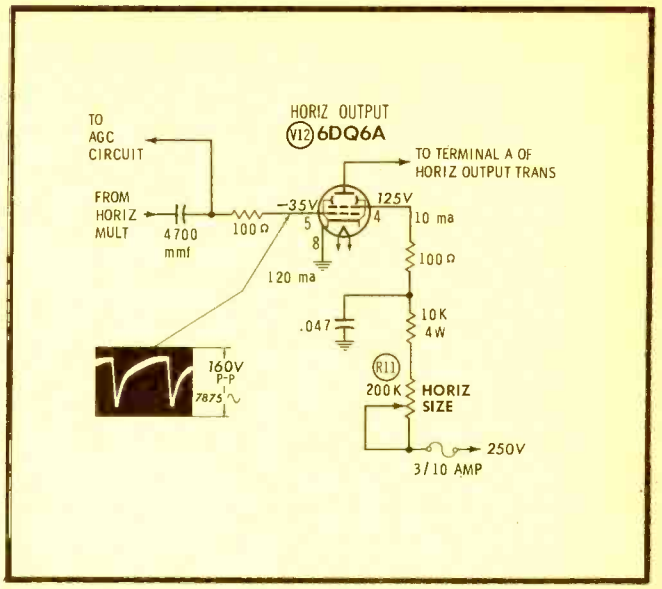
Card No: DM 120600A-1

Section Affected: Raster.

Symptoms: Flashes in raster; fluctuations in width.

Cause: Defective horizontal size control.

What To Do: Replace R11 (200K).



Mfr: DuMont **Chassis No.** 120600A

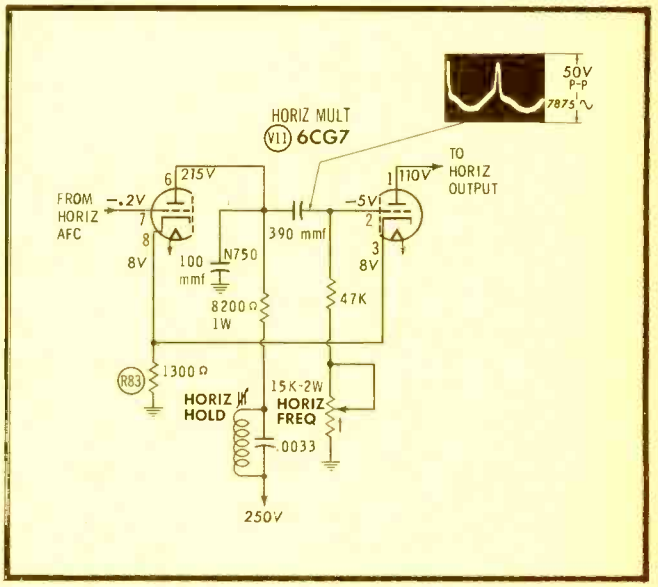
Card No: DM 120600A-2

Section Affected: Sync.

Symptoms: Loss of horizontal sync — cannot be corrected with horizontal hold control. Incorrect voltage at both cathodes (pins 3 and 8) of horizontal multivibrator (V11).

Cause: Common cathode resistor of horizontal multivibrator has changed in value.

What To Do: Replace R83 (1300 ohms).



Mfr: DuMont **Chassis No.** 120600A

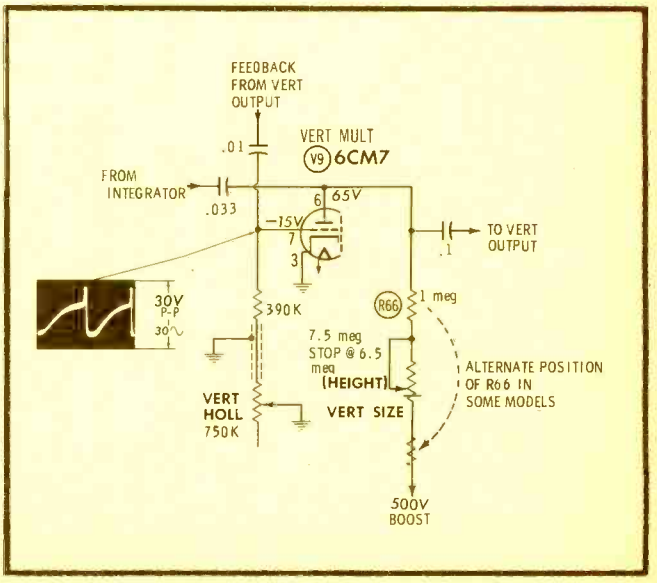
Card No: DM 120600A-3

Section Affected: Raster.

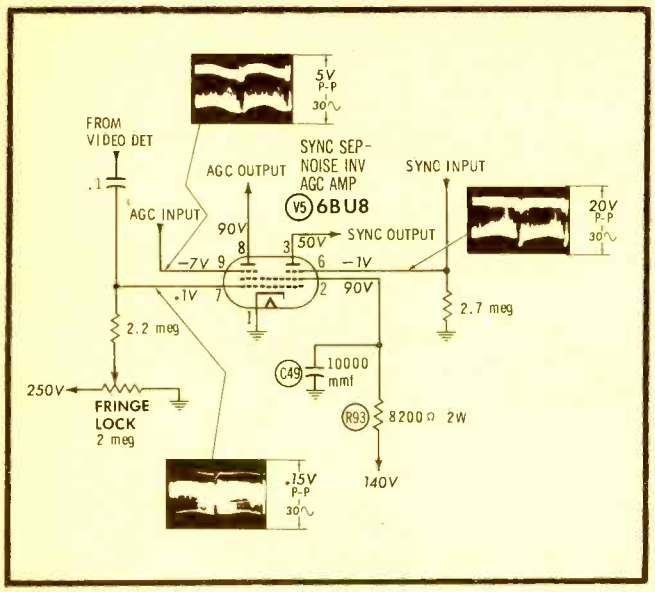
Symptoms: Insufficient vertical sweep.

Cause: Plate-load resistor of vertical multivibrator has increased in value.

What To Do: Replace R66 (1 meg).



See PHOTOFACT Set 503, Folder 1



See PHOTOFACT Set 503, Folder 1

Mfr: DuMont **Chassis No. 120600A**

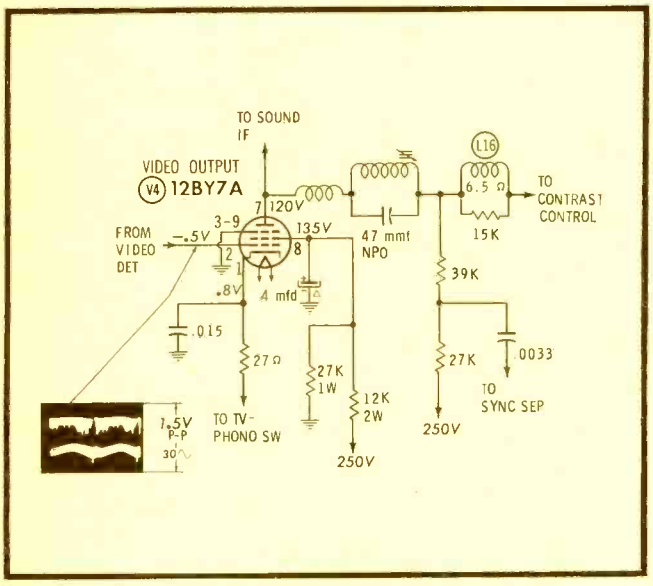
Card No: DM 120600A-4

Section Affected: Pix.

Symptoms: Video overloading; very low voltage at screen grid (pin 2) of sync separator-AGC keying tube (V5).

Cause: Resistor in screen circuit of V5 has burned open.

What To Do: Replace R93 (8200 ohms — 2W); check V5 (6BU8) and C49 (10000 mmf).



Mfr: DuMont **Chassis No. 120600A**

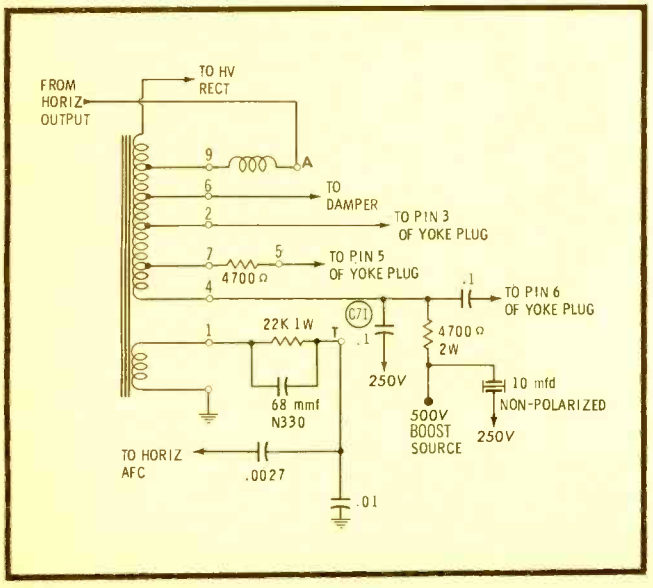
Card No: DM 120600A-5

Section Affected: Pix.

Symptoms: Smeared picture.

Cause: Open series peaking coil in plate circuit of video output tube.

What To Do: Replace L16 (105 uh).



Mfr: DuMont **Chassis No. 120600A**

Card No: DM 120600A-6

Section Affected: Raster.

Symptoms: Intermittent loss of raster, accompanied by loss of boost voltage.

Cause: Intermittent short in boost capacitor.

What To Do: Replace C71 (.1 mfd).

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THE Complete LINE THAT OFFERS MORE THAN MERE "CAPACITY"

"Rated" capacitance is not enough . . . *actual* capacitance during operation is equally important. Excessively high or low values as well as capacitance change with temperature can foul up a TV or radio set. Therefore, characteristics such as Capacitance Stability, Capacitance Tolerance, and Temperature Coefficient of Capacitance must be considered in replacement applications.

That's why the Sprague Ceramic Line is varied and broad —it includes capacitors with electrical and mechanical characteristics to meet practically every replacement requirement.

See complete listings in the new Sprague Catalog C-614. Get your copy from any Sprague Distributor, or write to Sprague Products Co., 105 Marshall St., North Adams, Massachusetts.

CERA-MITE® CAPACITORS

Tiny, tough, dependable. Silvered flat-plate construction for high by-pass efficiency, high self-resonant frequency. Available in the following types to meet specific requirements:

- *General Application,* for by-pass and coupling
- *High-K,* for applications requiring guaranteed minimum capacitance values
- *Temperature-Stable,* for minimum capacitance change with temperature
- *Temperature-Compensating,* for applications requiring negative temperature coefficient
- *NPO,* for use where capacitance change with temperature is undesirable
- *AC,* rated at 125 VAC
- *Buffer,* rated at 2000 WVDC
- *Low-voltage,* for by-pass and coupling in transistorized circuitry
- *TV Yoke,* rated at 3000 and 5000 WVDC

HYPERCON® CAPACITORS

Ultra-miniature discs for use in transistorized circuitry. Designed for by-pass and coupling applications in low voltage circuits where high capacitance and low power factor are important considerations. Superior in size and performance to comparably-rated aluminum electrolytic capacitors.

"UNIVERSAL" CAPACITORS

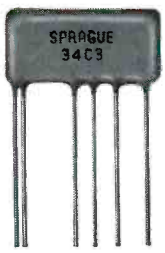
Have multiple leads. Quick-fix capacitors for on-the-spot repairs. By using certain leads for terminals, connecting certain leads together, and removing certain leads, various ratings may be obtained. Available in General Application as well as High-K types.

DOORKNOB CAPACITORS

Available in 20 and 30 KV ratings. Molded guard rings lengthen surface creepage path. Complete with variety of screw-in terminals to meet all replacement requirements.

BUTTONHEAD CAPACITORS

Screw-mounting units with flat disc capacitor elements seated in hexagon head. This series includes feed-thru capacitors for filtering leads through chassis, as well as standoff capacitors for by-pass applications.



BULPLATE® CAPACITORS

Rugged multiple-section units which combine in one compact assembly all the capacitors used in one or more stages of a radio circuit. These space-saving capacitors are ideal for miniature sets.

SPRAGUE®
THE MARK OF RELIABILITY

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PF REPORTER
including Electronic Servicing

VOLUME 11, No. 5 *MAY, 1961*

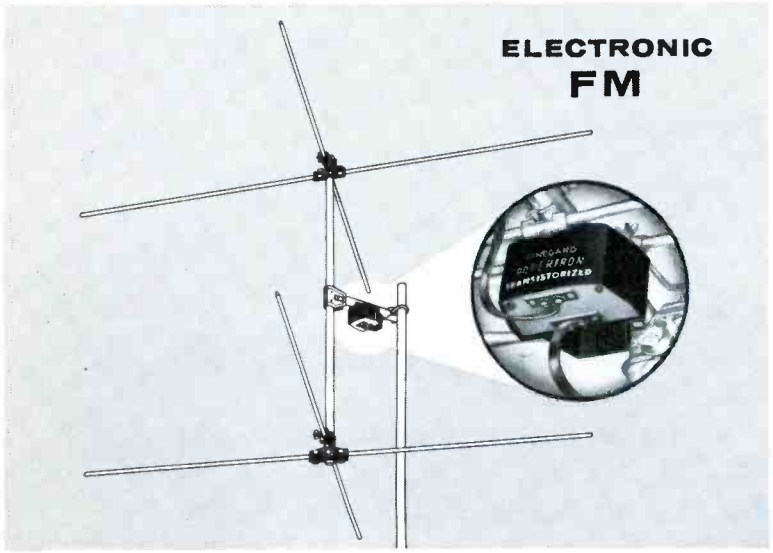
CONTENTS

ABOUT THE COVER

Are you missing the boat (or car, truck, tractor, etc.) on Citizens band equipment? Predictions for this year indicate that over 250,000 new units will be placed in service, representing over $25 million in transceiver sales alone. Income from accessory sales, installations, and service represents an additional potential of well over $10 million. Enterprising service dealers interested in getting a share of this lucrative, largely untapped market are urged to read the special feature beginning on page 30.

NOW...A Complete Line of

Built-in Amplifier clears up snow, improves

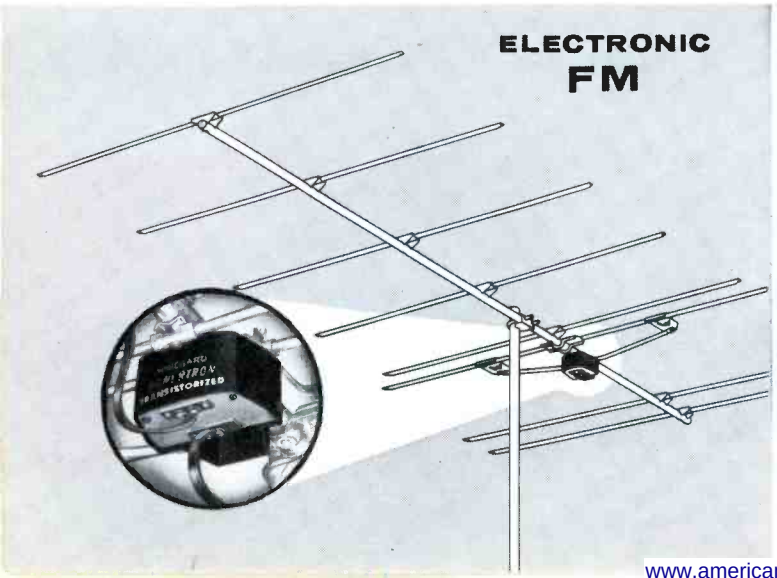


MODEL PF-T FM POWERTRON TURNSTILE Non-directional FM antenna with 16 DB gain in all directions over a folded dipole. Has unique offset mount and comes complete with built-in transistorized amplifier and TV-FM coupler.

NEW, POWERFUL TRANSISTORIZED FM POWERTRONS WITH FM-TV COUPLERS

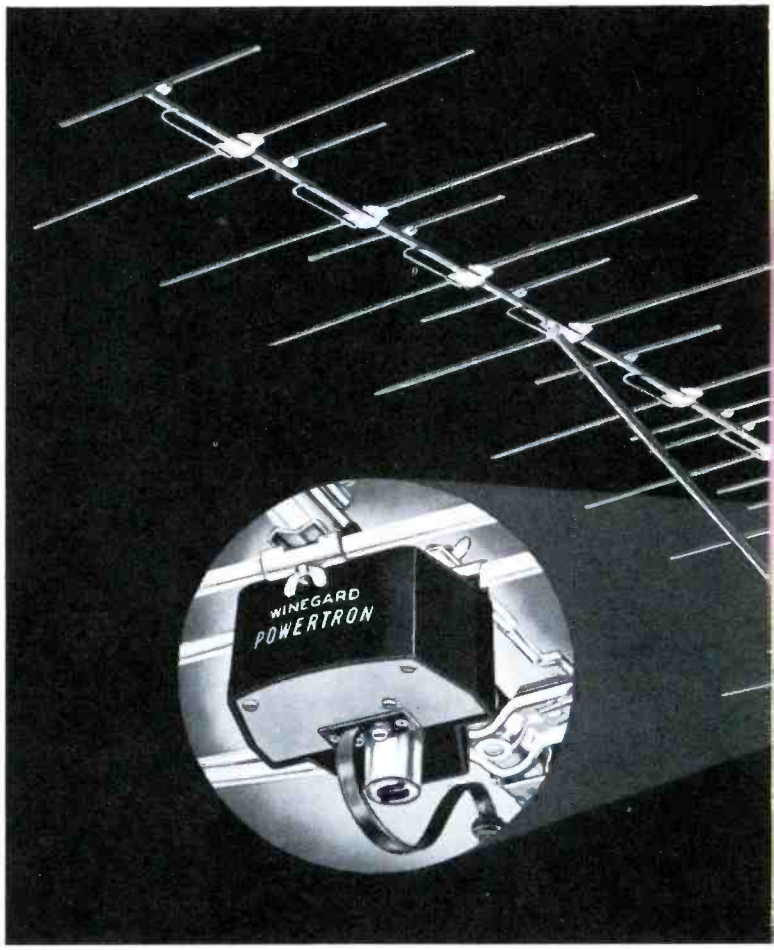
For the first time, FM antennas with built-in transistorized amplifiers are available for long range FM reception. Winegard offers two models—FM Powertron Turnstile (omni-directional) and the FM Powertron Yagi (directional). Both models have two 300 ohm terminals on the amplifier: one for down-lead connection to the set and one for connection to a TV Powertron antenna.

MODEL PF-8 FM POWERTRON YAGI This is the world's most powerful FM antenna. Makes weak signals come in like "locals". Has 25 DB gain over folded dipole. Eight elements with exclusive Winegard "tapered T" driven element. Built-in TV-FM coupler allows you to couple into TV Powertron with only one power supply. Complete with built-in transistorized amplifier.



In addition to three all-channel (VHF) Powertron antennas, Winegard now offers you 14 cut-channel and broad band Powertron yagis and two FM Powertrons. Each of these high gain antennas has the following important features:

1. Electronic amplifier for unprecedented antenna gain.
2. Amplifier connected *directly* to the yagi "Tapered-T" driven elements for best possible signal-to-noise ratio.
3. Linear frequency response for crisp, clear black and white and brilliant, true color reception.



ELECTRONIC ALL-CHANNEL YAGIS

. . . will greatly improve every channel. Weak, faded pictures become crisp and clear. "Good" channels will be even better. In many areas you'll watch channels you couldn't possibly see before. Because Powertrons are powerful enough to drive up to 10 TV sets, you can have plug-in outlets in every room . . . and in many locations you can install a Powertron lower than other antennas.

POWERTRON MODEL P-44 14-Elements

POWERTRON MODEL P-44X 21-Elements

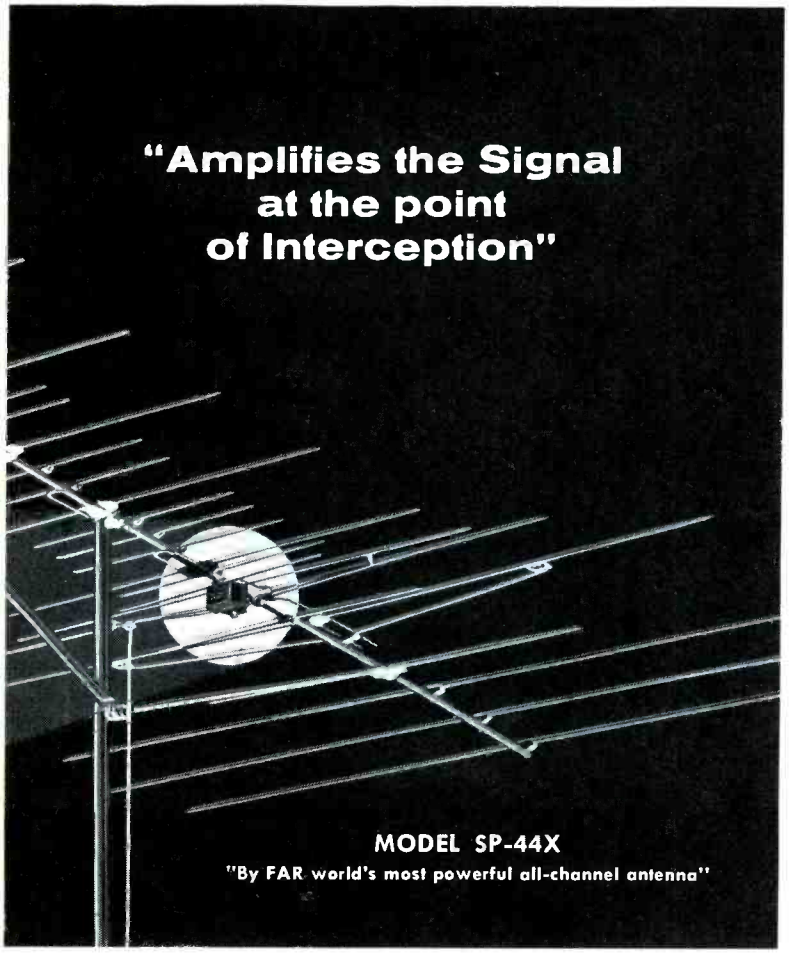
POWERTRON MODEL SP-44X 30-Elements

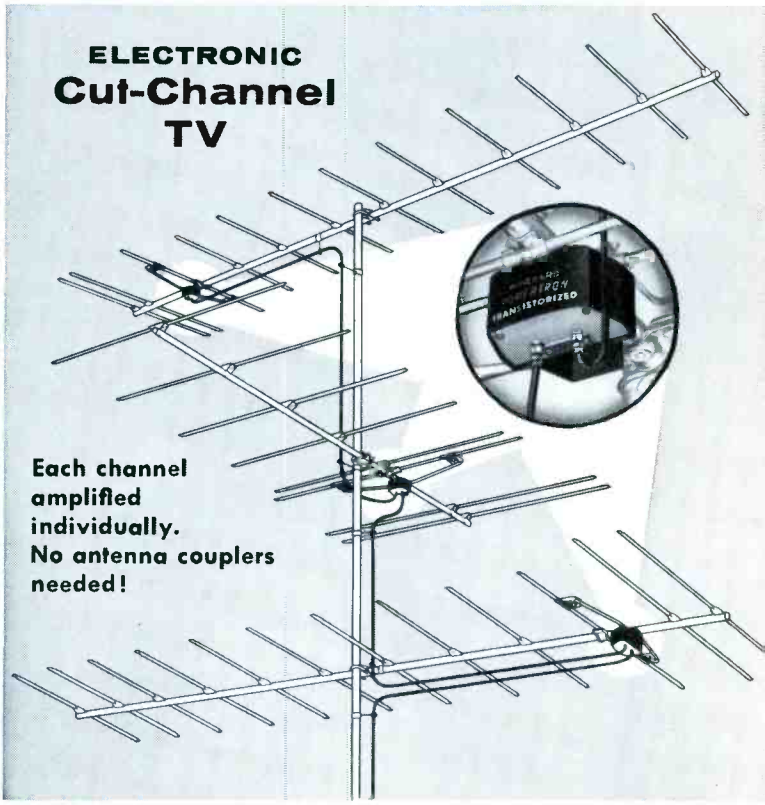
Winegard Electronic Antennas

contrast...gives you greater reception distance!

4. Gold Anodized finish for permanent corrosion protection and fine appearance.
5. Deluxe quality materials and workmanship.

Try a Powertron and see for yourself. Take a field strength meter reading with your present antenna and then take a Powertron reading. When you see the meter jump 5 to 10 times . . . and see the sharp, contrasty reception you get, you'll be convinced . . . and so will your customers.





NEW, TRANSISTORIZED CUT-CHANNEL YAGI POWERTRONS FOR THE FINEST INSTALLATIONS

Here are the highest gain (28 db) TV antennas ever made! Each is powered by a *built-in transistorized* amplifier. Because TV signals are amplified right at the point of interception, you get the best possible signal-to-noise ratio . . . resulting in the ultimate in reception!

Each Powertron yagi amplifier has two 75 ohm coaxial connectors: one for the down-lead to the power supply and one from the built-in coupler for connection to another Powertron yagi.

Because of the built-in mixing coupler, they can be connected directly to each other without interaction. The negligible power consumption of these transistorized antennas (.05 watt each) means you can tie as many as 8 Powertron yagis together and run them all from one power supply on one down-lead.

There are six (8-element) cut-channel and broad low band models —eight (12-element) cut-channel and broad high band models. Ideal for hotels, motels, apartment buildings or wherever the finest installation is needed.

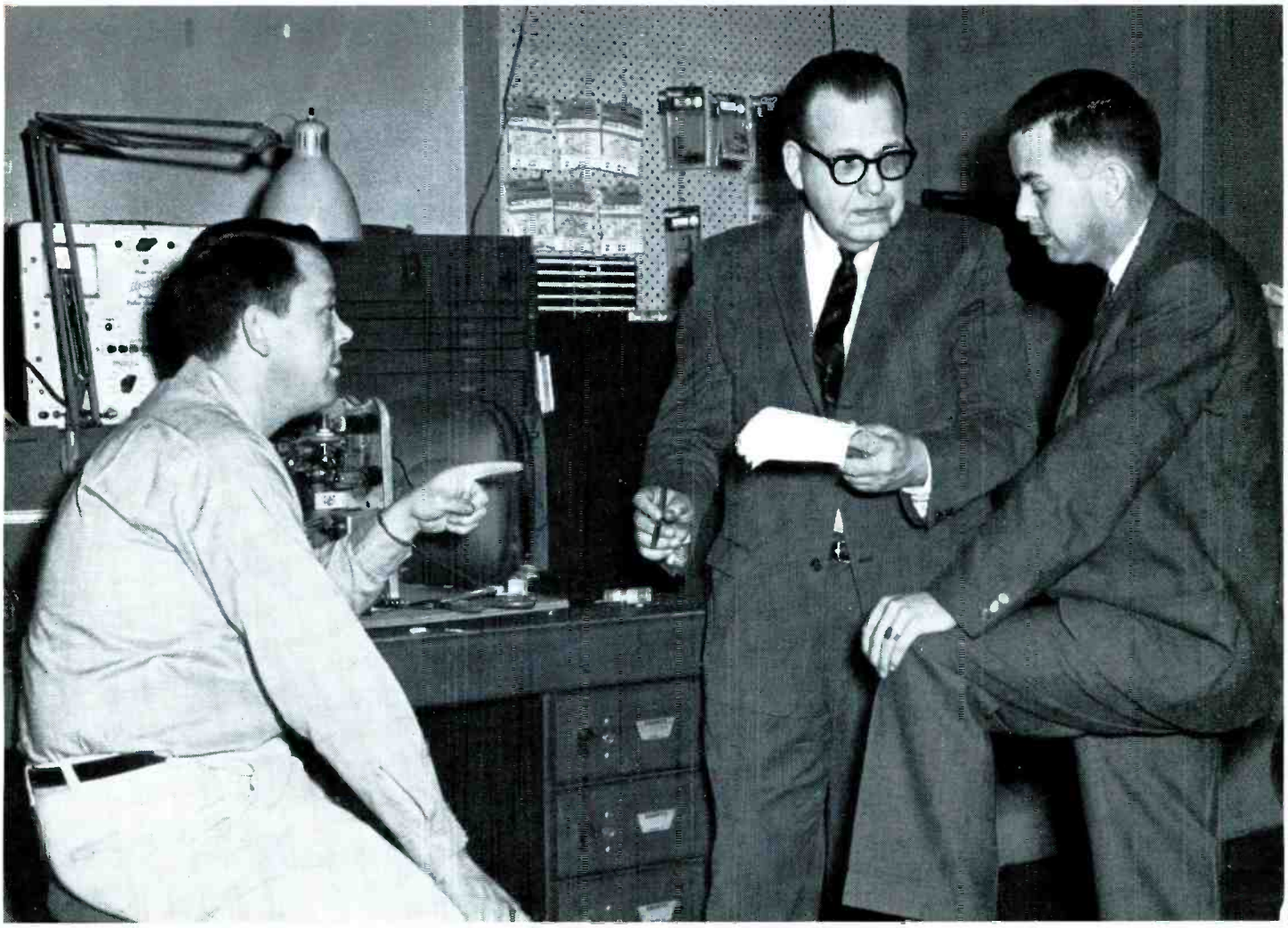
WINEGARD "SIX-SET" TV COUPLER

With the Powertron, hook up 3, 4, 5, or 6 sets by adding a Winegard "Six-Set". Here's the only 6 tap coupler on the market. Six no-strip terminals give you instantaneous taps with complete electronic isolation. Model LS-63.

Winegard
ANTENNA SYSTEMS
Winegard Co., 3009-5 Kirkwood St., Burlington, Iowa

Write today for technical bulletin on Winegard's complete line of Powertron antennas. Ask your distributor for details.

"When it's Mallory...I know it's reliable"



Don Domers (center), shown here with servicemen Everett Hammond and Jess Cody, has built a growing business on a reputation for quality servicing of radio, TV, auto radio, hi fi and stereo sets, and antennae installation. Don has had his own shop for 29 of his 34 years in radio servicing, now has 7 employees. He's also an authorized Philco, Motorola and Sylvania dealer, having carried the first two lines for 20 years.

Your Mallory distributor stocks these quality components

TC TUBULAR ELECTROLYTICS

Economical filter capacitors. Hermetically sealed. Also special TCX type for —55° C. Twin-pack keeps leads free from kinks.

FP ELECTROLYTICS

Original 85° C capacitor, now better than ever. Etched cathode gives hum-free performance. Chassis or printed circuit mounting.

STA-LOC® CONTROLS*

Your distributor can custom build in just 30 seconds, any of over 38,000 single or dual controls.

*U. S. Patent 2,958,838.

GOLD LABEL® VIBRATORS

Quietest ever made . . . for the best in auto radio servicing. Buttonless contact design gives longest trouble-free service, sure starts.

says Don Domers, Terre Haute service dealer

"Wherever possible, I always use Mallory parts . . . and I've never had a call-back caused by one. When they're labeled 'Mallory', I know they're dependable. I first tried new PVC capacitors for that very reason—then I found a lot more reasons for liking them. For instance, the handy zip-lip plastic pack keeps stock visible and easy to count, can be hung on my rack for fast use; and PVC's flexible plastic jacket never cracks when we bend or solder the leads."

You'll find this kind of money-saving, customer-pleasing reliability in all Mallory replacement parts. It's the industry's broadest line . . . all top quality . . . all sensibly priced. See your Mallory distributor soon.

Don Domers buys all his parts from Mallory distributor C. T. Evinger Co., Terre Haute, a quality distributor who handles quality parts. He's shown here with Charlie Evinger and salesman Max Springer.

Put an end to call-backs . . . buy your parts from Mallory authorized distributors.

Distributor Division, Indianapolis 6, Indiana

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MALLORY

In Canada: A. C. Simmonds & Sons, Ltd., Toronto

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New, blue Mylar** capacitors. Withstand moisture, heat, bending of leads and overloads.

**Reg. T. M., E. I. du Pont de Nemours & Co., Inc.

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GEMS

Rugged, moisture-proof tubular capacitors, great for filter, buffer, by-pass and coupling service. Handy five-pack keeps stock clean, leads kink-free.

RMC DISCAPS®

Quality standard for original equipment. In handy 3" x 5" file card package.

®Trademark Radio Materials Company, a Mallory division.

Dear Editor:

Thanks to Stan Prentiss for his fine article in the March issue, "Recovering From the Bends." I was very pleased with the information it contained, since it helped me fix a set I was having trouble with. The waveforms in particular were a big help, since they are not included in the PHOTOFACT Folder for this old Philco set. Checking the circuits as the article suggested, I was able to pin the fault down to the noise-limiter stage; plate resistor R83 had increased from 330K to 500K.

JESS ODEN

Spokane, Wash.

Take it from me, Jess—the article was prepared just for you.—Ed.

Dear Editor:

Your magazine has been read and reread so often that I never see the copy once it leaves my desk. Many thanks for an excellent trade publication and one that I take home when it first comes so it won't be snatched out of my hands.

JAMES WELLMAN

Service Manager, Electronic Shop
Parb Research Service
San Francisco, Calif.

