

AUGUST, 1964

50 CENTS



PHOTOFACT REPORTER

Including **Electronic Servicing**

Special

ANTENNA

SECTION



JA 2L 1104 1200
WY. M. DAVIS
RAD. & TV SERV.
118 RIVERSIDE AVE.
GARON CITY, COLOR.

**Servicing Master Antenna Systems
Techniques for Selling Antennas
Antenna Systems Can Be Safe**



How to replace top quality tubes with identical top quality tubes

Most of the quality TV sets you are presently servicing were designed around special Frame Grid tubes originated by Amperex. More and more tube types originated by Amperex are going into the sets you'll be handling in the future.

Amperex Frame Grid tubes provide 55% higher gain-bandwidth, simplify TV circuitry and speed up your servicing because their extraordinary uniformity virtually eliminates need for realignment when you replace tubes.

Amperex Frame Grid Tubes currently used by the major TV set makers include:

2ER5	2GK5	2HA5	3EH7	3GK5	3HA5	4EH7	4EJ7	4ES8	4GK5	4HA5	5GJ7
6EH7	6EJ7	6ER5	6ES8	6FY5	6GJ7	6GK5	6HA5	6HG8	7HG8	8GJ7	

If your distributor does not yet have all the Amperex types you need, please be patient—in some areas the demand keeps gaining on the supply. Amperex Electronic Corporation, Hicksville, Long Island, New York 11802.



NEW . . . JUST \$119.50 FOR A COMPLETE COLOR BAR GENERATOR WITH EXCLUSIVE SECO STABILITY!

- 15-second warmup for your convenience
- Day-long performance without variation
- Simple sync control—just vertical and horizontal hold
- Work-a-day ruggedness—crystal controlled in heavy metal case

JUST IN TIME FOR THE BIG BOOM IN COLOR TV!

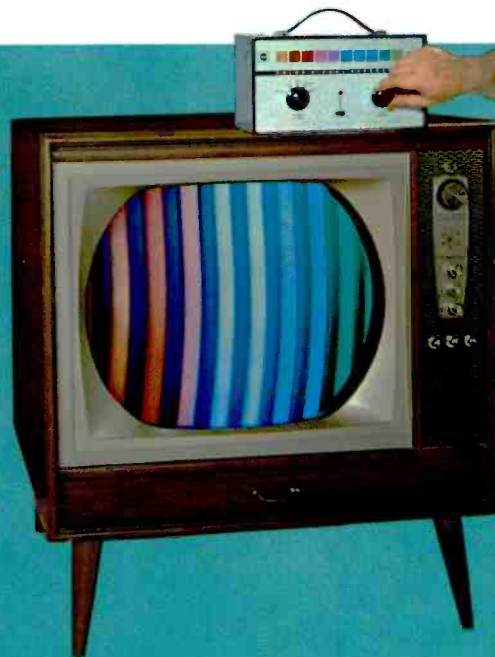
Cash in on the bigger volume coming from the new lower cost color TV's. Here are two color bar generators built to take the toughest use in truck or shop. Fast hookup—just clip on two antenna leads. Foolproof crystal controlled color bars. Fast warm up. Highly stable, after just 15 seconds and all day long—speeds work in home or at bench. Factory set to Channel 3 and can be tuned to Channels 2 or 4. Steel case. See your electronic supply dealer or write for information.



MODEL 990



MODEL 980



MODEL 980 does everything you need to set up a color TV set

- **KEYED COLOR BARS** for aligning and trouble shooting color circuitry—10 standard bars.
- **DOT PATTERN** for DC or static convergence—54 dots.
- **CROSSHATCH** for dynamic convergence, overscan and linearity adjustments—6 horizontal bars, 9 vertical bars.
- **VERTICAL BARS** for adjusting dynamic horizontal convergence controls—9 vertical bars.
- **HORIZONTAL BARS** for adjusting dynamic vertical convergence controls—6 horizontal bars.

ONLY \$119.50 net

MODEL 990 gives you all the deluxe features!

- **ALL** the tests of the Model 980—with these extra advantages—
- **COLOR GUN KILLER** to actuate any combination of guns.
- **RAINBOW COLOR PATTERN** to supplement keyed color bar tests.
- **VARIABLE DOT PATTERN** with 54 or 144 dots of adjustable size.
- **VARIABLE CROSSHATCH** with 6 or 16 horizontal bars.
- **VARIABLE HORIZONTAL BARS** with 6 or 18 lines.
- **GREY RASTER** for tests required on older sets.

ONLY \$149.50 net



SECO ELECTRONICS, INC.

SECO also manufactures a full line of tube testers—see back of this page.

1221 S. CLOVER DRIVE • MINNEAPOLIS, MINNESOTA 55420
A DIVISION OF DI-ACRO CORPORATION

Circle 2 on literature card.

PF REPORTER A1

SECO'S patented Grid Circuit Test detects "hard to find" tube faults

GRID CIRCUIT TEST makes up to 11 simultaneous checks for leaks, shorts and grid emission



MODEL 107B FEATURES "NO-SET-UP" TESTING

40 prewired sockets accommodate 63 basic pin arrangements for testing all modern TV, radio, industrial and foreign tubes. Also included is a plug-in chassis with 8 sockets wired to 14 lever type pin selectors for testing tubes circuit by circuit. To eliminate errors in reading, all information reads on *one* meter and *one* scale. Three comprehensive tests—Grid Circuit Test, Dynamic Mutual Conductance Test and Cathode Emission Test. Model 107B is always up to date—data book pages covering new tubes are mailed periodically to registered owners. **ONLY \$189.50 net.**



MODEL 98 FEATURES PICTURE TUBE TEST

Tests over 400 cathode ray picture tubes including 110° deflection types—has 12-pin picture tube socket. Also has replaceable plug-in chassis for receiving tubes—guaranteed up-to-date including novars, nuvistors, 10-pin types, compactrons and magnovals. This chassis can be replaced for new tubes or customized for special uses. Dial controls isolate or transpose tube circuits and select test current—Grid Circuit Test, Tube Merit Test and Heater Current Test. Removeable cover holds speed-indexed tube data cards, pin straighteners and condensed operating instructions. **ONLY \$99.50 net.**



MODEL 88—COMPLETE TESTER AT LOW COST

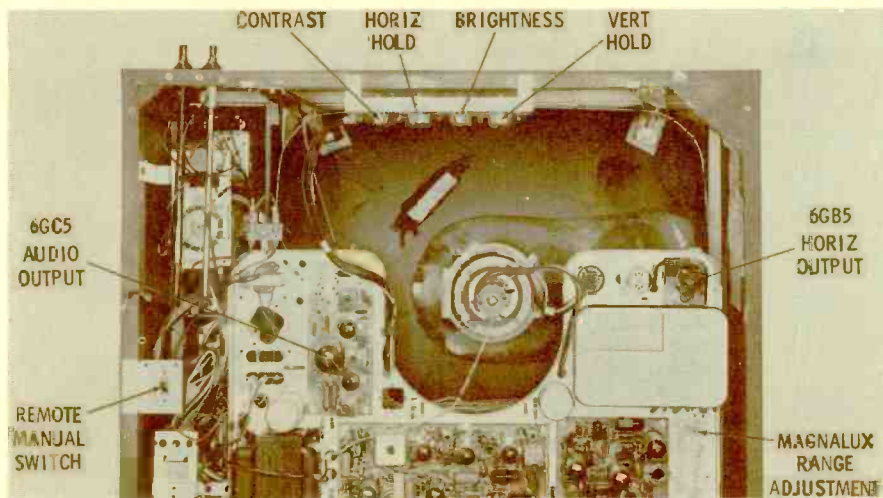
Performs the same picture tube test as Model 98. Tests all receiving tubes including novars, nuvistors, 10-pin types, compactrons and magnovals. Grid Circuit Test, Tube Merit Test and Filament Continuity Test—you can find cathode emission, leaks, shorts, grid emission, gas error, filament continuity and cathode-to-heater emission. Stationary receiving tube chassis. Unit comes complete with speed-indexed setup data, pin straighteners and 12-pin picture tube socket on a 3-foot cable. **ONLY \$74.50 net.**

See two new color bar generators on front of this page. For complete information on Seco test equipment, see your electronic supply distributor or write:

 **SECO ELECTRONICS, INC.**

1221 S. CLOVER DRIVE • MINNEAPOLIS, MINNESOTA 55420
A DIVISION OF DI-ACRO CORPORATION

Circle 2 on literature card.



**Magnavox
Model 1MR-303N
Chassis C44-03-00**

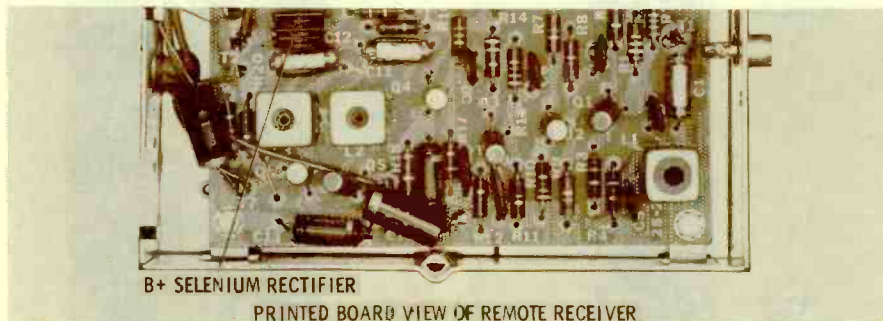
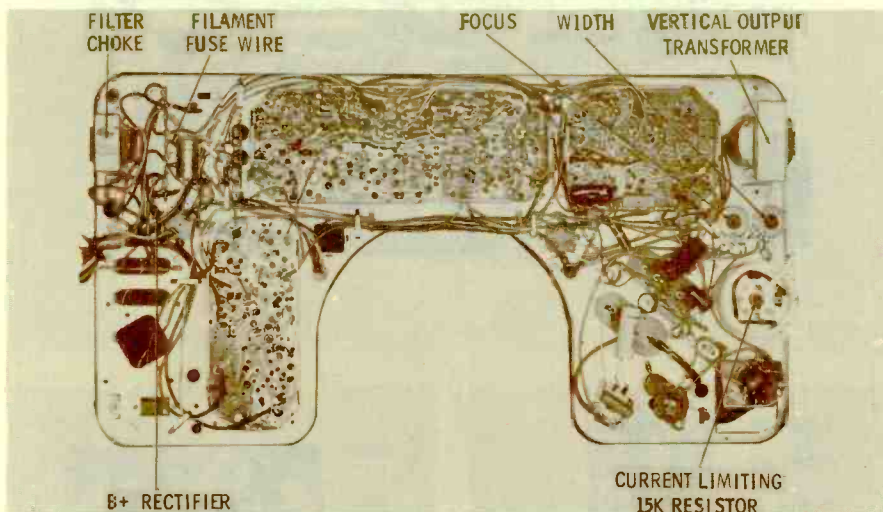
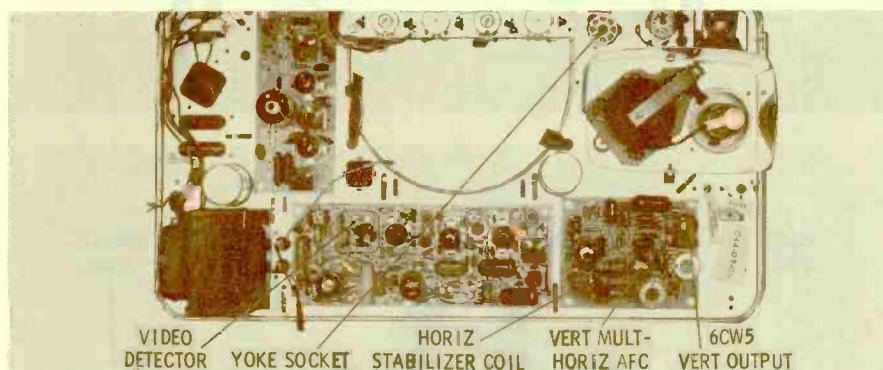
The 44-Series chassis is appearing this year in all 19" Magnavox portables. The one shown here also has an all-transistor remote-control unit. The U-shaped chassis design, found in last year's 35 and 36 series, also characterizes this 44 series; although the chassis is physically the same, several new tubes and some changed circuits do exist. The sweep circuits now operate from a lower B+, made possible by utilizing a 6GB5 and a 6CW5 as the horizontal and vertical output tubes; both precede a toroidally-wound deflection yoke.

Incorporated in this chassis is the new *Magnalux* circuit which automatically varies contrast and brightness as room light changes. An LDR (light-dependent resistor) varies the voltage on the screen grid of the video output tube and the first anode of the picture tube to obtain the desired automatic control over the picture. The LDR used in this set works in conjunction with a control which should be adjusted to maintain the correct ratio of contrast to brightness throughout the normal light ranges.

This transformer-powered chassis uses only one silicon rectifier to develop the B+; however, a slight step-up in the power transformer enables the supply to produce 150 volts DC. The plates of the sound- and video-IF stages receive their 135 volts from the cathode of a 6GC5 audio output tube, which works as a voltage divider. The only protective device in the power supply is a 1" piece of No. 24 wire, used as a fuse to protect the parallel filaments.

The video, sound, and deflection circuits each has its own individual printed-circuit board. Aside from the silicon rectifier in the power supply, the only other semiconductor is the 1N60 video detector. Automatic frequency control of the horizontal oscillator (cathode-coupled multivibrator) is accomplished by using the two diode sections of a 6BJ8; the triode section of this tube functions as the first half of the vertical multivibrator.

The remote-control receiver uses six transistors. This unit has its own power supply, consisting of a step-down power transformer and a selenium rectifier; this supplies the negative 18 volts for the collectors of the PNP transistors. Located on the rear of the cabinet is a remote-manual switch which enables the viewer to operate the TV receiver manually if desired.





**Philco
Model M4504MR
Chassis 14N50A**

Pictured above is one of the console models available from Philco, using a 92° bonded 23BVP4 picture tube. The chassis used in this receiver is not changed too much from the 13N50 series of last year.

Two printed circuit boards are used in the horizontally-mounted chassis. The small board contains the three-stage video-IF strip and video detector: 6EH7's in the first IF stages and a 6HJ8 as the third IF and video detector. The remaining tubes, with the exception of the 1G3 high-voltage rectifier, are all located on the large printed board. The transformers—vertical output, audio output, and power—are on the main chassis pan, as are the filter capacitors and high-voltage section.

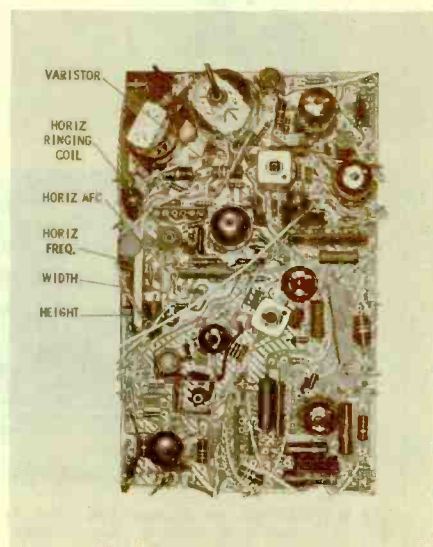
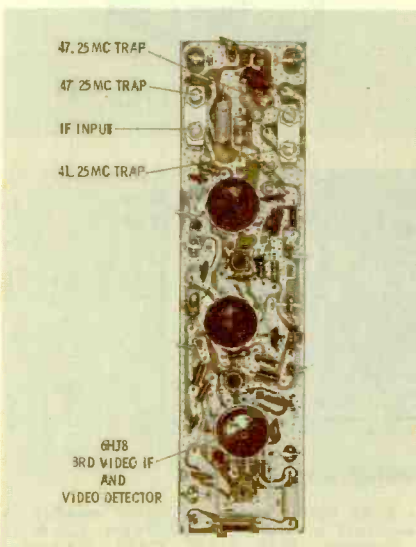
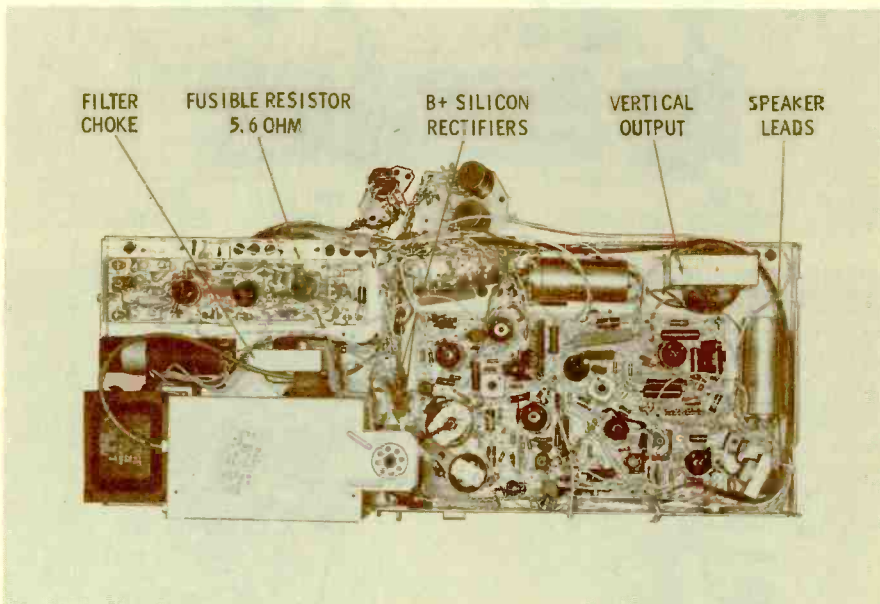
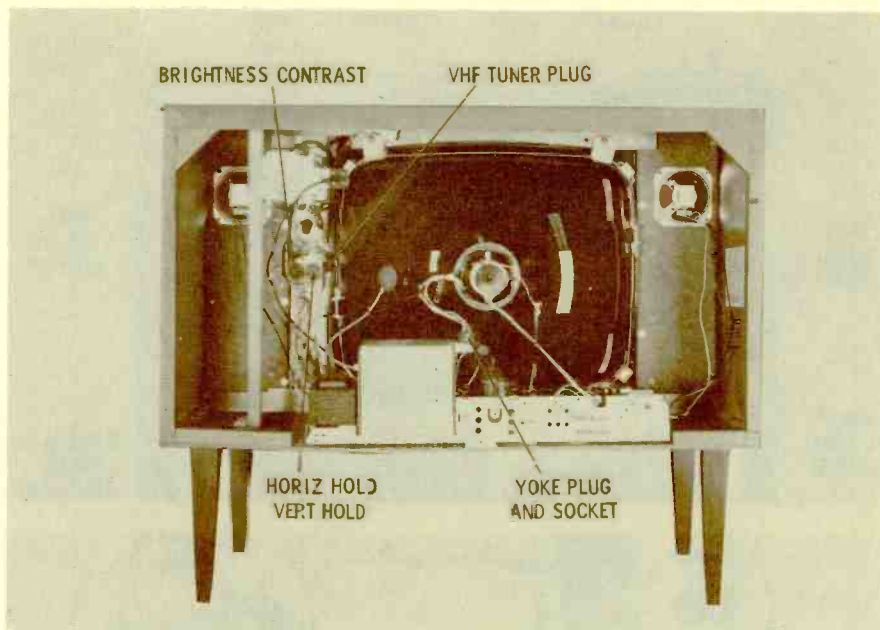
The low-voltage power supply consists of a power transformer and two silicon rectifiers which function as a full-wave voltage doubler. Protection is provided by a 5.6-ohm fusible resistor (plug-in type). This resistor and the rectifiers are shown in one of the photos and may be replaced without removing the chassis from the cabinet. The parallel filament circuit is protected by a No. 26 wire link.

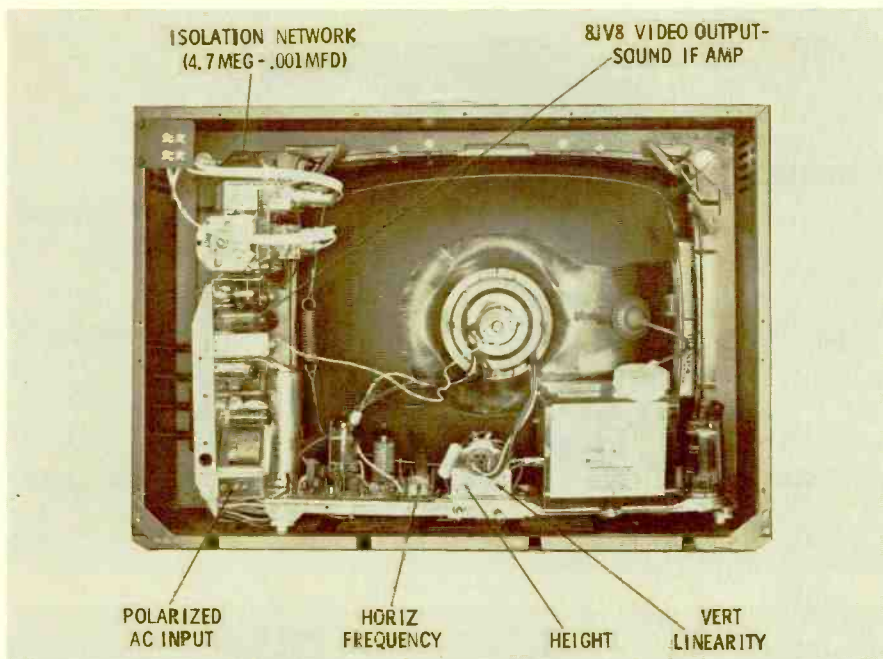
The horizontal circuit uses a 6FQ7 as the multivibrator and a 6DQ6B for the output. A common-cathode AFC diode is used. A varistor (VDR) in the horizontal-output grid circuit automatically regulates width and high voltage. A width control is also provided, and other horizontal adjustments include horizontal frequency and hold controls and an adjustable ringing coil. The horizontal frequency, width, and height controls are all in one triple-section unit (pointed out in the photo).

Nine resistor-capacitor component combinations are employed in this chassis as follows: one in each cathode of the second and third video IF's, one at the sync-separator grid, one as vertical integrator, another for vertical multivibrator feedback, one for vertical blanking, one at the sound IF cathode, one as horizontal phase comparator network, and one in the horizontal oscillator.

Other tubes, and their functions, include: 6BY8 AGC keyer-clamper, 6JE8 video output and sync separator, 6GH8 sound-IF amplifier and noise inverter, 6DR7 vertical multivibrator-output, 6CS6 sound discriminator, 6BQ5 audio output, and 6DE4 damper.

As in the past, the VHF tuner and deflection yoke cables both have their respective sockets (see photo for location) and there are no components located underneath the chassis.





**Silverstone
Model 4101
Chassis 528.60269**

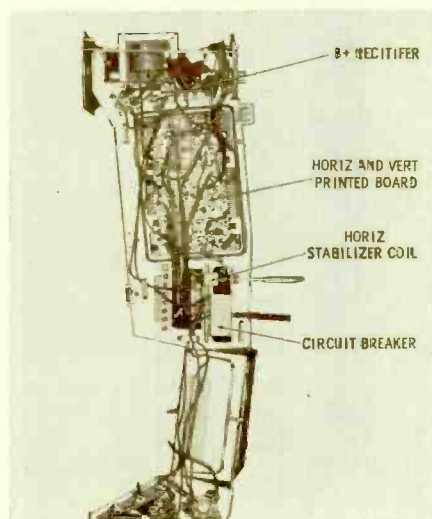
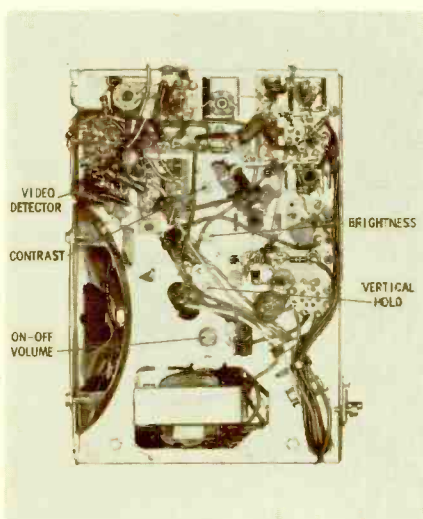
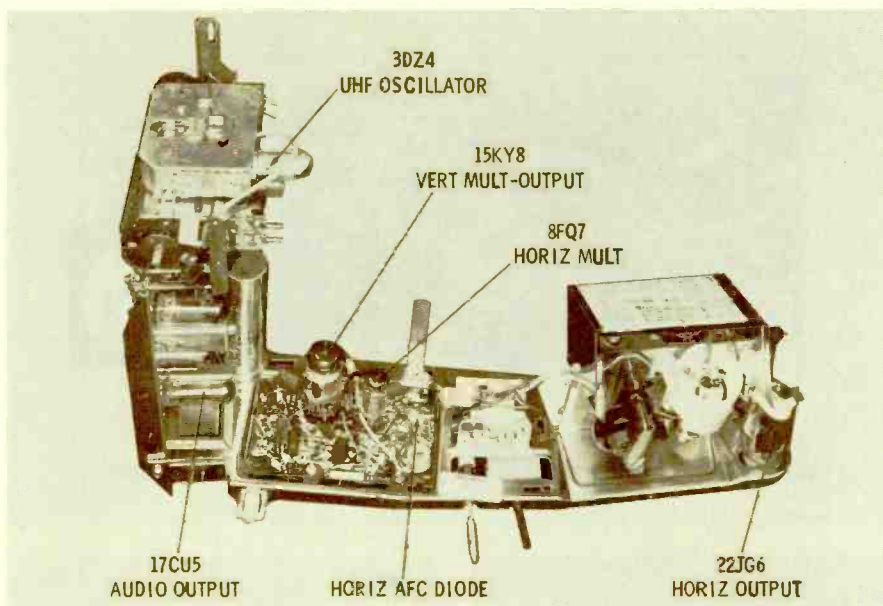
If you like variety you will love this set because it seems to have a little of everything. A vertically-mounted chassis, a horizontally-mounted one, hand-wired circuits, printed-circuit boards, common tubes, new tubes, VHF, UHF—are all found in this 19" portable with a 19AXP4 picture tube. The chassis are L-shaped to fit the slim contour of the cabinet. The vertical sweep circuit and the horizontal oscillator section are mounted on a printed circuit board, while the remainder of the circuits are hand wired. A tube placement chart is located on the high voltage cage to show the function and type of all tubes used.

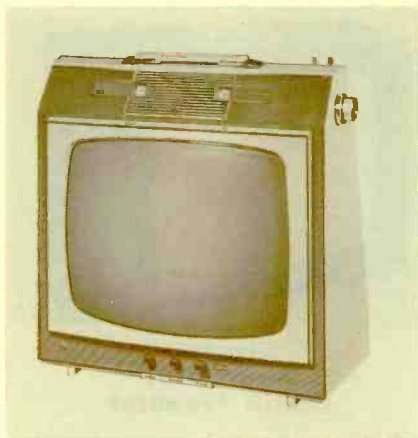
The VHF tuner has a 3HA5A RF amplifier and 6CG8A mixer-oscillator, with a 3DZ4 as the UHF oscillator. Other tubes used by Silverstone for the first time this year include: 8JY8 video amplifier and sound-IF amplifier, 15KY8 vertical multivibrator-output, 22JG6 horizontal output, and 17BS3 damper. These tubes, along with most others in this receiver, are designed to operate with low B+. Although several of the tubes used are new types, the circuits are not much changed from those used in past models. There is a two-stage video IF strip followed by a crystal-diode video detector; its location is pointed out in one of the photos. This receiver has a simple AGC circuit, and no control is provided to vary the AGC voltage. The dual diode used for horizontal AFC is a common-cathode type.

The vertical height and linearity controls are both in one dual ceramic unit. Also in this unit are four fixed-value carbon resistors: the linearity control has a 1.5-meg resistor in series with the arm and a 1.2-meg between one side and ground; in series with the height control and ground is a 680K resistor, and a 1.8-meg in series with B+.

B+ is supplied by a single silicon rectifier, which is protected by a circuit breaker and a 4.5-ohm, 10-watt wire-wound resistor. No special protection is provided for the 450-ma controlled-warmup filament circuit.

The horizontal stabilizer coil is used for horizontal hold control; however, a secondary range adjustment for horizontal frequency is provided by a potentiometer in the cathode circuit of the multivibrator. If proper horizontal hold cannot be obtained with the stabilizer coil, remove the rear cover, tune in an active channel, place a jumper across the stabilizer coil and adjust the frequency potentiometer until the picture locks in. Remove the jumper and adjust the stabilizer coil slug until the picture is again in proper horizontal sync.





Truetone
Model 2DC3416

The *Showcase* model shown above is Truetone's lightweight 16" portable with a 114° 16BSP4 picture tube. This CRT is quite different, in that it is not bonded, nor does it use a safety glass; it is made with the Owens-Illinois implosion-protection feature called *Kimcode*. A metal pressure band around the outer-edge of the screen and a fiberglass sleeve around the bell work together to prevent glass from shattering if the tube is ever broken.

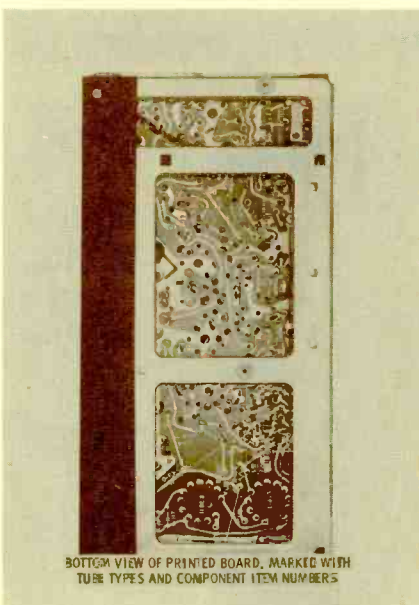
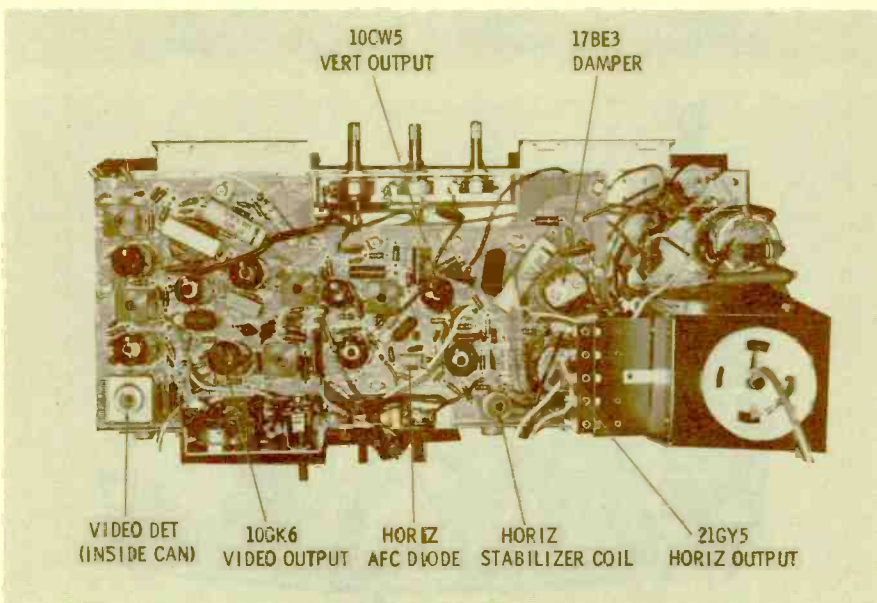
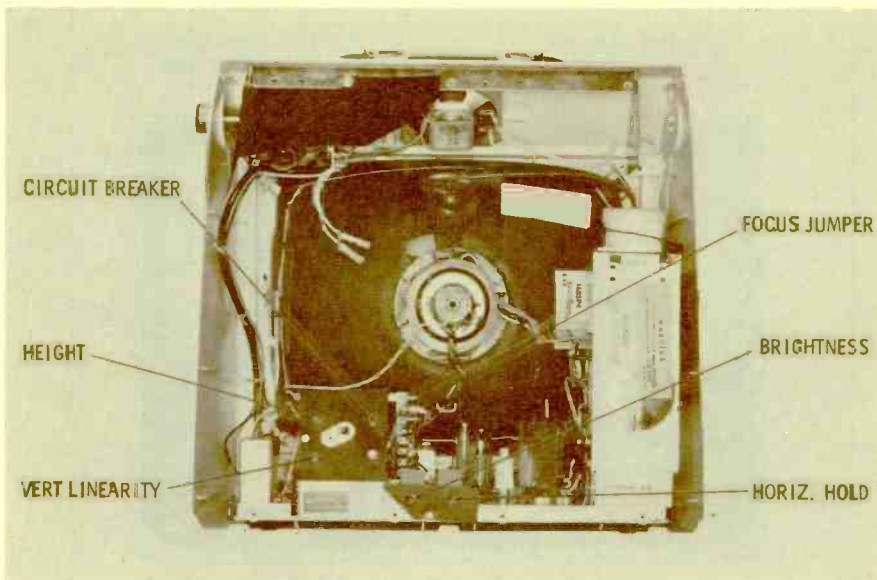
This set has a horizontally mounted chassis which, for the first time in Truetone, incorporates only one large printed-circuit board with most of the major components mounted on it. Several new tubes—of the low-B+ type—are found in this chassis; these include the 10GK6 video output, 10CW5 vertical output, 21GY5 horizontal output, and 17BE3 damper.

B+ is developed from a single silicon rectifier which is protected by a circuit breaker. On the input side of the circuit breaker is a 4.5-ohm, 10-watt wirewound resistor, functioning as a surge limiter. All the tubes in the series filament string have a current rating of 450 ma.

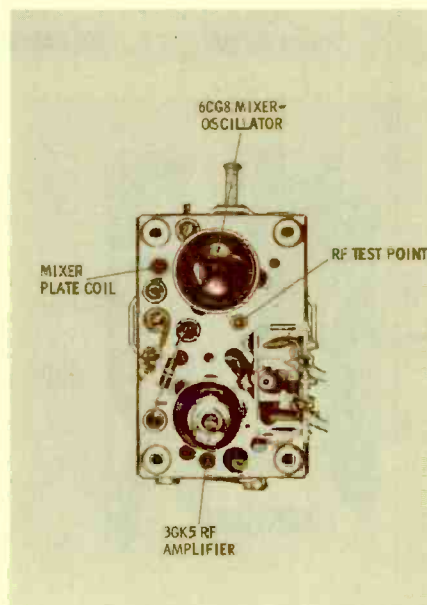
The two-stage video IF strip uses 4EH7 and 4EJ7 amplifiers respectively. Following these is a 1N295 germanium diode video detector. This diode is located under a shield that covers the final IF transformer. The horizontal AFC diode—a common-cathode, plug-in type—can be seen in one of the photos.

A 6BL8 works as sound IF amplifier and AGC keyer; however, no control is provided to vary the AGC voltage. Controls mounted on the front of the chassis are vertical hold, contrast, and a push-pull on-off switch combined with the volume control. Mounted on the rear are brightness, height, vertical linearity, and horizontal hold controls. The focus can be varied by connecting the focus jumper (a lead from the picture-tube socket) to B+, boost, or ground.

The VHF tuner incorporates a 3GK5 RF amplifier and a 6CG8 mixer-oscillator. Individual oscillator slugs for each channel may be adjusted from the front of the receiver after removing the channel-selector and fine-tuning knobs. Rotate the fine-tuning control until the slot in the fine-tuning disc coincides with the opening in the tuner mounting bracket. Using a nonmetallic screwdriver, adjust the appropriate oscillator screw for best picture and sound.



