JANUARY, 1963 35 CENTS

# PF REPORTER

PHOTOFACT

including Electronic Servicing

# Know Your '63 Color Circuits

Focusing on the Trouble

MPATI at Midterm

1962 Annual Subject Reference Index

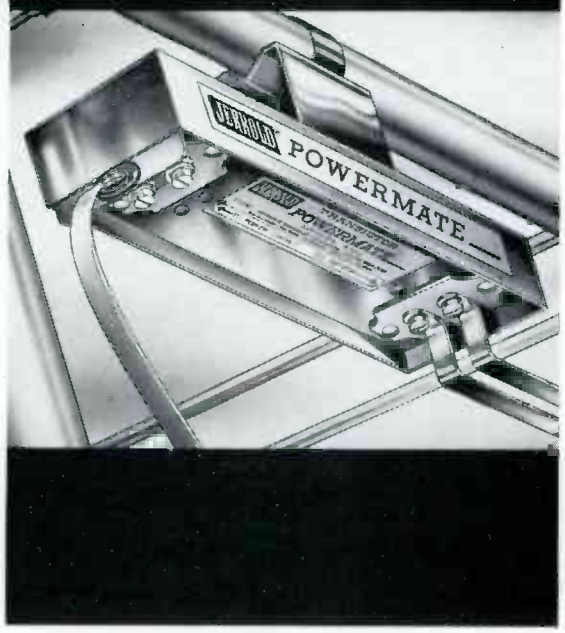
Two-Way Radio Expedites Service

Tube Expiration Code Guide

Symfact

# POWERMATE

## —rated No. 1

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# MODEL 3444 TUBE ANALYZER

## FACTS MAKE FEATURES:

1. The only tube tester under $1,000 that is simple and fast to operate, and will measure tube characteristics at known readable potentials.

2. The only tube tester under $1,000 that is simple and fast to operate, and provides readings to:
   (a) Plot tube characteristic curves.
   (b) Measure grid current at known potentials.
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3. The only tube tester under $1,000 that is simple and fast to operate, and reads directly in micromhos with a self checking Gm circuit.

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## FACTS MAKE FEATURES:

1. Popular streamlined tester with long meter scales arranged for easy reading. Fuse protected.
2. Single control knob selects any of 32 ranges—less chance of incorrect settings and burnouts.
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† 630A same as 630 plus 1½% accuracy and mirror scale only $59.50

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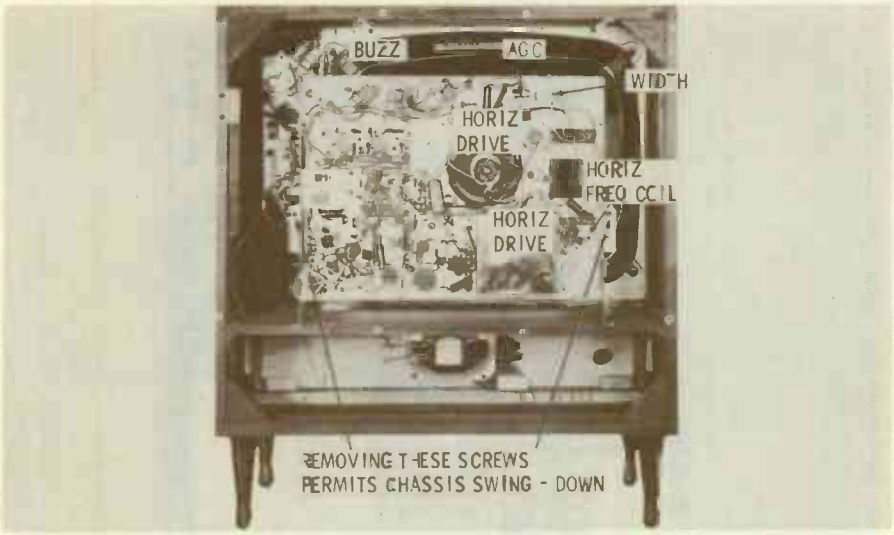
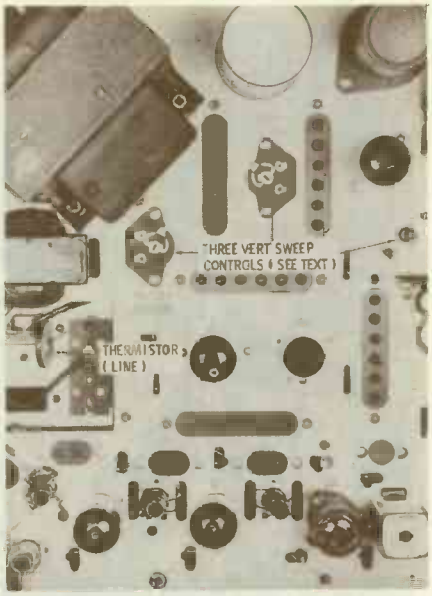
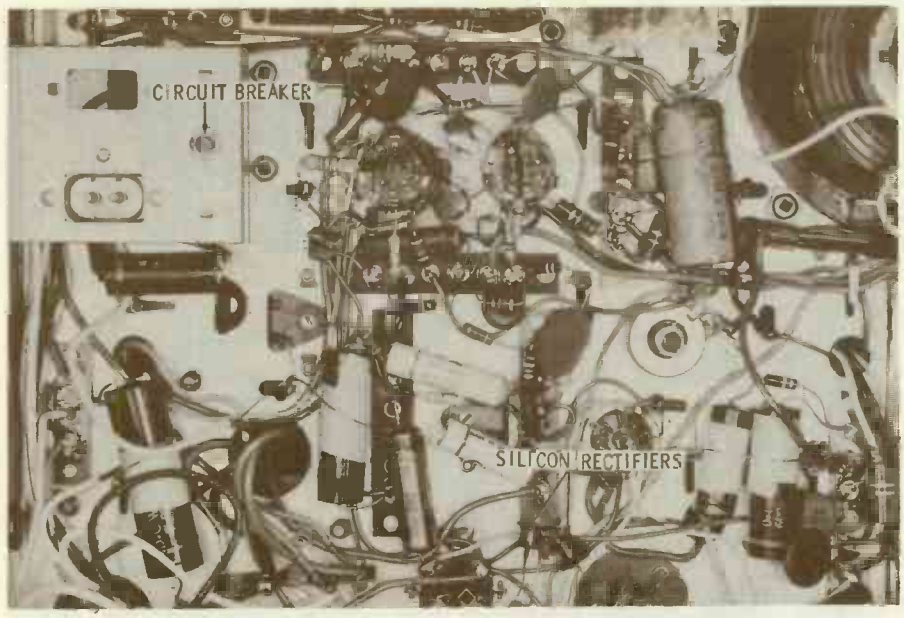
# Electrohome




**Electrohome**

**Model Gatewood**


This 23" console is just one of the Electrohome models, manufactured in Canada, that are now available in this country. The hand-wired chassis uses a bonded 23ARP4 picture tube and a turret-type tuner. A 6GK5 frame-grid pentode functions as the RF amplifier, and a 6CG8 is the mixer/oscillator. Channel slugs can be adjusted from the front of the cabinet, after the channel selector and fine tuning knobs are removed.

Other controls mounted on the front panel with the tuner include on-off-volume, contrast, vertical hold, and brightness. Controls for AGC, buzz, horizontal hold, horizontal drive, and width can be reached from the rear of the chassis. Rather unusual are the *three* controls (also at the rear) used to obtain correct vertical sweep. The TOP SHAPING and BOTTOM SHAPING controls are adjusted for vertical linearity, and the VERTICAL HEIGHT control is then adjusted to fill the screen.

A circuit breaker and a thermistor (175 ohms cold, 1.5 ohms hot), in series with the AC line, provide overload protection for the set. B+ is developed by two silicon rectifiers, wired as a full-wave doubler.

New tubes used in this chassis include a 6DX8 video output/sync separator, a 6GK6 audio output, and another 6GK6 as the vertical output. Not new, but seldom used on this side of the Atlantic, is the 6AL3 damper. Other tubes in the horizontal circuit are a 6AL5 AFC, a 6FQ7 multivibrator, a 6DQ6 output and a 1K3 high-voltage rectifier.

The chassis is mounted vertically, but is hinged on each side, and may be lowered to a horizontal plane. First, though, you must remove the rear cover and the two metal screws marked on the photo. This "fold-out" feature makes tube replacement and other servicing operations fairly easy.

If necessary, the chassis may be completely removed from the cabinet in the following manner: With the chassis lowered until it lies flat, remove the front control panel (held by two metal screws), the leads from the speaker, those from the CRT base and anode, the yoke clamp, and then the yoke. The chassis may now be slipped out of the cabinet.

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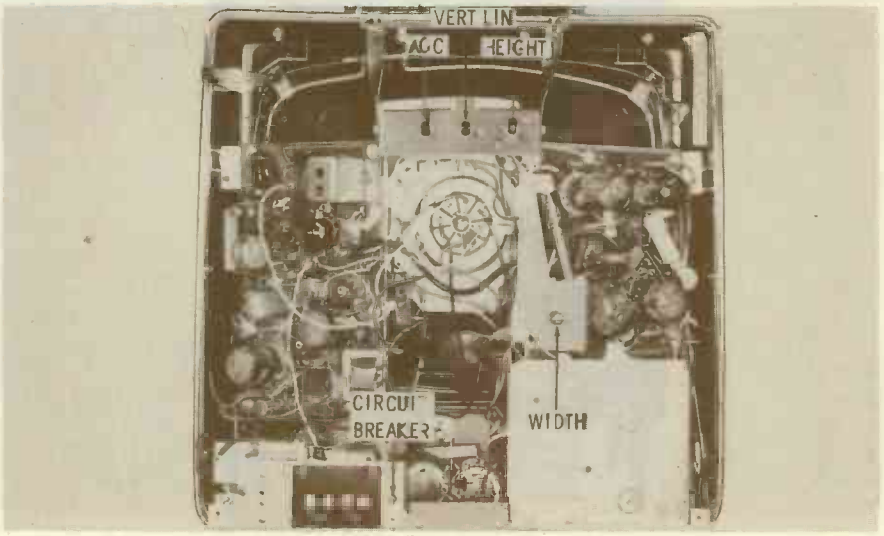



## General Electric
## Model M503XEB
## Chassis QX

G-E recently introduced the lightweight (22-lb.) portable TV shown here. This set uses a 16ATP4, 114° picture tube, with a brand-new type of implosion protection — the faceplate is not bonded, but is coated with a thin film of a special plastic. If the faceplate becomes scratched or marred, you can refinish it with a repair kit especially made for these tubes.

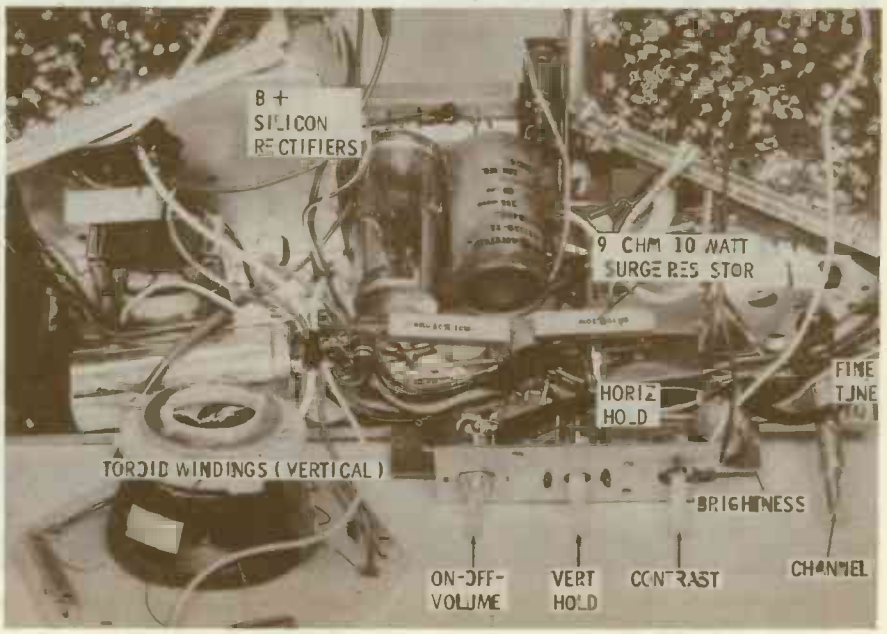
The VHF turret tuner in this set comes with UHF antenna terminals and UHF switch already installed. All that's needed for UHF reception is the installation of channel strips for one to four desired UHF stations. The tuner uses a 2DS4 nuvistor as an RF amplifier and a 6CG8A as the mixer/oscillator. Channel slugs are adjustable from the front of the cabinet after the selector and fine tuning knobs are removed.

Two silicon rectifiers, wired as a voltage doubler, develop the B+ for the set. A 9-ohm, 10-watt resistor (or a 6.8-ohm, 7-watt unit, in some chassis) provides surge protection for the rectifiers. A circuit breaker, wired in the AC line, is the overload device used in this set.

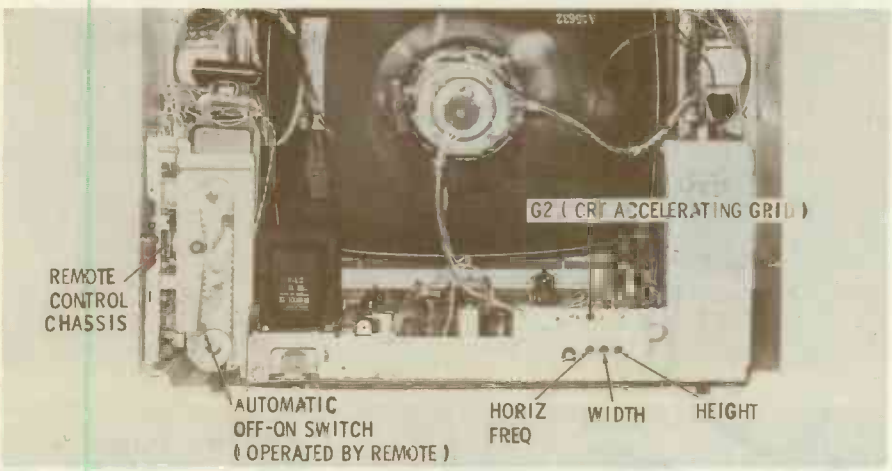
Channel selector, fine tuning, contrast, vertical hold, on-off-volume, horizontal hold, and brightness controls can all be reached from the front of the cabinet. The two latter controls are mounted on the bottom of the cabinet, but are still accessible from the front of the set.

This receiver uses a number of compactrons—a total of seven, to be exact. Here are their circuit functions; 11AR11, first and second IF amplifier; 15AF11, video output/sound IF/sync separator; 12AL11, audio detector/output; 15FY7, vertical multivibrator/output; 8B10, horizontal phase detector/multivibrator; 17-GE5, horizontal output; and 17AX3, damper. In case you're wondering about the third IF/AGC keying tube, it's a 6GH8. The only tube function not mentioned so far is the high-voltage rectifier—a 1K3.

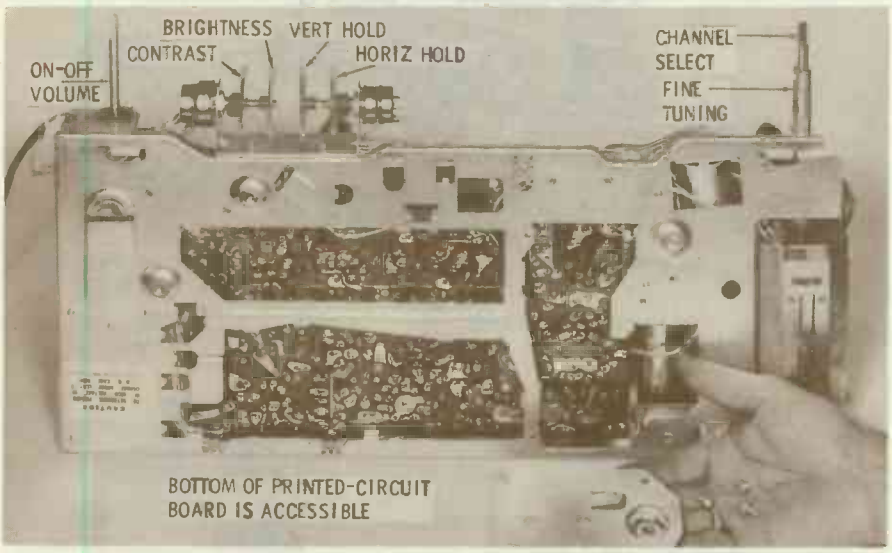


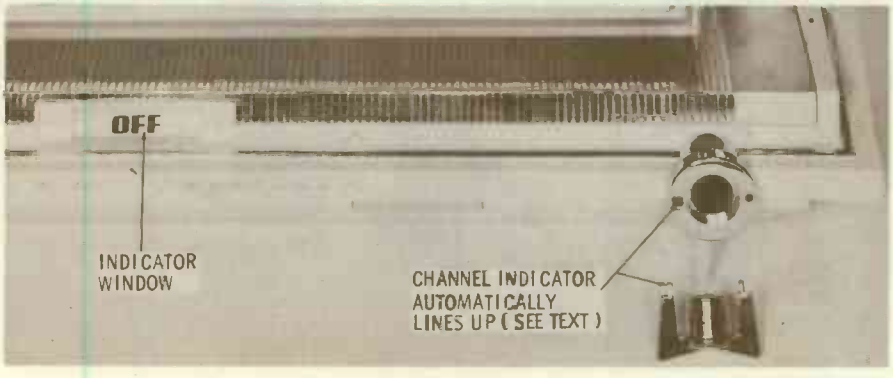


## Philco








**Philco**

**Model L-3814RWH**

**Chassis 13J42**

Representative of Philco's '63 "Town House" series is the 19" table-model television shown here. This model comes equipped with an all-transistor remote control, all components of which (including the function relays) are mounted on a single printed-circuit board.

The layout of the TV chassis is similar to that in other recent Philco models, except it uses one large printed-circuit board. Access to the bottom of the board is obtained by removing the partial cover, as shown in the photo.

A 6GK5 RF amplifier and a 6GH8 mixer-oscillator are included in the turret-type tuner. The channel indicator is part of the cabinet, and is automatically indexed by special keys on the tuner knob; the keys engage the slots in the indicator knob only when the correct channel number appears in the window. Thus, you cannot accidentally misalign the channel markings by removing the knobs.

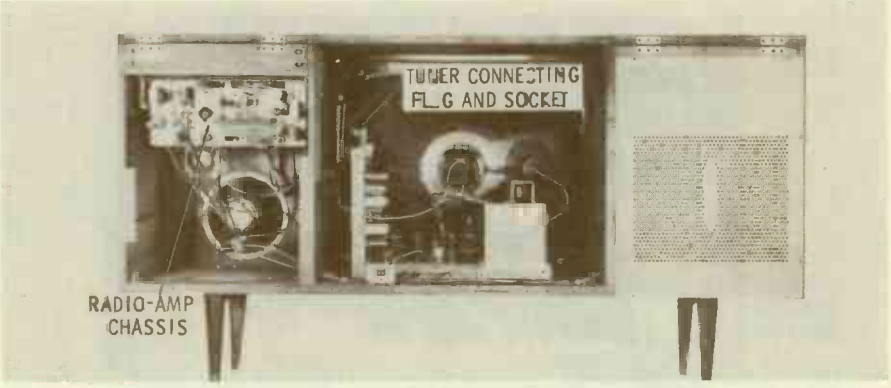
Thumbwheel knobs are used for the vertical hold, horizontal hold, contrast, and brightness controls, and they cannot be removed with the chassis in the cabinet. If you do pull the chassis for any reason, note carefully the many interchassis plugs and sockets used in this set—it will help during reassembly.

Controls which can be adjusted from the rear include vertical linearity, height, width, horizontal frequency, and G2 (accelerating voltage for the CRT). This last control is adjusted to obtain the best contrast range.

A full-wave doubler, using two silicon rectifiers, develops the B+ for this chassis. A 5.6-ohm fusible resistor protects this circuit from overload. The tube filament string uses a #26 wire-link fuse for protection.

A diode, accessible by removing a snap-on cover, is used for a video detector. The only other semiconductor in this chassis—except for those in the transistorized remote—is the dual-diode used for horizontal AFC.

Some of the tubes used in this set, and their functions, are as follows: 6EH7 first IF, 6EJ7 second IF, 6JE8 video output/sync separator, 6BY8 AGC keyer/clamper, 6FD7 vertical multivibrator/output, and 6GH8 sound IF/noise inverter. A familiar complement of tubes are used in the horizontal stages: 6FQ7 multivibrator, 6DQ6 output, 6DE4 damper, and 1G3 high-voltage rectifier.




## Symphonic

## Model 23BSC101

Among the sets in Symphonic's 1963 television line is the combination model shown here. With only minor modifications—mainly in the physical location of some components— this chassis is also used in 19" portables and 23" console models.

Major sections of this set include a TV chassis (using a bonded 23HP4 CRT), and an FM-AM-stereo amplifier chassis. Also included is a four-speed stereo phonograph. The radio-amplifier chassis has its own control panel, upon which are mounted a group of operating controls: function selector (a four-position switch with TV/phono, AM-FM simulcast, FM, and AM settings), AM tuning, FM tuning, off-tone, loudness—channel A, and loudness—channel B.

A separate panel contains the TV controls: channel selector, fine tuning (linked to the tuner by a metal bead chain), brightness, contrast, vertical hold, and a two-position switch for TV or phono operation. On the rear apron of the chassis you'll find controls for AGC, vertical size, vertical linearity, and horizontal hold.

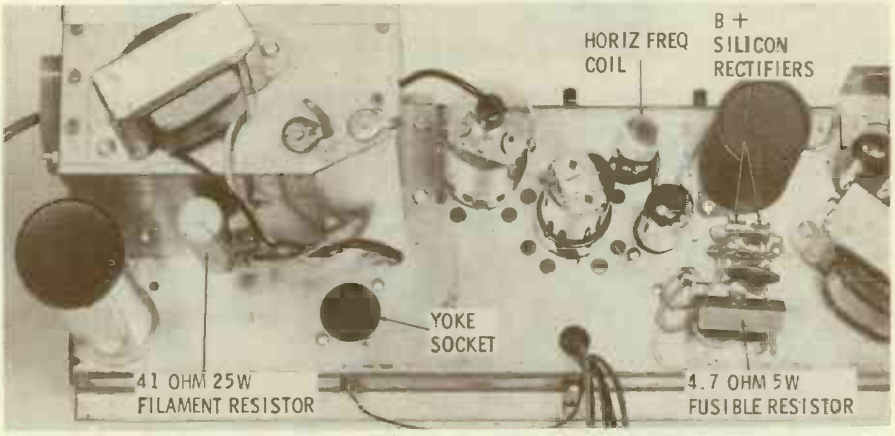
The tuner tubes used in this set are a 2FH5 RF amplifier, and a 5CG8 mixer/oscillator. The tuner is a turret type with provisions for adjusting the channel slugs after removal of the channel selector knob.

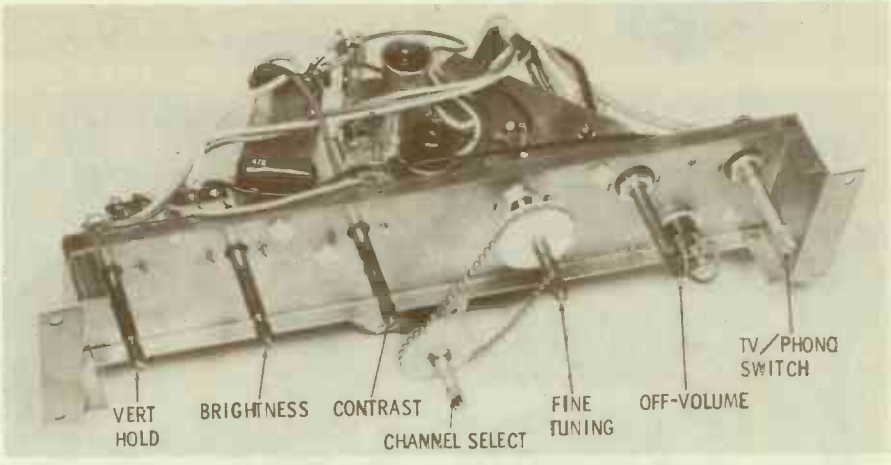
Two silicon rectifiers are used to develop B+ voltage of approximately 270 volts. Several stages are "stacked" with the 12CU5 audio output across this supply, to obtain a 135-volt B+ source.

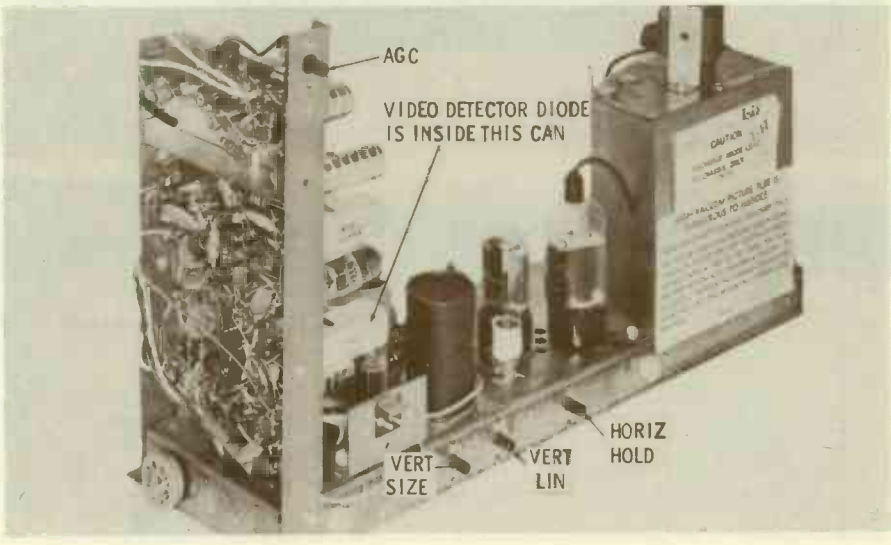
A 4.7-ohm, 5-watt fusible resistor is the only protective device used in this chassis. It is a plug-in type, which makes replacement of a defective unit very easy. The video detector diode, on the other hand, is not so easily replaced; it's located inside the third video IF can, and you'll need to remove the complete can before you can get at it.

The tubes used in the video IF strip are a pair of 3BZ6's in the first two stages, and a 3CB6 as a third IF amplifier. A 8CX8 functions as the video output/sync separator, and a 10DE7 is the combined vertical multivibrator/output tube.

The tubes used in this set are wired in series, and a large 41-ohm, 25-watt resistor is included in the string. Use normal "hot-chassis" precautions when servicing this receiver.



See PHOTOFACT Set 498, Folder 2

**Mfr:** Emerson **Chassis No.** 120507A

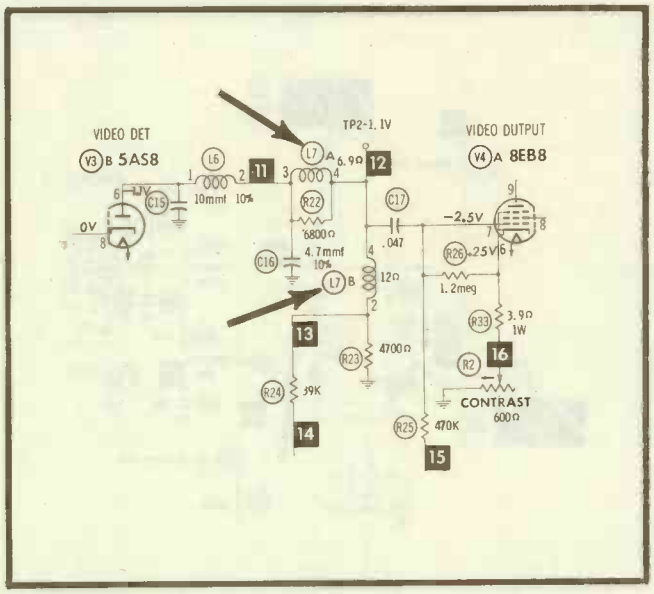
**Card No:** EM 120507A-1

**Section Affected:** Pix.

**Symptoms:** Video poor or absent.

**Cause:** Open peaking coil in video-detector load circuit.

**What To Do:** Physically inspect dual peaking coil L7. Open usually occurs where wire connects to mounting lug on coil, and can usually be repaired; if not, replace coil.




See PHOTOFACT Set 498, Folder 2

**Mfr:** Emerson **Chassis No.** 120507A

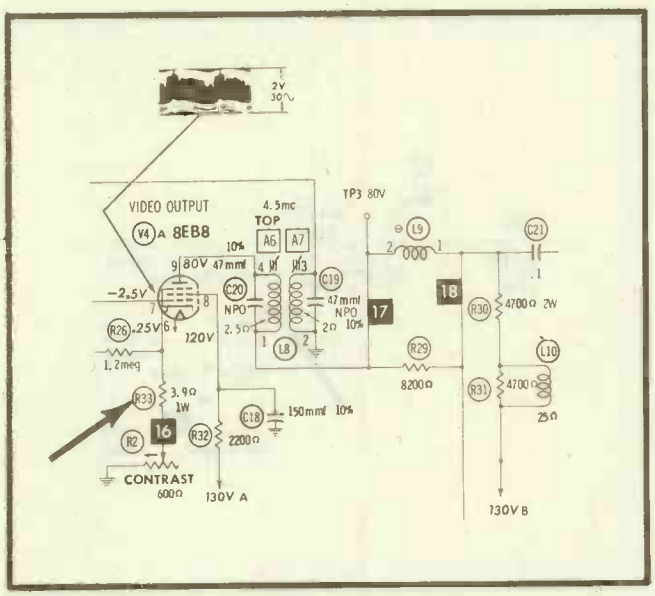
**Card No:** EM 120507A-2

**Section Affected:** Pix.

**Symptoms:** White compression (video overload) at high contrast setting.

**Cause:** Saturation of video output tube.

**What To Do:** Try several 8EB8 tubes. If condition persists, substitute larger-value resistor for R33. Use smallest value (3.9 to 30 ohms) which just eliminates white compression.