Dear Editor:

I cannot find words to express my appreciation for the many interesting technical articles published in PF REPORTER. Although this is only my second year of a three-year subscription, I am already renewing for an additional three years.

Your publication has helped me so often that I now give priority to it over others. Therefore, I urge you to keep printing the best possible articles, so that we readers, by your guidance, can expand our knowledge in the electronics field.

ORESTE G. GRECH

Detroit, Mich.

Dear Editor:

I'm very sorry to say your PF REPORTER is not what it should be — it's very poor. Your first issues of 10 years ago had more value and interesting material for the serviceman. Now your articles are for engineers that someday may design a set. Maybe?

If I had to follow some of those procedures, I would have closed up long ago. Most of the articles are too drawn out, and I fall asleep reading them. If all television sets were standard, it would be practical to remember these procedures — but as it is now, they are no help to a down-to-earth serviceman.

I must say, though, your PHOTOFACT Folders are the very best, for without them, many sets would have been junked a long time ago.

ANTHONY ANNELLI

Solo Radio-TV
Brooklyn, N. Y.

You seem to be outvoted, Tony, and while we're not pleased with your comments, we do appreciate your taking the time to criticize our work. Anyone else feel the same way?—Ed.

Dear Editor:

I have your VSM-3, VSM-4, and VSM-5 "Video Speed Servicing" volumes, and find them quite useful in my servicing work. However, I have been wondering why I have never seen any mention of VSM-1 and VSM-2. I would imagine that these two earlier volumes would be even more valuable, inasmuch as they would cover the very early models which are more prone to need service.

I am also wondering if the "Video Speed Servicing" material which appears in PF REPORTER will appear in later VSM volumes.

WALTER J. WILLIAMS

St. Clair, Mich.

"Video Speed Servicing" appeared initially in Service Dealer & Electronic Servicing, *which was acquired by us and merged into* PF REPORTER *in September, 1958. While VSM-1 and VSM-2 were not published by us, we did acquire a small stock along with the magazine. Volume 1 is out of print, but we still have a dozen or so volumes of VSM-2 (price is $2.95). You're right—it does cover "very early" models—many prior to 1952!*

While some PF REPORTER *material appears in the VSM volumes — to make them more complete — duplication is held to a minimum. Thus, most of the magazine material will never appear anywhere else. If you are missing some of the back issues and would like to complete your file, the order form on page 79 should come in handy.—Ed.*

Dear Editor:

I have just finished reading "A Survey of Upgrading Courses" in the February issue. You are certainly to be complimented on the lucid and extensive treatment of the subject. Such an article will certainly do much to enlighten your readers about the educational training offered by correspondence and resident schools.

As Supervisor of the Extension Division of National Technical Schools, I am naturally curious as to why you made no mention of our institution, since it is fully approved and accredited by groups such as the National Home Study Council.

Again, let me compliment you on your fine contributions to the field of technical education.

NORMAN J. ATTENHOFER

National Technical Schools
Los Angeles, Calif.

We apologize for not making it clear that the list of schools was not necessarily complete; however, survey forms were sent to several schools who did not submit information for inclusion in the article.—Ed.

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with your purchases of Philco receiving tubes

Genuine John Hancock Redwood Furniture

America's finest—all quality-crafted from TWO-INCH certified genuine California Redwood! All cushions covered in water-repellent heavy duck! Styled for beauty and comfort!

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Adjustable Chaise Lounge

70" long x 25" wide—5" solid wheels.

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Cushioned Settee

32" deep x 51" wide.

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Powerama 22" Rotary Mower

Super-quality plus deluxe features! One year warranty on 3 H.P. 4-Cycle Briggs and Stratton Engine. Lifetime guarantee on steel housing!

- Safe-T-Wind starter
- Safe Remote Control Starter with Control on handle
- Staggered Wheel Design
- Adjustable Cutting Heights

FREE with your purchase of 875 PHILCO receiving tubes

AD #3845

$16.95 RETAIL VALUE

Royal Chef Portable Barbecue Grille

Large size 21" firebowl—guaranteed for 5 years against burnout. Grid adjustable to 5 positions. Detachable windshield.

FREE with purchase of 150 PHILCO receiving tubes

AD #3850

Family Size **Picnic Basket** FITTED TO SERVE SIX

$9.95 RETAIL VALUE

- 26 piece ensemble—6 cups, 6 plates, 6 forks, 6 spoons, removable tray
- All in maple-tone basket with hinged cover. Lined interior.

FREE with purchase of 100 PHILCO receiving tubes

AD #3844

AD #3843

3-Tier Suburban Pool

- Strongest inflatable pool
- A full 66" x 10"
- Decorative design
- Large "sit-on" sides

FREE with your purchase of 100 PHILCO receiving tubes

Accumulate your purchases!

You can add orders together for any item. May 31 is final date for starting an "accumulating" order.

SEE YOUR PHILCO DISTRIBUTOR

ACROSS THE BENCH
by Stan Prentiss

The Case of the 10-Minute Fuses

It all started when an RCA Chassis KCS81F was brought into the shop with a notation on the service ticket, "Output tube looks gassy (glows blue) and the set blows high-voltage fuses after 10 minutes of operation—even with a new 6CD6 installed."

As I fired up the set, a quick glance at the schematic told me that I was dealing with the direct-drive circuit in Fig. 1. A check of the voltages failed to show any drastic discrepancies. The 340-volt B+ line was running at 350 volts, and the 540-volt boost source checked a solid 500 volts—both within 10% of the normal values. At the moment, I failed to realize the two voltages were off in opposite directions, and went ahead to measure the high voltage. It was supposed to be 17 kv according to the service data, but I obtained a reading of 15 kv—still no big clue.

At this point, I decided it was time to take a look at the drive signal on the grid of the horizontal output tube. When I saw the waveform in Fig. 2, I had my first clue to the problem. This sawtooth, with its flattened positive peak, contrasted sharply with the normal grid signal in Fig. 1. I didn't pay any attention to the ripple at the start of the sawtooth; it's a permanent fixture in these circuits, and causes no trouble because it occurs *before* the tube starts conducting. However, the flattened peak clearly indicated the grid was drawing current. This would normally be expected if the cathode of the output tube were grounded, but since the circuit in Fig. 1 depends mainly on cathode bias instead of grid-leak bias, the flat peak spelled trouble.

Up to this point, I had not substituted any tubes. However, now that I had something definite to go on, I decided it would be wise to slip a new 6CD6G into the socket. As the set warmed up again, I checked the old 6CD6 on my tube tester. Sure enough, there was a definite indication of excessive gas—which, of course, produces grid current. Generally speaking, a tube tester doesn't give a clear picture of how a tube will function in a pulse circuit, but this grid-current check was valid.

I took another look at the grid waveform, this time with the new tube in the circuit. The amplitude had increased to nearly normal, and the flat spot had all but disappeared; so it was time to check some place else.

Clipping the scope lead onto the insulation of the wire going to the 1B3 plate cap, I obtained the ringing waveform shown in Fig. 3.

• *Please turn to page 75*

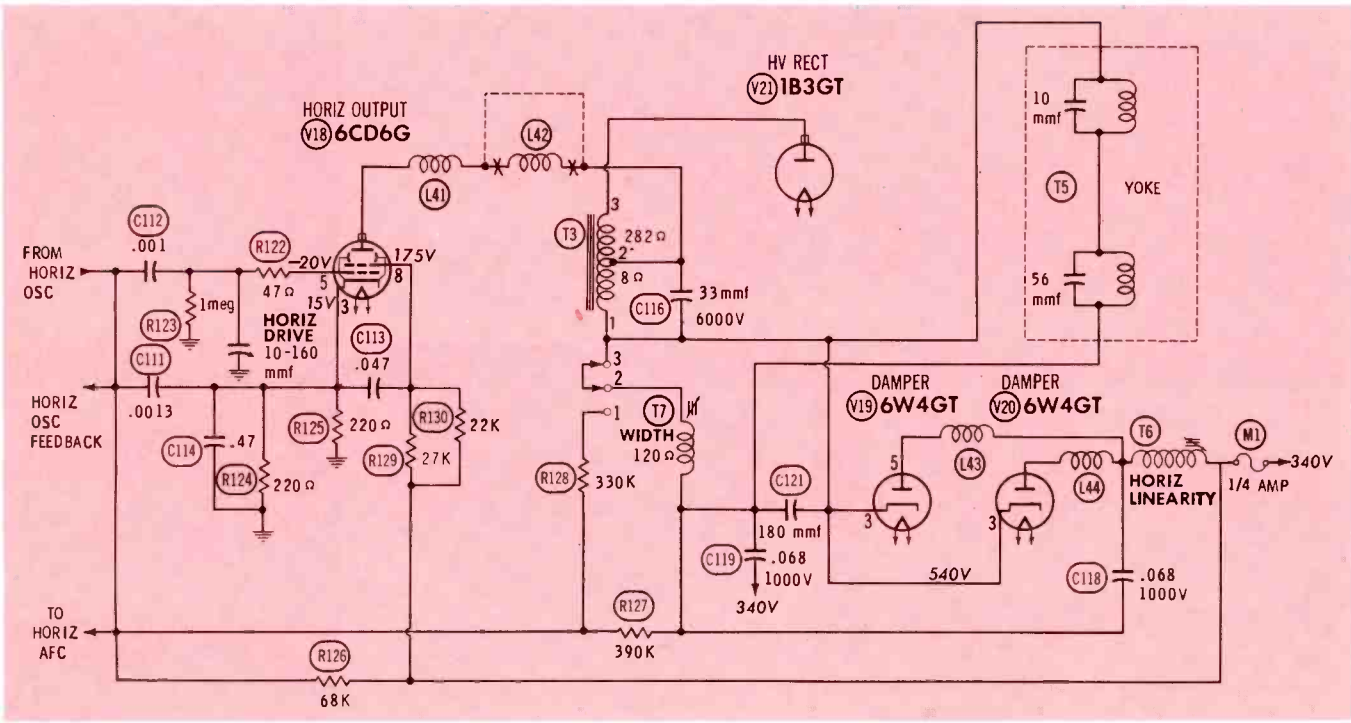

Fig. 1. Schematic of direct drive horizontal sweep circuit used in RCA Chassis KCS81F.

What Does F.C.C. Mean To You?

What is the F. C. C.?

F. C. C. stands for Federal Communications Commission. This is an agency of the Federal Government, created by Congress to regulate all wire and radio communication and radio and television broadcasting in the United States.

What is an F. C. C. Operator License?

The F. C. C. requires that only qualified persons be allowed to install, maintain, and operate electronic communications equipment, including radio and television broadcast transmitters. To determine who is qualified to take on such responsibility, the F. C. C. gives technical examinations. Operator licenses are awarded to those who pass these examinations. There are different types and classes of operator licenses, based on the type and difficulty of the examination passed.

What are the Different Types of Operator Licenses?

The F. C. C. grants three different types (or groups) of operator licenses – commercial radiotelePHONE, commercial radioteleGRAPH, and amateur.

COMMERCIAL RADIOTELE*PHONE* operator licenses are those required of technicians and engineers responsible for the proper operation of electronic equipment involved in the transmission of voice, music, or pictures. For example, a person who installs or maintains two-way mobile radio systems or radio and television broadcast equipment must hold a radiotelePHONE license. (A knowledge of Morse code is NOT required to obtain such a license.)

COMMERCIAL RADIOTELE*GRAPH* operator licenses are those required of the operators and maintenance men working with communications equipment which involves the use of Morse code. For example, a radio operator on board a merchant ship must hold a radioteleGRAPH license. (The ability to send and receive Morse is required to obtain such a license.)

AMATEUR operator licenses are those required of radio "hams" – people who are radio hobbyists and experimenters. (A knowledge of Morse code is necessary to be a "ham".)

What are the Different Classes of RadiotelePHONE licenses?

Each type (or group) of license is divided into different *classes*. There are *three* classes of radiotelephone licenses, as follows:

(1) Third Class Radiotelephone License. No previous license or on-the-job experience is required to qualify for the examination for this license. The examination consists of F.C.C. Elements I and II covering radio laws, F.C.C. regulations, and basic operating practices.

(2) Second Class Radiotelephone License. No on-the-job experience is required for this examination. However, the applicant must have already passed examination Elements I and II. The *second class* radiotelephone examination consists of F. C. C. Element III. It is mostly technical and covers basic radiotelephone theory (including electrical calculations), vacuum tubes, transistors, amplifiers, oscillators, power supplies, amplitude modulation, frequency modulation, measuring instruments, transmitters, receivers, antennas and transmission lines, etc.

(3) First Class Radiotelephone License. No on-the-job experience is required to qualify for this examination. However, the applicant must have already passed examination Elements I, II, and III. (If the applicant wishes, he may take all four elements at the same sitting, but this is not the general practice.) The *first class* radiotelephone examination consists of F. C. C. Element IV. It is mostly technical covering advanced radiotelephone theory and basic television theory. This examination covers generally the same subject matter as the second class examination, but the questions are more difficult and involve more mathematics.

Which License Qualifies for Which Jobs?

The THIRD CLASS radiotelephone license is of value primarily in that it qualifies you to take the second class examination. The scope of authority covered by a third class license is extremely limited.

The SECOND CLASS radiotelephone license qualifies you to install, maintain, and operate most all radiotelephone equipment except commercial broadcast station equipment.

The FIRST CLASS radiotelephone license qualifies you to install, maintain, and operate every type of radiotelephone equipment (except amateur, of course) including all radio and television stations in the United States, and in its Territories and Possessions. This is the highest class of radiotelephone license available.

How Long Does it Take to Prepare for F. C. C. Exams?

The time required to prepare for FCC examinations naturally varies with the individual, depending on his background and aptitude. Grantham training prepares the student to pass FCC exams in a minimum of time.

In the Grantham *correspondence course*, the average beginner should prepare for his *second class* radiotelephone license after from 200 to 250 hours of study. This same student should then prepare for his *first class* license in approximately 75 additional hours of study.

In the Grantham *resident course*, the time normally required to complete the course and get your license is as follows:

In the DAY course (5 days a week) you should get your *second class* license at the end of the first 9 weeks of classes, and your *first class* license at the end of 3 additional weeks of classes. This makes a total of 12 weeks (just a little less than 3 months) required to cover the whole course, from "scratch" through *first class*.

In the EVENING course (3 nights a week) you should get your *second class* license at the end of the 15th week of classes and your *first class* license at the end of 5 additional weeks of classes. This makes a total of less than 5 months required to cover the whole course, from "scratch" through *first class*, in the evening course.

The Grantham course is designed specifically to prepare you to pass FCC examinations. All the instruction is presented with the FCC examinations in mind. In every lesson test and preexamination you are given constant practice in answering FCC-type questions, presented in the same manner as the questions you will have to answer on your FCC examinations.

Why Choose Grantham Training?

The Grantham Communications Electronics Course is planned primarily to lead to an F.C.C. license, but it does this by TEACHING electronics. This course can prepare you *quickly* to pass F. C. C. examinations because it presents the necessary principles of electronics in a simple "easy to grasp" manner. Each new idea is tied in with familiar ideas. Each new principle is presented first in simple, everyday language. Then after you understand the "what and why" of a certain principle, you are taught the technical language associated with that principle. You learn more electronics in less time, because we make the subject easy and interesting.

Is the Grantham Course a "Memory Course"?

No doubt you've heard rumors about "memory courses" or "cram courses" offering "all the exact FCC questions". Ask anyone who has an FCC license if the necessary material can be memorized. Even if you had the exact exam questions and answers, it would be much more difficult to memorize this "meaningless" material than to learn to understand the subject. Choose the school that teaches you to thoroughly understand – choose Grantham School of Electronics.

Is the Grantham Course Merely a "Coaching Service"?

Some schools and individuals offer a "coaching service" in FCC license preparation. The weakness of the "coaching service" method is that it presumes the student already has a knowledge of technical radio and approaches the subject on a "question and answer" basis. On the other hand, the Grantham course "begins at the beginning" and progresses in logical order from one point to another. Every subject is covered simply and in detail. The emphasis is on making the subject easy to understand. With each lesson, you receive an FCC-type test so you can discover daily just which points you do not understand and clear them up as you go along.

HERE'S PROOF that Grantham Students prepare for F.C.C. examinations in a minimum of time. Here is a list of a few of our recent graduates, the class of license they got, and how long it took them:

	License	Weeks
Hugh J. Stock, Box 446, Lander, Wyo.	1st	11
Orlie W. McCool, 414 W. South St., Neosho, Mo.	1st	12
Eugene R. Kraus, Moore Drive, Peru, N. Y.	1st	12
Robert E. Sullivan, 2475 E. Douglas, Des Moines, Iowa	1st	12
Jack Hughes, 101 4th Street, Sebring, Fla.	1st	22
Dennis K. Bingaman, R.D. #1, Dalmatia, Penna.	1st	14
Earl Howard Tolley, RR #3, Eaton, Ohio	1st	11
Victor B. Arroyo, 3633 Gangel Ave., Pico Rivera, Calif.	1st	20
Henry N. Wright, 160 Cedar Street, Springfield, Mass.	1st	12

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To better serve our many students throughout the nation, Grantham School of Electronics maintains four separate schools – located in Hollywood, Seattle, Kansas City, and Washington, D. C. – all offering the same resident courses in F.C.C. license preparation. (Correspondence courses are conducted from Hollywood.)

For further details concerning F.C.C. licenses and our training, send for our FREE booklet, "Careers in Electronics". Clip the coupon below and mail it to the School nearest you.

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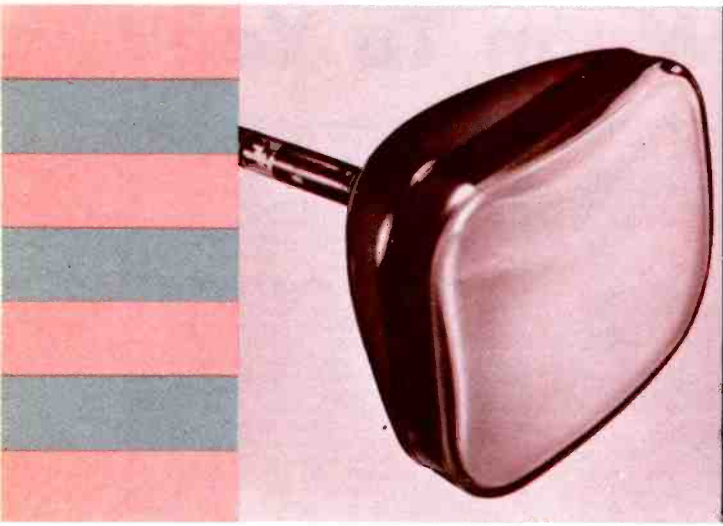

Selecting a CRT Replacement

A guide for replacing picture tubes.

When a picture tube needs replacing, there's more to be considered than first meets the eye. For one thing, you're immediately faced with the public-relations problem of telling your customer he needs a new tube. While you're thinking up the solution to this problem, also get ready to answer a couple of questions your customer is going to ask: "How much will it cost, and how can I pay for it?"

The announcement that the CRT needs replacing may strike an intolerable blow at family finances. In these cases, you'd better be prepared to offer some means of financing the job.

On the other hand, you may find the customer willing and able to have the tube replaced. In fact, national advertising may have prepared him so well for this day that he will tell you, "OK, I want a Brand XYZ." This, too, may prove to be a problem. Undoubtedly you have one or two "pet" brands you'd prefer to install, or perhaps it's inconvenient or even impossible to obtain Brand XYZ in your area.

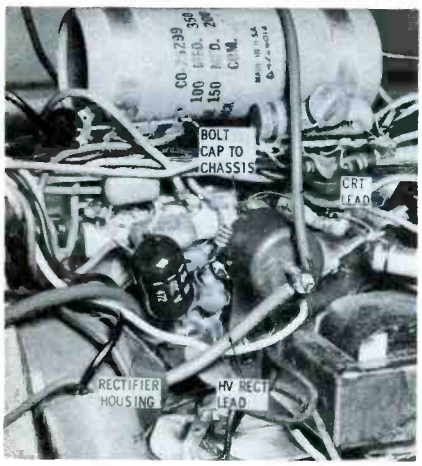

Fig. 1. CRT substitution may involve the addition of a high-voltage filter.

Another customer may say, "I want one of those aluminized replacements." Good news, you may think. But when you get ready to quote a price, don't overlook the possibility that you may have to make some minor revisions in the set.

Then, of course, you'll encounter those situations where the original tube type isn't available for replacement. It may be one your distributor doesn't stock because of insufficient demand, or one that is no longer manufactured. What then?

We've purposely called your attention to these points because you will need to consider them from time to time when selecting a CRT replacement. Fortunately, however, most picture tubes in use are readily available, most brands are easily obtained, and most aluminized tubes can be interchanged with "plain" types without modifications.

Tube Substitutions

One of the easiest ways to get around many CRT-replacement problems is to be fully aware of what can be accomplished through tube substitution. If you are hesitant about using anything except the original type, you may not realize how easily many CRT's can be interchanged.

When you consider using a substitute tube, it's best to turn to some form of interchangeability data for assistance. CRT-substitution guides are provided by tube manufacturers and independent publishers for this very purpose. The picture-tube substitution chart included in this article, although restricted to the most frequently-needed types because of space limitations, contains all the pertinent information for substituting 162 different CRT types. The substitutes are listed from left to right in order of preference. Most of the types listed are directly interchangeable; however, some carry reference notes to indicate minor changes that may be required before the substitute tube will work satisfactorily. Don't let these notes scare you away from a job or cause you to lose a customer! Let's take a close look at them and see what they mean.

Omit ion trap simply means you take the ion trap off the original and omit it from the replacement.

Add ion trap means you're replacing an aluminized tube with a non-aluminized type. In order to determine what style of ion trap you'll need, look inside the neck of the

• Please turn to page 66

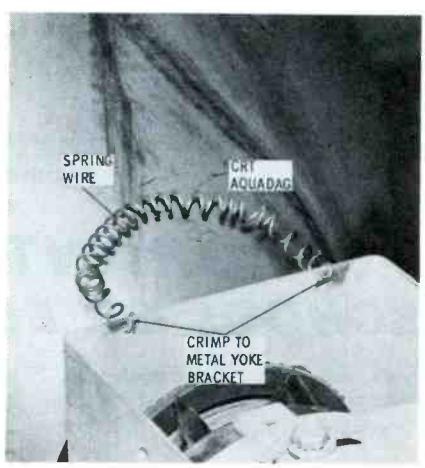

Fig. 2. Improvising a ground for the aquadag coating is no real problem.

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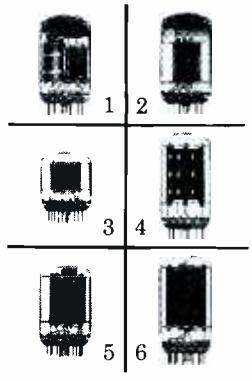
CIRCUITRY. COMPACTRON devices package a combination of functions into a single miniature envelope. The result: fewer components, less space per function, more compact circuitry than is possible with miniature tubes—and higher power output, greater sensitivity than transistors. Circuits with COMPACTRONS require fewer sockets and clips. Twelve stem leads serve as rigid mounting pins which can be inserted directly into clips on simplified circuit boards. Large ¾-inch diameter pin circle reduces clustering of associated components.

SERVICE. As more and more equipment with COMPACTRON devices comes on the market, you're the man who will need the answers to your customers' service and replacement needs. Equipment with COMPACTRONS offers the appeal of miniaturization plus the advantages of vacuum device reliability. Compatible functions in one envelope mean fewer components and plug-in replacement with no time-consuming hand selection of replacements.

SALES. You have a stake in COMPACTRON devices because your future replacement sales will include these revolutionary new multi-function devices. Six COMPACTRON types are now in production: *For table radios*—(1) Combined oscillator, converter and intermediate frequency amplifier; (2) Combined second detector, audio amplifier, audio output amplifier and rectifier. *For television*—(3) Horizontal oscillator and automatic frequency control; (4) Horizontal damping diode (single diode); (5) Vertical deflection amplifier and oscillator; (6) Horizontal deflection amplifier. Nine other types are committed to production and approximately 40 more are being developed now.



For more information about America's newest electronic marvel, contact your G-E tube distributor. Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.

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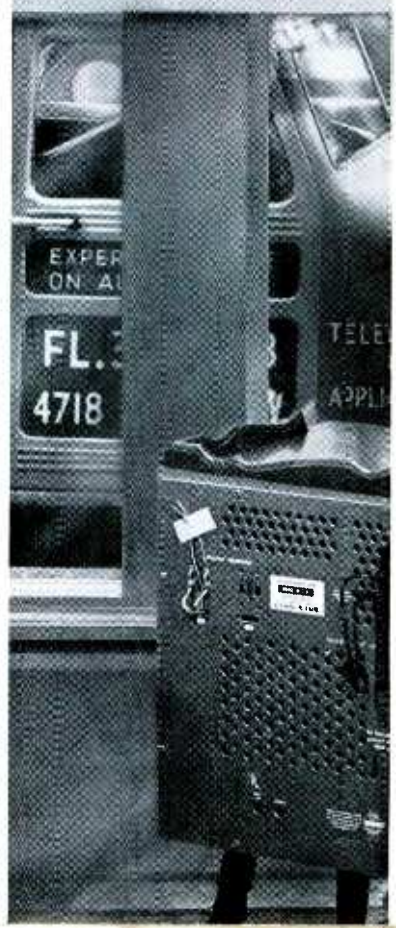
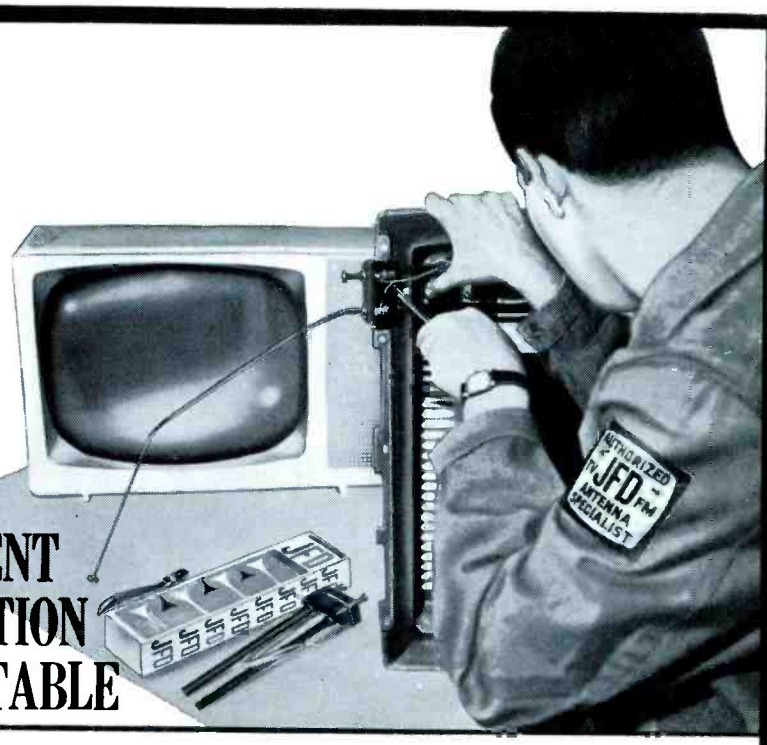


new COMPACTRON devices

TV sets ever

PICTURE OF A SERVICE-DEALER MAKING A $6.90 PROFIT IN 6 MINUTES WITH A JFD EXACT REPLACEMENT TV ANTENNA INSTALLATION FOR GE DESIGNER PORTABLE



The Place: Almost any service shop

The Time: Any time between 8 A. M. to 6 P. M.

The Product: JFD EXACT REPLACEMENT NO. TA362 (GE dipole) *one of 62 JFD O.E.M. antennas for portable TV sets now available from your local JFD distributor.*

The Facts: JFD TA362

Your actual selling price (no phony lists)	$9.75
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Profit on sale	3.90
Installation charge	3.00
TOTAL PROFIT	$6.90

You earn a double profit: a full mark-up profit on the antenna sale—and a profit on the installation. Your customer gets the antenna that's built precisely for his set—you get rid of low-profit "rabbit ears" and the cut-throat competition that goes with them.

The Aids:

Complete listings in SAMS Photofact folders...plus exclusive Exact Replacement Antenna Guide for portable and toteable TV's (printed by the Howard W. Sams & Co., Inc.) provide you with finger-tip reference data. See your JFD distributor for your aids or write direct to *JFD*.

The Moral:

Get your JFD PA500 and PA515 Exact Replacement Kits today from your JFD distributor and start earning yourself a fair share of the 3,500,000 dollar-portable antenna replacement market. Remember, next to receiving tubes, the antennas of portable and "tote-able" sets require the most frequent replacement.

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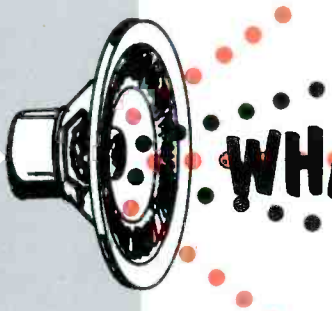
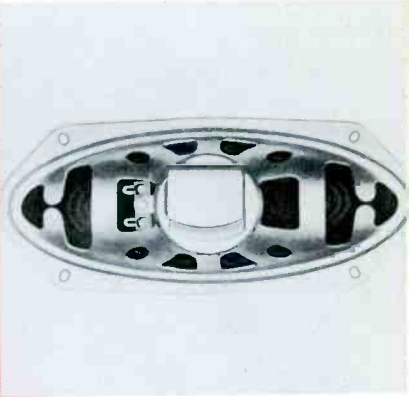


WHAT YOU SHOULD KNOW ABOUT SPEAKERS

Everywhere you look these days you see loudspeakers. Since they are used in such a wide range of applications, there are a multitude of types with different power ratings, frequency response, cone characteristics, voice-coil impedances, and dispersion patterns. All these factors enter the picture when you're selecting a speaker for replacement or making an initial installation. This comprehensive coverage explains why certain speakers are best suited for specific jobs.

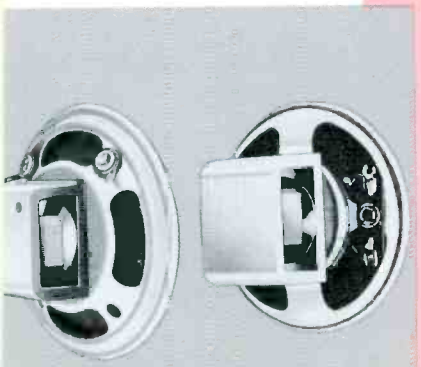
Most radio and TV receivers have an audio output of 3 to 5 watts and use 3″ to 8″ speakers of various shapes. Replacements with 3.2-ohm voice coils and a .7-oz. **Alnico V** magnet are generally considered standard for this class of service. However, some sets use more expensive 10″ and 12″ units.

Auto radios have 8- to 10-watt outputs and demand speakers more rugged than home-radio types. Heavier cones and 1.5- to 3-oz. magnets are common in these units. While the familiar 6″ x 9″ size predominates in this field, it is giving ground to other sizes and shapes.



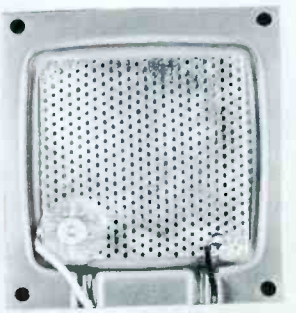
The demand for installing rear-seat speakers in automobiles can be met most easily with kits. Generally, these include a suitable oval speaker, a matching grille, "front/rear/both" speaker-selector switch (or fader potentiometer) for dash mounting, connecting wires or cables, and mounting hardware, together with wiring instructions.

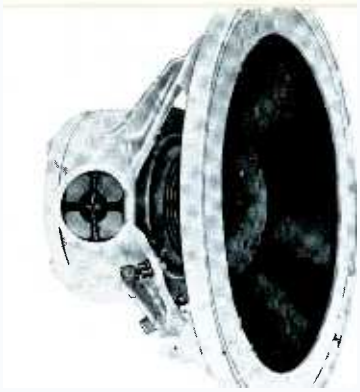
Most home-entertainment hi-fi systems use tweeters (speakers with a frequency response of about 2000 cps to 15-20,000 cps to reproduce the high notes). Although some tweeters look like small general-replacement speakers, most units are characterized by special features such as stiff, lightweight cones and 16-ohm voice coils.



Transistorized portable radios, with outputs of only .25 to 1.5 watts, have 2″ to 3″ speakers with extremely shallow frames. When you're selecting a replacement, pay particular attention to the output circuit of the set. Some designs use a transformer and require speakers with 3.2-ohm voice coils, while others have direct-drive circuits and demand special speakers with an impedance of 100 ohms or more.

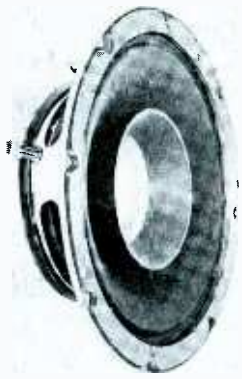
The electrostatic speaker is a special breed of tweeter consisting of two flat or curved plates separated by a flexible dielectric. A modulated DC potential is applied across the plates to produce sound. If necessary, you can replace an electrostatic unit with a conventional tweeter by simply connecting it in series with a crossover capacitor across the secondary of the output transformer.