BOTTOM VIEW OF PRINTED BOARD, MARKED WITH TUBE TYPES AND COMPONENT ITEM NUMBERS



See PHOTOFAC Set 561, Folder 1

Mfr: Airline Chassis No. WG-5218A

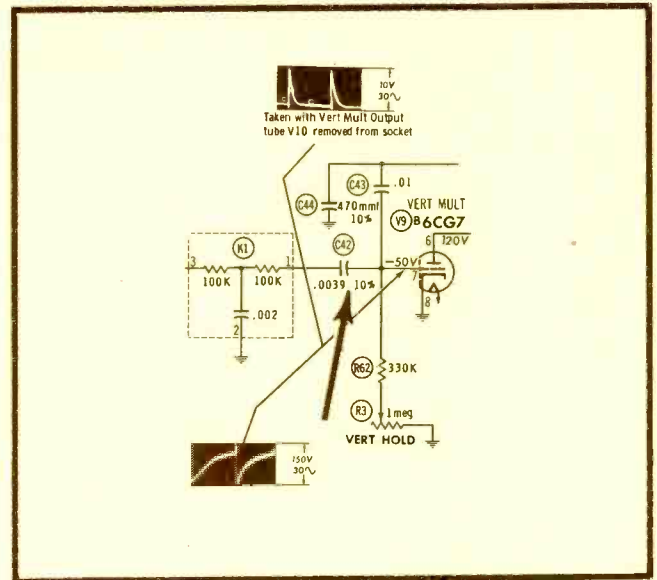
Card No: AI WG-5218A-1

Section Affected: Sync.

Symptoms: Vertical hold drifts out of range.

Cause: Leaky coupling capacitor between integrating network and vertical multivibrator.

What To Do: Replace C42 (.0039 mfd).



Mfr: Airline Chassis No. WG-5218A

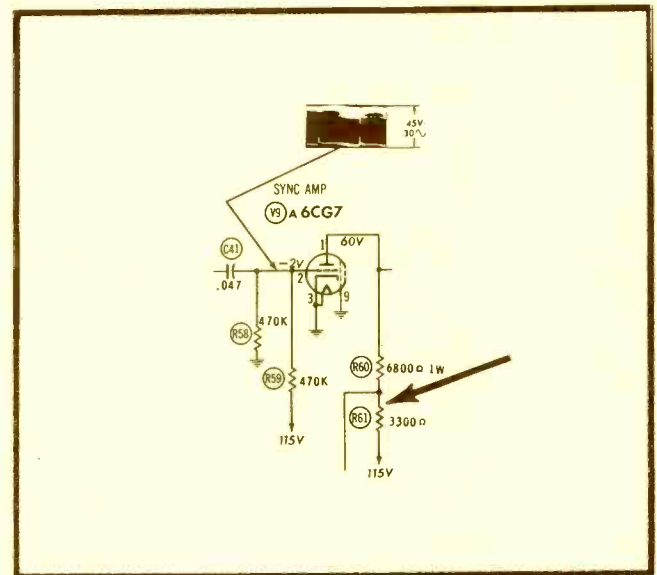
Card No: AI WG-5218A-2

Section Affected: Sync.

Symptoms: Erratic horizontal hold.

Cause: Plate decoupling resistor in sync amplifier decreased in value.

What To Do: Replace R61 (3300 ohms).



Mfr: Airline Chassis No. WG-5218A

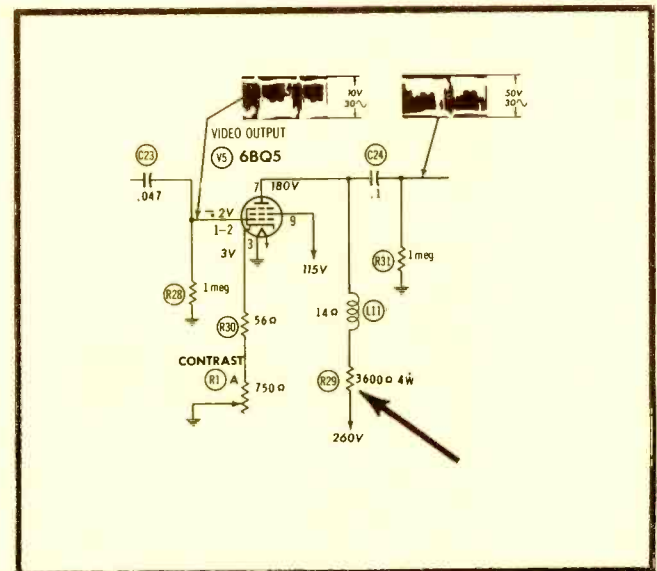
Card No: AI WG-5218A-3

Section Affected: Pix.

Symptoms: Video badly smeared.

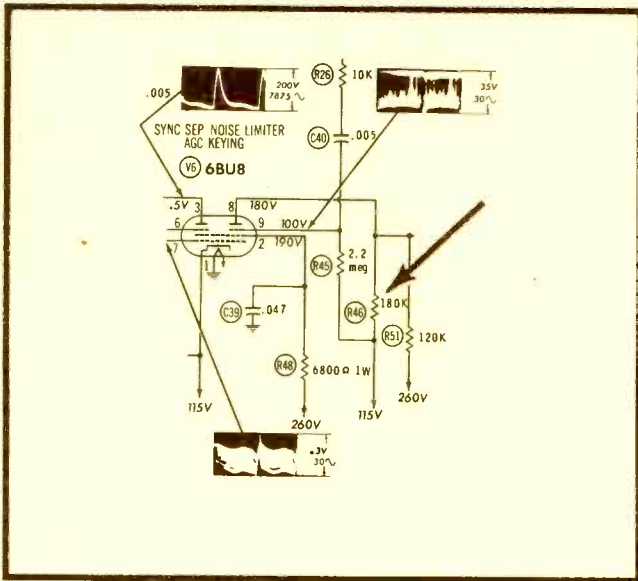
Cause: Video output plate-load resistor reduced in value. Voltage on pin 7 is too high.

What To Do: Replace R29 (3600 ohms).



See PHOTOFAC Set 561, Folder 1

See PHOTOFACT Set 561, Folder 1



See PHOTOFACT Set 561, Folder 1

Mfr: Airline Chassis No. WG-5218A

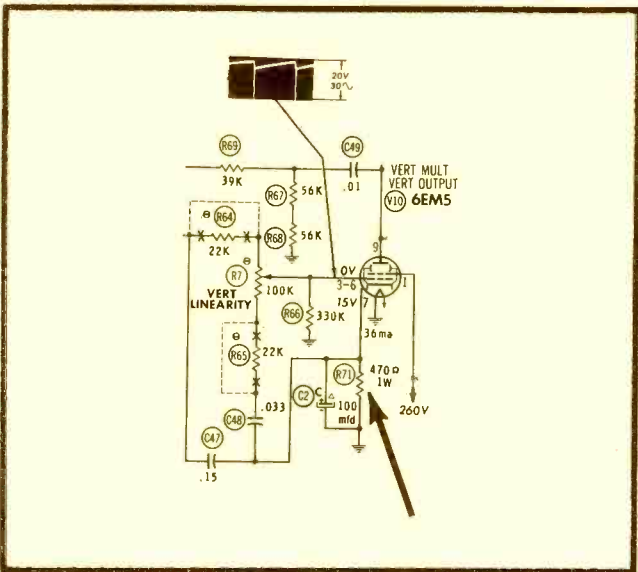
Card No: AI WG-5218A-4

Section Affected: Sync.

Symptoms: Vertical roll and poor horizontal hold. Voltage at pin 8 low.

Cause: Plate resistor in sync separator increased in value.

What To Do: Replace R46 (180K).



Mfr: Airline Chassis No. WG-5218A

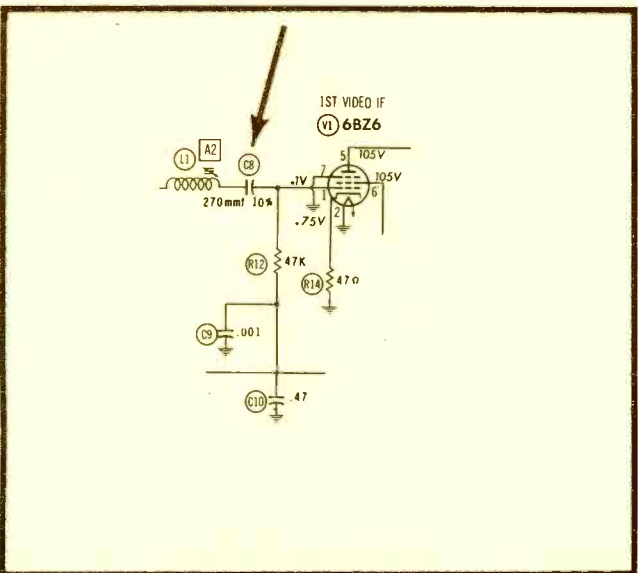
Card No: AI WG-5218A-5

Section Affected: Raster.

Symptoms: Vertical collapse after warmup. High positive voltage at pin 7 of V10.

Cause: Cathode resistor opens under load.

What To Do: Replace R71 (470 ohms). Check V10.



Mfr: Airline Chassis No. WG-5218A

Card No: AI WG-5218A-6

Section Affected: Pix.

Symptoms: Video overload. Positive voltage at grid of V1.

Cause: Leaky coupling capacitor between tuner output and first video IF.

What To Do: Replace C8 (270 mmf).

See PHOTOFACT Set 466, Folder 2

Mfr: Zenith Chassis No. 16D25,Q,U

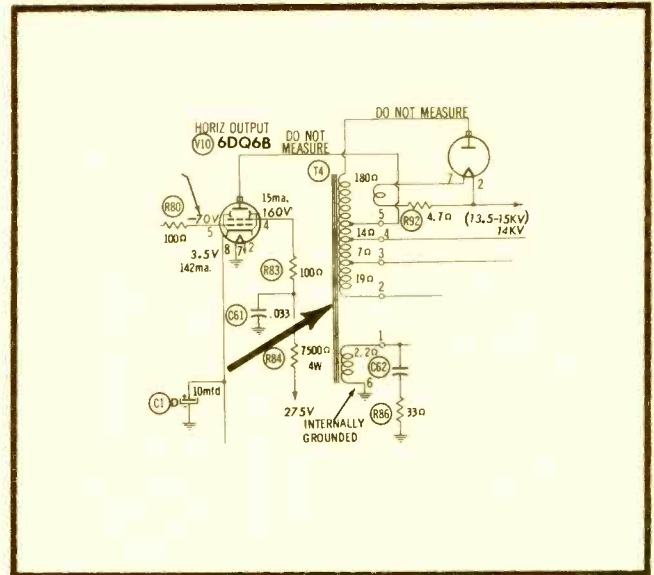
Card No: ZE 16D25-1

Section Affected: Pix and sound.

Symptoms: Horizontal tearing and streaking; clicks in sound.

Cause: Horizontal output transformer arcing to ground internally.

What To Do: Replace T4 (horizontal output transformer).



See PHOTOFACT Set 466, Folder 2

Mfr: Zenith Chassis No. 16D25,Q,U

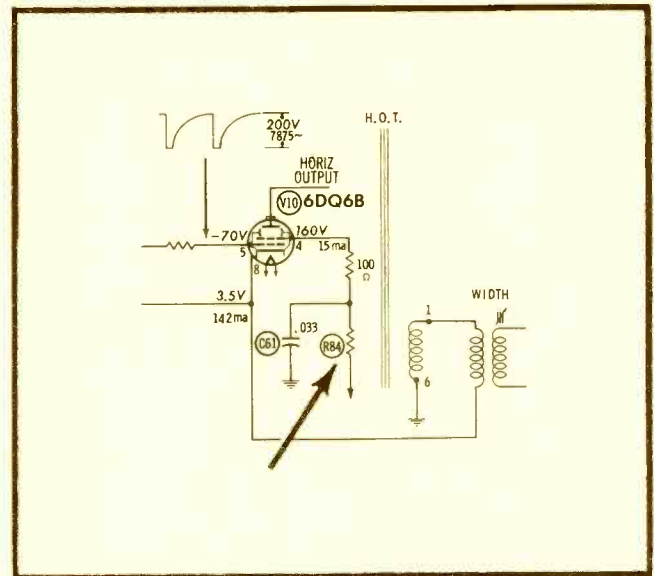
Card No: ZE 16D25-2

Section Affected: Raster.

Symptoms: Intermittent loss of raster. Voltage low on screen of V10.

Cause: Screen resistor in horizontal stage opens intermittently.

What To Do: Replace R84 (7500 ohms—4 watts); also check C61 (.033 mfd) and V10 for shorts.



Mfr: Zenith Chassis No. 16D25,Q,U

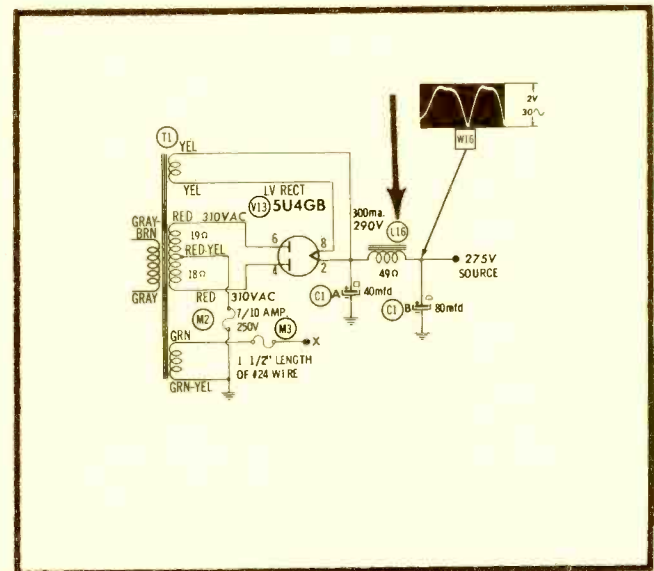
Card No: ZE 16D25-3

Section Affected: Pix and sound.

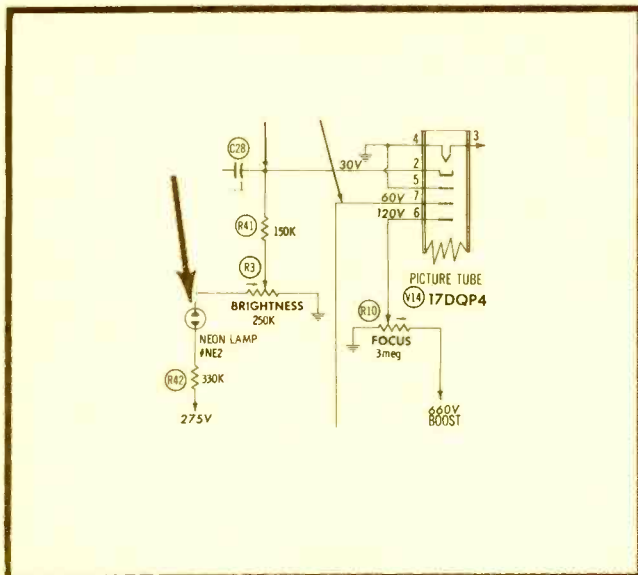
Symptoms: Bending in pix; slight hum in sound. Hum voltage high at 275-volt source.

Cause: Filter choke shorted internally.

What To Do: Replace L-16. Check V11 damper for shorts.



See PHOTOFACT Set 466, Folder 2



See PHOTOFACT Set 466, Folder 2

Mfr: Zenith Chassis No. 16D25,Q,U

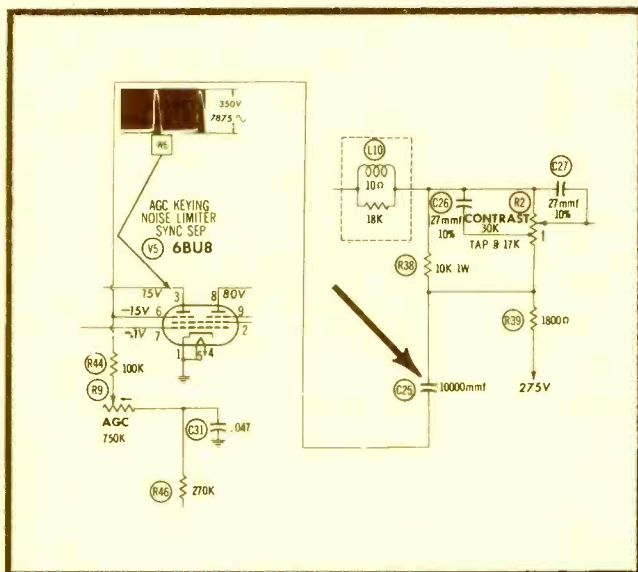
Card No: ZE 16D25-4

Section Affected: Raster.

Symptoms: Rotating brightness control has little effect. Only slight bias variation can be measured on CRT.

Cause: Neon lamp does not fire.

What To Do: Replace neon lamp (NE2). This lamp normally assures rapid spot decay when set is shut off. Lamp may be jumped temporarily until replacement is obtained.



Mfr: Zenith Chassis No. 16D25,Q,U

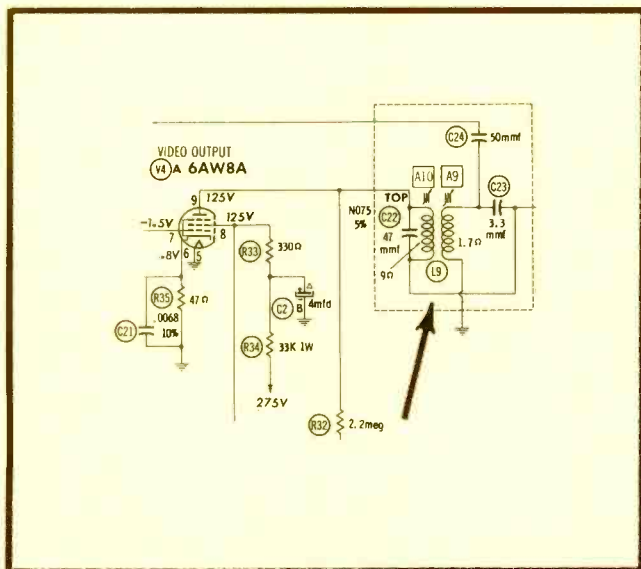
Card No: ZE 16D25-5

Section Affected: Pix.

Symptoms: Bending in pix, mainly at top. AGC setting extremely critical. Decreased bias on pin 6 of V5.

Cause: Leaky sync coupling capacitor.

What To Do: Replace C25 (10,000 mmf).



Mfr: Zenith Chassis No. 16D25,Q,U

Card No: ZE 16D25-6

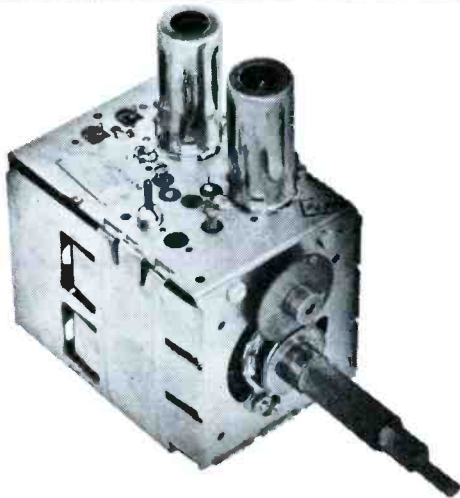
Section Affected: Sound.

Symptoms: Sound intermittent, sometimes accompanied by sync buzz.

Cause: Intermittent connection in sound-takeoff coil.

What To Do: Resolder all connections in L9.

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



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.

 **SARKES TARZIAN, INC.**
 Bloomington, Indiana

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

ONLY
\$9.50
INCLUDING

ALL PARTS
 (except tubes)
and LABOR

24-HOUR SERVICE
1-YEAR WARRANTY

**TWO SERVICE CENTERS
 TO SERVE YOU BETTER**

**See your distributor, or use the
 address nearest you for fast fac-
 tory repair service**

537 South Walnut St.
 Bloomington, Indiana
 Tel: 332-6055

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

publisher
Howard W. Sams

editor
Forest H. Belt

managing editor
George F. Corne, Jr.

associate editors
James M. Moore
Allen B. Smith
Stuart N. Soll
Norman D. Tanner

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

production manager
Robert N. Rippy

circulation manager
J. A. Vitt

circulation fulfillment
Pat Tidd, Mgr.
Katherine Krise, Ass't.
Cora La Von Willard, Ass't.

art directors
Gene La Rue
Robert W. Reed

advertising & editorial assistants
Hazel Boyer
Rebecca Clingerman

photography
Paul Cornelius, Jr.

advertising sales offices
Dove Milling, advertising sales manager

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

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

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

Address all correspondence to
PF REPORTER, 4300 W. 62nd Street,
Indianapolis 6, Indiana



Copyright © 1964 by Howard W. Sams & Co., Inc.
PF REPORTER is a trademark of Howard W. Sams
& Co., Inc. No part of PF REPORTER may be
reproduced without written permission. No patent
liability is assumed with respect to use of
information herein. Acceptance of advertising does
not in any manner signify the products, policies
and services so advertised have been approved,
endorsed or recommended by this magazine.
Subscription Prices: 1 year—\$5.00, 2 years—\$8.00,
3 years—\$10.00, in the U.S.A., its possessions and Canada.
All other foreign countries: 1 year—\$6.00, 2 years—
\$10.00, 3 years—\$13.00. Single copy 50¢; back copies 65¢.

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



PF REPORTER

including Electronic Servicing

VOLUME 14, No. 8

AUGUST, 1964

CONTENTS

SPECIAL ANTENNA SECTION

- | | | |
|---|---------------------|----|
| Servicing Master Antenna Systems | Jack Beever | 30 |
| A review of MATV distribution systems with servicing helps and hints. | | |
| Boosting and Distributing U and V Signals | Leo G. Sands | 32 |
| Improved equipment and modern techniques simplify installation and maintenance. | | |
| Antenna Systems Can Be Safe | Roland E. Palmquist | 39 |
| Quicker Servicing—Stop worrying and make all systems perfectly safe. | | |
| Techniques for Selling Antennas | James M. Moore | 56 |
| Dollar and Sense Servicing—Here are ideas designed to increase your antenna business. | | |

Previews of New Sets

Magnavox Model IMR-303N, Chassis C44-03-00
Philco Model M4504MR, Chassis 14N50A
Silvertone Model 4101, Chassis 528.60269
Truetone Model 2DC3416

Video Speed Servicing

Service hints on Airline Chassis WG-5218A and Zenith Chassis 16D25,Q,U.

Letters to the Editor

The Electronic Scanner

The Troubleshooter

Symfact: Turret Tuner (Frame-Grid RF)

See what happens to voltages and waveforms when trouble occurs.

Servicing Electronic Musical Instruments

Audio facts—Your next customer may have a sick guitar. Be prepared to fix it.

Servicing Electrostatic Air Cleaners

Industrial electronics—A quick course to improve your versatility and your income.

Book Reviews

Notes on Test Equipment

Lab reports on Cornell-Dubilier Model 12PP14 *Portapower*, Hickok Model 209B VTVM, and SENCORE Model MX129 FM Multiplex Generator and Analyzer.

Product Report

Free Catalog & Literature Service

Monthly Index

on free literature card

ABOUT THE COVER

The accent for August is on antennas. This issue shows several ways an improved understanding can provide more enjoyment for your customers and increased profits for you. Don't miss the opportunities presented by expanding markets for FM and UHF antenna sales and installations.



WHY risk your reputation with "just-as-good" capacitors?

When you pay little or no attention to quality in tubular replacement capacitors, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to take a chance on capacitors with unknown or debatable performance records when it's so easy to get guaranteed dependable tubulars from your Sprague distributor!

There's no "maybe" with these 2 great SPRAGUE DIFILM® TUBULARS!

The ultimate in tubular capacitor construction. Dual dielectric . . . polyester film and special capacitor tissue . . . combines the best features of both. Impregnated with HCX®, an exclusive Sprague synthetic hydrocarbon material which fills every void in the paper, every pinhole in the plastic film *before it solidifies*, resulting in a rock-hard capacitor section . . . there's no oil to leak, no wax to drip. Designed for 105°C (220°F) operation without voltage derating.



DIFILM® BLACK BEAUTY®
Molded Tubular Capacitors

The world's most humidity-resistant molded capacitors. Tough, protective outer case of non-flammable molded phenolic . . . cannot be damaged in handling or installation. Black Beauty Capacitors will withstand the hottest temperatures to be found in any TV or radio set, even in the most humid climates.



DIFILM® ORANGE DROP®
Dipped Tubular Capacitors

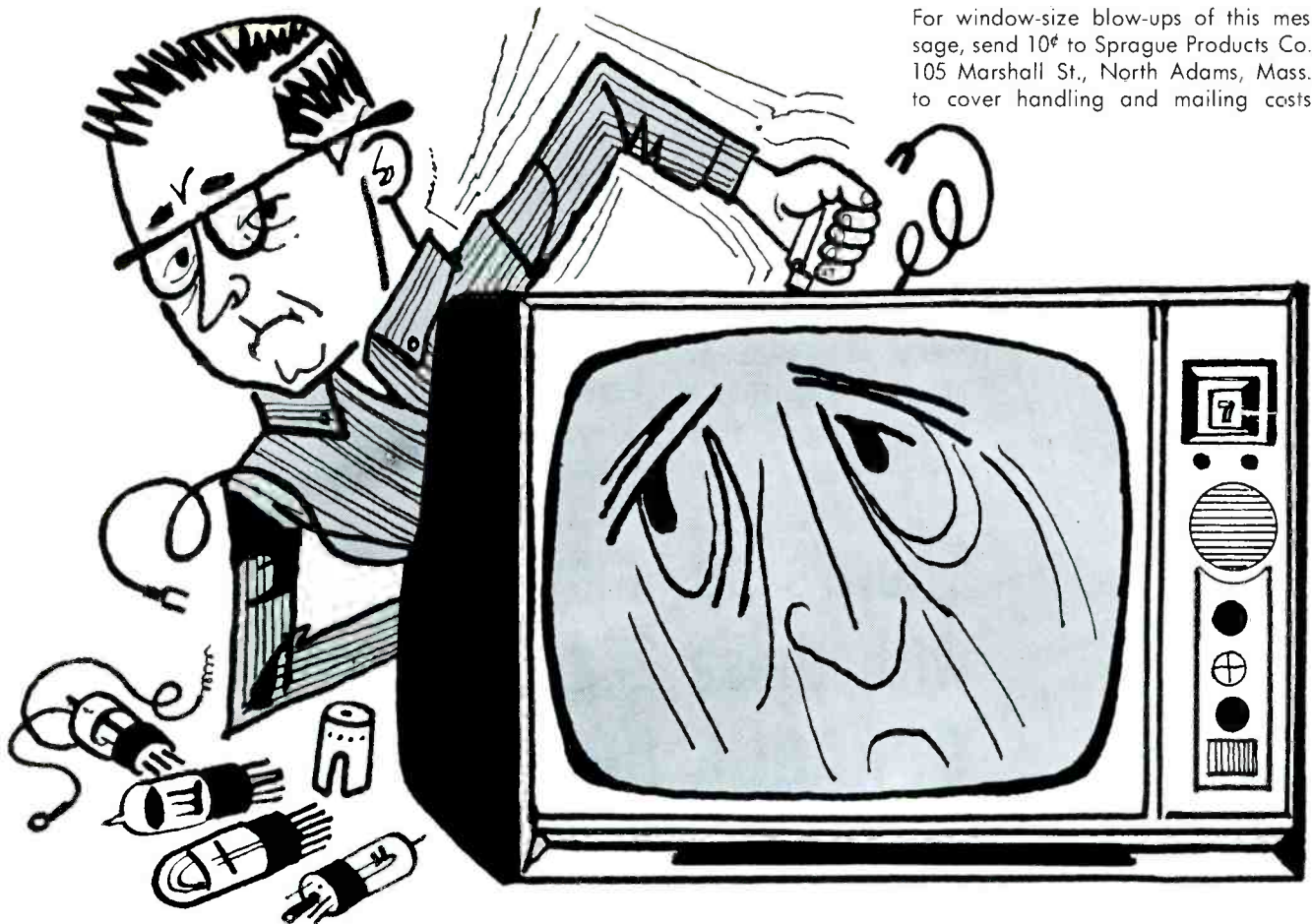
A "must" for applications where only radial-lead capacitors will fit . . . the perfect replacement for dipped capacitors now used in many leading TV sets. Double-dipped in rugged epoxy resin for positive protection against extreme heat and humidity. No other dipped tubular capacitor can match Sprague Orange Drops!

For complete listings, get your copy of Catalog C-616 from your Sprague distributor, or write to Sprague Products Company, 105 Marshall Street, North Adams, Massachusetts.



WORLD'S LARGEST MANUFACTURER OF CAPACITORS

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



Is “do-it-yourself” TV Service as dangerous as they say?

When a TV set starts “acting up,” a tube is often involved. At least, that’s where the trouble *appears* to be.

Some people will pull the back off the set, remove the tubes, and take them to the “do-it-yourself” tube tester at the neighborhood store. The test instrument shows which tubes are faulty (but not always—some faults do not show up on these testers). Replacements are purchased, then inserted into the set. Reception improves, and the trouble has been caught and corrected.

BUT HAS IT?

The self-service test instrument checks *tubes*. It can’t test the *more than 500 other parts* in

your set! It can’t show you the *source* of the trouble that probably blew the tube. Neither can it show the damage often suffered by other parts due to the faulty tube.

Mere tube replacements do not always cure these trouble spots. Weak links continue to exist, *setting up chain reactions of damage, trouble, and expense!*

The total failure of many a good TV set can be traced directly to “do-it-yourself” tinkering.

Your TV set is the most complicated device you own—far more complex than even your automobile. When you need TV service, call an expert technician—your fully trained and experienced Independent Service Dealer. *

AFTER ALL, YOU WOULDN'T ENTRUST YOUR JOB TO AN AMATEUR, WOULD YOU?

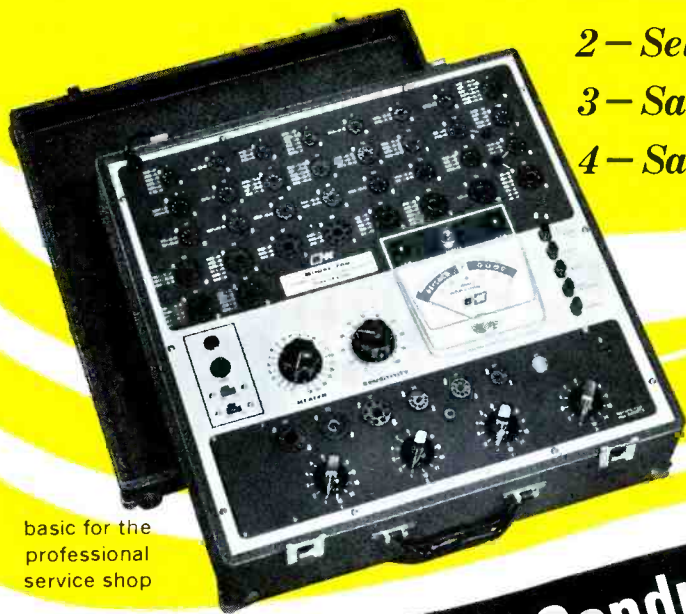
**THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR . . .**

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

Circle 5 on literature card

you profit 4 ways

- 1— Test tubes faster, more accurately
- 2— Sell more tubes per customer
- 3— Save call-backs
- 4— Satisfy more customers



basic for the professional service shop



**Model 700
DYNA-QUIK**

Dynamic Mutual Conductance Tube Tester

Multiple-Socket Speed with Gm Accuracy plus obsolescence protection

TESTS All TV and Radio Tubes, Old and New

TESTS Nuvistors and Novars

TESTS 10-Pin Tubes

TESTS 12-Pin Compactrons

TESTS European Hi-Fi Tubes, Voltage Regulators, and Most Industrial Types

Everyday use by thousands of professional servicemen has proved its speed . . . its accuracy . . . its efficiency.

You can quickly check all the tubes in the set, detect hard-to-locate weak tubes that need replacement . . . and sell more tubes. Provides multiple-socket section to quick-check most of the TV and radio tube types the *true dynamic mutual conductance way*—plus simplified switch section to check new tube types in Dyna-Quik emission circuit. Also includes provision for future new sockets.

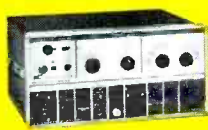
Makes test under set-operating conditions. Checks each section of multi-section tubes separately. Checks for *all* shorts, grid emission, leakage, and gas. Makes quick "life" test. Exclusive adjustable grid emission test provides sensitivity to over 100 megohms. *Insures your reputation. Quickly pays for itself.*

See your B&K Distributor or Write for Catalog AP21-R **\$179.95**

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



Model 960 Transistor Radio Analyst



Model 1074 Television Analyst



Model 1076 Television Analyst



Model 850 Color Generator



Model 445 CRT Rejuvenator Tester

NEW TUBE INFORMATION SERVICE

Available every 3 months, on subscription, for all B&K Dyna-Quik Tube Testers



B&K MANUFACTURING CO.

DIVISION OF DYNASCAN CORPORATION

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

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

Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

Circle 6 on literature card



NOW...
THE FABULOUS
***G. E. COMBO**



PLAYS ANYWHERE
ON 110 AC OR 12V DC
BATTERY CURRENT
For
Auto • Boat • Plane
Camps • Picnic • Trailer

ATR MODEL 12T-RME-1 INVERTER... \$39⁹⁵
*G.E. MODEL M110Y 11" PORTABLE TV \$99⁹⁵

*Available at G.E. TV Dealers

Both Only **\$139⁹⁰** Retail
THE **ATR** MODEL 12T-RME-1 ONLY ONE
OF A FAMILY OF FAMOUS DC-AC **INVERTERS**

Also NOW...

HAND WIRED—
NO PRINTED
CIRCUITRY

ATR ALL-TRANSISTOR
ULTRA COMPACT
UNIVERSAL MODEL 707



Karadio
IN DASH...
UNDER DASH...

Complete with variable tone control... R.F. stage
... Built-in speaker... and External speaker jack.

ATR MODEL 707... \$29⁹⁵ Retail



ATR ALL-TRANSISTOR
ROOF-MOUNT and
IN-DASH MODELS

TRUCK
Karadio
MODEL TR-720

FITS ALL TRUCKS • BOATS •
STATION WAGONS
INSTANT PLAY... POWERFUL

Complete with patented antenna-yoke assembly.
(U.S. Patent No. 3,087,118. Canadian Reg. 575,567)

ATR MODEL TR-720... \$44⁹⁵ Retail



ATR "A" Battery
ELIMINATOR

For Demonstrating and
Testing Auto Radios—
TRANSISTOR or VIBRATOR
OPERATED!
Designed for testing D.C.
Electrical Apparatus on Reg-
ular A.C. Lines.

MAY ALSO BE USED AS A BATTERY CHARGER
MODEL 610C-ELIF... 6 volts at 10 amps. or 12 volts
at 6 amps. Shipping weight 22 lbs.

USER NET PRICE... \$55⁰⁰

ATR AUTO RADIO and
COMMUNICATION

LONGER-LIFE
VIBRATORS

"The Best by Test!"



SEE YOUR ELECTRONIC PARTS DISTRIBUTOR OR
WRITE FACTORY FOR LITERATURE & DEALER PRICES

ATR ELECTRONICS, INC.

Quality Products Since 1931

St. Paul, Minnesota 55101—U.S.A.

Circle 7 on literature card

Letters to the Editor

Dear Editor:

I have reached the age of 68 and am retiring from the radio and television business. Your magazine has been a wonderful help to me, and I have enjoyed every article. Through the years I have built a big reference library thanks to PF REPORTER. Do you know of anyone who would be interested in buying my radio and TV servicing business? Wishing I were ten years younger, and wishing your magazine lots of luck, I am...

J. STEPHEN GOLD

Glenside, Pa.

We hope you can continue to enjoy PF REPORTER through all your GOLD-en years (pun intended). And we wish you all the luck in the world, too, Mr. Gold.—Ed. (P.S.—Readers, Mr. Gold's address is 452 Tyson Ave.)

Dear Editor:

After having received PF REPORTER regularly for over a year, I am writing to express my appreciation for the consistently interesting articles you publish. I have been most agreeably surprised to find that many of the problems experienced by TV technicians in the U.S.A. are very similar to those encountered here in England. In particular, I'd like to compliment you on the excellent SYMFACT series, many of which show faults common in British-made TV receivers. The waveform photographs and clearly labelled circuit extracts reflect great credit on your production department.

BRYAN P. JONES

Newton Abbot, Devon, England

Thanks, Bryan, for taking the time to write, and for the compliments. We are proud of our production department and of the editors who painstakingly research each and every SYMFACT.—Ed.

Dear Editor:

Just a note to thank you for your writeup of the Mark SSB-27 on page 92 of the May issue. The price you give is incorrect, however; the actual price is \$299.50 instead of \$229.50.

HAROLD M. STRAL

for Mark Products
Div. of Dynascan
Chicago, Ill.