**Mfr:** Emerson **Chassis No.** 120507A

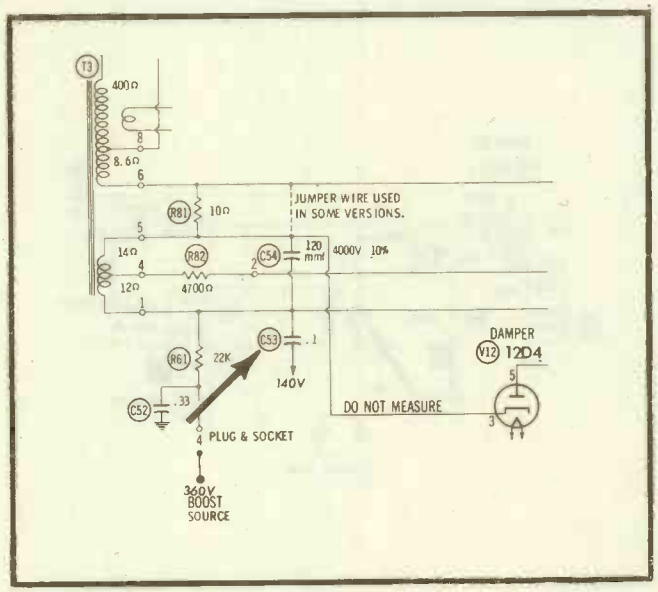
**Card No:** EM 120507A-3

**Section Affected:** Raster.

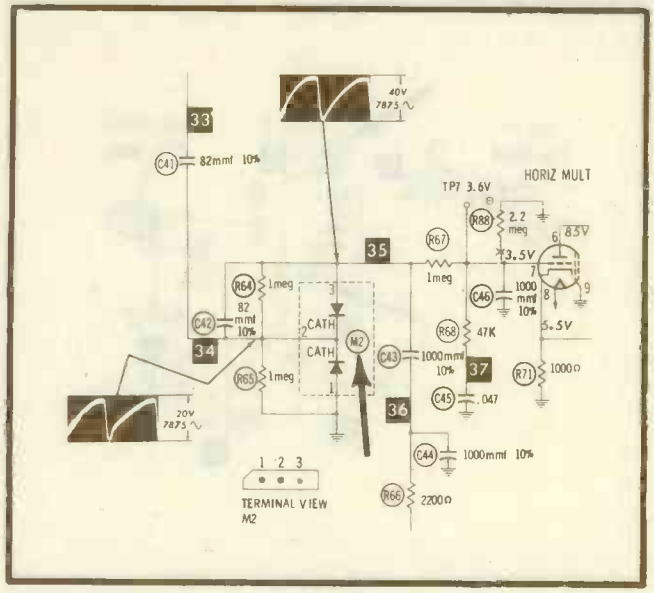
**Symptoms:** No raster.

**Cause:** Loss of boost voltage due to shorted boost capacitor.

**What To Do:** Replace C53 (.1 mfd—400V) with a 600-volt unit.



See PHOTOFACT Set 498, Folder 2




**Mfr:** Emerson **Chassis No.** 120507A

**Card No:** EM 120507A-4

**Section Affected:** Sync.

**Symptoms:** Picture locks in at one end of horizontal-hold control range; critical horizontal hold; horizontal drift.

**Cause:** Defective selenium dual-diode unit in horizontal AFC stage.

**What To Do:** Replace M2.

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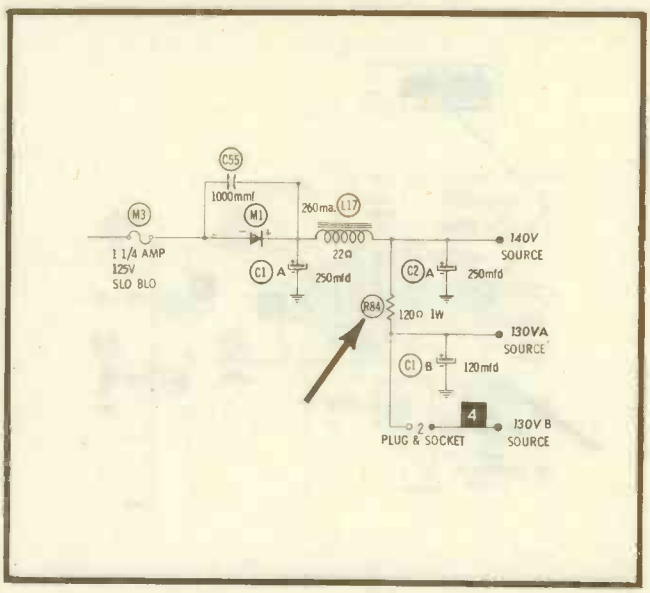


**Mfr:** Emerson **Chassis No.** 120507A

**Card No:** EM 120507A-5

**Section Affected:** All.

**Symptoms:** No picture, sound, or raster.

**Cause:** No voltage on 130-volt B+ line, due to open resistor in power supply.

**What To Do:** Replace R84 (120 ohms—1W); check for short in circuitry connected to 130-volt line.

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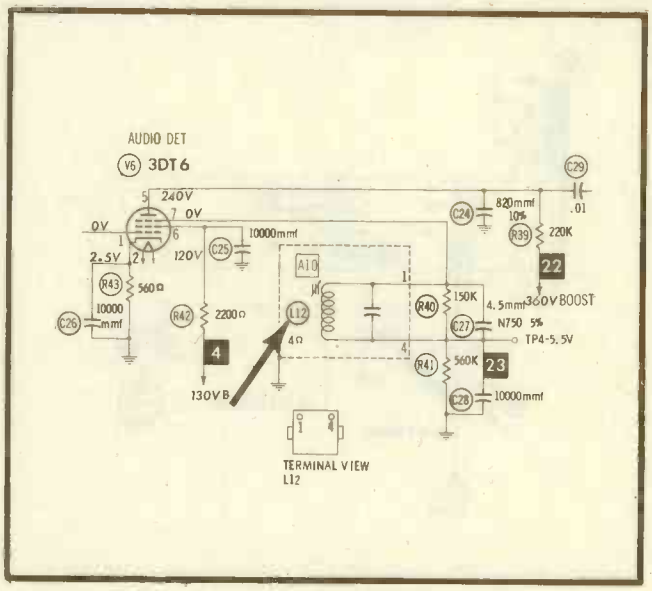



**Mfr:** Emerson **Chassis No.** 120507A

**Card No:** EM 120507A-6

**Section Affected:** Sound.

**Symptoms:** Sound distorted when set is cold, but OK after warmup; or vice versa.

**Cause:** Quadrature coil detuned, due to aging.

**What To Do:** Realign quadrature coil in following manner:

1. Using strong TV signal, adjust L12 for clearest and loudest sound. If two peaks are found, align to peak where slug is closer to etched circuit board.
2. If distortion still exists, return slug to top of coil and perform step 1 again.

See PHOTOFACT Set 510, Folder 1

**Mfr:** Magnavox **Chassis No.** 33 Series

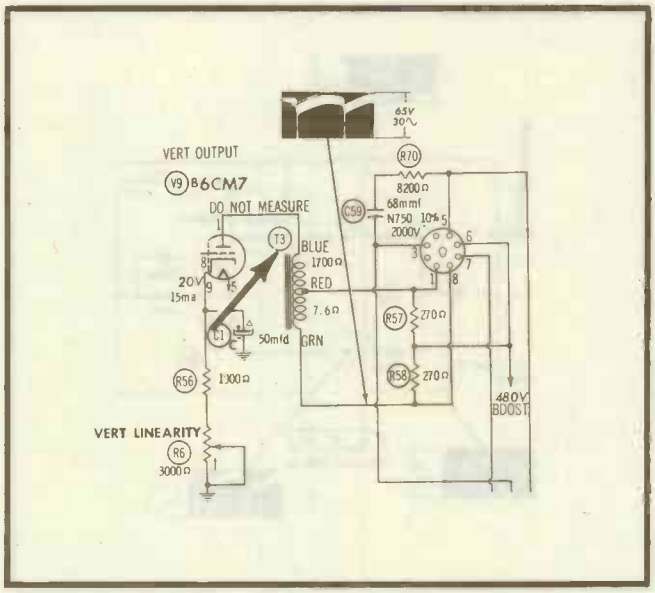
**Card No:** MA 33-1

**Section Affected:** Raster.

**Symptoms:** Reduced height; retrace lines visible in top portion of raster.

**Cause:** Shorted turns in vertical output transformer.

**What To Do:** Replace T3 (Magnavox part no. 320278-2).




**Mfr:** Magnavox **Chassis No.** 33 Series

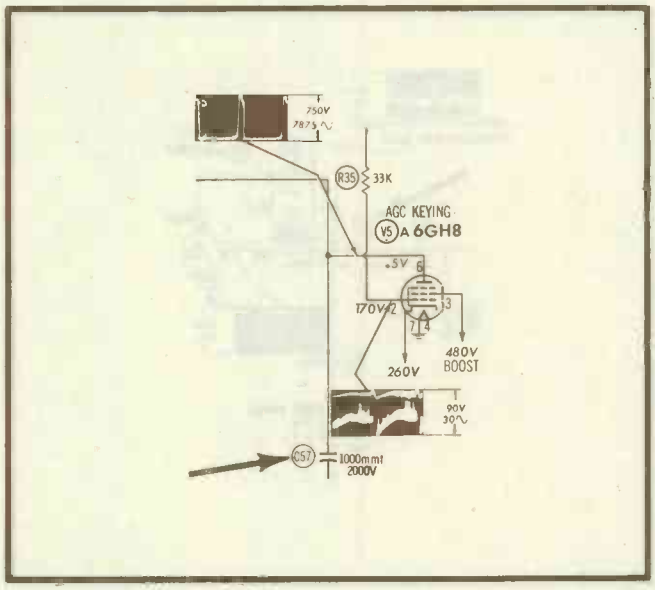
**Card No:** MA 33-2

**Section Affected:** Pix.

**Symptoms:** Video overload.

**Cause:** Open coupling capacitor between AGC keying tube and horizontal output transformer.

**What To Do:** Replace C57 (1000 mmf — 2000V).




**Mfr:** Magnavox **Chassis No.** 33 Series

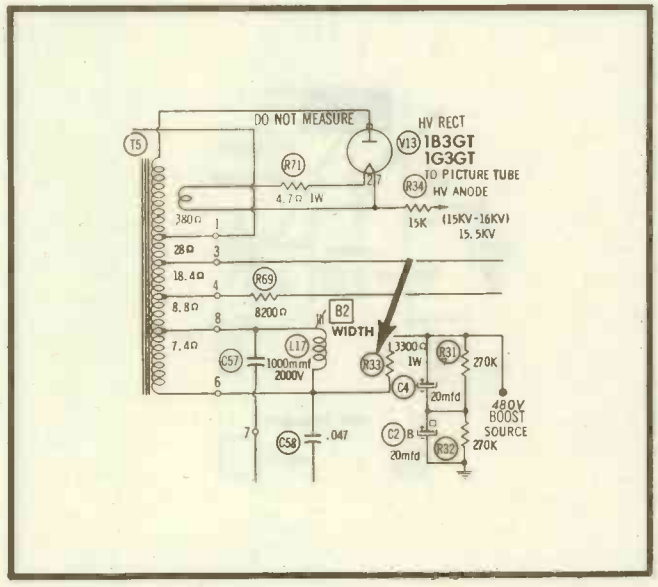
**Card No:** MA 33-3

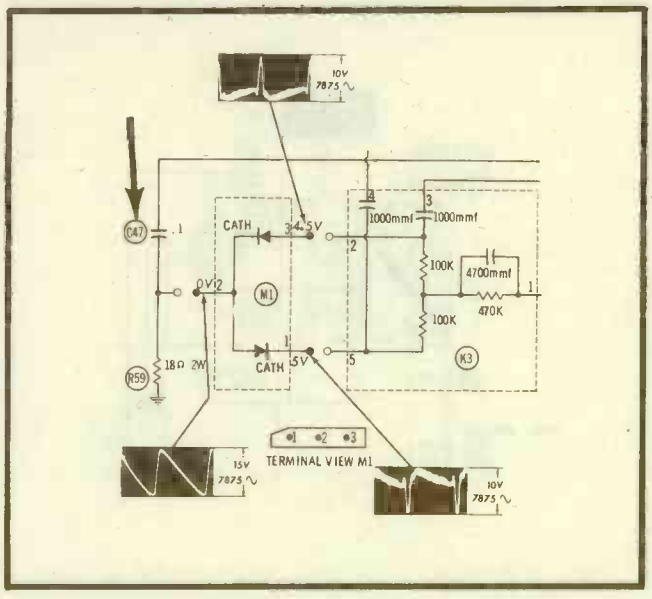
**Section Affected:** Raster.

**Symptoms:** No raster.

**Cause:** Open resistor in boost circuit, caused by short in AGC keying tube.

**What To Do:** Replace R33 (3300 ohms — 1W), and replace V8 (6GH8).






See PHOTOFACT Set 510, Folder 1

**Mfr:** Magnavox **Chassis No.** 33 Series

**Card No:** MA 33-4

**Section Affected:** Sync.

**Symptoms:** Poor horizontal sync.

**Cause:** Leaky feedback-coupling capacitor in horizontal AFC circuit.

**What To Do:** Replace C47 (.1 mfd—600 V). Also check damper tube, which may have been damaged by C47 trouble.

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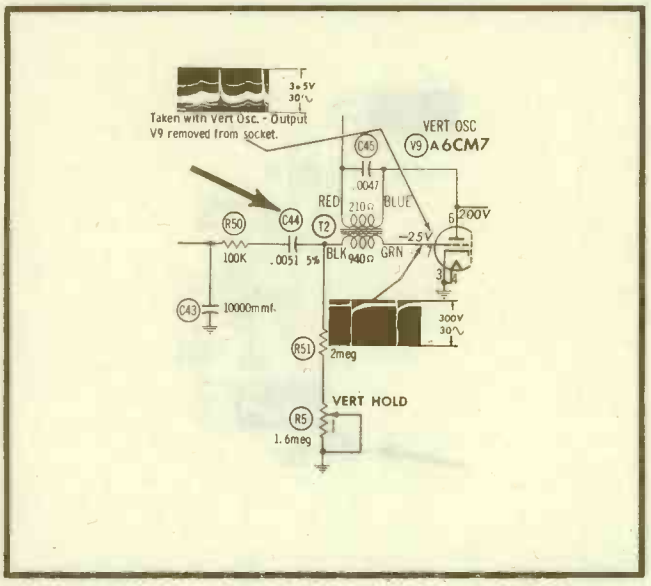


**Mfr:** Magnavox **Chassis No.** 33 Series

**Card No:** MA 33-5

**Section Affected:** Raster.

**Symptoms:** No vertical sweep; slightly positive voltage on grid of vertical oscillator.

**Cause:** Leaky coupling capacitor between sync phase inverter and vertical oscillator.

**What To Do:** Replace C44 (.0051 mfd, *Mylar*, 5%—400V).

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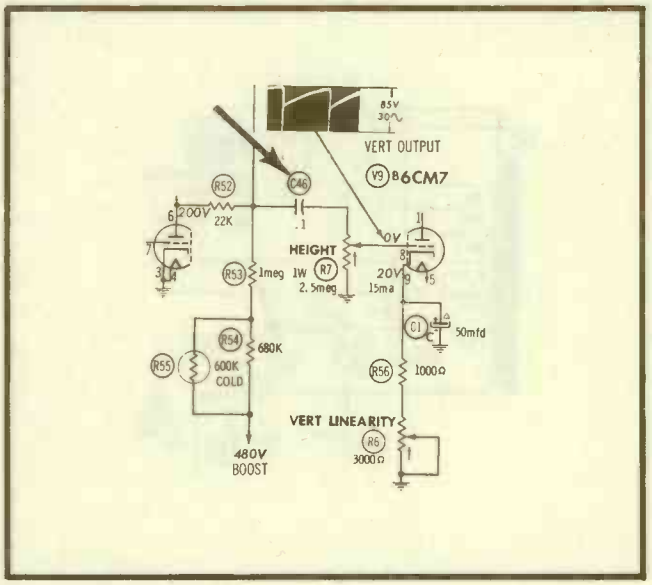



**Mfr:** Magnavox **Chassis No.** 33 Series

**Card No:** MA 33-6

**Section Affected:** Raster.

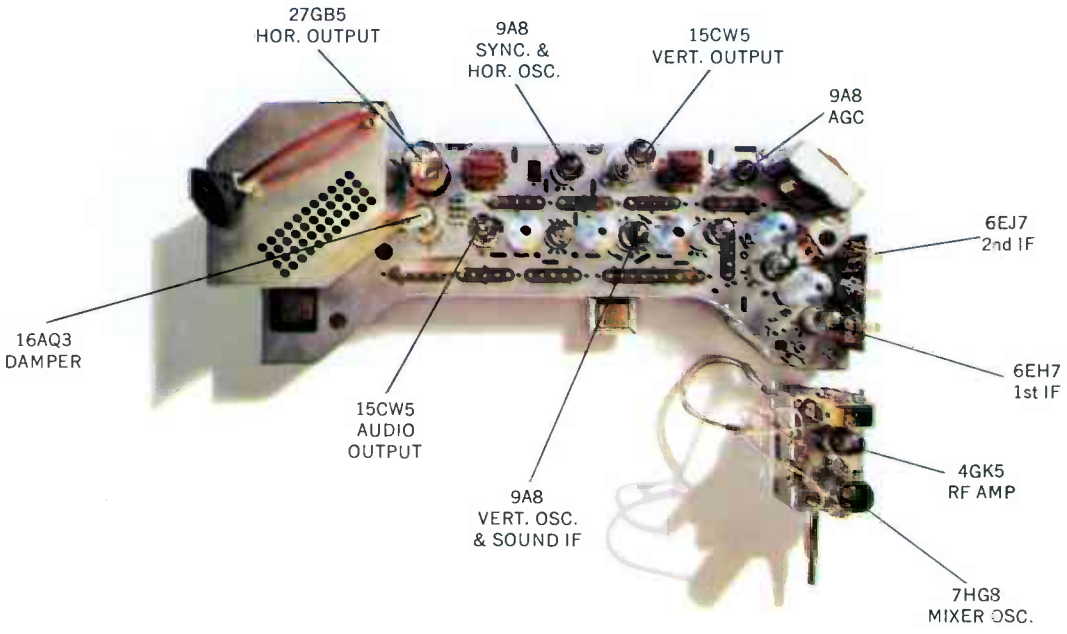
**Symptoms:** No vertical sweep.

**Cause:** Open coupling capacitor between vertical oscillator and output stages.

**What To Do:** Replace C46 (.1 mfd—400V).

# Do you recognize this high-performance TV Chassis? Its design was made possible by the use of 11 Amperex tubes

IT IS USED IN EIGHTEEN DIFFERENT CURRENT MODELS

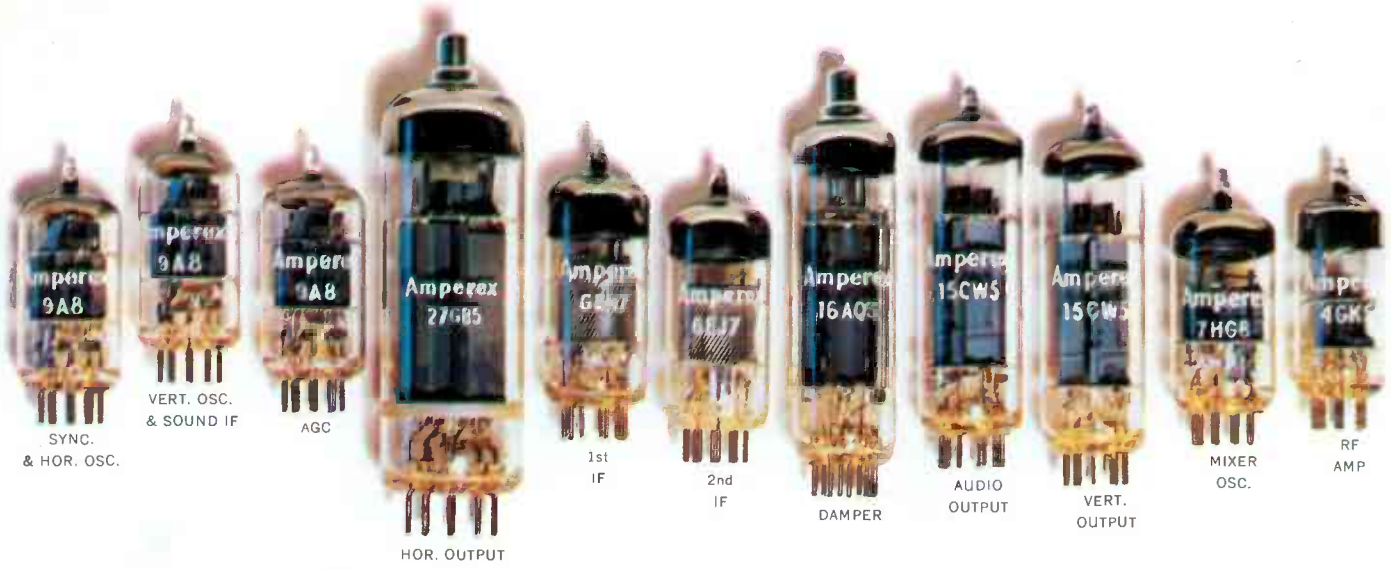



## If you can give us the manufacturer's name and chassis number

## you can win one of 10 model 23K95 Motorola Consoles

TURN PAGE FOR LINEUP OF AMPEREX TUBES AND OTHER CLUES AND SIMPLE DETAILS OF CONTEST

# These 11 Amperex tubes are found in the famous TV chassis shown on the reverse side of this page




## Additional Clues:

Chassis uses total of 14 tubes plus 19" CRT and 4 diodes in wired circuit.

Manufacturer is famous Chicago producer of automobile radios as well as TV and Hi-Fi.

Suggested Reference Sources: "Previews of New Sets," PF Reporter, February, 1962; Sams Photofact Folder Set No. 577, May, 1962; December (1962) Circuit Digests, Electronic Technician.

# 10 Motorola TV Consoles and 100 Additional Valuable Prizes to be Awarded in First of Amperex Telequiz Sweepstakes!

1. Fill in attached entry card (or official entry card available from your distributor) with all information requested.
2. Remove card from magazine and mail. No postage necessary. Entries must be postmarked by January 19 and received by January 25, 1963. All entries with correct answers become eligible for drawing of prizes on January 28, 1963 in the offices of and under the supervision of the D. L. Blair Corporation, independent contest managers.
3. Telequiz Sweepstakes subject to Federal, State and Local laws and regulations. Winners will be notified no later than January 31, 1963.

Contest limited to TV service dealers and technicians.


**Are you replacing top quality tubes with identical top quality tubes? Now you can!**

You can now carry the identical tubes that you find in most of the quality TV sets you're servicing.

For some time now, designers have been using many AMPEREX Frame Grid tubes in their quality TV chassis and we can tell you now that even more tubes originated by AMPEREX are being designed into more of the sets you'll be handling from now on.

We have decided that the simplest and most direct way to bring this important information to you is through a series of interesting 'Telequiz' Sweepstakes Contests, with the world's most fabulous TV consoles ever built awarded as prizes.

If the Contest Reply Card has been removed before this magazine got into your hands, your AMPEREX distributor will provide you with an official reply card for your own use. Good luck and good servicing!

## Amperex Electronic Corporation, Hicksville, Long Island, N. Y.

Prices effective January 1, 1963

# Tarzian offers FAST, DEPENDABLE TUNER REPAIR SERVICE (ALL MAKES)

ONLY $9.50 INCLUDING

## ALL PARTS (except tubes) and LABOR

## 24-HOUR SERVICE 1-YEAR WARRANTY

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

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

Tarzian-made tuners received one day will be repaired and shipped out the next. Allow a little more time for service on other than Tarzian-made tuners.

Tarzian offers a 12-month guarantee against defective workmanship and parts failure due to normal usage. And, compare our cost of $9.50 and $15 for UV combinations. There is absolutely no additional, hidden charge, for ANY parts except tubes. You pay shipping costs. Replacements on tuners beyond practical repair are available at low cost.

Ⓣ Tarzian-made tuners are identified by this stamping.

When inquiring about service on other tuners, always give TV make, chassis and Model number. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

TWO SERVICE CENTERS TO SERVE YOU BETTER

See your distributor, or use the address nearest you for fast factory repair service

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Bloomington, Indiana
Tel: 332-6055

10654 Magnolia Blvd.
North Hollywood, Calif.
Tel: 769-2720

SARKES TARZIAN, INC.
*Bloomington, Indiana*

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM/FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT

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When you "outgrow" your customers?

When you ration service according to their size?

When you put sales volume ahead of product quality?

When your service loses the *personal* touch?

When you become so self-important that you stop cooperating with the service technicians who helped build your business?

In short, when you forget that your first and biggest job is *satisfying your customers?*

We've seen a lot of companies grow too big for their britches. Not so with Sprague!

In today's complex electronics industry, a company *must* be big! For only bigness—in research, production, and distribution—can bring you the technical services you need. But bigness hasn't gone to our heads. We haven't lost the personal touch that helped us grow. Close attention to your needs is still primary with us.

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*WORLD'S LARGEST MANUFACTURER OF CAPACITORS*

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**midwestern**
Hugh Wallace
PF REPORTER
4300 West 62nd Street,
Indianapolis 6, Ind.
AXminster 1-3100

**eastern**
Charles Horner
Howard W. Sams & Co., Inc.
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# PF REPORTER

## including Electronic Servicing

VOLUME 13, No. 1 JANUARY, 1963

CONTENTS



### ABOUT THE COVER

If the circuits in the latest color sets look to you like just a bunch of assorted components, the feature article starting on page 32 of this issue will help you to see how these components are organized.

# LETTERS TO THE EDITOR

*Dear Editor:*

I have a suggestion. On many of the PHOTOFACT schematics I use in my shop, I pencil (in bright blue) critical DC voltages that remain unchanged with signal; with red pencil, I mark voltages that fluctuate with signal changes; and sometimes I trace the signal paths with green pencil. Why don't you start using this method for marking schematics used in PF REPORTER?

ROBERT DUFF

North Highlands, Calif.

*You'll notice a very similar method being used in the regular monthly* SYMFACT *feature. Voltages which vary with either signal or control changes are indicated on the schematic by an asterisk. In the column "Operating Variations," the changes are described in detail. Further, you'll notice voltages that change with symptoms printed in color on the symptom pages, to aid the technician in spotting such changes when he is actually troubleshooting the circuit.—Ed.*

*Dear Editor:*

I have an unusual method of keeping schematic diagrams flat, which makes them easy to follow. I use the 11" x 14" easel shown here. The "lift-up" frame around the border holds the diagrams in place; smaller diagrams can be accommodated in the same easel by using pieces of cardboard to cover the edges of the schematic.

H. LEEPER

Canton, Ohio

*Truly a handy device. You could probably place the easel in almost any position, even hanging out of the way above your bench.—Ed.*

*Dear Editor:*

I'm writing to tell you how good I think PF REPORTER is. I received two of your bonus books, and they are really worthwhile. Is there a Spanish edition of PF REPORTER available? (Most of my friends here are Spanish-speaking people.)

WILLIAM M. BRANNON

Curundu, Canal Zone

*Thanks, Bill, for the kind words. Sorry, but we haven't a Spanish edition yet; perhaps you can translate for your friends.—Ed.*

*Dear Editor:*

A great magazine — PF REPORTER! How about an article pretty soon on servicing tape recorders? There are other things than TV, you know.

JOHN T. SOWDER

Richmond, Ky.

*You're right; there are, indeed, many other types of electronic devices, as a quick thumbing through* PF REPORTER *will indicate. As for tape recorders, watch for a special section on that very subject; it's in the works.—Ed.*

*Dear Editor:*

I have a lot of back copies of PF REPORTER for sale. They cover from 1956 to the present.