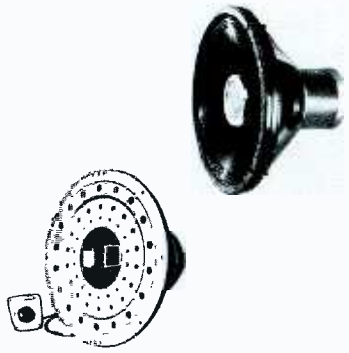
Woofers used in hi-fi systems have special cones with a frequency response of approximately 40-4500 cps. Most units have 3-8 lb. magnets and 8- or 16-ohm voice coils. Sizes range from 8" to 30", with 12" and 15" being the most common. However, in selecting a replacement, remember that not all speakers in this size range qualify as woofers.

Most midrange speakers for home hi-fi are 8" in diameter, but a few 6" and 10" versions exist. Their limited frequency response (example: 300-6000 cps), intended to bridge the gap between woofer and tweeter ranges, sets them apart from general replacement types. Most have 8- or 16-ohm voice coils and power ratings of 12-40 watts.



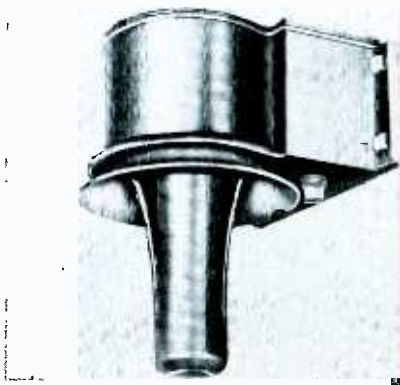
Extended-response or full-range speakers used in less expensive hi-fi installations are similar to midrange types except for their 60-15,000 cps frequency response. Special cones, stiffer in some areas than in others — or cones of special materials— will help identify this class of speaker.

Hi-fi systems often use a coaxial speaker to save cabinet space and to disperse all frequencies from a single point. Some of these easily-identified units employ one voice coil to drive a complex cone, while others have a separate tweeter and crossover network.



Many horns used in public address applications are two-piece units, with the voice coil and magnet housed in a detachable driver. However, one-piece horns are gaining popularity because of advantages such as lower price. Both integrated and two-piece types have similar electrical ratings—for example, outputs of 10-100 watts and frequency response of 75-7000 or 100-10,000 cps.

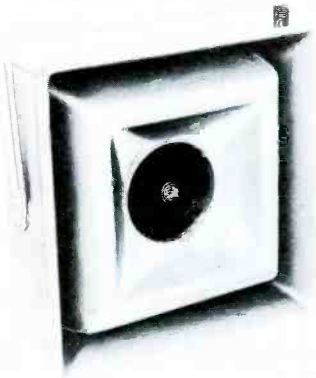
Some PA horns are hermetically sealed for installation in explosion-proof wiring systems or where there is a possibility of water damage. Designed for speech use, they normally have a 120°-360° directional characteristic, 16-ohm voice coil, 200-10,000 cps frequency response, and output rating of 15-30 watts.



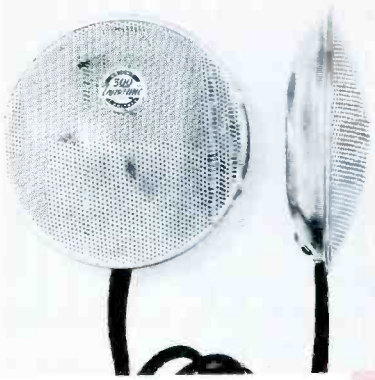
Paging speakers can also serve as microphones. Frequency response may be broad enough to permit use in combined intercom and background-music systems. Power ratings vary from 5-40 watts — depending on size. Most are single re-entrant horns, but special units may be used for bi-directional coverage.

Some cone-type speakers are designed specifically for use in intercom systems. A relatively narrow frequency response (for maximum intelligibility of speech) is an important characteristic of such speakers, which commonly have 3- or 4-ohm coils and 5-watt output.

Applications outdoors and in large industrial areas call for re-entrant horns with sound-dispersion patterns selected to provide adequate coverage without setting up echoes. Round horns are normally used to direct sound to a smaller area at a greater distance, while fan-shaped horns provide a wider dispersion pattern.



Some background-music systems require hi-fi horns with a frequency response of 60-18,000 cps. Large or noisy areas demand powerful (15- to 30-watt) speakers, while smaller (5-10 watt) units are better suited for locations such as lobbies, churches, etc.

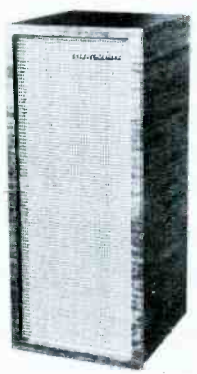


Although "personalized listening" once meant "earphones," accessory speakers are now available which can be slipped under a pillow or placed right next to the listener's ear. These units can be connected directly into the speaker circuit of home-entertainment equipment, and also used as a microphone.

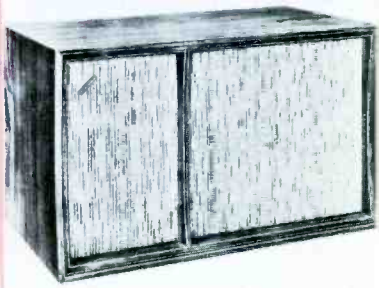
Small, weatherproofed speakers resembling those found in radios and TV's, housed in enclosures designed for hard use, are used in drive-in theaters and restaurants. Speakers of this type with a "push-to-talk" switch usually have a voice-coil impedance of 13 or 45 ohms to permit two-way operation.

Speakers used in aircraft applications must be light in weight and compact in size. Most have a 30-ohm voice coil and are moistureproofed to guarantee long service. Types with 3-5 watt output, used as intercoms between crew positions, replace separate microphones and conventional speakers to save weight.

Hi-fi speaker enclosures usually contain two, three, or more speakers with their associated crossover networks. The design of the enclosure depends largely on the characteristics of the woofer. The number and type of speakers govern the over-all frequency response. pedance of 100 ohms or more.



Some form of enclosure or baffle is required for cone-type speakers. The most elaborate of these, employed in hi-fi systems, must be acoustically balanced. These sometimes include unusual designs to disperse the sound in a particular pattern or extend bass response. Cone-type speakers for low-power PA, background-music, or intercom systems are often flush-mounted and covered by a decorative wall plate.



the service dealer

A candid report covering sales, installation, and maintenance opportunities in this field . . . by Joe A. Groves

Citizens band radio is growing like a weed. From its beginning in the fall of 1958, this new communications service has continually gained acceptance in both commercial and consumer markets. In 1960, the FCC processed and granted an average of over 300 new licenses a day for a total of around 110,000. Predictions for this year indicate there will be 150,000 new grants—each for a bare minimum of two transceivers! Figuring a conservative $100 per unit, this adds up to roughly $30 million in CB transceiver sales. With additional revenues from accessories and installations, CB represents one of the most lucrative markets ever offered to the service dealer.

Just where does the electronics service dealer fit into the CB picture? To answer this question, we interviewed CB manufacturers, distributors, and service dealers throughout the nation for firsthand reports on the status of CB in mid-1961.

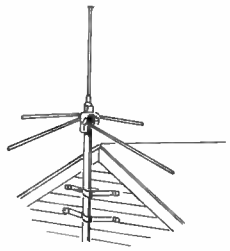
Two Markets

One of the first things we found was a distinct division of the CB field into two different markets. One consists of radio enthusiasts and industrial users, while the other includes the far larger areas of small business and the general public.

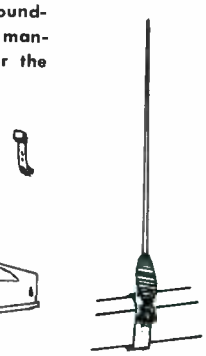
When the Citizens band was first allocated, radio hobbyists and industrial users showed immediate interest. With no other source of supply open to them, these people naturally contacted their local distributors in an attempt to obtain the new CB equipment. Once they obtained this gear, they either installed it themselves or found some electronics serviceman who would do the job for them.

As the demand for CB equipment increased, distributors attempted to set up CB dealers among their regular accounts. This proved an almost impossible job. Unfortunately, the vast majority of service dealers who were contacted didn't want to take time away from their daily activities to promote, sell, and install this new electronic equipment. This was no new reaction for the distributor. He had seen the same thing happen with commercial sound equipment, and again in the area of component hi-fi equipment—both of which had been rejected by the average service dealer *until* the mass market had developed.

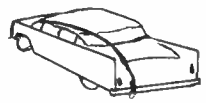
Some dealers, however, became aware of the sales potential offered by CB, and set about to get into the market. Since CB was still being sold predominantly to hobbyists and industrial users, these more aggres-

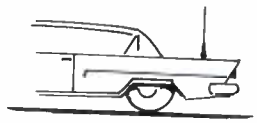


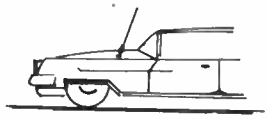
Base stations generally use a ground-plane antenna mounted in the same manner as a TV antenna. List prices for the antenna range from $25 to $50.



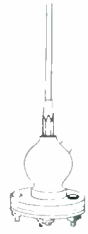
Most popular mobile antenna is 102" whip mounted in various ways. Complete kits normally list for around $30.







Special "loaded" antennas for mounting to fender, trunk, or roof are available for mobile use and list for around $25 complete.



Marine installations require slightly different antenna and special weather-resistant mounts. 108" whips and special ground-plane antennas are available. List is around $30 to $35.

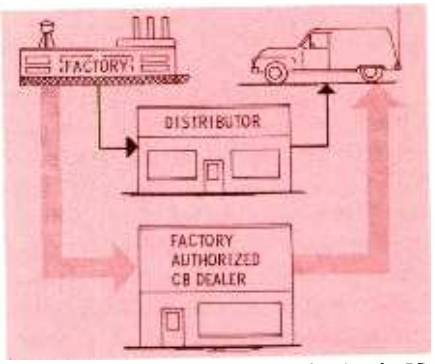
and the CB market

sive dealers were confronted with an existing market situation which demanded that equipment be sold at dealer-net prices. How to make a profit on equipment as well as on installation and accessory revenues became an issue of primary concern. The solution to this problem came about as CB manufacturers solved a problem *they* were facing.

Someone had to service the equipment. Since distributors had been unable to interest the electronics servicing industry in selling the sets, would it accept this new challenge? Early indications pointed to an unhealthy "No," and brought forth speculation that CB might have to be handled in much the same way as other two-way communications equipment.

Obviously, the regular distributor couldn't be held responsible for servicing the equipment—his primary purpose was to set up dealers who would take on this job in addition to sales. Therefore, the factory-authorized CB dealer came into being.

Most factory-authorized service stations have to meet certain basic requirements. These normally include a second-class radiotelephone license, necessary test equipment, and an investment of $50 to $80 for a minimum stock of specialized replacement parts. In turn, the manufacturer supplies service data, exclusive distribution of replacement parts, plus full privileges of selling at retail. (While the latter isn't true in every case, it is the most common arrangement.) This places most factory-authorized service stations in an unusually favorable marketing situation.



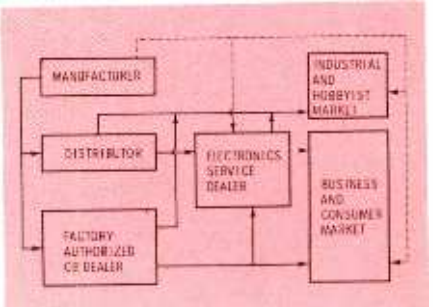
By establishing factory-authorized CB dealers, the manufacturer provided the interested technician with an "in" for the profitable sale of CB transceivers, and obtained badly-needed field-service facilities.

How CB is Marketed

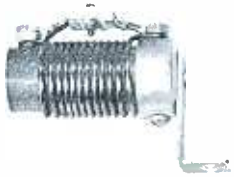
Citizens band equipment reaches the ultimate user by three normal channels. Most of the gear is marketed through one- and two-step distribution systems, while a small percentage of the equipment (predominantly kits) is supplied directly from the manufacturer to the user.

A glance at the complex CB distribution pattern reveals the enviable

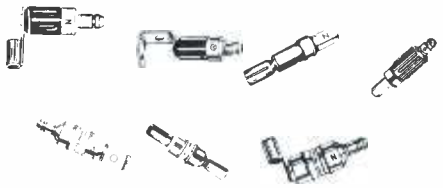
• *Please turn to page 71*



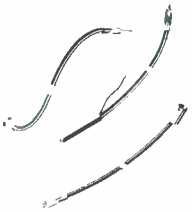
This marketing pattern shows the prominent place of the service dealer (factory-authorized or otherwise) in the merchandising system which has evolved for CB.



Special inductance-type suppressors are used to remove generator noise when CB gear is installed. List price is around $6 to $9.



Carbon and wirewound suppressors are used to eliminate ignition noise. Other suppressors in special mounts eliminate noise from gauges, switches, etc. List prices ranges from 75c to $1.25 each.



Antenna leads and extensions are available in lengths ranging from 1′ to 23′. Prices range from $1 up; 10′ to 15′ leads, at $5 to $6, are most often used.

Special connectors designed to adapt antenna leads to various types of connections list from 75c for the simplest designs to over $5 for complex right-angle types.

NEW DESIGNS

NOISE INVERTERS IN ACTION!

By Thomas Lesh

A growing number of the latest TV chassis designs include a noise inverter or canceller in the sync section. This feature is basically not new, since versions of it are found in even some of the oldest TV sets; however, it remains one of the least-understood of all television circuits. A moderate malfunction of a noise inverter can easily be overlooked or blamed on other stages, because the usual test procedures do not give a true picture of the inverter's dynamic operating conditions. This circuit is intended to function only in the presence of noise pulses having a greater amplitude than the video signal, and the only positive check on its action is to feed in a weak, noise-ridden signal and examine the results with a scope.

To meet this requirement, a number of the waveforms in this article were obtained from a fringe-area signal full of impulse-noise interference from a small electrical appliance. Practically the same effect is produced by other types of noise such as arcing in neon signs, ignition interference, or atmospheric static.

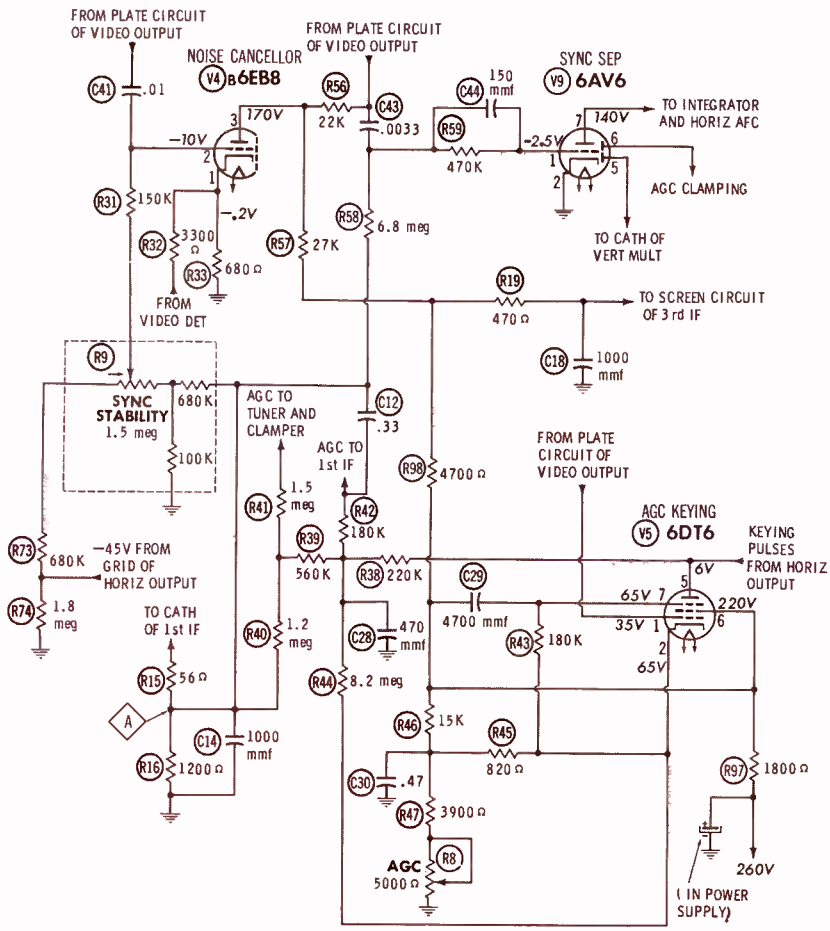


Fig. 1. RCA Chassis KCS131 has noise-inverter triode and 6DT6 AGC tube.

Why Noise Inversion?

The primary purpose of modern noise-cancelling circuitry is to increase the effective sensitivity of the receiver by providing a more stable picture, with greater contrast, in fringe areas. The inverter clips random noise pulses out of the sync-separator input signal, thus preventing these "false sync pulses" from traveling through the sync section and triggering the sweep oscillators at odd intervals. In many recent designs, the noise-cancelling action has also been extended to the AGC system. This feature compensates for any increase in the peak amplitude of the AGC-input signal due to impulse-type noise, thereby preventing the development of excessive AGC bias voltage. Normal contrast is then maintained in spite of noise, and sync stability is further improved by protecting the sync-input signal against undue fading and attenuation.

RCA Triode Circuit

In the RCA Chassis KCS131 and -2 (Fig. 1), a triode section of a 6EB8 serves as a noise canceller. Waveforms involved in its operation are shown in Fig. 2; normal, noise-free signals are displayed in the upper row of photos, while those in the lower row are weak and full of noise. In several of the latter group, the scope brightness was turned unusually high to capture the noise pulses, which are nonrecurring signals and thus leave only a faint trace. All photos were taken at a scope-sweep rate of 30 cps with the aid of a low-capacitance probe.

The grid of noise canceller V4B receives a composite video signal of only 4 volts peak to peak (Fig. 2A) from a voltage divider in the plate circuit of the video output stage. Meanwhile, a signal of opposite polarity (Fig. 2B) is obtained from the video detector and fed to the cathode of V4B. A voltage divider consisting of R32 and R33 reduces the signal amplitude to about 1 volt peak to peak, and also lets only a small proportion of the DC detector voltage appear at the cathode. Both signals are of such polarity that the tips of the sync pulses would be expected to drive V4B into conduction; however, a high grid bias is maintained to insure that the tube will remain in cutoff at all times during noise-free reception. This bias is obtained from the grid circuit of the horizontal output tube through the SYNC STABILITY control.

The plate of V4B is coupled to the video output stage through R56; therefore, a 20-volt signal (Fig. 2C) appears at pin 3 of the 6EB8 even though this tube is not conducting. Substantially the same signal is fed to the grid of sync separator V9 through C43. The separator circuit operates in a conventional manner, and a clean sync-pulse signal of 40-volt amplitude (Fig. 2D) appears at the plate of V9.

When the video signal contains strong noise interference, random-frequency pulses extend beyond the sync-tip level in both the grid and cathode signals of V4B (Figs. 2F and 2G, respectively). Each noise pulse causes a short burst of conduction in V4B, and the resulting negative-pulse signal at the plate is mixed with the signal coming from the video output stage. The positive noise pulses in this main input are then replaced by negative pulses, or at least "chopped off" near the base (Fig. 2H).

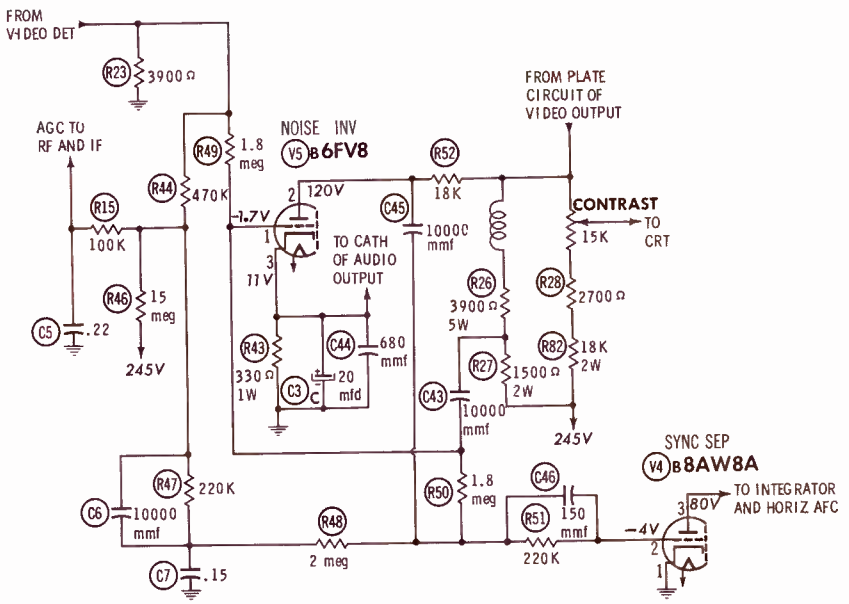


Fig. 3. Westinghouse V-2384-15 has different version of triode circuit.

The keyed AGC circuit in Fig. 1 has its own form of noise cancellation, which is used to supplement the action of V4B. A 6DT6 tube, ordinarily employed only as a sound detector, is used in this chassis as an AGC keying tube in order to take advantage of the sharp-cutoff characteristic of the suppressor grid.

The cathode, control grid, and plate circuits operate the same as in other keyed systems. However, the screen circuit includes unbypassed resistors R46 and R97, and a small signal (Fig. 2E—2 volts peak to peak) is developed across this parallel AC circuit. Any positive noise pulse occurring in the control-grid signal will cause a momentary increase in screen current, thus forming a sharp negative pulse in the screen waveform (Fig. 2J). This signal, fed through R98 and R57 to the plate of V4B, makes a small contribution to noise cancellation in the sync-input circuit. In addition, it is coupled through C29 to the sup-

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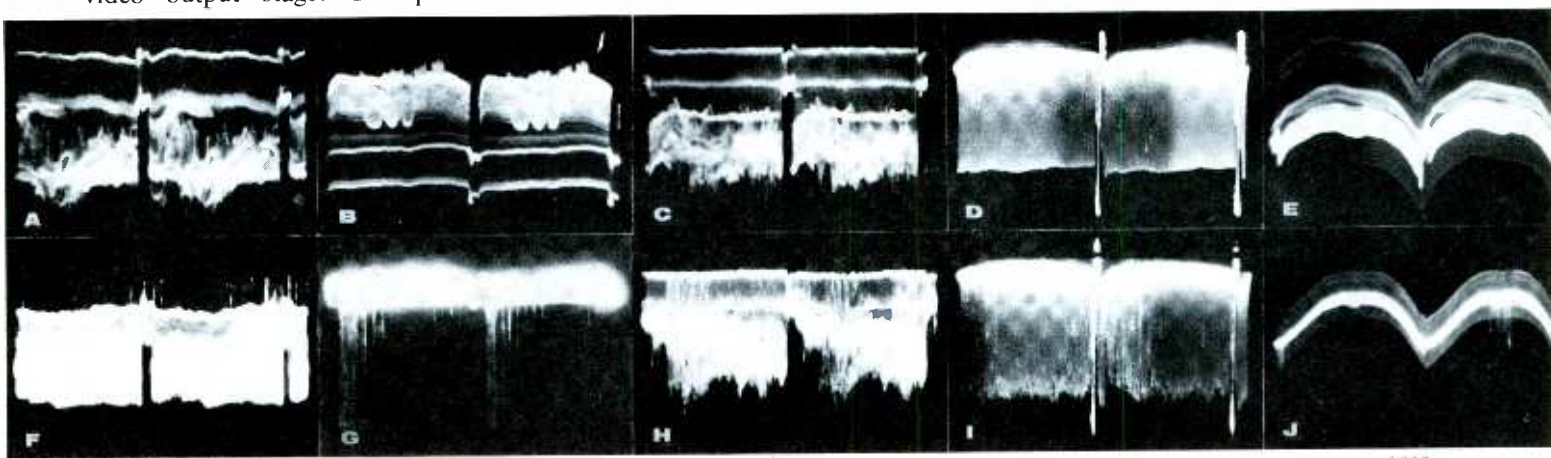


Grid of V4B. Cathode of V4B. Grid of V9. Plate of V9. Screen of V5.

Fig. 2. Waveforms in RCA noise-inverter circuit with normal signal (upper row) and noisy signal (lower row).

STOCK GUIDE FOR TV TUBES...

The tube types listed on this page should account for over 90% of your tube-stock requirements. To keep the chart down to a manageable size, about 100 of the rarest type numbers have been omitted; however, PF REPORTER will keep you informed on these rare types and where they are used.

Two columns of figures are listed along with the type numbers in the chart. The first column is purely a matter of statistics; if you took a cross-section sampling of 1,000 tubes from all TV sets now in service, you could expect to find the stated number of tubes of each type. This column of figures, as it stands, is naturally not a suggestion to stock the exact number of tubes listed. The statistics should be combined with your own experience to produce information tailor-made to your own needs. Here are three factors to be considered:

1. Relatively high failure rate of certain types such as power output tubes.
2. Specialization in certain makes of sets, such as regional brands.
3. Average age of those sets which contain a particular tube type.

The second column, marked "Caddy Stock," lists a suggested assortment of 350 tubes to be taken on home calls. With this stock, the serviceman can make several calls in succession while minimizing the risk of being "caught short."

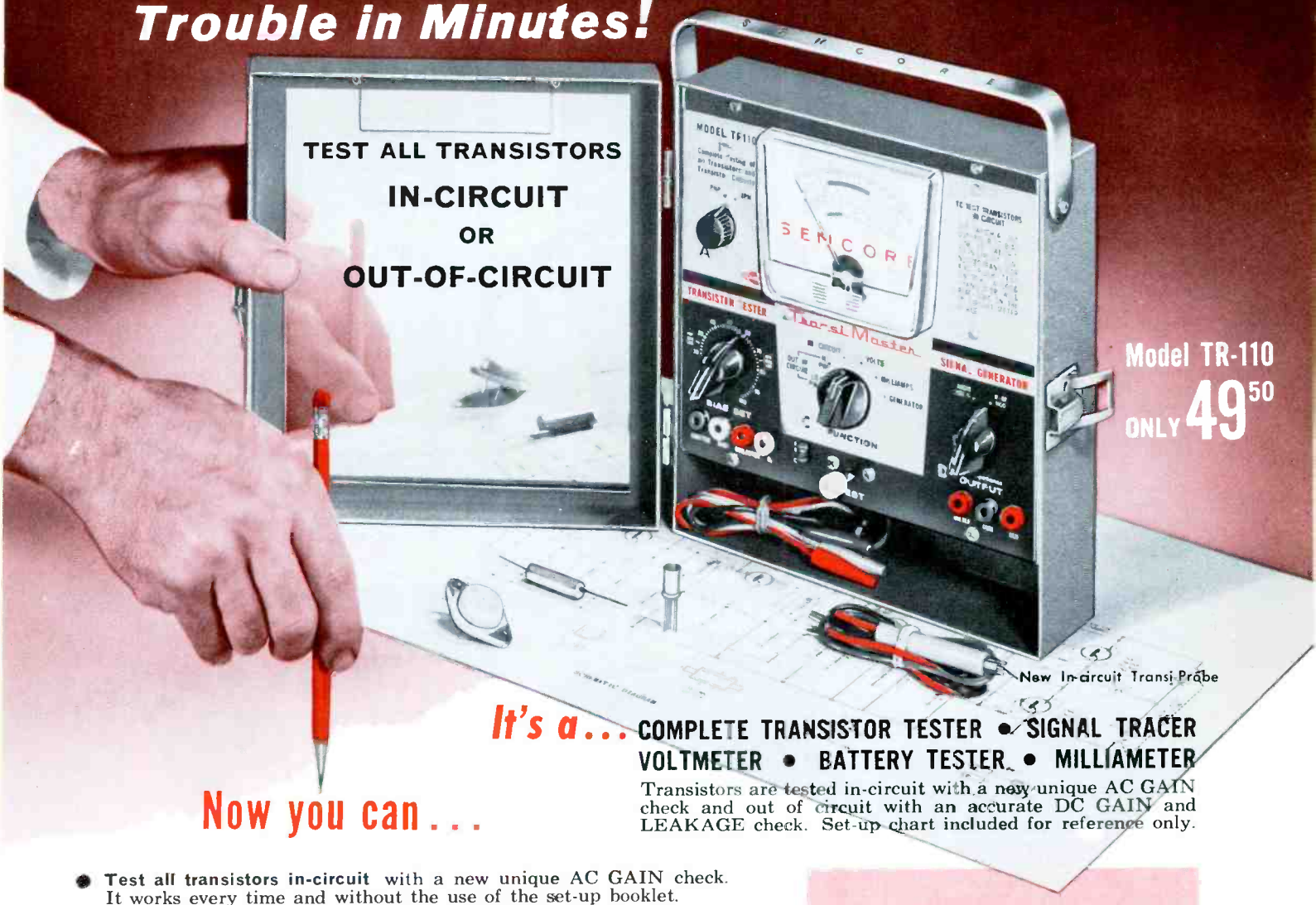
Keep yourself informed of trends toward increased or decreased use of various tube types. This is easy to do by comparing the current *Stock Guide* with the previous edition in the October, 1960 issue.

*Note: *means 450-ma series-string tube.*

PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE
31	3	1B3GT	1	1	5BW8	6	3	6BK7A/-B*	2	1	6DN7	1	1	8GN8
10	2	1G3GT	2	2	5CG8	3	2	6BL7GT	16	3	6DQ6B	1	1	*9AU7
4	1	1J3	2	2	5CL8A	2	2	6BN4	2	1	6DR7	1	1	9BR7
1	1	1K3	1	1	5EA8	7	2	6BN6	1	1	6DS5	2	2	10DE7
1	1	1S2A/DY87	1	1	5EU8	2	2	6BN8	1	1	6DT5	1	1	10EG7
7	2	1X2B	1	1	5GH8	5	2	6BQ5	7	2	6DT6	1	1	12AF3
2	2	2BN4	1	1	5J6	11	3	6BQ6GTB	1	1	6EA7	6	3	12AT7
3	2	2CY5	2	1	5T8	11	3	6BQ7A	6	2	6EA8	20	3	12AU7/-A
1	1	2EN5	36	3	5U4GB	1	1	6BR8A	3	1	6EB8	1	1	12AV5GA
1	1	2FH5	6	3	5U8	1	1	6BS8	1	1	6EM5	1	1	12AV7
2	1	3A3	2	1	5V3	5	2	6BU8	1	1	6EM7	8	2	12AX4GTB
2	1	3AL5	1	1	5X8	1	1	6BW8	2	1	6ER5	4	3	12AX7
4	2	3AU6	2	2	5Y3GT	1	1	6BX7GT	1	1	6ES5	1	1	12AZ7A
1	1	3BC5	1	1	6AB4	3	2	6BY6	2	1	6ES8	1	1	12B4A
3	2	3BN6	2	2	6AC7	1	1	6BY8	1	1	6EU8	8	3	12BH7A
4	2	3BU8	1	1	6AF3	24	3	6BZ6	1	1	6EV5	1	1	12BQ6GTB
19	3	3BZ6	3	2	6AG5	2	2	6BZ7	3	1	6EW6	1	1	12BR7
9	3	3CB6	1	1	6AG7	4	2	6C4	1	1	6EZ5	1	1	12BV7
2	1	3CS6	2	2	6AH4GT	78	4	6CB6	1	1	6FH5	10	3	12BY7A
1	1	*3CY5	3	2	6AH6	2	2	6CD6GA	1	1	6FM8	3	2	12C5/CU5
2	1	3DK6	1	1	6AK5	2	1	6CF6	1	1	6GH8	1	1	12CA5
6	2	3DT6	36	3	6AL5	32	3	6CG7	1	1	6GK6	1	1	12CU6
1	1	*4AU6	5	2	6AM8/-A*	6	2	6CG8/-A*	1	1	6GM6	2	1	12D4
2	1	4BC8	4	2	6AN8/-A*	2	2	6CL6	1	1	6GN8	1	1	12DB5
1	1	*4BN6	17	3	6AQ5/-A*	1	1	6CL8/-A*	1	1	6HJ8	8	3	12DQ6B
1	1	4BQ7A	3	2	6AS5	1	1	6CM6	1	1	6J5	1	1	12DQ7
1	1	*4BU8	1	1	6AS8	5	2	6CM7	13	3	6J6	1	1	12DT5
3	2	*4BZ6	2	2	6AT6	2	2	6CN7	4	2	6K6GT	1	1	12ED5
1	1	*4CB6	1	1	6AT8/-A*	2	2	*6CQ8	1	1	6S4A	1	1	12GC6
1	1	*4CS6	5	3	6AU4GTA	3	2	6CS6	1	1	6SL7GT	2	1	12L6GT
1	1	*4DE6	64	3	6AU6	1	1	6CS7	39	4	6SN7GTB	2	2	12SN7GTA
1	1	*4DT6	3	2	6AU8A	2	1	6CU5	2	1	6SQ7	1	1	12W6GT
1	1	4ES8	2	2	6AV5GTA	2	1	6CU6	10	2	6T8	1	1	*13DE7
2	1	4EW6	9	3	6AV6	1	1	*6CU8	14	3	6U8/-A*	1	1	*13DR7
3	2	5AM8	13	2	6AW8A	1	1	6CW4	1	1	6V3A	1	1	*17AX4GT
1	1	5AN8	26	3	6AX4GTB	2	1	6CX8	10	3	6V6GT/-A*	1	1	*17D4A
6	2	5AQ5	4	2	6BA6	2	2	6CY5	6	2	6W6GT	1	1	17DE4
1	1	5AS4	1	1	6BA8A	1	1	6CY7	6	3	6X8	2	1	*17DQ6B
1	1	5AS8	3	2	6BC5	1	1	6CZ5	2	2	7AU7	2	2	19AU4GTA
1	1	5AT8	2	2	6BC8	2	1	6DA4	1	1	7EY6	1	1	*22DE4
1	1	5AV8	4	2	6BE6	1	1	6DB5	1	1	*8AW8A	1	1	25AX4GT
1	1	5AU4	1	1	6BF6	2	1	6DE4	1	1	*8BA8A	1	1	25BK5
1	1	5B8	2	2	6BG6GA	5	2	6DE6	2	1	8BQ5	1	1	25BQ6GTB
1	1	5BE8	2	2	6BH8	1	1	6DE7	1	1	*8CG7	1	1	25CD6GB
1	1	5BK7A	1	1	6BJ8	2	1	6DG6GT	1	1	8CX8	1	1	25DN6
1	1	5BR8	1	1	6BK5	3	1	6DK6	1	1	8ET7	2	2	25L6GT

NEW SENCORE Transi Master

Analyze Every Transistor Circuit Trouble in Minutes!