OOPS! Our apologies, Hal. The editor who goofed has to make up the difference out of his own pocket.—Ed.

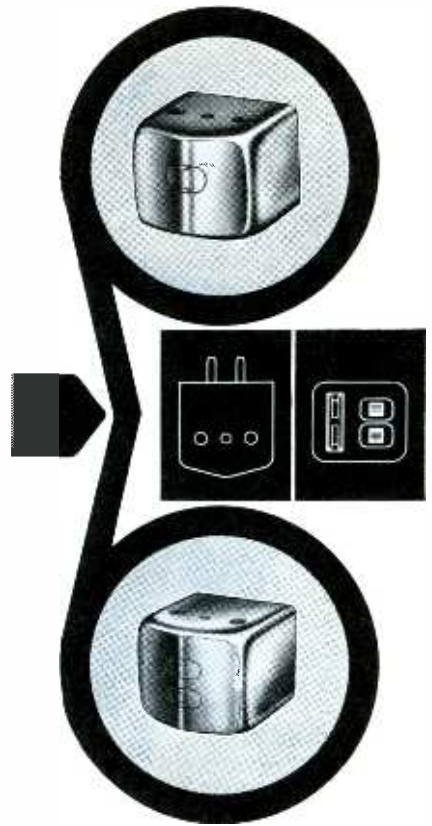
Dear Editor:

I have an Edison Model 19 record player complete with records. Could you please provide some information on it? It is in good working condition, but I'd like to have the service notes in case anything went wrong with it.

TOM WINDHOPE

Durham, N. C.

Sorry, Tom, we have nothing specific in our files. Does any reader want to contribute?—Ed.



NORTRONICS ANNOUNCES...

New Line of Tape Heads!

Designed for top performance and maximum efficiency, Nortronics' new line of tape heads is now available for more than 500 different tape recorders. These high profit, laminated core replacement heads have highly polished, all-metal faces and offer extended high frequency response—even at slower tape speeds. Other features include deposited quartz gaps and low-loss core structures.

ALL TAPE HEADS WEAR OUT!

Magnetic tape itself is the real cause of head wear. Check carefully for head wear—then upgrade your customers' tape equipment with these new replacement heads! The Nortronics Tape Head Replacement Program, with correctly matched "Quik-Kit" accessories will open up new sales and service business! Investigate Nortronics' profitable Tape Head Replacement Program now!

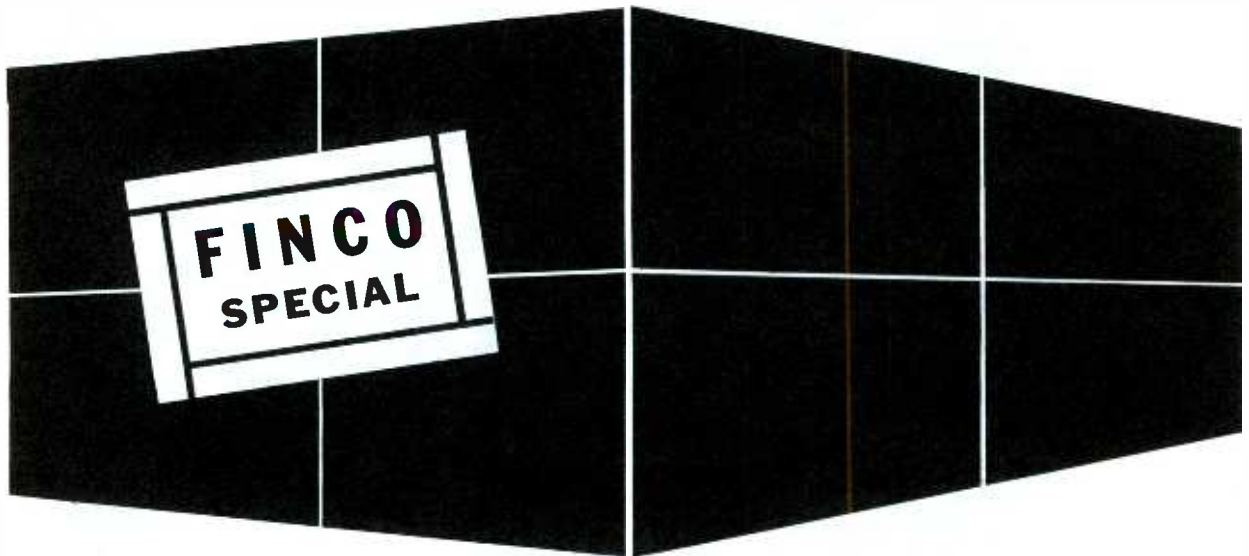
"Music sounds best on Tape—
Tape Sounds Best with Nortronics Heads!"

Nortronics

8161 Tenth Ave. N., Minneapolis, Minn. 55427

Circle 8 on literature card

EVERYDAY
EVERYDAY
EVERYDAY



not just once a year, **FINCO** designs and ships a new "special area design" TV ANTENNA. We've shipped 3,152 already. Each antenna proved best in its own area. Got a Finco Special in your area? Want one? See your Finco distributor, or write us.

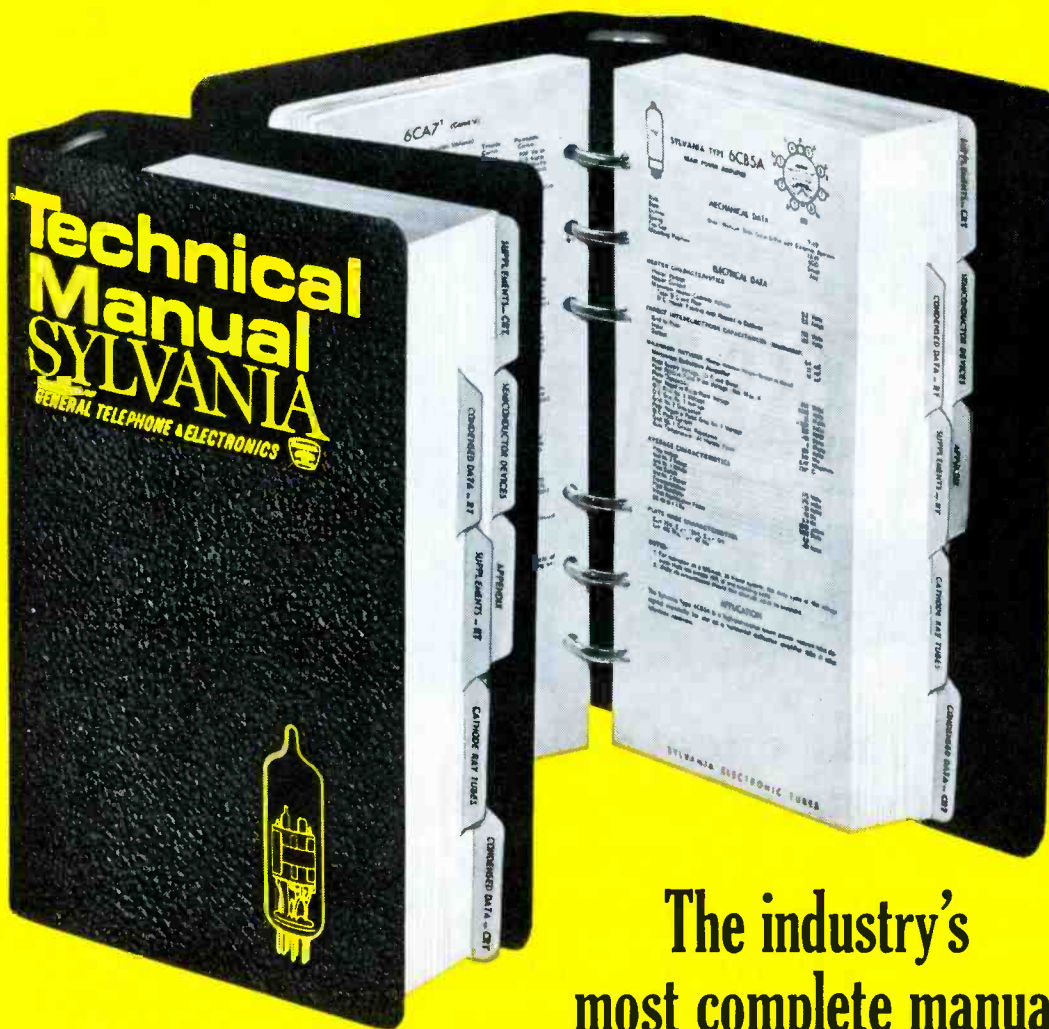
THE FINNEY COMPANY

Bedford, Ohio

Circle 9 on literature card

August, 1964/PF REPORTER 15

you get **PRODUCT PLUS** from your Sylvania Distributor



The industry's most complete manual

Even our non-customers say they can't do without it!

Sylvania's Technical Manual is still the most complete data source for up-to-date information on tubes... and has been since 1929. The current 12th Edition, for instance, will provide information on 2,225 tube types to more than 100,000 service men, technicians, dealers, distributors and other specifiers of tubes. (Incidentally, 2,225 is only the figure of the moment.) At periodic intervals, and at no extra charge, Sylvania mails supplementary data sheets to provide you with the latest information and insure that your Tech Manual is current.

Here are some of the other features you'll find in the manual's 700 pages:

- Data on Receiving Tubes, Cathode Ray Tubes, Semiconductor Diodes and Rectifiers, Special Purpose Tubes—all with complete characteristics.
- Picture Tube Interchangeability Guide
- European-American Receiving Tube Substitution Guide

- Semiconductor Diode Interchangeability Chart

- Master Index for quicker reference

All in a sturdy 9½" x 6½" 6-ring binder with tabbed dividers.

The cost for the industry's most comprehensive manual is only \$3.00. See your Sylvania Distributor. And don't forget to mail in the prepaid post-card for the free supplement service.

SYLVANIA
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS **GTE**

NEW CAPABILITIES IN: ELECTRONIC TUBES • SEMICONDUCTORS • MICROWAVE DEVICES • SPECIAL COMPONENTS • DISPLAY DEVICES

Circle 10 on literature card



The Electronic Scanner

news of the servicing industry

New Position



S. R. Herkes has been named Vice-President and General Manager of the Consumer Products Division of **Motorola, Inc.**, effective July 1. He succeeds Edward R. Taylor, who resigned. Mr. Taylor remains as a Director of the corporation. Mr. Herkes has been associated with Motorola's consumer products business since 1940 in a series of sales and managerial positions. Prior to his present appointment, he had held the post of Vice-President, Consumer Products Marketing since 1956.

Crystal Coding

A simplified coding system for Citizens band frequency-control crystals has been put in effect by Texas Crystals Division of **Whitehall Electronics**. To facilitate the buying and supplying of Citizens band crystals with the new code identification, a slide-rule chart is being distributed. It lists alphabetically all current manufacturers and models of transmitting and receiving equipment along with the appropriate code numbers and descriptions of the crystals required for each unit. Also available is a separate interchangeability chart that shows the various equipment models in which specific crystals can be used. Additional information about the system is available from your local distributor.

New Building



Ground has been broken for a new addition to be built directly adjacent to the present **CBS Laboratories Research Center** at Stamford, Conn. The new structure, which will double the space at the Center, will be completed this year. With the additional building, CBS Laboratories will occupy 60,000 square feet at High Ridge Road, where all the Laboratories' research and administration activities will be concentrated. Other locations in Stamford will house production facilities, machine shop, wiring shop, and other engineering support activities. CBS Laboratories does research and development for the Government, for industry, and for Columbia Broadcasting System, Inc.

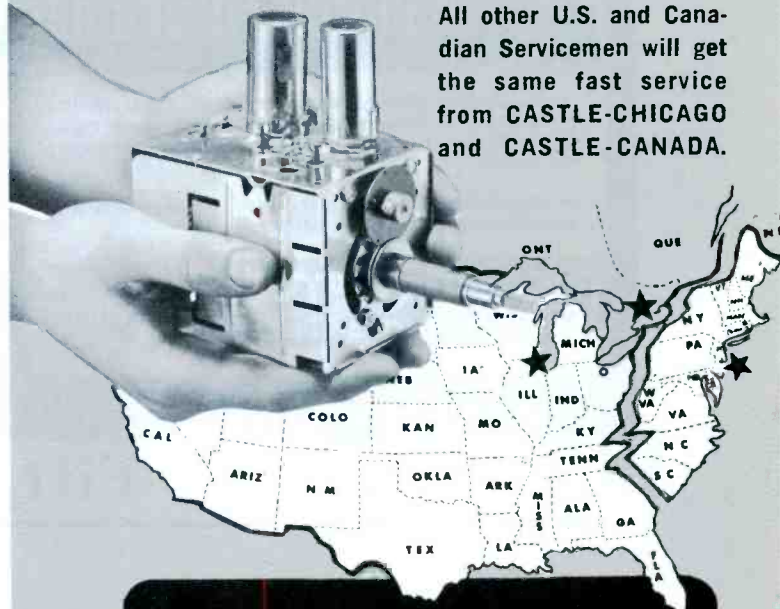
Wins Award

For the second consecutive year, **Philco Corporation** has been presented the "Friends of Service" award by the National Alliance of Television and Electronics Service Associations. Philco was cited for its continuing co-operation with the independent servicing dealer and technician. Alex Tagnon, field service manager, accepted the award plaque on behalf of the Philco Parts and Service Operation from William Childs, NATESA West Central Vice-President, at the Association's Spring Directors Conference in Memphis, Tennessee. Mr. Tagnon noted that Philco recently has expanded its electronics and appliance service programs. He said that the company has instituted service training techniques which enable instructors to present the most complicated servicing problems in simplified form. ▲

GOOD NEWS FOR EASTERN TV SERVICEMEN...

CASTLE TV TUNER-EAST HAS MOVED TO NEW LOCATION WITH IMPROVED FACILITIES

In Long Island City near Postal Concentration Center to provide faster service by mail.



All other U.S. and Canadian Servicemen will get the same fast service from **CASTLE-CHICAGO** and **CASTLE-CANADA**.

**ALL MAKES
ALL LABOR
AND PARTS
(EXCEPT TUBES)*
ONE PRICE**

995

THIS ONE LOW PRICE INCLUDES ALL UHF, VHF AND UV COMBINATION* TUNERS

Simply send us your defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint. 90 Day Warranty.

Exact Replacements are available for tuners unfit for overhaul. As low as \$12.95 exchange. (Replacements are new or rebuilt.)

*UV combination tuner must be of one piece construction. Separate UHF and VHF tuners must be dismantled and the defective unit only sent in.

Pioneers in TV



Tuner Overhauling

CASTLE

TV TUNER SERVICE, INC.

EAST: 41-90 Vernon Blvd., Long Island City 1, N. Y.
MAIN PLANT: 5701 N. Western Ave., Chicago 45, Illinois
CANADA: 136 Main Street, Toronto 13, Ontario

*Ma or Parts are additional in Canada

Circle 11 on literature card



Actual Size
 Only 1-5/8 inches long...
 Extends just 29/32 inch
 behind front of panel

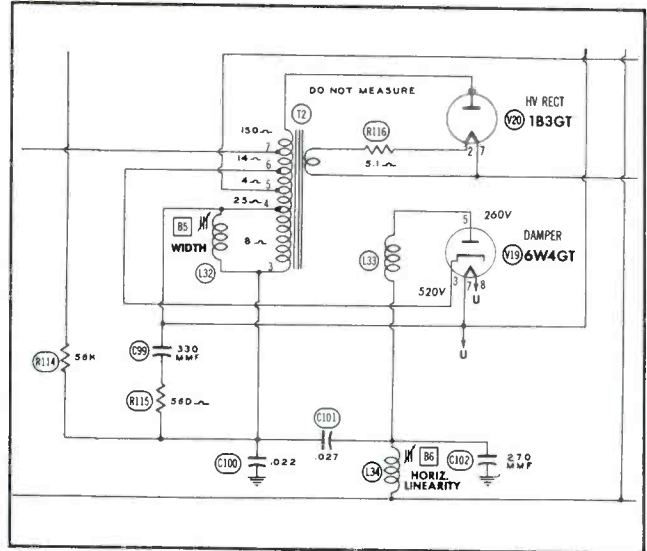
BUSS Space Saver Panel Mounted Fuseholder

- Fuseholder takes 1/4 x 1 1/4 inch fuses. Converts to 9/32 x 1 1/4 inch fuses simply by changing screw type knob. Holder is rated at 30 ampere for any voltage up to 250.
- Also available in military type which meets all requirements of MIL-F-19207A.

BUSS

Write for BUSS
 Bulletin SFH-10

BUSSMANN MFG. DIV., McGraw-Edison Co., ST. LOUIS, MO. 63107



produce a raster (with foldover) because the width coil shunted the circuit from terminal 3 to 4.

GEORGE CALVERLEY

Howard Beach, N.Y.

Thanks, George, for passing along this information. Incidentally, have you noticed that horizontal foldover problems are seldom encountered in receivers manufactured during the last four or five years? Autotransformer design is used in most of these sets, and many of the "extra" components have been eliminated. It was failure of an "extra" that frequently was the cause of foldover. Horizontal circuits now contain the least number of parts that will efficiently do the job.

BUSS: 1914-1964, Fifty years of Pioneering....



The Troubleshooter

answers your servicing problems

Foldover Plus

I would like to pass on for the benefit of other servicemen some experiences I had with an RCA Victor Model 17T200 (Chassis KCS72). It came in with the horizontal oscillator out of sync, and the horizontal hold control was ineffective.

After reading 'Squegs to Squeals' in the October 1962 PF REPORTER, and feeling rather confident, I replaced the capacitors most likely to cause this trouble. However, I still had the same problem when I turned the set on. I next did what I should have done in the first place: I connected the scope to the horizontal waveform coil and found the waveform was 'way off.

After adjusting the waveform slug for equal peaks and making further minor adjustments, the picture snapped right in and held over the full range of the hold control.

One week later the same set developed a series of foldovers with the picture locked in perfectly. The foldover (2" wide) started about 2" from the left side and appeared somewhat like evenly spaced drive lines.

Using PHOTOFAC T Folder 184-12 as a guide, I checked all voltages and waveforms throughout the horizontal section; they were all acceptable. Following the advice of another serviceman, I opened the width coil at terminal 3 of T2, and this killed the raster. With my ohmmeter, I found the winding between terminals 3 and 4 of T2 was open. The set could still



GMW FUSE
 AND HWA
 FUSEHOLDER
 FUSE SIZE
 ONLY .270 x .250
 INCHES

BUSS Sub-Miniature FUSE-HOLDER COMBINATION

Light-weight, protective device for spacetight applications. Fuse has window for inspection of element. Fuse may be mounted alone or used in holder.

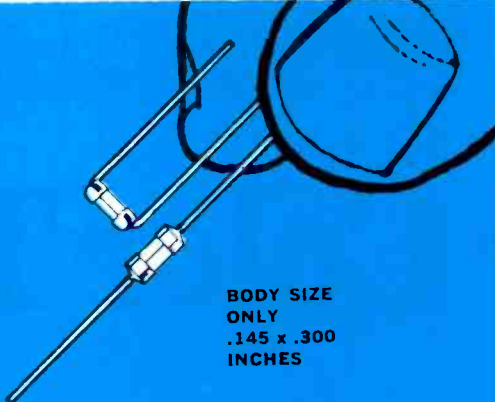
Holder can be used with or without knob. Knob makes holder water-proof from front of panel.

Military type fuse FM01 meets all requirements of MIL-F-23419. Military type holder FHN42W meets all military requirements of MIL-F-19207A.

BUSS

Write for BUSS
 Bulletin SFB

BUSSMANN MFG. DIV., McGraw-Edison Co., ST. LOUIS, MO. 63107



**BODY SIZE ONLY
.145 x .300 INCHES**

BUSS Sub-Miniature PIGTAIL TRON FUSES

Use Tron fuses where space saving is vital—on miniaturized devices—or on gigantic multi-circuit electronic devices.

Hermetically sealed for potting without danger of sealing material affecting operation. Extreme high resistance to shock or vibration. Operate without exterior venting.

BUSS Write for BUSS Bulletin SFB

BUSSMANN MFG. DIV., McGraw - Edison Co., ST. LOUIS, MO. 63107

Bar Identification

In your January column, the answer to Peter Gernat's question (about vertical-bar interference on a Silvertone TV) would be correct if the bars were actually being caused by oscillations in the IF or video circuits. However, since the set was displaying *vertical* bars, I would sooner suspect pickup of interference via radiation from the horizontal sweep and high-voltage circuits. Lead-dress conditions could explain why the lines show up only when the set is put together. Mr. Gernat may find that the high-voltage cage is not properly fastened to the chassis; I recently located this as the cause of a similar trouble.

DON BLECHMANN

Coatesville, Pa.

Oops—I forgot to remind Mr. Gernat about this problem, which we've repeatedly mentioned on other occasions (see page 87 of the April, 1963 issue). Horizontal-sweep radiation is a foregone conclusion if the bars decrease in intensity from the left to the right side of the screen; but if they are all of the same strength, there's still a definite possibility of oscillation in the picture circuits at approximately 50-100 kc.

Futile Filtering

In the May *Troubleshooter* column, under the heading "Off Again—On Again," you point out several parts as possible causes of an intermittently stopping horizontal multivibrator; but I believe you've overlooked the most likely cause. I have repaired a number of these circuits in which the electrolytic filter capacitor at the low end of the horizontal frequency coil had opened.

VICTOR CASTENS

Pittsburg, Kan.

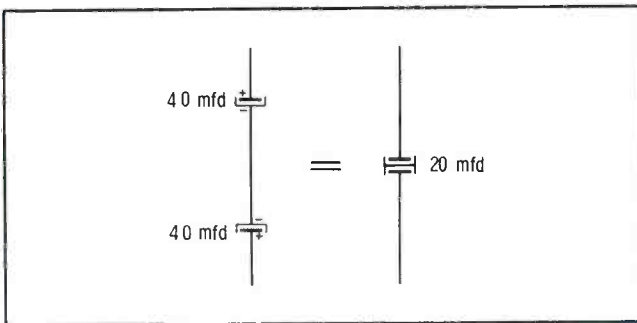
Joe A. Duerringer's trouble with a singing flyback and no high voltage, reported in May *Troubleshooter*, reminded

• Please turn to page 68

...New Developments in Electrical Protection

Polarized for Nonpolarized?

I would like to know if it would be possible to use two regular electrolytic capacitors back-to-back, in order to make one nonpolarized capacitor, such as:



There have been many cases where I have had to replace nonpolarized electrolytic capacitors and have had trouble obtaining them. Would the combination above do the job? Would it last as long?

RANDOLPH COLAIANNI

Marlboro, Mass.

Yes, it is possible to use two regular electrolytic capacitors back-to-back to replace one nonpolarized capacitor. The example you give—using two 40-mfd capacitors to equal one 20-mfd capacitor—is quite satisfactory.

The working voltage of the combination remains the same as that of one of the units, since one capacitor does not form completely when the alternating voltage is of the wrong polarity. We have no authoritative figures on the life expectancy of capacitors used in this way, but experience has shown no appreciable problem.



BUSS quick-acting Fuses

"Fast Acting" fuses for protection of sensitive instruments or delicate apparatus;—or normal acting fuses for protection where circuit is not subject to starting currents or surges.

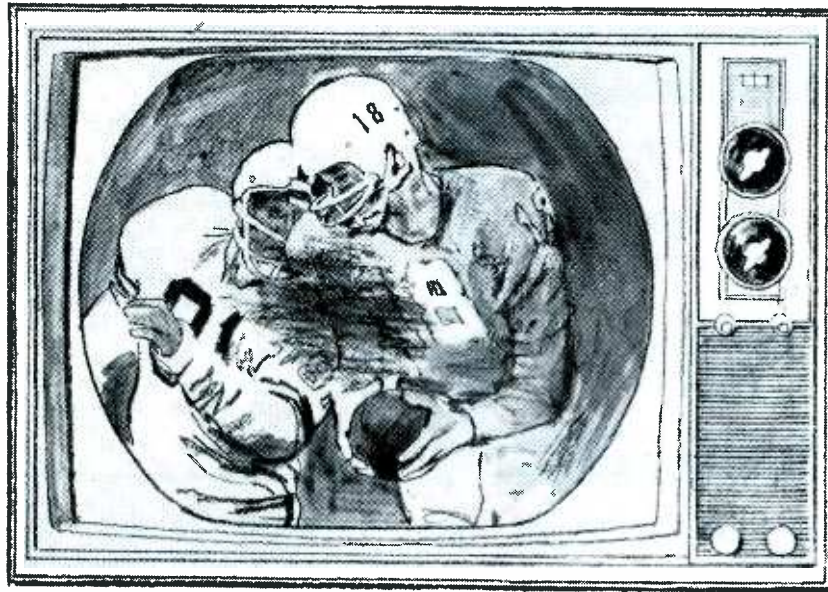
BUSS Write for BUSS Bulletin SFB

BUSSMANN MFG. DIVISON, McGraw-Edison Co., St. Louis, Mo. 63107

Circle 12 on literature card

Available Now

RCA Victor Color TV



Magnetism can cause impurities...

in the color picture—and unwanted color areas in the black and white picture. In the home, as you know, magnetic distortions may be caused by moving the set in relation to the earth's magnetic field or they can sometimes be caused by nearby electric appliances.

To "cancel" the magnetism and restore natural color...



simply turn off the set, let it cool 4 or 5 minutes, then turn it back on. That's all—no more need for a separate degaussing coil! The RCA Victor Automatic Color Purifier acts *every time the set is turned on* from a cool start. Color is bright, sharp, true—free of impurities caused by magnetism. The RCA Victor Automatic Color Purifier also removes unwanted color areas from the black and white picture. Here's another major "first" from RCA Victor that can give you a profitable advantage in extra sales . . . and in service savings!

SEE WALT DISNEY'S "WONDERFUL WORLD OF COLOR," SUNDAYS, NBC-TV NETWORK

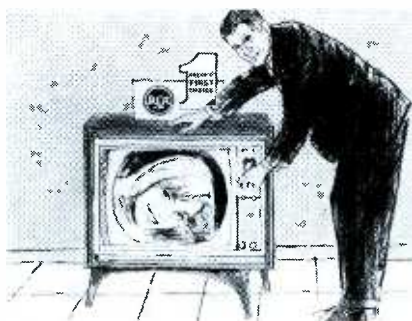
degausses itself!

Gives you 3 big advantages!

1

Floor models always ready for best color picture!

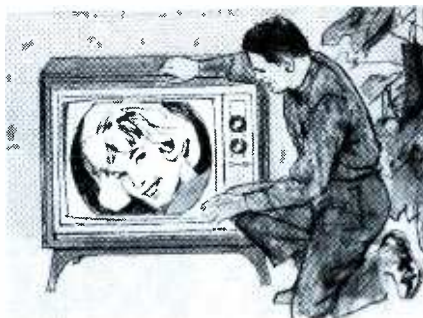
Ever lost a sale because your floor demonstrator needed degaussing? The RCA Victor Automatic Color Purifier cleans up that problem . . . helps make the sale easier for you. And with a swivel or caster model, you can quickly demonstrate how color TV can now be moved about without worry of magnetic distortion!



2

Faster, easier setup in customer's home!

The RCA Victor Automatic Color Purifier eliminates the need for you to perform time-consuming degaussing when you deliver the new Mark 10 color TV set. This makes setup faster, easier . . . freeing you for more profitable TV servicing. The Automatic Color Purifier is standard on all Mark 10 models except the price leaders.



3

Reduces unprofitable callbacks!

The RCA Victor Automatic Color Purifier will end those degaussing "nuisance" calls that can eat up service time and profits. They're a nuisance to customers, too! Increased customer satisfaction is sure to follow from this new RCA Victor "first"—and remember, a satisfied customer is very often your best salesman.



Make sure you get your share of the big Color TV sales forecast for '65...get with RCA Victor!

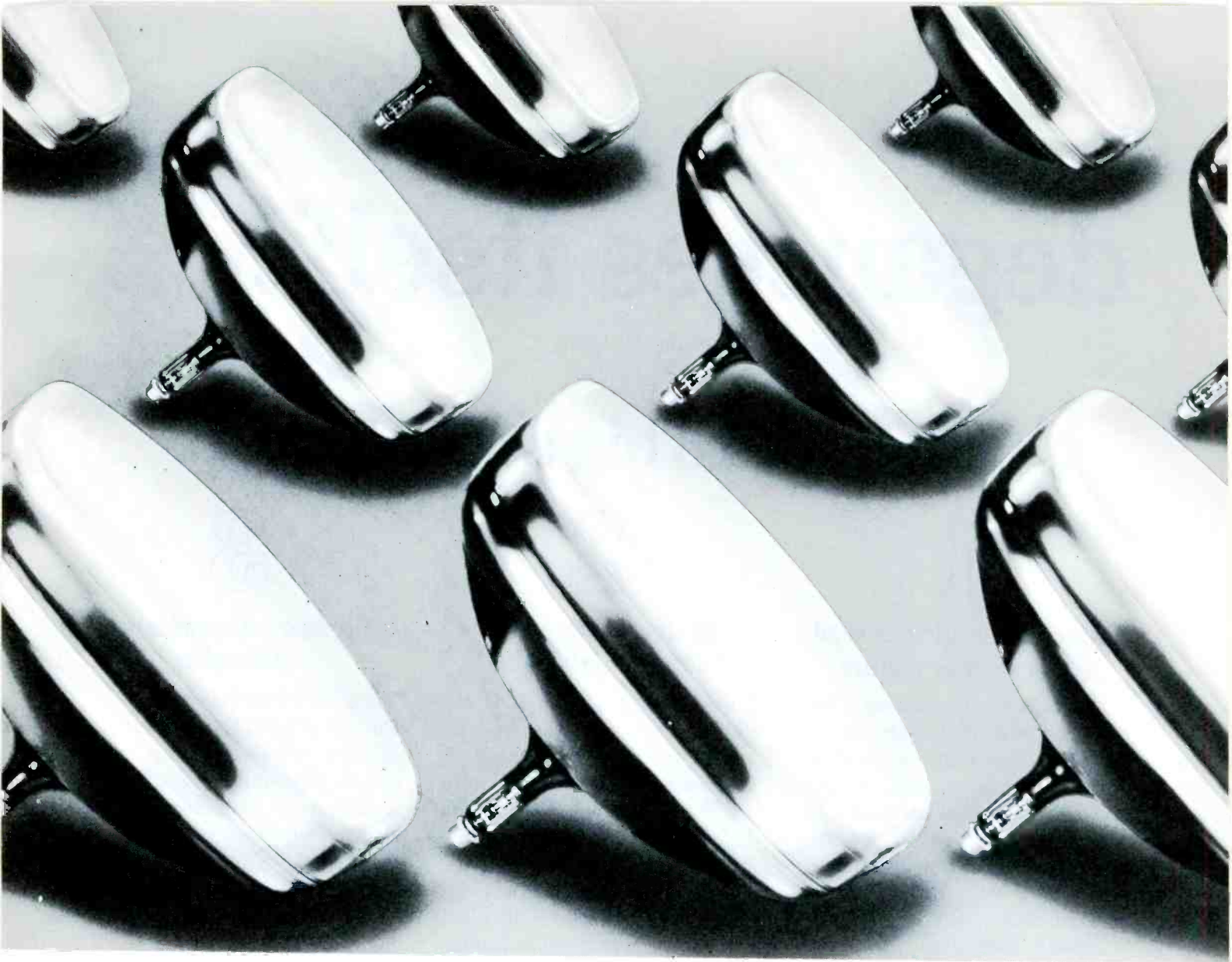


The Most Trusted Name in Television

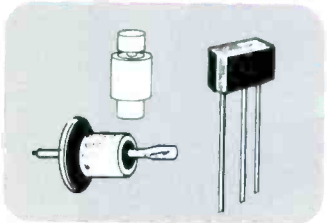
Tmk(s)®

SEE THE RCA COLOR TV CENTER AT THE WORLD'S FAIR

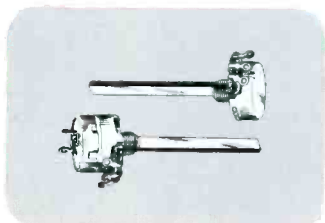
August, 1964/PF REPORTER 21



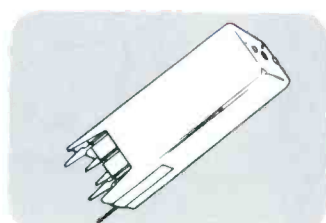
THE QUALITY OF YOUR SERVICE DEPENDS ON THE PARTS YOU USE...DEPEND



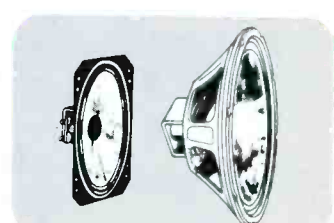
Diodes, Rectifiers, Condensers and Resistors
Complete variety for all makes and models.



Universal Controls
With or without on-off switch. Standard taper, 3 inch shaft, half flat. 1 meg, 2 meg, 500 K. Complete selection. Fit Philco and other makes.



I.F. Transformers
For printed circuits, 4 lug, 5 lug or 6 lug types . . . to fit Philco or other makes. Dependable Philco Quality.



Replacement Speakers
All sizes, round, oval or rectangular types. 3.2, 8, 16, 20 ohms. From tiny 1 3/4" to giant 15" sizes.



Philco Receiving Tubes
To fit any make, any model TV or radio, manufactured to exact Philco standards, thoroughly inspected. Original factory cartons.



Rotary Switch Antenna
High gain type with 6 position switch for best possible signal selectivity. 3 section brass dipoles. Padded cast iron base.



Contact Cleaner
Philco TV and Radio Contact and Control Cleaner, Lubricant in self spray can, complete with protective cap and spray nozzle.



Philco TV Yoke
Genuine Philco TV yokes, made to original factory specifications. Accurately wound and inspected. Packed in individual boxes, ready to install.

There's a Philco Fully Stocked Parts Center Near You!

IF YOU NEED A PHILCO PART...YOU CAN GET IT FAST...HERE'S WHY

1. Philco has a nationwide network of Parts distributors—THERE'S one in your area.
2. Philco distributors are backed up by Parts Warehouses with millions of dollars in Parts inventory.
3. NEW Parts for NEW Philco models are shipped automatically along with the NEW products.
4. All Parts orders are handled by experienced Parts specialists.
5. ALL EMERGENCY orders are transmitted over the nation's largest industrial communications system and processed within 24 hours.

Whatever you need—whenever you need it—if it's a Philco Part just dial your Philco distributor. He has thousands of Philco Parts right now on his shelves. If the item you need is temporarily out of stock—he can get it for you FAST. You may DEPEND on your Philco Parts distributor.

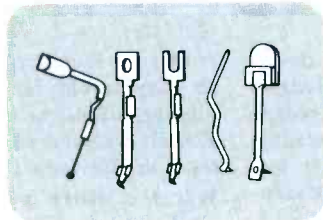
Customer Confidence Begins When You Use Genuine Philco Star Bright 20/20 Picture Tubes

Every CR Tube you replace represents a high-dollar service sale for you . . . and your customer. Play it safe with a brand that's known for Quality . . . PHILCO. All material and parts used in the manufacture of Philco Star Bright 20/20 Picture Tubes are new except for the envelope, which prior to reuse, has been inspected and tested to the same standards as new envelopes.

ON YOUR PHILCO DISTRIBUTOR FOR ALL YOUR PARTS AND ACCESSORIES



M62A 4-speed Record Changer
Intermixes all size records. Lightweight tone arm with retractable scratch protection assembly and famous Euphonics U8 cartridge. Changer ideal for built-in installations or "modernizing" record playing equipment. Template and instructions included.



Philco Phono Needles
A complete selection of types and numbers for Philco and most all other makes. Carefully made, attractively-packaged. ALL TIP TYPES and sizes, including Diamond. Special now available—"THE BIG 18 KIT." This attractive compact metal case contains 18 of the industry's fastest selling needles.

Your Philco Distributor Features These Famous Makes

PHILCO • PHILCO-Bendix • CROSLEY • EVEREADY Batteries and Flashlights • CAROL Cables • GOODRICH V-Belts • GC Products • AUDIOTEX • WALSCO Products • COLORMAGIC Antennas • PRECISION Test Equipment • SPRAGUE Capacitors

Philco Parts are Available Through a nationwide network of Parts Distributors. Mail the Coupon Today for the Name of the One Nearest You.