DANIEL SEIDLER

2644 W. 23rd St.
Chicago 8, Ill.

*I'm sure many readers will be interested in this collection, especially if the set is complete. A number of back issues are also still available from our Circulation Department at 50¢ per copy.—Ed.*

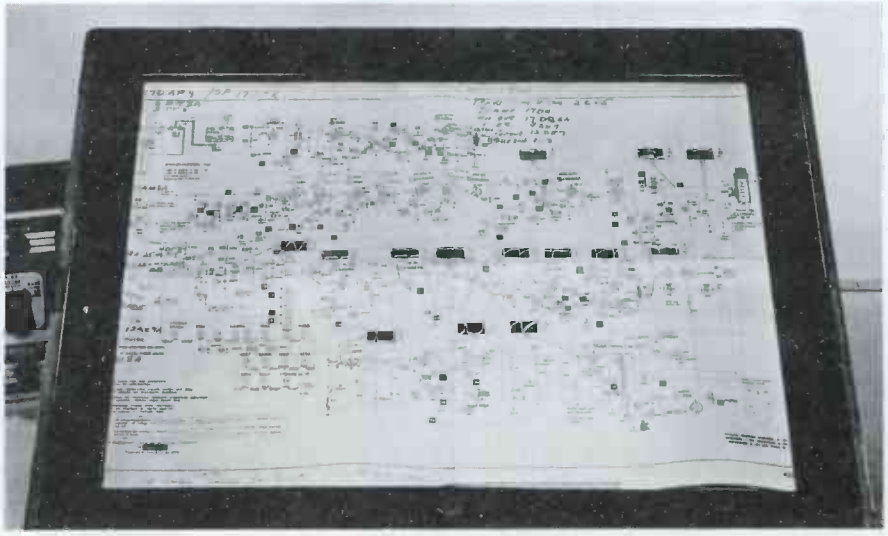
*Dear Editor:*

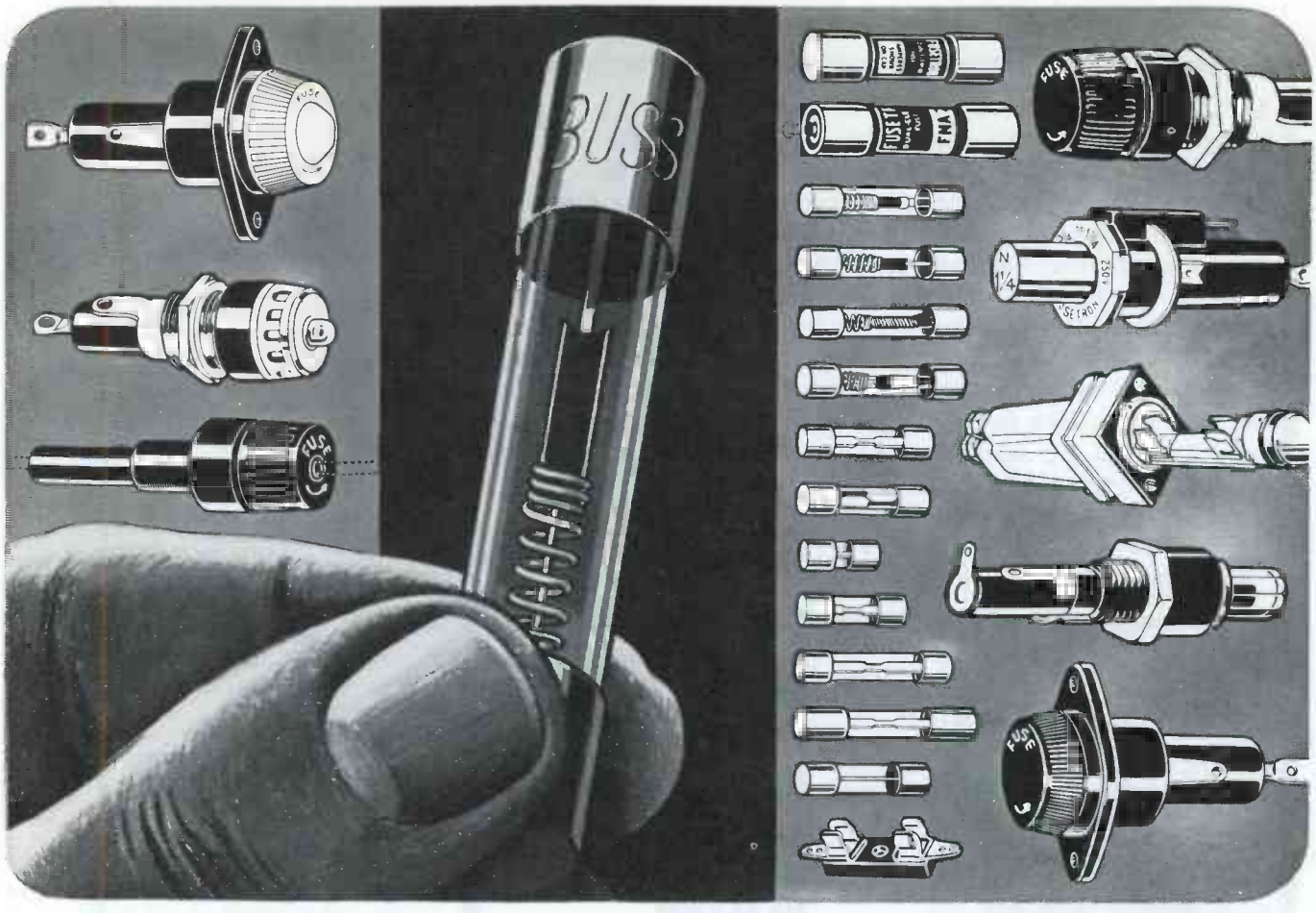
Ask Mr. Ember (November "Letters" where he got the pipe strencher. He certainly does use "Yankee" ingenuity if he can fit a ¾" pipe inside a ¼" one. Jokingly, from a converted "Rebel" . . .

J. BLACK

Bayport, Minn.

*It sure would be a tight squeeze. Of*






# For Every Electrical Protection Need

## *there's a safe and dependable BUSS or FUSETRON Fuse!*

BUSS fuse engineers have consistently pioneered the development of new fuses to keep pace with the demands of the Electronic industry. Today, the complete line includes:

Single-element fuses for circuits where quick-blowing is needed;—or single-element fuses for normal circuit protection;—or dual-element, "slow-blowing" fuses for circuits where harmless current surges occur;—or indicating fuses for circuits where signals must be given when fuses open. Fuses range in sizes from 1/500 amperes up—and there's a companion line of fuse clips, blocks and holders.

### Save time and trouble by furnishing only BUSS fuses

It's more convenient to stock one line of fuses—stock handling, records and inventory problems are simplified. The unfailing dependability of BUSS fuses protects you against "kicks" or call-backs that might otherwise result from faulty fuses.

For more information, write for BUSS bulletin SFB.

**BUSS: The complete line of fuses and fuse mountings of unquestioned high quality.**

FUSETRON BUSS McGRAW EDISON

**BUSSMANN MFG. DIVISION**
*McGraw-Edison Co.*
St. Louis 7, Mo.

163

*course, the item should have said the bottom antenna is mounted on a 1¼", not a ¼" pipe. Our apologies to Mr. Ember, and to any reader who tried building the assembly by those specifications.—Ed.*

*Dear Editor:*

I wonder if you have information or a schematic for an FM-TV sweep generator called the Ferret Model 720. It was made by Coastwide Electronics Co. of Los Angeles, Calif., but it seems they are no longer in business.

N. B. SANDMAN
Louisville, Ky.

*Sorry, we couldn't "ferret" out any information on this instrument. Can any of you readers help?—Ed.*

*Dear Editor:*

In your "Notes on Test Equipment" feature (October issue), you analyzed our Model 656XC NTSC Color Bar Generator. I notice you mention a price of $525.00 for the unit; it actually sells now for $549.50.

J. W. SIRINGER
Advertising Manager
Hickok Electrical Instrument Co.
Cleveland, Ohio

*Readers please take note.—Ed.*

*Dear Editor:*

Your "Symfact" section really paid off on a set I worked on two weeks ago. It pinpointed the trouble, and told how to correct it, all before I even removed the chassis from the cabinet. That one "Symfact" hint was worth more to me than the entire subscription cost of PF REPORTER. Thanks.

FRED HALL, JR.
Fort Carson, Colo.

*Your letter is typical of the many excellent reports we've had on "Symfact", Fred. It pleases us to know it is such a winner. We've plans for a bigger, better "Symfact"—you'll want to be watching for it.—Ed.*


"Your takeup reel is acting kinda funny, Ed."


# WHAT ELSE DOES PHILCO PUT IN THE CARTON?

When you pick up the box, you expect to find a receiving or CR tube in it. Naturally.

But when the name PHILCO is on the carton, you get something more . . . at no extra cost to you. In every Philco carton there is an important extra . . . a bonus that you can't see but is even more valuable to you!

What is it? . . . it's *A SATISFIED CUSTOMER!*

The name "Philco" has enjoyed prestige and respect in parts and accessories for over 33 years. Now, it has added resources and stability with another famous name . . . "Ford". Together they stand for products that assure your confidence and dependability . . . now, even more than ever before.

When you use Philco tubes, your customer knows you are delivering the best.

**Use the Tubes That Mean "Satisfied Customers"**

**PHILCO Star Bright 20/20 Picture Tubes and PHILCO Receiving Tubes**

A complete line of all types for all makes and models of television and radio receivers, manufactured under exacting quality standards, thoroughly tested and inspected.

PHILCO Factory-Supervised Service ®

**DEPEND ON YOUR PHILCO DISTRIBUTOR . . .**

your one-stop-shopping center for quality picture tubes and receiving tubes for Philco or ANY OTHER MAKE.

**PARTS & SERVICE OPERATIONS**

**PHILCO®**

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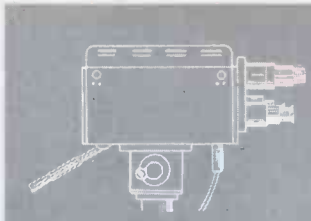
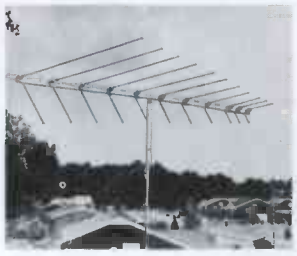


# The Electronic Scanner

### *Something New in Antennas*

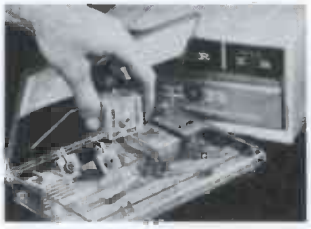


The first significant change in antenna design in recent years is incorporated by **JFD Electronics** in their new LPV series of television antennas. Based on a principle known as the "log-periodic" concept, these antennas display broad bandwidth combined with high gain. In addition, the directivity pattern of the antenna is remarkably free from back and side lobes, and the forward lobe is unusually narrow. Developed from the theory of an infinitely long logarithmic spiral, the new V-shaped antenna was designed in the Antenna Research Laboratory of the University of Illinois. The units are available in models with gain as high as 14 db, having flat response across both VHF television bands—making them useful for color TV and stereo FM, as well as for monochrome TV. They have been field tested in several areas, and the most efficient models have received television signals regularly from distances of 150 miles.

### *Boosters Get a Boost*

A new concept in selling television boosters has been introduced by **Blonder-Tongue.** The promotion centers around a "caddy/pak" that the serviceman can carry along on home service calls. The idea is to sell boosters through actual demonstration; special packaging is designed to stimulate the customer's curiosity and interest. The demonstration kit contains two indoor boosters—a transistorized and a tube model.

### *Rectifier Assortments Save Money*



Two basic assortments of semiconductor rectifiers are being offered to servicemen by **International Rectifier,** at reduced prices. Each assortment, with its container, sells for at least $3 less than the regular net price for the rectifiers alone. The "Caddy Kit" contains 16 most-used types, in a plastic divider box. A larger assortment, the "Bench Cabinet," contains 31 popular types in a four-drawer storage cabinet.

### *Annual Citation Given*

At their 1962 convention, the directors of NATESA selected the **RCA Electron Tube Division** to receive the annual "Friends of Service Management" award. Irving J. Toner, president of the national servicemen's organization, is shown here presenting the engraved plaque to Douglas Y. Smith and W. Walter Watts, vice presidents of RCA.

### *Space-Saving Tube Sockets*

Something different in tube sockets has been developed by **Aerovox**—right-angle sockets for mounting on printed boards. Four types are offered: two regular-duty types, with or without a shield shell, and two heavy-duty high-rigidity types, also with or without shield shell. Right-angle sockets will allow tubes to be mounted upright on vertical printed boards, or horizontally on others; the result will be a considerable saving of space.

### *Someone New in SCR Field*

A recent entry into the silicon-controlled rectifier field was made by **Mallory,** with the introduction of 18 new SCR types. The new units feature blocking voltages as high as 500 volts, with current-handling capacities up to 25 amps. Similar Mallory products include regulator (Zener) diodes, silicon rectifiers, and prepackaged semiconductor circuits.

### *Tuner Repairs Go West*

A new TV tuner repair center on the West Coast, located at 10654 Magnolia Blvd. in North Hollywood, Calif., is staffed with **Sarkes Tarzian, Inc.** engineering personnel and specialized technicians .This new addition will make possible faster, more efficient tuner service in the Pacific Coast area.

### *Fiberglass for Picture Tubes*

A new kind of 23" television picture tube is going into production at **Sylvania.** The "Kimcode" CRT uses fiberglass cloth around the funnel, and a .018" steel band, to hold the face glass in place, thus forming an implosion-proof CRT. The company indicates that 19" and 16" tubes also will be available in the near future.

### *New Plant for Antenna Company*

A new single-level, ultra-modern addition — covering 25,000 square feet — is being added to present facilities of **The Finney Company** in Bedford, Ohio. Here, company president Morris L. Finneburgh, Sr. (left) plays host to Bedford City Manager Joseph Banta and Bedford Police Chief James Gresham at ground-breaking ceremonies, aided by L. H. Finneburgh and M. L. Finney, Jr. It is said that, when the addition is completed early this year, Finco will have the world's largest single-plant operation devoted exclusively to producing TV, FM, and Amateur antennas.

### *Report on CCTV in Industry*

According to a booklet issued for management officials by **Blonder-Tongue,** closed-circuit television has emerged from the developmental stage and is taking its place as a major contributor to industrial efficiency. CCTV is being used in factories, schools, and churches to perform every imaginable function — from production control and plant protection to school-wide classroom instruction and "baby-sitting." The free booklet contains nontechnical descriptions of equipment, and points out how CCTV saves time and money by overcoming the limitations ordinarily imposed by distance, danger, inaccessibility, and the inability of personnel to be at several places at once.

# SENCORE
## SIMPLIFIES COLOR SERVICING

### NEW! CA122
### COLOR CIRCUIT ANALYZER

**A simple approach to a complex problem**

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

The CA122 offers more for less money:

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

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

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

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

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

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


**A must for color . . .**

**a money maker for black and white TV servicing**

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

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

You'll pay more for other color generators only.

**Dealer Net . . . . . 187.50**

### NEW! PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

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

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

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

**Kit . . . . . 74.50**


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

# SENCORE

## SIMPLIFIES SWEEP CIRCUIT TROUBLE SHOOTING

### SS117
### SWEEP CIRCUIT ANALYZER

**For Color and Monochrome Testing**

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

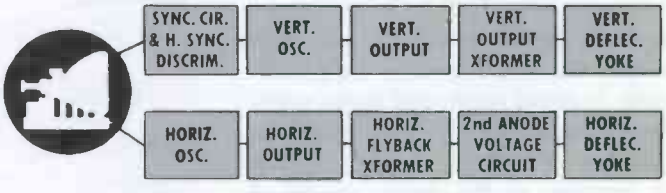
TV horizontal oscillator check is made by substituting a universal oscillator known to be good. Horizontal output check consists of a cathode current and screen voltage test. The TV horizontal yoke is checked by substituting a universal yoke from the SS117 and viewing brightness or restoration of 2nd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

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

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

**Dealer Net** ..... **89.50**


**The SS117 checks them all**




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

## FOR FASTER MORE ACCURATE TUBE TESTING

### TC114 MIGHTY MITE
### TUBE CHECKER

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

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

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

**Dealer Net** ..... **74.50**

**Fast, Accurate . . . never lets you down**




**A must for color**

### TM116 TUBE TESTER MODERNIZING PANEL

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

**Dealer Net** ..... **24.95**

# FOCUSING ON THE TROUBLE

Some years ago, focusing of most black and white picture tubes was done magnetically, either with a bulky, electrically driven coil or with heavy magnets mounted on the CRT neck. Now CRT's are all focused electrostatically, with voltages—usually 700 volts or less—applied to an internal focus element. Considering this simplification, it might seem that focus problems would simply boil down to whether or not the proper voltage is present at the focus anode of the picture tube. Actually, focus problems can still be quite complex, depending on conditions.

### What is Focus?

Focus, whether of light or of an electron beam, is simply a matter of directing the points of light or the electrons so they converge at a specified point and concentrate their force in one place. This is shown graphically in Fig. 1, using a flashlight as an example. The rays of light from the flashlight will *normally* continue in their original direction (as in A), and the light will never be concentrated at one point. However, if we insert a lens (as at B), we can redirect these light rays along different paths that will intersect at a point called the *focus point*. Thus, we have concentrated the light into a beam, which will be extremely small and highly concentrated at the focus point. At this point, therefore, we have the condition we call "in focus."

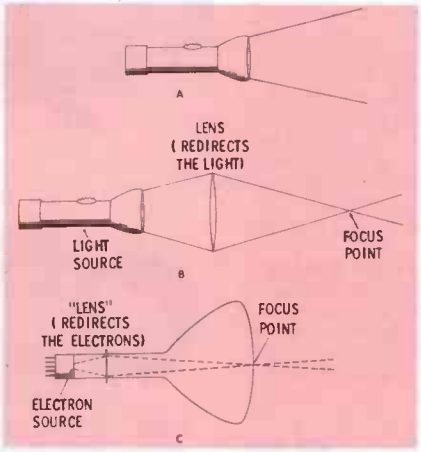



**Fig. 1. Comparison between focusing of a flashlight beam and electron beam.**

The electron beam in a TV picture tube is formed in much the same manner. (The focus point is on the phosphor face—as at C in Fig. 1.) But, in focusing electron beams, other factors than position or dimensions of the "lens" are involved. In fact, the many electrical factors that affect electron-beam focusing explain why the problem of locating focus troubles involves more than merely checking the focus voltage.

The first picture tubes to use electrostatic focusing required a high voltage (several kv) on the focus anode. This high voltage was supplied from an extra HV rectifier utilizing a portion of the flyback pulse from the horizontal output transformer—see Fig. 2. The focus adjustment was a potentiometer across the DC output circuit. A more elaborate version of this type of focusing is still used with color TV picture tubes.

Modern black-and-white picture tubes use electrostatic focusing derived from B+ or boost. The voltage for the focus anode may be supplied through taps on a power-supply bleeder (as in Fig. 3A) or from a high-resistance focus control (as in Fig. 3B). Or, it may be supplied by a jumper at the picture tube socket, connecting the focus anode to the first anode of the picture tube, to some other element, or perhaps even to ground (one side of the heater)—whichever point offers the best focus. A few picture tubes have the focus anode connected internally to other elements, which supply the focus voltage; these are called self-focusing tubes. Small test CRT's are good examples of this type of focusing.

• *Please turn to page 76*

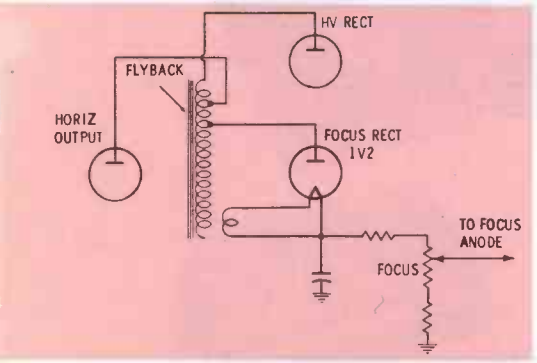



**Fig. 2. Older circuit seldom used in monochrome sets, popular in color TV's.**

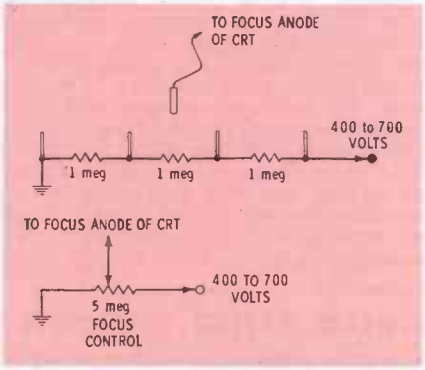



**Fig. 3. Most modern receivers use one of these circuits for focusing the CRT.**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|---|---|---|---|---|---|
| BOSTON—NEW YORK | 18 | 5 hrs. — min. | $1.80 | $2.10 | $2.35 |
| PITTSBURGH—CLEVELAND | 14 | 2 hrs. 55 min. | 1.60 | 1.85 | 2.15 |
| CHICAGO—ST. LOUIS | 8 | 6 hrs. 10 min. | 1.90 | 2.15 | 2.45 |
| LOS ANGELES—SAN DIEGO | 38 | 2 hrs. 30 min. | 1.25 | 1.45 | 1.70 |
| CINCINNATI—LOUISVILLE | 15 | 2 hrs. 40 min. | 1.50 | 1.70 | 1.95 |

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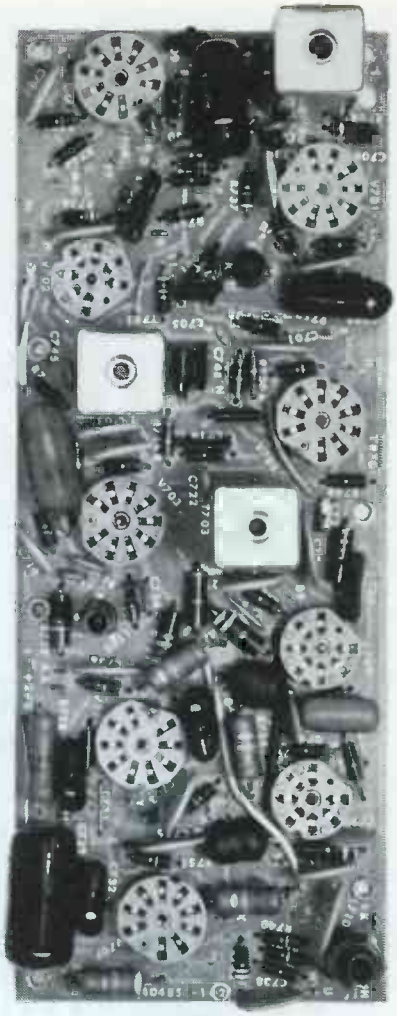
Old



New

# Now, RCA VICTOR takes the tangle out of TV's toughest circuitry

The advantages of the new RCA Security Sealed Chroma Circuits are plain to see. The simple fact that they're Precision Crafted Security Sealed boards tells you most of the good news . . . clean; easy to get at; "road-map" tracking, and just generally a cinch compared to their old, hand-wired counterparts.

This newly developed RCA chroma board sets many more benchmarks. For example, the color bandpass amplifier circuit operates near Class "A," providing linear amplification of chroma signals. Color video amplifier outputs are 100% DC coupled to reduce drift in color temperature set-up.

The chroma circuit also features two new multi-grid pentode color demodulators to improve color with better matrixing. No "short cuts"—this is full-function circuitry...demodulators *plus* amplifiers for extra color brilliance and stability! This circuit is very stable, and tube change has almost no effect on performance of matrixing.

The new Precision Crafted Security Sealed Chroma Circuit board is part of RCA's continuing program for faster, easier servicing of today's fastest-growing home entertainment medium . . . Color TV.

See Walt Disney's "Wonderful World of Color" Sunday's, NBC-TV Network.

RCA The Most Trusted Name in Television

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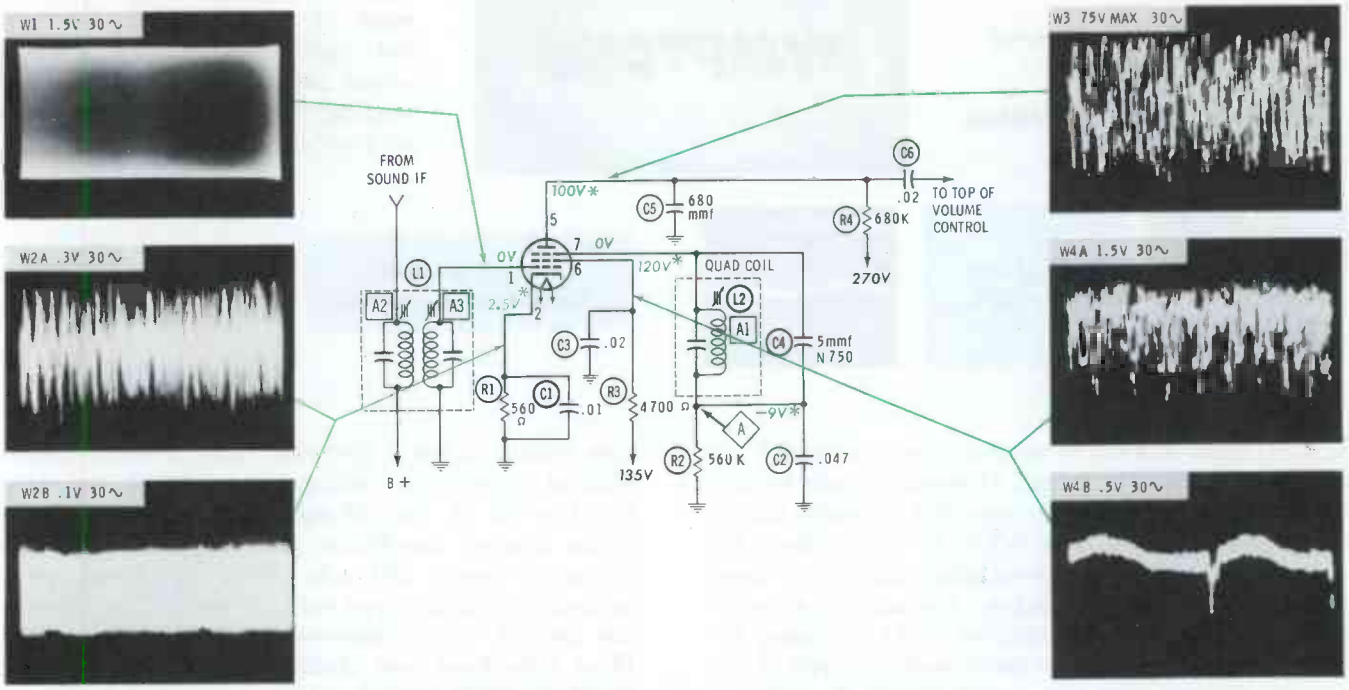
# 6DT6 Sound Detector




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

**WAVEFORMS** taken with wide-band scope; fine-tuning control adjusted for best picture just below sound peak on strong station; direct probe usable at all points in the circuit.

## Normal Operation

Plate current is determined by both control grid (pin 1) and quadrature grid (pin 7). Frequency-modulated 4.5-mc input (W1) induces similar signal at pin 7 by electron coupling. Signals are 90° out of phase at exactly 4.5 mc; frequency swings due to FM cause corresponding phase shift, varying average plate current at audio rate. Limiting of stray AM peaks takes place in control-grid circuit. Very weak incoming signals induce oscillations, locked in phase with input; these reinforce and stabilize signal. Not all tube pins are useful as test points; VTVM probe at pin 1 or 7 (or scope at pin 7) loads circuit and falsifies indication. A1 should be adjusted on strong signal (intercarrier sound from TV station, or crystal-controlled 4.5-mc CW). Sharp peaking of A2 and A3 is attained only on extremely weak signal, when accompanying video is too snowy for viewing. Proper tuning of each slug can be checked with VTVM: positive DC peak at pin 2, negative peak at point A, or dip at pin 6. Final peaking of A1 is best done while listening to signal. Tuning of this slug is critical, characterized by point of severe garbling just to one side of point that gives maximum volume and clarity.

## Operating Variations

**PIN 5** Slight variations in alignment, signal conditions, and component values have extreme and rather unpredictable effect on DC voltage. In some sets, plate is supplied from boost, and sweep trouble can affect sound. Station signal (W3) is complex, fluctuating audio. Best scope frequency for analyzing hum and buzz is 30 cps.

**PIN 6** DC voltage decreases about 10% when signal is applied. Audio appears in ripple waveform (W4A) except during pauses, when hum and video predominate (W4B). Exact waveshape depends on design of screen-bypass circuit.

**PIN 2** DC voltage rises to 5-7 volts with signal applied. Waveform looks like W2A on audio peaks, W2B on pauses; note video, which enters via sound IF.

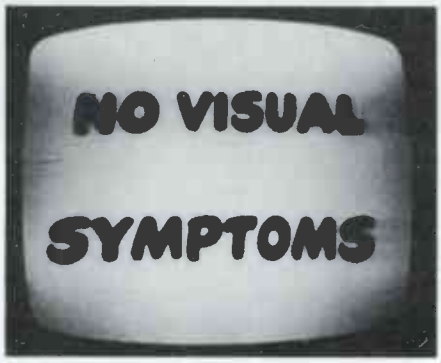
**A** This is best point for checking quadrature circuit. DC reading goes several volts more negative with signal applied. Scope trace bounces erratically, making detailed study impossible.

## SYMPTOM 1

### Scratchy or Muffled Audio

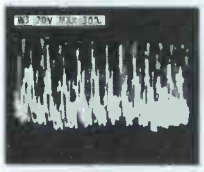
**Volume Slightly Reduced**

**R3 Increased in Value**

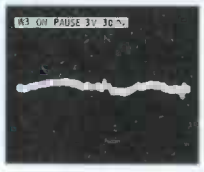



### Symptom Analysis

Trouble before volume control is indicated, since audio signal injected at this point produces clear sound from speaker. Slight readjustment of A1 decreases distortion, but slight buzz remains. Clearest sound occurs below peak VTVM reading; this proves trouble is only covered up by readjustments.



### Waveform Analysis



### Voltage and Component Analysis


Station audio is hard to analyze, since frequency and amplitude constantly change. However, certain features of this signal furnish valid clues. For example, loudest audio peaks should expand W3 to 50 volts or more, but trouble in R3 holds maximum amplitude to only about 20 volts. Also, while watching fluctuations of waveform, observer will note positive peaks extending farther from base line than negative peaks—a sign of distortion. Pips on base line during pauses in audio are remnants of vertical sync pulses, which cause buzz.