Model TR-110
ONLY 49.50

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Transistors are tested in-circuit with a new unique AC GAIN check and out of circuit with an accurate DC GAIN and LEAKAGE check. Set-up chart included for reference only.

Now you can . . .

- **Test all transistors in-circuit** with a new unique AC GAIN check. It works every time and without the use of the set-up booklet.
- **Test all transistors out of circuit** with the AC GAIN check or with a more accurate DC current gain and leakage check.
- **Read current gain (beta) direct** for experimental, engineering work or for matching transistors.
- **Check diodes** simply and accurately with a forward to backward ratio check.
- **Signal trace** from speaker to antenna with a special low impedance generator. No tuning, adjustments, or indicating device needed for transistor radio trouble shooting. Just touch output leads to transistor inputs and outputs until 2000 cycle note is no longer heard from speaker. (Generator output monitored by meter.) It's a harmonic generator for RF-IF trouble shooting and a sine wave generator for audio amplifier trouble shooting.
- **Check batteries** under operating conditions as well as the voltage dividers with a special 12 volt scale.
- **Monitor current** drawn by the entire transistor circuit or by individual stages with a 0 to 50 Ma current scale. A must for alignment and trouble shooting cracked boards.

Benefit from these Sencore extras

- Lists Japanese equivalents.
- Automatically determines NPN or PNP.
- Mirror in detachable cover to reflect opposite side of printed board.
- Special clip to fit between batteries for current check.
- Transi-probe for making in-circuit transistor checks.

Color	modern two tone gray
Size	8" x 7⅝" x 3"
Weight	only 5 lbs.
Meter	0 to 3 Ma, 3½", 5% tolerance, modern plastic
Batteries	two size "C" cells

ALL PARTS ARE SENCORE® MADE IN AMERICA

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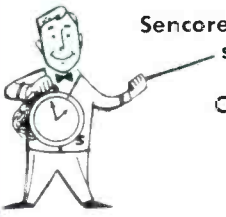

Sencore Sam says, "You'll save hours servicing transistor circuits. Only 49.50, see it at your distributor."

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TUBE CHECKER

Smaller than a portable typewriter . . . yet will outperform testers costing hundreds of dollars.

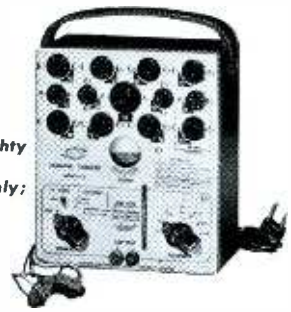
$59.50

A new dynamic approach to tube testing. Check over 1,300 tubes for cathode emission, grid emission, leakage, shorts and gas. A "mite" to carry but a whale of a performer that outperforms testers costing much more. New unique "stethescope" approach tests for grid emission and leakage as high as 100 megohms yet checks cathode current at operating levels. Special short test checks for shorts between all elements. The Mighty Mite will test every radio and TV tube that you encounter (over 1,300!) plus picture tubes. Set up controls as easy as "ABC" from easy to follow tube chart. New features: • Meter glows in dark for easy reading behind TV set. • Stainless steel mirror in cover for TV adjustments. • Rugged, all steel carrying case and easy grip handle. • Smallest complete tester made. Measures only 9" x 8" x 2½" and weighs just seven pounds.

It's a real money-maker

LC3 LEAKAGE CHECKER

Provides grid emission and leakage checks with the same sensitivity as the famous Mighty Mite but checks critical tubes only; 172 types



$28.95

Ask any serviceman who owns one . . . or try one for just one day of servicing. You'll see for yourself how much time the LC3 can save you. Checks for leakage between all elements, whether caused by gas, grid emission or foreign particles. Also checks leakage on all capacitors with voltage applied — including electrolytics. Provides instant filament checks in "Fil-Check" position—no need for a second filament checker. One spare pre-heating socket and new roll chart prevent obsolescence. New charts provided free. For 110-120 volts, 60 cycle AC.

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The Missing Link in TV Service . . .

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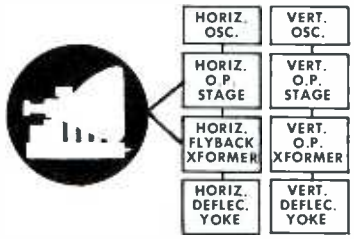
UNIVERSAL HORIZONTAL OSCILLATOR. For direct substitution. No wires to disconnect in most cases. Traces trouble right down to the defective component. Variable output from 0-200 volts, peak-to-peak. Oscillator will sync to TV sync signal giving check on sync circuits.

HORIZONTAL OUTPUT CATHODE CURRENT CHECKER. A proven method that quickly checks the condition of the horizontal output tube and associated components. Adaptor socket prevents breaking wires. Easily replaceable Roll Chart gives all necessary pin, current and voltage data. New Roll Charts are Free.

UNIVERSAL DEFLECTION YOKE. A new, simple way to determine yoke failure accurately—without removing yoke from picture tube. Merely disconnect one yoke lead and substitute. If high voltage (also bright vertical line) is restored, TV yoke is defective.

DYNAMIC FLYBACK TRANSFORMER CHECKER. Merely flip switch to "Flyback Check" and meter will indicate condition of flyback transformer, in degrees of horizontal deflection. Extremely sensitive and accurate; even shows up one shorted turn on flyback.

VOLTMETER. For testing bootstrap, screen and other voltages. Direct-reading voltmeter, 0-1000 volts.



UNIVERSAL VERTICAL OSCILLATOR. Checks oscillator, output transformer and yoke. Merely touch lead to component and check picture on screen.

SS105 is completely self-contained, nothing else is needed.

New, improved Circuit.

FC4 FILAMENT CHECKER

The ideal tool for servicing series string filaments.

$2.75

Purposely works off your cheater cord to give you a positive check on line voltage. Prevents checking all tubes to find that your trouble was no line voltage. Only checker that checks all tubes automatically and has no batteries to replace. Cost half that of battery operated testers. Patented.

FC4 with test leads for checking continuity or AC or DC Voltage **$2.95**

VB2 "VIBRA-DAPTOR"

Checks 3 and 4 prong Vibrators Faster and Easier . .

$2.75

Plugs into any tube checker; ideal for use with LC3 or the Mighty Mite. To check 6v. vibrators, set for 6AX4 or 6SN7; for 12 v. vibrators, set for 12AX4 or 12SN7. Two No. 51 lamps indicate whether vibrator needs replacing. Instructions on front panel. Steel case.

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Instantly tells you whether or not it is safe to replace fuse resistors, fuses, or circuit breakers. Separate red and green scale for each commercially available fuse resistor used in radio and TV. Eliminates guesswork, wasted time. Also handy for wattage checks up to 1100 watts at 115v.

$8.95

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You can own all these popular Time Savers for less than some Mutual Conductance Tube Testers!

For TRANSISTOR RADIO SERVICING

Everything you need for less than $50.00

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TRANSISTOR-RECTIFIER CHECKER

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Now lists Japanese equivalents

Checks Transistors, Diodes, Rectifiers . . . A transistor tester that is used by over 50,000 servicemen, engineers and experimenters from Coast to Coast. Recommended by TV and Radio manufacturers; used by such leading companies as Sears Roebuck, Bell Telephone and Commonwealth Edison. Tests indicate that the TRC4 will outperform testers costing many times more. The TRC4 tests all transistors for gain, leakage, and open or shorts. Simple to operate without set-up chart for service work and with set-up chart for more accurate checks. With batteries.

SENCORE PS103

BATTERY ELIMINATOR & TROUBLE SHOOTER

$19.95

Replaces Batteries During Repair . . . Replaces batteries during repair time of transistor radios and helps trouble shoot, too. For transistor radio servicing, experimenting and to charge nickel cadmium batteries. Dial output voltage from 0 to 24 volts DC and read on meter. Low ripple insures no hum or feedback problem. Meter reads from 0 to 100 MA. Shorted stage will cause current to read high as indicated on PF schematics; open stage will cause current to read low. To align transistor radio, tune in station signal and adjust IF slugs for maximum current. The PS103 is the only supply that will operate radios with tapped battery supplies; such as Philco, Sylvania, Motorola, etc.

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Finds Defective Stage in a Minute . . . Believe it or not. Just touch the output leads of the HG104 to inputs and outputs of transistors and a clear 1000 cycle note from speakers will tell you whether or not the stage is defective. Here is an unexcelled time saver, not a "pencil" gimmick. It actually works every time from speaker to antenna. Two leads and calibrated output (not found on pencils) are a must for speaker connection, grounding to prevent RF spray and front end checks. Also saves time when servicing HiFi, TV and radios. With life-time batteries.

Get all 3 ▶ **COMPLETE TRANSISTOR RADIO SERVICE LAB**

All 3 Time Savers shown above in handsome display carton carrying case

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$49.85

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Goodby to messy parts . . . the mess of soldering and unsoldering in testing.

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"HANDY 36"

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Substitute for Capacitors, Resistors . . . Provides the 36 most often needed resistors and capacitors for experimenting, substituting or testing. Eliminates searching for replacement components, unnecessary soldering and unsoldering and the mess it creates. Says goodbye to crumpled parts. Flick of a switch instantly selects any of: 24 Resistors from 10 ohms to 5.6 megohms, 10 Capacitors from 100 mfd to .5 mfd, 2 Electrolytics, 10 mfd and 40 mfd at 450 Volts. All components are standard American brand.

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Substitute for Electrolytic Capacitors . . . Complete, safe substitution . . . from the smallest electrolytics used in transistor radios to the largest used in costly Hi-Fi amplifiers. Contains 10 electrolytics from 4 to 350 mfd. Select correct value with the flick of a switch. Features automatic discharge, surge protector circuit. Prevents accidental "healing" of capacitor being bridged. Completely safe—no arc or spark when connecting or disconnecting. Usable from 2 to 450 volts, DC.

SENCORE RS106

RECTIFIER TROUBLE-SHOOTER

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Locate faulty Rectifiers, Diodes . . . This unique substitution unit simplifies trouble shooting rectifiers and diodes, gives you a positive check every time. Substitute for suspected rectifier or diode, watch picture or listen to sound and you'll know in seconds whether or not the rectifier or diode should be replaced. No guess work, soldering mess or time lost. The RS106 costs less than having loose rectifiers and diodes in the shop for testing and is worth many times more. A must for servicing voltage doubler circuits. Protected by a ½ amp. Slow Blow Fuse.

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SENCORE BE3 "ALIGN-O-PAK"

Eliminates messy batteries in TV service work. Handy for alignment, AGC troubleshooting or checking gated sync circuits. Dial the voltage you need, 0-18 volts, positive or negative. Completely isolated DC supply, less than 0.1% ripple. Covers all voltages recommended by TV set manufacturers and in Photo Fact schematics. For 110-120V, 60 cycle AC.

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NEW! POWER RESISTOR SUBSTITUTION SENCORE BIG 20 MODEL PR111

For all resistors up to 20 watts from 2.5 to 15,000 ohms. Covers all power resistors encountered in Radio, Hi-Fi and TV circuitry.

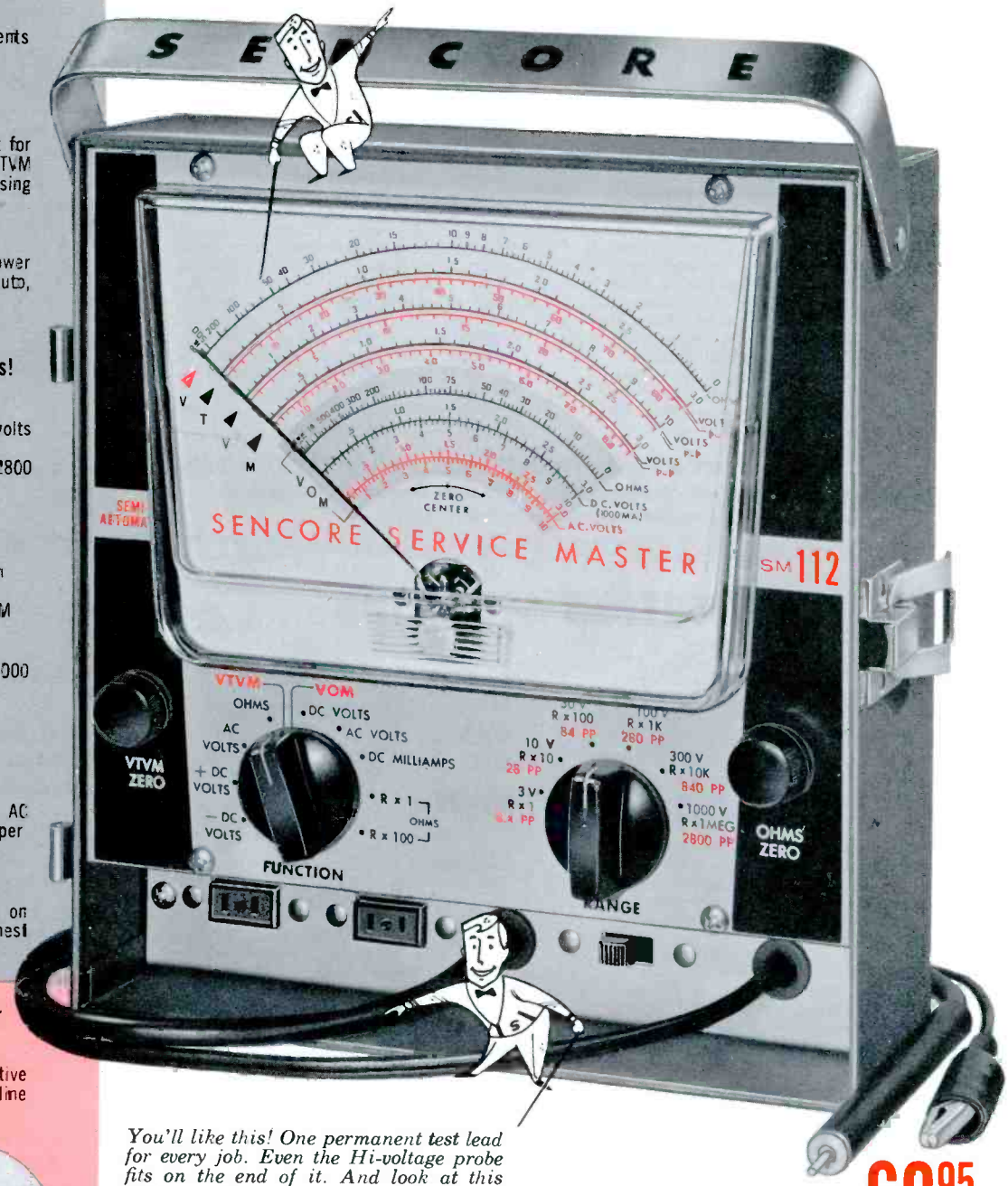
$12.75

Substitute for all questionable power resistors; determine values of burned out 2 and 4 watt carbon resistors, wire wound potentiometers, fuse resistors and resistor value in a hundred and one places in servicing and engineering. A great time saver in restoring circuit to normal fast so that you find the actual defective component. Each resistor stands up to 20 watts normal testing time. The Big 20 pays for itself the first month in time saved.

NEW From a deluxe VTVM to a VOM with the flick of a switch!

For the First Time in Electronic History . . . a VTVM with laboratory accuracy for bench, lab, or anywhere 115 volt AC current is available . . . flick the function switch and it's a portable VOM that you can use anywhere, anytime.

Look! Another Sencore first . . . automatic scale indication. What a time saver! Rotate the controls and watch the indicating lights follow you. You can't go wrong!



You'll like this! One permanent test lead for every job. Even the Hi-voltage probe fits on the end of it. And look at this storage compartment for test lead and line cord. The two 115 volt AC outlets sure come in handy on service calls!

Model SM112 Only 69.95

No more than a complete VTVM alone!

Ask your Sencore distributor for the New Combination VTVM-VOM – there is no other!

Typical examples where a VTVM performs best . . .

- minimum circuit loading
- very high resistance measurement
- measuring peak to peak voltage
- alignment, AGC trouble shooting or ratio detector touch up
- reading 2nd anode voltage
- transistor radio voltage measurements

Typical examples where a portable VOM is best . . .

- instant action when you can't wait for warm up and stabilization. The VTVM can be warming up while you are using the VOM.
- working on a hot TV chassis
- checking anything remote where power isn't available such as antennas, auto, etc.
- reading DC current

And look at these specifications!

Voltage
6 AC and DC ranges from 0 to 1000 volts on both VTVM and VOM
6 peak to peak ranges from 0 to 2800 volts peak to peak on VTVM
Zero center scale on VTVM

Resistance
6 ranges from 0 to 1000 megohm on VTVM
2 ranges from 0 to 1 megohm on VOM

Current
one easy reading scale from 0 to 1000 milliamp on VOM

Batteries
one 1.5 volt "D" cell

Accuracy
3 percent on DC volts; 5 percent AC volts with a 6 inch, 200 microamp, 2 per cent meter.

Circuit Loading
10 megohms on VTVM, 15,000 ohms on VOM low range, 5 megohms on highest range.

Special Servicing Features for the Man on the Go!

Unbreakable steel case and protective removable cover. No leads to drag or line cord to "hank".

Inside the cover is a real surprise: short cut technical data to make every job easier and faster . . . standard transformer lead color code, fuse resistor burn out voltage, transistor testing guide, etc.

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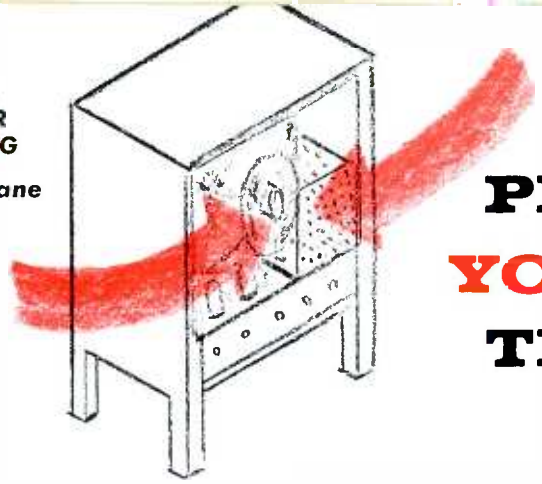

PINPOINTING YOKE AND FLYBACK TROUBLES

Of all the sections of a TV receiver, the horizontal flyback circuit (including the yoke) gives the average serviceman the most trouble. His difficulties stem from several causes. One of these is purely a physical problem of gaining access to parts mounted in the high-voltage cage; another is the inability to check many high-voltage points in the circuit with standard test instruments. In addition, there is an inventory problem; since a wide variety of special transformers are used in these circuits, the particular type in question is seldom available in the shop's parts stock for direct substitution testing. Lastly, and most important of all, a widespread lack of understanding about the way this circuit should normally operate is a great handicap to overcoming flyback-circuit troubles.

How It *Should* Work

When you refer to a typical schematic diagram of a yoke and flyback circuit (Fig. 1), you can immediately see why the basic function of the major components is not better understood. The fundamental circuit is nearly covered up by auxiliary components — yoke connections, damping networks, width coil, boost-load circuit, etc. — which tend to obscure the main working parts. The horizontal-sweep and high-voltage section can be analyzed much more easily when stripped down to essentials, as in Fig. 2.

The chief aim of this circuit is to transfer energy from the horizontal output stage to a load—the yoke. As shown by the solid lines in Fig. 2, horizontal output transformer T4 (the flyback) matches the impedance of output stage V12 to that of yoke T3 in much the same manner as an audio output transformer couples an output stage to a speaker.

For maximum efficiency, modern horizontal-sweep circuits utilize an autotransformer for this function. A single winding with several taps is used, and the yoke is connected across a smaller portion of this winding than the output tube. In Fig. 2, the portion of T4 between terminals 3 and 1 is the "secondary," while the winding between 5 and 1 is the "primary." Filter capacitors on the boost and B+ lines maintain the bottom (terminal 1) at AC ground.

The sweep current resulting from the conduction of V12 is the key factor in producing not only horizontal sweep, but also boost B+ and high voltage; thus, the importance of the solid-line portion of Fig. 2 must be fully realized. If this part of the circuit fails to operate properly, it is impossible for the remaining portions to function as they should. Conversely, a malfunction in any part of the dotted-line portion can overload the basic circuit and prevent it from operating normally; in fact, a failure in the damper circuit can disable the flyback system by depriving V12 of plate voltage.

Therefore, it is important for you to develop a troubleshooting technique that quickly and efficiently lets you know if the yoke or flyback is at fault, or if there is trouble in the associated circuits. Naturally, before you get around to suspecting yoke or flyback trouble, you will have substituted tubes; also, you will have made certain that the proper drive signal is arriving at the grid of the horizontal output tube, and that B+ is being applied to the screen circuit

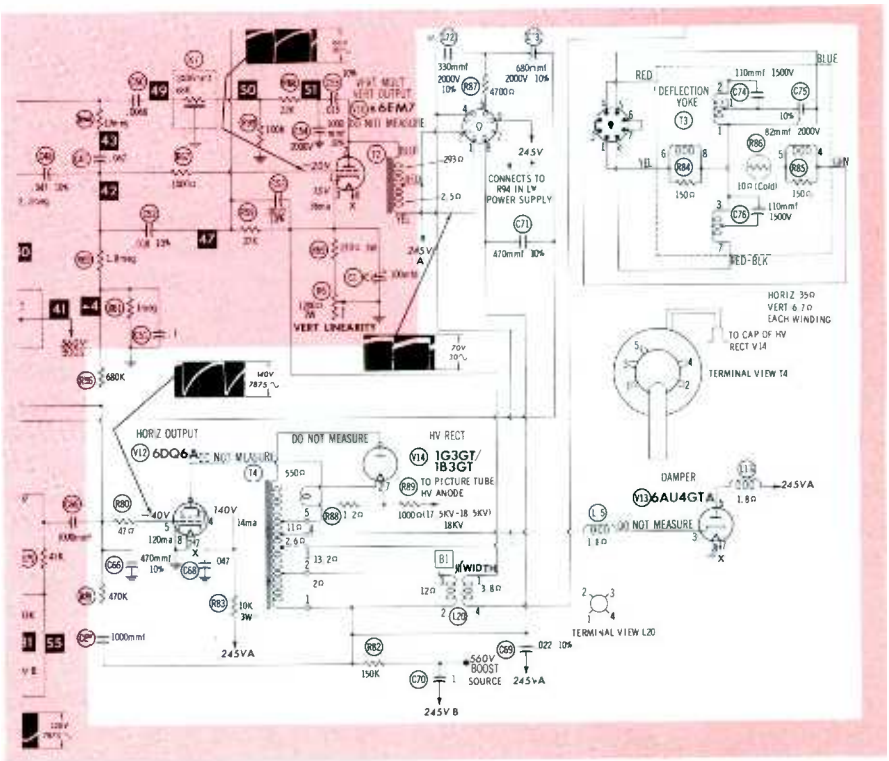

Fig. 1. Auxiliary features add to the complexity of flyback-yoke circuit.

to permit the stage to function.

Troubleshooting

Some of the observed symptoms which give rise to the suspicion of flyback or yoke trouble are loss of raster, insufficient width, blooming, horizontal foldover or nonlinearity, a keystone-shaped raster, streaks in the raster accompanied by the sound of arcing, wavy raster distortion, and high-frequency "singing" from the vicinity of the cage. Occasionally, a faulty yoke or flyback gives readily-noticed "distress signals," including a burnt odor from either component, a blown sweep-circuit fuse, melted wax insulation, or visible arcing around the components in the sweep section.

Your troubleshooting approach will naturally depend on the symptoms you actually encounter. For example, if the raster is keystone-shaped, your attention will immediately be drawn to the yoke circuit. Don't be misled, though, into assuming that the yoke itself is bad. The same symptom could also be produced by a short in the damping capacitor (C1 in Fig. 2). For this sort of problem, a logical troubleshooting technique involves disconnecting any auxiliary components which may be in parallel with the main circuit. In this particular case, clipping the lead of C1 and firing up the set again will quickly tell you which is at fault—the yoke or C1.

Width, linearity, and high-voltage defects call for a different approach. Conventional arc tests can provide useful information when there is no high voltage at the CRT anode, but it's usually necessary to use more refined techniques to pinpoint the trouble directly to a specific component.

Measuring boost voltage is a logical first step in tracing troubles of this nature. A complete loss of voltage at the junction of R1, C2, and terminal 1 of the flyback is a sign that the damper may not be conducting, the flyback may be open, or the circuit may be shorted. In this case, it's safe to check at pin 3 of the damper to see if you can get a reading. An indication of full B+ means that the flyback is open between terminals 4 and 1. If no voltage is present, there's a possibility of a flyback-circuit short and/or a dead

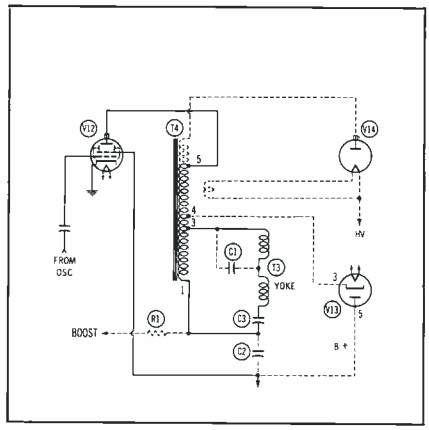

Fig. 2. The horizontal sweep and high-voltage circuit reduced to essentials.

damper tube. Before replacing the damper, you'd be well advised to take an ohmmeter and check to make sure there are no short circuits. If the boost circuit employs electrolytic capacitors, the ohmmeter will normally give an indication of a charging (or charged) 'lytic; otherwise, you should obtain an infinite resistance reading from the boost line to ground. In either case, a normal indication means you can replace the damper and try voltage measurements again. If the fuse blows, the damper glows red, or no voltage develops, turn the set off and make further isolation checks. Disconnect the load circuits from the boost line and repeat the voltage test until you find out which circuit is killing the damper cathode voltage. On older sets, don't overlook the possibility that the damper cathode and filament may be wired together and returned to a separate filament winding—which could be shorted.

If boost voltage measures the same as B+, the most likely source of your trouble is a shorted boost capacitor. In receivers with parallel filaments, you'll have more conclusive evidence of this condition if you remove the damper tube and still find B+ on the boost line.

Boost voltage at or near the B+ level may also be due to an open winding between terminals 4 and 5 on the flyback transformer, or to a shorted width coil or yoke. If you find the same voltage reading on both the cathode and the plate of the damper, you can safely touch your probe to the plate of the horizontal output tube; no voltage at this point means the flyback is open.

Many times, you can isolate the trouble by disconnecting the yoke

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and checking for increased boost or high voltage. (Remember to jumper the B+ interlock at the yoke plug, if the set is equipped with this feature.) *This test must not be made in a direct-drive circuit,* or damage to the flyback may result. However, valid results are generally obtained in other circuits.

Some fellows like to make resistance measurements of the yoke and flyback to help isolate the trouble. This is an acceptable procedure for finding opens and severe shorts, but you must always remember that a few shorted turns in either component can cause a great deal of trouble without ever showing up as an appreciable change in resistance. Generally speaking, it's better to test these components with special test instruments; or, in the case of the yoke, another unit with equivalent inductance can be substituted from stock or from a known good set. (Some special test instruments feature a variable inductor which can be used to substitute for the yoke.)

Clipping an oscilloscope probe to the insulation of the leads going to the output-tube plate, high-voltage rectifier, or damper tube can also provide helpful clues for pinpointing troubles. (See "The Case of the 10-Minute Fuses" in this issue.) Substitute signals, obtained from special test instruments or "borrowed" from another TV, can help isolate the trouble to the horizontal-output or high-voltage rectifier circuit. However, it is difficult to pinpoint a defect directly to a yoke or flyback transformer by substituting signals.

The important thing to remember, before plunging headlong into unnecessary component substitution, is that many things other than the yoke and flyback can produce symptoms that seem to indicate trouble in these two components. Following a logical process of elimination is the best way of tracking down these problems. Carefully evaluate your test results, and you, too, can become an expert at pinpointing yoke and flyback troubles.

TV Signals From the Walls

I recently chanced upon a TV wiring kit made by Mosley Electronics, Inc., of St. Louis. This Model BK-1 package includes everything necessary to feed a signal from an antenna to four outlets. The hardware and wall plates furnished with the kit are designed so the antenna outlet can be installed next to a regular AC outlet. Further investigation showed that Mosley also produces a two-outlet system, Model BK-2.

Since we are just approaching the peak season for both home building and antenna work, these kits seem to be right down the serviceman's alley.

Transmission Line Cables

8225


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Microphone and Shielded Power Supply Cables


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Ask your Belden jobber about this complete wire and cable line

What types of wire and cable do you need? Ask your Belden electronics jobber for complete specifications on types, sizes, insulations, and convenient spooled lengths. Available from stock.

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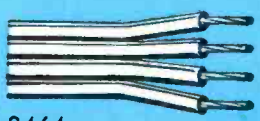
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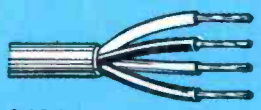
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Hook-Up Wire


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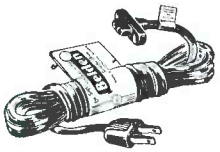
TV and Cheater Cords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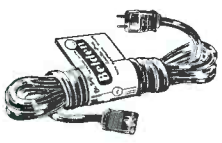
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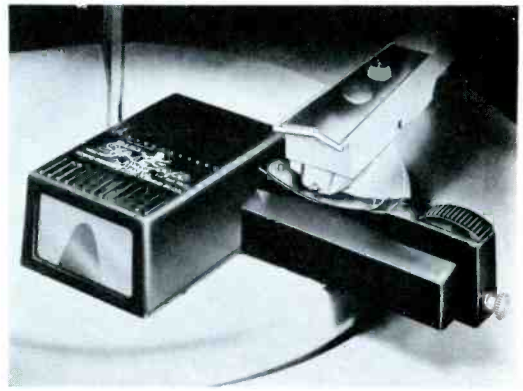


They can supplement your income both as an addition to your own antenna work, and as "across-the-counter" items for those customers who prefer to do their own lead stringing and wall-plate mounting.

Needle Flaw Finder

Want to hire a needle salesman? Robins Industries Corp., Flushing, N. Y. is producing a lightweight, battery-powered *Syl-A-Scope* designed for making close inspections of stylus tips. It fits nicely into a tube caddy and can be used very easily in the customer's home. When the tone arm of the phono is placed in a designated position, an illuminated and enlarged image of the stylus is projected on a ground-glass screen. Then the customer can see for himself if there are signs of excessive wear, chips, or other flaws.

By the way, this caddy-size unit (Model SG-33) has a big brother—an AC-operated unit for use on the service bench or sales counter. ▲

"You'd like me to come and fix your TV set? Sorry, you have the wrong number."

PROFITS GOING UP IN "SMOKE" OVER TUNER TUBE "BURNOUTS"?

Sylvania 6BZ7 and 6BQ7A "douse" the major cause of tuner tube failures.