PARTS AND SERVICE OPERATIONS
PHILCO
A SUBSIDIARY OF *Ford Motor Company*

Philco Parts & Service Operations
C & Tioga Streets, Phila. 34, Pa.

I am interested in receiving information about special Philco Parts offers, prices and facts. Please send me the name of the nearest Parts distributor.

Name _____

Address _____

City _____ Zone _____ State _____

UNIQUE

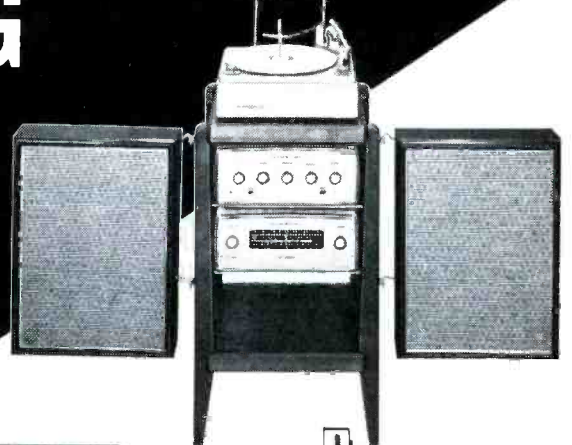


"COMPONENT SYSTEMS"

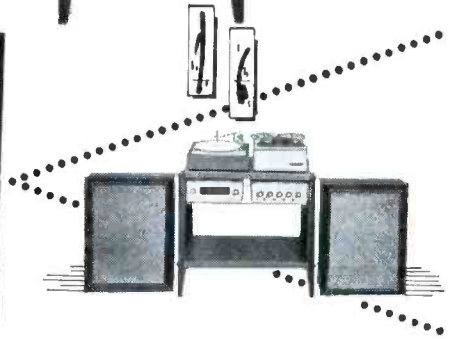
THE VOICE OF MUSIC
COMPATIBLE COMPONENTS

THE VOICE OF MUSIC
COMPATIBLE COMPONENTS

SELLING PLAN



THE VOICE OF MUSIC
COMPATIBLE COMPONENTS



NEW, "2-way" Component Selling Centers in Fine Furniture Designs . . .

1. Sell V·M Compatible Component Systems FIRST . . .
2. Then go home with the buyer as choice furniture!



V·M has produced a new, easy to understand, full-color booklet telling how to select a component music system. Be sure to see this invaluable merchandising aid and learn how it can play an important part in building your component business.

Just look at all V·M has done to make your components selling easier and more effective! First, we designed three separate component selling and demonstration centers with one characteristic in common: each was created specifically to sell *complete V·M compatible component systems* . . . most acceptable to your customer, most profitable for you. Then, we designed them for effective step-up selling to help every salesman do a better job, more easily.

Finally, we planned these centers so V·M identification can be removed in a jiffy, and they are ready to go home with the customer to help you complete the sale. We had them

built to a fine-furniture standard of quality so they would be welcome anywhere . . . quality walnut is used throughout. What a closer! No need to ever discount when you have selling tools like these.

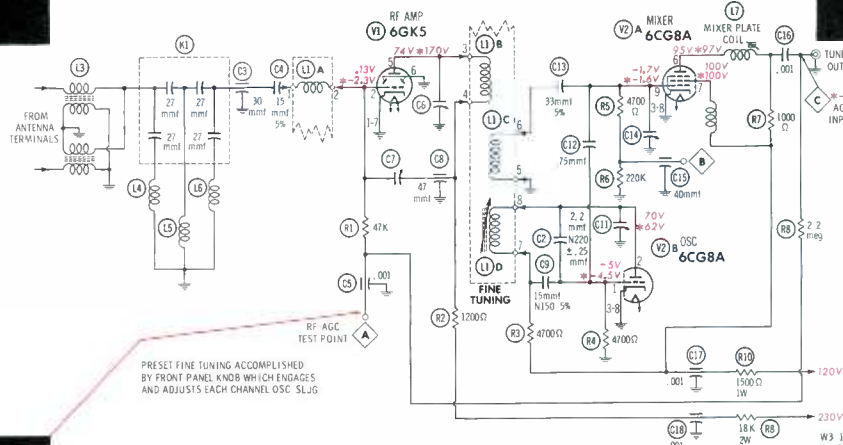
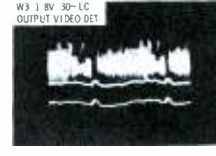
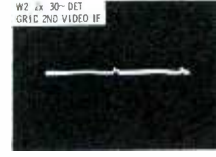
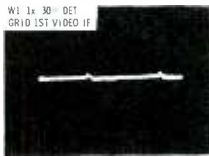
What's more you get the complete package of selling center and the components it contains for the price of the components alone! Fair enough?

Discover for yourself all the profit potential built into this unique "2-way" selling center plan . . . a telephone call is all it takes. And, we have two important new speaker systems to show you, too, designated Model 43 and Model 33. See them soon!





Frame-Grid RF



PRESET FINE TUNING ACCOMPLISHED BY FRONT PANEL KNOB WHICH ENGAGES AND ADJUSTS EACH CHANNEL OSC. SLUG

DC VOLTAGES taken with VTVM, on inactive channel; antenna terminals shorted. *Indicates voltages taken with signal present—see "Operating Variations."

WAVEFORMS taken with wideband scope; TV controls set for normal contrast. DET (detector), LC (low-cap), and DP (direct) probes are used where indicated.

Normal Operation

Turret tuner shown here (from Setchell-Carlson Chassis 400) features frame-grid 6GK5 as RF amplifier. Tube is special triode type with dual cathode leads and partial grid between control grid and plate; resulting lower capacitance makes neutralization easier. Higher gain and lower noise-to-signal ratio (compared with normal triode) make tube very suitable for use in front-end stage. Input from antenna is coupled by impedance-matching balun L3, LC network L4-L5-L6-K1, C4, and coil L1A to grid of V1. Tube is controlled, receiving AGC voltage through R1, R8, and tuner IF output jack; tuner AGC connection originates in grid circuit of first IF amplifier, which returns to AGC source. Plate circuit of V1 is tuned, as are grid circuit of V2A and oscillator tank, by coils contained in individual channel "strips." Output of V1 is coupled to grid circuit of V2A by L1B, L1C, and capacitor C13. Feedback to neutralize RF stage is via trimmer C7. 6CG8A is familiar tube type, functioning as mixer-oscillator. Triode section is oscillator, whose frequency of operation is determined by L1D. Tuner features preset fine tuning; slug in L1D is adjustable with front panel knob. Trimmer C11 in plate circuit of V2B is overall oscillator adjustment; if channels can't be tuned with L1D slug, C11 may need slight adjusting. Oscillator-signal injection to mixer grid is via C12. Plate circuits of V1 and V2 return to separate B+ supplies—RF amplifier via R2-R9; V2 mixer plate through R7-R10; V2 oscillator plate through L1D, R3, and R10.

Operating Variations

- PIN 2 V1** DC voltage is determined by strength of incoming signal and AGC action; ranges from .02 to -4.2 volts on channels in metropolitan area. Average is -2.3 volts.
- PIN 5 V1** Plate voltage with signal follows grid bias; ranges from 78 volts for weak signal to 200 volts for strong signal.
- PIN 1 V2** DC voltage at oscillator grid ranges from -4 to -5.4 volts depending on channel selected—more negative if strong.
- PIN 2 V2** Voltage here shifts from high of 70 volts to low of 62 volts—according to grid voltage. Oscillator bias is affected slightly by signal, as seen at pin 1.
- PINS 6-9 V2** Very little voltage change on mixer grid or plate, with or without signal; .1-volt change on grid, 2-volt on plate.
- WAVEFORMS** W1, W2, and W3 are signals taken throughout video IF strip. W1 and W2 are very small, but do indicate signal is passing tuner; notice vertical sync pulse is easily identified. Designation of 2x, etc., indicates waveform amplitude compared with normal 1x amplitude of W1. W4 is normal ripple on AGC line to tuner.

Snowy Picture

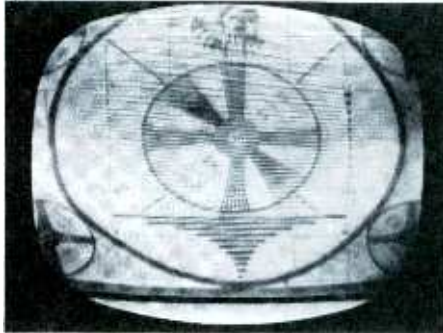
SYMPTOM 1

Unstable Sync

R2 Increased in Value

(RF Plate Supply Resistor—1200 ohms)

Symptom Analysis

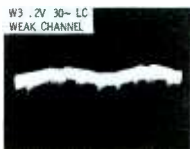


Strong stations produce snowy picture with vertical and horizontal pulling; fringe-area stations are missing. Clamping AGC helps, but only on some channels—misleading unless all local stations are checked. Snow and missing channels hint strongly at tuner trouble.

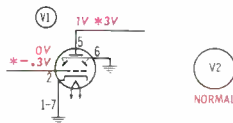


Waveform Analysis

Video-detector output has almost normal amplitude on strong channel, but notice unwanted *hash* overriding sync pulse. On fringe channel, only noise is visible in W3; amplitude is normally at least 1 volt. W3, taken with AGC clamped at Point A, is nearly normal, but slight snow is still noticeable on screen. AGC is probably okay—clamping didn't completely cure problem. Analysis thus confirms tuner trouble.



Voltage and Component Analysis



Conclusive voltage clue is only 1 to 3 volts on RF amplifier plate, with or without signal. Normally, operating voltage here varies widely as AGC voltage responds to strength changes in received signal. For this reason, it's best to check voltage under no-signal conditions when troubleshooting this type of circuit. With V1 dead, weak stations are lost; strong signals are merely coupled through RF tube to mixer, producing snowy picture. Shorted V1 may cause R2 (and/or R9) to be damaged. Faulty C8 or C18 could cause similar failures.

Best Bet: VTVM will find this trouble.

Heavy Snow

All Channels Affected

L3 Open

(Antenna Coils—Balun)

SYMPTOM 2

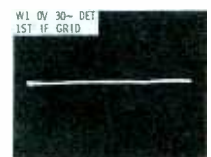
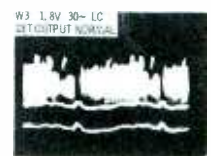
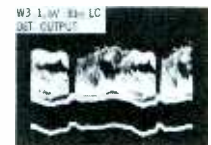
Symptom Analysis



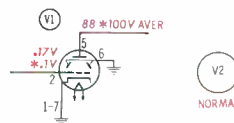
Snow on all channels in local area indicates RF amplifier is weak. Weak stations can sometimes be received, but much snow is present. Contrast control is operative. Clamping AGC doesn't cure problem. Symptoms are typical of defective antenna or RF stage.

Waveform Analysis

With this symptom present, waveforms offer only vague clue to troubled area—but still a clue. With strong station, W3 at detector output has sufficient amplitude, but snow is visible. If trouble were in IF stage, acceptable waveform probably wouldn't appear here. Scoping for W1 at grid of first IF indicates signal isn't passing tuner. Combination of clues increases suspicion of defect somewhere in tuner.



Voltage and Component Analysis



Gleaning significant voltage clues from RF stage is quite difficult—unless normal value for individual channels is known. 88 volts on pin 5 without signal is within tolerance, as is 100 volts with signal. However, grid bias stays same, with or without signal. Clamping AGC shows symptom is not caused by improper DC conditions in grid circuit, therefore trouble must be in signal path prior to grid. Don't overlook antenna input circuit when trouble of this nature appears. Lightning discharge is most common cause of L3 damage.

Best Bet: Careful voltage analysis and visual inspection.

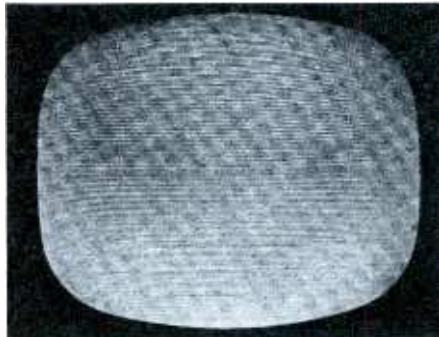
Loss of Some Channels

SYMPTOM 3

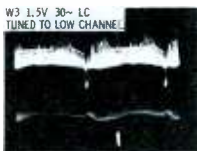
Sound Also Missing

R3 Increased in Value

(Oscillator Plate Supply Resistor—4700 ohms)

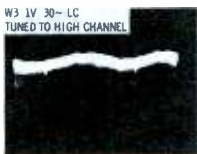


Picture may appear when tuned to strong local station, but snowy. Other local stations—especially highband ones—are missing or produce very faint picture. Sound is often missing or distorted. Clamping AGC doesn't help; symptoms are not eliminated.

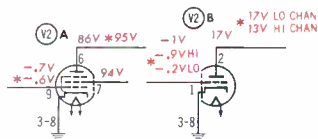


Waveform Analysis

With set tuned to low channel, W3 at detector output *does* contain some video information, but 1.5-volt signal is mainly noise; actual video portion is only .5 volt. Snowy picture appears on screen. On some high channels, W3 is mostly noise; video is only .1 volt. Lack of readable waveform at grid of first IF (W1)—even on strong local channel—indicates trouble due to malfunction prior to this point.



Voltage and Component Analysis



When reception varies between channels, most logical source of trouble is tuner—especially oscillator. Voltages in mixer stage (V2A) are within tolerance. Good clue is reduced plate voltage on oscillator plate (V2B); normal 60 to 70 volts is down to approximately 17 volts—with or without signal. Poor oscillation results in change of grid voltage from -5 to -1 volt. Weak injection to mixer stage causes poor signal to reach IF; result is snow. High channels are lost when value of R3 increases to approximately 70K.

Best Bet: VTVM for voltage and resistance measurements.

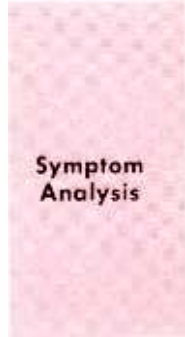
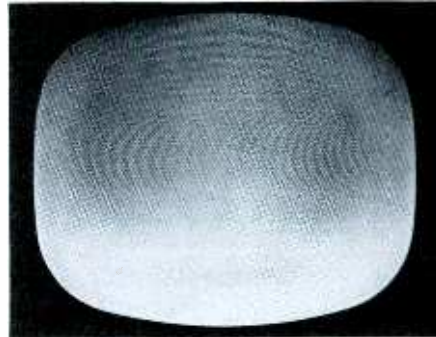
No Video, No Audio

No Snow in Raster

L7 Open

(Mixer Plate Coil)

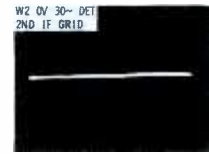
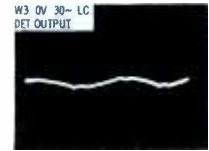
SYMPTOM 4



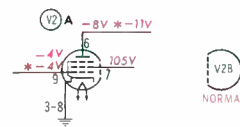
Screen is blank on all active and inactive channels. Only sound heard from speaker is familiar background noise. Clamping AGC line doesn't help. Symptom is typical of failure of mixer-oscillator stage. Trouble could also be in some IF stage, or video detector stage.

Waveform Analysis

Scope checks help clear IF and video stages of suspicion. Looking for W3 suggests that stages following video detector are okay—no video signal is present. Missing W2 and W1, at second and first IF grids, offer more positive indication that trouble *is* in tuner. When symptoms hint trouble could be in tuner or IF strip, this sequence of scope checks helps tag defective area more quickly than do VTVM checks.



Voltage and Component Analysis



Visual and scope analyses lead immediately to voltage checks directly in tuner. Most logical stage to check is mixer-oscillator—it's already under suspicion. Biggest clue, giving definite isolation of defective stage, is negative voltage on plate of V2A; B+ supply to plate is entirely missing. Voltage check on supply side of plate coil (or on screen grid) pinpoints open path; 105 volts here is close to full supply value. Signal path from mixer to IF stages is also open, and noise can't pass; thus raster is free of snow.

Best Bet: Scope helps, but VTVM gives answer.

Weak Video

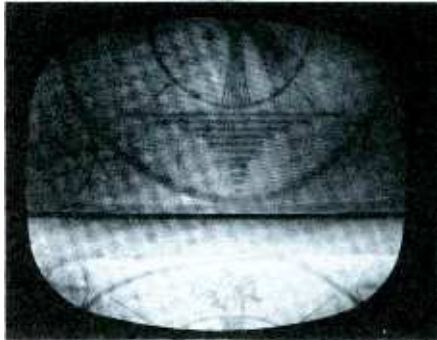
SYMPTOM 5

Critical Sync

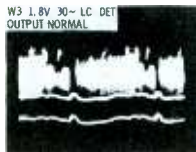
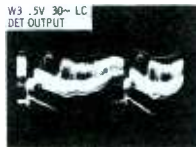
R7 Increased in Value

(Mixer Plate Supply Resistor—1000 ohms)

Symptom Analysis



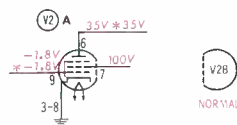
Picture is washed out on all channels in local area; both vertical and horizontal sync are very touchy. Sound is normal. Symptoms normally indicate trouble in IF stage or video amplifier; contrast control is operative—a hint video amplifier may be okay.



Waveform Analysis

Suspicion of video amplifier or IF circuits diminishes with check of W3. Overall amplitude is down over 50% (only .5 volt), accounting for weak picture; wave-shape explains critical sync problem—sync pulses are compressed and slight hum modulation is present. W2 offers clue of trouble in some previous stage; waveform contains small amount of video, and sync tip is visible. Scope saves search in video amplifier.

Voltage and Component Analysis



Checks must be made in IF stages to be sure of defective tuner. Voltage checks quickly clear IF's. No snow is present (RF amplifier probably okay), so attention focuses on V2. Low plate voltage on V2A is conclusive proof of failure in mixer section—measurement shows only 35 volts, with or without signal, instead of the normal 95 volts. Normal voltage on screen pin-points R7 as most likely culprit. With low plate voltage, mixer introduces great loss instead of normal slight gain. Result is weak video on screen.

Best Bet: Scope and VTVM to pin trouble to tuner.

Insufficient Fine Tuning

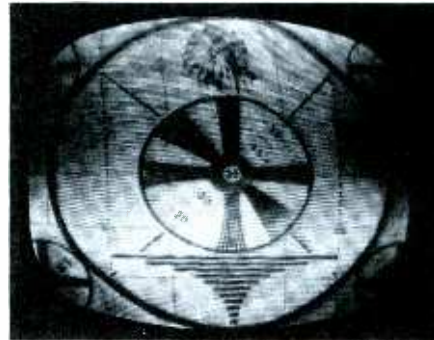
Some Stations Okay

SYMPTOM 6

C9 Changed Value

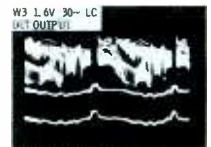
(Oscillator Feedback Capacitor—15 mmf)

Symptom Analysis



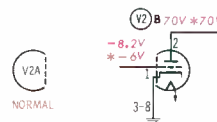
Some channels can be received by readjusting individual oscillator slugs with preset fine tuning; on others, only snow is present; sound may be missing or distorted. First thought is to replace V2, but symptoms remain. Adjustment of overall trimmer (C11) may help.

Waveform Analysis



Actually, waveform checks aren't much help in isolating trouble. On some stations, picture is okay but sound is missing. In some rare instances, sound may not be picked up from any station. Checks in sound section may seem in order. With best picture tuned in, scope for signal at grid of sound IF stage. If signal is present, trouble may be in sound section; if not, defect is likely in some stage before sound takeoff.

Voltage and Component Analysis



First logical step, following clues in Symptom Analysis, is voltage checks in oscillator circuit. Slightly abnormal grid voltage should attract attention; normal no-signal value of -5 volts has increased to -8.2 volts. Plate voltage remains near normal at 70 volts. Component substitution may be necessary to be sure C9 is bad. Capacitance change in C9 upsets frequency of oscillator; fine-tuning range is not sufficient to return frequency to normal. When frequency shift causes sound carrier to fall outside IF passband, loss of sound results.

Best Bet: Careful symptom analysis and then VTVM.

Delco Radio

TRANSISTOR REPLACEMENT CHART

United Delco

Small Inventory

DELCO SERVICE "DS" TRANSISTORS WILL REPLACE VIRTUALLY EVERY TRANSISTOR NEEDED FOR NEARLY ALL RADIO REPAIRS

Broad Coverage

DELCO TYPE	APPLICATION	BASE DIAGRAM	TYPES TO BE REPLACED											
DS25 R.F.—I.F. AMPLIFIER CONVERTER	MAXIMUM RATINGS AT 25°C		7N111	7N485	7N538	7SA101A	7SA201	AF114	C7560	8B2222	7109	810036-1	121-206	
	PNP V _{CB} 32V V _{CE} 32V I _C 5 MA I _B 1 MA GAIN 29-34 DB POWER 80 MW		7N112	7N486	7N539	7SA102	7SA211	AF115	C7560	8B2223	7110	810036-2	121-207	
DS26 AUDIO AMPLIFIER		PNP V _{CB} 32V V _{CE} 15V I _C 20 MA I _B 1 MA GAIN 28-34 DB POWER 250 MW		7N113	7N487	7N540	7SA103	7SA212	AF116	C7561	8B2224	7111	810037-1	
	7N114			7N488	7N541	7SA104	7SA213	AF117	C7562	8B2225	7112	810037-2		
DS34 R.F.—I.F. AMPLIFIER	V _{CB} 32V V _{CE} 32V I _C 9 MA I _B 3 MA GAIN MIN. 28.5 DB POWER 80 MW		7N175	7N177	7SA216	61839	121-222	709418-1	AF114	DS 37	DS 38	8626	9N25	
	DS41 FM—R.F.		V _{CB} 20V V _{CE} 20V I _C 10 MA I _B 1 MA GAIN MIN. 12.5 DB POWER 80 MW	7N209	7SA225	121-228	177-229	709417-1	709417-2	709417-3	AF114	AF115	DS-42	1-2179
DS44 A.F. AMPLIFIER	V _{CB} 32V V _{CE} 32V I _C 10 MA I _B 1 MA GAIN 40 DB POWER 200 MW		7N94	7N304	7N1099	7N1251	7S264	7S268	96113	709409-1	62785	8623	959202	
	DS46 AUDIO DRIVER		V _{CB} 16V V _{CE} 16V I _C 100 MA GAIN 41 DB POWER 200 MW	7N183	7N738A	7N305	7N1261	7S265	7S269	96112	709409-2	62786	8624	959201
DS520 POWER AUDIO OUTPUT	PNP V _{CB} 40V V _{CE} 20V I _C 5 A I _B 1 A GAIN 25.34 DB POWER 60 WATTS		7N201B	7N173	7N2260	7N267	7N285	7N308	7N1369	7N1245	CT1124	5F801-1	8F804	
	DS501 HIGH POWER AUDIO OUTPUT		PNP V _{CB} 50V V _{CE} 30V I _C 1.5 A I _B 0.2 A GAIN 28.32 DB POWER 80 WATTS	7N176	7N226	7N268	7N309	7N312	7N313	7N314	7N315	7N316	7N317	7N318
DS503 POWER AUDIO OUTPUT	PNP V _{CB} 60V V _{CE} 30V I _C 5 A I _B 1 A GAIN 30.84 DB POWER 80 WATTS		7N178	7N228	7N268A	7N310	7N311	7N312	7N313	7N314	7N315	7N316	7N317	
			7N179	7N229	7N269	7N311	7N312	7N313	7N314	7N315	7N316	7N317	7N318	7N319

MC102 GENERAL MOTORS CORPORATION 1964

LITHO IN U.S.A.

FREE

This is United Delco's new transistor replacement wall chart. □ It lists hundreds of transistors that Delco's compact line will replace (as you can see, that pretty well wraps up the field).

It also features specifications for many other applications. It's easy to read (11" x 17"), and it's yours for the asking. □ Just let us know you want one.

Delco Radio automotive radio service parts are distributed nationally through **United Delco**

simply say Delco

United Delco

DELCO RADIO • Division of General Motors • Kokomo, Indiana

Circle 14 on literature card

www.americanradiohistory.com

Servicing

Master Antenna

A study of distribution-equipment troubles and how to solve them . . . by Jack Beaver

Servicing TV master antenna (MATV) systems can be a profitable sideline for TV-shop owners. Every technician should have a working knowledge of these systems, if for no other reason than to keep peace between those who service systems and those who service sets. No viewer is more infuriated than one who is told by his set repairman that the master antenna is bad and then is told by the system technician that his set is bad. In these all-too-common cases both technicians lose time and money, and the set owner loses his temper.

How They Work

No one can properly service a system without understanding the theory of its operation. It is necessary, therefore, that we first discuss the basics of MATV systems. Fig. 1 is a block diagram of a typical system that consists of antennas to obtain optimum signals for each channel in use and amplifiers to increase the amplitudes of those signals to overcome system losses.

The theory is simple and is best understood by taking the "view-point" of a television set on the system. A set looking toward the antenna from the end of the longest leg of the system "sees" the greatest loss. If the total loss is less than the system gain, the TV set receives a stronger signal than the antenna delivers to the amplifier. If the loss is greater than the gain, the set receives less signal than the antenna delivers to the amplifier. Sets connected to the system near the head end receive an adequate signal if the last set on the system does, since they are connected to points on the cable where higher signal levels exist.

The foregoing can be easily understood by making a short analysis

Table 1

Line losses per 100'	
(RG-59/U at channel 13)	6 db
4-way splitter loss per leg	6 db
2-way splitter loss per leg	3 db
Typical tap-off unit isolation loss	20 db
Typical tap-off unit insertion loss	.25 db

of the system shown in Fig. 1. Some typical essential figures are listed in Table 1. Assume leg A (Fig. 1) is 200' long. A set connected to the last tap sees a total loss of 40 db: an isolation loss of 20 db, a total insertion loss from 8 taps of 2 db, a loss of 12 db from 200' of cable, and a splitter loss of 6 db. Leg B, with the same number of taps as A but only 150' of cable, has a lower loss. Leg C is a special case with a 350' run of cable to a reamplifier. Legs D1 and D2 have more loss (43 db) than leg A because the two-way splitter adds 3 db of additional loss in each leg. Therefore, D1 and D2 are the longest legs of the system, electrically speaking.

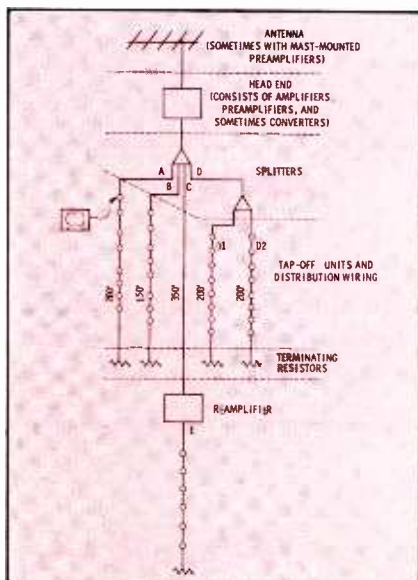


Fig. 1. Typical MATV system block diagram.

It is apparent, then, that the amplifier at the head end must have a gain of at least 43 db to supply the last set on D1 or D2 with a signal equal to that at the head-end input. This requirement is usually important only when input signal levels are low. If the head end received 20,000 uv, for example, this would be far more signal than that needed for a single set, and less than 43 db of gain would be required. However, signals should always be in excess of 1000 uv, visual carrier level, at the antenna terminals of each set. In electrically noisy areas, higher-level signals may be required at the set to increase the signal-to-noise ratio.

Servicing

With this background, we can take up the servicing of MATV systems. Equipment and information necessary (beyond that usually found on the bench) include a VHF field-strength meter and the technical data on amplifiers and taps used in the system. These aids allow practically all repairs to be performed easily. However, a warning is in order: Do not attempt to realign broadband or strip-type (single-channel) VHF amplifiers without the manufacturer's specifications and instructions and the proper sweep equipment. These amplifiers are more difficult to align than TV IF amplifiers. If some "screw-driver mechanic" has disturbed the adjustments, a complete realignment may be necessary; the best procedure in this case is to have the amplifier manufacturer perform the realignment.

Various system faults and their causes and cures are listed below. Each of the faults produces characteristic symptoms that can be observed on the receivers.

Systems

Vertical or Horizontal Instability

When a significant number of sets (10% or more) show vertical instability or horizontal jitter, the system is probably clipping sync pulses. Clipping occurs when an amplifier is driven beyond its rated output, and, since the sync pulses have the highest signal level, they are affected first. This clipping causes instability of both the vertical and the horizontal synchronizing circuits.

The usual cure is to reduce the amplifier output below the level of clipping. Set the amplifier to its rated output. (Some amplifiers have no gain controls. In this case the output can be reduced by using an attenuator in the input lead.) If this does not cure the problem, it is possible that the output tubes are low in emission and thus clipping at lower levels than normal. Try tube substitution, but replace the original tube if it is not the source of trouble. If these steps fail, the problem is probably due to misalignment or component failure.

Sound Bars on All Sets

This fault is more likely to occur in systems using ganged single-channel amplifiers than in those using broadband amplifiers. The cause is intermodulation of the television signal. When a "strip" head end is overdriven, the sound carrier may be clipped. When clipping occurs, the aural carrier modulates the visual carrier, and sound bars appear. This fault is usually accompanied by sync compression, and the cures are the same as those for sync compression.

"Windshield-Wiper" Interference

In this type of interference, black vertical and horizontal bands move across the screen of the receiver. Occasionally, the bands will frame a ghostly picture. This fault usually occurs when one station in a VHF

band overdrives the amplifiers; intermodulation distortion then causes the blanking intervals of one station to be superimposed on the image of another.

Generally, one station will be viewable, and the others will have "windshield wipers." The offending signal is the *unaffected* one, which is overdriving a broadband amplifier. The remedy is to reduce the signal level of the offending channel without lowering the levels of the others significantly. When individual antennas are used, the process is usually simple; merely insert an appropriate attenuator in the antenna down-lead. However, it may be necessary to pass signals on other channels in the same band through bandpass filters to prevent large amounts of the interfering signal from entering the amplifier through other antennas.

When broadband, all-channel antennas are used, the problem is more difficult. Special networks must be used to separate the signals, set their individual levels, and recombine them. Fig. 2 is a block diagram of an equalization system designed for a seven-channel area. Low- and high-channel signals are separated in the low-high splitter-mixer, and the low-channel signals are separated by a backward-connected antenna mixing network. The channel-4 signal level is then attenuated to match that of channels 2 and 5, and the three outputs are remixed in a second network. Low- and high-channel signals are recombined in the low-high splitter-mixer and fed into the system amplifier. Both high- and low-

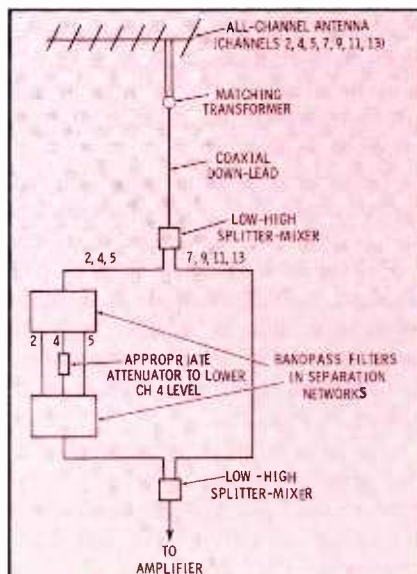


Fig. 2. All-channel equalizer block diagram.

channel mixers are available, so that all signals may be equalized by attenuating the stronger ones to the level of the weakest one.

Snow, Thermal Noise

When a complaint of snowy pictures is received, it is important to know whether all sets on the system are so affected and whether the pictures are snowy on all channels. The troubles differ according to the symptoms.

When such pictures are observed on all channels on all sets, the symptom usually results from insufficient signal input to the amplifier or amplifiers. Typical faults are open antenna leads, collapsed antennas, slewed antennas, and defective tubes in the low-level amplifier stages. Coaxial-connector center pins sometimes fail to make contact due to corrosion or weakened springs.

If the trouble occurs on only a few channels but on *all* sets, the trouble is in one set of strip amplifiers or the antenna or preamplifier feeding this strip. Such faults are quickly located by measuring signal strengths at the outputs of various components.

When receivers in only certain portions of the system have snowy pictures, the problem can be complex. It is necessary to see if these portions of the system are all at the ends of long cable runs. If, for example, a system has two short runs and two long runs and the last few receivers on each of the long runs have snowy pictures, a logical assumption is that the head-end amplifiers lack sufficient gain to overcome line losses. This could be caused by reduced gain due to tube aging. In some cases, attenuators may be removed or gain controls increased to provide sufficient signal. When these measures do not succeed in rectifying the trouble, the possibility of using tap-off units with lower insertion losses or lower isolation figures should be checked. These may deliver more signal to the receivers, thus overcoming the snow problem.

Broken or shorted cables can be another cause of trouble. Cables not run in conduit are sometimes shorted by nails driven into the walls or by over-ambitious customers prying into the tap-off units. When this happens, two symptoms will be noted.

• Please turn to page 70

Boosting and Distributing



Modern equipment solves many former difficulties by Leo G. Sands

Now that all new TV sets must be equipped for both VHF and UHF channels, there will be more TV stations on the air in the UHF band. This means that VHF-TV signal-distribution systems and CATV installations now in use may become obsolete or may have to be modified to handle UHF.

Antenna Coupling

A single all-channel antenna can be used for VHF- and UHF-band reception when all desired stations are in the same direction. When only one TV set is to be served and the TV set has separate VHF and UHF antenna terminals, the resistive diplexer shown in Fig. 1A can be used; two TV sets can be served by the same antenna if each has only one pair of antenna terminals. To serve two TV sets which have

separate VHF and UHF antenna terminals, a VHF-UHF mixer-splitter network may be used at each set as shown in Fig. 2A.

To serve two or more TV sets, the resistive distribution system shown in Fig. 1B can be used. With four taps, as shown in the diagram, four TV or FM sets, each with a single pair of antenna terminals, can be served by the same antenna; or two VHF-UHF sets with two pairs of antenna terminals each can be served. The values of resistors R1, R2, and R3 depend on the number of sets to be served; appropriate values are shown in Table 1. The resistors are not critical in value and may be standard, readily available non-inductive carbon resistors of any power rating ($\frac{1}{2}$ watt will do).

The two resistive distributors in Fig. 1 will operate at any frequency from DC to 1000 mc. The signal fed to each TV or FM set is less than that available at the end of the antenna lead-in since the total signal power is distributed among the receivers. Additional power is lost in the distributor and the lead-in due to mismatch at the antenna and the receiver inputs.

Separate antennas may be required when the VHF stations are in a different direction than the UHF stations or when higher UHF antenna gain is required. A resistive signal-distribution system may be used if a UHF-VHF mixer-splitter is installed near the antennas as shown in Fig. 2B.

Antenna couplers employing coils are generally more efficient than resistive types but are not satisfactory for reception on all VHF and UHF channels. Fig. 3A shows a typical two-set coupler which covers VHF

channels 2 through 13. The insertion loss is only 3 db, whereas the loss of the resistive coupler shown in Fig. 1 is 6 db. The insertion loss of the four-set coupler shown schematically in Fig. 3B is 6.5 db. This coupler also covers all VHF channels.

While it is important in low-signal areas to have low insertion losses, it is also important to have a high degree of isolation between sets. Otherwise, the local oscillator of each receiver may cause interference to other receivers tuned to different channels. The resistive couplers shown in Fig. 1 provide about 12 db of isolation, whereas the more complex coupler shown in Fig. 3B provides 26 db of isolation in the 54-108

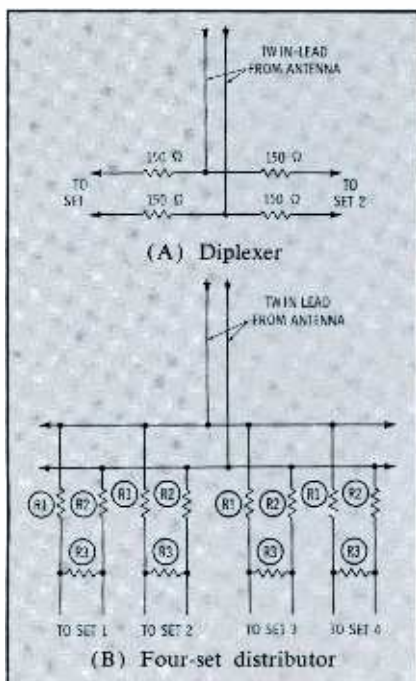


Fig. 1. Resistive antenna distributing networks suitable for use on VHF-TV, UHF-TV, or FM.