Low voltage at pin 6 pinpoints fault in screen circuit. Without signal, other voltages are normal; but when signal is fed in, they change as secondary effects of screen trouble. Insufficient plate current raises plate voltage to nearly 200 volts; weak signal induced at quadrature grid develops only –1 volt DC at point A; and cathode voltage measures slightly below normal. These indications were obtained when R3 had risen to nearly ten times normal value—a condition that could develop as consequence of short in C3 or tube.

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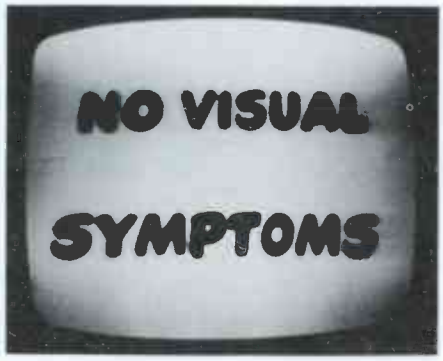
## SYMPTOM 2

### Audio Weak and Garbled

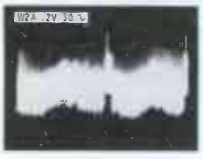
**Effect Similar to "Rubbing" Voice Coil in Speaker**

**C5 Open**

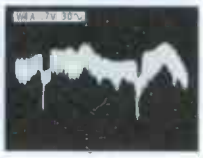



### Symptom Analysis

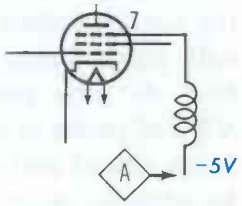
Substituting for speaker does not affect trouble, and signal injection at volume control gives clear sound. Loud rushing noise on vacant channels proves audio circuit has ample gain. Slightly retuning A1 restores acceptable volume and clarity, covering up trouble. A2 and A3 react normally to adjustment.



### Waveform Analysis



### Voltage and Component Analysis




Scope helps pinpoint this trouble by acting as capacitor substitution box! As soon as probe is touched to pin 5 of 6DT6, sound returns almost to normal, because input capacitance of scope (with direct or LC probe) takes place of C5 as filter for 4.5-mc component of plate signal. W2A and W4A both display somewhat weaker audio component than normal. Although they are no great aid in spotting trouble, they are presented here to give demonstration of how faults can reflect trouble indications into other parts of circuit.

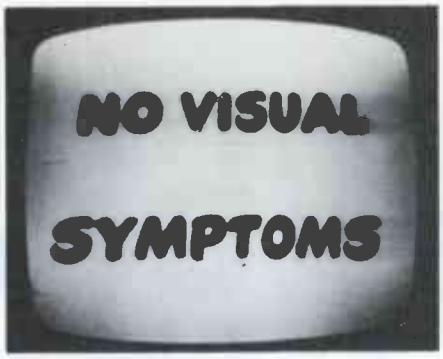
VTVM does not provide enough shunt capacitance to remove symptom, as scope does. DC plate voltage is near normal; only VTVM reading that would arouse suspicion with no signal present is at test point A in quadrature-grid circuit. Negative voltage here is only about half normal value. When strong input signal is applied, voltage at point A reacts normally. Misleading "normal" reading may occur on channels adjacent to active channels, since enough signal usually reaches detector to make it react as if station were tuned in.

## SYMPTOM 3

### Very Weak Audio

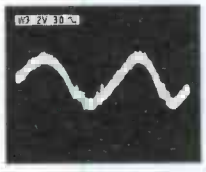
Loud Noise on Vacant Channels

### C2 Open

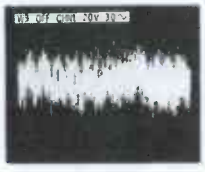



### Symptom Analysis

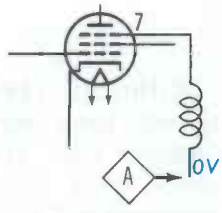
Sound is faint, but reasonably clear. Buzz is present, although at such low level it sounds like faint hum in background. Sound increases to usable level at high volume settings, where noise between stations is deafening. A1 has no effect; slight touch-up of A2 or A3 may improve sound quality enough to conceal trouble.



### Waveform Analysis



### Voltage and Component Analysis




Scope isolates trouble to 6DT6 stage by same technique that applies to most circuits: input signal (W1) is normal, but output (W3) shows severe distortion. Maximum amplitude is only 2 volts, a small fraction of what it should be. Sinusoidal 60-cps hum dominates W3, but is amplified less than audio signal by output stage—so is less noticeable than audio in speaker. Intense hiss "off channel" is explained by 20-volt spikes of random noise in W3. This waveform is half normal amplitude, indicating little effect on "no-signal" operation.

With no signal applied, zero voltage is indicated at point A, because open C2 removes grid-leak bias from quadrature grid. No secondary effects on other voltages in stage are noted until signal is applied; then plate voltage soars to level nearly as high as supply voltage, indicating virtual cutoff of plate current. Since plate normally draws only a small percentage of total cathode current, DC voltages at cathode, control grid, and screen grid are scarcely affected by troubles that disable plate or quadrature-grid circuit.

---

## SYMPTOM 4

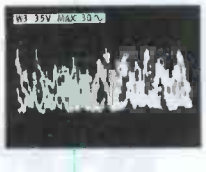
### Distorted Audio

Volume Nearly Normal

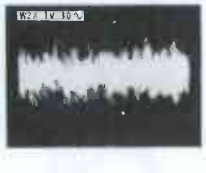
### R1 Increased in Value


### Symptom Analysis

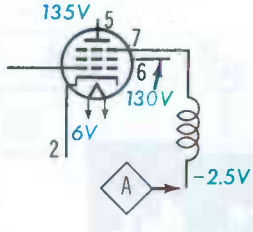
Station sound has muffled, wheezy tone such as that produced by badly torn speaker cone. Distortion cannot be removed by adjusting A1; but detuning either A2 or A3 improves sound. Normal setting of A2 causes *dip* instead of peak in output volume; in A3, peak is merely shifted to one side of normal.



### Waveform Analysis

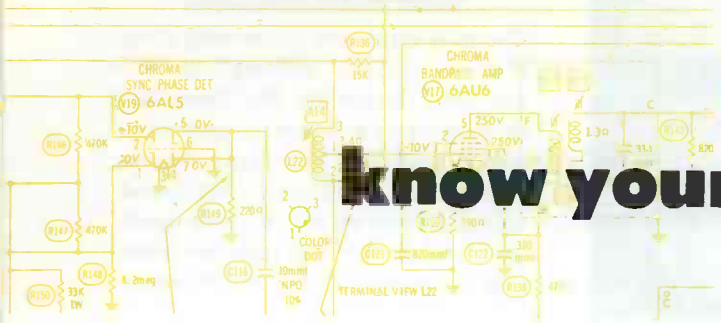


### Voltage and Component Analysis




Output waveform W3 is similar to that in Symptom 1, although somewhat stronger. Distortion in complex waveform of station audio signal is difficult to see, but can be spotted by noting greater postivie than negative excursions of scope trace from base line on signal peaks. Waveform should be symmetrical at correct setting of A1. Shape of W2A appears unaffected; but amplitude is several times normal, since signal is developed across abnormally high resistance. Trouble produces no noticeable effect on either W1 or W4.

All DC voltages are upset, because excessive cathode bias reduces both plate and screen current. When signal is tuned in, cathode voltage rises to 17 volts. Reduced plate current is indicated by rise in plate voltage to 175 volts. In normal fashion, screen current *increases* and pulls screen voltage down to 120 volts. No voltage appears at point A when signal is present. First trouble symptoms appear when cathode resistance has increased to approximately 2500 ohms; slight further increase cuts off 6DT6 when signal is applied.




# know your '63 COLOR CIRCUITS

Although chroma bandpass circuits have been only slightly "warmed over" from those in last year's color chassis, the service technician will find that keeping up with the latest changes will make his job easier. This article will acquaint you with the chroma bandpass circuits used in 1963-vintage receivers. Also, it will serve as a review of 1962 bandpass circuits—in case you're not too familiar with them. Included is the schematic of each circuit analyzed, with tube-element voltages taken during reception of a monochrome signal as well as during color reception, and with peak-to-peak waveforms taken with signals from both NTSC and keyed-rainbow color-bar generators.

During these voltage and waveform measurements, the RF output cable of the color-bar generator was connected to the receiver antenna terminals, and the monochrome operating controls—brightness, contrast, and horizontal hold—were set to produce a normal picture on the TV screen. The tint (hue) control and color control were adjusted to produce normally saturated colors on the CRT—in order not to overdrive the color amplifier circuitry.

Two main types of bandpass circuits are being used in the new color receivers. Zenith is continuing to employ a two-stage amplifier to provide the bandpass and gain necessary for the chroma signal. RCA, on the other hand, uses a single bandpass amplifier stage, as in last year's set. We'll discuss these circuits separately, point out some of the features of each, and see how the color signal progresses through them.

### Two-Stage Circuit

A schematic of the bandpass amplifier used by Zenith is shown

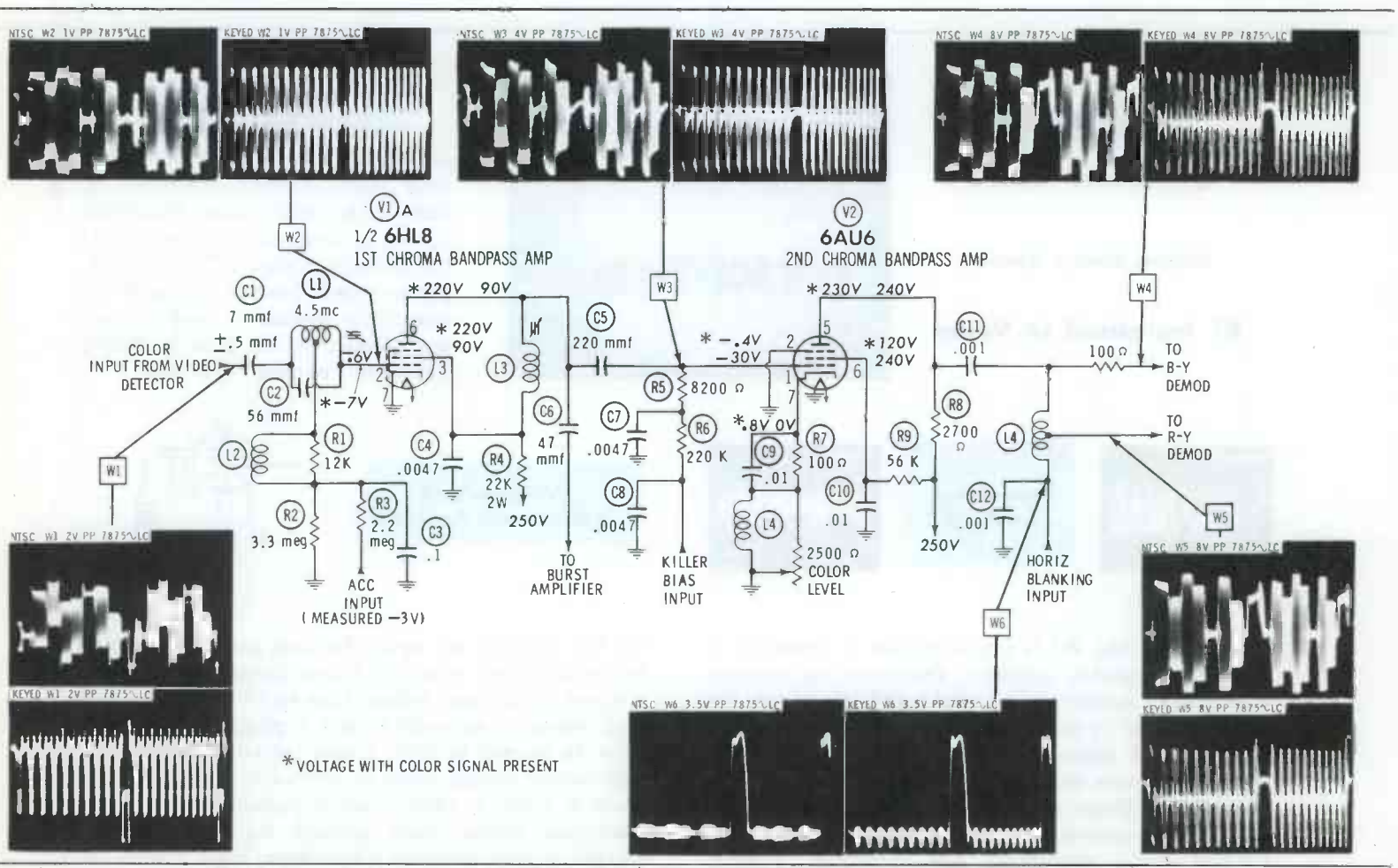



Fig. 1. Two-stage bandpass amplifier in Zenith Chassis 27KC20 receives input from video detector.

# Chroma Bandpass Amplifiers . . .

## by George F. Corne, Jr.

in Fig. 1. The biggest change from last year is in the first amplifier stage; the 6GH8 used in '62 models has been changed to a higher-gain 6HL8, and color sensitivity is further increased by omitting the cathode resistor and bypass capacitor.

The composite video signal (W1) is coupled from the output of the *picture detector* through C1, a 7-mmf unit, to the grid of V1A. W2 shows the composite video signal as it is fed to the grid circuit, together with the burst and chroma components.

The grid circuit includes a 4.5-mc trap (L1, C2) to prevent the sound-IF signal from passing through the chroma circuits and causing 920-kc beat interference in the color picture. Automatic color control (ACC) is also used in this year's chassis. ACC action can be compared to familiar AGC operation; a small control voltage from the ACC stage is applied through R3 to the grid of V1A, and this voltage keeps the gain constant during minor changes in the amplitude of the incoming color signal. (A negative 3 volts was measured in this particular chassis during the tests we performed using the color-bar signal.)

The plate circuit of V1A contains the only *tunable bandpass* component in these two amplifiers —L3, which is designed to peak on chroma frequencies in the 3- to 4-mc range.

The output circuit of V2 is resonant to approximately 3.6 mc, and the response of both amplifiers results in the needed 1-mc bandpass.

Interesting, and important to remember during servicing, are the changes in operating voltages on V1A, between monochrome and color reception. During black-and-white operation, the reading on the grid of V1A is −.6 volts. With the cathode grounded, and this small voltage on the grid, V1A is conducting heavily—notice the plate and screen voltages are only 90 volts. But, when a color signal comes along, the grid voltage of V1A shifts to −7 volts, and cuts down conduction through the tube —causing an appropriate rise in the plate and screen voltages, to 220 volts. These wide operating variations lead to the conclusion that the circuit of V1A is designed for broad response, rather than high gain. It amplifies the color signal only about two times, as you'll see by comparing the amplitudes of W2 and W3.

The plate circuit of V1A includes the takeoff point for the burst signal fed to the color sync section of this chassis. Don't overlook this dividing point when the complaint is loss of color sync or loss of color;

• *Please turn to page 71*

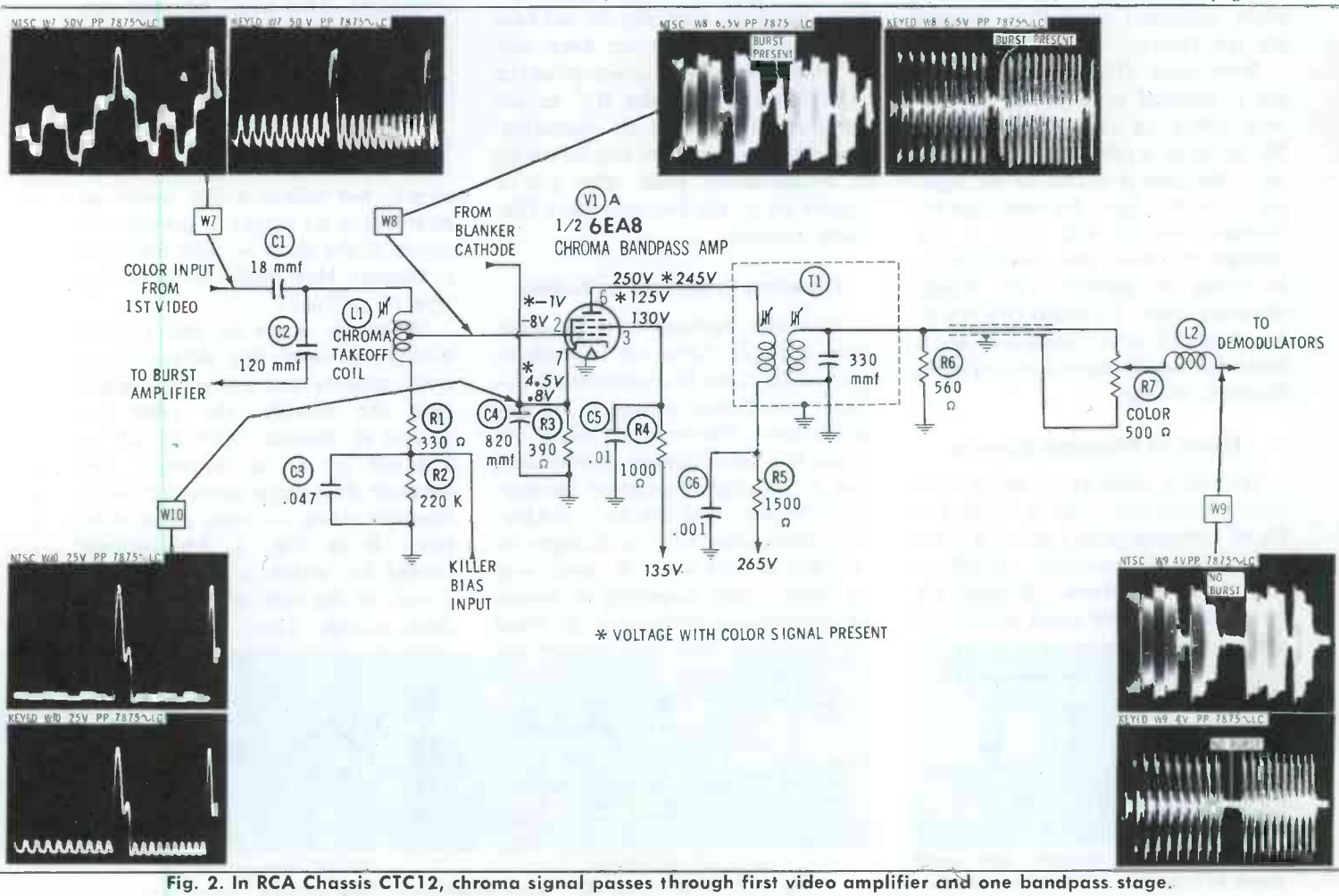



**Fig. 2. In RCA Chassis CTC12, chroma signal passes through first video amplifier and one bandpass stage.**

Shop Talk

# unusual faults in Filament Circuits

by Allan F. Kinckiner

Troubles resulting from defects in filament circuits often enter the tough-dog category — not because the defect is actually hard to find, but because filament circuits are generally less likely to be suspected than other circuits. This is especially true of simple parallel or series circuits; since these ordinarily give very little trouble, checking them is often neglected until they become the last resort.

Sometimes filament-circuit testing is delayed because the serviceman relies on visual appearances. He looks at a tube and assumes it's okay because it seems to be lighting normally; later, he measures the filament voltage and finds it low enough to cause the condition he is trying to correct. This wastes servicing time. To avoid this waste, he shouldn't have relied on just a look; he should have *measured* the filament voltage!

### Types of Filament Circuits

Orthodox parallel or series filament circuits are found in the majority of tube-equipped radios, TV receivers, tape recorders, amplifiers, and other electronic devices the technician is called upon to service. Designs using a combination of series and parallel filaments are less common. One example is a TV receiver in which some of the filaments are wired in series, but others are operated in parallel across a transformer winding. In a few unusual sets, filament power is supplied by a portion of the regular B+ or by bridge- or ring-rectifier supplies designed specially to activate the filaments. There are even sets in which the filaments are powered by a full-wave doubler B+ circuit on one half-cycle of its operation. These unusual circuits can be tricky to troubleshoot, even after you've caught on to the fact you have filament trouble.

### Filament Problems in Radios

In radios, various troubles other than a simple "dead set" complaint can result from filament-circuit defects. Insufficient voltage to an amplifier-tube filament is likely to cause low amplification. Sometimes, too, a filament connection periodically "makes and breaks," producing intermittent volume changes or "cutting in and out." A quick way to check a tube suspected of having an intermittent filament is to shunt it with a neon bulb. If and when the filament opens, the neon bulb will glow.

While weak or intermittent radios are common, and usually are easily serviced, one transformer-powered AM-FM radio gave me a king-sized headache: The set operated normally on AM, but the FM volume faded in and out. The trouble was finally found to be caused by a cold-soldered joint on a 6AL5 filament connection.

AC-DC-battery radios, commonly known as three-way portables, rank high as users of unusual filament circuits. When they are being operated from line voltage, the filaments are powered by a portion of the rectified B+.

A very common fault in these receivers is an intermittent oscillator. In too many cases, the serviceman will replace the 1R5 (or whatever tube type is used as an oscillator) and, since the set does not cut out after prolonged checking, he'll consider the trouble corrected. In a short time, often only a few days, the set is returned with the same complaint. This time, he goes one step farther: he operates the set from a *Variac,* or voltage-dropping transformer, and picks out a 1R5 that will not cut out even with the set operating at about 95 volts AC. Now he is sure the trouble is corrected, but within a few weeks or months the set makes its unwelcome return to the shop — with the same complaint. How could he avoid this type of callback?

Whenever a set of this type is brought in with this defect, don't even consider that a new 1R5 might cure the trouble; the odds are against it. Instead, open the set so you can get at its "innards," and measure the voltage across the entire filament string — from point A to point B in Fig. 1. The voltage should be within a few tenths of a volt of the sum of the tube-filament ratings. Thus, in a set using

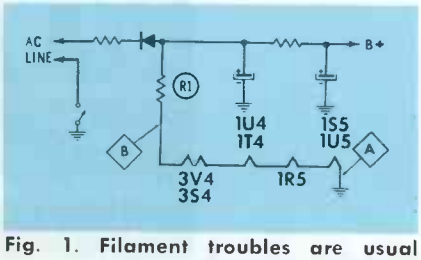
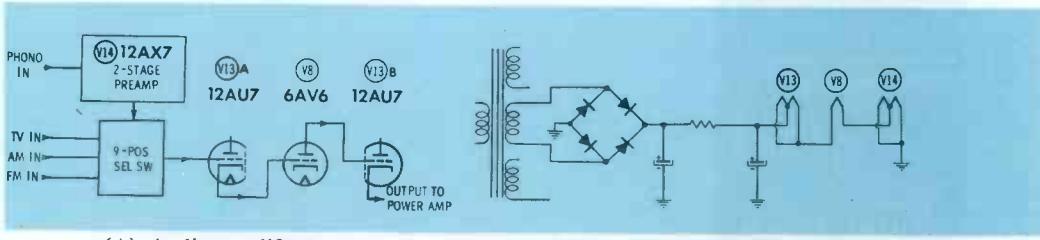



Fig. 1. Filament troubles are usual cause of fading in three-way portables.




(A) Audio amplifiers. (B) DC filament circuit.

Fig. 2. Parts of Fisher 70RT tuner involved in "low volume" complaint.

tubes similar to those in Fig. 1, the total filament voltage should be approximately 7.5 volts. If you read a voltage lower than this, attach a pair of clip leads to a 75-ma selenium (not silicon!) rectifier and shunt it across the rectifier in the set, being careful to observe correct polarity. Measure the filament voltage with the new rectifier connected; if the voltage increases by .5 volt or more, you can be sure a new rectifier is needed.

While replacing the rectifier will cure many of these sets, occasionally the new unit will not raise filament voltage sufficiently. Two other components have been found to cause trouble: the filter capacitor and the filament-dropping resistor. If the filter is at fault, the B+ will measure less than normal; bridging this capacitor with a known good unit will serve as a check. Dropping resistor R1 can be checked with an ohmmeter, or by substitution.

If the filament-string voltage is okay, check the voltage across each tube. There have been cases where one tube (the 3V4 in particular) dropped far more voltage than normal across its filament, resulting in lowered voltages across other tubes. Simply replacing the tube solved the problem.

### Weak Hi-Fi

A custom hi-fi installation with an uncommon filament-circuit fault resulted in a very interesting servicing job. The system consisted of a Fisher 70RT AM/FM tuner with a 40-watt power amplifier driving six 10-watt coaxial speakers. Included in the tuner chassis were three low-level audio amplifiers; Fig. 2A shows this latter section, with its four inputs, two outputs, and a 9-position function switch.

The installation seemed to have plenty of power, but the customer assured me the volume was considerably less than it had been. On further questioning I learned that *all* audio programming was affected by low volume. Since this would ordinarily suggest trouble in the power amplifier, I tested and substituted the tubes in that section, to no avail. Still believing the power amplifier contained the root of the trouble, I decided to take it into the shop for servicing; as an afterthought, I also took along the tuner.

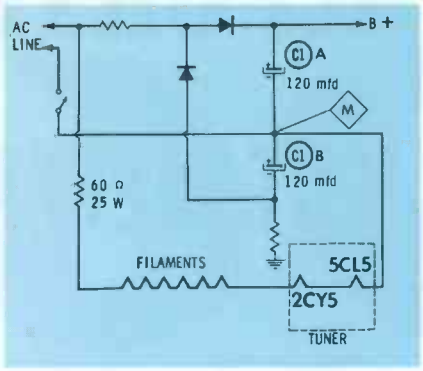
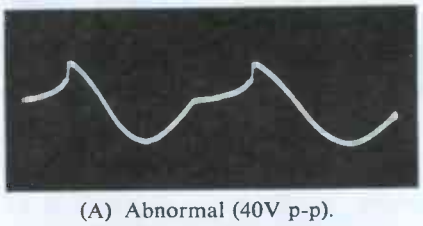


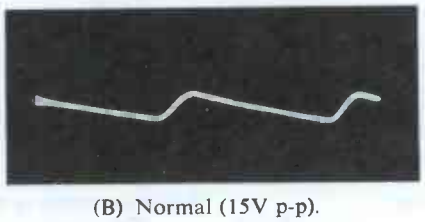

**Fig. 3. Point M is low end of series filament string in one Silvertone set.**

In the shop, the power amplifier was thoroughly checked, but no faults were found; a gain test proved the amplifier was capable of putting out its rated 40 watts. So I turned to the 70RT. Radio reception seemed normal, so I concentrated on the low-level amplifier section shown in Fig. 2A. With an audio generator and scope, I soon determined that each stage was amplifying, but I didn't know for sure what the normal amplification should be for each stage. I made voltage checks on the plate, cathode, and grid, critically comparing them with voltages given in the PHOTOFACT schematic; all were within tolerance.

Finally I tumbled to the fact that filament voltages on these stages were not supplied from the power transformer — they were DC, supplied by a bridge rectifier as shown in Fig. 2B. One voltage reading here supplied the answer to the entire trouble. Instead of 20 volts DC across the filament string, I found only 15 volts; no wonder each amplifier stage was operating a little weakly. Replacing M1, a 25-volt, 300-ma bridge rectifier, cured the low-voltage condition and increased system volume to normal.



(A) Abnormal (40V p-p).



(B) Normal (15V p-p).

**Fig. 4. Ripple at point M.**

### Mystifying Tube Burnout

Our house-call serviceman replaced the 5CL8 in the tuner of a Silvertone TV set twice in one week, finding an open filament each time. When the customer called the third time, we got out the PHOTOFACT Folder for the set. A study of the circuit, portions of which are shown in Fig. 3, suggested that a short from cathode to filament in the 2CY5 might possibly burn out the 5CL8, so this time we replaced both tubes. Result: a repeat call about four days later. Needless to say, the set was brought in for shop servicing.

Take a look at Fig. 3. The tuner filaments are at the "low" end of the string, but this end does not return to ground; instead, because of the power-supply design, it returns to the 130-volt DC point (M) between C1A and C1B. This would not necessarily cause burnouts or filament-to-cathode shorts, because the tubes are quite capable of working with 150 volts between filament and cathode.

The set owner had mentioned that the burnout always occurred when the set was turned on after having been off for a while. If the set was turned on before it cooled off, apparently nothing happened. With this in mind, I connected some test instruments to the set before turning it on.

First, the VTVM was connected to read DC voltage between point M and ground. Next, the scope was hooked to the same point. The set was turned on, with the following results: DC rose quickly to about 140 volts, but the scope showed an odd ripple at point M—see the waveform in Fig. 4A. This waveform remained for about two minutes, and then changed to the normal one shown in Fig. 4B. The amplitude of waveform 4A was about 40 volts, and that of 4B about 15 volts.

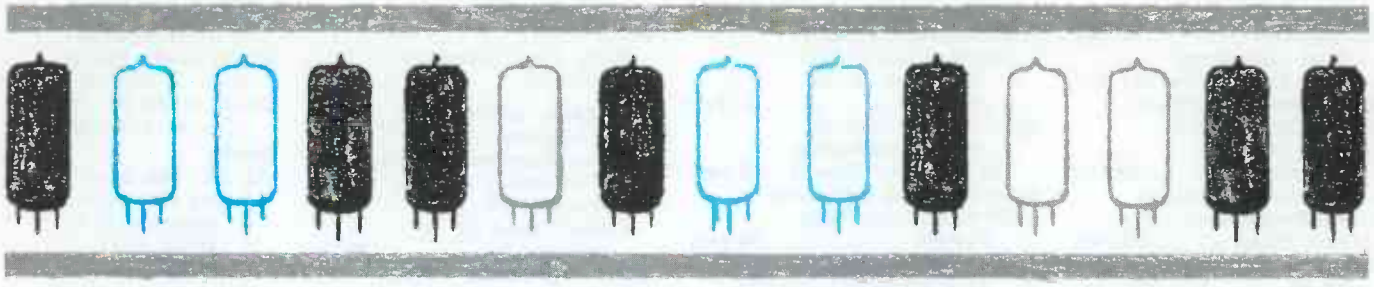
Only one component was likely to cause this sharp-pointed, excessive ripple—filter C1. Replacing this unit resulted in a normal waveform each time I fired up the set regardless of how long it had previously been off.