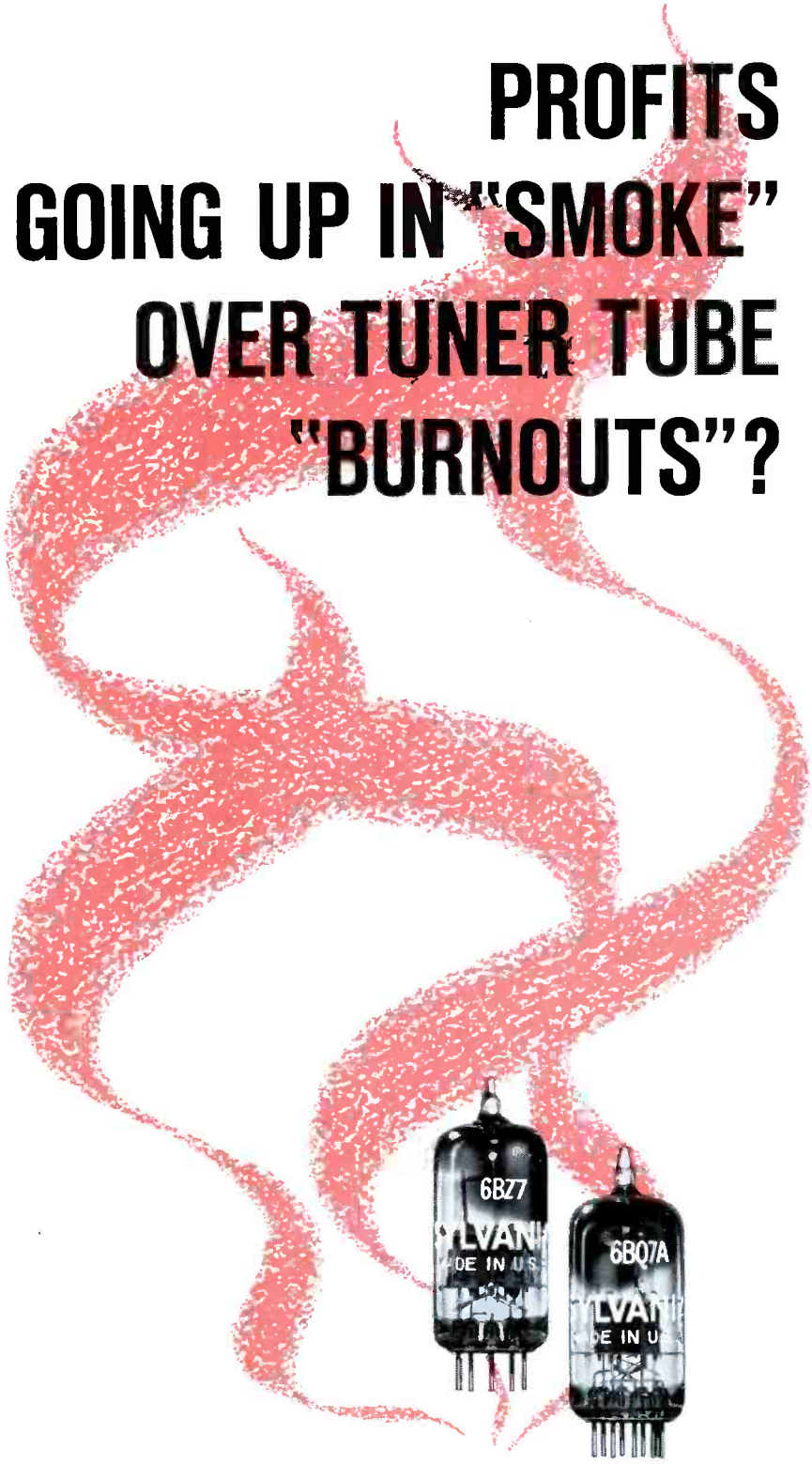
There's nothing that takes a bigger chunk out of your hard-earned servicing dollars than unnecessary callbacks. And here's how Sylvania has improved the 6BZ7 and 6BQ7A to give you the kind of dependability profits are made from.

- Gold-plated grid wire and an oxygenated heater wire reduce runaway and burnouts.
- The famous Sylvania Sarong cathode eliminates hot spots, assures uniform temperature and emission over the entire cathode surface.
- Unique getter support – a Sylvania exclusive – extends from top to bottom micas, provides rigid support to eliminate noise of getter vibration.

More, too – every tube is tested for continuity, filament current, gas, plate current, plate current cutoff, mutual transconductance and heater-cathode leakage. That's why the Sylvania 6BZ7 and 6BQ7A are your best replacement buys. Over ten years of Sylvania production (more than 3 million produced with the Sarong cathode) gives you extra profit assurance.

So, if you want to stop "burning" profits, make sure you specify Sylvania next time you're out of 6BZ7's and 6BQ7A's. The tubes with the built-in profit protection.

Electronic Tubes Division, Sylvania Electric Products Inc., Dept. 416, 1740 Broadway, New York 19, New York.



SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

by Joe A. Groves

EXPANDING INTO TV SALES

Sooner or later, practically every service dealer toys with the idea of getting into sales. This is only natural, for sales and service go together like ham and eggs. If you're contemplating an expansion into sales, or if you've already made this move and are beginning to build a sales business, here are several suggestions that can help you make wise decisions and aid you in your march toward the top.

First of all, have you thought about **why** sales and service go so well together? To name one excellent reason, you (as a TV serviceman) are Johnny-on-the-spot when your customer is thinking seriously of buying a new set. The average person is more willing to consider trading in his set when he is having trouble with it, and if he's taken the initiative in calling you for service, he has offered you an exclusive sales opportunity. By the same token, he's trusting you to "do right by him." If you overestimate the cost of repairs in an attempt to sell him a set, you may lose out completely—missing both the service job and the new-set sale. But if you can convince him of your honesty, he will normally be guided by your judgment in deciding whether to keep the old set or buy a new one. By being prepared for both sales and service, you may even encourage him to buy a new set for the living room and also have the old one fixed up "for the kids."

Naturally, the constant opportunity to meet customers when they are in a buying mood is only one reason why sales and service are a good combination. You have several other advantages, including a technical background which recommends you as a TV expert, an established service business which enables you to stand behind the sets you sell, and business connections which permit you to provide your customer with his "pet" brand.

In interviewing sales and service dealers all over the country, we've found a vast majority of them following a consistent pattern in embarking upon and building their sales businesses. Significantly, a fair percentage of dealers got their start on a proverbial "shoestring," beginning with limited capital and expanding the business with profits derived from sales; in the meantime, they make their living from service.

What brands will you want to sell? In deciding this question, first take a look at your competition. You'll need to know what brands are being sold in your trading area, and by whom, in order to make a logical choice for yourself. Obviously, if you have a limited trading area and there are already several other outlets for a particular make of set, you'll be likely to steer clear of this line. Also, if several of the dealers now handling a certain brand have thriving service facilities in addition to their sales departments, you'll undoubtedly prefer to select brands being offered by some nonservicing dealer. Don't let competition from discount houses and cut-price dealers keep you from selling a favorite brand. True, they may be able to offer your customers initial dollar savings, but you can counterbalance this offer with personalized service. After all, you've been servicing your customers' sets for some time, and you have proved your concern for their satisfaction. There is no greater selling tool!

Once you've decided what sets you're going to sell, you'll want to drop around and see the distributors who handle the various lines. Explain that you're just getting started, and that you want catalogs and brochures of the line so that you can offer your customers any "Brand XYZ" set they may want. You'll normally find that distributors are willing to supply you with just one set if you so choose. While you're there, be sure to fill out all of the necessary credit information so that you can obtain the sets on a 30-day charge basis. Then, when you need a set, all you'll have to do is drop by and pick one up without having to worry about paying for it until the normal billing period (some 30 days later).

You should be able to offer some form of financing to your customers. As a rule, your banker can help you on this count; however, if you find it difficult to sell contracts to the bank, don't hesitate to turn to local savings and loan associations, or to other local lending agencies. You won't have any trouble finding someone to buy your sales contracts these days. Of course, the lending agency will provide you with the necessary sales contracts and will help you find out if your customer is a good credit risk.

Once you get into sales, you'll have to revamp your bookkeeping system. The best thing to do is keep a completely separate set of records for all of your sales activities. It's a good idea to contact a local lawyer or accountant who can provide you with firsthand information of the legal requirements for a sales business in your immediate area. He can also help you set up a bookkeeping system that will furnish the necessary data for computing taxes and for analyzing your sales activities.

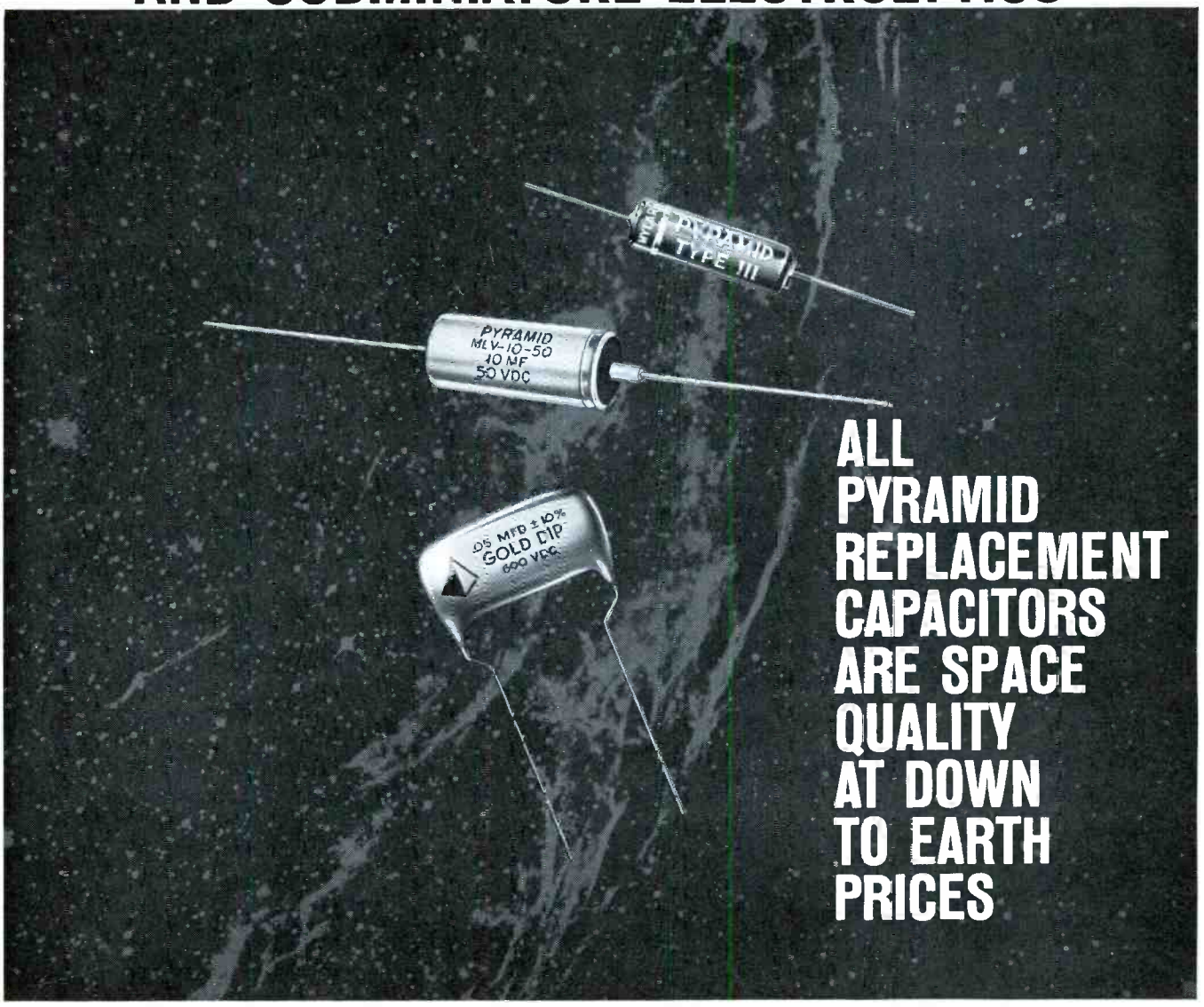
Selling and Growing

Just how do you go about selling a set? To answer this question with an example, let's assume we're in a typical customer's home and see how you might proceed. Remember, he's invited you into his home to service his TV. If it's advisable for him to replace the set, you should explain why this is so — and be prepared to suggest two or three models which you feel would interest him. Offer to put the one he likes best in his home for a week on a "no strings attached" basis. This will let him see how he likes his choice without assuming any obligation. If he's at all interested, he will probably agree to your offer. Once you get the set into his home, you have at least a 50-50 chance that the sale will go through. If he decides not to buy the set, pick it up promptly, and thank him for trying it out; also assure him that you'd appreciate his continued patronage.

Once you've picked up a new set, back to the shop it goes. Now, to help you sell it, you must have some sort of display area — and the more attractive it is, the better off you'll be. Putting up a good front means more than many servicemen realize. Some of the more successful dealers "shuffle" their merchandise (move the various pieces to different locations every week or so), thus helping to give window-shoppers and walk-in customers the impression that there's always something new. If several sets have "bounced back" from home trials, and you have a random selection on hand, you're usually better off if you keep some of them out of sight and confine your display to perhaps two brands.

Of course, once a customer has turned down a set, you'll undoubtedly be anxious to sell it before you have to pay the distributor for it. One good way to provide "sales exposure" is to loan the set to customers whose receivers are in the shop for repairs. Your explanation, "I've just picked up a new set and would be

DIPPED AND MOLDED MYLAR* CAPACITORS AND SUBMINIATURE ELECTROLYTICS



ALL PYRAMID REPLACEMENT CAPACITORS ARE SPACE QUALITY AT DOWN TO EARTH PRICES

Pyramid makes the capacitors you want for replacement. Every type of Pyramid capacitor is manufactured under the most rigid standards to insure their high reliability and long life. You can depend on them.

MOLDED MYLAR

Type 111 "Gold Standard" Molded Mylar Capacitors are now available in greatly reduced sizes. They have a noninductive polyester film extended foil section, and are molded in a noninflammable thermosetting plastic case. These capacitors have very high insulation resistance, are impervious to moisture and are extremely rugged.

Operating temperature range: —55°C to +100°C.

SUBMINIATURE ELECTROLYTICS

MLV Miniature Electrolytic Capacitors are ideally suited for transistorized radio receivers, hearing aids, portable TV sets, and miniaturized circuit requirements. These capacitors are noted for low leakage and a long shelf and operating life. They are designed for 85°C operation.

DIPPED MYLAR

Type 151 Gold-Dip Mylar capacitors are designed to be used for printed board circuitry as well as conventional applications. They are engineered for the highest reliability, are moisture resistant and have high insulation resistance.

Operating temperature range: —55°C to +110°C. Look for them on Pyramid's new Whirl-o-mat, five to a package, in Clear-Vu paks.

*DU PONT TM

PYRAMID ELECTRIC COMPANY
DARLINGTON, SOUTH CAROLINA

Canada: Wm. Cohen, Limited, 8900 Tanguay Street, Montreal
Export: Morhan Exporting Co., 485 Broadway, New York 13, N.Y.

happy to let you use it for a few days," will sound perfectly natural — and you'll work in another demonstration.

From time to time, you may have to consider sacrificing your profit on a set for the sake of quickly recovering its cost; but *don't be too quick to cut the price!* Once the word has spread that you'll back down on price, you will have cut your own throat as far as future sales profits are concerned. To give the customer a break without sacrificing your basic price policy, you can offer "fringe benefits." For instance, you might provide 90-day free service (parts and labor), or offer to install a two-set antenna-distribution system for the price of materials alone.

Newspaper "want ad" columns are a good place to promote quick sales. (However, don't advertise "take over payments" unless you mean just that; false advertising can get you in trouble.) Carefully-positioned classified ads not only help sell "distress" merchandise, but also offer an economical advertising medium for the dealer who is just getting started in sales.

As you sell more sets and begin diverting sales income into business expansion, it will become desirable to stock a few sets. You'll have learned from experience which types of sets are your "best movers," and these are the ones to keep on hand. Most distributors will cooperate by offering a 90-day floor plan that will permit you to stock a representative selection. Remember, though, you'll have to pay for any sets which are still on your floor at the end of the 90 days. Therefore, your floor stock should consist of models you can be reasonably sure of selling within this period.

The distributor can also be of great help in providing promotional material, sales-area displays, and many other dealer aids to help you merchandise sets and improve your "store image." Also, as your volume increases, you'll be able to take advantage of cooperative advertising programs he has available to supplement your advertising budget.

If you follow the pattern we've found to be typical throughout the nation, you'll soon start adding to your sales facility by branching out to include other consumer products such as tape recorders, hi-fi equipment, small appliances, air conditioners, etc. This is how today's successful dealers generally have grown in sales. Your actual growth rate will depend a lot on your selling ability, the surrounding market area, and your promotional programs.

You must establish a consistent advertising program if you are to succeed. Since your sales efforts are an outgrowth of a successful service business, never let your prospective customers forget this fact. Stressing that service is at the hub of all sales activity is almost certain to produce favorable results.

Service supplementing sales and sales supplementing service—this is the path followed by most successful service dealers. Build your business on this proven pattern, and you, too, will find yourself climbing to the top in sales. ▲

CBS 6SN7GTB FREE!
with New CBS "Preferred Line" Profit Pack

Introductory "P-L" tube offer gives you these 15 fast-sellers: 5–5U4GB, 4–6CB6A, 3–6SN7GTB, 2–6BQ7A, 1–12AU7A

What a deal! You get a selection of the hottest tube types on the market – 15 tubes in the five types that account for 20% of your business. Best of all you pay for only 14. CBS gives you a 6SN7GTB *free!*

"Preferred Line"–the Dealer Line

CBS Electronics' new "Preferred Line" consists of the types *you* sell the most. And each and every CBS "P-L" type is quality-controlled for Total Reliability. This is your assurance of the best quality in the industry. To prove it to yourself try the free 6SN7GTB that comes with this offer.

See your distributor today. Get your free 6SN7GTB with your purchase of this "P-L" Profit Pack. Act now, offer is good for a limited time only.

CBS ELECTRONICS
Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.

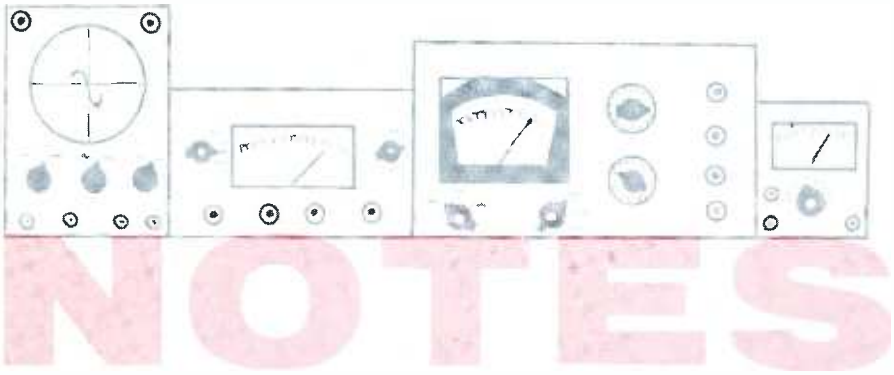
Receiving, industrial and picture tubes • transistors and diodes • audio components • and phonographs

CBS "Preferred Line" tubes have TOTAL RELIABILITY to cut callbacks

All CBS "P-L" tubes are specifically engineered for utmost dependability. Total Reliability features include non-emissive plates (5U4GB), anti-gas bulb coating and anti-sag molybdenum screen grid (6CB6A), low-microphonic mount (6SN7GTB), long-life coil heaters (6BQ7A and 12AU7A).

And all CBS receiving tubes have earned the Good Housekeeping Guaranty Seal. The lady of the house will recognize it immediately as a seal of confidence in you and the CBS tubes you sell.

REPLACEMENT OR REFUND OF MONEY
Guaranteed by Good Housekeeping
IF NOT AS ADVERTISED THEREIN



NOTES ON TEST EQUIPMENT

by *Les Deane*

New Way to "Master" Transistors

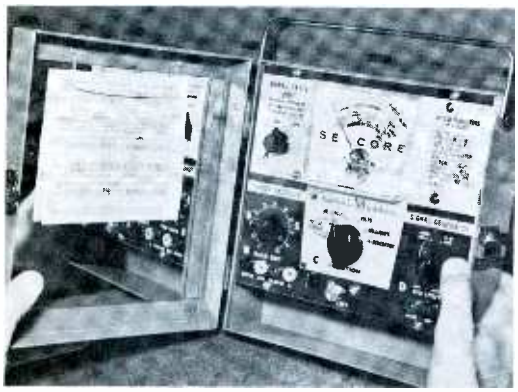


Fig. 1. *TransiMaster* is troubleshooting aid as well as a transistor tester.

SENCORE of Addison, Ill. is now offering the serviceman a new instrument that makes both in- and out-of-circuit tests of transistors, and also provides signal-injection, voltage, and current checks to aid in troubleshooting transistorized equipment. The Model TR110 *TransiMaster* pictured in Fig. 1 comes in an all-metal portable case complete with test leads and a booklet listing test data for over 2000 transistors.

Specifications are:

1. *Power Requirements—two self-contained 1.5-volt C cells (supplied), rapid "battery check" procedure provided.*
2. *In-circuit Tests—ability of transistor to function in oscillator circuit indicated on panel meter; special in-circuit test probe provided; test procedure printed on front panel.*
3. *Out-of-Circuit Tests—measures both small-signal and power transistors for shorts, leakage, relative gain, and beta; direct beta readings obtained on panel meter;* NPN-PNP *and* HI-LO POWER *selectors provided; standard test socket and three plug-in leads supplied; data booklet includes cross-reference information for Japanese types.*
4. *Special Tests—signal and power diodes checked by meter indication of front-to-back ratio, with polarity reversal provided by* NPN-PNP *switch; testing procedures for determining noise level and for checking tetrode-type transistors given in manual.*
5. *Signal Generator — self-contained 2000-cps oscillator circuit produces either simple audio frequency sine-wave output or signal rich in harmonics for troubleshooting RF-IF stages; built-in panel meter serves as output indicator; output jacks and* AUDIO-IF/RF *selector provided on panel.*
6. *Voltmeter—metering circuit with 12-volt full-scale range to test batteries and voltage dividers; meter jacks provided on panel.*
7. *Milliammeter—panel movement functions as direct-current meter with range of from zero to 50 ma; test leads have special circuit-breaker tip.*
8. *Other Features — a detachable lid equipped with mirror and clip holder for data booklet; case includes storage compartment for test leads; 3½" panel meter has 0- to 3-ma movement.*
9. *Size and Weight—8" x 7⅝" x 3", 5 lbs.*

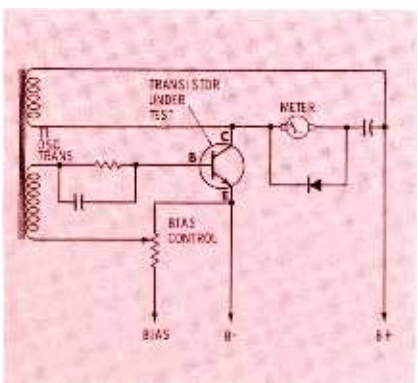
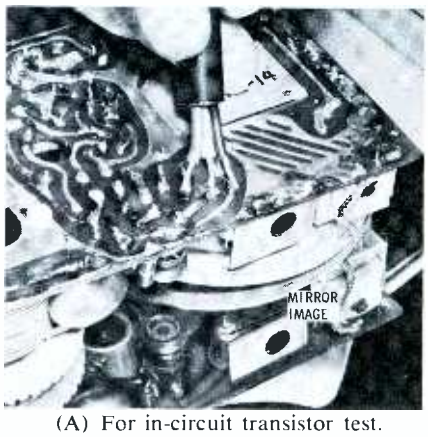


Fig. 2. NPN transistor connected into the oscillator circuit of Model TR110.

Since transistors are generally soldered to printed-board wiring, the in-circuit transistor test is one of the most useful functions of the Model TR110. This test hinges on whether or not the transistor under evaluation operates when connected to the test circuit (which is basically an Armstrong oscillator). The panel meter of the instrument is wired to read the output of the oscillator, as shown in Fig. 2.

This oscillator test, like an in-circuit capacitor check, is subject to a limiting factor—namely, the impedance of the circuit in parallel with the component being tested. From my experience with the SENCORE unit, I have found that an impedance of less than 150 ohms between the base and emitter of a transistor under test usually places enough of a load on the tester so that the circuit fails to oscillate. Occasionally, you will encounter a circuit in which the external resistance between base and emitter is near or below this value. In borderline cases of this nature, I have sometimes been able to obtain oscillations by readjusting the front-panel bias control.

The unique accessory probe shown in Fig. 3A is used in the above test. The tinned tips of the three leads can be touched to the printed wiring pattern at the proper points to make contact with the emitter, base, and collector connections of the transistor being tested. The tips are rigid enough to stay in position when held against the board, but flexible enough so that they can be rearranged into various patterns as needed for simultaneous contact with the three transistor terminals (which are not always in a perfectly straight line or triangle). With this probe, the serviceman uses only one hand to make all the necessary connections for an in-circuit transistor test, with no need for clip leads or soldering.



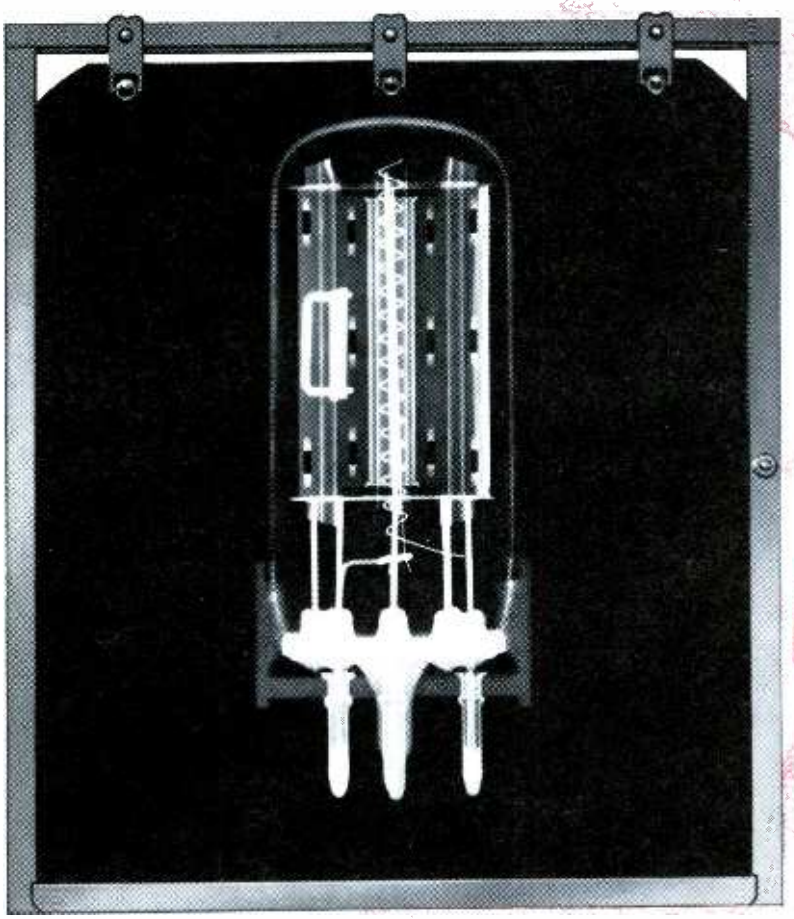
(A) For in-circuit transistor test.

(B) For battery-current check.

Fig. 3. *TransiMaster* accessory leads.

damper tube exhibits tolerance of high voltages

Thorough examination of the subject reveals physical characteristics conducive to exceptional longevity. Immunity to the high voltage ailments that plague so many less rugged damper tubes is due mainly to unusual care attending the tubes' formative stages. Outstanding qualities are noted in electrophoretically coated heater peaks and insulator coils; a "cool" running cathode; a copper core plate designed for maximum dissipation and less back emission. All of these minimize arcing. In addition, the electrically isolated insulator coil maintains high voltage insulation with the shortest possible warm-up time. In every respect, the Tung-Sol damper tube exhibits structural standards that approach an ideal far above more common types. Tubes of this family are certain to prove fully reliable under the most adverse conditions.



JUST WHAT THE DOCTOR ORDERED

All modern damper tubes trace their genealogy directly to improved designs created by Tung-Sol. Where diagnosis of a customer's TV set indicates damper tube replacement, be sure to prescribe Tung-Sol. These are some of the more popular Tung-Sol damper tubes:

6/12AF3	6DA4A
6/12/17AX4GTB	6DE4
6/19AU4GTA	6V3A
6/25W4GT	12D4A

the first name to ask for when ordering

TUNG-SOL®

DAMPER TUBES

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

The out-of-circuit transistor-testing procedures, outlined in paragraph 3 of the specifications, are self-explanatory. However, the *TransiMaster* does more than just check transistors. It is also useful for spotting other troubles in transistor radios, as I learned when using it in servicing a typical portable.

The radio was dead, so I naturally wanted to check the battery first. After placing two single test leads in the meter jacks of the TR110, I flipped the function switch to VOLTS and checked directly across the radio battery. Instead of deflecting to the expected reading of 8 or 9 volts on the 12-volt meter scale, the needle hardly moved—so the battery was dead! This wasn't all the trouble, because the symptom remained even after I replaced the battery.

At this point, I decided I'd better check and see how much current the set was drawing. Again turning to the TR110, I plugged one of the special accessory cables (Fig. 3B) into the meter jacks, placed the function switch in its MILLIAMPS position, and slipped the shim-like probe down between the battery terminal and its spring clip. Current was actually below normal, but I realized this might simply be a result of the lack of signal.

My next step was to employ the *TransiMaster* as a generator to signal-trace the receiver. Connecting a pair of test leads to the generator output jacks, moving the function switch to GENERATOR, and placing the AUDIO-IF/RF selector in its AUDIO position, I then injected a signal at the base of the output transistor. A high-pitched tone came through the speaker loud and clear. After proceeding to the detector and finding no break in the signal path, I switched the generator output to IF/RF and continued tracing all the way through to the RF stage. At the end of the trail, I was unable to radiate the test signal into the ferrite antenna, and for good reason; the antenna circuit turned out to be defective.

The metal mirror inside the lid of the instrument proved to be of great help for circuit-tracing the printed-wiring board. Since most of the test points are accessible from the wiring side of the chassis, it was easiest to service the radio with this side up. By reference to the mirror, the exact positions of transistors and other components on the opposite side of the board could be judged without difficulty.

Portable Parts Stock

The piece of equipment shown in Fig. 4 is the Model 500 *Component Substitutor*, recently developed by Mercury Electronics Corp. of Mineola, N. Y. The unit furnishes substitutes not only for standard-value resistors and capacitors, but also for other components and bias voltages.

Specifications are:

1. *Resistors — Substitutes 1-watt units from 33 ohms to 100K ohms (± 10%) in 13 standard values, and ½-watt units from 180K ohms to 10 megohms (± 10%) in 7 standard values; units will withstand 100% overload for approximately 30 seconds.*
2. *Capacitors—Substitutes 600-volt units from 100 mmf to .5 mfd (± 10%) in 10 standard values.*
3. *Electrolytics—Substitutes 10 standard-value 450-volt units from 4 to 330 mfd.*
4. *Power Resistors—Continuously-variable potentiometer substitutes for units rated at 4 watts or less in all values from zero to 5000 ohms; resistance element can withstand intermittent 10-watt power dissipation.*
5. *Crystal Diode—1N48 germanium unit with 70-volt peak inverse rating substitutes for detectors, bias rectifiers, mixers, etc.*
6. *Power Rectifier — 125V silicon unit with current rating of 500 ma substitutes for line-voltage rectifiers commonly used in radio, TV, and other equipment.*
7. *Bias Supply—Substitutes for AGC or any low-current bias voltage of either polarity; continuously variable from zero to 15V DC; internal 15-volt battery supplied, standard replacements available.*
8. *Other Features—Resistance and voltage control, plus function and range selectors, provided on front panel; two 3' test leads with clips supplied.*
9. *Size and Weight—Case 7¾" x 6" x 3½", 4 lbs.*

Parts substitution, like signal substitution, has long been an accepted method of localizing radio and TV troubles. Indiscriminate replacement of parts is, of course, neither a systematic nor a profitable way to repair a set; however, having a component replacement at your fingertips can save untold troubleshooting time and quickly eliminate doubts that might otherwise go unchallenged.

I put the Model 500 through its paces in the lab to give you an idea of its operating procedure and a glimpse of some typical applications. Using one of our experimental TV chassis, I first tried substituting for a number of resistors in circuits known to be frequent troublemakers. Referring to the front panel of

Fig. 4. The Mercury Model 500 provides a total of 44 substitution features.

New Type
BUSS FUSE SERVICE-STAND ASSORTMENTS

Supplies fuse needs and saves service time

Most Practical Stand Yet Devised

Made of metal, the stand is sturdy and unbreakable, not like a fragile, plastic stand.

Keeps the fuses needed by the serviceman at his fingertips. Prevents scattering of fuses.

Can be hung on the wall or placed on the counter where the stand's wide base prevents accidental tipping.