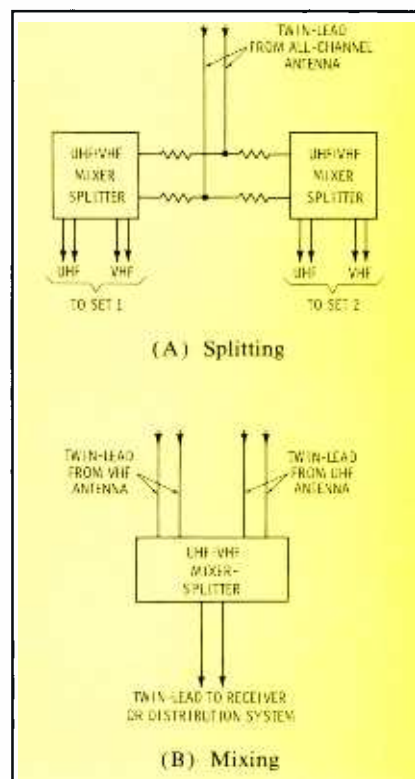


Fig. 2. UHF-VHF mixer-splitter applications.

Signals

mc range and 14 db in the 174-216 mc range.

Amplifiers

Since each set consumes its proportionate share of the available signal, it may be necessary to boost the signal level by installing amplifiers. The number and types of amplifiers required depend on local conditions and the number of receivers to be served.

An amplifier may be used at the antenna, to boost the signal before it is fed into the transmission line, or at the feed point of the distribution system. In some cases amplifiers are used at both places, particularly if the antenna transmission line is long.

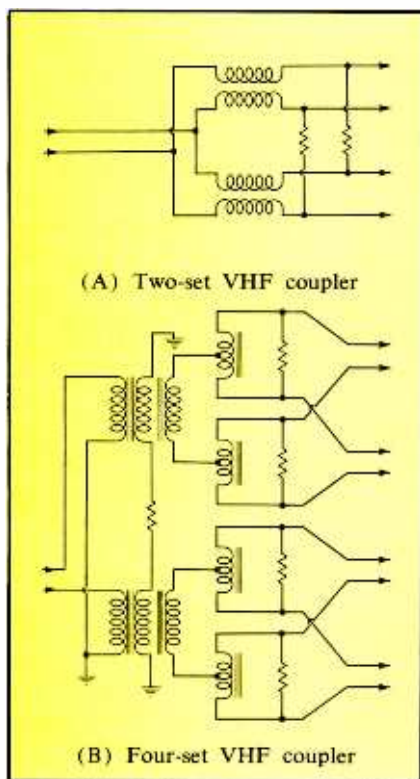


Fig. 3. Circuits of coil-type antenna couplers.

Separate amplifiers are required for boosting VHF and UHF signals. There are units available which provide as much as 25 db of gain on all VHF channels. Higher gain can be provided by single-channel amplifiers. A typical single-channel amplifier provides 46 db of gain on channel 2, 3, 4, 5, or 6; 38 db on channel 7, 8, 9, or 10; and 35 db on channel 11, 12, or 13.

While it is practical to build a broadband amplifier to cover all VHF channels (a span of 162 mc), it is difficult to build a low-cost amplifier to cover the 420-mc spread of UHF channels 14 through 83. As a consequence, UHF amplifiers generally boost only one channel or a narrow block of channels within the UHF band. Typically, such amplifiers provide a gain of 14 db and cover channels 14-24, 25-40, 41-55, 56-69, or 70-83.

Distribution Systems

Since there are so many amplifiers, couplers, mixers, splitters, and other distribution hardware items available, it is possible to design systems to meet almost any situation. The basic requirement is that the TV signals must be sufficiently above the ambient noise level to permit amplification. If the signal at the antenna is buried in noise, both the signal and the noise will, of course, be boosted by amplifiers. The signal-to-noise ratio can be improved by using a better or higher antenna.

Transmission losses of UHF-band signals (through the air, the antenna transmission line, and the signal-distribution system) are higher than those of VHF signals and increase as the frequency increases. However, higher antenna gain can be obtained for optimum performance on a single channel or a narrow portion of the band.

Coaxial cable is often used in lieu of twin-lead for distributing TV signals and may also be used as the antenna transmission line. Generally, 75-ohm coax is used. In systems using coax, all distribution hardware must accommodate coaxial fittings and operate at 75 ohms impedance. When connecting coax to any 300-ohm circuit (including the antenna), it is necessary to employ transformers which match a 300-ohm balanced circuit to a 75-

Table 1

Sets or Inputs	R1 (ohms)	R2 (ohms)	R3 (ohms)
2	220	220	390
3	390	390	390
4	470	470	330
5	620	620	330
6	750	750	330
7	1000	1000	330
8	1100	1100	330
9	1200	1200	330
10	1300	1300	330
11	1500	1500	330
12	1600	1600	330

ohm unbalanced circuit (one side grounded). It is usually necessary to use different transformers for each of the bands.

In motels, hotels, schools, and other places already equipped with VHF television receivers, reception of UHF channels can be provided by installing a UHF-to-VHF converter for each available UHF channel. In the VHF-UHF antenna system illustrated in Fig. 4, VHF-channel information only is fed to the TV receivers. Incoming VHF signals are fed from the antenna to an impedance-matching transformer, then to the mixer, and finally, without conversion, to the signal distribution system. For UHF reception, however, a fixed-tuned UHF-to-VHF converter is used for each channel. Each converter output is tuned to a different vacant VHF channel. Converter outputs are then mixed with the direct VHF signals and fed into the distribution system.

A typical mixer will accommodate up to four low-band VHF inputs and three high-band VHF inputs. It equalizes the input signals so that all channels fed to the receivers will be at approximately the same level.

• Please turn to page 69

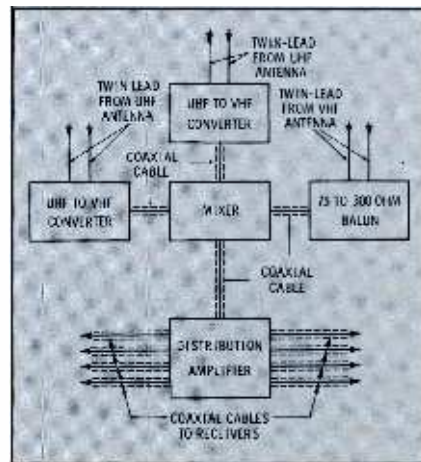
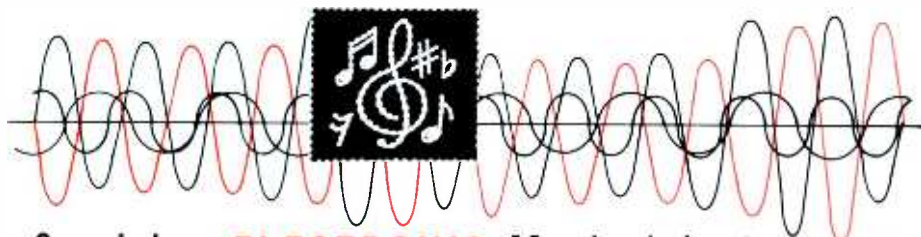


Fig. 4. A system for distribution of signals from VHF and UHF stations to VHF receivers.



Servicing **ELECTRONIC** Musical Instruments

by Norman Crowhurst

At some time in his career, the electronic serviceman is likely to be called upon to service an electric guitar, accordion, etc., or he may even be asked to install the electronic parts of such an instrument. He should encounter no great difficulty, however, if he is familiar with the practical aspects of dealing with such instruments.

How Instruments Work

To be acceptable, electronic musical instruments must make recognizable musical sounds. Therefore, the first step toward understanding these instruments is a knowledge of how nonelectronic ones produce their characteristic sounds.

Stringed Instruments

Stringed instruments have one or more stretched strings or wires which are struck, plucked, or bowed to produce vibrations. However, a string stretched between two rigid supports will not produce a loud sound, no matter how strongly it vibrates. Nor is its sound distinguishable from that produced by another string of the same length, cross section, and composition. No, any stringed instrument needs something else besides stretched strings to produce its characteristic sound.

Resonance, both mechanical and acoustical, is the quality that gives a musical instrument much of its musical "color." Resonance is defined as the enriching of a musical tone by supplementing the vibration (in stringed instruments, of the

string). This supplementing is done by the soundboard in a piano, the wooden body of a guitar or violin, the smaller structure of a mandolin, and the drum-shaped body of a banjo.

Wind Instruments

An essential difference between wind and stringed instruments is that the former produce sound directly as an acoustic wave, whereas stringed instruments generate a mechanical vibration which is then converted into an acoustic wave.

Horns, trumpets, and trombones are all basically pipes with one end flared out to radiate the acoustic vibrations. The vibration of air in the pipe consists of three parts that produce the ultimate sound:

1. A steady flow of air through the instrument.
2. A fundamental note, due to a resonant vibration of the air, determined mainly by the length of the pipe.
3. Other frequencies, in addition to the fundamental, determined by the diameter and composition (brass or wood) of the pipe.

In a reed organ or an accordion, the tones are generated by reeds instead of pipes. The reeds used in some wind instruments (such as the oboe) are not resonant. Instead,

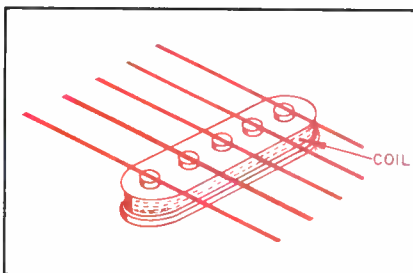


Fig. 1. Steel-string pickup with multiple pole pieces permits best pickup from each string.

the dimensions of the pipe determine the note played; the reed merely vibrates in sympathy with the acoustic vibration in the pipe. In the accordion and the reed organ, however, the reeds are resonant—they will vibrate only at their natural frequencies.

The sound of a reed instrument can be modified by the shape of the sound box. Some of the better accordions are capable of considerable expression (volume expansion) when shutters are used on the sound box or chest.

Transducers

Some sort of transducer must be employed to couple the sound from the instrument to the amplifier. Microphones and pickups serve this purpose. Speakers (which are also transducers) then convert the amplified electronic signals into sound.

Microphones

Most microphones used with musical instruments are quite simple in design, utilizing either magnetic or crystal (ceramic) elements. Usually, the microphone case is sealed on one side of the diaphragm or has only a small hole to equalize atmospheric pressure. This makes the microphone sensitive to variations in outside sound pressure, but not to the direction or distance from which the sounds come.

The commonest microphone has a ceramic element, which is inexpensive, provides a high output, and does not pick up hum. The lead connecting the element to the amplifier input is shielded to keep it from picking up hum. If tone and volume controls are desired, the high capacitive impedance of a ceramic element is a disadvantage, however.

The electrical output of a magnetic microphone is provided by a steel diaphragm which, as it is moved by air waves, fluctuates the magnetic field through a fixed coil. This type of microphone is more suitable for use with conventional tone-control circuits than the ceramic type, which is often used if only a volume control will suffice.

Pickups

The choice of pickup depends on the kind of vibration and the manner in which it is to be picked up. Magnetic pickups may be used on instruments with steel strings. The

Material for this article was adapted from the Howard W. Sams book "Electronic Musical Instrument Handbook" by Norman H. Crowhurst.

disadvantage of this method is that the output represents the movement of the string at only one point, not its total movement. Thus, some of the overtones may be lost. However, use of more than one pickup can remedy this deficiency.

The simplest pickups are arranged so that all strings are in the field of one magnet and coil assembly. Better pickups, which enable closer adjustment of output from different strings, employ a separate pole piece for each string and a single coil encircling all pole pieces (Fig. 1).

Two types of pickups can be inserted into the bridges of stringed instruments. One is the ceramic, a readily installable stress-sensitive device (Fig. 2). It is particularly suited for the conventional, classical instrument, where the vibrations which the bridge transmits from the strings to the body must be reproduced.

For other instruments, it is desirable to modify the effect by introducing artificial resonances to the pickup mountings. These resonances will simulate the timbre effects of a classical instrument as closely as possible. A magnetic pickup can be coupled to the bridge in one of several ways (Fig. 3), according to the kind of sound required. There are two types of pickups in this group. The conventional type has a piece of magnetic material—either steel or iron—which moves in the field of a magnet. The more modern method is to do away with the fixed magnet by substituting a small magnet (usually ceramic) for the moving piece. The coil picks up the resulting magnetic-field fluctuations.

In an electronic piano, the pickup is usually electric (often called electrostatic). Its capacitance changes (like a variable capacitor's) as the string moves.

Speakers

Speakers used with musical instruments can contribute quite significantly to the tone coloration. A high-fidelity speaker may therefore be useless for a particular musical instrument. Moreover, a speaker may suit one instrument but be totally unsuited for another. Many of the speakers used in electronic musical instruments are made es-

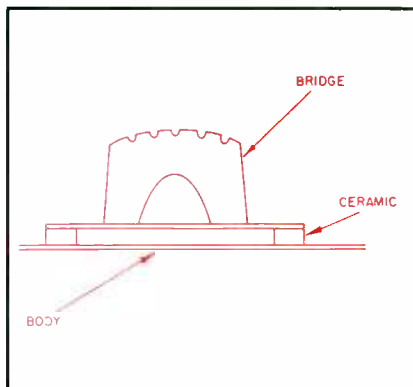


Fig. 2. Method of positioning ceramic pickup in bridge structure of a stringed instrument.

pecially for the purpose. A person experienced in high fidelity may think that his instrument should sound better with a high-fidelity speaker than with the one provided. But upon substituting a better speaker, he will find that the whole effect which the designer built into the instrument will be lost.

Installation Details

Different instruments can be fitted with appropriate microphones or pickups. Two points to consider in making any installation are:

1. Any structural work such as drilling holes or fitting brackets must not interfere with the playing of the instrument.
2. The sound relayed by the pickup or microphone must match the quality of the unamplified sound.

Other problems may demand your attention when you install the amplifier and speaker in their cabinet.

Mechanical Fitting

In stringed instruments whose bodies contribute to sound quality, be careful not to interfere with that quality when adding parts. Drilling a hole at a point where the body is under stress will weaken that point

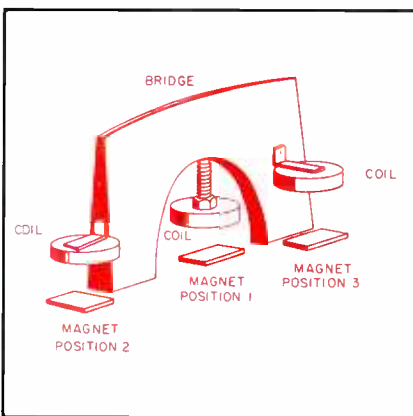


Fig. 3. Three possible placements for pickup on bridge of a stringed musical instrument.

and thereby destroy the whole vibrational quality of the instrument. Clamping a fitting to the body can likewise restrict or modify the natural vibration—either by restricting the movement of the body or by adding mass (weight) which the vibration is forced to carry.

The best form of mounting is a fixture of rubber or another compliant material. If possible, mount parts where vibrational nodes occur, in order to minimize both restriction and mass-loading effects (Fig. 4).

Leads should be taken through existing holes where possible, rather than boring new holes and weakening the structure. The only exception is straight posts or pegs under lengthwise stress; they can be bored lengthwise and the lead taken through them. This idea is the basis of the Ampeg patent for string bass; the microphone connection is brought out through the peg on which the instrument rests.

In reed instruments like the accordion, vibration of the frame does not contribute to the sound (although the contour may); the restriction on drilling does not apply here. However, be extremely careful not to drill through any vital component. For the same reason, the mounting positions must be carefully chosen.

Precise placement of microphone or pickup is usually very important to sound quality. It is the next step after a suitable mounting method has been found. With a string pickup, the lengthwise position and the proximity of the strings make a difference in quality. Of course, the closer the pickup is to the strings, the louder the volume is. But if you compensate for volume by adjusting the amplifier gain, the tone quality will change, too.

Where a microphone is used, the air-particle movement and pressure pattern are so complicated in and around any instrument that precise placement of the microphone can have a very dramatic effect on tone quality. Placement is something you will have to experiment with by ear until you find the spot where the amplified sound is most natural.

Don't forget the other variable—the way the microphone faces. The program output from a microphone is due to sound pressure at its front.

• Please turn to page 72

TV-RADIO SERVICE
 **tubes** 
YOUR NAME HERE

ETR 1290

TV-RADIO SERVICE

  **ELECTRONICS**

ETR 1566

ETR 1569

TV-RADIO SERVICE
 **tubes** 

TV-RADIO SERVICE
 

ETR 1565

TV-RADIO SERVICE


ETR 1568



ALL Radio-TV service clothing



ETR 3288

PATTERN-PERFECT PICTURE SERVICE?
GENERAL ELECTRIC
 Best Tubes For YOUR SET 

ETR 3287



ETR 1291

 **ELECTRONICS**

TV RADIO SERVICE



ETR 1564

TV-RADIO SERVICE
 **tubes** 
YOUR MESSAGE HERE

ETR 1556

G-E FIX-UP, DRESS-UP



Be "Best Dressed" at half the catalog price!

The better your shop looks, the better is the outlook for business. Customers prefer to do business at a shop that has a neat, "careful" look. It gives them confidence in your work. But time and use *can* and *do* affect appearance.

It may be just that time—when your outdoor signs are looking a bit under the weather, or perhaps you could use a display clock or thermometer to functionally dress up your shop. Need a new service hat or jacket?

For a limited time, General Electric is sponsoring a "Fix-up, Dress-up" campaign to make you, the dealer, "best dressed" at half price. Choose from over 25 items, including signs and display materials, clocks and thermometers, and a complete selection of wearing apparel—hats, shirts, pants, caps, jackets—ALL AT 1/2 THEIR CATALOG PRICE. All special-priced display and clothing items may be obtained on a cash basis by mail or directly from your distributor with the purchase of G-E tubes.

CHOOSE FROM THESE ITEMS:

ETR 1290	SIGN, outdoor, illum., 2 face, 24" x 48"	\$168.75	\$84.37
ETR 1566	SIGN, nameplate, outdoor, 2 face, 48" x 36"	27.00	13.50
ETR 1565	SIGN, flange, outdoor, 2 face, 15" x 12"	2.25	1.13
ETR 1564	SIGN, tack-on, outdoor, 14" x 42"	2.70	1.35
ETR 1556	SIGN, indoor, with changeable letter kit (37" x 14")	27.50	13.75
ETR 1291	CLOCK, indoor, illum., 16" dia.	14.95	7.48
ETR 1568	THERMOMETER, indoor/outdoor, 12" dia.	5.95	2.98
ETR 1569	BACKDROP, corrugated, 36" x 24" (2 per carton)	2.00	1.00
ETR 3288	TUBE CARTON, giant, 7 1/8" x 17 5/8"	.35	.18
ETR 3287	DECAL, 1 side, back stick, 16" x 12"	.25	.13

Catalog Price	Special Price
\$168.75	\$84.37
27.00	13.50
2.25	1.13
2.70	1.35
27.50	13.75
14.95	7.48
5.95	2.98
2.00	1.00
.35	.18
.25	.13

AND

You may use form ETR 1499B for ordering *any* radio-TV service clothing at half price. Obtain this form from your local distributor or complete and mail the coupon below. Please check the box requesting ETR 1499B.

**Send To: General Electric Co., Dept. B
3800 N. Milwaukee Ave.
Chicago, Illinois 60641**

Name _____

Address _____

City _____ Zone _____ State _____

I enclose \$_____ in check or money order for the following half-price items, including applicable local and/or state sales/use taxes:

- | | |
|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> ETR 1290 | <input type="checkbox"/> ETR 1291 |
| <input type="checkbox"/> ETR 1566 | <input type="checkbox"/> ETR 1568 |
| <input type="checkbox"/> ETR 1565 | <input type="checkbox"/> ETR 1569 |
| <input type="checkbox"/> ETR 1564 | <input type="checkbox"/> ETR 3288 |
| <input type="checkbox"/> ETR 1556 | <input type="checkbox"/> ETR 3287 |

Please send me service clothing order form ETR 1499B.

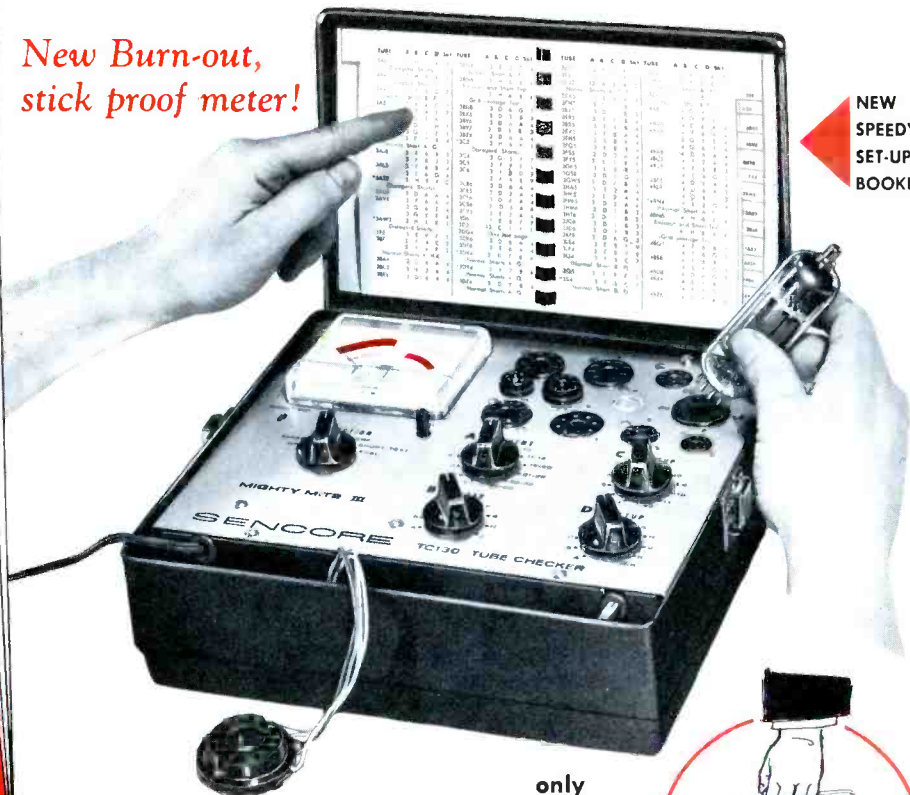
Progress Is Our Most Important Product

GENERAL  ELECTRIC

fast, accurate, never lets you down . . .

New Burn-out,
stick proof meter!

NEW
SPEEDY
SET-UP
BOOKLET



NEW

IMPROVED

**MIGHTY
MITE**

NEW

Lower voltage checks for Nuvistors and all new frame grid tubes, as demanded by tube manufacturers, but not found on other tube checkers.

NEW

Speedy indexed set-up cards to reduce "look-up" time. No more cumbersome booklets, or incomplete charts.

NEW

Simplified panel layout reduces set-up time — prevents set-up errors.

NEW

Streamline styling with rounded corners and rubber feet, prevents marring Furniture — presents that "Professional look".

only

NEW TC 130

\$7450

Checks them all . . .
including Novars, Compactrons,
Nuvistors, 10 pin tubes — plus
Picture Tubes!

Only 7 Lbs. . .
Smaller Than A Portable Typewriter

Here's the famous MIGHTY MITE, America's fastest selling tube checker, with an all-new look and many new exclusive features. MIGHTY MITE III brings you even greater portability, versatility and operating simplicity beyond comparison. Controls are set as fast and simply as A-B-C right from the speedy set-up cards in the cover. The new functional cover can be quickly removed and placed in a spot with more light for faster reading of the set-up data or "cradled" in the specially designed handle as a space saver as shown above. New unique design also prevents cover from shutting on fingers or cutting of line cords as in older models.

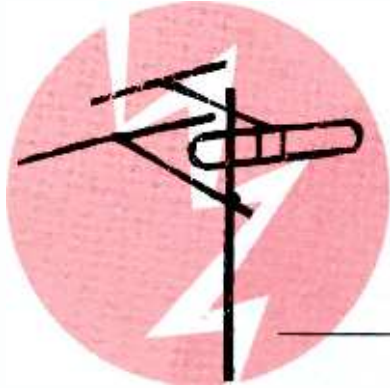
In a nut shell . . . the MIGHTY MITE III is so very popular because it checks for control grid contamination and gas just like the earlier "eye tube" gas checkers (100 megohm sensitivity) and then with a flick of a switch, checks the tube for inter-element shorts and cathode emission at full operating levels. Sencore calls this "the stethoscope approach" . . . as each element is checked individually to be sure that the tube is operating like new. User after user has helped coin the phrase "this checker won't lie to me". Most claim that it will outperform large mutual conductance testers costing hundreds of dollars more and is a real winner in finding those "tough dogs" in critical circuits such as color TV and FM stereo.

**See Your Parts Distributor -- And See
The Mighty Mite III For Yourself!**

SENCORE

"Quality at its finest"

426 SOUTH WESTGATE DRIVE
ADDISON, ILLINOIS



Antenna Systems can be **SAFE!**

Anyone can erect an antenna, but how many people realize the dangers that result from improper installation? Let's not restrict this question to the do-it-yourselfers; let's examine our own work and see if we know how to properly and safely install antennas.

National Electrical Code

Radio and television equipment installation is covered in Article 810 of the National Electrical Code (NEC). The Code, Pamphlet NFPA 70, is prepared and published by the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. The price of the 1962 edition is one dollar.

The NEC has been adopted, entirely or with modifications, by most state and local governments. Licensing, inspections, and fees have been adopted by most of these governmental units as means of enforcing the NEC. This Code is written with the help of all agencies connected with the electrical industry.

It is considered to be a minimum standard, and revisions are made periodically as experience shows them to be needed.

Compliance with Article 810 of the NEC has often been lax, but with the growing list of accidents, fatalities, and fires, strict adherence to the Code is fast becoming a necessity. Whether or not the provisions of Article 810 are enforced in your area, they can serve as excellent guide lines in the installation of antennas.

Equipment Approval

When purchasing equipment for antenna installations—lightning arresters, boosters, distribution equipment, etc.—be sure it is approved equipment. Each inspection authority adopts some method of approval. Most of them approve equipment tested and listed by Underwriters' Laboratories, Inc.; such equipment bears the UL label.

Conductor Separation

Among other things, Article 810 specifies minimum clearances between power lines and antenna lead-ins. The reason for these spacings is obvious: Every precaution must be taken to prevent antenna conductors from accidentally coming in contact with power conductors. Lead-in conductors attached to buildings must be so installed that they cannot swing closer than 2' to the conductors of circuits having 250 volts or less between conductors. In the case of circuits having not more than 150 volts between conductors, the clearance may be reduced to not less than 4" if all

conductors involved are supported so as to insure permanent separation. For circuits having more than 250 volts between conductors, the minimum distance is 10'.

The clearance between lead-in conductors and any conductor forming part of a lightning-rod system cannot be less than 6' unless the grounding electrodes for the antenna and the lightning-rod system are bonded together.

Lightning Arresters

The Code specifies that each conductor of the lead-in from an outdoor antenna must be protected by an approved lightning arrester, unless the lead-in is enclosed in a metallic shield such as conduit. In this case the lightning arrester may be attached to the shield instead of the conductors; if the shield is grounded, no arrester is necessary. The arresters should preferably be located outside the building, but they may be placed inside the building as near as possible to the point where the conductors enter.

Grounding Practices

One of the most important parts of Article 810 deals with grounding. It is required that masts and metal parts supporting antennas be permanently and effectively grounded without intervening splices or connections. A minimum of No. 10 copper or No. 8 aluminum wire is required for grounding.

When attaching ground wires, approved connectors should be used to assure a proper connection to the grounding electrode. There are approved clamps for attaching alumi-

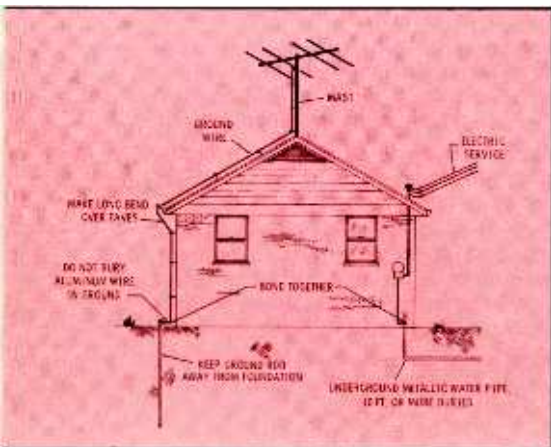


Fig. 1. Proper method for grounding antenna support structure when using grounding rod.

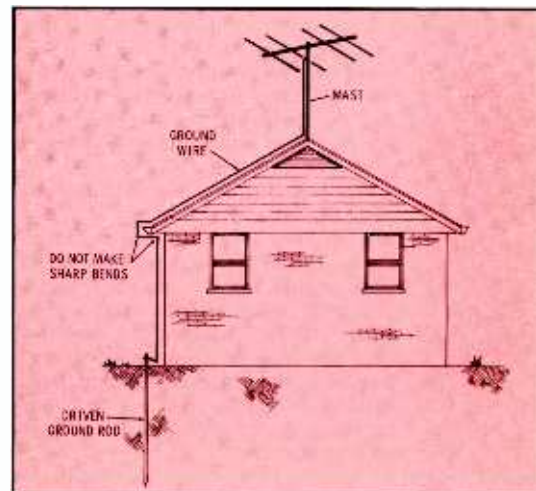


Fig. 2. An antenna installation in which proper grounding practice hasn't been used.

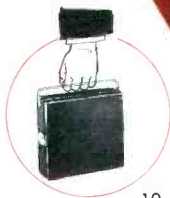
Qualify for the most profitable service business of all...



**FM
STEREO
SERVICE**

**with the all new Sencore
MX129 FM STEREO MULTIPLEX
GENERATOR AND ANALYZER**

\$169.50



19 TRANSISTORS
ALL CRYSTAL CONTROLLED
TRULY PORTABLE ONLY 7-1/2 LBS.

It has been established by all Radio and TV manufacturers that you must have a generator of this type to service FM stereo receivers. Here is a new field just waiting for qualified men, a field that is growing as fast as color TV. Multiplex is simple to service with this generator. If you can service an FM receiver, you can service multiplex once you have the MX129.

Look at the outstanding features of this all transistorized Sencore unit and you will see why it is the most versatile, most portable, most trouble free unit on the market. It is just like having your own FM stereo transmitter on your bench or service truck. All signals are crystal controlled and instantaneous because there are no tubes to warm up. Powered by 115 volts AC to insure top performance at all times.

The MX129 produces all signals required for trouble shooting and aligning the stereo portion of the FM multiplex receiver and can be used as a stereo demonstrator by feeding in left and right audio signals into the jacks marked LEFT and RIGHT EXT. SIG. This unique feature will allow you to demonstrate stereo to the customer even when a stereo program is not being broadcast.

The MX129 becomes a complete trouble shooting analyzer with the addition of a meter calibrated in peak to peak volts and Decibels. No other equipment is required for checking channel separation or alignment. A jack marked EXT. METER is provided for connecting the meter to the stereo speakers or at other points after detection.

Here are the signals available on the MX129 for alignment, trouble shooting and analyzing:

- FM-RF carrier with composite multiplex audio signal just like that transmitted from the FM station: 38kc suppressed carrier, 19kc pilot and 67kc SCA signal. This signal available at RF output cable.
- Multiplex signal is formed by either 60 cycle or 1000 cycle internal tones for greater flexibility in testing.
- Full control over left and right channel amplitude (and therefore modulation). Built-in meter is used to set controls for equal modulation of FM carrier. Channels can be turned completely off when desired.
- 19kc pilot calibrated directly in percentage of modulation; can be generated separately for 19kc amplifier peaking by turning down left and right channels.
- External 67kc SCA (subscription) signal available at jack marked SCA OUT (67KC) for trap adjustment. This signal, not found on some high priced multiplex generators, is very important on new stereo receivers with adjustable 67kc traps.
- Composite signals, same as described above, available on jacks marked COMP. OUT for signal injection beyond the FM detector.

SENCORE

Quality at its finest
426 SO. WESTGATE • ADDISON, ILL.

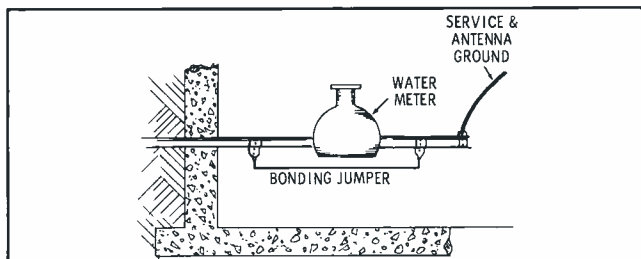


Fig. 3. Location of jumper if grounding wire is on house side of meter.

num to copper, copper to galvanized steel, etc.

Grounding conductors must be run as nearly in a straight line as possible from the mast and/or arrester to the grounding electrode. Fig. 1 illustrates the proper method of grounding an antenna, and Fig. 2 illustrates an improper method.

Water-Pipe Grounds

Whenever possible, a metallic cold-water pipe must be used as the grounding electrode, provided that 10' or more of metallic pipe in the system is buried. Jumpers must be placed around any meters, unions, couplings, etc. between the point of attachment of the grounding wire and the point at which the pipe enters the ground (Fig. 3). The jumpers maintain continuity around any insulated couplings or portions of the water system that could be removed.

Alternate Grounding Electrodes

In some installations it is not possible to use a cold-water pipe as the grounding electrode, or the available pipe is not suitable for this purpose. The NEC specifies the types of substitute electrodes that may be used in such cases. Rods, plates, or sections of pipe so used are called "made electrodes."

Driven ground electrodes must be at least 8' long. They must have a minimum diameter of 1/2" if copper-covered rods, 5/8" if galvanized rods, and 3/4" (inside diameter) if galvanized pipe. Sometimes it is necessary to use longer rods or rods in parallel to secure a proper ground. A lower resistance results if the rod is driven 18" or more from the foundation than if it is driven next to the foundation; there is more effective grounding area in the former case. If more than one grounding electrode is used at the same location, all of them should be bonded together as in Fig. 1.

Town and Rural Grounds

It is important that the grounding practices described here be followed whether the installation is in town or in the country. There seems to be less trouble in obtaining good grounds in towns, however, because a water system forms a grounding grid all over the town and the electrical supply system has a number of grounds in a small area.

Sell Proper Installation

The importance of proper antenna installation cannot be over-emphasized. The small extra investment in time and material will give you the satisfaction of having done the job right, and it may save you a call from the customer's attorney.

Sell proper installation to your customers. Tell them why the slight extra cost is necessary, why you do not use a 3' ground rod, etc. Explain the reasons in clear, simple language. If a customer is convinced, he will

JOIN THIS MAN!



MAKE MORE MONEY IN ELECTRONICS

SEND COUPON NOW FOR FREE BOOK

Trained men get ahead fast in the exciting field of Electronics. Learn all about Transistors, Communications, Aerospace Electronics, Computers. Cleveland Institute of Electronics can teach you . . . at home for a fraction of classroom training cost. Check these CIE advantages:

No Experience Needed: "Check-Point" Home Study Plan presents material in small, easy-to-understand bits . . . reinforced with clear explanations, diagrams, examples.

Nationwide Job Placement: Cleveland Institute students get bi-monthly listings of hundreds of high-paying jobs in electronics . . . the world's fastest growing industry!

A Commercial FCC License . . . or Your Money Back: Should you fail your FCC exam after completing your licensing program, CIE will refund all your tuition!

Cleveland Institute is an accredited member of the National Home Study Council; is also approved for Veteran's training under the Korean GI Bill.