• *Please turn to page 74*

# PF REPORTER

# 1962 ANNUAL SUBJECT REFERENCE INDEX

• *Please turn to page 79*



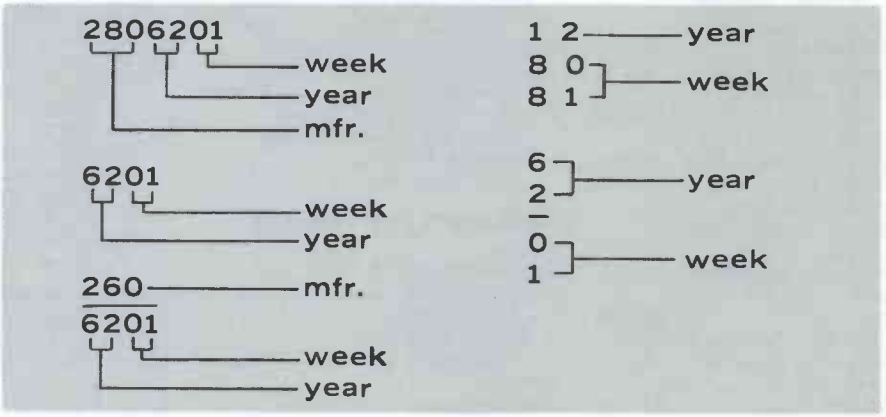
# TUBE EXPIRATION CODE GUIDE

How often have you, as a serviceman, looked at a receiving tube and wondered, "Is this item still in warranty?" This problem faces technicians every day. However, by becoming familiar with the code dates stamped on tubes, you will be able to tell at a glance if they are still covered by the standard warranty (effective for one year from the date printed on the tube). If you purchase a tube, and find from the code date that it is no longer in warranty at that time, you should make some specific arrangement with regard to further warranty. For example, when you buy a rare tube that has been on the distributor's shelf for several years, you might retain your sales slip marked to indicate that the tube you have purchased is guaranteed for one year from the date of purchase.

### Tubes Not Warranted

The following list shows receiving tubes that may not be subject to adjustment, even though they are still in warranty:

**A few ways EIA tube code dates appear on receiving tubes.**




1. *Broken*—tubes which have received rough handling.
2. *Abused*—tubes which have had improper voltages applied.
3. *Serviceable*—tubes which show by test to be in satisfactory condition.
4. *Defaced* — tubes with code-date markings removed or obliterated.
5. *Burned out*—tubes with open filaments (electrical abuse).

### How to Read the Code

The EIA standard four-digit numbering system is used by the makers of most brands of receiving tubes. The first two digits indicate the year, and the remaining two digits refer to a specific week of the year. (Weeks are numbered consecutively from 01 to 52.)

RCA, Raytheon, and Sylvania are among the few who use letters, or a combination of letters and numbers, to designate the code dates on tubes in their replacement line. The charts show codes that expire during 1963. ▲

### 1963 Expiration Code Dates For Receiving Tubes

| Mfr. | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RCA | MO | MP | MQ | MR | MS | MT | MU | MV | MW | MX | MY | MZ |
| Raytheon | K-24 | K-22 | K-20 | K-18 | K-16 | K-14 | K-12 | K-10 | K-08 | K-06 | K-04 | K-02 |
| Sylvania | JB | JC | JD | JE | JF | JG | JH | JJ | JK | JL | JM | KA |
| Standard* | 62-04 | 62-09 | 62-13 | 62-17 | 62-22 | 62-26 | 62-30 | 62-35 | 62-39 | 62-43 | 62-48 | 62-52 |

*EIA four-digit code

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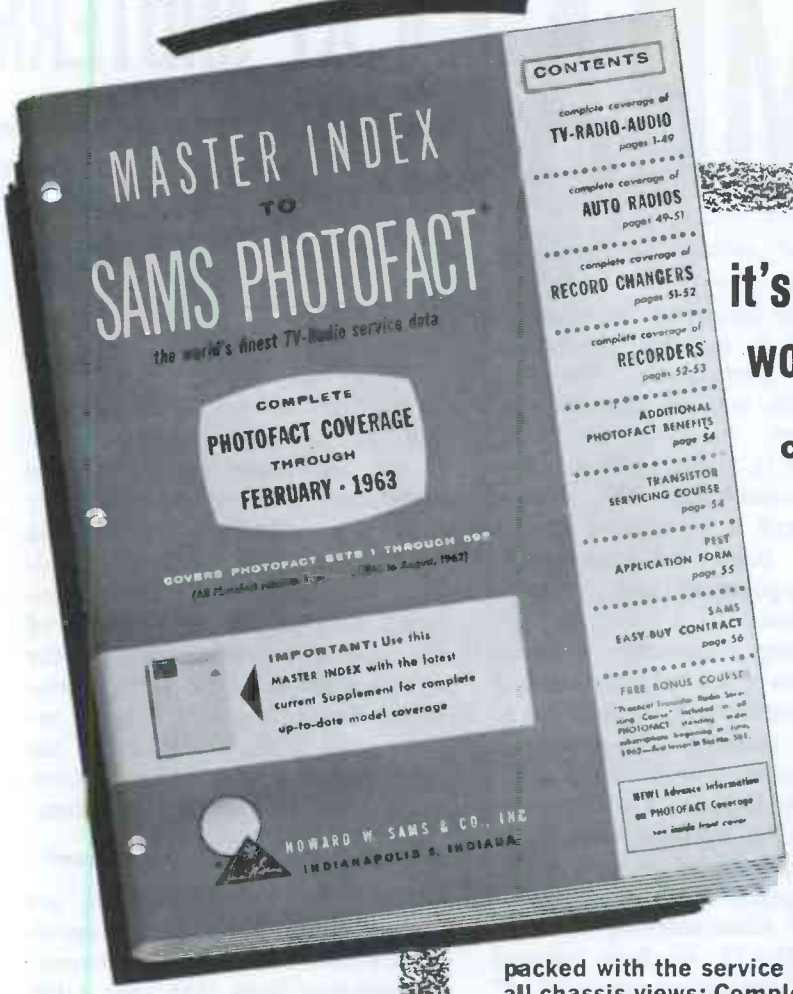


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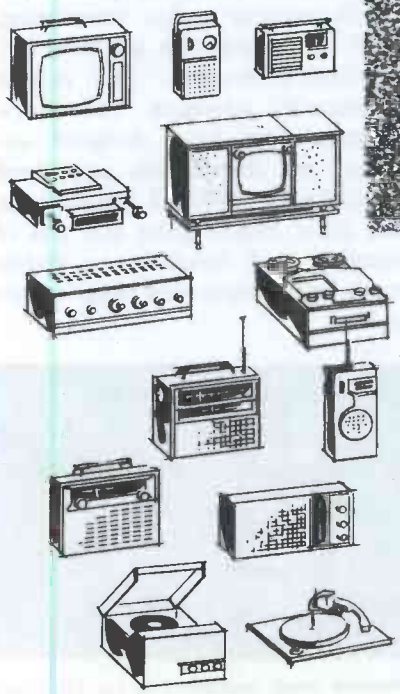

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# MPATI AT MIDTERM

**The "flying TV station" is still going strong.**

—by Forest H. Belt

In January of 1962, just one year ago, a group of 45 men met at Purdue University in Lafayette, Indiana, to settle the future of the Midwest Program for Airborne Television Instruction—better known as MPATI. The outcome of this meeting was the incorporation of MPATI, Inc. as a full-time nonprofit organization. This decision made MPATI a permanent influence on the future of educational TV.

The airborne system had already been proved successful through several months of experimental telecasting. In October, 1961, the PF REPORTER article "Schoolroom TV Takes to the Air" described the new airborne ETV system and informed the service technician about techniques and procedures which he might expect to encounter with this entirely new form of UHF transmission. Since that time, MPATI has finished one full school year of educational telecasting, and is nearing the midterm of its second. The resulting backlog of experience has proved the need for special methods to insure satisfactory reception of MPATI signals. With installation facilities available through local service shops and distributors, even the smallest rural schools can have exactly the same benefits from this educational system as the most modern city school.

Projected budgets have disclosed that, with a nominal percentage of school participation, the total cost can be held to less than $1 per student. To cover the 200-mile MPATI radius with conventional ground-based TV stations would entail a prohibitive investment in large antennas, high-powered equipment, and expensive relay facilities.

The flying transmitter is much the same as when the program first began, broadcasting on two separate UHF channels—72 and 76—while the plane flies "lazy 8's" over Montpelier, Indiana. Two tape machines feed a separate lesson into each transmitter, so students at two different grade levels can receive instruction simultaneously.

The MPATI teachers prepare their half-hour lessons under "ideal" conditions; the lessons are recorded on video tape and sent to the modern tape-reproducing facility at MPATI headquarters in Lafayette. There, two copies are made from the master tape; one is for the plane scheduled to televise that day's programming, and the other is for the standby plane, to insure that the lesson will be telecast regardless of weather or mechanical difficulty.

As either of the two DC-6 transmitter planes leaves for the day's flight, it carries tapes for the next three days' programming. Thus, if the plane cannot return to the home base at the end of the day, lessons will still go on tomorrow, even though the plane may spend the night away from home. The standby plane sits ready each day with the same 3-day stock of lessons. Advance planning such as this, combined with careful maintenance of the planes, is responsible for the excellent record of the MPATI program: During the first year of experimental flying, one plane or the other was "on station" over Montpelier 99% of the scheduled time.

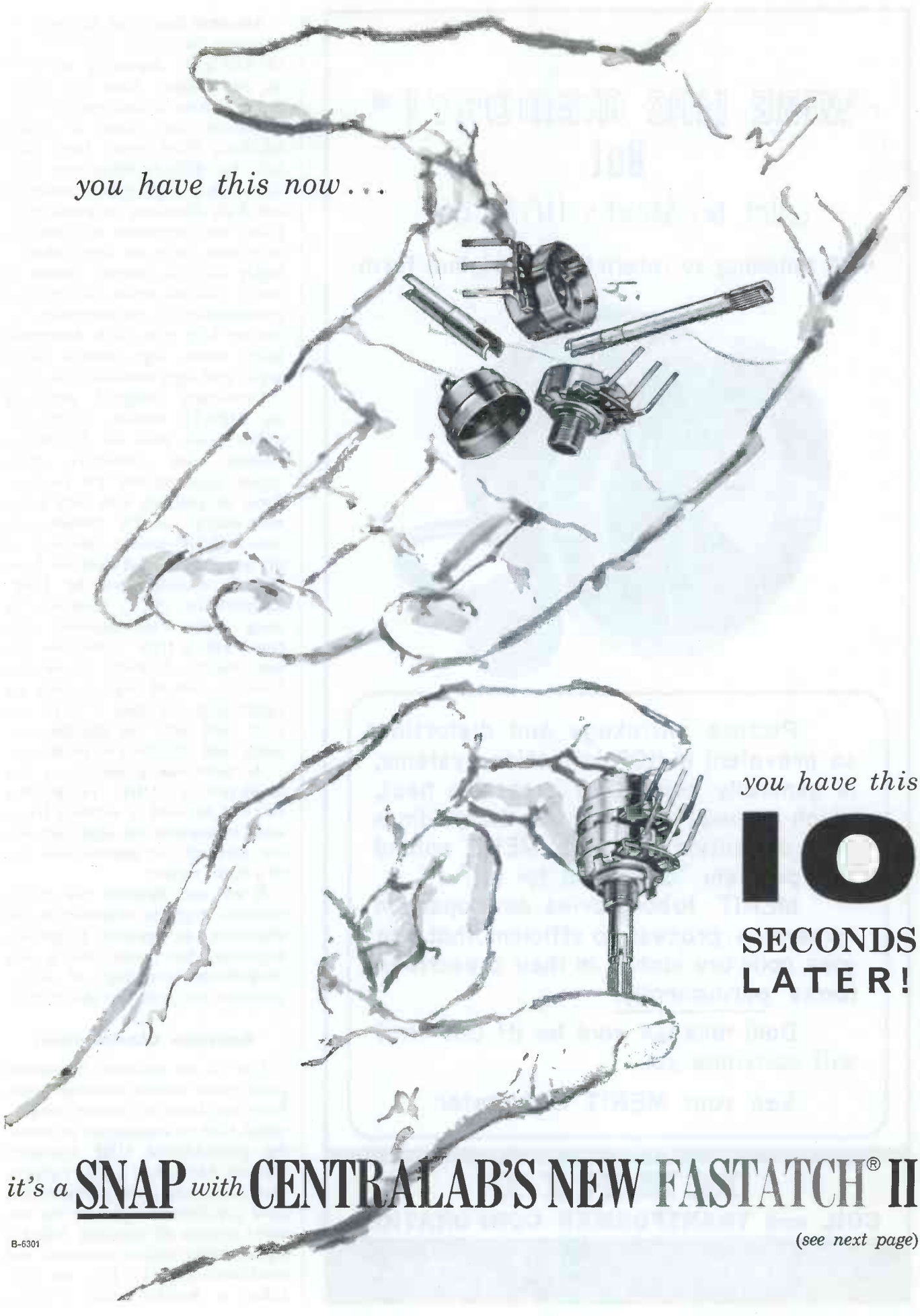
### Improvements in Equipment

Since the airborne classes are broadcast on UHF, MPATI installations must include UHF antennas, transmission lines that pass UHF signals without undue attenuation, UHF converters with standard TV distribution systems, and regular commercial television receivers. Manufacturers have designed antennas and distribution equipment especially for MPATI installations, and these items make the job of planning and installing a system much less complicated than it used to be.

Specially equipped DC6B plane carries transmitter and antenna for MPATI.

Inside of flying TV station, with engineer operating two-channel console.

Modern tape reproducing facilities are in headquarters at Purdue University.

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(*see next page*)

Antennas have been designed for operation in specific zones of the MPATI area, depending primarily on the distance from the plane. Some reflector designs produce better results than others, in certain localities. Yagi types have been built for difficult fringe-area locations, where high gain is desirable and high directivity is permissible. (Since the transmitter is constantly in motion, there are areas where a highly directive antenna cannot be used.) Stacked arrays offer various combinations of characteristics, including high gain, wide horizontal beam width, high vertical beam angle, and high front-to-back ratio.

Converters designed especially for MPATI include crystal-controlled types, units for distribution systems, and converters which mount right on the TV receiver. Some installations with only a few sets simply use TV models with built-in UHF tuners. (Because of the new All-Channel Receiver Law, all new receivers will be UHF-equipped by 1965.) However, by using regular VHF receivers, combined with a UHF conversion system ahead of VHF distribution facilities, costs of larger systems are significantly less than if UHF sets were used, with the attending antenna and distribution problems.

At least one manufacturer has developed a UHF preamplifier that can be used in extreme fringe areas to improve the signal fed into the converter or transmission line of a direct system.

It was once believed that special receivers might be necessary in the classroom to prevent tampering; experience has proved that a very insignificant percentage of service problems are caused by this trouble.

### Reception Considerations

Use of an airborne transmitter poses some unique reception problems—at least in certain areas—which have no counterpart in receiving ground-based UHF television stations. More than a year's experience in solving these problems has shed considerable light on the unusual aspects of receiving suitable signals under various situations and conditions. MPATI, Inc., has published a booklet called "School

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One of the problems has to do with the vertical angle from which signals are picked up. They are traveling slightly downward, instead of tangent to the curvature of the earth (as with ground-based signals). In fringe areas, 100 miles or more from the plane, this angle is almost insignificant—a fraction of one degree above the horizontal. Even as close as 40 miles, the angle is less than 5°—hardly any cause to tilt the antenna upward. Near the plane, however, this problem is considerable, and is aggravated by the movements of the plane in flying its 20-mile-long figure-8's. The solution is the use of special antennas having wide vertical and horizontal beam widths, pointed slightly above the horizontal.

### *Reflections*

It is the "dropping in" of the signal that accounts for the great range of the airborne telecasts; signals can hurdle obstacles which would block UHF waves from a conventional antenna. However, there's one disadvantage: *ground reflections*. Signals can bounce off smooth surfaces, such as playgrounds, and be reflected upward at a low angle. When the reflections reach the receiving antenna, they can produce ghosts and partial cancellations of the direct signal. As pointed out in the October, 1961 article, the best remedy in most cases is to mount the antenna on the side of the roof away from the plane, so the roof will block these undesirable reflections.

If reflections persist, it's helpful to know where they are coming from. The distance from the receiving antenna to the reflecting surfaces will vary according to the distance from transmitter to receiving site, and MPATI has prepared a table of these distances. As an example, take a modern one-story school, 100 miles from the plane. The antenna will probably be about 20′ above the ground. The table shows that a reflecting area approximately 600′ from the antenna (in line with the transmitter) will be most troublesome. If the school were only 50 miles away, the reflecting distance would be cut by more than half—to approximately 250′. Doubling the antenna height would just about double the critical reflecting distance.

### *Movement of the Plane*

Generally it's not difficult to place the antenna so reflections are avoided. Problems that are more critical arise in some locations because the transmitting antenna is not fixed, but moves in a 20-mile figure-8 orbit. The constant changing of transmitter position may make it difficult to select the proper antenna, or height and direction, for consistent pickup. One complication is that the figure-8 even changes direction from day to day, to allow for wind direction. Therefore, in these areas, an antenna position that works well one day may render very poor results the next. "Nearer and farther" variations of plane position can cause the picture, in critical fringe locations, to become snowy or even to disappear once in each orbit. "Crosswise" flying of the transmitter plane causes little signal variation in fringe areas, but

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is more likely to cause problems at receiving sites closer to the plane. Here, the horizontal beam width of the receiving antenna may be too narrow to pick up the signal at all times.

Highly directive antennas are common in UHF work, and the MPATI installer may be tempted to use them rather freely for the extra gain they provide. But he may find that, if these types are installed too close to the transmitter, the signal will fade during each orbit, as the plane flies from one side to the other. This effect may be noticed even beyond 50 miles from the transmitter, depending on the particular antenna. (As an example: An antenna with a horizontal beam width of 15° should be used no closer to the plane's orbit than 75 miles, according to information furnished by MPATI.)

The solution is to use antennas with less razor-sharp directivity at locations near the transmitter. At moderate distances, the corner reflector and four-bay "conical" type with flat reflector are not overcritical as to directivity, and provide sufficient gain for ample signal strength. For close-in installations, the simple bow-tie unit with flat reflector may well be the answer.

### *One Fringe-Area Solution*

In Detroit, a UHF translator unit is being used to rebroadcast the lesson programs in that area, thus eliminating the need for several fringe-area installations. Perched atop a 285-foot building in downtown Detroit, the system picks up the signals from 165 miles away and converts them to other UHF channels for beaming to schools in the Detroit educational system. This arrangement is so practical that other large school systems in fringe locations are considering this method of participating in MPATI.

### What the Future Holds

Here are some of the improvements proposed for the MPATI plan: The entire program will eventually be self-supporting, and controlled largely by the participating schools and colleges. The experimental stage was financed largely by the Ford Foundation — aided by grants of more than $1 million from

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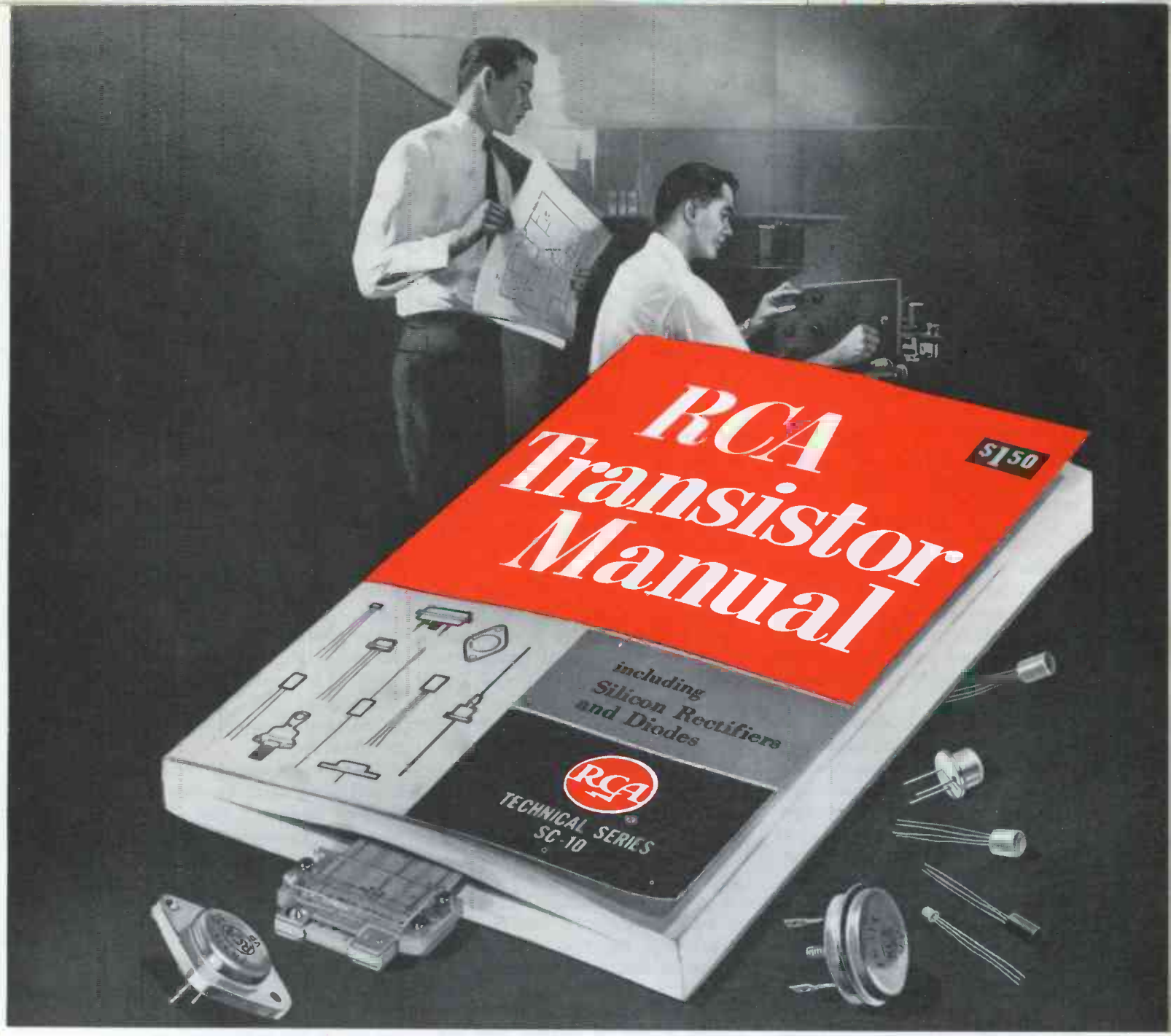
other foundations and private industry — and another $7.5 million has been granted by Ford to finance the continuance of the program through 1965. By that time, membership is expected to include a substantial percentage of the schools in the six-state area; MPATI officials predict the possibility of 7,000 member schools registered, with a total enrollment of 4 million students.

Plans are afoot for using two higher-flying aircraft of advanced design, which will increase the present coverage area by more than one-third. Ultimately, this would mean the MPATI region would embrace most parts of the present six states, one additional state, and a bit of Canada.

In addition to the present two channels, four more channels have been spoken for, and are awaiting approval by the FCC. A total of six channels would allow the number of program hours to be tripled or quadrupled, with a considerable increase in the grade level which could be covered and the variety of subject matter which could be offered. New narrow-band telecasting techniques promise even greater versatility of the system.

If you're located in an MPATI region, you have an opportunity to be actively promoting, selling, installing, and servicing school TV systems. They're not difficult, and they're a good "foot in the door" for many other types of school business — intercoms, record changers, and public-address systems, to name a few. Furthermore, the idea of including CCTV facilities has caught on in some schools, enabling them to originate their own "all-school" classes or programs. Many service technicians are already making such installations, and finding them quite a profitable undertaking.

Those of you who are not located in MPATI territory had better keep your eyes and ears open. More airborne systems are bound to spring up, and if you're alert and ready, you can obtain your share of the first installation business. Getting in on the "ground floor" is a good way to establish a reputation for service; the man who is "in the know" about new developments is always in demand. ▲

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The table of contents of the new manual indicates the broad span of subjects covered: 1. Materials, Junctions, and Devices. 2. Transistor Designs and Circuit Configurations. 3. Transistor Characteristics. 4. Transistor Applications. 5. Silicon Rectifiers. 6. Tunnel, Varactor, and Other Diodes. 7. Transistor Installation. 8. Interpretation of Data. 9. Selection Charts. 10. Technical Data on Semiconductor Devices. 11. Outlines. 12. Circuits. . . . plus a Reading List and Index.

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DOLLAR & SENSE *Servicing*

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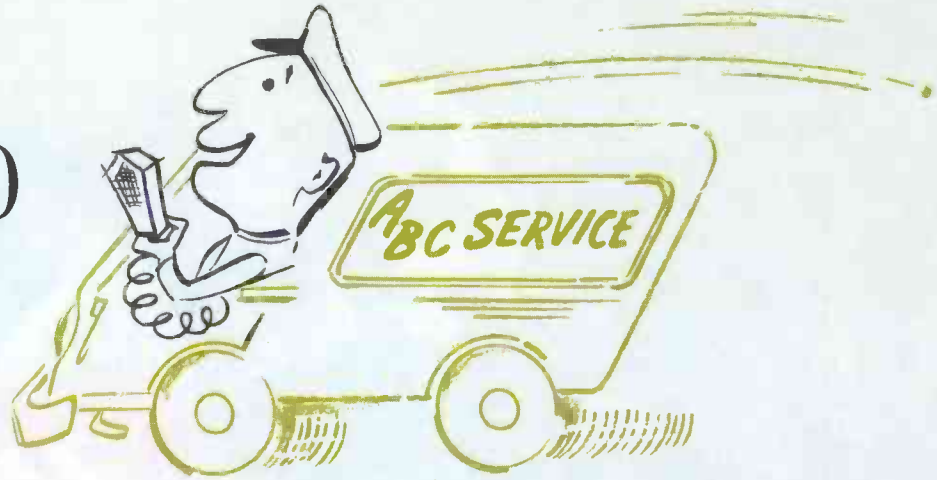
# TWO-WAY RADIO *Expedites* SERVICE




If profitability of a service business could be reduced to a simple formula, it would probably look something like this:

$$\text{Profit} = \frac{\text{Business done}}{\text{Time spent}}$$

Income will increase according to the number of jobs completed, but *the part you keep as profit* will not increase unless you can reduce the amount of time spent on each job. Nonproductive time must be cut to a minimum.

One item that accounts for a great deal of lost time (to say nothing of added operating expenses) is the vehicle mileage wasted on unnecessary and poorly scheduled trips. Much of this running around could be avoided simply by enabling outside technicians to keep in closer touch with the shop.

Strangely, surprisingly few radio-TV service businesses have made much effort to solve the travel-time problem; they could have done so with a device that is right in their own line of work: two-way radio.

Taxicab companies discovered 15 years ago that two-way radio could make their operations more profitable. Taxicab operators found they could reduce wasted mileage and attract more business through better service by using radio. They have since invested millions of dollars in two-way radio systems; today, more than 100,000 radio transmitters have been authorized by the FCC for use in taxicabs.

TV-radio service businesses are discovering the same "secret." Every week, a half dozen or so radio and TV shops are granted licenses to operate private mobile radio systems. They use two-way radio, like taxicab operators, to increase their efficiency and to win more business.

One enterprising New Jersey serviceman proudly declares to his customers: "If I'm not on time, I'll be early." It has paid off.

Any service-shop owner can similarly raise his earning capacity by using two-way radio. Technicians making service calls can be contacted from the shop without having to be traced by numerous annoying phone calls to customers. When a service-call request is received, it can be relayed over the radio to a technician in the same neighborhood, saving the cost of a trip back to the same area later. Trips to the homes of customers who have changed their appointments can also be avoided.

Fig. 1. Colored pins identify which serviceman is taking care of each call.

### Keep Technicians "Pinpointed"

One way to increase the time saved with two-way radio is to use a street map of the service area, as shown in Fig. 1. The map, mounted on a slab of cork tile or wall board, uses colored pins to mark the locations where service calls are to be made. The color of the pins identifies each technician.

Upon arriving at his destination, each technician reports by radio, and a king-size pin of the appropriate color takes the place of the plain pin used when the call is scheduled. When the serviceman finishes the job, he calls in by radio, and the pin is removed from the map.

When a call is cancelled or postponed, the dispatcher advises the scheduled technician by radio, and the appropriate pin is removed from the map. When a new call is received, it is assigned by radio to the nearest man, and a pin is inserted in the map to show which man is to make the call.

If the street map is cemented to a steel plate, small bar magnets can be used instead of pins. They can also be color-coded to identify the serviceman to whom a call has been assigned. The magnets stick to the map face and can be moved without defacing the map.

### On The Job

Some jobs can be completed on the scene, without having to pull the set, if the technician can order a picture tube or other part by radio; one of the other technicians might have one in his truck, or may be nearer the shop or a parts job-

Fig. 2. Home-call technician can obtain servicing help directly from the shop.