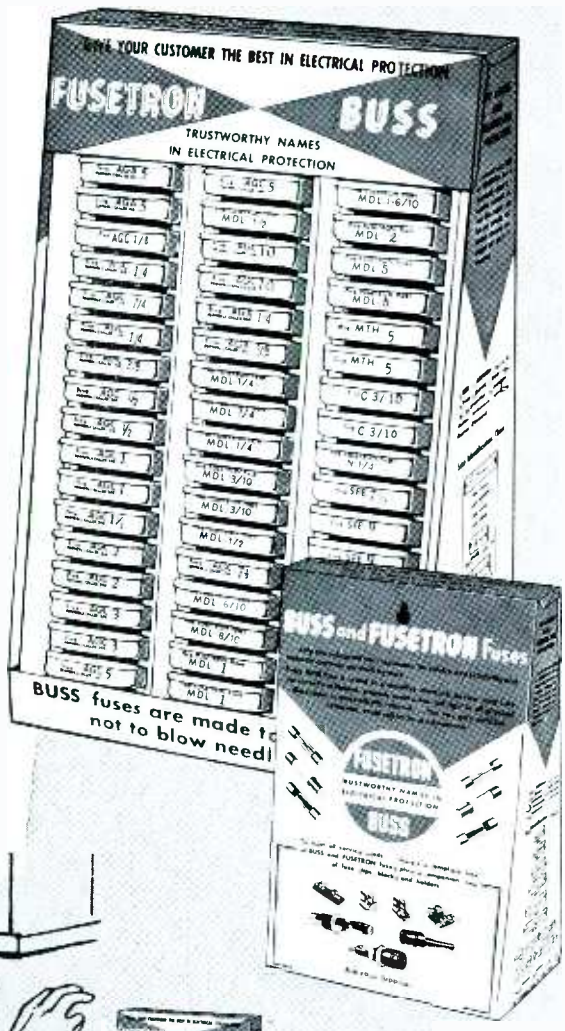
Each 5-in box is neatly held on its own shelf—easy to slide out without disturbing other boxes.

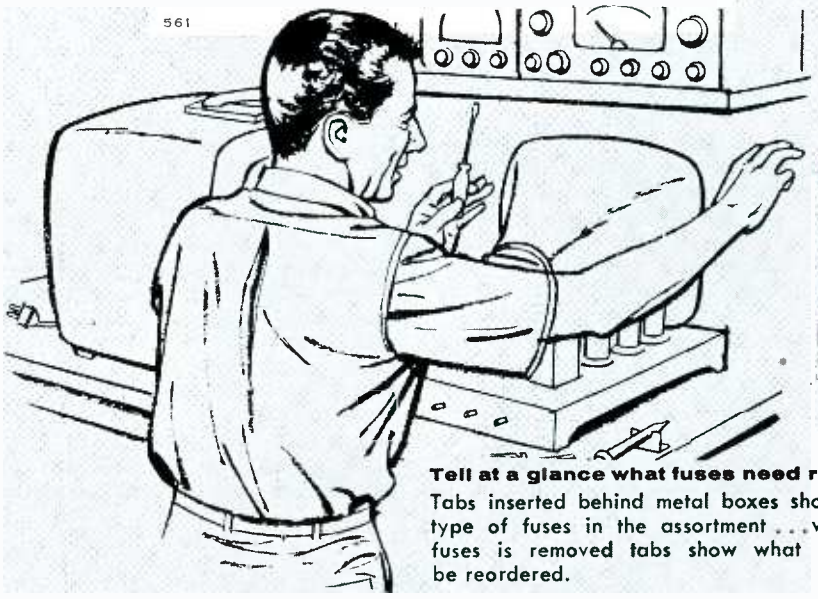
Two Quick-Service Assortments with Stand

No. 255 Full-Service electronic fuse assortment contains 255 fuses—practically all the fuses you might need for TV and other electronic devices.

No. 130 Special electronic fuse assortment contains 130 fuses. It gives you one box of each size and type of all the popular fuses at a minimum investment.

Make your service work easier and more profitable by ordering the BUSS Electronic Fuse Service Stand Assortment best suited to your needs. Your Jobber has it or will get it for you.





Tell at a glance what fuses need re-ordering
Tabs inserted behind metal boxes shows size and type of fuses in the assortment . . . when box of fuses is removed tabs show what items should be reordered.

BUSS makes a complete line of fuses of unquestioned high quality for electronic, commercial, industrial automotive, farm and home use.

FUSETRON BUSS TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION McGRAW EDISON

BUSSMANN MFG. DIVISION, McGRAW-EDISON CO. • UNIVERSITY AT JEFFERSON • ST. LOUIS 7, MO.

Fig. 5. Two switches and one control select all functions of the *Substitutor*.

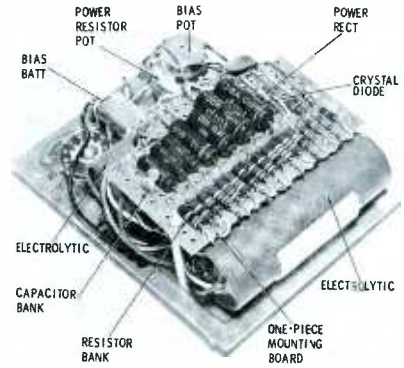


Fig. 6. Note the ease of accessibility to components on the Model 500 chassis.

the instrument (Fig. 5), I placed the SELECTOR switch in the appropriate position (either R x 1 or R x 1K) as I selected the desired values on the calibrated circular arcs surrounding the upper knob.

To use the power-resistance feature of the unit, I switched the SELECTOR to its POWER RES. position and adjusted the control on the right until the knob pointed to the desired value. This comes in handy for substituting resistors in cathode and screen circuits of output tubes.

Routine servicing procedures often call for substitution of paper tubular, mica, and ceramic disc capacitors in bypass, coupling, and decoupling applications all through a receiver. After setting up for this function by placing the SELECTOR in its PAPER-MICA COND. position, I substituted for various capacitors on the B+, boost, and AGC lines, choosing the desired values in the center arc of the upper knob scale.

When substituting electrolytics, I disconnected various sections used as B+ filters, decoupling units, and cathode bypasses, and attached the test leads. (The polarity of these leads is identified and should be observed for this operation.) Incidentally, the substitute 'lytic will retain its charge if you remove it from the circuit before turning off the equipment under test; therefore, you should make a practice of discharging it as soon as you disconnect the lead.

For diode detectors or power rectifiers, the SELECTOR remains in its POWER RECT. DIODE position, while the upper knob is used to select either the crystal or silicon substitute. When doubling for a video detector, the substitute often produces picture distortion; this is understandable, of course, since the added capacitance of the test leads changes the frequency response of the original circuit. However, this effect is negligible in audio detector stages of transistor radios and other low-frequency systems.

By the way, when you're getting ready to substitute for a power rectifier, be sure that you don't connect the silicon diode into a circuit where its 125-volt rating will be exceeded.

To operate the instrument as a bias supply, I placed the SELECTOR switch in its extreme clockwise position and adjusted the bias control to obtain the required voltage. I found the unit very satisfactory for clamping AGC lines and for other low-current applications. Calibrations on the voltage control are reasonably accurate up to current loads of 1 or 2 ma; however, for higher loads, such as those required by transistor portables, the output voltage will be somewhat less than that indicated by the bias dial.

Fig. 6 shows you what's inside the *Component Substitutor*. All parts except the two multisection electrolytics are mounted on one side of a single board. This naturally makes it easier to replace components, should the originals be damaged by overload.

I found the Model 500 easy to use and capable of doing many jobs. The convenience of having a wide selection of replacement parts available at the flick of a switch makes such substitution units really handy to have around the bench.

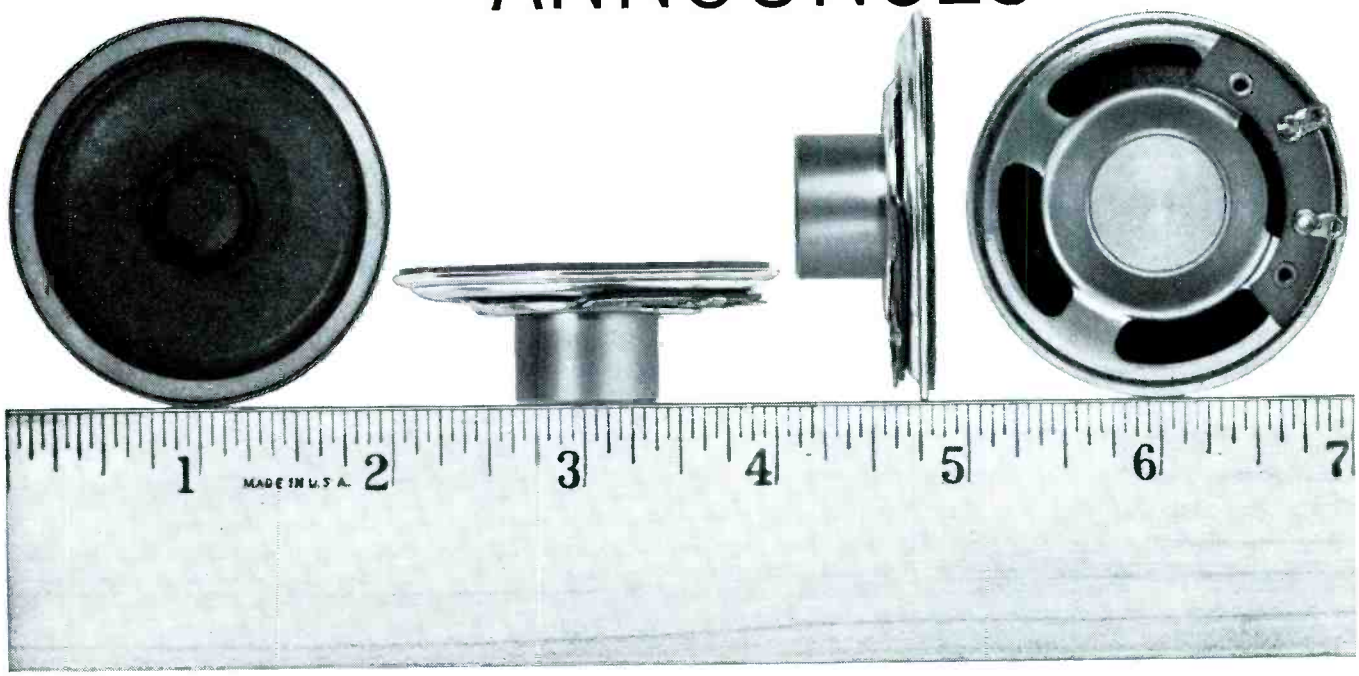
Portable Tube Tester

Superior Instruments Co. of New York City has recently introduced an inexpensive tube tester designed for use by technicians or for "self-service" operation by customers. Pictured in Fig. 7, the Model 85 *Dynamic Tube Tester* is housed in a slim carrying case, and comes complete with a tube chart booklet and an instruction manual.

Specifications are:

1. *Power Requirements—110/120V AC, autoformer supply.*
2. *Tube Tests—shorts and leakage indicated by neon lamp on panel; emission registered on panel meter with* GOOD-?-BAD *and relative quality scales provided; multipurpose tube sections tested individually; defective elements identified by lever switches.*
3. *Other Features — five standard test*

UTAH ANNOUNCES

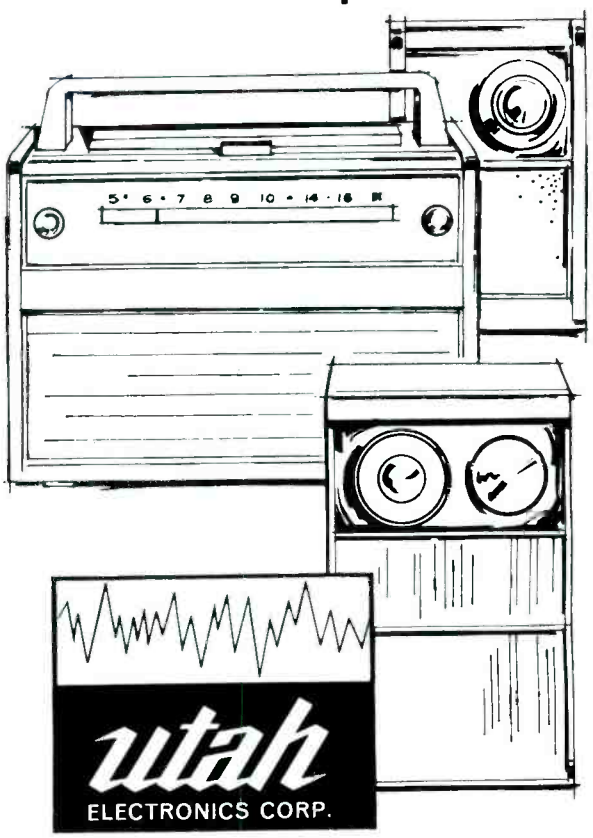


...the first complete line of all-American-made replacement speakers for transistor radios!

Hardly surprising that Utah becomes the first domestic source for transistor radio replacement speakers. A pioneer in developing electronic and acoustical products, Utah uses only 100% American labor and 100% American parts in building these miniature speakers. Seven basic speaker models fit both imported and domestic sets. Performance equals or betters that of original equipment speakers. Compare these features and you'll see why it pays to buy and replace with all-American-made speakers from Utah!

• extra shallow baskets for clearance in crowded cases • special terminal strips keep basket depth wafer-thin • deeper models (SP25A, SP27A) for larger domestic sets will handle more power • all steel surfaces cadmium plated • voice coil impedance 12 ohms (correct value for most sets)

Model No.	SP2T	SP22T	SP25A	SP25T	SP27T	SP27A	SP3T
Size and Description	2" round	2¼" round	2½" square	2½" round	2¾" round	2¾" round	3" round
Total diameter	2"	2¼"	2½" sq.	2 19/32"	2 25/32"	2¾"	3"
Basket Depth	7/32"	¼"	½"	⅜"	11/32"	13/32"	11/32"
Total Depth	11/16"	¾"	1 5/16"	27/32"	13/16"	1 3/16"	13/16"



Huntington, Indiana

ORDER NOW! Write direct for full specifications and prices.

sockets plus 7- and 9-pin straighteners for miniature tubes provided on panel; raised 3¾" panel meter; setup data for over 800 tube types supplied.

4. *Size and Weight—case 10" x 13¼" x 3½", 5 lbs.*

When I examined the Model 85, I noticed that it has a detachable lid, eight rounded metal feet to protect the case in either of two resting positions, and a small compartment on one side for storing the line cord. As illustrated in Fig. 8, the front panel of the instrument is laid out with a bank of tube-element levers in the center, filament-voltage and load adjustments in the lower two corners, and the panel meter and test sockets occupying the upper section. Note the unusual symbols, such as ★ and ▲, used in place of letters or numbers to designate the positions of the lever switches.

In the 8" x 10½" setup booklet, there are 11 columns on each page. One lists the tube type; another designates the heater-switch position; four show the special code symbols for the various element-lever positions; and other individual columns identify the correct test socket, the elements that will normally show a short, the load value, the position of the REGULAR-SPECIAL switch, and the meter scale to be used. Normally, only four or five of these 11 items require changing at any one time when the tester is being reset to check a different tube type.

After the filament selector has been adjusted and the lever switches have been positioned, the tester is ready for the shorts-leakage check. All levers are normally in the "down" position except those which have been placed in the ★ or + row according to instructions. Observing the shorts indicator, the operator moves the remaining levers to the ▲ position one at a time (see Fig. 9). A steady glow of the panel lamp indicates that a short or interelement leakage exists in the tube —unless a short for that particular element is stipulated in the data booklet.

To continue with the quality test, additional levers are positioned as directed, and the load control is adjusted; then the spring-return switch directly to the left of the load control is held down to obtain a reading of tube emission on either the A or B meter scale as specified in the booklet.

The meter for the Model 85 is calibrated in three separate scales. The larger top scale or arc, labeled "A," is used to indicate emission for the most common radio and TV tube types. This arc is divided into BAD (red), QUESTIONABLE (white), and GOOD (green) areas. The center arc, a linear scale calibrated in relative values from 0 to 100, is useful for comparing the operation of two or more tubes or matching a pair for certain applications. The lower arc, identified as "B," is divided into only two areas—BAD and GOOD. This scale is primarily used for types having relatively low emission, such as high-voltage rectifiers and certain battery-powered tubes.

Fig. 7. Superior Model 85 checks the tubes for shorts, leakage, and quality.

Although the sensitivity of the leakage test is not given in the specifications for the instrument, I was able to determine it experimentally. After setting up the unit for a typical shorts-leakage test, I introduced a variable resistance between different pin connections to simulate tube-element leakage. Using a decade arrangement, I gradually reduced the resistance until the short indicator just began to glow. According to this test, the over-all sensitivity of the leakage indicator was approximately 2 megohms—adequate for practical radio and TV servicing.

Ease of operation makes the Superior tester suitable as a service-shop counter unit for customers to use in checking their own tubes; in another application, its portability renders it convenient for servicemen to carry on home calls.

To keep the setup chart of the Model 85 up to date, the manufacturer furnishes free data on new tubes for a period of five years from date of purchase. ▲

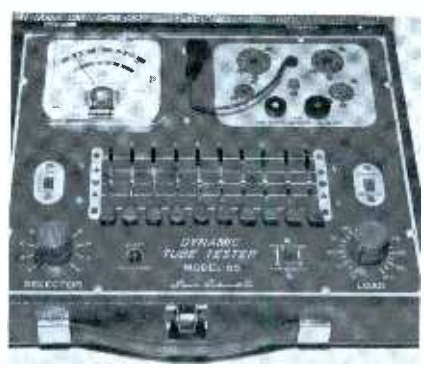


Fig. 8. Front panel of Model 85 has no roll chart; setup data is in booklet.

Fig. 9. Tube-element levers are moved up one at a time to check for shorts.

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make your servicing easier...faster!

SAVE 28¢

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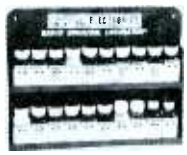

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THE TROUBLESHOOTER

answers your service problems

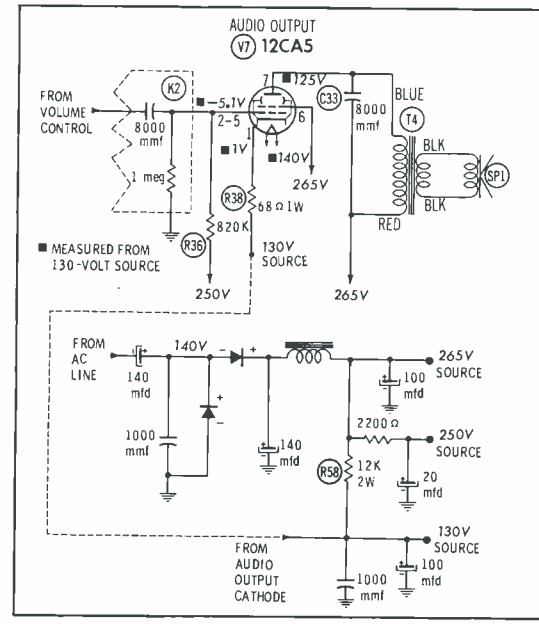
CONELRAD Alarm

The FCC requires all Citizens band radio stations to have a CONELRAD monitor. If you can give us and other CB licensees a simple circuit for converting a regular radio so it can be used for this purpose, I'm sure it will be greatly appreciated.

TERRY A. MCDONALD
Toledo, Ohio

There are several ways of doing this. The simplest conversion involves adding a switch and a No. 47 dial lamp to the output-transformer circuit (see inset in schematic), so the lamp can be substituted for the speaker by throwing the switch. When in use, the lamp will continuously flicker when a station is being received—and go out when the transmission stops. Of course, the volume control must be set at a normal level in order to provide sufficient signal to cause the lamp to flash.

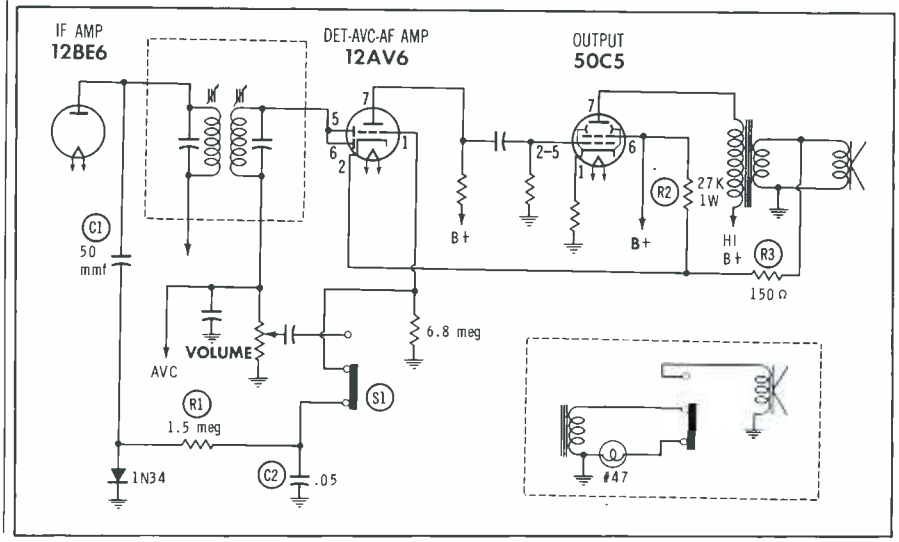
A more complex circuit converts the audio amplifier and output circuits of a receiver into a multivibrator to produce a loud buzz when a CONELRAD alert occurs. The input signal is taken off the plate of the final IF amplifier and fed to a detector. The demodulated output is filtered and fed through switch S1 to the grid of the AF amplifier. Since the volume control is switched out of the circuit, it may be set at any level. The values of the numbered components may have to be changed to provide enough bias on the AF amplifier so it will remain cut off while a signal is being received. (The exact values shown will not necessarily be correct for all receivers.) Without a signal, the bias drops, and multivibrator operation begins. If you encounter a circuit which refuses to act as a multivibrator, the feedback signal from the output transformer may be of the wrong polarity. Try interchanging the secondary leads.



Morse Callback

While reading the *Troubleshooter* column in the February issue, I came across Mr. G. H. Morse's service problem on page 70 concerning a Philco Chassis 8H25. I recently had one of these chassis with a similar complaint.

The high voltage on pin 1 of the 12CA5 was not caused by incorrect bias on the tube, but the bias was caused by



high voltage on pin 1. A close look at the schematic of the power supply quickly reveals this paradox. The cathode circuit of the 12CA5 is returned to B+ through R58 (12K ohms, 2 watts). In the chassis I serviced, R58 had cooked down to only a few hundred ohms, resulting in a lower voltage drop across it and raising the 130-volt source well above normal.

V. A. STIGLICH

Woodbridge, N.J.

. . . Inasmuch as I obtained the same voltage as Mr. Morse, I assume the same part is bad. If you'll notice, the cathode of the 12CA5 is fed from the 130-volt source in the power supply and does not in itself act as a voltage divider. I'm sure Mr. Morse will find that R58 (12K-2W) is the guilty component.

JAMES W. PRATT

Lake Charles, La.

Please finish the job . . . R58, a 12K resistor in the power supply, changes in value and biases the 12CA5 below cutoff. I've serviced several of these sets, and have found it advisable to use a 10-watt replacement.

D. W. ALLEESON

Los Angeles, Calif.

Thanks to you and to the many others who have written to point out that R58 is the most common offender in this case.

The primary purpose of R58 is to apply proper bias to the audio output stage during warm-up time. Since it's in parallel with the series circuit of the 12CA5 and R38, it does handle a small amount of the current for the 130-volt line. However 90% of the current is normally supplied by the tube acting as a voltage divider; for this reason, R58 was overlooked as a likely suspect.

Apparently, the surge current through R58 during warm-up overheats this component and causes enough of a change in value to affect the operation of the circuit. With this point in mind, Mr. Alleeson's suggestion of using a 10-watt replacement seems to offer the best solution.

Why the Gap

Will you please explain why a spark gap is used in Zenith Chassis 16F28Q? I'm sure other fellows who read your February "Previews of New Sets" column would like to know the theory of these devcies; I know I would.

FRED J. ARDOLINO

Brooklyn, N.Y.

As stated in "Previews," the spark gap protects the accelerating anode of the picture tube from excessive pulse voltages. Spark gaps are also used to protect picture-tube cathode and control-grid circuits in some receivers in order to reduce the possibilities of interelectrode arcing within the picture tubes, which could lead to permanent damage.

The 23ATP4 picture tube used in these receivers is designed for low accelerating-anode voltage (50 volts maximum), and a deficiency in the vertical blanking network or related circuitry could easily apply a damaging pulse voltage to the tube element. The spark plate will break down sooner than the picture tube and provide a discharge path to ground for the pulse voltage.

When Is Ground Not Ground

Servicemen sometimes run into confusing effects when dealing with ground points in a circuit, even when confined within a single item of electronic equipment such as a radio, audio amplifier, or TV chassis. For example, two points may both appear to be at ground potential on a schematic diagram; yet, if these two are too close physically (or too far apart), oscillation may develop. If they are both at ground, why should it matter how near or far apart they are? Why does touching a "grounded" chassis sometimes detune a circuit using this ground?

EMIL H. FREY

Detroit, Mich.

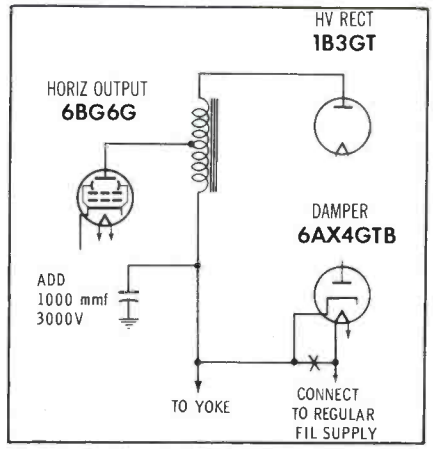
The effects you mention are observed chiefly at higher frequencies, where the chassis or ground-wire system has enough inductance that various ground points can no longer be considered to be at the same RF potential. Another case of trouble arises when circulating 60-cps currents of considerable strength flow through the ground conductors, causing hum in various circuits.

Problems of this kind were treated in some detail in "Reading Between the Lines" in our October, 1959 issue.

Damper Trade-In

In your December, 1960 column, I noticed that two readers were experiencing damper-winding failures in power transformers.

I recently tried the same cure you recommended on an RCA Chassis KCS47, except that I connected the damper filament to the other filaments. However, I couldn't hold a yoke in the set until I bypassed the damper cathode to ground with a 1000-mmf, 3000-volt capacitor. The set would operate for an hour or two, and then the horizontal yoke winding would start arcing to the vertical winding. Since I installed the bypass capacitor, it has held up.



DEAN STRAYER

Colby, Kansas

In this direct-drive circuit, you are effectively bypassing the yoke with the added 1000-mmf capacitor; thus, you are reducing the peak-to-peak voltage across the yoke. A rating of 3000 volts is not too generous for this application. If you notice reduced sweep or high voltage, try a smaller value of capacitance.

Missing High Frequencies

I have a Revere T-1100 tape recorder that doesn't reproduce high frequencies. The head is properly aligned, azimuth is OK, and the pressure pads are properly adjusted. Also, there are no highs when the recorder is used for low-power P.A. I assume the trouble is in the amplifier, but where?

AARON SITTNER

New York, N.Y.

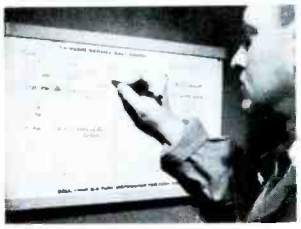
Your assumption sounds logical. The only other likely cause would be the speakers. Although the two 5¼" all-purpose types in this unit will reproduce high frequencies, the treble response won't be as "brilliant" as in recorders with a tweeter.

Make a careful check of the tone-control circuit. First see if varying the control setting has any effect on the tone, and follow any lead suggested by this test. If there is no conclusive indication, make a critical check of the components associated with the tone-control circuit. Don't overlook the function-switch contacts and speed-equalizing circuits as potential trouble spots.

If you fail to find the trouble from the above tests, you'll save time by making a stage-by-stage frequency-response check. Monitor the output with an AC VTVM or scope and inject a signal from an audio sine- or square-wave generator into the output-tube grid circuit. If it checks out OK, inject the signal into preceding stages until you find the one lacking in high-frequency response. Once the defective stage is located, critical voltage, resistance, and component tests will lead you to the trouble.

The Electronic Scanner

Weekly Service Call Board



To help busy servicemen organize their calls several days in advance, **General Electric** has made this "TV-Radio Service Call Board" available through their receiving tube distributors. Making use of a rotating plastic sleeve, the board has space for 7 days' appointments and shows the work schedule for 3 days at a time.

Seminar Draws 1200 Servicemen

Chicago distributor **Nation Wide W-J Electronics,** in conjunction with **Channel Master Corp.,** recently held a radio-TV service dealer seminar which drew a record-breaking crowd of over 1200 at McCormick Place. **John Cihocki** of **Channel Master** spoke on transistor radio servicing. Other speakers were **Russ Jimieson** and **Joe Nicolan** of **Nation Wide.** Extreme interest in this and 5 previous seminars has prompted plans for another to be held on June 14th. Speaking of transistor radios, check **Channel Master's** play-it-yourself, pilfer-proof, retail display unit.

New Name for Old Company

One of the pioneers in the electronics industry, **American Television & Radio Co.** of Minneapolis and St. Paul, has changed its corporate name to **ATR Electronics, Inc.** The firm is presently tooling up for a new line of auto radios as well as other undisclosed electronic products.

500th Service Clinic

Radio Specialties Distributing Co. of Detroit had the distinction of playing host for the 500th **SENCORE** "Time-Saving Service Clinic" on March 20th. Highlight of the meeting was the introduction of the **SENCORE** "Servicemaster," a newly-introduced VOM-VTVM combination instrument. Conducting the session were **SENCORE** v.p. **Ed Flaxman** and the firm's area rep, **Jim Flora.**

Merger Combines Accessory Lines

South River Metal Products Co., Inc., manufacturers of TV antenna mounting accessories, has purchased **Apex Hardware Mfg. Co.** of Paterson, N. J. The two manufacturing facilities are to be consolidated, adding **Apex** products of phonograph and electronic chassis slides to the **South River** line.

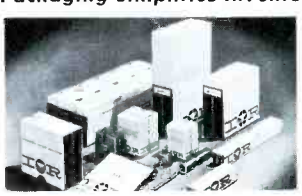
Anniversary Celebration

Note where another fine company has chalked up a milestone in the parade of progress. March 6th marked the 15th anniversary of **Switchcraft, Inc.** During this time, the firm has expanded its lines of plugs, jacks, and switches several times, and is now serving all segments of the industry. In commemoration of its 15 years, the company introduced 15 new products at the New York I.R.E. Show.

New "Glareless" Picture Tubes

Sylvania Electric Products, Inc. is now sampling TV set manufacturers with 19" and 23" picture tubes using a "Velvetone" anti-reflection bonded safety glass. The new shield, developed by **Corning Glass Works,** eliminates glare and provides much improved contrast and resolution over conventional anti-reflective panels. **Sylvania,** incidentally, was granted 13 patents on CRT's during 1960.

Packaging Simplifies Inventory



Be on the lookout for the "new look" in semiconductor packaging from **International Rectifier Corp.** Salient features include individual component protective packaging, uniformity of 10 units per package for simplified inventory control, easy identification of part numbers and component ratings, and complete step-by-step installation instructions.

Noise Inverters

(Continued from page 33)

pressor grid of the 6DT6, where it momentarily reduces conduction and offsets the effect of positive noise pulses at the control grid.

Both the noise inverter and the AGC plate circuit are interconnected with the cathode circuit of the first video IF amplifier (point A in Fig. 1). The cathode return to ground includes bypassed 1200-ohm resistor R16 as well as the usual 56-ohm resistor R15, and the positive voltage developed across R16 by cathode current reaches as high as 10 volts under no-signal conditions. With a signal applied, the conduction of the first IF tube is reduced by AGC action, and the voltage at point A decreases to as low as +2 volts. This variable positive voltage is used to oppose the negative grid bias on both V4B and V9. Since the opposition is greatest on weak signals, the sensitivity of both stages is increased for fringe-area operation.

Point A is also connected to the AGC line through R40 to aid in delaying the application of bias voltage to the tuner. The potential at the junction of R40 and R39 is positive under all but the strongest signal conditions, but a clamper diode in V9 prevents the voltage on the tuner-AGC line from becoming more than slightly positive with respect to ground.

Since the first IF stage has an unusually high positive voltage on the cathode, the grid voltage of this stage must also be positive except when a very strong signal is present. The AGC line includes several ingenious features to meet this requirement. The basic method of operation is conventional — keying pulses on the plate of V5 cause a pulsating plate current which charges the AGC filters in proportion to signal strength. However, IF filter capacitor C12 is returned to point A instead of ground, and a connection through R44 to the cathode of V5 maintains this tube's plate at several volts above ground potential in the absence of a signal. The plate voltage shifts in a negative direction as progressively stronger signals are applied, and the rate of change is such that the grid voltage of the first IF stage will decrease faster than the cathode voltage. Eventually, the IF branch of the AGC line becomes more negative than ground. Since the delay voltage from point A is minimum at this time, a negative voltage begins to appear on the RF-AGC line soon after the IF-AGC voltage passes through zero.