ACT NOW...SEND COUPON FOR FREE BOOK

Cleveland Institute of Electronics

1776 E. 17th St., Dept. PF-15
Cleveland, Ohio 44114

Please send FREE Electronics Career Book without obligation. I'm a high school graduate interested in (check one):

- | | |
|--|--|
| <input type="checkbox"/> Electronics Technology | <input type="checkbox"/> Broadcast Engineering |
| <input type="checkbox"/> Industrial Electronics | <input type="checkbox"/> First Class FCC License |
| <input type="checkbox"/> Electronic Communications | <input type="checkbox"/> Advanced Engineering |



Your Occupation _____

Name _____ Age _____
(Please Print Clearly)

Address _____

City _____ State _____ Zip Code _____

helps you make more money
than any other test instrument

Checks CRT emission, interelement shorts and grid cutoff in a jiffy.

NEW

IMPROVED

CRT

CHECKER

and rejuvenator

Only tester that checks all black and white and color tubes without adaptors.

Uses DC on all tests as recommended by tube manufacturers.

Exclusive automatic controlled rejuvenation (ACR) insures just the right amount of rejuvenation for each job. You just push the button: The ACR circuit takes over and applies rejuvenation voltage for just the right amount of time.

All hand-wired — all American made.



COLOR CABLE

B&W CABLE

Weights only 10 lbs. — Unbreakable all steel case for home or shop.

SENCORE CR128

\$69⁹⁵

Here is a new CRT checker and rejuvenator with the latest in design but at a price far below testers that check round color tubes only. The CR128 checks them all; conventional black and white tubes, new low drive B&W tubes, round color tubes and the recently announced rectangular color tubes.

Tests made are standard in the industry, using DC for all checks to prevent damage and erroneous readings. Color guns are tested individually as recommended by CRT manufacturers. Procedures for color gun tracking tests are explained on back cover of instruction manual.

Exclusive automatic controlled rejuvenation applies rejuvenation voltage for a longer period of time to guns that are lowest in emission. Merely push the rejuvenation button and the RC timer takes over to automatically rejuvenate cathodes, clear shorts or weld open cathodes. A must for equalization of beam currents in poor tracking color tubes. Once RC timer discharges, new rejuvenation voltage cannot be re-applied until button is released and depressed again. It really works; you merely push the button and the automatic circuit takes over.

New all steel portable carrying case protects meter and panel when carried in a service truck. Removable cover can be used as a handy parts tray in the home and fitted to the back while in the shop.

Let your SENCORE Distributor show you how the CR128 will pay for itself the very first month in picture tube sales.

SENCORE

426 SOUTH WESTGATE DRIVE
ADDISON, ILLINOIS



GUIDE TO PROFITS

Quality components are the first, and basic step, in profitable servicing. For resistors, potentiometers and switches always refer to the brand-new 1964 Clarostat Service Components Catalog now available from your Clarostat distributor, or write . . .

CLAROSTAT

MFG. CO. INC., DOVER, NEW HAMPSHIRE



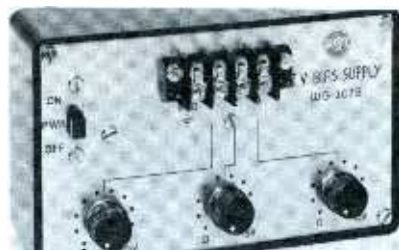
tell his friends and neighbors. This is the most effective and least expensive form of advertising.

Conclusion

There is more in Article 810 that you will want to read; only the highlights have been covered here. Additional information on grounding is contained in Article 250. If you have trouble interpreting any provision of the Code, consult your local electrical inspector. This is part of his job, and he will be most happy to co-operate.

Color Alignment Accessories

Here's a multiple bias supply for use when aligning color television circuits or performing other servicing operations requiring more than one bias source. This RCA supply features three separate outputs, each obtainable from individual terminals and adjustable from 0 to 15 volts. Either positive or negative bias voltages may be obtained by merely reversing the leads. The transformer-powered unit measures 6 1/8" x 3 3/4" x 2", weighs only 22 oz, and operates from 117 volts AC.



The factory-wired version is Model WG-307B; the kit version is Model WG-307B(K).

Sweep alignment of a color receiver is made easier by the WG-295C Video Multimarker. It provides markers at .5, 1.5, 2.5, 3.08, 3.58, 4.08, and 4.5 mc for use in aligning or troubleshooting chroma circuitry in color sets. This accessory is very simple to connect into an alignment test setup; it connects directly in series with the output of the sweep generator. Each high-Q tuned

absorption circuit causes a small dip in output amplitude as the sweep signal passes through the frequency of the tuned circuit. The markers thus appear as small dips, or notches, in the sweep-response curve.

A terminal is provided on top of the unit for each of the seven markers; the definite location on the response curve of a specific marker can be determined by placing your finger on the desired terminal, thereby extinguishing the marker. An in-out switch is provided to permit either using the markers or feeding the sweep directly through the unit. When the markers are not in use, the response is unaffected (up to 50 mc), and the Multimarker can remain connected during IF alignment.

Each of the seven tuned circuits is adjustable by means of an inductive slug accessible through a corresponding hole in the bottom of the unit. Adjustment requires a sweep generator, a detector, and a crystal-calibrated signal generator. ▲

For further information, circle 47 on literature card

THE WONDERFUL WIZARD 300*

1 ANTENNA + 2 WIZARDS = 2 OUTLETS
 1 ANTENNA + 3 WIZARDS = 3 OUTLETS
 1 ANTENNA + 4 WIZARDS = 4 OUTLETS
 1 ANTENNA + 5 WIZARDS = 5 OUTLETS
 1 ANTENNA + 6 WIZARDS = 6 OUTLETS
 1 ANTENNA + 7 WIZARDS = 7 OUTLETS
 1 ANTENNA + 8 WIZARDS = 8 OUTLETS
 1 ANTENNA + 9 WIZARDS = 9 OUTLETS
 1 ANTENNA + 10 WIZARDS = 10 OUTLETS
 1 ANTENNA + 11 WIZARDS = 11 OUTLETS
 1 ANTENNA + 12 WIZARDS = 12 OUTLETS
 1 ANTENNA + 13 WIZARDS = 13 OUTLETS
 1 ANTENNA + 14 WIZARDS = 14 OUTLETS
 1 ANTENNA + 15 WIZARDS = 15 OUTLETS
 1 ANTENNA + 16 WIZARDS = 16 OUTLETS
 1 ANTENNA + 17 WIZARDS = 17 OUTLETS
 1 ANTENNA + 18 WIZARDS = 18 OUTLETS
 1 ANTENNA + 19 WIZARDS = 19 OUTLETS
 1 ANTENNA + 20 WIZARDS = 20 OUTLETS
 1 ANTENNA + 21 WIZARDS = 21 OUTLETS

TV SERVICEMEN ARE MAKING GOOD MONEY
Installing Wizard Systems

The Beacon St. Apts. (62 outlets in 32 units): Another fast, simple, profitable Wizard System done entirely in twinlead. Two separate systems eliminated the need for amplification.

WRITE FOR SCHEMATIC DIAGRAM & SPECIFICATIONS
CHARLES ENGINEERING, INC.
 3421 NORTH KNOLL DR., LOS ANGELES, CALIF. 90028
 LIST \$1.95. OBTAINABLE AT YOUR DEALER OR WRITE.

U.S. LETTERS PATENT NO. 2,913,679

Circle 19 on literature card

CORRECT OFF-STANDARD VOLTAGE WITH

Acme Electric

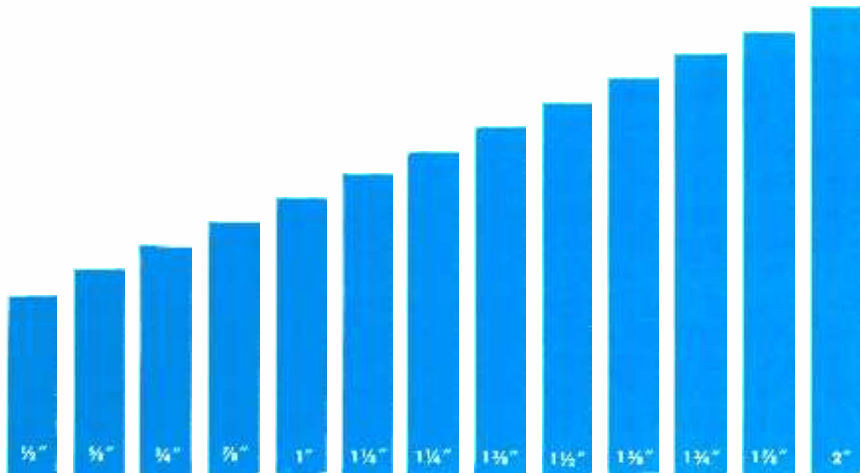
VOLTAGE ADJUSTORS

You can't get the best performance from a TV set or other electronic equipment unless it's operating on proper voltage. The Acme Electric T-8394M Voltage Adjustor corrects voltage over a range of 95 to 125 volts to normal 115/120 volts, simply by turning a regulating switch. Have a T-8394M Voltage Adjustor with you on every service call. You can use it for testing the line—and sell it on more jobs than you realize. A full 300 watts. Compact. Inexpensive. Most good supply dealers stock them. For full information write for Bulletin 161. SAA 3673-3027

ACME ELECTRIC CORPORATION
 948 WATER ST. • CUBA, N. Y.
 Canadian Representative: Polygon Services Ltd.
 50 Northline Rd., Toronto 16, Ont.
 Circle 20 on literature card

FASTATCH II CONTROL SYSTEM
MORE CONVENIENT AND
VERSATILE THAN EVER!

now
Centralab
gives you



SINGLE SHAFT CONTROLS

with exact length shafts



Need a control with a flat shaft—or split knurled—or screwdriver slot?

Maybe you need it with—or without—an attached line switch.

But two things are sure: You need a certain *exact* shaft length—and your Centralab distributor can supply it!

Centralab's new exact length solid shafts provide exact replacements for ALL your single control requirements, as well as twins for stereo, triples, and quads.

If you have the FRK-100 Fastatch II Kit, you can add these exact length shafts as you need them; they snap into place on the Fastatch II front controls. Or, you can get the exact control you need, instantly assembled by your Fastatch II distributor.

For a complete catalog on the Fastatch II Control System, write to Centralab or contact your distributor.

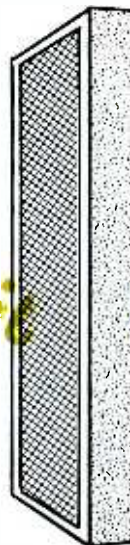
The Electronics Division of Globe-Union Inc.
P. O. Box 591 Dept. 94H Milwaukee, Wisc. 53201
In Canada: Centralab Canada Ltd., P. O. Box 400, Ajax, Ontario

B-6420



Circle 21 on literature card

August, 1964/PF REPORTER 45



Servicing Electrostatic Air Cleaners

by Melvin G. Whitmer

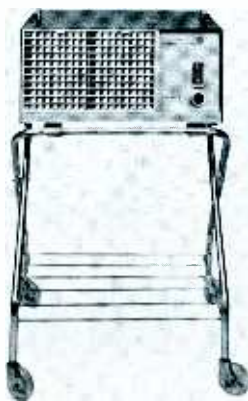


Fig. 1. This room size electronic air cleaner makes a home a haven of clean, healthy air.

The electronic air cleaner is a device used by industrial firms to remove smoke particles and ash dust from smoke stacks, thus reducing air pollution. This same type of air

cleaner is now available for the home. A portable model is shown in Fig. 1; it is accompanied by a roll cart, which facilitates easy handling. Other models are available for permanent installation in the heating or air-conditioning system of a house.

Smog has been blamed for the death of a great many people; yet, as early as 1948, the electrostatic air cleaner was recognized as a means of saving lives. In that year, an asthma sufferer living in Donora, Pennsylvania, had equipped his home with a homemade electronic air cleaner. Twenty-two people died in that town from a choking smog that lasted several days; yet, he stayed in his house and reportedly felt no ill effects. Since that time, many asthma and lung-disease suf-

ferers have turned to the electronic air cleaner for relief.

The electronic air cleaner is likely to become as common as the air conditioner in our homes. City, state, and federal agencies are actually aware of the ills attributable to air pollution and are attempting to control it at its sources. However, pollen, dust, and bacteria, independent as they are from industrial or automotive sources, are best controlled in the home by the use of an air cleaner.

Air is cleaned by passing it through an electrostatic field, as illustrated in Fig. 2. This field induces a positive charge in each particle of matter. The air containing the charged particles passes between two sets of plates. One set is connected to 6000 volts DC, while the other set is grounded. Once the particles are attracted to the ground plates, they remain there until the plates are cleaned.

The size of particles normally encountered in the air we breathe varies from 50 microns (fog particles) to .01 microns (fine tobacco smoke), as indicated by the graphs in Fig. 3. Most odors are included in this range; some of the finest restaurants in the country are using electrostatic air cleaners to remove odors and smoke, thereby providing their customers with clean, fresh air.

Many of our precision instruments for space exploration are made in electronically cleaned, temperature controlled assembly areas called "white" rooms. The air in these "clean" rooms is purified by electrostatic air cleaners.

Air cleaners are built in sizes ranging from the 7' model shown in Fig. 4 to the portable research collector in Fig. 5. The typical home

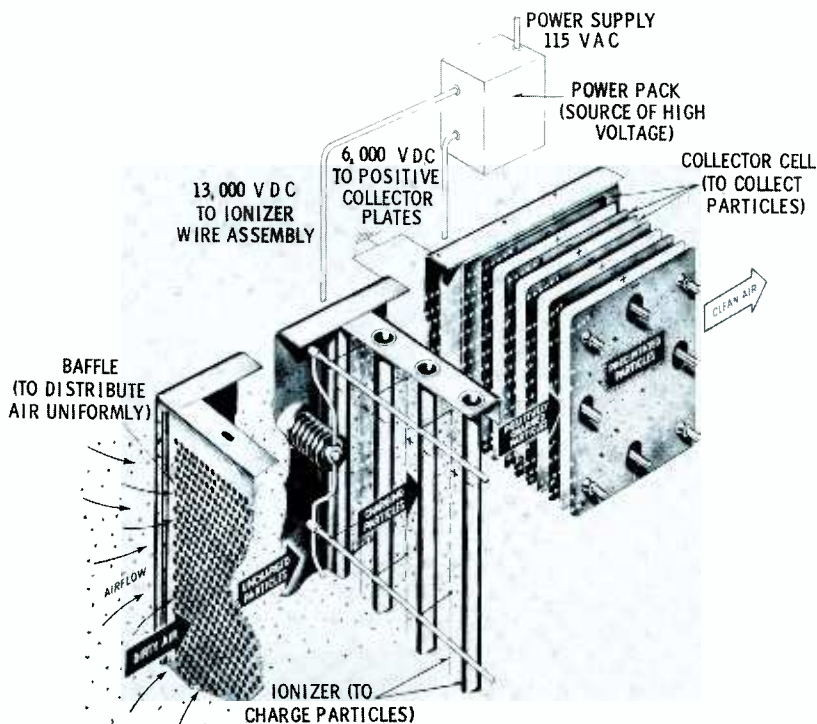


Fig. 2. The dirt becomes trapped in the cleaner by passing an ionizing and a collector area.

why **two** JFD UHF log-periodic TV antennas?

Because our engineers realize that **no** single antenna design is the answer to all UHF reception conditions.

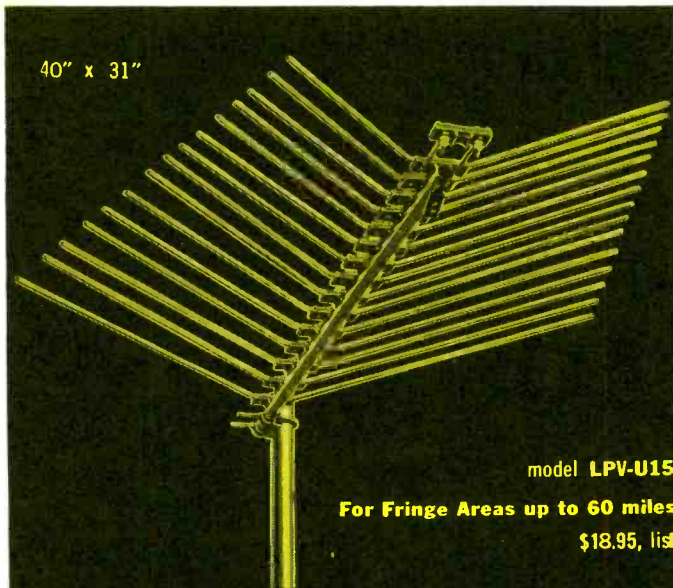
UHF frequencies are more adversely affected by surroundings. Degradation due to receiver noise is greater on UHF. Also, UHF signal losses are greater than VHF.

Consequently, our R & D Laboratories in Champaign, Illinois, have developed **two** new UHF antenna concepts based on the acclaimed patented Log-Periodic formula of the Antenna Research Laboratories of the University of Illinois:

JFD LPV-U LOG-PERIODIC UHF ANTENNAS

1

for reception of UHF Channels 14 to 83 and VHF 7 to 13 in cluttered city or hilly areas where high gain and sharp directivity is needed for crisp ghost-free UHF reception in B/W or COLOR!



26° to 29° narrow "E" plane (horizontal) beamwidths eliminate ghosts resulting from horizontal reflections—and combine with . . . "H" plane (vertical) beamwidth, as low as 40°, to give over-all high gain.

- Exclusive new UHF Log-Periodic frequency independent design provides flat, high gain across the band—excellent 300 ohm match gives below 2:1 VSWR.
- 30% to 50% more effective gain and directivity than corner reflectors and stacked bowtie-screens on UHF channels 14 to 83—plus a bonus VHF gain of up to 6 db on channels 7-13.
- Inline solid aluminum rod construction for least wind and ice loading area.
- Beautifully gold alodized for lasting eye-appeal.
- 100% pre-assembled—nothing to swing out or tighten—no movable joints.
- Stainless steel take-off terminals.

JFD UHF ZIG-A-LOG LOG-PERIODIC UHF ANTENNAS

2

where the "ultimate" in UHF color, and black and white reception is required.

model LPV-ZU10 I-Bay Zig-A-Log \$17.95, list

31" H. x 6" W. x 43" D.

Provides rotator-less reception of stations as far as 48° apart—up to 60 miles distant. (If the LPV-ZU10 receives 707 micro-volts or more signal voltage when pointed directly at each of the stations, then it will receive all stations clearly when pointed toward the center of the group of stations desired. The angle between stations on extreme left and right, however, should not exceed 48°.)

- Gain: 13.5 to 14 db. VSWR: under 1.8 1. 300 ohm impedance.
- Cutperforms 8-Bay bowtie-screen reflector antenna.
- Ultimate in corrosion-protection: Gold alodized aluminum elements . . . Rohm & Haas Implex & square crossarm . . . stainless steel take-off terminals.

31" H. x 29" W. x 43" D.

model LPV-ZU20 "E" plane stacked Zig-A-Log array \$37.50, list

TAME
KEEP TV FREE

Narrow 25° "E" (horizontal) and 30° "H" (vertical) plane patterns minimize ghosts caused by horizontal and vertical reflections in flat fringe terrain up to 90 miles from transmitters.

- Gain: 16-17 db, VSWR: under 2:1. 300 ohm impedance.
- Today's most powerful UHF array—matches effective gain of large parabolics—with much less wind, snow and ice-loading area.
- Locks on transmitter signal—no need to re-orient.
- Ultimate in corrosion-protection: Gold alodized aluminum elements . . . Rohm & Haas Implex & square crossarm . . . stainless steel take-off terminals.





Whether the location calls for VHF . . . or UHF . . . or FM . . . or VHF/UHF/FM—there is a JFD Log Periodic antenna to suit your installation needs—perfectly.

WRITE FOR BROCHURES 624 & 711 FOR FULL DATA.

BETTER YET, GET THEM FROM YOUR DISTRIBUTOR TODAY!

JFD JFD ELECTRONICS CORPORATION
15th Avenue at 62nd Street, Brooklyn, N. Y. 11219
JFD Electronics-Southern Inc., Oxford, North Carolina
JFD International, 64-14 Woodside Ave., Woodside 77, N. Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario,

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280 AND ADDITIONAL PATENTS PENDING IN U. S. A. AND CANADA. PRODUCED BY JFD ELECTRONICS CORPORATION UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

FOUR JFD LPV-U LOG-PERIODICS TO CHOOSE FROM:				
Model	Range	Outperforms	List	
 LPV-U21	up to 80 miles	12-bay bowtie-screen	\$27.95	
 LPV-U15	up to 60 miles	8-bay bowtie screen	18.95	
 LPV-U9	up to 40 miles	4-bay bowtie-screen	12.50	
 LPV-U5	up to 25 miles	corner reflector	6.95	

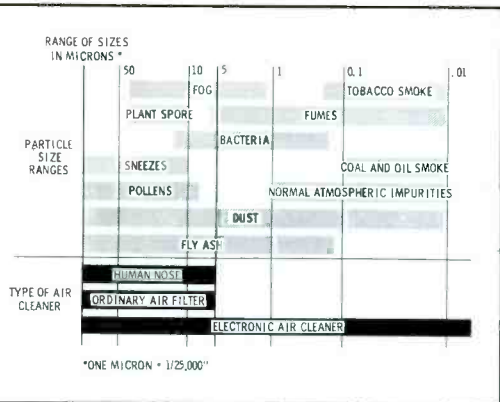


Fig. 3. All types of annoying particles are removed by the electronic air cleaning device.

furnace unit, illustrated in Fig. 6, measures 23" x 22" x 27".

One version of the electrostatic air cleaner is made in sizes equal to standard, forced-air, mechanical filters, and works almost as efficiently as the duct-type units. All you do to install this system is take out the furnace filter and slip in the three segments shown in Fig. 7 (which together are as thick as the original filter); mount the power-supply box at a convenient location, connect the high-voltage cable to the three segments, and plug in.



Fig. 4. Large units are installed in the air-circulating systems of commercial buildings.

Installation

Installation is rather easy in homes using forced-air heating, since the air cleaner fits into the cold-air-return ducts. Fig. 8 shows where the air cleaner should be placed in three common furnace arrangements. One section of the air duct is removed and replaced by the air cleaner.

Air-cleaner manufacturers make installation procedures as easy as possible, especially when they also make furnaces. Chances are good that any air cleaner can be readily added to that manufacturer's furnace without involving sheet-metal work or extensive wiring.

Most furnace duct work is assembled using "S" clips and cleats, as illustrated in Fig. 9. The air cleaners have flanges that stick out at the air-input and -output ends. These flanges require only the addition of the proper number of "S" clips to form a connection with the duct work. The joint is then sealed, using duct tape, which is obtainable from any sheet-metal dealer.

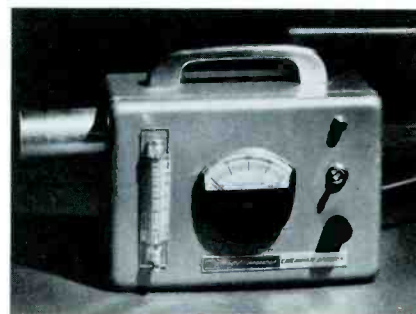


Fig. 5. Research electrostatic precipitators collect the air-borne particles for analysis.

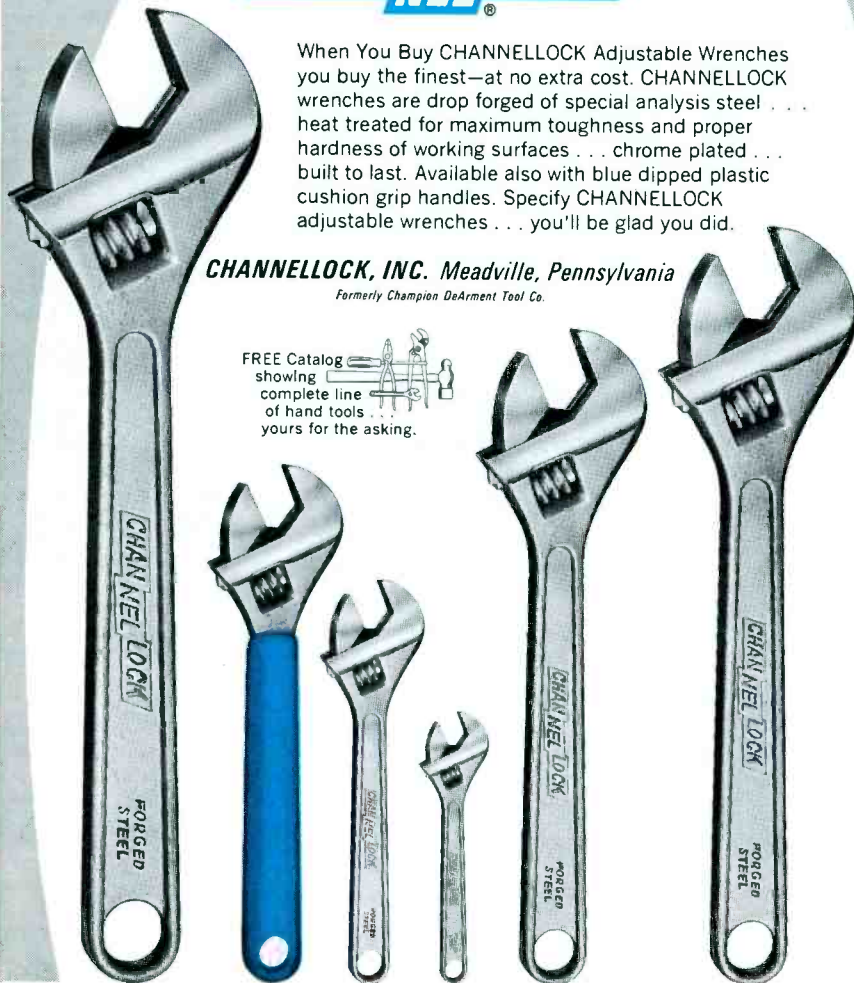
Choose the
RIGHT wrench for your job...

Tools by
CHANNEL LOCK

When You Buy CHANNELLOCK Adjustable Wrenches you buy the finest—at no extra cost. CHANNELLOCK wrenches are drop forged of special analysis steel . . . heat treated for maximum toughness and proper hardness of working surfaces . . . chrome plated . . . built to last. Available also with blue dipped plastic cushion grip handles. Specify CHANNELLOCK adjustable wrenches . . . you'll be glad you did.

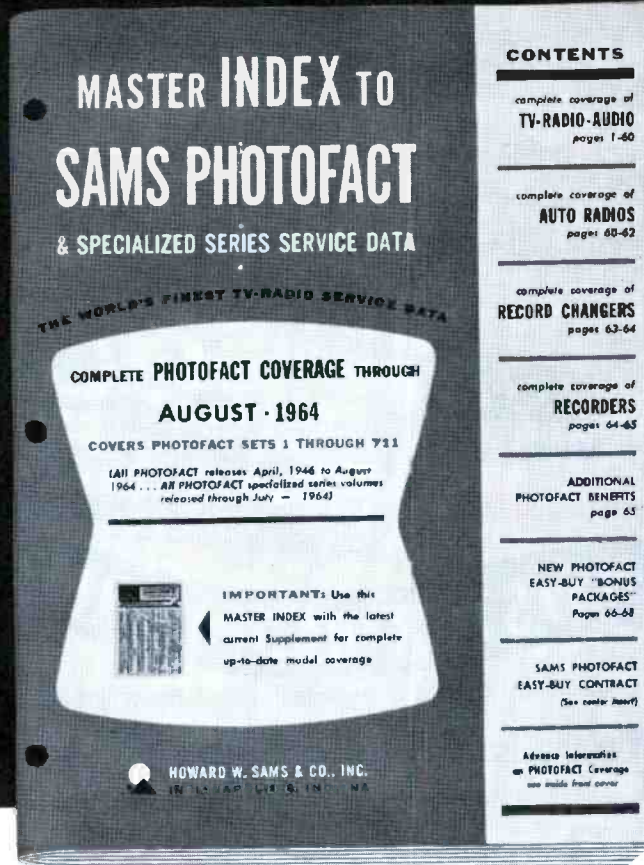
CHANNELLOCK, INC. Meadville, Pennsylvania
Formerly Champion DeArment Tool Co.

FREE Catalog showing complete line of hand tools yours for the asking.



Circle 23 on literature card

**need
reliable
service
data?**



CONTENTS

complete coverage of
TV-RADIO-AUDIO
pages 1-60

complete coverage of
AUTO RADIOS
pages 60-62

complete coverage of
RECORD CHANGERS
pages 63-64

complete coverage of
RECORDERS
pages 64-65

**ADDITIONAL
PHOTOFAC BENEFITS**
page 65

**NEW PHOTOFAC
EASY-BUY "BONUS
PACKAGES"**
Pages 66-68

**SAMS PHOTOFAC
EASY-BUY CONTRACT**
(See center insert)

Advance information
on PHOTOFAC Coverage
see inside front cover

Free SEND TODAY FOR THE LATEST
INDEX TO PHOTOFAC!

your handy guide to the world's finest electronic service data

covers over 58,000 listings of:

- TV Receivers
- Home & Auto Radios
- Phonos & Hi-Fi
- Tape Recorders
- CB Radios
- Record Changers

Send today for this valuable 72-page guide covering virtually every model of home-entertainment electronic equipment produced since 1946! Helps you locate the proper PHOTOFAC Folder to quickly solve any service problem in any model. PHOTOFAC provides *everything* you need in complete, uniform style for quick, effective repairs: Famous Standard Notation Schematics packed with the service details you need; Full Photo Coverage of all chassis views; Complete Replacement Parts Lists; Tube Placement Diagrams; Alignment Instructions; CircuiTrace® for printed boards; Disassembly Instructions; Dial Cord Diagrams; Changer and Recorder "Exploded Views"—plus dozens of other great features. Send coupon for your FREE copy of the latest PHOTOFAC Index to the service data you need!

Take the Right Step to Time-Saving, Profit-building Servicing... See your Sams Distributor for details on an Easy-Buy PHOTOFAC Library and Standing Order Subscription.

NOW! INDEX INCLUDES MODELS COVERED IN THE PHOTOFAC SPECIALIZED SERIES MANUALS...

Lists all models now covered in the PHOTOFAC Specialized Series: Transistor Radios, Auto Radios, CB Radios, and Tape Recorders—absolutely complete!



HOWARD W. SAMS & CO., Dept. PFF-8
4300 W. 62nd St., Indianapolis, Indiana 46206

Send **FREE Photofact Index**

Send full information on Easy-Buy Plan and Standing Order Subscription

My Distributor is _____

Shop Name _____

Attn.: _____

Address _____

City _____ Zone _____ State _____

easily service transistor radios...and make money!

B&K

Model 960



TRANSISTOR RADIO ANALYST

with Exclusive

Dyna-Trace Single-Point Probe and Built-in Metered Power Supply and VTVM.

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

This is the way to profit from transistor radio servicing. *There's no hit or miss, no waste of time and work.* The B&K "960" Analyst gives you a complete transistor radio service shop in one easy-to-use instrument. It provides signal-generator, power supply, milliammeter, VTVM, battery tester, ohmmeter, and both in-circuit and out-of-circuit transistor tester—all in one. Also speeds servicing of tube-type radios. Brings you new customers, and new profit.

Net \$995

Unique Point-to-Point Signal Injection
Easily enables you to troubleshoot any stage of any transistor radio—fast.

Built-in Metered Power Supply
Makes it easy to operate radio under test. Provides from 1 to 12 volts in 1½ volt steps. Supplies bias taps.

Simplifies In-Circuit Transistor Test
Dyna-Trace single-point probe needs only the one contact to transistor under test. Gives fast, positive meter indication.

Built-in VTVM
Includes essential high-input-impedance vacuum-tube voltmeter for correct servicing.

Test All Transistors Out-of-Circuit
Meter has "good-bad" scale for both leakage and beta; and direct-reading beta scale. Also automatically—determines NPN or PNP. Meter is protected against accidental overload and burn-out.

See Your B&K
Distributor
or Write for
Catalog
AP21-R

B&K

B&K MANUFACTURING CO.

DIVISION OF DYNASCAN CORPORATION

1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 253 Broadway, New York 7, U. S. A.

Circle 25 on literature card

PRECISION TUNER SERVICE

P. O. BOX 272

1200 S. WALNUT ST.

BLOOMINGTON, IND.

EDISON 99653

7.50
V or U
COMBO PLUS
9.95 POSTAGE

6 MONTH WARRANTY



All Types T.V. Tuners Cleaned, Repaired and Aligned to Factory Specifications. Same day in shop service on most Tuners. Price Includes Minor Parts, Major Parts at Cost Price. We use Original Parts if possible. State Make Model and Enclose all Parts and Tubes. Pack Well and Insure.

ALSO HAVE LARGE STOCK OF EXCHANGE TUNERS, WRITE FOR TYPES AND PRICES.

Circle 26 on literature card

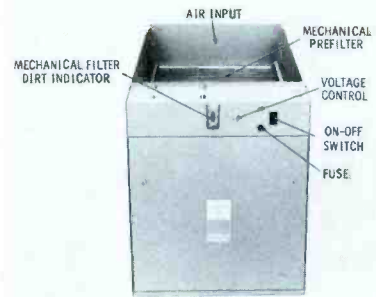


Fig. 6. This furnace-installed model fits easily into the present air-circulating duct work.

Occasionally, someone desires to have an air cleaner added to an existing furnace (forced-air type only) where duct-work sizes are not compatible with the air cleaner openings. The sheet-metal work required may then involve an adapter section, which leads to the input side of the air cleaner, as well as another adapter that extends from the output end of the air cleaner to the duct work leading to the furnace. Several possible shapes of adapters are shown in Fig. 10.

If the air cleaner is not supported by the furnace or floor, hanger bolts or wall brackets may be required; but the type and method of support is usually best determined by the person making the installation.

Wiring

Permanent installations depend on the furnace fan for circulation; therefore, the power supply requires less than .5 amp. It is usually wise to connect the air-cleaner power supply to the furnace-fan power leads so the air-cleaner ionizer is on only when the furnace fan is also on. Conduit should be used for all runs between the furnace and the air cleaner. Usually, an electrical knock-out hole is conveniently lo-

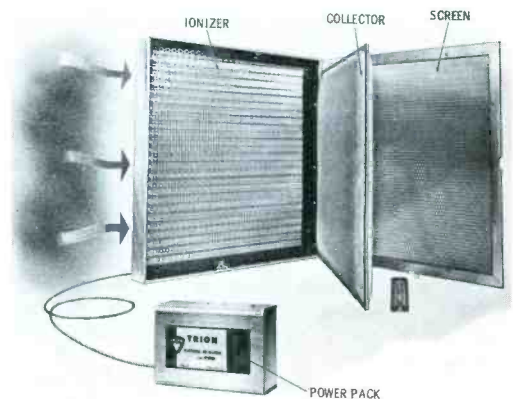
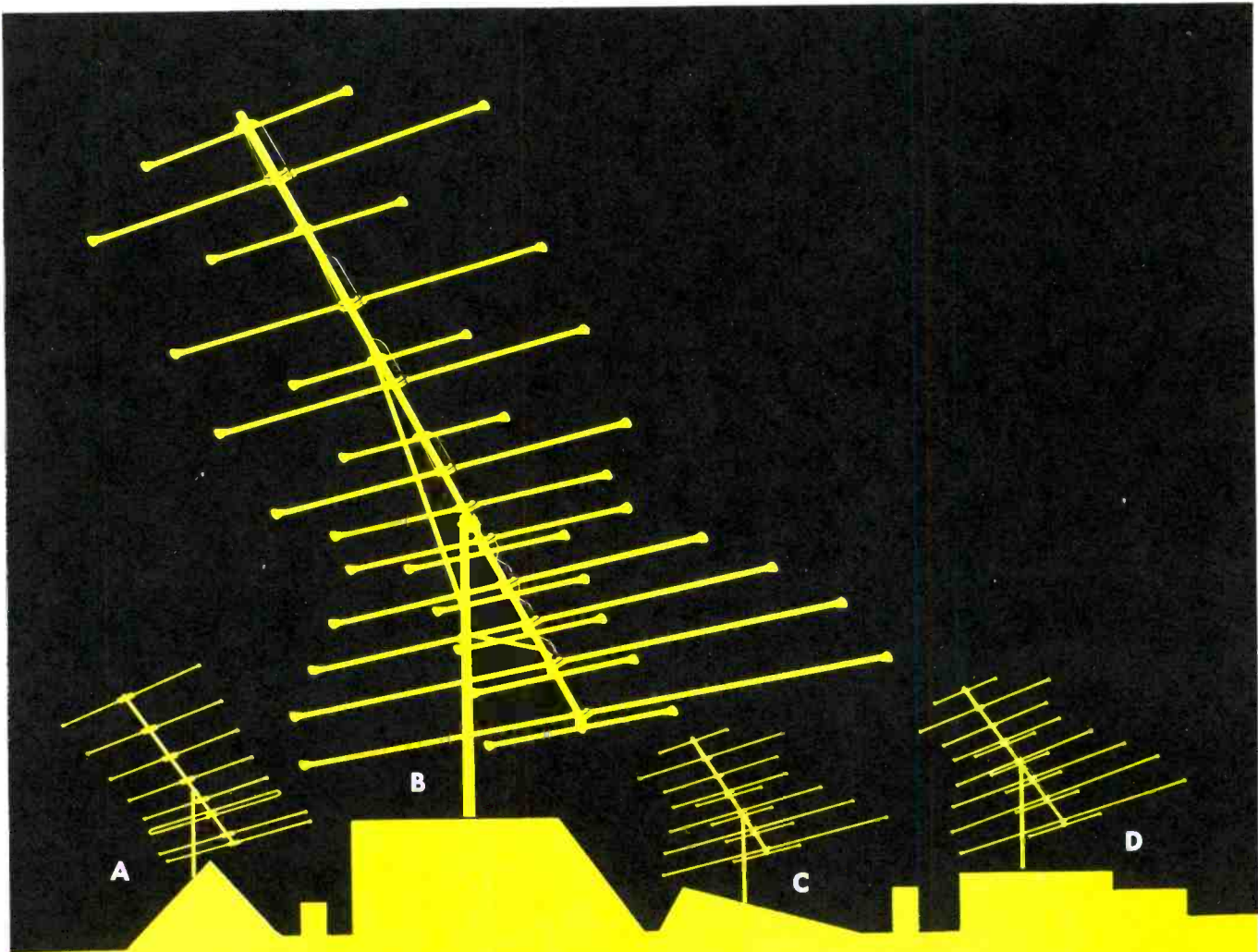


Fig. 7. The electronic air cleaner is easily installed by this replacement for the filter.