# DESIGNED FOR COLOR TV

## WINEGARD COLORTRON ANTENNAS

***4 gold anodized models from $24.95***

*Pat. Nos. U.S. 2,700,105; 2,955,289 • Canada 511,984 • Others Pending.


## • • • • • AVAILABLE WITH REVOLUTIONARY NUVISTOR COLORTRON AMPLIFIER...

Now, through continuous Winegard research, a new, improved Electro-Lens yagi has been developed—the NEW WINEGARD COLORTRON—PERFECT ANTENNA FOR COLOR TV!

Colortrons have a flat frequency response (plus or minus ½ DB across any 6 MC channel), no "suck-outs" or "roll-off" on end of bands . . . accurate 300 ohm match (VSWR 1.5 to 1 or better) . . . unilobe directivity for maximum ghost and interference rejection. They deliver today's finest color reception, give a new picture quality to black and white. Colortrons are the only outside antennas that carry a WRITTEN FACTORY GUARANTEE OF PERFORMANCE.

And Colortrons are built to last. High tensile aluminum tubing for rigidity and stability, insulators with triple moisture barrier, GOLD ANODIZED for complete corrosion-proofing.

There are 4 Colortron models to cover every reception need, from suburbs to distant fringe areas . . . $24.95 to $64.95 list.

*New Winegard Colortron twin-nuvistor amplifier perfectly matches Colortron antennas.* Gives added gain and sensitivity on both color and black and white. Ultra-low noise, high gain Colortron Nuvistor Amplifier can easily drive 6 or more TV sets.

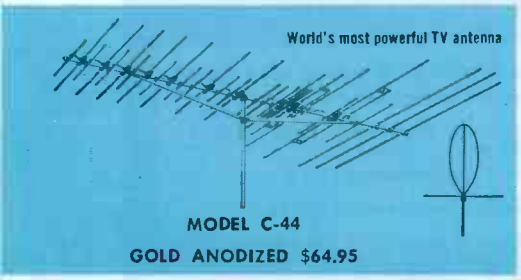
With revolutionary twin-nuvistor circuit, Colortron amplifiers can handle up to 400,000 micro-volts of signal without overloading. *This is 20 times better than any single transistor amplifier.* The Colortron Amplifier will bring the weakest signals up out of the snow, yet strong local TV & FM signals will not overload it. A special life saver circuit gives the two nuvistors a life of 5 to 8 years.

This amplifier is completely trouble free and the finest performing antenna amplifier you can own.

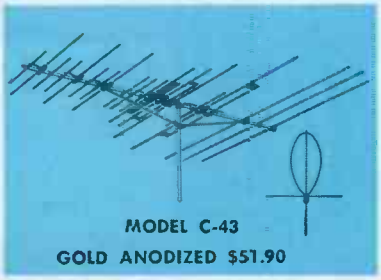
Completely weather sealed, nothing is exposed to corrode and cause trouble . . . has all AC power supply with 2 set coupler. (Model No. AP-220N, $39.95 list). Twin transistor model also available up to 80,000 micro-volts input. *New type circuit protects transistor from static electricity built up in lightning flashes.* (Model No. AP-220T, $39.95 list).

*Colortron Amplifier can be added to any good TV antenna for sharper, clearer TV reception.*

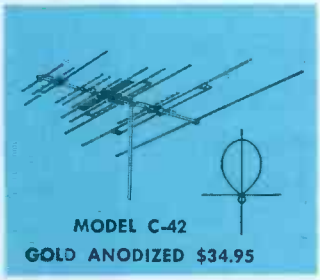
Ask your distributor or write for technical bulletin.



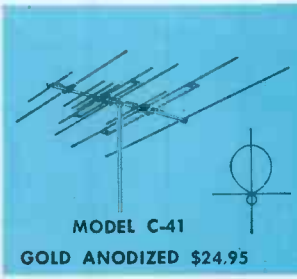

MODEL C-44
GOLD ANODIZED $64.95



MODEL C-43
GOLD ANODIZED $51.90



MODEL C-42
GOLD ANODIZED $34.95



MODEL C-41
GOLD ANODIZED $24.95

**Winegard** ANTENNA SYSTEMS

*There's an extra bonus of quality and performance in every Winegard product.*

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ber. A serviceman needing technical assistance can use the two-way radio in his truck to talk with someone at the shop, taking advantage of the main service-literature file located there.

Of course, the telephone can be used for reaching technicians at customers' homes or for leaving messages. But, this is an imposition on the customer and ties up his telephone as well as yours. And, anyway, your phone should be left free for receiving new calls. When using a customer's telephone, your technician may have to guard what he says in the customer's presence.

### Count the Savings

If each of your service vehicles operate an average of only 30 miles per day, 270 days a year, you're racking up 8100 miles of driving at a cost of approximately $800. Two-way radio can reduce your mileage by as much as 20%, and thus will be saving $160 per year for you. Multiply this saving by the number of vehicles you operate and you'll realize a substantial sum is involved.

And, that isn't all! Two-way radio can help you build more business. Not only do you save the cost of extra driving, but you win more business by being able to dispatch a technician *now*, rather than "tomorrow." If two-way radio helps you handle even one extra service call per day, you will add $1200 or more to your yearly service income. Considered on this basis, your investment in two-way radio is a sound one.

### Equipment

In a typical service shop, the base station transceiver is often installed at the service manager's desk; in a small shop, it can be located near the telephone, or above the service bench — as in Fig. 2.

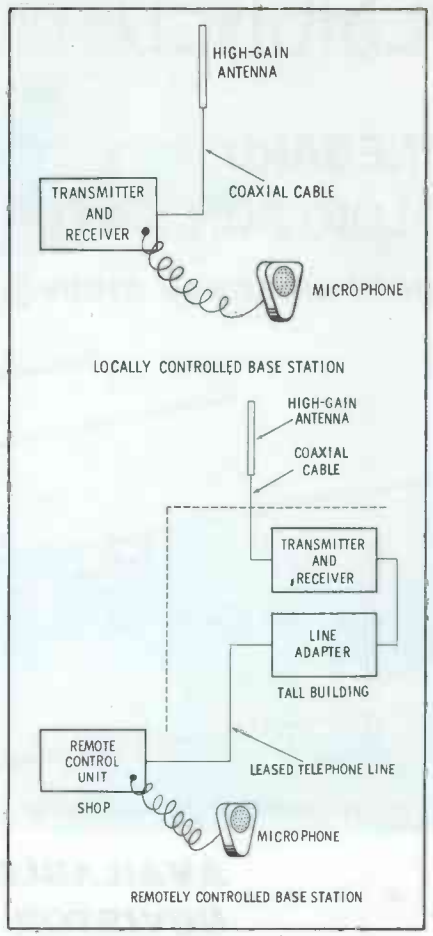



**Fig. 3. Two ways in which two-way systems can be installed for best use.**

An elaborate base station is not required to cover a small town. The antenna can be mounted on a piece of pipe on the roof of the building. Typical installations are detailed in Fig. 3. Except where the shop is in the bottom of a valley, or hemmed in by taller buildings, communication within a radius of 8-10 miles should be easily obtained — depend-

ing on the equipment, of course.

Where terrain and nearby buildings have a serious effect on range, the antenna might have to be mounted on a tower, to place it above interfering objects. For best results, the base station should be installed at the highest point available, such as a hilltop or the roof of a tall building. Such a station can be controlled remotely by the use of a leased telephone line.

In difficult areas, an additional investment of $150 or so in a high-gain antenna for the base station may be wise. With a suitable antenna, the effective radiated power of most stations can be quadrupled.

Mobile transceivers can be installed permanently or temporarily in your trucks and cars — see Fig. 4. Some types are designed for universal use, and are interchangeable among 6- or 12-volt DC and 115-volt AC installations. Some are equipped with a carrying handle, for easy portability from one installation to another.


**Fig. 4. Universal-type unit can be used in the shop or mounted in truck.**

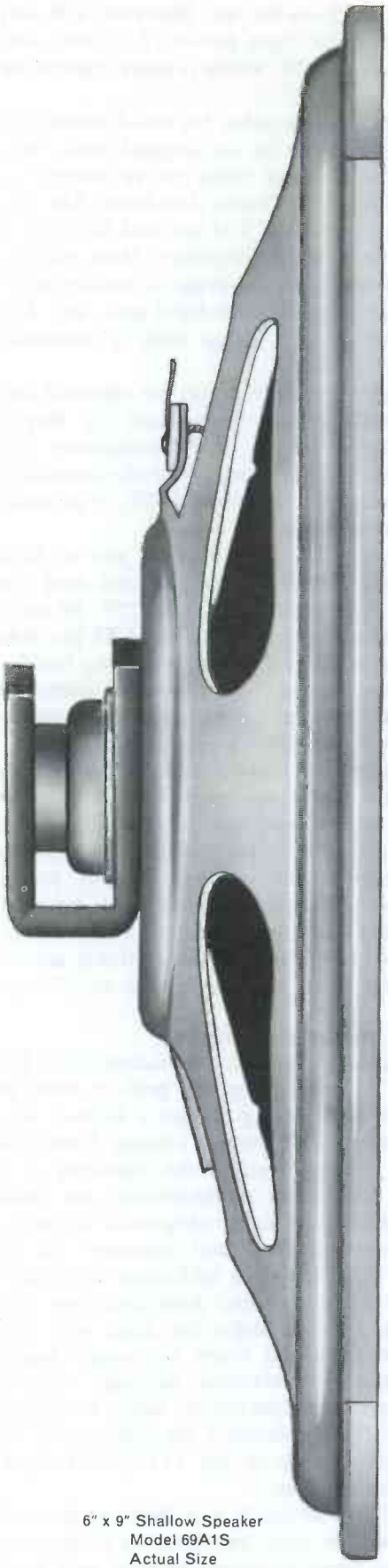
### Getting Started

The service establishment has a choice between Citizens-band radio at 27 mc, or the Business-radio bands in the low VHF range (25-50 mc), the high VHF range (152-174 mc), or UHF (450-470 mc).

Citizens-band radio may be satisfactory in a small town where relatively few hobbyists use the band. The cost of transceivers ranges from under $50 for a kit to about $225

**Table I—Manufacturers of Two-Way Radio Equipment**

Aircraft Radio Corporation, Boonton, N. J.
Aeronautical Electronics, Inc., Box 6527, Raleigh, N. C.
Communications Company, Inc., Box 520, Coral Gables 34, Fla.
Allen B. DuMont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.
G-E Communications, Lynchburg, Va.
The Hammarlund Mfg. Co., Inc., 53 West 23rd St., New York 10, N. Y.
E. F. Johnson Co., Waseca, Minn.
Kaar Engineering Corp., 2995 Middlefield Rd., Palo Alto, Calif.
Motorola Communications & Electronics, Inc., 4501 W. Augusta Blvd., Chicago 51, Ill.
Outercom Electronics Corporation, 502 Charlottetown Mall, Charlotte 4, N. C.
Radio Corporation of America, Communications Products, Cherry Hill, N. J.
Shirdan Corporation, Route 46 and Dye Ave., East Paterson, N. J.
Union Switch & Signal Division, Westinghouse Air Brake Co., Pittsburgh 18, Pa.



6" x 9" Shallow Speaker
Model 69A1S
Actual Size

# For those special applications choose a Quam speaker

When you need a 2¼" unit for a transistor radio—or a shallow 6" x 9" for a Thunderbird replacement—Quam has it!

When you need a special voice coil impedance or special field resistance—Quam has it!

Quam gives you the widest selection and the highest quality in the entire speaker industry! Ask for Quam, the Quality line, for all your speaker needs.

2¼" Transistor Radio Speaker
Model 22A06Z8
Actual Size

QUAM

QUAM-NICHOLS COMPANY
234 East Marquette Road
Chicago 37, Illinois

for a high-grade, ready-to-use set. However, CB sets are restricted to 5 watts input power (2-3 watts output) and to the use of AM, which is more susceptible to noise than FM.

A better bet is Business radio, for which more than 200 channels are available on an assigned basis. Mobile transceivers for Business radio can be bought for approximately $200 for a 5-watt low-band AM set, $400 for a 35-watt high-band FM set, and $550 for a 10-watt FM set on a UHF frequency. Most popular are the high-band sets, since coverage is usually better in "shielded" areas than with low-band sets, and they provide greater line-of-sight range than is ordinarily achieved in the UHF band.

The base station transceiver may be identical and interchangeable with mobile transceivers (if they're both of the "universal" type), or the transceiver may be one designed for fixed use only. A locally-controlled FM base station can cost as little as $500, or as much as $2500 including antenna.

If the area you must cover requires you to have a remotely controlled base station, the cost may run somewhat higher — starting at about $750. In addition, you will have to pay between $3 and $5 per mile per month for the rental of a private telephone line for controlling the base station. Sometimes, the owner of a building or tower charges as high as $65 a month for the use of his facilities for a base-station site.

The cost to equip two trucks and the shop with two-way FM radio can run as low as $1200. To recover your investment in one year, you need only to save, on the average, just over $2 per day per truck. If the drop in your costs or the increase in your profits amounts to an average total of $4 per truck per day, you will be realizing a return of almost $1000 per year, or 80% over your investment. One additional service call, provided there is no increase in time or mileage, will do the trick!

### A Bonus Opportunity

The figures quoted do not include maintenance; but a typical radio-TV service shop can perform most of this, provided one technician possesses a First-or Second-class Radio-telephone Operator License. From this start, expanding into two-way radio servicing is a natural next step. Equipment manufacturers (see Table I) are seeking independent service shops who are qualified to maintain equipment for their customers. An investment of less than $1000 in additional test equipment can get you started. Several good books on two-way radio servicing are available for those who lack experience in the field, and many equipment manufacturers will furnish instruction manuals without charge. More than two million mobile radios have been authorized by the FCC, creating a big opportunity for the aggressive service shop in the $125,000,000-per-year two-way radio business.

Like the cobbler who finally puts shoes on his children, radio-TV service shop operators are recognizing the value of radio communications in their own business. Two-way radio can save time and money for any business which uses vehicles, and particularly for those in the service business where *time* is the key income-producer. And the radio-TV business fits this description precisely. ▲


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

# COLOR-APPROVED and NTSC for $200 less!

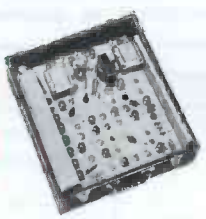
*Model 661—NTSC Bar-Dot Generator—$349.50*

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

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

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

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

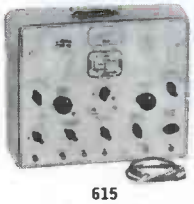


**656XC**
**NTSC** Color
Bar Generator

**660**
White Dot-
Bar Generator

**675A**
Wide-Band
Oscilloscope

**691**
Marker
Adder



**615**
Sweep &
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**CR33**
Color
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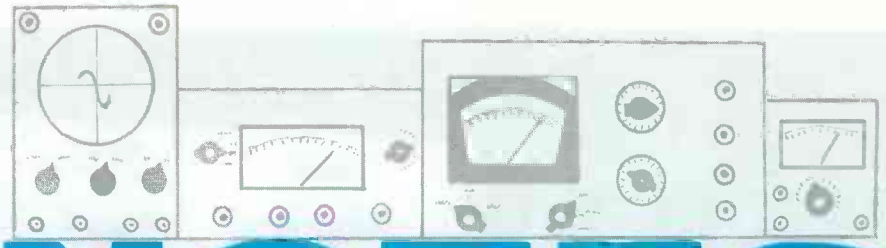

# NOTES ON TEST EQUIPMENT

*by Forest H. Belt*

## Seeing Double

There are numerous uses for a device which will enable the service technician to compare different signals by looking at more than one waveform simultaneously on the scope screen. If he has a device such as the EICO Model 488 Electronic Switch—pictured in Fig. 1—he can do this with his regular service scope.

Specifications are:

1. *Power Required — 105-125 volts AC, 50-60 cps, 25 watts.*
2. *Switching Rates—low range, 10 cps to 100 cps, continuously variable; middle range, 50 cps to 400 cps, continuously variable; high range, 250 cps to 2000 cps, continuously variable.*
3. *Frequency Response — each channel, from 30 cps to 25 kc, ± 1 db.*
4. *Controls and Terminals—4 potentiometer controls:* AMPLITUDE *1,* AMPLITUDE *2;* POSITIONING, *and* FREQ. VERNIER; *one* FREQ. SELECTOR *rotary switch; six combination-type terminal posts, two for each input and two for the output;* POWER *toggle switch; jeweled pilot lamp.*
5. *Size, Weight, Price—6" x 8" x 6"; 7 lbs; $23.95 kit, $39.95 wired.*

An electronic switch is often considered only as an accessory for scopes used in research and development. The fact is, an electronic switch such as the Model 488 has many applications in service work. The most common example is the use of the instrument to superimpose


**Fig. 1. Electronic switch permits comparing similar waveforms on the scope.**

input and output waveforms of an amplifier, allowing a direct comparison of the two on one scope.

Since the advent of stereophonic hi-fi systems, another use of the electronic switch has become common: The signal from the left channel can be fed into one section of the switch, while the signal from the other channel is fed into the second section. Thus the audio technician can go through a stereophonic system, step by step, observing the signals in both channels simultaneously, and noting any phase shift in one channel or cross talk between channels.

The Model 488 consists essentially of a square-wave generator that switches

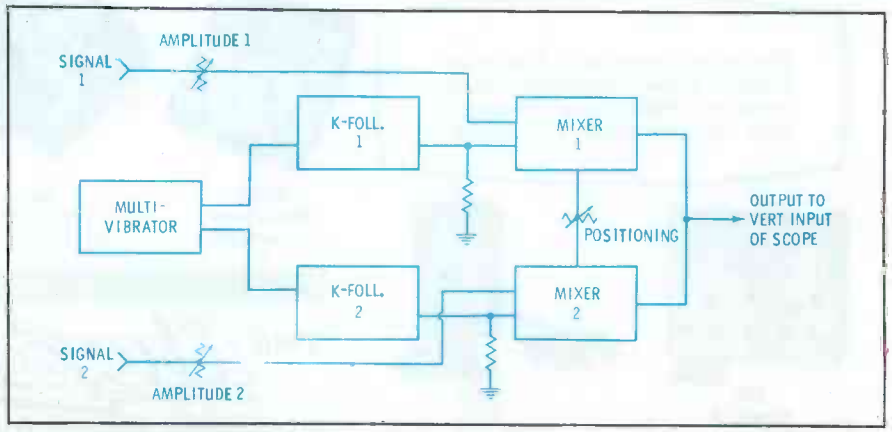


**Fig. 2. Block diagram shows circuits that combine signals and switching.**

# Find it and Fix it in ½ the time!

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


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

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

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

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

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

Net, $299.95

**SIMPLIFIES COLOR TV SERVICING, TOO**

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

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

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

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

Model 960 Transistor Radio Analyst

Model 360 V O Matic Automatic VOM

Model 375 Dynamatic Automatic VTVM

Model 700 Dyna-Quik Tube Tester

Model 440 CRT Rejuvenator Tester

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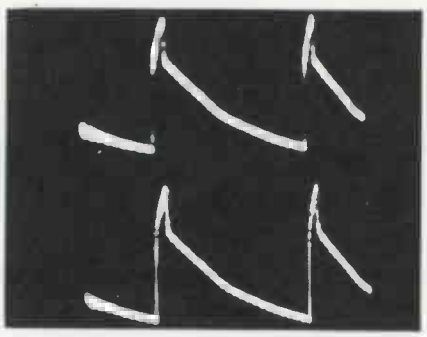
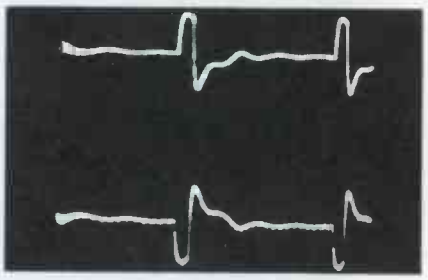


(A) Sawtooth modulating voltage.



(B) Output of demodulator probes.

**Fig. 3. Waveforms from special test, as developed on screen of oscilloscope.**

the instrument's output terminals alternately from one input to the other. By careful choice of the switching rate (frequency), a relatively flicker-free reproduction of both input-signal waveforms will be developed at the output of the switch, and can be applied directly to a scope.

The block diagram in Fig. 2 illustrates the relationship between the various circuits in the Model 488. The square-wave generator in the Model 488 is a cross-coupled multivibrator, using a 12AU7 tube. The multivibrator frequency is controlled by capacitors in the feedback circuit, and by a dual-control potentiometer for vernier (or fine) frequency control. The output from each half of the multivibrator is fed to a separate cathode follower, causing that stage to conduct during one flat portion of the square-wave cycle. The cathode followers also serve to isolate the multivibrator from any loading effects of the mixer or output circuits.

The output from each cathode follower is fed—via a common cathode resistor—to the cathode of a mixer pentode. Thus, the cathode followers actuate first one mixer and then the other. Meanwhile, each signal to be viewed is fed into the grid of each respective mixer. The plate circuits of the mixer pentodes are combined in such a way as to feed the two outputs (which are alternately being switched on and off) to the output terminals and thus to the vertical input of a scope. The result is the appearance of both waveforms, one above the other, on the scope-CRT face. The POSITIONING control on the Model 488 permits the technician to separate the two traces for easy viewing, or to bring them together sufficiently to superimpose them.

The first use to which we put the Electronic Switch in our lab was to check the characteristics of a pair of

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Tips for Technicians

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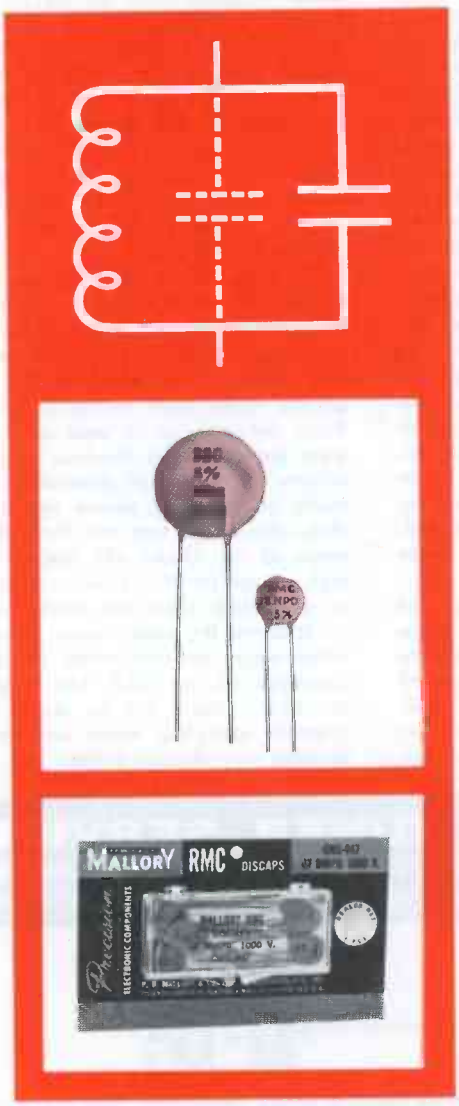
# How to use temperature compensating ceramic capacitors




While an oscillating circuit is warming up, its frequency changes. Distributed capacitance in tubes and coil will drift in the "positive" direction—tending to decrease the resonant frequency. Unhappily, the tuning capacitor, if it is a conventional mica or paper unit, also drifts in this same direction . . . thereby adding to the downward frequency shift.

This can be a real nuisance. In the local oscillator circuit of a superhet receiver, it leads to constant readjustment of tuning as the set warms up. It may also introduce appreciable error in a ringing oscillator timing circuit in TV sets.

Here's where ceramic capacitors enter the scene. Unlike capacitors which have a "natural" material as dielectric, they use a man-made, rock-like material whose composition can be adjusted to just about any capacitance-temperature characteristic you want.

Some ceramic capacitors have a positive temperature coefficient: these are the kinds you'd use in bypass, coupling and buffer applications. Others have a zero temperature coefficient, remaining unchanged in the range from 25° to 85° C. And you can get 'em with a *negative* coefficient so that the capacitance change goes opposite to that of the other circuit elements, giving a constant LC product and substantially steady frequency during the warm-up period.

The usual negative temperature coefficient is 750 parts per million per degree C. But if you happen to need some non-standard coefficient to compensate your particular circuit, there's a simple way to calculate the parallel combination of zero and negative coefficient types that will do the job. Write to us and we'll give you details.

When you go looking for ceramics, be sure to ask for Mallory Discaps®. They're made by Radio Materials Company, a division of Mallory—world's largest manufacturer of ceramic capacitors. Your Mallory distributor has a complete stock, in the handy five-pack, mounted on a file card that's especially easy to keep on a peg board or in a file drawer.

RF demodulator probes we had been using in some RF line-balancing experiments. We wanted to be sure one probe was not more efficient than the other.

We started by feeding a 60-cps sawtooth signal, which we were using for modulation during the tests, simultaneously into both inputs of the Model 488. We then adjusted the amplitude controls to produce equal waveforms (Fig. 3A) on the oscilloscope, thus assuring ourselves that each channel would produce the same-sized waveform when equivalent signals were fed in.

Next, we connected the output of the first probe to one input and the output of the second probe to the other input. For this particular test, the sawtooth waveform gave us a means to check the symmetry of the output from each probe (one was a negative probe and the other a positive probe).

We applied the sawtooth modulation to the signal generator, connected the generator output to both probes, and adjusted the frequency selector and vernier of the Model 488 to give us a reasonably solid display (at lower switching frequencies, the scope display appeared in "segments"). The resulting output of each probe is shown in Fig. 3B; as you can see, they were quite symmetrical. Note that one waveform is exactly the reverse of the other, since the probes have opposite polarity. This test proved our probes were okay for balancing tests, since each produced the same output amplitude and waveform when an equivalent signal was applied.

Next, we checked over a stereo preamplifier-amplifier system. We fed the signal from the left stereo channel into one channel of the Model 488, and that from the right one into the other Switch input. Then the audio signal, a 1000 cps sine wave, was fed into both stereo channels. Using the same technique as before for "setting up" the Model 488, we proceeded to check—stage by stage—each section of the stereo set.

When we reached the latter stages of the power amplifier, the amplitudes were so great the signals were overlapping on the scope screen; this was eliminated simply by recalibrating the Model 488. With the amplitude controls reset at much lower levels, we proceeded to test the last stages of the amplifier with no problem.

From this test, we reached two conclusions: First, certain stages in one channel were weaker than their equivalents in the other channel. In this particular unit, however, the slight difference in gain between channels was easily taken care of by a "balance" control.

Secondly, the test showed there was very little phase shift between the two amplifiers. The small amount that existed was discovered by lining the signals up with a vertical line on the scope graticule and noting that one waveform shifted slightly along the horizontal base line as we progressed through the set. Since one-half cycle is equal to 180°, we judged the phase shift to be only about 10°, or approximately 3%; this small amount is hardly noticeable and will have little effect on listening enjoyment.

We made an interesting discovery during tests of the Model 488. In certain instances, it is difficult to get the scope to synchronize on the test waveforms; the tendency was to "lock in" on the switching frequency of the electronic switch, causing the waveform displays to "travel." To eliminate this tendency, we switched the scope to "external sync" and ran a clip lead from the scope's sync-input jack to the waveform signal source. After this step was taken, we had no more problem with "creeping" waveforms.

We found some auxiliary uses for the Model 488, in addition to its intended use as an electronic switch. With no input signals, the output of the unit is a very clean square wave, having a frequency range from 10 cps to 2000 cps. Thus, the unit can be used as a square-wave generator for checking audio amplifiers. This type of generator is normally an excellent means for checking video amplifiers, too, but the frequency range of the Model 488 doesn't extend high enough for this. However, we found an acceptable video test could be made by applying the square-wave signal to a video stage and observing the pattern developed on the CRT. The "edges" of the square wave are so sharp that a properly operating video amplifier will produce very sharply defined bars in the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| JAN. 28 | | MEMPHIS | CINCINNATI | CHICAGO | DALLAS (N) | |
| FEB. 4 | | | | MILWAUKEE | | |
| FEB. 11 | | | CLEVELAND | | HOUSTON (N) | |
| FEB. 18 | BOSTON | ATLANTA | | | | LOS ANGELES |
| FEB. 25 | | | PITTSBURGH | ST. LOUIS (N) | | |
| MAR. 4 | UNION, NY (N) | | | KANSAS CITY | | |
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| MAR. 18 | PHILADELPHIA | | | OMAHA | | |
| MAR. 25 | | | | | DENVER | PORTLAND |
| APR. 1 | TARRYTOWN, NY | NEW ORLEANS | BUFFALO | | | |
| APR. 8 | | | | | | |
| APR. 15 | | | | MINNEAPOLIS | | |
| APR. 22 | BOSTON | | | | EL PASO (N) | LOS ANGELES |
| APR. 29 | | CHARLOTTE | | WICHITA (N) | | |
| MAY 6 | WASHINGTON | | | | | |
| MAY 13 | | | | CHICAGO | | |
| MAY 20 | PHILADELPHIA (N) | | BUFFALO | | | |
| MAY 27 | | | | | | |
| JUNE 3 | ALBANY, NY (N) | | | | | |

N—Night classes

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raster. If these bars have hazy edges, the video amplifier is not up to par. This test can be applied directly to the CRT, although the indication is not so strong —due to lack of amplification.

The imaginative serviceman will think of other uses for an electronic switch such as the Model 488. Like many other test instruments, an electronic switch is as useful as the understanding and ability of its user permits. We've certainly found it handy in our lab.

## A "Square" Deal

For a really thorough check of audio and video systems, the serviceman needs a generator that provides a full frequency range of both sine-wave and square-wave signals. The PACO Model G-34 Sine-Square Generator—shown in Fig. 4—is just such an instrument.