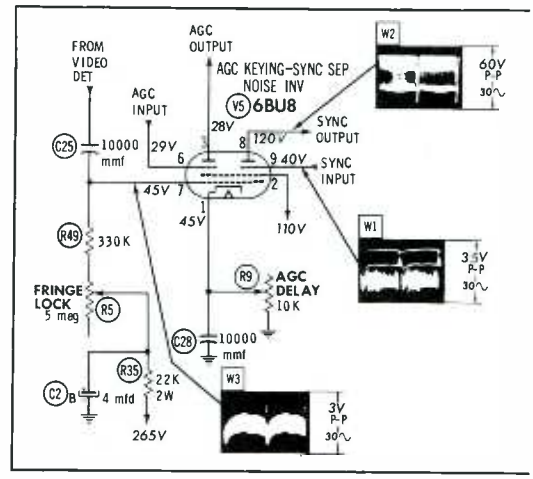


Fig. 4. Zenith Chassis 16F25 has a typical 6BU8 noise limiter circuit.

Westinghouse Circuit

Another triode-type noise inverter, used in the Westinghouse Chassis V-2384-15, is shown in Fig. 3. Signalwise, this circuit is generally similar to Fig. 1; however, there are some interesting differences in the way DC voltages are obtained.

Sync separator V9 has a complex bias network which develops as much as –50 volts on strong local signals, and proportionately less on weaker signals. The grid of the noise-inverter tube V5B is located at the midpoint of a resistive voltage divider (R51, R50, R49, and R23) between the grid of V9 and ground. Thus, the grid voltage of V5B is always roughly half that of V9, and is automatically adjusted for less bias on weak signals.

Cathode bias for V5B is developed by the cathode current of the audio output tube flowing through R43; the voltage across this resistor stays practically constant at about +11 volts. Note that an open C3C would cause interaction between the sync and audio sections.

The main sync-input signal is fed from the top of the contrast control through R52 and C45 to the grid circuit of V4B. Its waveform is similar to Fig. 2A, and its amplitude is approximately 80 volts. A portion of this signal (about 30%) is tapped off at the junction of R26 and R27, and is then coupled through C43 to the grid of V5B.

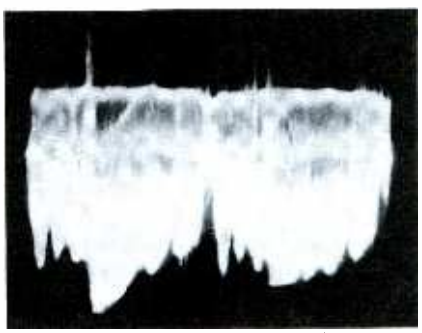
This receiver uses no AGC ampli-

fier or keying tube. The input to the AGC filter (C5 and R15) is derived by combining the negative-going voltage across the video-detector load with a portion of the sync-separator grid voltage, and opposing the resultant with a positive delay voltage obtained from B+ through R46. In this arrangement, the AGC bias is greater than that which could be obtained from the detector alone. The dual input circuit also compensates for variations in the background-brightness level of the picture signal, since the detector and sync-separator voltages change in opposite directions when there is a shift in average brightness of the scene.

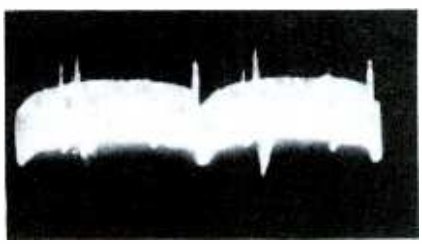
6BU8 System

A circuit more widely used than the triode type incorporates both a sync separator and a noise limiter in a single multielement tube. The most highly-developed version of this system, utilizing the 6BU8 twin pentode (Fig. 4), also includes a keyed AGC circuit.

Pins 9 and 8 of V5 function as a



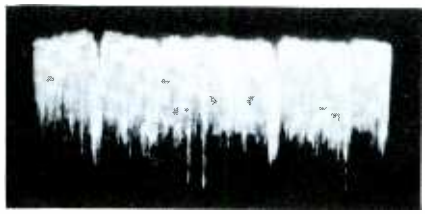
(A) Input to sync separator.



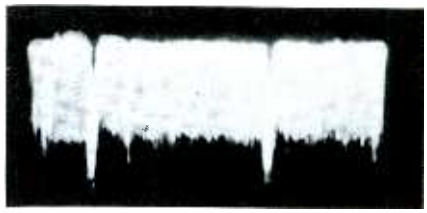
(B) Pin 7—R5 at minimum.

(C) Pin 7—R5 advanced.

Fig. 5. Noisy signal fed to 6BU8.



(A) Without noise cancellation.



(B) Noise limiter functioning.

Fig. 6. Noisy sync-output signal.

sync-separator grid and plate, as evidenced by W1 and W2. Likewise, pins 6 and 3 are equivalent to the grid and plate of an AGC keying tube. The noise-limiter grid (pin 7) receives a sample of the video-detector output signal. As taken from the detector, this signal has the same waveshape as W1, although it is opposite in polarity and smaller in amplitude. However, the signal actually appearing at pin 7 is compressed into the shape shown in W3, because the grid normally operates in the saturation region. A return circuit to B+ through the high resistance of R49, R5, and R35 causes the grid to draw a slight current, thus tending to swamp out the signal. In this way, W3 is prevented from having much effect on tube conduction except when noise interference is actually present.

The most troublesome noise pulses in the sync and AGC input signals are those strong enough to rise above the positive peaks formed by the sync pulses. (See Fig. 5A). The same noise spikes form negative pulses in W3; but these are swamped out by grid current, as in Fig. 5B, if the FRINGE LOCK control R5 is in its full-counterclockwise or minimum-resistance position. However, advancing the control adjusts the bias on pin 7 so that strong noise pulses can momentarily interrupt the grid current and drive the grid voltage sharply negative—thus reducing or cutting off plate current in both sections of V5. (Note the "stalactites" in Fig. 5C.)

The effect on the sync section is revealed in Fig. 6. With the FRINGE LOCK setting at minimum, noise pulses in W1 produce strong, random-frequency negative pulses in W2, as shown in Fig. 6A. On the other hand, active operation of the FRINGE LOCK circuit prevents the sync section from responding to most of the noise pulses, and the irregular peaks in W2 are mostly smoothed out (Fig. 6B). A sync pulse is occasionally clipped out along with the noise, but this can be tolerated with little effect on sync stability.

If the FRINGE LOCK control is advanced too far, the amplitude of W3 increases, and the sync-pulse tips in this signal cut off V5. The consequent destruction of the sync-output signal is demonstrated in Fig. 7 at a 7875-cps scope-sweep rate. In receivers with keyed AGC, the loss of horizontal sync deprives the AGC system of properly-timed keying pulses, thus producing overloading of various video stages and greatly aggravating the symptoms.

After any service job involving a noise-inverter circuit, reception on all channels should be checked *in the customer's home* to make sure the noise-inverter control is not turned high enough to cause sync clipping. Clues to trouble in this circuit are best obtained by carefully analyzing both voltages and waveforms *in relation to each other*, since signals and DC sources both play a part in establishing the somewhat critical bias on the noise inverter. ▲

(A) Normal sync-pulse waveform.

(B) Pulses cancelled by limiter.

Fig. 7. Sync output at 7875 cps.

SERVICE DEALER ADVERTISING PROGRAM

Response to the unique PF REPORTER advertising program has proved beyond any doubt that such a service is needed. This response is a healthy sign that the radio-TV electronics service industry is aware of the necessity for *good* advertising copy.

To make sure these ads will get results, the program has been carefully developed and field-tested. As a service to our readers, each month's selection of 5 ads is available *at cost* in two forms—durable newspaper mats at $1.75 per set, or high-quality reproduction proofs at only $1.00 per set. The latter will serve as finished artwork for offset printing of handbills, postcards, doorknob hangers, direct-mail pieces. etc. To obtain your set of this month's ads, or the entire series at a reduced rate, use the convenient order form on page 73. Your ads will be sent to you postpaid.

ES-3: 1⅞" x 4⅞"
This ad proclaims your company to be "Professional Ghost-Chasers" who can put new life back into a TV. Also, you get in a plug for your radio and hi-fi service.

ES-6: 1⅞" x 4¾"
The down-to-earth approach of this ad sets things right for potential customers to call "The most dependable TV Bug-Killer in Town." You, of coursel

ES-10: 3¾" x 2⅝"
Comic cartoons and wrestling seem to go together. Here they blend to bring a "real gone" message to potential customers tired of wrestling with their TV.

ES-20: 1⅞" x 2¾"
Got an eye for selling TV service? This eyestopper carries a terrific punch for such a small package.

ES-36: 1⅞" x 3"
Warm weather is an ideal time for TV antenna installation and repair. This ad lets people know you are in the business.

CRT Replacement

(Continued from page 22)

tube to see if it uses a straight gun that requires a double-magnet trap, or a bent gun that requires a single-magnet trap. Or, if you're just getting ready to order the tube, look in a tube manual to see what type of trap is required. Always use a new ion trap with these tubes—old ones that have been lying around will normally have lost some of their strength.

Parallel-filament circuits only means that the substitute tube can't be used in a series filament circuit because of different current ratings. This note usually accompanies a tube meant for use in a 450-ma filament string.

Mechanical changes may be required is a phrase that disqualifies a substitution as far as many servicemen are concerned. They visualize everything from obtaining a new CRT mask to cutting up the front of the TV cabinet. Actually, the note usually refers to some slight difference in the over-all length of the tube. As a rule, this minor discrepancy can easily be overcome. Check a tube manual to see what differences exist; then, before removing the old picture tube, check to see if there are any critical size limitations in the set. Can you install a tube with a 1" longer neck, for example? Is the yoke bracket adjustable? Are there any objects right against the bulb of the picture tube? If there *are* limitations, will it be easy to modify the set to accept a slightly different tube?

Change of accelerator-grid voltage may be required indicates a need for a minor circuit revision. However, this job is almost as easy as changing the focus potential of an electrostatically-focused CRT. The majority of picture tubes operate with an accelerating-grid voltage somewhere in the range from 250 to 500 volts. A few types, however, require only 50 to 110 volts. When you encounter this note, be sure to check a tube manual to see what particular operating potential should be applied to the accelerating grid of the substitute tube. Normally, the required potential can be obtained from the regular B+ or boost-voltage source in the receiver. If not, obtain the correct potential from a voltage divider installed between one of these source points and ground. The total resistance of the voltage divider should be as high as possible in order to reduce the drain on the power supply. This poses no operating problem, since there is very little current flow in this circuit.

Change of focusing voltage may be required shouldn't create any unusual problem, since the same precaution applies even in most cases where the replacement tube is identical to the original. A common design feature in present-day TV chassis is a focus terminal board which serves as a convenient source of several often-needed focusing potentials. Generally, you should have no difficulty in obtaining sharp focus even when using a substitute CRT type.

One unusual situation arises when a regular electrostatic tube, requiring a focusing potential ranging from 0 to 500 volts, is substituted for one of those rare types that demand a potential ranging from 2000 to 3000 volts. Chassis using these CRT's employ a special focus rectifier. When substituting

for these tubes, ignore the focus-rectifier circuit and return the focus lead to a normal low-voltage source.

Change of brightness-control voltage may be required indicates a need for the same sort of minor circuit revision which was discussed under the heading, "Change of accelerator-grid voltage may be required." The only additional work entailed in providing a different brightness-control voltage is the installation of an additional decoupling capacitor (.05 to .1 mfd) from ground to the CRT side of the voltage-divider network.

Add high-voltage filter capacitor is a reminder that the substitute picture tube does not have an external aquadag coating, but the original tube does. Therefore, a separate 500-mmf, 20,000-volt capacitor must be used as a high-voltage filter to take the place of the external coating on the CRT. Fig. 1 shows a typical installation, with the added capacitor placed as near as possible to the high-voltage rectifier tube and positioned to minimize the possibility of corona discharge.

Ground Aquadag coating means it's necessary to select a conductor of some sort, attach it to the TV chassis, and see that it also maintains a pressure contact with the aquadag-covered surface of the CRT. A wire or strip of metal under spring tension serves this purpose well. Fig. 2 shows a typical way to accomplish the required alteration.

Change anode connector involves no time-consuming labor for you. This note merely calls your attention to the fact that you'll have to solder a different type of anode connector to the high-voltage lead. The proper connector is readily available from your local electronics parts distributor.

Change ion trap means to switch to a different type. If the original tube was fitted with a double-magnet ion trap, use a single-magnet trap with the replacement. Again, it needs to be stressed that you should use a new ion trap rather than salvaging one from the junk box.

Now that we have looked at each of the modifications listed as footnotes in the accompanying chart, we see that it isn't too much trouble

to substitute for most picture tubes, after all.

Tubes Not Listed on Chart

What about the tubes not listed in the substitution chart? In the first place, most of the tubes not appearing on this chart are readily available and require no substitutes. The only problem you're apt to encounter in replacing a readily-available type comes when an aluminized version is requested as a replacement for a tube not having this feature. Actually, aluminized versions have characteristics almost identical to those of nonaluminized tubes of the same basic type. The only modification problem you are apt to encounter is that of adding an additional high-voltage filter capacitor. The simplicity of this modification has already been described.

Some tubes have been omitted from the chart because more extensive modifications are required when it becomes necessary to use a substitute tube. Generally speaking, these modifications aren't too difficult to accomplish, even though they are a little more involved than the ones associated with the chart.

CRT Specifications

There are several things to consider when you're trying to decide on a satisfactory replacement for a tube not listed in the chart. The first thing to do is obtain a reliable source of information about the tube in the set so you can compare the specifications of other tubes to

Type	Replacement	Type	Replacement
10ABP4	10ABP4A,B,C	16MP4	16MP4A
10BP4,A	10BP4C[9],D[9],10FP4*,A*	16RP4	16RP4A,16KP4,A
10FP4	10FP4A,10BP4**,A**,C**, 10BD4D**	16SP4	16SP4A,16WP4[3,5],A[3,5], B[3,5]
10MP4	10MP4A	16TP4	16UP4[5,6]
12JP4	12RP4**	16UP4	16TP4[5,7]
12KP4	12KP4A,12ZP4**,A**	16WP4[9]	16WP4A[7],B[7],16SP4[3,5],A[3,5]
12LP4	12LP4A,C,12TP4[6],12KP4*,A*	16ZP4	16LP4,A
12QP4	12QP4A,12ZP4[8],A[8],12KP4**,A**	17ATP4	17ATP4A,17AVP4,A
12RP4	12JP4*	17AVP4	17AVP4A,17ATP4,A
12TP4	12LP4[7],A[7],C[7]	17BKP4	17BKP4A,17BSP4*
12UP4	12UP4A,B[9]	17BMP4	17BUP4[3,5],17CBP4[3,5],17CLP4[3,5]
12VP4	12VP4A	17BP4C	17BP4[6],A,B,17JP4
12ZP4	12ZP4A,12KP4*,A*	17BRP4	17BZP4,17CAP4,17CKP4
14AEP4	14ARP4[3,5]	17BSP4	17CRP4[3,5]
14ARP4	14AEP4[3,5]	17BUP4	17CBP4,17BMP4[3,5]
14AUP4	14AWP4	17BVP4	17BWP4*[2],17CSP4*[2]
14AWP4	14AUP4	17BWP4	17CSP4,17BVP4**[2]
14BP4	14BP4A,14CP4,A,14EP4	17BZP4	17BRP4,17CAP4,17CKP4
14CP4	14CP4A,14BP4,A,14EP4	17CAP4	17BRP4,17BZP4,17CKP4
14EP4	14BP4,A,14CP4,A	17CBP4	17BUP4
14KP4	14KP4A	17CKP4	17BRP4,17BZP4,17CAP4
14NP4	14NP4A,14SP4,14WP4*	17CLP4	17BMP4[3,5]
14QP4	14QP4A	17CP4	17CP4A
14RP4	14RP4A	17CRP4	17BSP4[3,5]
14SP4	14NP4,A,14WP4*	17CSP4	17BWP4,17BVP4**[2]
14WP4	14ZP4	17DJP4	17DCP4*
14XP4	14XP4A,14AWP4*[,3,5],14AUP4*[,3,5]	17FP4	17FP4A
14ZP4	14WP4	17HP4B	17HP4,A,17RP4,C
15DP4	15DP4A	17KP4	17KP4A
16AP4	16AP4A,B	17LP4	17LP4A,17VP4,B
16DP4	16DP4A	17QP4	17QP4A,17UP4,17YP4
16EP4[9]	16EP4A,B[9]	17RP4C	17RP4,17HP4,A,B
16GP4	16GP4A,B,C	17UP4	17QP4,A,17YP4
16HP4	16HP4A	17VP4	17VP4B,17LP4,A
16JP4	16JP4A	17YP4	17QP4,A,17UP4
16KP4	16KP4A,16RP4,A	19AFP4	19AUP4
16LP4	16LP4A,16ZP4	19AP4	19AP4A,B,C,D

* Omit ion trap.
** Add ion trap.
[1] Parallel-filament circuits only.
[2] Mechanical changes may be required.
[3] Change of accelerator-grid voltage may be required.
[4] Change of focusing voltage may be required.

Type	Replacement	Type	Replacement
19AUP4	19AFP4	21DKP4	21DKP4A
19DP4	19DP4A	21DP4	21MP4[1]
20CP4,B,C	20DP4,B,20CP4A[7],D[7], 20DP4A[7],C[7]	21DSP4	21CBP4[3,5],A[3,5],21CHP4[3]
		21DWP4	21CEP4[5],A[5],21DFP4[5]
20CP4A,D	20DP4C,20CP4[6],B[6],C[6], 20DP4[6],B[6]	21EP4	21EP4A[7],B[7]
		21FP4	21FP4A[7],C[7]
20DP4,B	20CP4,B,C,20DP4A[7],C[7],20CP4A[7],D[7]	21JP4	21JP4A
20DP4A,C	20CP4A,D,20DP4[6],B[6],20CP4[6],B[6]	21KP4	21KP4A[7]
20HP4B,C	20HP4A[7],D[7],20LP4[7],20MP4[7]	21WP4	21WP4A
20HP4A,D	20LP4,20MP4,20HP4[6],B[6],C[6]	21XP4	21XP4A,21AYP4
20LP4	20MP4,A,D,20HP4[6],B[6],C[6]	21ZP4	21ZP4A[7],B[7]
20MP4	20LP4,A,D,20HP4[6],B[6]C[6]	23ACP4	23TP4
21ACP4	21ACP4A,21AMP4,A,21BSP4,21AQP4[6],A[6]	23KP4	23KP4A
21AMP4	21AMP4A,21ACP4,A,21BSP4,21AQP4[6],A[6]	23XP4	23YP4
21ANP4	21ANP4A	23YP4	23ZP4
21AQP4	21AQP4A,21ACP4[7],A[7], 21AMP4[7],A[7],21BSP4[7]	23ZP4	23YP4
		24AHP4	24ALP4,24BAP4[3]
21ARP4	21ARP4A	24AJP4	24ATP4
21ATP4B	21ATP4,A,21ALP4,A,B,21BTP4, 21BAP4*,21BNP4*	24ALP4	24AHP4,24BAP4[3]
		24ANP4	24DP4,A,24YP4,24AEP4*,24ZP4*
21AUP4	21AUP4A,B,21AVP4,A,B,21BCP4*	24AP4	24AP4A,B
21AVP4	21AVP4A,B,21AUP4,A,B,21BCP4*	24ATP4	24AJP4
21AYP4	21XP4,A	24BAP4	24AHP4[3],24ALP4[3]
21BAP4	21BNP4,21CVP4	24CP4	24CP4A,24ADP4,24QP4,24TP4,24VP4,A
21BCP4	21BDP4,21AUP4**,A**,B**, 21AVP4**,A**,B**	24DP4	24DP4A,24ANP4,24YP4,24AEP4*, 24ZP4*
21BDP4	21BCP4,21AUP4**,A**,B**, 21AVP4**,A**,B**	24QP4	24ADP4,24CP4,A,24TP4,24VP4,A
		24VP4	24VP4A,24ADP4,24CP4,A,24QP4,24TP4
21BNP4	21BAP4,21CVP4	24XP4	24ADP4,24CP4,A,24QP4,24TP4,24VP4,A
21CBP4B	21CBP4,A,21CHP4[3,5], 21CXP4[3,5],21DSP4[3,5]	24ZP4	24AEP4,24ANP4**,24DP4**,A**,24YP4**
		27EP4	27GP4,27NP4[7],27RP4[7]
21CDP4	21CDP4A,21CKP4*	27GP4	27EP4,27NP4[7],27RP4[7]
21CHP4	21CBP4[3,5],A[3,5],21CXP4[3],21DSP4[3]	27NP4	27RP4,27EP4[6],27GP4[6]
21CQP4	21CSP4[1]	27RP4	27NP4,27EP4[6],27GP4[6]
21CSP4	21CQP4[1]	27SP4	27UP4
21CVP4	21BAP4,21BNP4	27UP4	27SP4
21CZP4	21DEP4,A,21DAP4[1,5]		
21DFP4	21DWP4[5]		

[5] Change of brightness-control voltage may be required.
[6] Add high-voltage filter capacitor.
[7] Ground AQUADAG coating.
[8] Change anode connector.
[9] Change ion trap.

those of the original. Conventional tube manuals will provide most of the data you need. In the event the tube is not listed in your manual, special picture-tube manuals and characteristics charts are available to provide this information.

The characteristics of vital importance are:

Deflection Angle
Face Plate and Bulb
Screen Dimensions
Heater Ratings
Type of Focus
Length (if limited)
Anode and G2 Volts
Base Type
Cutoff Voltage
Trap (if required)
Aquadag Coating
High-Voltage Connector

Once you become familiar with these characteristics, you'll have little trouble in comparing particular specifications of different types to aid in determining your final selection.

To illustrate what might be involved, let's assume we can't obtain a replacement for a 21AWP4 picture tube. Looking up the specifications for this type in a tube manual, we find that it's a rectangular tube with 70° deflection and magnetic focusing. Looking at its other characteristics, we see very few which differ from those of the 21AVP4 listed directly above. The only real differences appear in the columns "focusing" and "basing." The readily-available 21AVP4 uses electrostatic focusing and a 12L base, while the 21AWP4

is magnetically focused and has a 12N base.

This substitution is an easy one to make. All we need to do is remove the focus magnet from the neck of the tube, change the tube socket, and connect pin 6 to some B+ point ranging between 0 and 350 volts. Also, we'll need to obtain centering rings or a similar device that will enable us to center the image on the screen. The only remaining problem concerns what to do with the focus coil removed from the old tube. This can be either secured to the chassis, fastened inside the cabinet, or if necessary, replaced with a choke coil.

Don't think the above example is a special case. A little ingenuity will usually permit you to accomplish substitutions which are generally considered "too complex" to be included in CRT-replacement charts.

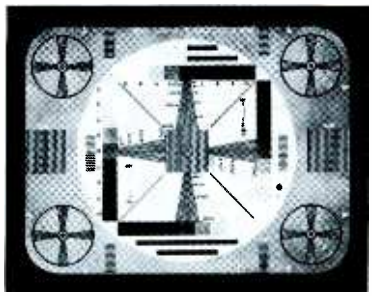
Besides the differences in focusing and basing just cited, various other factors can prevent tubes from being listed as substitutes for other types. One of the most important of these is the high-voltage rating. In receivers with considerable control over the high-voltage output, this will pose only a minor problem. In other cases, if a replacement tube requires lower high voltage, it is a simple process to add a 1- or 2-meg resistor in series with the high-voltage lead in order to reduce the anode potential. In other cases, when the replacement calls for a higher voltage than is obtainable in the receiver, you'll normally find you can obtain sufficient brightness and adequate control of sweep width even when the new tube is listed as requiring as much as 4000 additional volts at the anode. True, you may not have quite as much brightness as the new tube is capable of producing, but there will be plenty for most applications.

Conversions

Once you become familiar with the techniques involved in replacing picture tubes with substitute types, you may want to branch out into conversions. This offers a considerable challenge to the ingenuity of a technician in that it is often necessary to modify the cabinet and mask, and in many cases, make design modifications in the horizontal sweep circuits. Generally speaking, the average serviceman feels this is too much trouble, considering the financial return he can get from such a job.

Most conversions are contemplated when the serviceman finds it impossible to obtain a metal picture tube, and begins to consider using a glass replacement. He should also find it easy to sell the customer on this idea, once he's quoted the price of the metal tube. Complete details of what is involved in such a conversion were contained in the article "Replacing Metal CRT's with Glass" in the May, 1958 issue.

After gaining a greater insight of what you can do when called upon to replace a picture tube, you'll undoubtedly find yourself tackling some new challenges in the area of CRT substitution. If the situation warrants, never give up on a substitution until you've investigated every possibility. Remember, customer satisfaction and profitable service are the reasons for attempting the picture-tube replacement in the first place. ▲



TV TIPS FROM TRIAD

NO. 12 IN A SERIES

"—and you can see the 'glitch' on the trailing edge of horizontal sync," said Bill as he pointed to the offending interloper on the scope pattern. "Now, let's review: You're worried about your procedure because of the days you've lost on this job with multiple trouble. It loses horizontal hold on change of channels, or on some station switches, but it's perfectly stable otherwise. It has a slight 'S' in the vertical raster and a variable sync buzz in the audio. Now, what have you done so far ?"

"What haven't I done?" muttered Joe under his breath, "so far I've shunted the electrolytics with good units of greater capacity than the originals, I've rebuilt the sync separator, AFC, and horizontal oscillator, with new parts and realigned the sound detector, all with no results."

"Sounds a little long on 'shotgun' and a little short on planning," commented Bill, with a twinkle in his eye, "since the 'glitch' shows up at the video detector it's very likely introduced in the tuner because of poor bypass. The 'S' in the vertical is also indicative of poor bypass, and you may have been fooled by trying to shunt a multiple unit like that four section electrolytic. Install a new high quality electrolytic and I'll wager that your buzz and 'glitch' will disappear. That spike is getting in at the tuner and looks just like sync to the sync separator.

"Whenever you change channels or the station switches in a way that interrupts sync, the AFC system locks in on its own reference pulse and 'hold' is not only lost, but actually locked out if the circuit incorporate a keyed AGC system.

"The hardest lesson I had to learn was to discipline myself to determine the basic problem, and then, one by one, repair the obvious. This meant not only taking positive steps with the filter system, but also not worrying about shading in the raster until I had replaced the covers on the cage or IF strip. If I fixed the visible problems, one at a time, the mysterious elements seemed to take care of themselves, or become easy to identify."

* * *

MORAL: Many a Professional Television Man has had to replace a flyback or other component before he could determine the original reason for receiver failure. "Multiple trouble" is the theme of PTM #4 which will be mailed to people on our mailing list in the near future. If you are not on our mailing list, you can be by writing to ***Renewal Division, Triad Transformer Corp.,*** 4055 Redwood Ave., Venice, Calif.

The CB Market

(Continued from page 31)

position of the factory-authorized CB dealer. He can compete for the industrial, hobbyist and consumer markets, with the advantage of being able to offer service; in addition, he can vie for sales of equipment to other electronics service dealers. Fortunately, many openings still exist for men capable of assuming the responsibilities of a factory-authorized CB dealer.

The electronics service dealer is also fortunate in having the opportunity to become one of the central figures in the expanding CB market. He can profitably compete with the factory-authorized CB dealer for installation, accessory, and service business from industrial and hobbyist customers. In addition, he has a direct shot at the much larger business and consumer market.

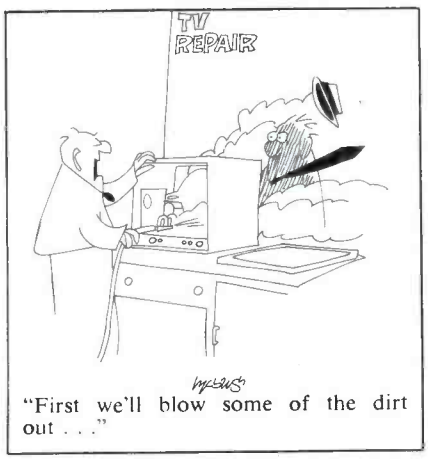
New Day Dawning

Although Citizens radio has developed to its present state primarily from the demands of industrial and hobbyist users, more and more consumers and businessmen are finding out about the advantages of CB radio. We are currently in the early stages of a tremendous demand for CB equipment, and the alert electronics service dealer has an excellent opportunity to cash in on this new branch of electronics.

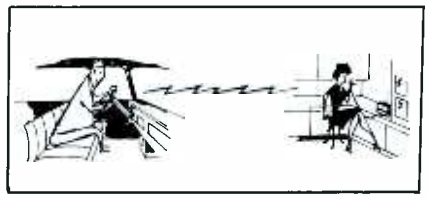
One of the basic truths about CB equipment is often overlooked: It was authorized and developed for the *average citizen*. For the first time in history, two-way communications equipment is available to the general public at a price well within reach. Many radio and television personalities have discussed this new means of communications openly and freely on their shows, thus giving it countless hours of free commercial time on two of the greatest sales media in America. In addition, the CB user himself is contributing much toward creating today's demand for CB equipment by talking about its convenience.

No matter where you look, you can find an application for CB equipment. For example, look at the average American's leisure-time activities. Compact, moderately-priced CB units that require no license (except when used in conjunction with a full-powered CB installation) are

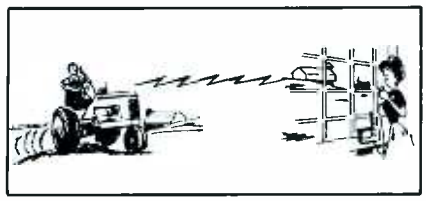
ideally suited for use in many sports activities. Hunters, fishermen, skiers, sports car enthusiasts, boaters, and others all find these little units just what they need to provide communications over short distances.



"First we'll blow some of the dirt out . . ."

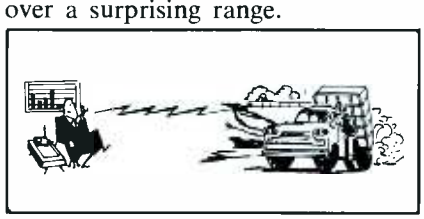


Not to be overlooked is the convenience afforded by mobile installations of CB equipment. It's often desirable to have communications between the home and the family car. Although this was not too practical before the advent of CB, the moderate price of this new two-way communications system is within the means of the average family's budget.



Folks living in rural areas have found CB exceptionally useful as a means of maintaining communications when regular power and telephone lines have been knocked out of commission during severe storms. In fact, CB has proved its worth many times by supplying two-way communications during an emergency. In addition, it can be used to provide closer co-ordination of activities during daily farm work.

Private-plane owners are finding CB equipment useful as an accessory. While it doesn't take the place of standard radio equipment, it does provide two-way communications not possible with the regular aircraft radio. Although the power output of CB gear is low, it is not uncommon for a plane flying at around 5000 feet to have reliable communications over a surprising range.



Of course, the examples cited above account for only a fraction of the thousands of uses found for CB gear in the consumer market. Tied in quite closely with consumer use are many business and professional applications for CB. All firms offering services, such as your own shop, dry cleaners, service stations, garages, etc., find CB a useful tool in maintaining contact with outside personnel. Many doctors have come to realize the value of CB in being able to keep in touch with their office, as have realtors, salesmen, and scores of others having similar business demands.

City, county, and state governmental agencies are typical "big-time" users of CB equipment. Construction firms, contractors, taxi companies, and many industrial firms are further examples of quantity purchasers who are taking advantage of the low-cost two-way communications offered by CB. Of course, we have mentioned only a few of the potential customers in the business market. A quick glance through the classified section of a telephone directory will disclose the names of many firms who could put CB to effective use.

Installation

In looking at the over-all picture of CB, we cannot place too much emphasis on the importance of a *good* installation; the installation can make or break a sale. In fact, it isn't difficult to find a service dealer who has witnessed an increase in sales when the word got around among CB'ers that he had installed so and so's rig. Don't get the idea that CB is difficult to install—far from it! However, it does take technical know-how and a reasonable amount of test equipment to be certain a CB unit is radiating the best possible signal.

Many CB installations are the product of the do-it-yourselfer. Because of this, the service dealer can supplement his income by reworking some of the installations now in the field. Also, the active CB service dealer may find it possible to obtain additional installation work from other dealers within the area.

While we're talking about installations, don't forget that CB units are normally compact and easy to move. Service dealers often find it possible to sell two or more sets of

installation facilities for each piece of CB equipment so it can be used at different locations. For example, a businessman might have a CB installation in his automobile so he could transfer one of the units from a service vehicle into his car whenever he wanted.