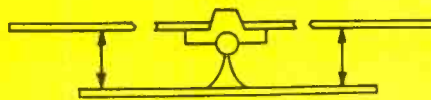


RCA OUTDOOR ANTENNAS

the name... the features... the line that sells

Now you can select the best model for your customer's location from this new RCA outdoor antenna line that combines all-channel yagi and multiple cross-driven types. Satisfy them with the sharpest color and black-and-white pictures.

Explain the RCA *exclusive* feature in customer language. Only RCA antennas feed energy directly into the transmission line from low band driven elements. These are capacitively coupled, positioned directly above high band driven elements. RCA, of course, phases low and high band directors for best high band performance.



CAPACITIVELY COUPLED

In addition, RCA's electro-lens director system absorbs maximum incoming signal power, gives extremely high gain across the VHF band, offers excellent forward gain on the front end.

More customer interest! A gold anodized finish protects every RCA antenna from weather corrosion. Wrap-around mast clamp aligns antenna on mast, prevents boom crushing.

Just call your RCA Victor distributor. Look at and learn about RCA 200, 300, 400 antennas... from the color TV pioneer! From there on... sell!

A. RCA 500 FM antenna. Eight-element yagi. Acute directivity. 88 to 108 MC. VSWR 1.25:1. Average eight db gain.

B. RCA 400 antenna. 19 elements, for fringe area or distant reception.

C. RCA 200 antenna. 11 elements, for local reception.

D. RCA 300 antenna. 13 elements, for suburban and near fringe area locations.

RCA PARTS AND ACCESSORIES, CAMDEN, N.J.



THE MOST TRUSTED NAME IN ELECTRONICS

CHEK-IT CIRCUIT TESTER

FOR ONLY **\$1.49** DEALER NET
LESS BATTERIES

**BATTERY OPERATED
TESTS WITH POWER OFF**



MADE IN
U.S.A.

- CONTINUITY • FUSES • SWITCHES
- CHIMES • APPLIANCES • MOTORS
- BUZZERS • PUSH BUTTONS
- AUTO IGNITION and VOLTAGE REGULATORS, ETC.

ASK YOUR ELECTRONIC
PARTS DISTRIBUTOR FOR

W MODEL NO. **BZ5**

MANUFACTURED BY
WORKMAN Electronic
SARASOTA, FLORIDA PRODUCTS INC

Circle 28 on literature card

"Eliminates Soldering"

PERFECT *Audio*

"PIN-PLUG" CRIMPER

SLIP WIRE IN "PIN-PLUG"
INSERT IN TOOL AND SQUEEZE
JOB IS DONE



USE END OF BLADE
AS SCREWDRIVER

U. S. Pat. 2,878,698
Canadian Pat. 592,702

USE END OF TOOL TO
PUSH ON GROUND CONNECTOR

Useful in making hi-fi, audio and sound, radio, phono, and TV equipment connections.

only

\$1.25

C-rings 1c each

Get the tool that makes solid electrical pin-plug connections without soldering or destroying pin form. Use one end for pin crimping, the other to push on C-ring clamp for braided-shield ground connection. Nothing like it anywhere.

MODEL PT-1

Picture-Tube Repair Tool

Also for—5U4, 6SN7, 6BQ6, etc.

Model LC-3 for 5/32" pin diameter

At your parts distributor or write us

BERNS

Mfg. Co.
9853 Chalmers,
Detroit 13, Mich

Circle 29 on literature card

cated on the air-cleaner unit. Connections consist of two wires at the air cleaner and two wires at the furnace. For mobile or portable units, the power should be connected to a source capable of supplying up to 5 amps.

Special Features

Some manufacturers supply mechanical filters to catch the larger dirt particles. These filters are reusable and are made of a fine metal mesh, which requires cleaning about twice a year. Another feature found on most air cleaners that use some form of mechanical prefilter is the filter gauge, which indicates when the mechanical filter should be cleaned.

One model of a duct-installed air cleaner provides a washing facility, which must be connected to water through a valve and a drain. This built-in washing feature enables the owner to clean the collector plates by simply opening a water valve while the electrical power is off. Performing this operation about every 30 days assures proper performance of the air cleaner.

Starting Procedure

While the specific instructions of the manufacturer should be followed carefully, some typical steps are:

1. Check the collector plate and ionizing frame positions and contacts.
2. Check the safety switches and door interlocks.
3. If the power supply has a voltage control adjustment, set it for minimum voltage (usually counterclockwise).
4. Turn the unit on.
5. Turn the voltage control clockwise until arcing or corona discharge occurs (a cracking or hissing sound).
6. Turn the voltage control counterclockwise just enough to stop this discharge.
7. The unit is now properly adjusted.

Maintenance

The electronic air cleaner requires little maintenance other than the routine cleaning recommended in all manufacturers' literature. The cleaning operation, however, can be

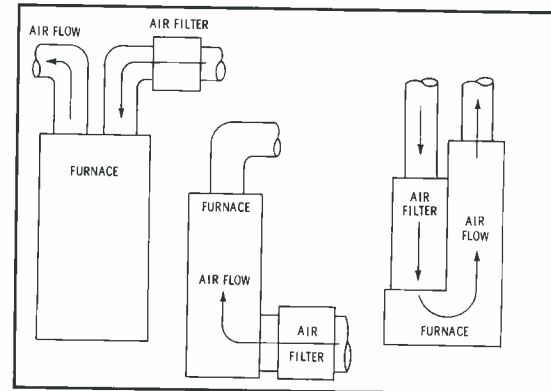


Fig. 8. Air cleaners may be installed in any position as long as the air flow is proper.

set up on a regular every-four-months service-call basis at a nominal charge.

The power supply can be a voltage doubler or full-wave bridge rectifier, to hold the transformer bulk to a minimum. Some units use selenium stacks, while others employ silicon rectifiers. In either case, the rectifiers are underrated to extend their life; replacement need not be expected during the first five years of operation. When service is needed, the replacement units

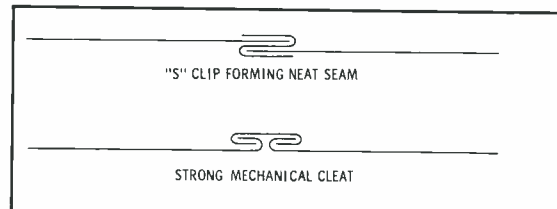


Fig. 9. Sheet-metal duct work is assembled with the use of special cleats and "S" clips.

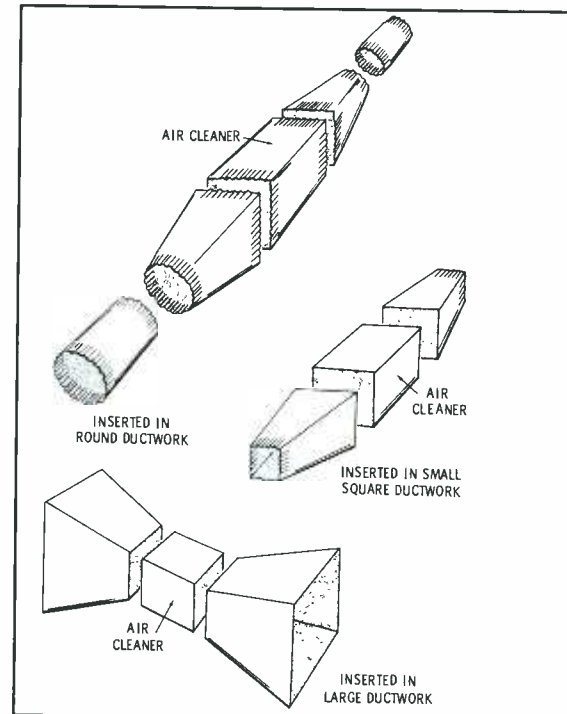



Fig. 10. Differences in size between duct and air cleaner are overcome by adapter sections.


Any type of TV lead-in...

BELDEN makes it!


Your BELDEN distributor has it!




PERMOHM* 8285 . . . excellent for color TV. Gives stronger, clearer UHF and VHF signals under conditions of extreme salt spray, industrial contamination, rain, and snow. 300 Ohm.




WELDOHM 8230 . . . resists pulling, whipping, twisting. Weldohm has two and a half times the flexing life, and one and a half times the breaking strength of ordinary 300 ohm lead-in.




COAXIAL TRANSMISSION LINES—RG/U AND FOAM RG/U TYPES . . . low-loss signal transmission for multiple TV installations such as motels.



STANDARD 300 OHM LINE 8225 . . . low losses at high frequencies. Well suited for use with FM receiving antennas.

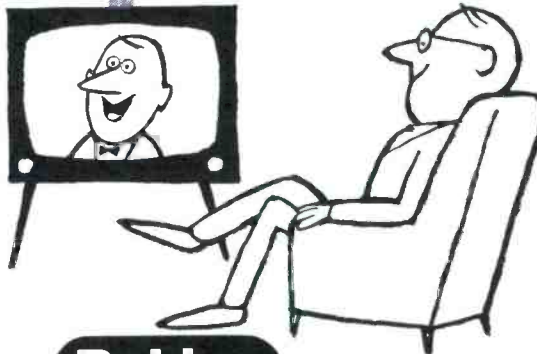


CELLULINE* 8275 . . . installs easily . . . no end sealing necessary. Has excellent resistance to sun, abrasion, and wind. Delivers strong UHF and VHF signals. 300 Ohm.



DECORATOR CABLE 8226 . . . for interiors . . . neutral color blends into decor of any room. No dark brown color to contrast with light carpets or walls. 300 Ohm.

Your Belden distributor has a complete line of Belden TV lead-in cable . . . in standard lengths for easy handling. He also carries microphone and shielded power supply cables; hi-fi, stereo, and phonograph cables; power supply cords; multi-conductor portable cordage; antenna rotor cables; hook-up wire; TV and cheater cords; aluminum ground wire . . . plus many other related items.



Better Built . . . Better Buy . . .

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902 — CHICAGO

WELDOHM, PERMOHM, CELLULINE are Belden Trademarks
Reg. U.S. Pat. Off. *Belden Patents U.S. 2,782,251 and 2,814,666

B-9-3

cord sets and portable cables • electrical household cords • magnet wire • lead wire • automotive wire and cable • welding cable

Circle 30 on literature card

August, 1964/PF REPORTER 53

Air Filter Manufacturers

Westinghouse Air Conditioning Division,
Staunton, Va.
Trion, Inc., McKees Rocks, Pa.
The Bendix Corp., Cincinnati, Ohio
American Air Filter Co., Louisville, Ky.
Minneapolis Honeywell, Minneapolis,
Minn.

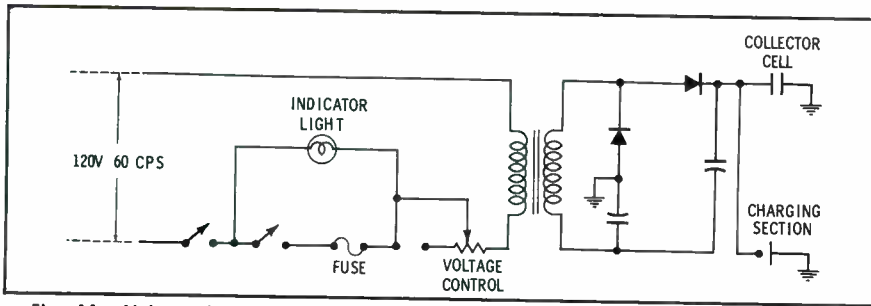


Fig. 11. Voltage-doubler circuit with current-limiting transformer and safety switches.

should be equal to or better than the original equipment.

A typical power supply is shown in Fig. 11. The main features of the

circuit are a blown-fuse indicator light, safety switches (interlocks), a current-limiting transformer, and a voltage-doubler rectifier. The illus-

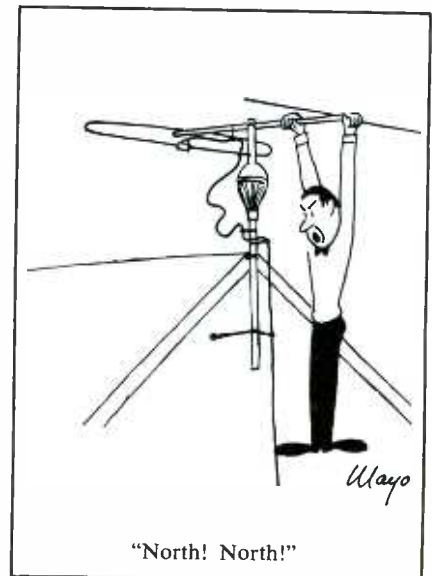
trated power supply furnishes about 8000 volts DC, which is used for both the ionizing section and the collector section.

The current-limiting transformer prevents injury in the event of electrical shock, and also prevents the destruction of circuit components if the output becomes shorted.

Service Hints

For speedy location of trouble, remember that:

1. Removing the fuse on equipment having blown-fuse indicators will cause the indicator to glow, if all input power circuits are closed.
2. Arcing at minimum voltage settings may indicate excessive dirt on the collector plates, broken parts (ionizing wires may break), or the presence of foreign metallic objects.
3. On units with voltage controls, you should be able to cause arcing or corona discharge at the maximum voltage settings. The inability to cause an arc may indicate a short or open power-supply circuit.
4. You should always make voltage measurements by connecting the meter with the unit off, and never touch the meter when the equipment is on. ▲



CAN THIS PICTURE TUBE BE SAVED?

**Fading dull picture tubes
bounce back pronto
with *Perma-Power Briteners***

Give new life, new brightness to aging picture tubes—and watch your customer's confidence in you bounce back, too, when you sell a \$4.00 britener instead of a \$70.00 tube. (Then you're a cinch for the tube sale later.)

It's easy with Perma-Power's Tu-Brite. Handsomely packaged for instant acceptance, color-coded by base type for instant selection. The right voltage is assured. With Tu-Brite, *if the base is right, the boost is right.* Make sure you have all three models in stock.

Model C-202 for duodecal base CRT's.

Model C-212 for 110° button base CRT's.

Model C-222 for 110° shell base CRT's. Net \$2.25 each.

Write for free Britener Selector Chart, your guide to the base type of every picture tube now in the field.

YES! Perma-Power Brightens Color Sets, Too. **Color-Brite Model C-501**, Net \$5.85 each.



Perma-Power[®] COMPANY

5740 North Tripp Avenue • Chicago, Illinois 60646

Phone: 539-7171 (Area Code 312)

Circle 31 on literature card

Get The GENERATOR That Has EVERYTHING!

3. EXCLUSIVE 5:4 CROSSHATCH

Faster convergence, easier linearity checks

4. SINGLE COLOR BAR

3.58MC color reference signal, gives *positive*, simple color performance check

5.

500-DOT PATTERN

0.1 μ sec dot—smallest anywhere! Complete screen coverage, more accurate convergence

2. GUN KILLERS

Check all three color guns, speed purity checks

1. READY FOR THE FUTURE

Broad-Coverage signal for VHF and UHF. Interchangeable CRT assemblies handle *all* color tubes



6. SEPARATE HORIZONTAL & VERTICAL BARS

Spot vertical and horizontal misconvergence faster, speeds over-all job

HICKOK

Model 662
\$159.⁹⁵

- 1. Ready For The Future**—Untuned, broad-coverage RF signal injects signal directly into antenna terminals, covers both VHF and UHF. Interchangeable CRT assemblies assure coverage of all present and anticipated color tubes, including new 25" tubes.
- 2. Gun Killers**—Individual pots and switches control each of the CRT guns separately. You can check the picture for emission, gas, shorts, in addition to individually checking the R-Y, B-Y and G-Y signals.
- 3. 5:4 Crosshatch**—Means more vertical lines, more horizontal lines and complete screen coverage including hard-to-converge areas at the edges.

- 4. Single Color Bar**—Simplified color reference bar at 3.58MC color burst frequency for definite color performance checks, impossible with gated rainbow generators.
- 5. 500-Dot Pattern**—Superior to 150-dot system because dot size is smaller (actual size, 1 line or 0.1 μ sec) for accurate convergence and complete screen coverage—no *blank* spots.
- 6. Separate Horizontal and Vertical Bars**—Quickly determines major areas of misconvergence, saves time by showing you where to start first.

HICKOK

THE HICKOK ELECTRICAL INSTRUMENT CO.

10566 Dupont Avenue • Cleveland, Ohio 44108

Represented in Canada by Stark Electronics, Ajax, Ontario

Internationally by Hughes International, Husint, S. A., Culver City, Cal.

Circle 32 on literature card

by James M. Moore

TECHNIQUES FOR SELLING ANTENNAS



Indications are that this will be a boom year for sales of electronic home-entertainment equipment. Color television, UHF television, and FM stereo are all areas that promise new growth and millions of dollars of increased sales. An important but frequently overlooked market opportunity is closely related to these highly advertised new types of receivers; for optimum performance, each of them requires a proper antenna. Furthermore, there is a potential market of considerable proportions for replacement antennas. Since you are in business to make money, you should do everything you can to take advantage of all these sales possibilities.

Nature of the Market

Before considering some techniques for selling antennas, it is wise to examine the nature of the market you seek to enter. A little forethought in this respect can help direct your activities in the most productive directions and save much wasted effort.

Color TV

In only rare cases can really satisfactory color reception be obtained using a built-in antenna, rabbit ears, or a random length of wire. Flat response over the entire channel, good signal-to-noise ratio, elimination of multipath reception, and low VSWR are all highly desirable in black-and-white reception, but they are absolutely essential for good color reception.

Even if the customer already has an outdoor antenna, it may be unsatisfactory for color due to deterioration or inherent design limitations. In many cases, the set owner may wish to keep his old black-and-white receiver and operate both it and the new color set from the same

antenna. His old antenna may not be able to provide enough signal for both receivers.

UHF TV

A Federal law (as implemented by FCC Rules and Regulations) now requires that virtually all new television receivers be equipped to receive all 82 television-broadcast channels. This requirement has received widespread publicity not only in the electronics industry but among the general public as well.

The new law should stimulate UHF activity in two ways: A number of new UHF stations are expected to be constructed, and viewer interest in existing UHF stations should be increased. In some cities these effects will be evident almost immediately; in other areas they will occur more slowly. Estimates vary, but certainly within the next ten years almost all of the TV sets in use now will be converted to all-channel reception or replaced with all-channel models. Each converter or new receiver sold during this period represents a potential UHF-antenna sale.

Another aspect of the hoped-for multiplicity of UHF stations should not be overlooked. In many locations, one or more stations in neighboring communities may provide signals in addition to those broadcast locally. Since these signals may arrive from different directions and with reduced strength, a potential market for towers, rotators, and high-gain antennas will thus be developed.

Good, high-gain antennas are a must in areas served by VHF-to-UHF translators. If you are in one of these areas, take advantage of the possibility of increasing your antenna sales by replacing or upgrading existing installations.

FM Reception

Over the past few years there has been a steadily increasing listener interest in FM broadcasting. Many new stations have come on the air or are under construction. Even so, many communities have not been allocated FM channels, and others do not yet have operating stations. Such areas must depend on out-of-town stations for FM service. A market for good FM antennas thus exists in these places.

The interest in FM broadcasting has been heightened considerably by the advent of stereo broadcasting by means of FM multiplex. Antenna requirements for stereo are much more severe than for mono, even in metropolitan areas, and this situation can be a source of many dollars for the alert dealer. Just as is the case in TV, every new FM receiver or multiplex adapter represents a potential antenna sale.

Replacements

Don't rule out the possibility of selling an antenna just because the customer already has one. Many of the antennas in use today were originally installed ten or more years ago. The performance of such antennas can have deteriorated considerably since they were installed. Terminals can be corroded, and insulators and lead-ins may have become cracked, broken, or dirty. Elements may be bent, broken, or missing. Guys may be weak or broken, and masts can be bent or rusted. The grounding system may be rendered useless by corrosion, broken wires, etc. In short, the entire system may need replacement.

Much progress has been made in the design of new and better antennas. Even if an old antenna is in reasonably good physical condition, a new model would probably give much better performance, especially for color or multiset operation. New stations may have begun operating after the antenna was installed, and higher gain or broader bandwidth may be required. Any number of other reasons might indicate the advisability of replacing an old antenna.

Antennas Everywhere

Opportunities for selling antennas don't exist just in fringe areas. A good outside antenna is the only

what PARALOG brought to VHF...

NEW

PARACYL

BRINGS TO UHF TV



...UHF all-channel antenna with fantastic vertical directivity

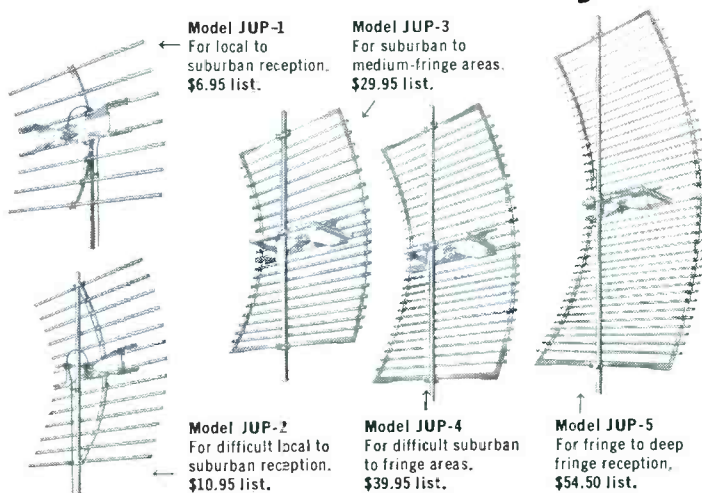
Good news! The new Jerrold-Taco PARACYL antenna combines cylindrical-parabolic construction with an exclusive "Extended Resonance" driven dipole* to deliver superior TV reception throughout the entire UHF band (channels 14 through 83).

Cylindrical-parabolic configuration assures the wide vertical interception area so necessary to capture elusive UHF signals, protect against "dead spots", and provide the greatest directivity. The "Extended Resonance" dipole driver actually changes its electrical length to present a half-wave appearance at the low and high ends of the UHF band, giving optimum gain and match all the way from 470 mc to 890 mc.

See your Jerrold-Taco distributor now, and learn how PARACYL antennas can open the door wide to big UHF sales for you.

*Patent pending

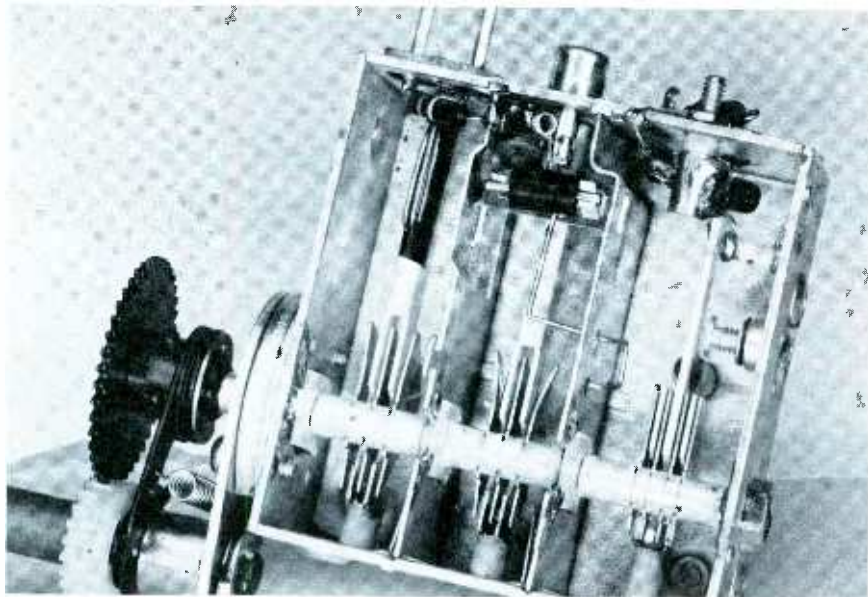
Distributor Sales Division, Philadelphia, Pa. 19132



Circle 33 on literature card

www.americanradiohistory.com

Coming in the SEPTEMBER ISSUE . . .



- **Transistorized UHF Tuners**
The newest tuners are analyzed from the serviceman's viewpoint.
- **Sync Simplified**
Here's an easily understood version of control circuits.
- **TV Circuit-Protection Devices**
There are many different types, but they all serve the same purpose.
- **AGC Troubles and Solutions**
- **Solid-State Rectifiers**

Plus Our Regular Servicing Features:

Symfact
Notes on Test Equipment
Previews of New Sets
Video Speed Servicing
The Troubleshooter

Get Free Premium Books With Subscription

Enter my subscription to PF REPORTER
and send me free book(s) checked.

3 Years \$10.00 2 Years \$8.00 1 Year \$5.00

- Symfact Handbook Vol. 1
- The Troubleshooter's Handbook No. 2
- Servicing Industrial Electronics
- Servicing TV from Tuner to Picture Tube

Check one for
each year you
subscribe

Bill Me

Remittance Enclosed

Extend Present Subscription

Take this coupon to your distributor, or mail to:

Howard W. Sams & Co., Inc.

4300 W. 62nd St., Indianapolis, Ind. 46206

Name _____

Firm _____

Address _____

City _____ State _____ Zip Code _____

Please Check Your
Business Classification

- Independent Radio, TV Serviceman
- Retailer with Service Department
- Industrial Electronics Service
- Other (Specify occupation and title) _____
- Owner, Mgr.
- Service Mgr.
- Employee

answer to reception problems in many urban areas, too. Multipath reception, shadow areas, detuning of indoor antennas by nearby objects, etc. are all conditions that fall in this category. Of course there are many locations in which a simple indoor antenna is perfectly adequate; in such cases sell the customer an indoor antenna.

Making Sales

Once the nature of the potential market has been determined, it is appropriate to examine ways of selling real antennas to real customers. Naturally, you'll take advantage of existing opportunities, but if you intend to make the maximum profit from your antenna sales, you'll have to create some new opportunities as well.

Use Existing Opportunities

The need for a good antenna with a color TV receiver has already been discussed. When you sell a new color set, explain these facts to the customer. He will probably feel that he has already made a sizeable investment in the set and a good place to start economizing is with the antenna. Point out, tactfully of course, that the cost of the antenna is small compared to the total amount he is spending. Try to explain to him that without a good antenna he will not get the performance he expects and is paying for. In other words, convince him that the antenna will ensure his getting full value for his money.

Although the amount of money involved is not as great, the foregoing arguments also apply to the sale of UHF and FM antennas. The customer is much more likely to gain satisfaction from his investment in new receiving equipment if he has a proper antenna.

Where possible, don't be satisfied with selling just a UHF antenna. A UHF-set sale offers an excellent opportunity to sell a replacement VHF antenna as well, or you may choose to offer a UHF-VHF (or UHF-VHF-FM) combination. When planning the installation, don't overlook the possibility of selling a rotor and other accessories if they are needed. Be sure also to point out to your customer the advantages of using good-quality transmission line for UHF (and VHF, too). In this



MALLORY

Tips for Technicians

Mallory Distributor Products Company
 P.O. Box 1558, Indianapolis, Ind. 46206
 a division of P. R. Mallory & Co. Inc.

How to choose and use replacement controls

1—Audio taper. 2—Reverse taper. 3—Linear taper.

TOTAL RESISTANCE 50%

Using ohmmeter to check control taper

STA-LOC technician kit

There's more to replacing a volume control, "pot", or trimmer than simply selecting the proper value in ohms and watts. Naturally you *need* the proper value, but you also need the correct *taper* or the circuit won't perform properly.

What's taper? Briefly, it's the way resistance changes as you rotate the shaft. There are three basic tapers normally used which match the needs of different kinds of circuits. The chart shows how each of the three works.

Audio taper (often called left hand logarithmic by people who like big words) gives you a small increase in resistance at the beginning of shaft rotation and a faster increase toward the end (clockwise rotation). This matches the response of the human ear and is the reason audio tapers are generally used in volume controls and similar shunt circuits.

Linear taper is just that. Resistance change is exactly proportional to shaft rotation. All standard wire-wound controls have linear tapers. Carbon controls with linear tapers are commonly used in tone controls, sweep controls and other straight voltage-division uses.

Reverse taper (right hand logarithmic) is the opposite of an audio taper. You'll get a big change in resistance in the first half of shaft rotation and very little in the last half. This taper is used with cathode voltage controls such as TV contrast and many bias voltage controls.

In the Mallory STA-LOC® control system, it's easy to remember which taper is which. Linear controls end with "L", and audio with "A", and reverse with "R".

You can check which taper is used in an unknown control by connecting an ohmmeter as shown in the drawing.

First, measure total resistance. Then turn the shaft to 50% of rotation. If resistance is 50% of total, you have a linear taper. If it is 10% to 20% of total you have an audio taper. If it is around 80% of total you have a reverse taper.

To be sure you have the exact control when you need it, ask your Mallory distributor to show you one of the STA-LOC technician kits. With a STA-LOC kit you can make exact on-the-spot replacements of any of literally *thousands* of single, dual, push-pull, tandem, or clutch controls. Pieces snap together and *stay* together. STA-LOC kits are sensibly priced and are real money-makers and time-savers. See your Mallory distributor for everything you need in controls, capacitors, batteries, switches, resistors, and semiconductors.

BOOK REVIEW



Audio and Acoustics

Author, G. A. Briggs; Sub-Editor, J. Moir; Wharfedale Wireless Works Ltd., Yorkshire, England; 167 pages, \$2.95. In the typical Briggs manner, this little (5 1/2" x 8 1/2", paperback) book begins by bringing the reader through a historical analysis to the modern state-of-the-art in audio and acoustic technology. An analysis of the human ear leads them to chapters on resonance, echo and reverberation, and transient response. The subject of room acoustics is treated in detail by sub-editor Moir. There is even a chapter on stereo. The remainder of the book is devoted to the electronic and acoustic aspect of systems in concert halls, studios, and schools.

The book sets out to be a revision of Briggs's earlier book, *Sound Reproduction*, which was allowed to run out of print in 1962. Numerous reminders of this fact are sprinkled throughout the book, but ample new material is just as obviously included.

This book should offer a painless way for any service technician to learn more about the theory and practice of

audio and acoustics, at the same time being entertained by the engaging, free-swinging manner of Briggs's writing.

Transistor Television Receivers

Author, T. D. Towers; John F. Rider Publisher, Inc.; 194 pages, \$6.95; hardbound. Written primarily for the technical student and the service technician, this volume contains descriptions and analyses of the circuits used in transistorized television receivers of the world's major manufacturers. Each chapter is devoted to one basic circuit; therein are several specific configurations from various sets, usually of varied national origin to point up major variations, accompanied by a brief analysis. A general circuit description introduces each chapter, and basic differences between tube and transistor circuits are outlined. The language of the text and the illustrations are both direct and clear.

The final two chapters of the book are devoted to an elementary examination of the physical and electrical parameters of semiconductors, and to a generalized servicing approach to transistorized receivers. Information is generally nonspecific, but there are several servicing hints which should make repair of transistorized sets a bit easier.

respect, a more effective approach may be to point out the *disadvantages* of using low-quality line.

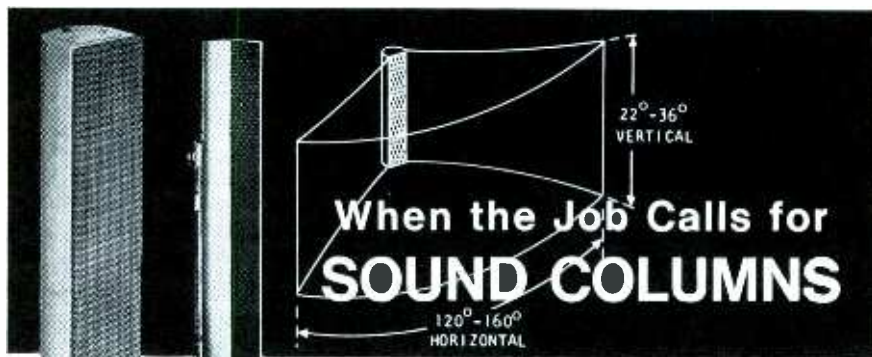
Every house call you make provides an excellent opportunity to sell a replacement antenna. Make a quick visual inspection of the antenna; its appearance will reveal if it is in a generally run-down condition. Be especially watchful for bad grounding of outdoor antennas. Explain to the customer the absolute necessity of correcting this condition, and suggest to him that this would be a good time to install a modern, efficient antenna. Ask him if he has trouble receiving a particular station; if he does, he probably is not aware that his antenna is a likely cause of the trouble. Since antenna deterioration occurs gradually, picture deterioration from this cause occurs gradually, too. With a little help from you, the customer may realize that his pictures aren't as clear and snow-free as they once were. The prospect of restoring lost performance may very well sell the antenna for you. Remember, service calls provide your best opportunity to sell replacement antennas.

When selling a replacement antenna (or a new one), determine whether the customer plans to purchase a second set or a color set in the future. If he does, be sure to explain the savings advantage to be realized by installing an adequate antenna now. Also try to sell him on the idea of using good-quality materials in the installation. Naturally you will profit from this, but the customer will also profit from the longer life of his antenna system. See to it that he understands the latter point.

Finally, don't ignore the do-it-yourself market. Even though your profits on antennas sold over the counter are not as great as if you install the antennas, they are profits just the same. The do-it-yourselfer is going to buy his antenna from someone, and that someone might just as well be you.

Make New Opportunities

Try to keep informed of developments in station activity in your area — station openings, authorizations for new stations, power increases, new color TV programming, etc. You can often use such information not only to sell new UHF, color, or



BE COLUMN RIGHT

When the job calls for columns — the controlled distribution of sound to cope with acoustic feedback — all the reasons add up to specifying "Columair" C-46 and C-66 columns by ATLAS SOUND.

EFFECTIVENESS — Feedback-generating low frequencies have been engineered out deliberately. Focused dispersion pattern controls "howl" in reverberant trouble spots by restricting coverage to audience.

CONVENIENCE — Compact design fits neatly anywhere with handling ease that king-size sound columns cannot match. Exclusive "EASY-MOUNT" brackets by ATLAS SOUND simplify installation and critical aiming for accurate coverage. Neutral-finish metal enclosure blends with decor. For special matching, grill cloth replacement and refinishing are easy. The SS-4 Stand and MK-1 Attachment Kit make child's play of portable applications and rental jobs.