Specifications are:

1. *Power Required—117 volts AC, 50-60 cps.*
2. *Frequency Range—from 7 cps to 750 kc, both sine waves and square waves; accuracy ±5%.*
3. *Output Voltage—sine wave, from 0 to 10 volts rms across 600-ohm load; square wave, from 0 to 20 volts peak to peak, no load; output flat within ±1 db from 7 cps to 750 kc.*
4. *Controls and Terminals*—FREQUENCY *dial;* VERNIER *potentiometer;* FUNCTION/FREQUENCY RANGE *rotary switch;* OUTPUT *rotary switch;* POWER ON-OFF *toggle switch;* OUTPUT LEVEL *potentiometer; two* OUTPUT *terminal posts; two* METER *pin jacks; pilot lamp.*
5. *Size, Weight, Price—8½" x 13" x 7"; 11 lbs; $64.95 kit, $99.95 wired.*

The Model G-34 produces virtually distortion-free sine waves and square waves for testing audio amplifiers, video amplifiers, or certain kinds of test equipment. Fig. 5 shows a block diagram of the instrument. The sine wave is developed in a feedback oscillator consisting of two amplifiers—one a pentode, and the other a 6BK7 dual triode in a cascode circuit. As in other oscillators, the cycle is initiated by the first plate-current surge in one of the amplifiers. This pulse is amplified by the other circuit and fed back to the initial stage to sustain oscillation.

The frequency of oscillation is con-


**Fig. 4. Sine-wave and square-wave generator has wide frequency range.**

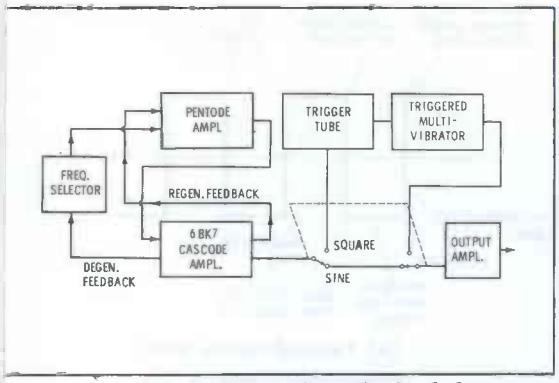



**Fig. 5. Unusual method of frequency control is shown in block diagram.**

trolled by adjustment of the frequency-selective R-C feedback network. Regenerative feedback through a tungsten filament lamp tends to sustain oscillation in the circuit, while a bridged-T degenerative feedback network controls the frequency in an unusual manner. The degenerative network is tuned by the main frequency dial, and shunts the selected-frequency signal to ground. Thus, the first amplifier receives a considerable amount of degenerative feedback at all frequencies except the one to which the frequency dial is set, preventing oscillation of the circuit at any but the selected frequency. Although unusual, this arrangement is quite accurate and stable.

The square wave section of the Model G-34 generates a true square wave; that is, it is more than a mere clipper which chops the peaks from a sine wave in order to develop a "square" wave. However, the frequency of this section is controlled by the sine-wave generator. The square-wave generator is a "Schmitt-trigger" type, basically a cathode-coupled multivibrator that operates only when triggered. The circuit is designed so a positive cycle from the sine-wave oscillator keys the trigger tube and actuates the multivibrator circuit.

Fig. 6A shows a graph of the plate voltage on V1A, indicating the actions within the circuit (Fig. 6B). The initial current rise in V1A is triggered by the tip of one positive half-cycle from the sine-wave generator. The sudden voltage reduction at the plate is directly coupled to the grid of V1B, causing its plate voltage to rise as the tube cuts off. When the negative trigger pulse reaches the V1A grid, it aids the common-cathode voltage in stopping conduction. The resultant plate-voltage rise is coupled to the grid of V1B, causing conduction in that tube to increase, and thus reducing its plate voltage. In this way, the square waveform is produced, with the tips of the sine waves triggering the square-wave generator via the trigger tube. When the sine wave output of the Model G-34 is used, the square wave section is completely bypassed by the function switch.

From the function switch, which chooses either sine-wave or square-wave operation, the signal is fed into a two-stage output amplifier. From here, the signal is developed across an output-level potentiometer, the slider of which

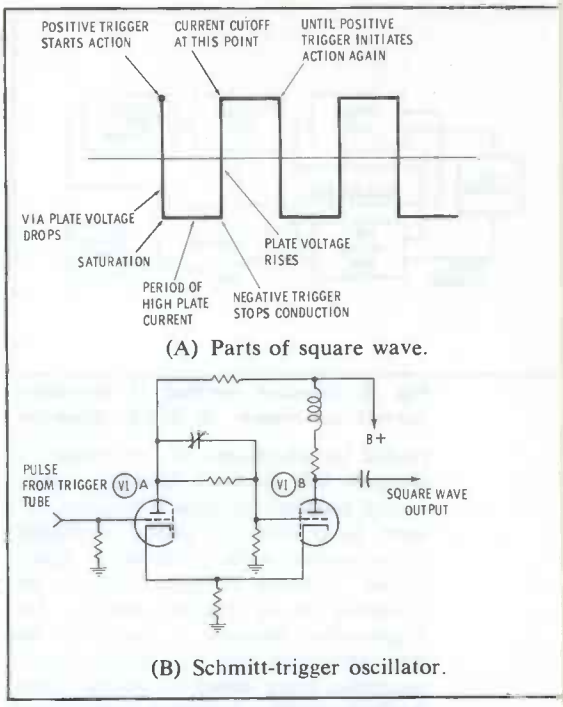



**Fig. 6. Square-wave section of G-34.**

connects to a resistive-type attenuator network.

The attenuator switch is combined with the function switch, and provides four attenuator levels for each type of signal. Multiplier markings on the panel are used in conjunction with markings on the output-level control to permit reading output voltage on the front panel.

The output voltages determined in this manner are reasonably accurate as long as the instrument is operated into high-impedance loads. However, when the output terminals are connected to a low-impedance load—100 ohms or less—the internal (output) impedance of the Model 488 causes a voltage drop, which reduces the output voltage and renders the panel indications meaningless. With the attenuator set at X1, the output impedance of the unit varies between 0 and 3000 ohms, depending on the setting of the output-level control; at other attenuator settings, the impedance is essentially constant at 67 ohms.

Regardless of the effects of the load, however, the true output voltage can be determined simply and easily. Metering jacks allow the user to connect an audio voltmeter (or a scope) and measure the voltage at the input to the attenuator. When this method is used, the attenuator multiplier indicates what portion of the measured signal actually reaches the output jack of the instrument.

The accuracy of the Model G-34 frequency dial, while only 5%, is sufficient for most service work. By using the instrument in conjunction with a scope, the service technician can check the frequency of any audio signal. For example, in the case of some unwanted oscillation, knowing the frequency might suggest possible causes of the oscillation. With a signal from the G-34 fed into the vertical terminals of a scope, and the unknown frequency fed into the

horizontal terminals, the resultant *Lissajous* figure can be used to determine the frequency of the unknown signal. From this, the RC (or LC) time constant of the oscillatory circuit can be calculated, and will serve as a possible clue to the defect.

The wide frequency range of the G-34 enables the audio technician to test all sorts of audio, video, and ultrasonic equipment. Using the square wave function of the instrument, the audio technician can quickly analyze complete amplifiers or single stages—checking frequency response, low- and high-frequency phase shift, and measuring other types of distortion. The unit can be used to check video amplifiers in television receivers and transmitters, cameras, closed-circuit TV systems, video and audio transmission cables, and frequency-response and modulation-clipping characteristics in two-way radio speech circuits.

In addition, we found the unit stable enough to trigger the resonant-reed circuits in tone-coded squelch systems of two-way radio receivers. The frequency dial is accurate enough that, by setting the main frequency dial to indicate the desired reed frequency, the technician can use the vernier control to locate the exact frequency. It would be a simple operation to make a chart of precise dial settings for specific reed frequencies, thus enabling the communications technician to check a reed suspected of being off frequency. Using the Lissajous-figure method discussed earlier, he can also check the frequency of the transmitter reed.

The Model G-34 has sufficient output to modulate most service-type RF signal generators, and thus can provide the technician with precise sine-wave modulation of variable frequency. The square wave could be used to modulate signal generators, too, but not very many generators contain a modulator capable of handling square-wave signals at frequencies much above 200 or 300 cps.

The attenuator multiplier network proved to be accurate, and was consistent for various output levels. These characteristics are important to the technician who is making gain checks of audio or video stages. When the Model G-34 is used in conjunction with a wide-band scope, its low internal impedance and broad frequency coverage make the instrument suitable for testing a wide variety of circuits and equipment types.▲

**now in our lab . . .**

**We're analyzing these test instruments for future "Notes" columns.**

Adjust-A-Volt Model IV1-4M Power Supply
B & K Model 850 Color Generator
G-C Model 36-568 Transistor Radio Tester
Hickok Model 661 Chrom-Aligner
Seco Model 250A Transistor and Tunnel Diode Tester

# THE TROUBLESHOOTER

*answers your service problems*

## A Volt Is a Volt Is a . . .

I wish you could settle an argument that has been going on for years between two electronic "dabblers."

"A" says: A pocket transistor radio designed to operate from a 6-volt dry-cell battery can also operate from an automobile battery, without ill effect or damage. He says a volt is a volt.

"B" says: Although a volt may be a volt, other things have to be considered, such as the internal resistance of the battery, and how much current the unit will require.

JOHN R. ZANATH

Aliquippa, Pa.

*In a way, both are right. The automotive battery has a very low internal impedance, so a radio designed to operate on a 6-volt dry cell should operate from a storage battery (which has a very low internal resistance) without any ill effects.*

*However, I think "B" is trying to make the point that an auto radio would not operate from a small 6-volt dry battery for any length of time. The internal resistance of the small battery is comparatively high, and the current needs of the auto radio would be too great. The battery would overheat, and the output voltage would become very low.*

## Scratch Filter Needed

I have a collection of rare 78-rpm records which I want to transfer to tape or unbreakable discs. Would it be possible to build a scratch filter to eliminate or reduce the surface noise? If so, what components would be needed and how would they be connected?

EDWARD LINDSELL

Jamaica, N. Y.

*A very efficient scratch filter can be put together by using a 2-mh choke and an 820-mmf capacitor.*

*This circuit has a cutoff point in the high audio range, and reduces surface*

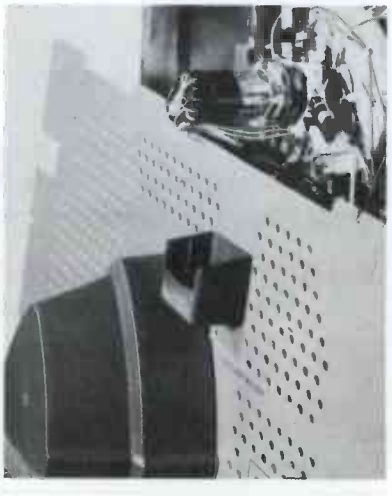
## COLOR COUNTERMEASURES

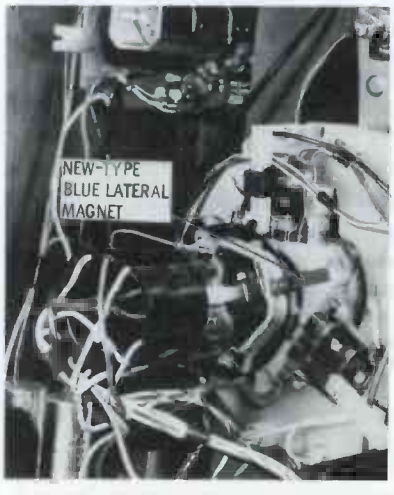
**Symptoms and tips from actual shop experience**

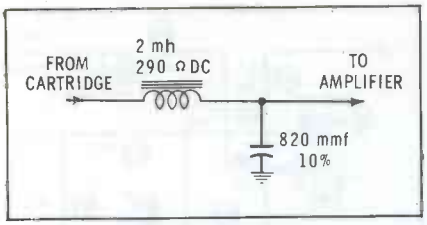
**Chassis:** RCA CTC12

**Symptoms:** Misconverged screen.

**Tip:** This trouble may happen to you during initial setup of this new color receiver, or it could occur during normal servicing operations. The blue lateral magnet is easily knocked out of adjustment during removal or replacement of the rear cover, because the CRT neck extends farther out from the cabinet than in previous chassis, and because of the new physical shape of the lateral magnet itself. A quick check to see if this is the cause of misconvergence can be made by inspecting a dot pattern. If the dots are equally deconverged all over the screen, chances are you've accidentally hit the lateral magnet. It's simple to readjust the set for proper convergence; just move the blue lateral magnet until you obtain a white dot in the center of the screen. Leave the other static adjustments alone.








*noise which usually consists of frequencies above this point. For sharper cutoff and greater attenuation, you can cascade two such circuits.*

### Diode Polarity

How important is it to observe polarity when replacing a 1N82 diode crystal in UHF tuners? There seem to be varied opinions on this subject.

ROMANO MOGLIA

St. Petersburg, Fla.

*Generally speaking, the polarity of the 1N82 diode mixer in UHF tuners is not important. However, it has been found that the noise level varies slightly in some of these units, depending on their polarity in the circuit. While the average serviceman is not likely to have the delicate instruments necessary to measure this noise factor, he can get a general idea by observing reception of a distant station. If the picture becomes more snowy (indicating more noise) when the crystal is inserted in one particular direction, use the polarity resulting in the clearer picture.*

### Possible Oscillation

A Silvertone Chassis 528.50030 (covered in PHOTOFACT Folder 339-13) works fine on the bench; however, when the unit is placed in the cabinet, vertical bars appear from left to right across the screen.

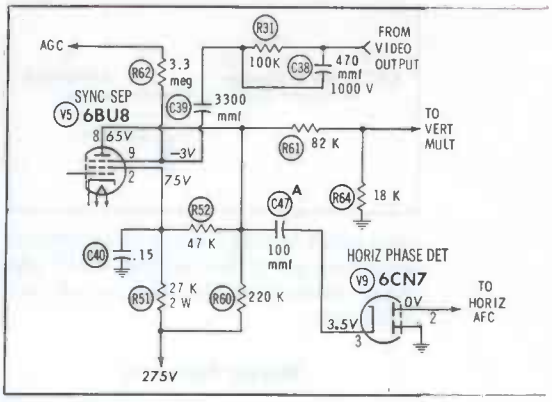
PETER GERNAT

Warren, Ohio

*Sounds like oscillation is taking place when the unit is placed in the cabinet. Locating the trouble may be a slow process, but you can isolate it by bypassing the grid of each individual stage (connecting a capacitor between grid and ground). By disabling each stage—one at a time—you can see if the oscillation stops when you put the unit back in the cabinet. The capacitor will also short out the signal, but as long as you still have the oscillation, the trouble lies somewhere between the shorted grid and the picture tube. Be sure to check the bypass and decoupling capacitors, and the plate- and screen-supply resistors. Also, carefully check alignment to be sure no IF stage is oscillating because of having been tuned to a wrong peak.*

### Intermittent Bends

On my bench, I have a Zenith Chassis 17A20 (covered in PHOTOFACT Folder 393-4) that has an intermittent case of the "bends." Tube substitution and component checking in the horizontal AFC and sync separator circuits brings me no closer to a solution. Voltage and resistance measurements turn up nothing. The




only waveform trouble is at the screen of the 6BU8; the scope trace looks fuzzy instead of having the shape shown on PHOTOFACT. Both horizontal and vertical hold are critical. Can you help?

VAL O. SMITH
Overton, Nev.

*To ascertain where the bends are being caused, try grounding pin 3 of the 6CN7 phase detector. The set will lose horizontal sync, but you can straighten it up with the hold control. If this test removes the bends, you have cleared the phase detector and AFC of suspicion; judging from your description of the symptoms, you are most likely to find trouble in the 6BU8 sync separator.*

*If the sync circuit is operating incorrectly, there is a strong possibility that C40 is open, since you mention an abnormal waveform at this point. Other components to check are C38, C39, R52, R60, R61, and R64. Also, be very sure R62 has not opened or increased in value.*

## Silenced

Once again I have to call on you for assistance. I have an Emerson Model 673B (covered in PHOTOFACT Folder 131-6) on the bench, with sound trouble. I used signal injection to trace from the speaker to as far back as the grid of V8, the 6AU6 limiter tube; but this is where the signal stops.

I've taken voltage readings at the plate and screen of V8, and find –90 volts instead of the 30 volts stated on the diagram. The common reference point for these measurements is not chassis ground, but a line which connects the cathode of the limiter to several other points in the set.

AUSTIN D. MILLER
Bronx, N. Y.

*This reference point is the "middle level" in a stacked B+ system that serves various sound, video IF, and tuner stages. Normally, it should be about 100 volts more positive than ground. The unusual readings you describe could be developed if either the cathode circuit or plate/screen circuit have been accidentally connected to either chassis ground or the –115 volt B-minus supply line. You might check carefully to see if any part of the limiter stage is returned to the wrong point; if necessary, also trace the supply lines back to their source, looking for incorrect connections or a short in the wiring.*

## '63 Color Circuits

*(Continued from page 33)*

it's a good place to start scoping.

The chroma information is coupled to the grid of second bandpass amplifier V2 (a 6AU6) via C5, a 220-mmf unit. Conduction of V2 depends on a high negative voltage (derived from the color killer stage) which holds V2 in cutoff during black-and-white reception, but allows the tube to conduct when a color signal is present (as the killer tube is then inoperative). The gain of V2 is controlled by the COLOR LEVEL control in its cathode circuit. Notice the similarity between this circuit and a regular video output stage which has the contrast control in its cathode circuit? Except for the killer bias input cutting off V2, the circuit — and testing methods — are very similar to those for most video output stages.

V2 amplifies the chroma signal by an amount proportional to the setting of the control. W3, applied to the grid of V2, shows a peak-to-peak voltage of 4 volts, while the amplitude of the chroma signal fed to the demodulator grids (W4 and W5) is 8 volts. Of course, rotating the COLOR LEVEL control will provide more output—up to a maximum of 26 volts.

W6 shows the horizontal blanking pulse which is applied to the grids of the demodulators through the bottom of L4. A small bit of color signal (missed by bypass capacitor C12) may be seen on the base line of W6; similarly, the blanking pulse can be seen in waveforms W4 and W5. The amplitude of the blanking signal remains constant (unless the horizontal hold control is readjusted), no matter what the amplitude of the chroma information.

### Points to Remember

Here are a few suggestions, and circuit features, you should keep in mind when you service chroma bandpass stages such as these:

1. The 4.5-mc trap is in the *grid* circuit of V1A. Misadjustment of this trap may cause a herringbone pattern (920-kc beat) in a color picture.
2. ACC voltage (which seldom

gives any trouble) is applied to the grid of the first amplifier. It maintains constant stage gain during minor input-signal changes.

3. When a chroma signal is received, the voltage on the grid of V1A will be approximately −7 volts. The plate and screen voltages on this tube are low during monochrome reception, and higher during color reception—that's normal.
4. The burst signal must pass through V1A before it can reach the color sync stages.
5. A high negative bias voltage from the color killer tube is applied to the grid of V2 and cuts it off; however, when the killer stage is rendered inoperative by the incoming burst signal, the bias will decrease, allowing V2 to conduct.

### One-Stage Amplifier

The schematic of the single bandpass amplifier stage used in RCA's '63 color chassis is shown in Fig. 2. The circuit is basically the same as in '62 models, with a few component changes. This circuit uses the pentode section of a 6EA8; the triode section of the same tube operates as the color killer.

The composite video signal is taken from the plate circuit of the first video amplifier. W7 shows the color-bar signal at this point; note the differences between this waveform and W1 in Fig. 1.

The first difference is in the polarity of the signal. This bandpass amplifier, since it contains only one stage, inverts the chroma signal only once; thus, it requires an input signal opposite in polarity to that required for the demodulator. Secondly, you'll notice the horizontal sync pulse is quite prominent in this waveform; however, it is attenuated considerably by the time it passes through the 18-mmf coupling capacitor C1 and takeoff coil L1, and reaches the grid of V1A—see W8.

Chroma takeoff coil L1 is tuned to complement the bandpass response of the RF, IF, and video stages. The response of L1, in conjunction with that of double-tuned transformer T1, provides flat bandpass in the amplifier circuit for frequencies in the 3- to 4.1-mc range.

Bias from the killer stage is applied to the grid of V1A via R1 and the lower portion of L1. V1A is held in cutoff by this bias during monochrome operation; but when the killer is driven into cutoff by an incoming burst signal, the bias is removed from the bandpass amplifier, and the tube is allowed to conduct.

The chroma signal applied to the grid of V1A is shown in W8. The burst signal can be seen in the waveform, just beside the horizontal pulse. Glance at W9, though, and you'll see that burst is not present. This bandpass amplifier, unlike the previous two-stage circuit, does not form a part of the burst-signal path. Instead, burst is coupled via C2 directly to the color sync section. V1A cannot pass the burst signal, because its cathode is connected directly to the cathode of the blanker stage, and a positive horizontal pulse (W10) from the blanker cuts V1A off during horizontal retrace time (when the burst signal occurs).

Transformer T1 couples the chroma information, via the COLOR

control, to the grids of the demodulators. W9 represents this chroma output. If you'll compare this waveform with W4 in Fig. 1, you'll see it contains the same chroma information, except that W4 also has burst and horizontal blanking signals visible.

### Points to Remember

Keep these circuit features in mind when servicing this bandpass circuit:

1. The 4.5-mc trap *precedes* the first video amplifier stage.
2. The burst signal is taken off *before* the bandpass amplifier—it cannot pass through this stage.
3. Killer voltage is applied to the grid of V1A, keeping it at cutoff, during monochrome reception; V1A conducts only during color reception.
4. V1A is keyed off during horizontal retrace time by a pulse from the blanker stage. This pulse is positive-going and is applied to the cathode of V1A.
5. Two *tunable* components, L1 and T1, are adjusted for a flat response to frequencies of 3 to 4 mc.
6. The color saturation control selects the *amount* of chroma signal to be fed to the demodulator grids.

### Summary

Whether the bandpass amplifier is a one- or two-stage circuit, a color-bar generator and a scope (equipped with a low-capacitance probe) are necessary if you are to quickly locate a defective color stage. With these instruments, you can easily find the trouble spot; then voltage and resistance checks will pinpoint the defective component. ▲


"Er . . . Brace yourself, Mr. Higgins . . . that little ol' tube you figured you'd need measures 23 inches."

## Filament Circuits

*(Continued from page 35)*

### DC Filament Supply

A low-priced record player was shop-borne by its owner who complained of no volume. Actually, the only sound to be heard was from needle vibrations. I removed the panel and noted the tubes were not lighting, but their filaments all checked okay in a tube checker. Next, I checked the entire filament string, but couldn't find the expected continuity from the AC input.

I decided to check the circuit step by step. The player had no identification, so I was forced to trace the circuit and draw my own schematic. As you can see from Fig. 5, the circuit was unusual. The B+ circuit is a full-wave doubler—used extensively in modern sets—but the filament string is not connected directly across the power line. Instead, the filaments draw their power from the rectified DC output in one section of the doubler circuit, resulting in a DC filament supply with a slight 60-cps ripple.

Checking components, I found the silicon rectifiers were good, but

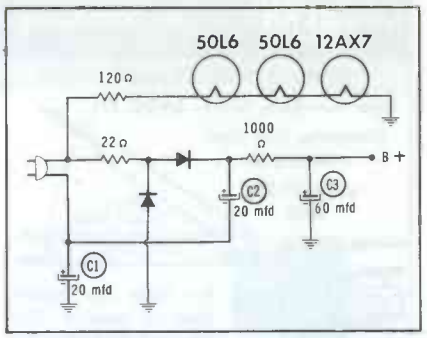



**Fig. 5. "Different" method of obtaining DC voltage for hum-free operation.**

filter capacitor C1 was open. This prevented operation of the half-wave filament supply, and the filament string received no power. A new 250-volt capacitor put the amplifier back in business.

### Components

No mention has been made so far about the effects of filament-circuit components. Take RF chokes, for instance: Whenever a filament choke is found open, it should be replaced and not merely shunted by a piece of wire. This slipshod repair will restore the set to operation, but it can also result in certain types of interference in the picture. I recently serviced several TV sets in which such shunting had been done. In every case, interference of one sort or another had developed on one or more channels.

RF chokes are invariably found in FM receivers that use series-string filaments. They are sometimes in the middle of the filament string, but more often at the ends, as in Fig. 6. The chokes serve two purposes: to keep RF signals from being radiated and causing interference on nearby TV receiver screens, and to keep the FM signal on a power-line antenna from being absorbed in the receiver filaments. Fig. 7 shows the interference picked up by a TV set in the shop while I was working on an FM set in which

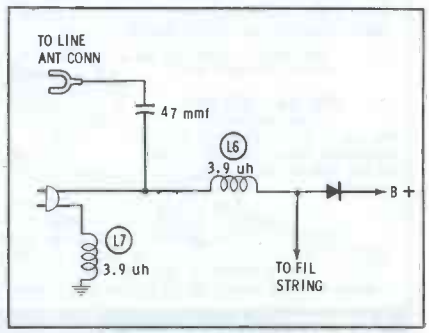



**Fig. 6. Filament chokes in FM sets are usually at ends of series string.**


**Fig. 7. One type of interference pattern due to shunting a filament choke.**

a filament choke had been bypassed by a piece of wire.

Faulty chokes are sometimes as apparent as A or B in Fig. 8. Less apparent is the slight discoloration shown at C. Unit D is a common replacement-type RF choke. Incidentally, the resistance of these chokes should be very low—usually less than 3 ohms. In one set I found a choke where the resistance had increased to 50 ohms, lowering filament voltages on the tubes enough to result in noticeably weak operation.

### Conclusion

The point to remember about unusual filament circuits is that they can develop faults that are also unusual. A quick look at the schematic will usually reveal any unorthodox circuit arrangement. It doesn't pay to wait until a lot of time has been lost; when voltages on or around a tube socket seem odd, check the filament voltage. It may save you a lot of fruitless searching. ▲

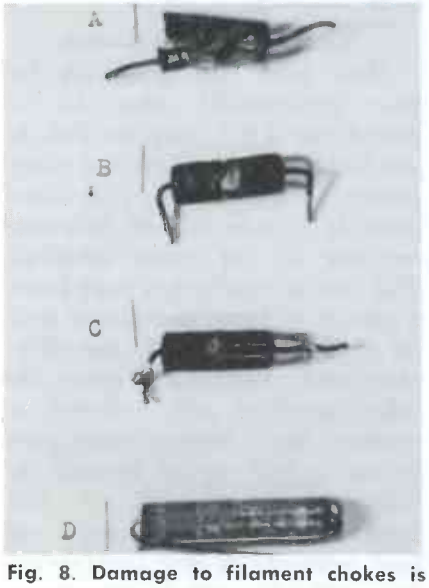



**Fig. 8. Damage to filament chokes is usually spotted by visual inspection.**

## Focusing On the Trouble

*(Continued from page 26)*

### Causes of Poor Focus

Obviously, poor focus can be caused by incorrect focusing voltage, or its complete absence. For example, it is easy to forget the jumper across the socket when replacing a picture tube. Sometimes, when the focus anode is connected to a tap, the connection may have simply become loosened from the correct terminal. Occasionally a focus pot will open, and correct focus will be virtually impossible to obtain.

Perhaps the next most common cause for poor focus is incorrect adjustment of the ion trap. Actually, many electrostatic tubes don't use an ion trap, but on those that do, the ion trap adjustment is most critical for proper focus. If this is the problem, the cure is simply a matter of rotating the trap for best brightness, while at the same time checking for best focus.

Needless to say, the use of an ion trap on a tube which requires none can upset the focus quite noticeably. When replacing an older CRT with one of the newer, straight-gun types, a technician may unthinkingly place the ion trap on the new tube only to find the focus terrible, even though the brightness is ample.

Often overlooked as a cause of poor focus is the effect of incorrect voltages on *other* CRT elements—for example, the first or second anode. CRT focus is dependent upon *all* the electrical factors in the tube; therefore, the element voltages all interact to some extent, affecting the focus. Indequate high voltage, for instance, may first appear as poor focus on the picture tube screen. Always check the high voltage (with a voltmeter and HV probe) when you suspect it to be the cause of focus trouble.

Defective picture tubes sometimes cause the appearance of poor focus, usually accompanied by a reduction in brightness. A good CRT checker will almost invariably spot this trouble. Rejuvenation may increase the apparent brightness, but sometimes at the expense of sharp focus. This is because the control-grid aperture of the CRT becomes enlarged and no longer has much control over the electron beam. As a result, the beam tends to splatter, making it next to impossible for the focus anode to perform its task. For this reason, it may be wise to try a brightener before rejuvenating. If you do try rejuvenation, be careful not to overdo the process; otherwise you may damage the tube beyond usability.

### An "Apparent" Cause

More than one technician has been embarrassed when he replaced the CRT only to find he still had the same trouble—a milky, poorly focused raster. The actual cause is a restriction of frequency response in the video amplifier. This sort of trouble has been found a number of times in a circuit similar to that in Fig. 4. If the 6800-ohm plate resistor (R1) opens, the video amplifier will continue to operate after a fashion, since plate voltage is still applied through the 2200-ohm resistor and the 30K contrast control; but, because the load resistance is now considerably increased, the high-frequency re-

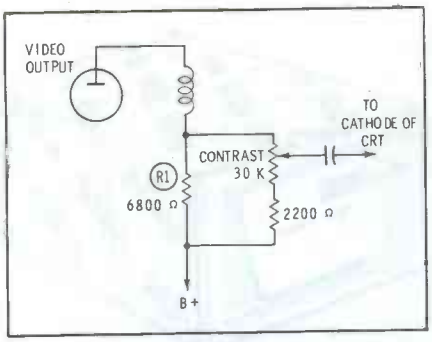



**Fig. 4. Circuit with high-level contrast control causes unusual symptom.**

sponse of the video stage is severely restricted. The result is that the focus *appears* to be defective.