CB Assembler

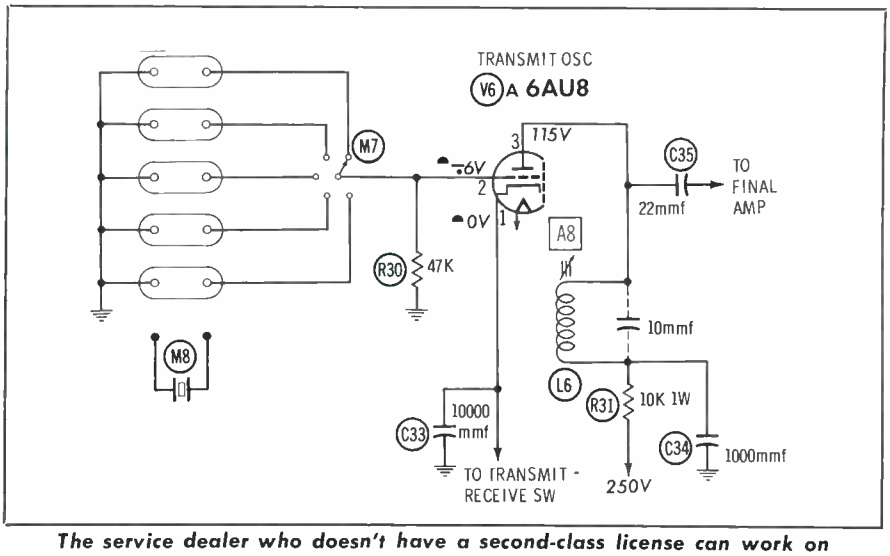
Some service dealers are putting their spare time to good advantage by assembling and selling CB kits. Since the FCC requires kit manufacturers to make certain the finished units will operate at the proper frequencies and within rated power limits, it does not take a licensed person to build kits or test them when completed. Obviously, if a CB kit is simple enough for a layman to construct, it poses no problem for the qualified technician.

One of the major attractions afforded by kits is that of price. Most prewired kits sell for under $100, thus appealing to the budget-minded customer. Some service dealers have found it highly profitable to purchase kits, assemble them, and sell them at prewired-unit price to those people who want the most economical type of CB equipment.

Servicing CB

Most service work on CB transceivers can be performed by the average TV technician. It is a misconception to believe that a license is required before a serviceman can touch a CB repair job. Granted, there are areas of CB service work that do require at least a second-class license. FCC rules call for this minimum standard in making any repair or adjustment that will alter the operating frequency or exceed the maximum power-output rating of a CB unit. Since CB manufacturers are designing their equipment so it is impossible for power ratings to be exceeded, the unlicensed service dealer can service any part of the equipment except the transmitter oscillator circuit.

Obviously, the service dealer who becomes deeply involved in CB sales and service will want to obtain a license. This way, he will have no restrictions imposed upon him and can solicit business from unlicensed dealers in his area who encounter jobs requiring transmitter-oscillator service or adjustment.



The service dealer who doesn't have a second-class license can work on a CB transceiver as long as he doesn't alter the frequency of this circuit.

Genenally speaking, service and installation charges for CB equipment run somewhat higher than TV service charges. Practically all CB service stations have a fixed minimum charge based on an hourly rate. (A $5 minimum based on a $7.50 hourly rate is a typical example.)

Flat-rate pricing seems to be the accepted procedure for installation work. Typical charges for putting in a base station usually range from $20 to $25. Of course, exceptions are made for unusually easy or difficult installations. Charges for installing a mobile unit normally average from $10 to $15, although an additional charge is made whenever extensive noise-suppression equipment is required.

Dealer Support

One of the things the average service dealer wants to know when considering his place in a newly expanding field is, "What kind of support do I get?" Fortunately, CB service dealers are receiving considerable help.

Manufacturers are providing service dealers with attractive brochures which spell out the capabilities of the equipment and offer many suggestions for possible uses. Many are also developing educational programs to help service dealers technically and in sales. In addition, factory-authorized service stations are spreading across the nation to provide an adequate supply of any specialized component that may be required, and to handle inquiries from their respective trading areas about a particular manufacturer's CB gear. In fact, all the necessary help is there for the asking—it's now up to the service dealer to take the initiative.

Conclusion

Now that we have taken a critical look at the CB industry as it exists today, we can come to a logical conclusion in determining where the service dealer fits into the CB picture. First of all, there is a healthy demand for CB equipment. In addition, the terrific potential for future sales is restricted only by the imagination of the man who sells CB equipment. Since the average radio-TV-electronics service dealer is in constant contact with this potential market, has the technical background to enable him to install and service the equipment, and will be required to make only a minimum additional investment in equipment, it's only logical for him to join the swing to CB and strive for his share in the returns from this new market. ▲

Test Instruments Needed for CB Service

- VOM and VTVM
- Scope
- RF Generator: ranges for 27 mc, 5000 kc, 455 kc.
- Audio Generator
- Power Supply: 6- and 12-volt DC
- Transistor Tester
- RF Wattmeter, or Field-Strength Meter, or Standing-Wave Meter
- Frequency Meter (for transmitter oscillator work.)
- Miscellaneous Hand Tools

When you compare these test-instrument requirements with your present equipment, you'll probably find it will cost less than $100 to obtain everything you need.

10-Minute Fuses

(Continued from page 20)

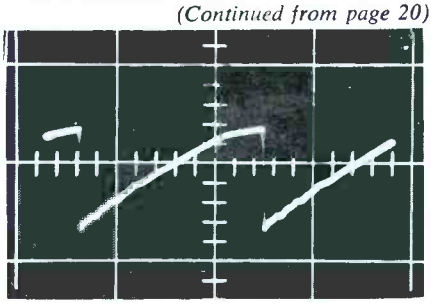


Fig. 2. The flattened grid waveform at the output tube held the first clue.

These oscillations clearly indicated something wrong in the damper circuit. (A normally-operating damper removes the oscillatory currents which immediately follow retrace, as shown in Fig. 4.) Substituting both damper tubes failed to correct the ringing in the waveform, and also had no effect on the drive signal.

By now the set had been in operation long enough for the wax on the flyback and linearity coil to begin giving off a pungent odor. Both components were getting so warm that the wax was beginning to melt and drop to the chassis. Just as I made this discovery, pftt —the quarter-amp sweep fuse blew.

Time Out to Think

Since the blown fuse had temporarily halted the troubleshooting procedure, this was a good time to pause and evaluate what had already come to light. Obviously, there was excessive current flow in the circuit. Substitutions had eliminated the possibility of tube trouble, and the horizontal drive signal had been restored to nearly normal.

From the waveform obtained at the high-voltage rectifier lead (Fig. 3), the trouble appeared to be centered in the damper circuit. With this all-important clue, the earlier voltage measurements took on a new meaning. Boost voltage had been *low* and B+ *high!* Normally, higher B+ would indicate that boost voltage should also be higher.

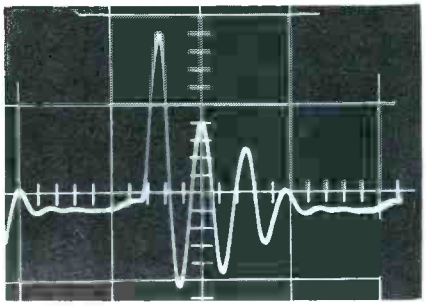


Fig. 3. Ringing in waveform taken from 1B3 lead pointed to damper trouble.

To be certain that the old output tube hadn't been the cause of the lowered boost voltage, I paralleled the blown fuse with a new one and fired up the set again. There had been no change—boost was still low and B+ was high. The grid voltage on the output tube wasn't quite as negative as it should have been, the cathode voltage was a little high, and the screen was a little low. Adjusting the horizontal drive trimmer varied both the grid voltage and the amplitude of the grid waveform. However, the flat top couldn't be completely eliminated, nor could the DC grid voltage be returned to normal.

Digging Deeper

I pulled the plug to save the fuse, and took a more critical look at the schematic (Fig. 1). Perhaps, I reasoned, the grid signal couldn't be restored to normal because the discharge capacitor C111 was unable to receive a full charge. This component is supplied with boost

voltage via R127, as well as regular B+ from R126. With boost voltage low, my assumption seemed logical, so I ignored the grid circuit and redirected my attention to the boost source.

Thinking again of the ripple waveform I'd obtained, I set out to find the reason why the damper tubes weren't smoothing out the oscillations as they should. The tubes were good, the voltages at both damper tube plates were okay, and the negative pulses of the oscillations created by the collapsing yoke field were present—so there had to be some other reason for reduced damper conduction. Of course! I'd almost forgotten the boost capacitors.

Proper cathode voltage on the dampers depends on correct operation of these components (C118 and C119) in combination with linearity coil T6.

During normal operation, the dampers are driven into conduction immediately after the retrace period by a negative pulse at the cathode. Current is then drawn upward through the yoke circuit, and the boost capacitors become charged.

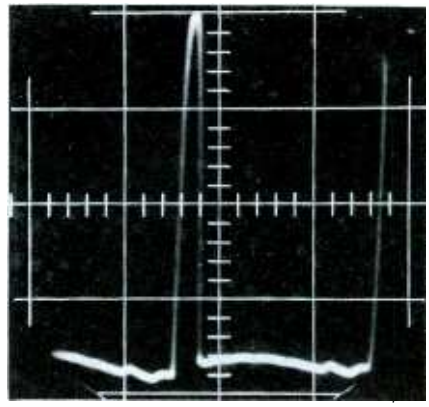


Fig. 4. Waveform normally obtained when scope probe is attached to 1B3.

As the dampers continue to conduct, a high positive voltage (normally well above 500 volts) is built up on the yoke side of C118 and C119. This increasing voltage, applied to cathodes of the dampers, helps to bias these tubes into cutoff toward the middle of the horizontal-trace period. At the same time, the horizontal output tube begins to conduct, and the charge on C118 and C119 is utilized as a source of plate voltage for the output stage. As this tube operates, it partially discharges the capacitors. However, another retrace pulse soon occurs, followed by another cycle of damper conduction which replenishes the charge. The result is a parabolic voltage waveform on the boost line, as shown in Fig. 5.

The linearity coil, a "frill" seldom found in later-model sets, provides a means of slightly varying the phase of the parabola. This adjustment permits a change in the instantaneous value of boost voltage during the critical period of transition between damper current and output-tube current, thereby making it possible to correct for nonlinearity at this point in the yoke-current waveform.

So much for the normal operation of this circuit; now, what about abnormal operation? If C118 or C119 were shorted, sweep and high

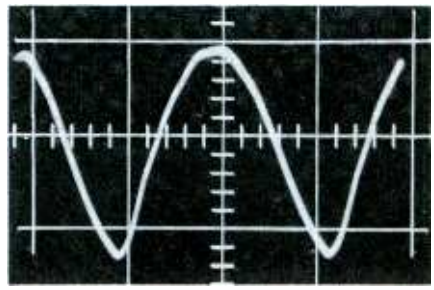


Fig. 5. Linearity-coil setting affects the phase of 15,750-cps boost waveform.

voltage would be entirely killed. Even a small amount of leakage in either capacitor would prevent it from accepting a full charge, thus lowering the boost voltage; in addition, the current drain on the damper circuit would be increased. Assuming that the leakage would become gradually worse as the set continued to operate, it was easy to see that the overload could become serious enough to blow a fuse before very long.

There wasn't much use trying to check the capacitors for leakage, because this fault was probably developing only under the extreme stress imposed by the high current and voltage in the damper circuit. Therefore, the best thing to do was substitute them. This took only a minute, after which I plugged the set in to see how accurate my diagnosis had been.

To my relief—but not surprise—boost voltage now read 600 volts. The drive signal had resumed its normal appearance (Fig. 6). The high voltage, with no picture tube to load it down, had jumped to 18 kv.

The normal grid waveform in Fig. 6 had proved my theory about boost affecting the charge on C111. Pleased at the way things had turned out, I pushed the chassis aside to let it cook for a while.

The Wrap-Up

After the set had operated normally for an hour or so, I decided I was ready to complete the job. The flyback, width, and linearity coils didn't seem to be any worse for the wear, even though they had lost some of their wax coating. Therefore, I left them in the circuit and noted on the repair bill that they had been subjected to damage and might fail at some future time.

At last I was ready to make the final adjustment of the horizontal linearity coil to insure maximum operating efficiency in the sweep circuit. I have a pet method of doing this in the KCS81F and similar receivers. Making certain the ¼-amp fuse was of the standard type (not slow-blow), I watched it carefully, and adjusted the linearity coil until the fuse element just began to glow. I then backed off the adjustment 1½ turns from this point to a final setting that seemed to give excellent results. However, if you prefer a more conventional method, it's no great amount of trouble to substitute a milliammeter for the fuse and adjust the linearity coil for minimum current consistent with normal horizontal sweep. (130 ma is a typical reading for this chassis.)

A final touch-up of the horizontal oscillator and waveform adjustments completed the job. Another mysterious case had been solved by making meaningful tests and correlating them with a practical application of theory. I knew there would be no more 10-minute fuses in this set—at least not for some time. ▲

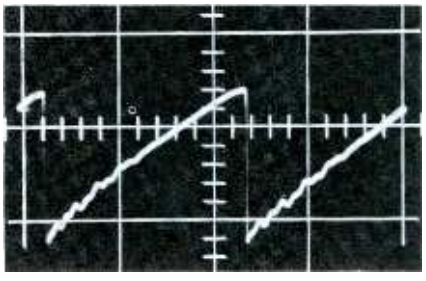


Fig. 6. Final check at grid of the horizontal output tube confirmed theory.

PRODUCT report

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

Dual Bias Source (37B)

The **SENCORE** Model BE113 "Align-o-pak," a dual version of the Model BE3, is designed to supply two individually-variable negative DC voltages for AGC clamping and similar applications. The output from each section of this AC-powered unit ranges from 0 to 20 volts with less than 0.1% ripple. Dealer net price is $12.75.

Variable Isolation Transformers (38B)

A continuously-variable output from 0 to 140V AC, isolated from the 120V input, is furnished by **Standard Electrical Products'** "Adjust-A-Volt" IV Series transformers. Capacities range from .28 to 4.8 KVA. Deluxe units in portable cases, with output voltmeter and thermal circuit breaker, are made in three sizes; there are also two sizes of uncased units for built-in installations.

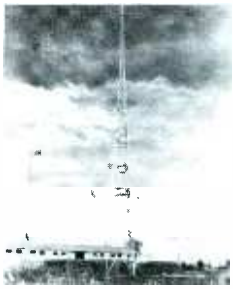
Matched Hi-Fi Tubes (39B)

The **Mullard** line of hi-fi tubes in "laboratory-balanced" matched pairs has been expanded to include several new types. New "dual-tube" packaging has also been adopted. Types available include the EL34/6CA7, EL37, EL84/6BQ5, EL86/6CW5, EL90/6AQ5, EL95/6DL5, ECL82/6BM8, UL84/45B5, and 7189.

Tool Caddy (40B)

The vertical rack of the **General Electric** "Tool Toter" provides a storage place for hand tools, and miscellaneous small parts can be kept in trays molded into the plastic base. Pegboard construction of the rack simplifies adding hooks and clips as needed to hold extra tools. Equipped with a carrying handle, the caddy can be used in the shop or taken on service calls.

Free-Standing Tall Tower (41B)

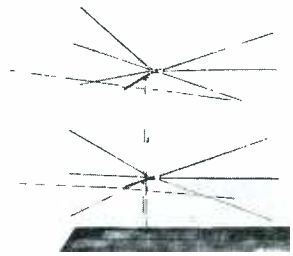


Rohn has introduced a new self-supporting communications-radio tower which can be erected to a maximum height of 170'. Formerly, the tallest tower of this type available in the line measured 130'. The increased height was gained by modifying the basic self-supporting design to incorporate three extra-heavy 20' sections. The photograph shows the new No. 170 tower installed to a height of 140'.

Alkaline Batteries (42B)

With two to eight times the life expectancy of conventional zinc-carbon batteries, **RCA's** new alkaline units are priced midway between conventional and mercury types. Three general-purpose 1.5-volt cells are available — "penlite" (VS1334), "C" size (VS1335), and "N" size (VS1073). In addition, one 4.5-volt type—the VS1149—is offered for use in transistor radios.

Conical TV Antennas (43B)



The **TACO** "Courier" series of conical antennas are factory-preassembled, with all terminals and wing nuts staked in place, so they can be readied for installation within a minute. Crossarms are 1"-diameter aluminum for extra rigidity. Models are available with a choice of straight-dipole or X-type reflector, and with or without a high-band director. The antennas are packed two to a carton, with stacking bars included.

Miniature Citizens Band Transceivers (44B)

Operating on Citizens-band frequencies, but usable under FCC low-power rules without a license, **Seiscor** "Telepath" miniature transceivers are designed for short-range communications. One type, the Model PM-A, is a transistorized shirt-pocket unit (2¾" x 5¾" x 1⅜", 12½ oz.) powered by a 9-volt battery. The other, Model SC-A, is a 20-oz. base station which can be operated from a rechargeable or mercury battery, 12-24V DC source, or 110V AC power line. Prices are: PM-A $125; SC-A, $250.

Tube Caddy-Tester Combination (45B)

The **G-C** "Vis-U-All" tube tester is built into a 20" x 14" x 8" caddy that has space for approximately 150 tubes. The unit checks receiving tubes for emission and current leakage, and can also indicate the general operating condition of a CRT. One of the three main setup controls is a "master switch" for rearranging tube-socket connections to test various types. The tester (Cat. No. 36-504) has a dealer net price of $89.50.

High-Impedance Headset (46B)

The new Mark III "Magna-Twin" magnetic headset, developed by **Telex** for communications, language teaching, and similar uses, has a maximum impedance of 200K ohms, sensitivity of 120 db (at 1000 cps and 1 mw input), frequency response of 50-9000 cps, and weight of 12 oz. New-type foam rubber muffs, with secondary ear seals, exclude ambient noise. Boom-type microphones can be attached.

Tube Tester (47B)

Besides testing conventional TV and radio tubes, the **B & K** Model 600 can check the new 10-pin miniature tubes, 12-pin "Compactrons," "Nuvistors," VR tubes, thyratrons, hybrid auto-radio tubes, many industrial types, and European hi-fi tubes. Test functions include a "good-?-bad" indication, shorts, grid emission, leakage, and gas. Tube-test setup information is given in a reference index. Price is $69.95.

TV Tables (48B)

First in a new line of roll-about tables for portable TV sets and similar equipment, the **JFD** "Mardi Gras" series includes 7 models of various sizes. Finished in polished brass and lacquered bronze or satin black, the tables incorporate solid wrought-iron extension arms and a utility rack for holding magazines, records, etc. The clear "Lucite" wheels are mounted in casters equipped with 1" steel bearings.

Miniature Soldering Irons (49B)

Different models in the **Ungar** "Imperial" line of soldering irons are assembled from the following assortment of interchangeable, individually-available components: 25-, 30-, and 40-watt heat cartridges; polycarbonate-resin "Perma-Cool" handles with patented heat-sink design, in three pastel colors; 42 threaded "Mini-Tips" in a choice of three materials; and three types of power cords, including two designs for use with grounded three-terminal outlets.

Check-Tube Adapter (50B)

A multipurpose adapter newly introduced by **Antronic Corp.**, the Anchor Model TC-438 "Chek-Tube Convertor," permits connecting either the 90° or 110° type of 8" check tube to a CRT socket designed for either the conventional 12L duodecal base or the 8HR standard 110° miniature 8-pin base. In addition, a selector switch sets up the proper base connections and power ratings for substitution testing of five groups of CRT's having unusual filament characteristics. Price is $11.95.

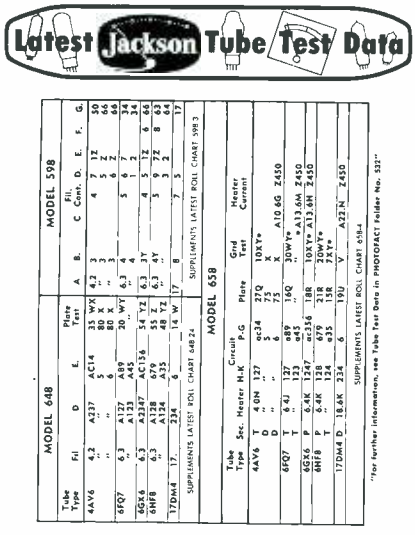
Stereo Cartridges (51B)

In two new, low-cost **Sonotone** ceramic cartridges, the terminal-wire connections are housed in a protective plastic plug. The "16T" series develops an output of 0.5V with 22-db channel separation, while the "18T" series has 0.7V output and 20-db separation. Frequency response of both types is flat within ±1 db from 20 to 10,000 cps, with a smooth roll-off to 12,000 cps. Price is $12.50 with dual sapphire tips or $15.50 with diamond-sapphire combination.

INDEX TO ADVERTISERS

CATALOG AND LITERATURE SERVICE

May, 1961



ANTENNAS AND ACCESSORIES

1B. JFD—New 1961 *Exact-Replacement Antenna Guide Wallchart for Portable and Toteable TV Sets.* Gives TV-receiver model number, manufacturer's antenna part number, and model number of corresponding JFD exact-replacement antenna. Also Form 940 dealer catalog illustrating and describing 1961 line of natural silver and gold-anodized *Hi-Fi* TV antennas, mounts, masts, *Mardi Gras* TV tables, and accessories. *See ad page 26.*

2B. JERROLD—"Products For Better Televiewing," a 12-page catalog of home TV reception aids, TV distribution systems, antenna-system test equipment, and accessories. *See ad 2nd cover.*

3B. WINEGARD—Brochure describing the *Powertron*, a new and popular "electronic TV antenna with built-in tube." *See ad pages 12-13.*

AUDIO AND HI-FI

4B. DUOTONE—1961 Needle Replacement Wall Chart. *See ad page 64.*

5B. EICO—New 28-page catalog of kits and wired equipment for stereo and monophonic hi-fi, test instruments, "ham" gear, Citizens band transceivers, and transistor radios. Also "Stereo Hi-Fi Guide" and "Short Course for Novice License." *See ad page 61.*

6B. SONOTONE—Information on newly-introduced "16T" and "18T" stereo ceramic cartridges. *See ad page 67.*

7B. SWITCHCRAFT—New Product Bulletin 109 describing three-conductor *Littel Plugs* (part nos. S-260 and S-290), which feature 206"-diameter finger and are interchangeable with MIL Type PJ-068 plugs. *See ad page 62.*

8B. UTAH—Specification sheet on Series D *Dual Diameter* coaxial high-fidelity speakers. *See ad page 55.*

COMMUNICATIONS RADIO

9B. MARK MOBILE—Data sheets on base-station and vehicular antennas for use on 27-mc Citizens band; also information on models for two-way communications services in 25-50 mc, 144-174 mc, and 450-470 mc bands.

COMPONENTS

10B. ARCO—Circular on *Deal No. 140W* kit, including 140 *Elmenco dp* dipped *Mylar*-paper capacitors (in 10 most popular values) plus 100-watt soldering gun, at special combination price of $29.95. *See ad page 17.*

11B. BUSSMANN—Bulletin EFA on two new fuse assortments in new-style metal display stand which incorporates a special inventory feature. Stand may be hung on wall or stood on service bench. *See ad page 53.*

12B. CENTRALAB — New 16-page catalog listing full line of ceramic capacitors, controls, and *P.E.C.* packaged circuits. *See ad page 63.*

13B. SAMPSON — Transistor Battery Data and Reference Guide, with size, price and cross-reference data on batteries used in all transistor radios; also information on "Point-of-Purchase Profit Pak," a counter display for *Samco* dry batteries. *See ads pages 40, 42.*

14B. SPRAGUE — New 44-page Catalog C-614, showing complete listings of all stock parts for TV and radio replacement use, as well as *Transfarad* and *Tel-Ohmike* capacitor analyzers. *See ad page 10.*

RADIOS

15B. ATR—Descriptive literature on *Karadios* for compact and imported cars, trucks, etc. These are vibrator-operated, 6-tube superheterodyne radios, offering excellent sensitivity, tone, and volume. *See ad page 16.*

SERVICE AIDS

16B. BERNS—Data on 3-in-1 picture-tube repair tool, 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 74.*

17B. CASTLE—Leaflet describing fast overhauling service on television tuners of all makes and models. *See ad page 71.*

18B. ELECTRONIC CHEMICAL—Data on new pressurized *No-Noise* rubber coat insulating spray, 5" plastic extender for pin-point chemical spray application, and new formula EC-44 contact cleaner. *See ad page 74.*

19B. MAGNAVOX — Information on new stereo-mono test record developed for service technicians' use in audio service work, signal tracing, testing, and stereo balancing.

20B. McCABE-POWERS — Bulletin SM-601 picturing and describing *Service-Master* all-purpose truck bodies, designed specifically for on-the-job service work, in ½-, ¾-, 1-, and 1½-ton sizes.

21B. PRECISION TUNER—Information on repair and alignment service available for any type of TV tuner. *See ad page 66.*

22B. YEATS — Literature describing *Appliance Dolly* and padded delivery covers. *See ad page 60.*

TECHNICAL PUBLICATIONS

23B. CBS ELECTRONICS — Complete descriptive folder on revised *Transistor Home-Study Course. See ad page 49.*

24B. GRANTHAM — Booklet entitled, "Careers in Electronics," outlining training courses available. *See ad page 21.*

25B. RIDER—Latest book list. *See ad page 52.*

26B. HOWARD W. SAMS — Literature describing all current publications on radio, TV, communications, audio and hi-fi, and industrial electronics servicing. *See ads pages 58, 59, 64, 72.*

27B. WESTINGHOUSE (Television - Radio Div.)—Complete information about receiving factory service information, including monthly publication *Tech-Lit News* which contains articles of interest to electronics service technicians.

TEST EQUIPMENT

28B. B & K—Catalog AP17-R giving information on new *V O Matic 360 Automatic Volt-Ohm-Milliammeter*, new Model 600 *Dyna-Quik* tube tester, Model 1076 *Television Analyst*, Models 1070 and A107 *Dyna-Sweep Circuit Analyzers*, Models 550, 650, and 675 *Dyna-Quik* mutual-conductance tube testers, Model 610 test panel, Model 160 transistor tester, and Model 440 CRT rejuvenator-tester. *See ad page 9.*

29B. ELECTRO PRODUCTS LABS—Product-information sheet on Model PS-30 heavy-duty DC power supply for communications servicing, which provides 30 amps at 12 volts in continuous duty, with less than 1% ripple. *See ad page 66.*

30B. METREX—Serviceman's guide, "Cramful of Shortcuts," dealing with trouble-shooting, alignment, and calibration of radio, TV, hi-fi, and related equipment; also manual for operation of new *Genie* pocket-size signal generator. *See ad page 42.*

31B. SENCORE—New booklet, *How to Use the SS105 Sweep Circuit Troubleshooter*, plus brochure on complete line of *time-saver* instruments. *See ads pages 35, 36-37, 38.*

TOOLS

32B. VACO—Catalog sheets on new *Side-Arm* screwdriver set and on new assortments of solderless terminals. *See ad page 60.*

TUBES

33B. INTERNATIONAL ELECTRONICS — New consumer-directed folder designed to help the service dealer educate his customer about the benefits of matched-pair tubes for best-quality high-fidelity reproduction; includes information about expanded line of *Mullard* laboratory-balanced matched pairs of tubes. *See ad page 65.*

34B. RAULAND—20-page, 8½" x 11" booklet describing tube-manufacturing facilities; also samples of consumer handout pamphlets promoting Rauland receiving and picture tubes, plus complete pricing schedules. *See ad page 23.*

35B. SAMPSON Hitachi receiving-tube manual, giving extensive specifications, basing diagrams, and outlines for complete tube line; also catalog sheet with color photos and descriptions of *Hitachi* broadcast-band and two-band transistor radios. *See ads pages 40, 42.*

36B. SYLVANIA—Brochure, "A New Era of Sylvania Electronic Tubes," giving inside information on latest developments in receiving tubes—*Sarong* cathode, strap frame grid, stacked mount, automation, etc. — liberally illustrated with actual assembly-line photographs. *See ad page 45.*

RCA STICKS TO ITS GUNS

The life of RCA Picture Tubes depends on it

The electron gun, heart of every TV picture tube, is a precision instrument. A speck of dust in the wrong place can mean the difference between poor and outstanding performance in a picture tube.

RCA assures outstanding performance in Silverama Picture Tubes by assembling every electron gun in the super-clean, dust-free atmosphere of the "White Room" at RCA's modern plant in Marion, Indiana.

Measured in terms of your business—this extra precaution helps to substantially reduce troublesome "in-warranty failures" and costly call-backs. Sell the finest name brand picture tube—RCA Silverama.

Silverama contains all-new electron gun, all-new parts and materials except for the envelope which is used. See your Authorized RCA Distributor today.

Workers wearing lint-free smocks, must enter "White Room" through an airlock. Room is kept under constant pressure to force any air-borne dust out when a door is opened.

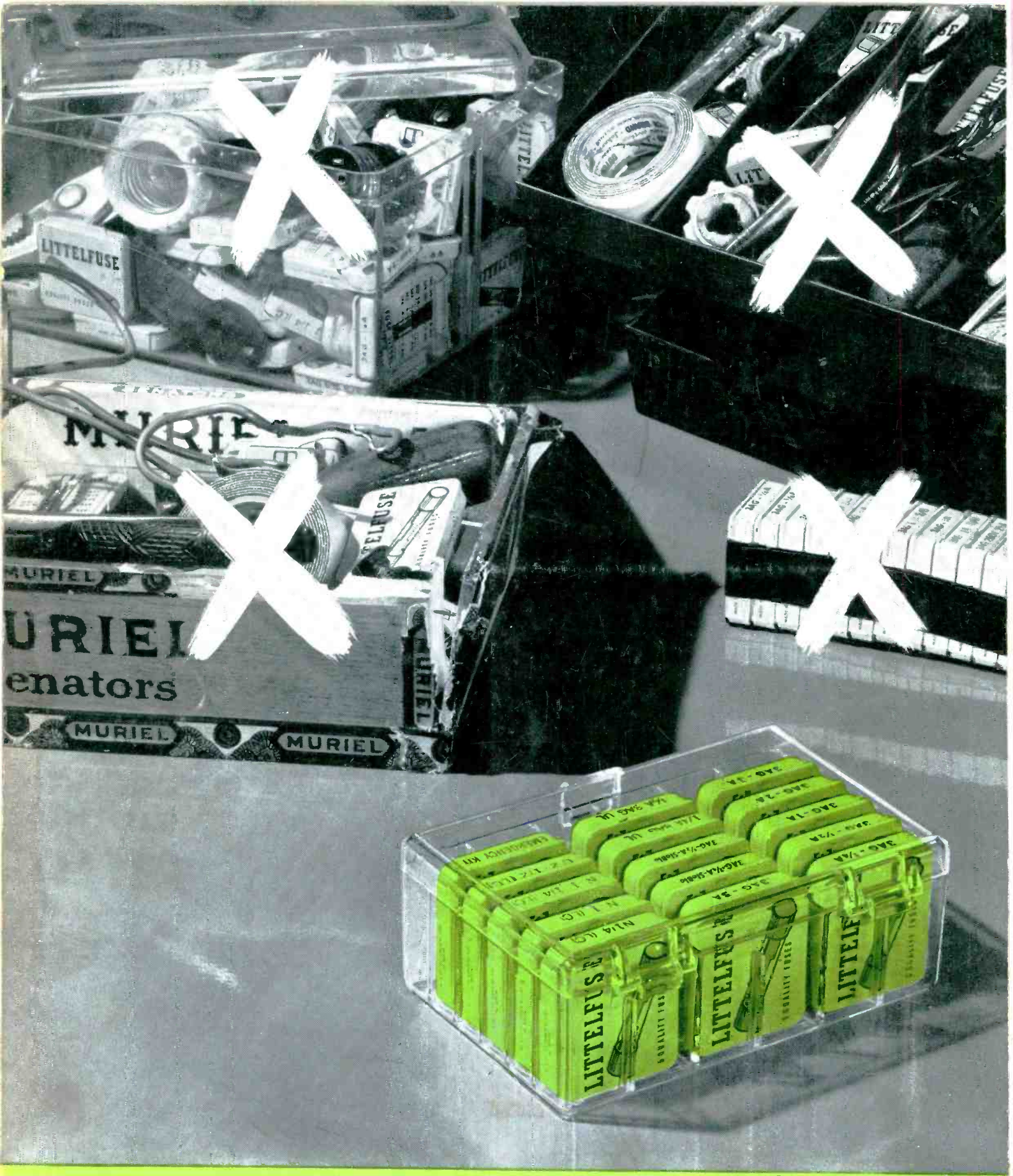
Finished guns after ultrasonic cleaning in a super wetting agent are carried to the assembly line in these covered plastic cases —further protection against contamination.

Guns await final assembly in this pressurized plastic housing. Blower at top maintains pressure, prevents dust from entering housing.

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.

The Most Trusted Name in Television

RADIO CORPORATION OF AMERICA



Burton browne advertising

THERE'S ONLY ONE RIGHT WAY

A *fuse caddy* for your *tube caddy:* 18 individual compartments for fingertip selection. The fuse caddy is complete with the 15 boxes of fuses required to service 93% of all TV sets. Three spare compartments are provided for additional fuses of your own selection.

LITTELFUSE *Des Plaines, Ill.*