### Older Sets

Nearly all early picture tubes used electromagnetic focusing, controlled by varying the amount of current through the focus coil. In some, the position of the coil on the CRT neck had a decided effect on the quality of focus. In most cases, focus current was taken from the B+ power supply.

Troubles in this type of focus device consisted mostly of burned controls, defective or malpositioned focus coils, or defects in the power supply. Of course, faults in CRT's and their associated voltages caused the same troubles as in modern receivers. Ion traps deserved more than the usual suspicion in these sets, as their effect on focus was quite pronounced.

More recently, permanent magnets were used for focusing; control was accomplished either by sliding a sleeve into and out of the magnetic field, or by moving the magnet itself back and forth on the CRT neck. In these, focus faults that cannot be cured by adjustment of the magnet are almost invariably caused by defective operating voltages on the CRT—usually the high voltage.

### Conclusion

Focusing on the trouble consists first of making sure the trouble really is a matter of focus, and is not caused by some trouble elsewhere in the set. After that, pinpointing the fault is simply a matter of checking a few things; the focus adjustment (or tap), jumpers, the ion trap (if used), voltages on the CRT, and the CRT itself. The

possibilities are really not so many, when you know what you're looking for.


**Noise Silencer**

Certain Citizens-band sets, and most HF communications and short-wave receivers, are not equipped with squelch circuits. Likewise, several of these don't include a noise limiter. As a result, the sets seem noisy when no signal is present, and often pick up interference even during signal reception. The Seco Model 530 *Signal Filter* is a device that can be added to any communications or short-wave receiver to provide both squelch and noise-limiting functions.

An instruction sheet explains how to wire the Model 530 into any receiver, and includes schematic diagrams of the pertinent circuits in most popular Citizens-band equipment. Connections must be made to B+, a filament source, the detector (for input audio), the volume control or audio amplifier (for output of the unit), and a ground point. The filaments of the Model 530 can be operated at either 6 or 12 volts.

The audio signal taken from the detector in the receiver is split and fed to a series noise-clipper diode and to the squelch circuit. One section of a triode is used to set the clipping level according to the amount of input signal, so impulse noise above the audio level will be clipped.

The squelch circuit operates in conjunction with a shunt clipper diode to block noise signals, whether from external sources or from the normal circuit action within the receiver. When a carrier signal is received, the internal noise is quieted, releasing the squelch circuit, and permitting the audio signal to pass through. ▲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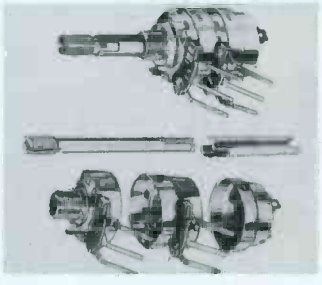
# PRODUCT report

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

## Exact Replacement Controls (39V)



A completely new line of replacement controls, by **Centralab,** is called *"Fastatch II."* This dual controls as well as dual-concentric types. The units snap together, and are designed to prevent the exact-replacement shafts from coming loose or pulling out. Terminals on the units can be used with printed-circuit, conical-lug, or wire-wrap wiring.

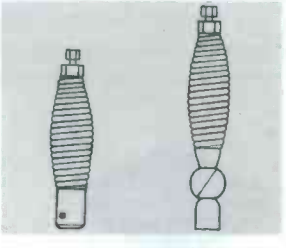
## Multiband Receiver (40V)

The "Globeceiver," made by **Globe Electronics,** contains three short-wave bands in addition to standard broadcast frequencies. The unit features electrical bandspread, a slide rule dial that reads through 30 mc, and a BFO-pitch control for ease in copying code. This item comes equipped with a 3" x 5" speaker, headphone jack, receive-standby control, and a built-in telescopic antenna. Retail price is $64.95.

## Universal Knob Line (41V)

New additions to the line of universal knobs by **Colman Electronic Products** are designed to replace channel selectors and tuning dials of TV and radio sets. The new units have a variety of inserts covering the different dial-numbering systems in use. When fitted with the appropriate shaft, each "Tuning Head" can replace up to 600 original types.

## Mobile Mounts (42V)

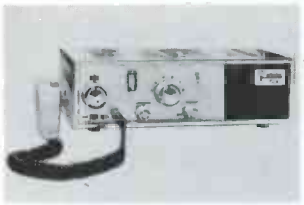


Two new mobile antenna springs, by **G. A. M. Electronics, Inc.,** are made of a non-corrosive stainless steel. The springs can be adapted to most existing mobile antennas. One unit is available with a standard base, while the other has a ball-joint base to allow for mounting at any angle.

## Continuity Checker (43V)

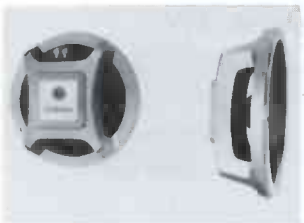
A new battery-powered device to be used for checking circuit continuity with power off has been introduced by **Workman.** Designated the Model BZ5 "chek-it", the unit can be used to check continuity of fuses, printed boards, motors, and other electrical apparatus. The BZ5 sells for $1.49.

### CB Transceiver (44V)



The "T & C II," a six-channel crystal-controlled Citizens-band unit, has been introduced by **Utica Communications Corp.** The set features dual conversion, a calibrated "S" meter, an auxiliary speaker terminal, a transmit-crystal socket on the front, and a universal power supply for either 6 or 12 volts DC, or 115 volts AC. This unit comes equipped with one set of crystals.

### Hi-Fi Loudspeaker (45V)



A new high-fidelity loudspeaker, developed by **Electro-Voice,** has up to 24 watts peak output and a flat frequency response from 50 cps to 13 kc. The "Michigan" MC8 is suited for home hi-fi systems, background music, and many industrial applications. The unit lists for about $25.00.

### Portable Phonograph (46V)

This newly introduced phonograph, available from **Dynavox,** features a stereo amplifier, two 6" speakers (extendable), a four-speed turntable, and a turnover cartridge equipped with two sapphire needles. The unique "hide-a-way" design of the case permits the unit to be folded into the lid. During transportation, the separate wing speakers lock on the sides of the main unit. Designated as the Model 629, this unit has a list price of $99.95.

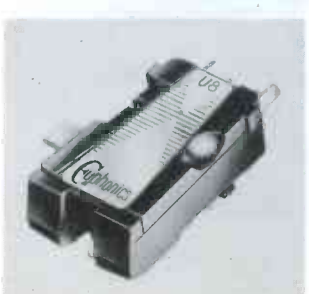
### Fiberglass Antenna (47V)

A linear fiberglass "Mark Heliwhip" motorcycle whip antenna is being marketed by the **Dynascan Corp.** Designated the LW-40, this unit is 50" long and is designed to operate in the 30-50 mc band. Designed to eliminate the common problem of breakage, it can also be obtained for operation in the 152 mc band.

### Stereo Amplifier (48V)

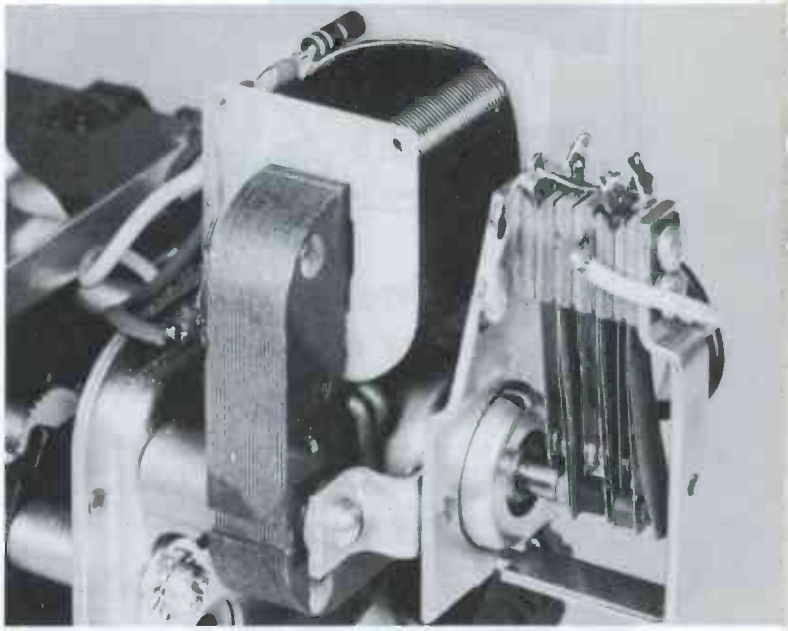
With the introduction of the Model VC-50, a combination stereo amp and preamp featuring an electronic indicator for balancing both left and right channels, **Vidaire Electronics** has entered the hi-fi field. Containing eleven tubes, the unit has a power output of 25 watts for each channel and a frequency response from 30 to 30,000 cps. Cabinet size: 15¼" x 10¾" x 5¼".

### Ceramic Cartridges (49V)



A series of ceramic replacement stereo cartridges, having a dual stylus for playing either stereo or monaural records, is now available. Made by **Euphonics,** the U-8 and U-9 feature a tracking force of 2 grams and high compliance. The U-8, with the sapphire dual stylus, carries a list price of $9.95. The U-9, with a .0007" diamond and .003" sapphire stylus, lists for $14.95.

# Coming in FEBRUARY PF REPORTER



### Dissassembling Motorized TV Tuners

When you remove the motor, gears, and switches to make way for tuner repairs, you'd better note how they fit together.

### Tough Dogs Lose Their Bite

Stop and ask yourself, "What makes this TV set a dog?" Simply trying to answer this question can lead you to the trouble.

### Make Room for Speakers

Usually, an audio system should be as inconspicuous as possible. Special enclosures help meet this objective.

### Molecular Electronics Explained

"Micromodules" and complete circuits no larger than a match head are becoming a reality through startling new techniques.

### Minimizing Income-Tax Problems

Your Federal tax return can't be made painless, but you can steer clear of pitfalls.

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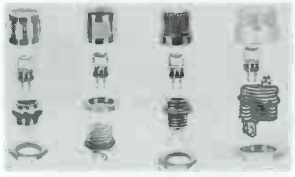
Troubleshooting aids for the type of video amplifier having a contrast control in the cathode circuit.

## Subminiature Fuseholders (50V)

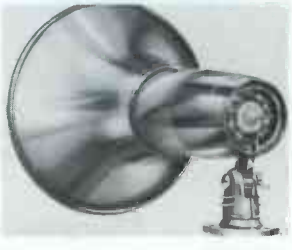


Four new fuseholders—two metal and two phenolic—have been introduced by **Littelfuse,** to complement their line of "Microfuse" products. Each is designed for panel mounting, and is complete with knurled cover cap. One is of the indicating type, with a small indicating bulb that glows when the fuse blows. All are designed with sealing rings in the cap and body to provide moisture protection, and can be hermetically sealed.

## Metal Glaze Resistor (51V)


A metal-glaze film-type resistor developed by **IRC** is priced to compete with regular composition types. These units are rated at 2 watts and are available in standard EIA values from 120 ohms to 40K ohms. The dielectric strength is over 1000 volts rms, and the units can withstand overloads up to ten times their rated wattage for as long as five seconds. The resistance elements are applied in spiral form, then coated with a protective silicone compound.

## All-Weather Speakers (52V)

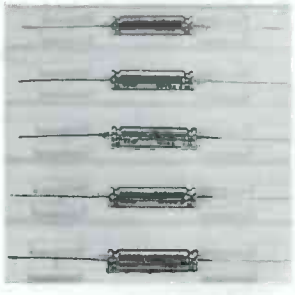


Two sizes of all-weather trumpet speakers are available from **Racon.** The RL-10T has a bell diameter of 8" and weighs 5 lbs., while the RO-25T has a bell diameter of 10" and weighs 7 lbs. Both have a frequency response from 250 cps to 13,000 cps. Other features include built-in line transformers and shielded terminal blocks for easy choice of impedance and power. The RL-10T carries a list price of $42.25; the RO-25T lists for $48.50.

## Soldering-Aid Kit (53V)

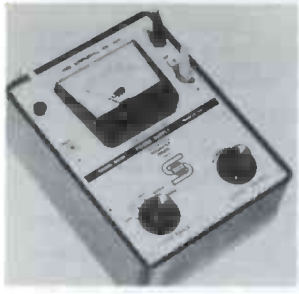

An assortment of six soldering-aid tools is available from **Beau-Tech Tools.** The set consists of forked ends for twisting component leads and wires, knives and scrapers for repairing printed circuits, probes to check for loose connections, and brushes for removing splattered solder and cleaning connections. The kit retails for approximately $4.87; the tools may also be purchased individually.

## Niobium-Foil Electrolytics (54V)



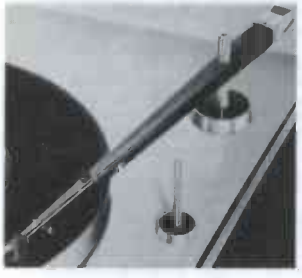
Niobium electrolytic capacitors weighing up to 25% less than equivalent tantalum capacitors have been developed by **Cornell - Dubilier.** These units, designated Type NBM, are designed with either plain or etched foil, in both polarized and nonpolarized ratings, and are available in various sizes. The units are rated from 6 volts to 50 volts DC and can operate at temperatures ranging from −55° C to +85° C. Capacitance values range from 1.5 mfd to 200 mfd; tolerances are ±20% for plain units, and −15+75% for etched-foil types.

### DC Power Supply (55V)



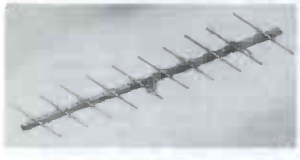
The Model RPS-4 transistor power supply, manufactured by **Seco,** provides a DC output voltage from 0 to 28 volts, continuously variable, maintained constant within 5% up to 100 ma. A special tap is provided for bias—0 to 7.5 volts. Built-in overload protection prevents damage in case of excessive current drain. The instrument is designed to operate from 115 volts AC, and has a list price of $36.95.

### Lightweight Tone Arm (56V)



The Model M222 tone arm, which uses an N22D tubular stylus with a .0005" diamond point, is new from **Shure.** It has a tracking pressure of less than 1½ grams, frequency response from 20 cps to 20·kc, channel separation of more than 22.5 db at 1000 cps, and output voltage of 4.5 mv. Audiophile net price of the M222, including the N22D stylus, is $89.50. The N22D stylus is available separately for use with Model M212/216 tone arms, at a price of $24.75.

### Heavy-Duty Antenna (57V)



A high-gain, high-directivity unit was recently added to the "J" series of yagi antennas by **Taco.** Treated aluminum is used in the manufacture of this heavy - duty, weather - resistant antenna. This unit provides a gain of at least 10.5 db within the high VHF band and 8 db within the low band. Some of the low-band elements are filled with sand to minimize vibration. These units may be cut to either TV or FM frequencies, and are priced at $62.50 each.

### Transistorized Converter (58V)

A transistorized converter, developed by **Terado,** changes 12 volts DC into 110 volts AC, and has a maximum continuous output capacity of 550 watts. This power capability makes it possible to use the unit in a "rolling service shop" to power test equipment, lights, a soldering gun, and the television set being repaired. The Model 50-202 comes equipped with a light to signal proper AC output. The unit weighs approximately 60 lbs, measures 10¾" x 13" x 7¼", and carries a suggested list price of $399.95.

### CB Transceiver (59V)

A Citizens-band transceiver, the **Hammarlund** Model CB-23, is suitable for either base or mobile operation. The unit features: crystal control on both transmit and receive for all 23 CB channels, ability to operate on either 115 volts AC or 12 volts DC, a dual - conversion superheterodyne receiver, a series-type noise limiter, and an adjustable squelch control. The unit comes equipped with all crystals and a built-in "S" meter, and has a list price of $229.50.

# INDEX TO ADVERTISERS

**January, 1963**



# CATALOG AND LITERATURE SERVICE

## ANTENNAS & ACCESSORIES

*1V. ANTENNACRAFT* — Brochure describing anodized aluminum UHF antennas: Model SA-1483 (channels 14 to 83) and Model SA-7083 (channels 70 to 83), guaranteed for black-and-white or color reception.

*2V. B & K / MARK*—Catalog HW19-R giving complete information on Mark "Super-Beacon" and "Beacon" base station antennas for Citizens-band operation, and on Mark "Heliwhip" antennas for mobile, marine, and amateur communications.

*3V. JFD* — Brochures on LPV log-periodic TV antennas and *Transis-tenna;* also bulletins and catalogs showing entire line of TV-FM indoor and outdoor antennas and accessories.

*4V. TACO*—Catalog sheet giving specifications and information on Taco's Golden 'Color Guard" antenna (Model C-33).

*5V. WINEGARD* — New 16-page manual, "How to Plan and Install Master Antenna Systems the Profitable Way." *See ad page 51.*

## AUDIO & HI-FI

*6V. ATLAS SOUND*—Catalog No. 562 listing specifications of microphones and loudspeakers for public address, commercial, and industrial use. *See ad page 64.*

*7V. EICO*—New 32-page catalog of kits and wired equipment: stereo and monophonic hi-fi, test equipment, Citizens-band transceivers, ham gear, and transistor radios. Also "Stereo Hi-Fi Guide" and "Short Course for Novice License." *See ad page 69.*

*8V. ELECTRO-VOICE* — Catalog No. 154 giving specifications and information on hi-fi speakers and enclosures, and dynamic microphones. *See ad page 62.*

*9V. PRECISION ELECTRONICS* — New 1963 catalog of high-fidelity stereo amplifiers, tuners, and receivers.

*10V. QUAM-NICHOLS*—New catalog sheet on hi-fi speakers, including data on enclosure construction. *See ad page 55.*

## COMMUNICATIONS

*11V. CADRE* — 16-page booklet "Businessman's Guide to Citizens-Band Two-Way Radio." *See ad page 60.*

*12V. SONOTONE* — SAH-62 color brochure on Sono/Com headsets and microphone units for language laboratories. *See ad page 46.*

## COMPONENTS

*13V. ANTRONIC*—Free reference chart for Anchor picture tube brighteners.

*14V. BUSSMANN*—Bulletin EFA listing two special fuse assortments available to dealers and servicemen. *See ad page 19.*

*15V. SPRAGUE*—Catalog K-106, a cross-reference manual covering replacement electrolytic capacitors. *See ad page 16.*

*16V. VACO*—Catalog No. T-90 listing solderless terminals and connectors for every use.

## SERVICE AIDS

*17V. CASTLE*—Leaflet describing fast overhaul service on television tuners of all makes and models; also illustrated lists describing universal and original-equipment tuners. *See ad page 65.*

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

*19V. PRECISION TUNER* — Information on repair and alignment service for any TV tuner. *See ad page 62.*

*20V. SWING-O-LITE*—12-page catalog listing complete line of swinging-arm lamps for home, office, studio, or industry.

*21V. TECHNI-PARTS* — Brochure describing *Mak-a-Belt Kit* and other products.

*22V. YEATS*—Literature describing the new Model 14 appliance dolly, featuring all-aluminum I-beam construction. *See ad page 70.*

## SPECIAL EQUIPMENT & SERVICES

*23V. ACME*—Illustrated catalog sheet 24B01 listing specifications and applications for control-type magnetic amplifiers; includes units with capacities from 5 to 1000 watts and voltage ranges from 24 to 160 volts. *See ad page 84.*

*24V. ATR* — Literature on new series of *Karadio* models, including Series 600 tube-equipped types and Series 400 transistorized versions. All sets available as "universal" or "customized." *See ad page 18.*

*25V. GREYHOUND*—Brochure giving information on and rates for Greyhound Package Express. *See ad page 27.*

*26V. UNITED CATALOG PUBLISHERS*—Descriptive literature on the 1680-page 1963 edition of "The Radio-Electronic Master" catalog, official buying guide of the TV/Radio industry. *See ad page 58.*

*27V. VOLKSWAGEN* — 60-page illustrated booklet "The Owner's Viewpoint" describing how various business enterprises use VW trucks in their operations; also booklet with complete specifications on VW truck line.

## TECHNICAL PUBLICATIONS

*28V. RIDER*—Catalog listing over 300 titles of books for the electronics technician.

*29V. HOWARD W. SAMS* — Literature describing all current publications on radio, TV, communications, audio and hi-fi, and industrial electronics, including new Fall-Winter 1962 Book Catalog and descriptive flyer on 1962 Test Equipment Annual. *See ads pages 39, 73.*

## TEST EQUIPMENT

*30V. B & K*—Catalog AP20-R, giving data and information on Model 850 *Color Analyst*, Model 960 *Transistor Radio Analyst*, Model 1076 *Television Analyst, Dynamatic* 375 VTVM, *V-O-Matic* 360, new Model 625 *3-in-1 Dyna-Tester*, Models 600 and 700 *Dyna-Quik* tube testers, Models 420 and 440 CRT Tester-Reactivators, and Model 1070 *Dyna-Sweep* Circuit Analyzer. *See ads pages 45, 47, 59, 72.*

*31V. HICKOK*—Form TT-627 describing new Model 661 *Chrom-Aligner* NTSC-standard color-bar generator; also booklet on NTSC color system. *See ad page 57.*

*32V. SECO* — Folder describing the new Model RPS-5 zero-to-30-volt DC power supply for transistorized equipment. *See ad page 77.*

*33V. SENCORE*—Complete literature on the CA122 Color Circuit Analyzer and the PS120 wide-band scope. *See ads pages 24-25, 75.*

## TOOLS

*34V. BERNS*—Data on 3-in-1 picture tube repair tools, on Audio Pin-Plug Crimper that lets you make pin-plug and ground connections for shielded cable without soldering, and on ION adjustable "beam bender." *See ad page 73.*

*35V. ENTERPRISE DEVELOPMENT*—Literature from Endeco on improved desoldering and resoldering techniques for use on PC boards.

*36V. EVERSOLE* — Sheets describing and listing prices of *DeSod* desoldering tools for removing and replacing parts on printed-circuit-boards, including new tip for compactron sockets.

*37V. WELLER* — Catalog No. 32 showing complete line of power tools. *See ad page 48.*

## TUBES

*38V. AMPEREX* — 16-page semiconductor catalog describing *Amperex* Post Alloy Diffusion Process (PADT) of manufacturing transistors; also basic specifications on full line of semiconductors. *See ads pages 11, 14.*


**MODEL 648**

| Tube Type | Fil. | D. | E. | Plate Test |
|---|---|---|---|---|
| 6AR11◆ | 6.3 | A2357 | C689* | 33XZ |
| | Nor.—S switch in S position | | | |
| | 6.3 | AB39 | 124* | 33XZ |
| 6HC8 | 6.3 | 125 | AC389 | 40WZ |
| | | 127 | AC46 | 62XY |
| 6M11◆ | 6.3 | AC1 | AB278 | 22WY |
| | Nor.—S switch in S position | | | |
| | | AC6 | A58 | 29YZ |
| | | AC3 | A49 | 29YZ |
| 21GY5◆ | 25. | AC7 | 126 | 22Z |
| | Connect top cap to octal socket pin 2 | | | |
| 7867 | 6.3 | 124 | AB369 | 34VW |

**MODEL 658**

| Type Type | Sec. | Heater | Circuit H-K | Circuit P-G | Plate | Grid Test | Heater Current |
|---|---|---|---|---|---|---|---|
| 6AR11◆ | P | 6.4K | 2358 | ab670 | 63R | 10WY• | |
| | P | " | B34 | 129 | " | 10WY• | |
| 6HC8 | P | 6.4L | 125 | ac389 | 22Q | 70VY• | |
| | T | " | 127 | ac46 | 28R | 10XY• | |
| 6M11◆ | P | 6.4L | C7 | b128 | 40R | 10WY• | |
| | T | " | C6 | a50 | 36R | 10WY• | |
| | T | " | C3 | a49 | 36R | 10WY• | |
| 21GY5◆ | P | 22. J | C7 | 126 | 17R | 80VY• | A30.G Z450 |
| | Connect top cap to octal socket pin 2 | | | | | | |
| 7867 | P | 6.4M | 124 | ab360 | 11Q | 95VY• | |

**MODEL 598**

| Tube Type | A. | B. | C. | Fil. Cont. | D. | E. | F. | G. |
|---|---|---|---|---|---|---|---|---|
| 6HC8 | 6.3 | 4Y | | 5 | 6 | 3 | 7 | 20 |
| | | 4Y | | | 9 | 1Z | | 66 |
| 7867 | 6.3 | 2YZ | | 7 | 0 | 5 | 8 | 35 |

*An important message to electronic technicians . . .*


## *RCA invites you to*

# PUT YOURSELF IN THE COLOR PICTURE

Color television today is a 300-million-dollar-a-year business—and the fastest growing segment of the home entertainment industry.

Color TV programming is at an all-time high. If you still limit yourself to black-and-white servicing, you put yourself in the same position as the village blacksmith who considered automobiles a fad.

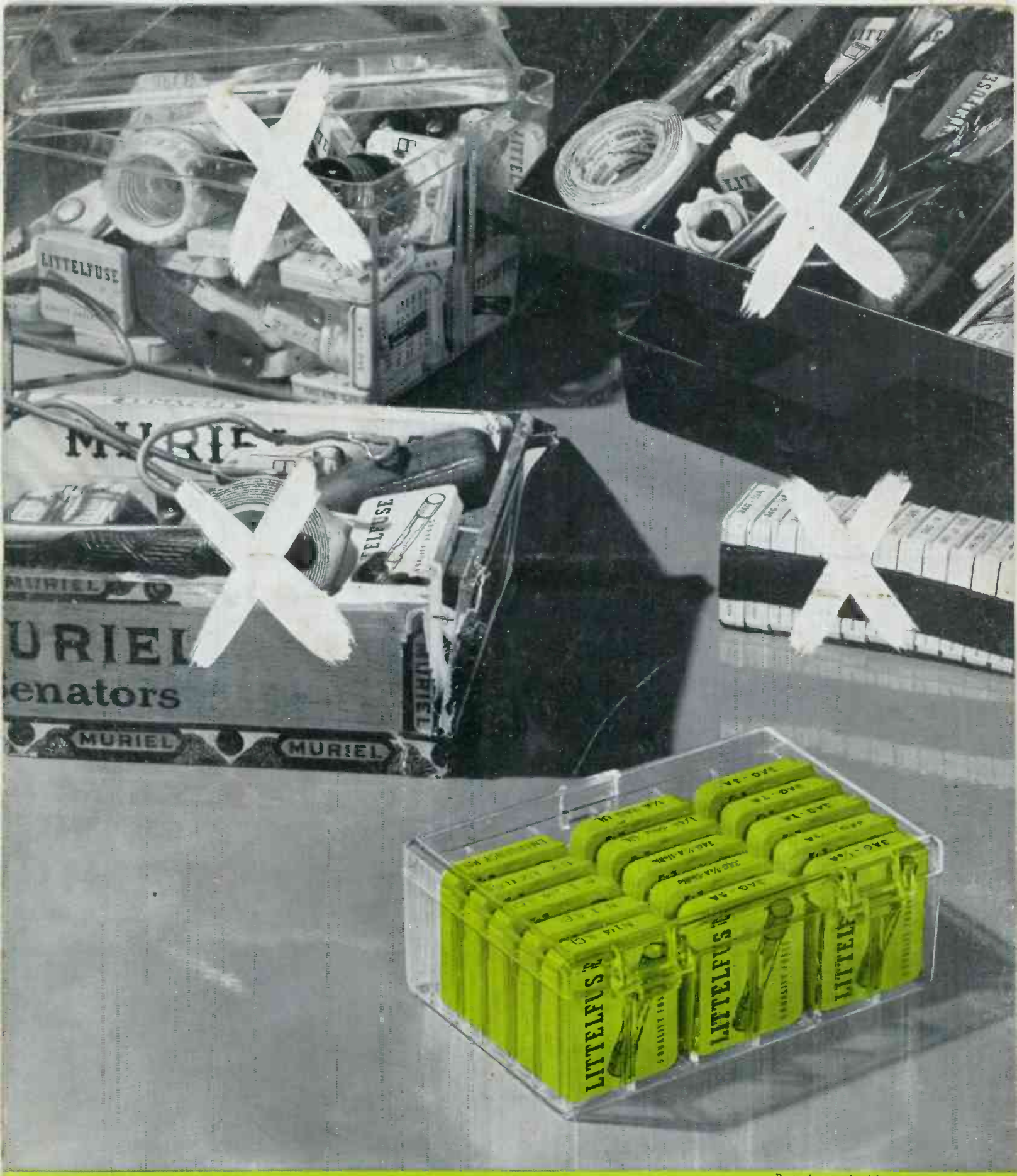
Leading manufacturers are now turning out color TV sets with the color picture tube developed by RCA. Servicing these sets means big and highly profitable business, but it requires special skills, knowledge, equipment and parts. What are you doing to take advantage of this great new business opportunity?

To the public, *color TV means RCA!* It was RCA who conceived and pioneered the compatible color system in universal use.

*How can you climb on the color bandwagon?* Associate your business strongly with the prestige and customer acceptance of the recognized pioneer of color TV. See your authorized RCA distributor; stock and advertise RCA tubes and associated products for color. Isn't it time you started seeing yourself in color?

RCA ELECTRON TUBE DIVISION, HARRISON, N.J.

**THE MOST TRUSTED NAME IN TELEVISION**




*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.*