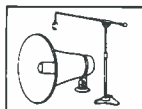
ECONOMY — You can afford better coverage at "Columair" budget prices. C-46 (Six 4" speakers, 20 watts), \$37.50 Net. C-66 (Six 6" speakers, 40 watts), \$57.00 Net. SS-4 Stand, \$13.50 Net; MK-1 Kit, \$1.20 Net.

For full specifications on "Columair" sound columns — and for the ATLAS SOUND answer to all your needs in public address speakers and microphone stands — write for Catalog PF-G18



ATLAS SOUND, Division of
AMERICAN TRADING AND PRODUCTION CORPORATION
1419-51 39th Street, Brooklyn, New York 11218

Canada: Atlas Radio Corporation, Toronto



THIRTY YEARS OF LEADERSHIP IN COMMERCIAL SOUND

Circle 36 on literature card

FM sets but also to sell a better antenna than the customer might otherwise buy. Be sure, however, that your information is accurate, and be sure that the customer understands that proposed operations are just that.

Special situations sometimes exist that offer unexpected antenna sales potential. These are not always obvious; a little thought may reveal such an opportunity in your area. One of the best examples of such a condition occurred in a large metropolitan area. High-gain—and expensive—TV antennas on tall towers began to appear, even though they were not needed for reception of local stations. The reason was quite simple: Certain sports events were blacked out in the local area, and these viewers were willing to invest in costly antennas to get the programs they wanted from an out-of-town station. This example serves to illustrate that with the proper encouragement most television viewers are willing, if not eager, to pay for the reception they want. Another network, special programs, or color—anything that is available from a distant station and not available locally can be used as a good incentive for buying an antenna.

Use Demonstrations

Overworked as it may be, the expression “seeing is believing” is true none the less. Don’t pass up the opportunity to demonstrate the results that a good antenna can produce. If you display operating TV sets in your shop, *connect them to a good antenna*. This simple point, often overlooked or ignored by TV dealers, is one of the most important single things you can do. The customer may feel that if an antenna really made any difference you’d use one. If your display sets have snowy, washed-out, unstable pictures, they serve as negative advertising not only for antennas but for receivers as well.

There may be other cases where antenna demonstrations are appropriate. Some servicemen have made effective use of truck-mounted, collapsible antennas. This idea is probably of greater value for selling VHF antennas than UHF antennas. Critical UHF positioning problems might necessitate more adjustment time than is justified, and you could get

a big improvement on an old favorite...

NEW WINEGARD BOOSTER COUPLER



Model BC-208

*Runs 1 to 4 TV or FM sets
Replaces Model WBC4-X*

Boosts Signal... Cuts snow... no picture smear... no interaction... 8 DB gain to each output.

Winegard engineers have taken advantage of the newest ampliframe shielded triode tubes to develop an improved booster-coupler. The new BC-208 uses *two* 6HA5 tubes

for higher gain and less noise. FM gets a boost, too, in this new circuit as it covers the entire FM band 88-108MC. It's a great new product from Winegard for better color, black & white or FM reception. Ask your distributor or write today for spec. sheets. Check the comparison chart against the old Winegard Booster Coupler.

	BC-208	WBC4-X
Number of tubes	2 6HA5	1 6DJ8
Gain to each isolated output	+8db	+5.8db
Gain across FM Band	+7db	+1.2db
Noise Figure, Low Band	3.7db	3.8db
Noise Figure, High Band	5db	5.2db
Isolation between outputs	18db	8db
Signal Input	20 to 350,000 microvolts	20 to 300,000 microvolts
Maximum Signal Output	1,800,000 microvolts	1,500,000 microvolts
ON-OFF Switch	Yes	Yes
Response	Flat ± 1/2db per any 6mc channel	Flat ± 1/2db per any 6mc channel
No-strip terminals	Yes	Yes
Removable mounting bracket	Yes	No
Module wiring	Yes	No
Number of isolated outputs	4	3



Winegard Co.
ANTENNA SYSTEMS

3009-H Kirkwood, Burlington, Iowa

Circle 24 on literature card

FAMOUS AUDEL GUIDES

Now Available From

▲ HOWARD W. SAMS & CO., INC.

--- USE THIS HANDY ORDER FORM ---

Popular AUDEL Guides are now part of the Sams book line, and are now available to you. AUDEL Guides enjoy wide public recognition and acceptance. They have long been famous for their practical help and technical excellence. These are the kind of books ideally suited to the interests and needs of all mechanics, engineers, students and do-it-yourselfers.

APPLIANCE SERVICING

Home Appliance Service Guide. AUD-2 \$6.00

AUTOMOTIVE GUIDES

Auto Mechanics Guide. AUD-1..... \$6.00
 Domestic Compact Auto Repair Manual. AUD-52 5.95
 Foreign Auto Repair Manual. AUD-53 5.00
 Truck and Tractor Guide. AUD-5..... 5.95
 Diesel Engine Manual. AUD-9..... 4.95
 Gas Engine Manual. AUD-48..... 4.00

BOATING

Outboard Motor & Boating Guide. AUD-49..... \$4.00

BUILDING TRADES GUIDES

Carpenters & Builders Guides (4 Vols.). AUD-8 \$10.50
 Plumbers & Steamfitters Guides (4 Vols.). AUD-6 10.50
 Masons & Builders Guides (4 Vols.). AUD-26... 10.50
 House Heating Guide. AUD-41..... 5.95
 Oil Burner Guide. AUD-28..... 3.95
 Water Supply & Sewage Disposal Guide. AUD-46 4.00
 Painting & Decorating Manual. AUD-7..... 4.95
 Do-It-Yourself Encyclopedia (2 Vols.). AUD-43. 8.95

CHEMISTRY

Practical Chemistry for Everyone AUD-57. \$5.95

DRAFTING GUIDES

Answers on Blueprint Reading. AUD-25..... \$3.95
 Mechanical Drawing Guide. AUD-31..... 3.00
 Rogers Drawing & Design. AUD-32..... 3.95

ELECTRICITY & ELECTRONICS GUIDES

Programmed Basic Electricity Course. AUD-54. \$ 4.00
 New Electric Library (10 Vols.). AUD-15A..... 25.00
 Handy Book of Practical Electricity. AUD-4..... 5.95
 Wiring Diagrams for Light & Power. AUD-13..... 4.00
 New Electric Dictionary. AUD-36..... 3.50
 Electric Motor Guide. AUD-27..... 5.95
 Questions & Answers for Electricians
 Examinations. AUD-34..... 3.00
 Radiomans Guide. AUD-3A..... 5.00
 Television Repair Manual. AUD-3B..... 5.00

ENGINEERS' GUIDES

Power Plant Engineers Guides. AUD-37..... \$6.95
 Questions & Answers for Engineers & Firemans Examinations. AUD-38..... 4.00

MATHEMATICS GUIDES

Mathematics & Calculations for Mechanics. AUD-11..... \$4.95
 Electrical Power Calculations. AUD-35..... 3.95

MECHANICS' GUIDES

New Mechanical Dictionary. AUD-44..... \$6.95
 Millwrights & Mechanics Guide. AUD-42..... 6.95
 Machinists & Tool Makers Handy Book. AUD-12 6.95

PHOTOGRAPHY

Guide to Creative Photography. AUD-47..... \$3.95

PUMPS

Pumps, Hydraulics, Air Compressors. AUD-40..... \$6.95

REFRIGERATION & AIR CONDITIONERS

Refrigeration & Air Conditioning Guide. AUD-14 \$6.00

SHEET METAL GUIDES

Sheet Metal Workers Handy Book. AUD-30..... \$3.95
 Sheet Metal Pattern Layouts. AUD-29..... 7.50

WELDING

Welders Guide. AUD-10..... \$4.95

Send FREE Audel Booklist

Order Audel books checked above from your Sams Distributor today, or mail to Howard W. Sams & Co., Inc., Dept. APF-7, 4300 W. 62nd Street, Indianapolis 6, Indiana.

Name _____
PLEASE PRINT

Position _____

Address _____

City _____ Zone _____ State _____

into a very embarrassing situation if it takes you a half hour to produce an acceptable picture. If you are aware of the pitfalls and know how to avoid them, however, the portable antenna can be a useful sales tool.

One effective antenna demonstration is to provide a simple switching arrangement to select, at will, either a "good" or "bad" antenna. The difference in performance between the two can be demonstrated rather dramatically by throwing the switch. Such a demonstration is most conveniently set up in the shop, of course.

Sometimes a newly installed antenna does not give the improvement that it should. In many cases the cause of the poor picture is not the antenna system, but the receiver. A good, properly adjusted portable television receiver provides a quick check in such cases and can help avoid customer dissatisfaction with the antenna installation.

Promotion

Wise use of promotional techniques can help sell antennas just as it helps sell anything else. Direct mail, newspaper advertising, and even radio and TV spots can be used to advantage. As a general rule, a series of small advertisements is more effective than a single large ad. Antenna manufacturers generally supply, through distributors, a variety of advertising and promotional material. Where possible, take advantage of this.

Where the competition permits, price your antennas so that you can offer some form of discount. One frequently used device is to allow a nominal trade-in discount on the old antenna. On large sales, such as a color TV set, you can offer "free" installation of a new antenna purchased at the same time. Be sure to feature these discounts prominently in your advertising. A little cost figuring is in order, however, to be sure you don't give away all your profit to capture the sale.

A less obvious promotional device is the appearance of the store. A neat and orderly appearance can go a long way toward building customer confidence. Make all displays as interesting as possible, and change them occasionally to make the busi-

ness look active and to maintain interest.

General Pointers

So far much has been said about the potential markets for antennas and some of the devices and techniques for selling them. Perhaps a few general comments will serve to tie all these points together.

The customer is interested in only one thing, the best possible performance from his receiver, and in most cases he is willing to pay for it. He isn't interested in gain, front-to-back ratio, or any other technical specification of the antenna. Therefore, concentrate your efforts toward showing that the antenna you are trying to sell will give him better reception than he is presently getting.

Since what you are really selling is performance, start by trying to sell the best performance. This obviously means starting with the best antenna. If the customer won't buy the best, you can then come down to a lower-priced model. It is generally easier to come down in this way than it is to "sell up." However, if a customer expresses an initial interest in a low-priced antenna, don't hesitate to point out to him the advantages of a better model.

In trying to sell the best, don't forget this fundamental rule: *Don't sell the customer more than he really needs.* There are many cases in which an elaborate antenna gives a marked improvement in reception quality. In these cases you should naturally attempt to sell the best installation that is needed. But there are also situations in which an expensive antenna simply cannot be justified. At these times resist the temptation to oversell; you may gain a few dollars, but you will lose your good name. Without customer confidence, you will soon be without customers.

Conclusion

Sales of color-TV, UHF-TV, and FM-stereo receivers are increasing, and prospects of even greater sales volume are bright. New-set sales coupled with the already existing replacement market promise great antenna-sales opportunities. By aggressively taking advantage of these opportunities, you can add substantially to your profits. ▲

Find it and Fix it in 1/2 the time!

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



MODEL
1076

TELEVISION ANALYST

BLACK & WHITE AND COLOR
NOW WITH KEYED RAINBOW DISPLAY

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

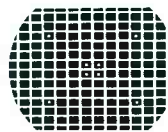
Simplified technique stops lost hours never recovered on "tough dogs", intermittents, and general TV troubleshooting. This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half... service more TV sets in less time... satisfy more customers... and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

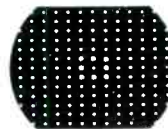
Available on Budget Terms. As low as \$30.00 down.

Net, \$32995

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 445 CRT Rejuvenator Tester

See Your B&K Distributor
or Write for Catalog AP21-R



B & K MANUFACTURING CO.

Division of DYNASCAN CORPORATION

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

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

Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

Circle 37 on literature card

August, 1964/PF REPORTER 63



Notes on Test Equipment

analysis of test instruments . . . operation . . . applications

by Stephen Kirk

AC in a Box



Fig. 1. This DC-to-AC converter also has provisions for recharging its battery from AC.

Basically the Cornell-Dubilier Portapower Model 12PP14 (Fig. 1) is a device for changing 12 volts DC to 120 volts AC. By reversing the process, the unit changes 120 volts AC to 12 volts DC to recharge its own battery. The supply is intended to operate a variety of AC equipment—TV sets, shavers, radios, transceivers, record players, tape recorders, etc.—requiring 140 watts or less continuously or 170 watts intermittently.

The converter unit is housed in a heavy steel case that measures 9 3/4" x 10" x

14" including the carrying handles. The case provides ample room for a 9" x 5 1/2" x 12 1/2" battery, a readily available size. (The converter unit without the battery box is designated as Model 12CS14.)

A novel connector is used for the DC leads to the converter. The connector consists of a screw-cam arrangement that accommodates a variety of wire sizes and locks tightly with a half turn of a screwdriver. AC output goes to a female connector; AC input (for battery charging) is through a regular two-bladed male connector.

Fig. 2 shows the complete circuit of the converter. A series-connected vibrator is the heart of the DC-to-AC conversion. The vibrator output is applied to step-up transformer T1, and the high-voltage winding of T1 is connected to the AC output plug through S1 and S2. Three output voltage ranges—low, medium, and high—are provided by S2.

In the CHARGE position, S2 is used to select (note the reversal) high, medium, and low charging rates for the 12-volt battery. The battery will not overcharge in either the MEDIUM or LOW position. The HIGH charge position permits recharging a fully discharged battery in 12 to 15 hours. At the end of this time, the charger should be switched to MEDIUM so that the "self-tapering" action of this range will prevent possible damage to the battery due to overcharging. Silicon rectifiers are used to provide DC for the charging process.

A DC voltmeter is switched across the battery in the CHARGE position to indicate relative battery condition. In the AC OUTPUT position, the meter (now connected to the AC output through a diode and a multiplier) shows relative AC output; a red mark on the scale indicates the output voltage reference.

A 2-amp fuse in the AC input circuit and a 20-amp fuse in the battery input circuit protect against overloads. A replacement for each fuse is mounted in a clip on the lid.

For further information, circle 48 on literature card

Sensitive Wide-Range VTVM

This new Hickok Model 209B VTVM (Fig. 3) is designed to measure a wide range of DC currents, AC and DC voltages, resistances, and capacitances. The



Fig. 3. VTVM features measurement ranges for current, voltage, resistance, capacitance.

design of the instrument makes it suitable for making voltage measurements in the millivolt range and for making resistance measurements with a low current level.

AC voltages can be measured accurately over a wide frequency range even in high-impedance circuits because the AC input impedance is 10 megohms shunted with approximately 5 uuf. To achieve this low loading, a special peak-AC probe containing a 6AL5 diode is used.

On the DC voltage ranges, the input impedance is 11 megohms. In the NULL position (zero-center), the input impedance is 22 megohms. DC milliamperage ranges are from 0.1 to 1000 ma (full scale). The impedance on the milliamperage ranges varies from 1000 ohms for the 0.1-ma range to 0.1 ohm for the 1000-ma range. The 30-ma range has an impedance of 10 ohms, and the 100-ma range has an impedance of 1 ohm. Either of these two ranges is suitable for measuring battery current in transistor radios.

The large, easy-to-read meter is 8" x 6" and has white and red numerals on a black background. The overall size of the 209B is 13" x 18" x 8" (including knob and meter protrusions).

Fig. 4 is a functional block diagram of the 209B. Three separate input probes are used. These are the diode probe already mentioned, a DC probe with a built-in one-megohm isolation resistor, and a straight-through lead for ohms, milliamperes, and capacitance.

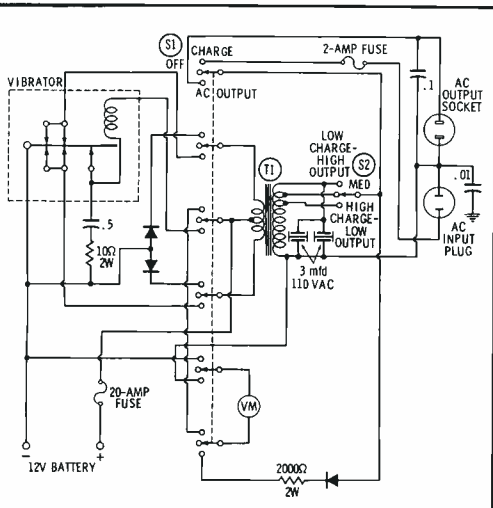


Fig. 2. Model 12PP14 schematic diagram shows circuit switching between functions.

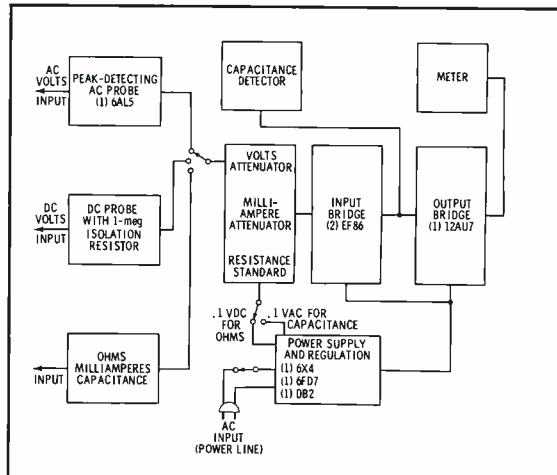


Fig. 4. Functional block diagram of VTVM shows use of 3 probes, dual bridge circuit.

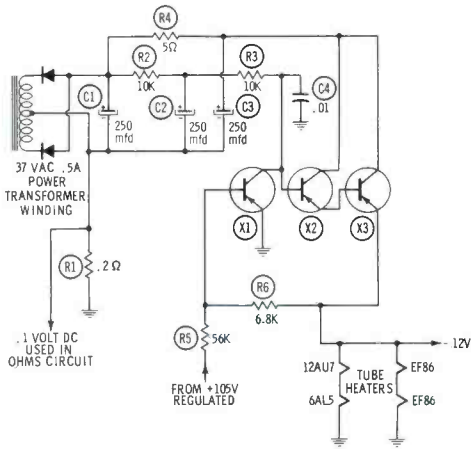


Fig. 5. Transistor regulator serves as stable -12-volt DC source for other parts of circuit.

All power, including a regulated voltage for the ohms circuit (no batteries are required) is taken from the power line. Fig. 5 is a schematic diagram of the DC-heater and -12-volt regulated power supply. Three PNP transistors are used in the regulating circuit. Reference bias for this regulator is taken from the +105-volt high-voltage regulated source. Any change in the -12 volts is fed through R6 to the base of X1. For example, if the -12 volts becomes more negative, this voltage change increases the current through X1. The voltage drop across R3 consequently increases, the base of X2 becomes more positive, and the current through X2 is reduced. Since the emitter of X2 is tied to the base of X3, the current through X3 is reduced, and this transistor appears as a larger series resistance. The increased resistance reduces the -12 volts and completes the regulation cycle. Ripple (which is really poor regulation at a 60-cps rate) is also automatically reduced by this circuit.

The high-voltage regulator circuit uses a dual-triode tube (6FD7) with dissimilar sections. An OB2 gaseous regulator

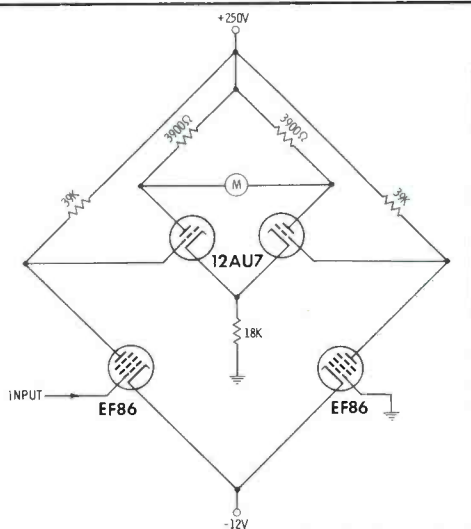


Fig. 6. Dual bridge circuit has added pentode bridge section to provide greater sensitivity.

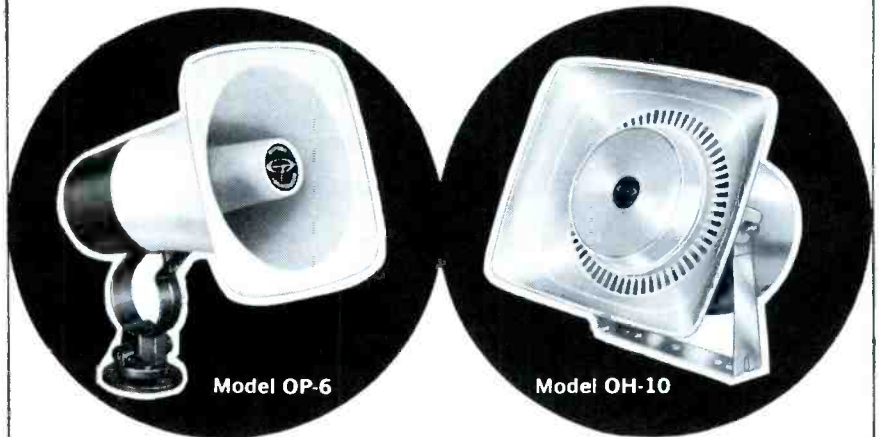
With the introduction of the Outdoor Specialist Series and the Model OH-10 weatherproof high fidelity sound system, Oxford has the most advanced, most imaginative units on the market.

The Outdoor Specialists (Models OP-6 and OP-8) incorporate new materials and design innovations that result in indestructible paging and talkback speakers with the highest efficiency available. This new series also features the most versatile mounting bracket — Oxford's LEVER-LOCK* swivel bracket which has complete freedom of motion to position the speaker and locks tight with the flip of a lever.

The OH-10 is a masterful blending of the most advanced acoustic and mechanical design. Its woofer-tweeter speaker system reproduces the entire audio range with comparable quality to expensive speaker systems used in the home. Mechanically, its die-cast aluminum construction will withstand severe abuse and so attractive is its decorator design that it will blend with almost any surrounding.

If you want public address speakers incorporating today's advanced design and newest techniques — write today for complete information and specification sheets.

*patent pending



NOW, IT'S OXFORD FOR ADVANCED OUTDOOR SPEAKERS



OXFORD TRANSDUCER CORPORATION

A Subsidiary of OXFORD ELECTRIC CORPORATION

2331 North Washtenaw Ave. • Chicago 47, Illinois

Circle 38 on literature card

Give your CB mobile antenna sales this **PROFESSIONAL "SPRING" TUNE-UP!**

Antenna Specialists does it again—with the newest, slickest "Hot Rod" in mobile CB antennas! All the high-performance, high-reliability features of the famous M-67... now with a beautiful and functional stainless steel shock spring. Get up and go for more sales!



M-124
for 3/4" hole

M-125
3/8" hole, snap-in mount

M-123
Like M-125 less spring

M-126
Shock Spring Kit—converts M-67, M-73, M-74

new

M-124 "SUPER MAGGIE MOBILE"

(every high-powered combination you can think of)

the antenna specialists co.

12435 Euclid Ave., Cleveland, Ohio 44106
see your A/S rep for details!



T.M. "Stripes of Quality"

Circle 39 on literature card

provides a voltage reference for the 6FD7. This regulator provides a +250-volt output.

Fig. 6 is a simplified diagram showing why the sensitivity of the 209B is unusually high: A dual bridge circuit is used. Essentially this is a conventional triode VTVM bridge with a pentode bridge added for amplification.

Working with the 209B made one thing clear—here was an instrument with good accuracy and extreme sensitivity. This sensitivity can be a little disquieting at first; on the low voltage ranges the meter goes wild when touched. However, this is normal and no cause for alarm.

The 30-ma and 100-ma current ranges were both used for checking transistor-radio supply current. Even using an older radio design with a notorious inclination to motorboat with weak batteries, there was no trouble in measuring the battery current on the 100-ma range.

Measuring low values of capacitance sent us back to the instruction book, although we should have anticipated that stray capacitance and AC pickup would cause erroneous readings. Small-value capacitors may be measured by connecting them directly to the input jacks and keeping the hand away. Another method is to connect the small capacitor in parallel with a larger capacitor; then remove the small capacitor and note the amount of reduction in capacitance. We found that better accuracy resulted if both ends of a suspected capacitor were removed from the circuit for testing. This was especially true for capacitors smaller than about .001 mfd.

Because of the added sensitivity of the dual bridge circuit, only 0.1 volt (taken from the regulated power supply) is required in the ohms circuit. This means that current through the tested component is reduced 15 times from that of a conventional VTVM. This could be a significant factor in measuring delicate circuitry.

Accuracy of all ranges of the 209B was good—better than 3% of full scale.

For further information, circle 49 on literature card

Solid-State Stereo

FM stereo is steadily becoming more popular. Many FM stations are already transmitting stereo programs, and numerous others are preparing to do so. Hence, most manufacturers are equipping their FM receivers with built-in multiplex circuits or with provisions for an adapter.

In spite of this growth, many servicemen have failed to prepare either themselves or their shops for servicing multiplex receivers. These receivers are not difficult to service. The only additional test equipment required is an FM stereo generator; a complete alignment cannot be performed accurately and satisfactorily from a station signal. In the early days of multiplex, stereo generators were quite expensive; however, as the increased popularity of stereo led to an increased demand for these generators, their price decreased.

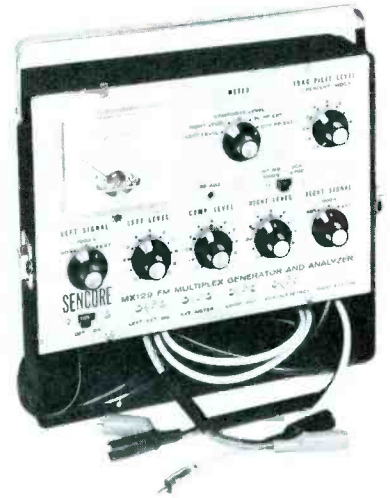


Fig. 7. Compact, all-transistor generator that has necessary multiplex alignment signals.

The SENCORE Model MX129 FM Multiplex Generator and Analyzer (Fig. 7) sells for \$169.95. This instrument is completely transistorized and provides all signals necessary for aligning or troubleshooting any multiplex circuit.

The composite multiplex signal from this generator is basically the same as that transmitted by a stereo FM station. It consists of left- and right-channel information and a 19-kc pilot subcarrier. A 67-kc signal is also available when the INT SIG-SCA switch is in the SCA position. The COMP LEVEL control adjusts the level



ASK YOUR WIFE

if she could use some extra Cannon terry cloth printed dish towels. If she says "yes" then

ASK YOUR JOBBER

how you can get them for her FREE with the purchase of certain PLANET condensers.

PLANET SALES CORP.

225 Belleville Ave.
Bloomfield, New Jersey

Circle 27 on literature card

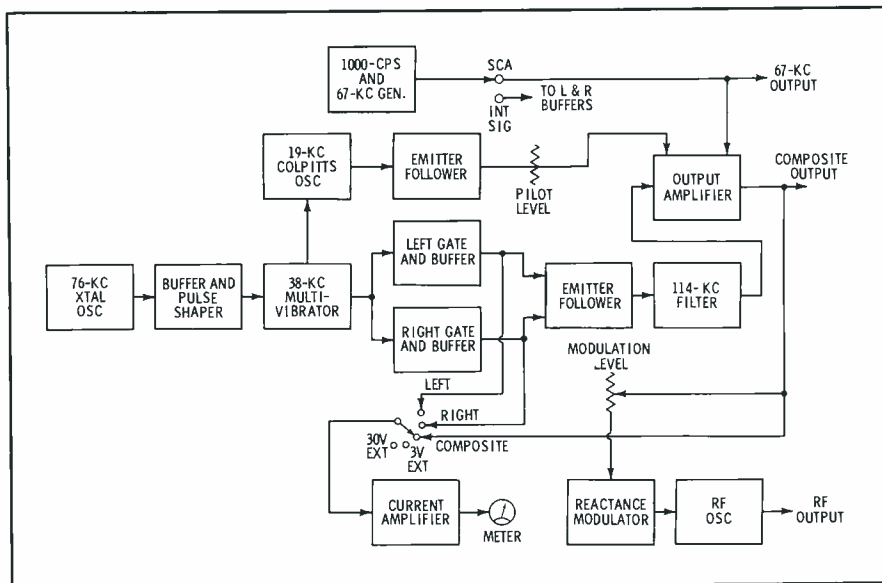


Fig. 8. Functional block diagram of the SENCORE Model MX129.

of the composite signal applied to both the COMP OUT jack (used when the composite signal is to be fed directly to the input of the multiplex section of the receiver) and the modulator. When the meter switch is in the COMP LEVEL position, the peak-to-peak AC voltmeter measures the output signal voltage. The INT P/P VOLTS scale indicates output voltage, and the COMP MOD LEVEL scale indicates modulation percentage. This modulation level should be 40% without the pilot or SCA signals present.

The 19 KC PILOT LEVEL control varies the level of the 19-kc signal added to the composite signal. This control is calibrated from 0 to 10% modulation. According to FCC standards, the level should be 10% for a normal stereo signal. The level may be reduced for more accurate alignment of the multiplex circuits in the receiver.

The RF output consists of a carrier frequency-modulated by the composite stereo signal. This output is fed to the antenna terminals of the receiver under test. The RF carrier is factory-tuned to 100 mc. However, if a local station is operating on or near this frequency, it may cause interference; therefore, the output can be adjusted from 90 mc to 105 mc by turning the RF adjustment located on the front of the instrument.

An internal 67-kc generator provides a signal for aligning the SCA traps in the receiver. This signal may be obtained separately at the SCA OUT (67-kc) jack or combined with the composite signal as previously mentioned.

When the LEFT and RIGHT SIGNAL switches are in the EXT position, an outside signal source may be connected to the LEFT and RIGHT EXT SIG jacks to demonstrate stereo in the absence of a station signal. The 1000 cps and 60 cps positions of the signal switches produce signal tones of the frequencies indicated by their respective settings. The amplitudes of these signals are adjustable from 0 to 10 volts with the LEFT and RIGHT LEVEL controls. The INT P/P VOLTS scale on the meter indicates the amount of signal

when the meter switch is in the RIGHT LEVEL or LEFT LEVEL position. The normal operating level is 5 volts.

The METER switch has five positions: LEFT LEVEL, RIGHT LEVEL, COMPOSITE LEVEL, 3V P-P EXT, and 30V P-P EXT. The first three functions have already been discussed. The remaining two can be used for aligning the coils in the receiver for either a minimum or maximum indication. This is done by connecting one end of a cable to the desired point in the receiver and plugging the other end into the EXT METER jack. One scale of the meter is calibrated in db for determining the exact amount of db separation.

The key stage in any stereo generator is the oscillator. In this instrument a crystal-controlled oscillator operates at 76 kc. Its output is coupled through a buffer and pulse-shaper stage to a bistable 38-kc multivibrator (Fig. 8). The transistors in the multivibrator stage switch at a 38-kc rate and produce square-wave signals for the left and right gate and buffer stages. This same signal is used to trigger the 19-kc Colpitts oscillator that develops the 19-kc pilot subcarrier.

The combined left- and right-channel information is coupled through an emitter follower to a 114-kc filter that attenuates the third harmonic of 38 kc and passes all frequencies below 75 kc. At the output amplifier, the signal has added to it the 19-kc pilot subcarrier and, depending on the position of the front-panel switch, the 67-kc SCA subcarrier. The resulting signal is used to modulate the RF output from the generator. It also is fed to the composite position of the meter switch for monitoring and to the COMP OUT jack.

This generator operates from 117 volts AC. Compact and lightweight, it measures 4" x 9 1/4" x 10" and weighs 7 1/4 lb. Packed with the unit is an instruction manual giving a complete description of operation, disassembly instructions, adjustment instructions, sample waveforms, and a complete schematic diagram. ▲

For further information, circle 50 on literature card

now there are 3 time & tool-saving double duty sets

New PS88 all-screwdriver set rounds out Xcelite's popular, compact convertible tool set line. Handy midgets do double duty when slipped into remarkable hollow "piggyback" torque amplifier handle which provides the grip, reach and power of standard drivers. Each set in a slim, trim, see-thru plastic pocket case, also usable as bench stand.



WRITE FOR CATALOG SHEET N563

XCELITE®

XCELITE, INC., 18 Bank St., Orchard Park, N.Y., U.S.A.
Canada: Charles W. Pointon, Ltd., Toronto, Ont.

Circle 40 on literature card

August, 1964/PF REPORTER 67

NEW SAMS BOOKS

Introduction to Microelectronics & Integrated Circuits

by *Allan Lytel*. Provides a clear explanation of this increasingly significant development. Tells you what microelectronics is, how these astonishingly small integrated circuits are designed, how they work, and how and where they are used. Includes special glossary of terms to help you understand and work with miniature components and circuits. Chapters include: What is Integrated Electronics; Integrated Circuit Design; Printed Circuits; Micromodules; Microcomponents; Linear Circuits; Digital Circuits. 160 pages; 5½ x 8½".

Order ICL-1, only. **\$295**

Science Projects in Electricity/Electronics

by *Edward M. Noll*. Like the two preceding volumes in this series, this new book presents useful construction projects which help the experimenter to learn basic principles as he builds. Each individual project, when completed, is a useful piece of equipment. Detailed drawings, numerous photographs, and complete parts lists make construction easy. Projects include: Audio Power Amplifier; Crystal-controlled RF Oscillator; RF Amplifier; FM Tuner and Antenna System and others. A valuable and instructive book for hobbyists, students, and do-it-yourselfers. 128 pages; 5½ x 8½".

Order SPN-1, only. **\$295**

Tape Recorders—How They Work—New 2nd Edition

This popular book for tape recorder owners and repair technicians has been fully revised and completely updated. Explains the principles of magnetic recording; covers mechanisms and components; describes the various types of tape recorders; gives test procedures. Comprehensive and easy-to-read. Includes numerous illustrations and charts. A valuable reference book for everyone interested in tape recording. 224 pages; 5½ x 8½".

Order TRW-2, only. **\$395**

Electronic Gadgets for Your Car

by *Len Buckwalter*. This practical projects book includes complete instructions for building numerous electronic gadgets for automobile use. Projects include a tachometer, a transistorized battery checker and charger, a handbrake protector, and other practical automotive electronic devices. Do-it-yourselfers and auto mechanic hobbyists will find this a fascinating book. All projects are easy to construct; parts used are readily available. 128 pages; 5½ x 8½".

Order CAR-1, only. **\$295**

Microwave Test & Measurement Techniques

by *Allan Lytel*. The first comprehensive book on microwave tests and measurements. Clearly written for easy understanding by technicians, engineers, and students. Of special value to technicians interested in entering the microwave field. Fully describes microwaves; covers the various applications; explains how to test and measure microwave power, impedance, attenuation, frequency, noise, etc. Includes special chapters on radar equipment and microwave tubes. 224 pages; 5½ x 8½"; hardbound.

Order MIL-1, only. **\$695**

Closed-Circuit Television Handbook

by *Leon A. Wortman*. Now—an authoritative guide to closed-circuit TV systems and applications. Absolutely the most comprehensive book on the subject. Provides a complete explanation of closed-circuit TV, the equipment used, applications in every conceivable field. Covers microwave relays, circuits, and service. Easily understandable for the interested nontechnical reader; invaluable for technical personnel involved in planning, installing, operating and maintaining CCTV. Fully illustrated and indexed. 288 pages; 5½ x 8½"; hardbound.

Order CLC-1, only. **\$695**

HOWARD W. SAMS & CO., INC.

Order from your Sams Distributor today, or mail to Howard W. Sams & Co., Inc., Dept. PF-8, 4300 W. 62nd Street, Indianapolis, Ind. 46206

Send me the following books:

- ICL-1 TRW-2 MIL-1
 SPN-1 CAR-1 CLC-1

\$_____ enclosed. Send FREE Booklist

Name _____

Address _____

City _____ Zone _____ State _____

My Distributor is _____

IN CANADA: A. C. Simmonds & Sons, Ltd., Toronto 7

Troubleshooter

(Continued from page 19)

me of a tough job I ran into some time ago. In an Admiral Chassis 18A6C, pulling the cap lead of the horizontal output tube would restore the oscillator to the correct frequency. One difference between this and Mr. Duerringer's trouble was that I had enough high voltage available to develop a dim raster at moderate brightness settings. I finally noticed it was shaded from top to bottom; this led me to think of filtering and helped me find an open 100-mfd output filter in the B+ supply.

HAROLD S. VANDEMAN

San Bernardino, Calif.

Defective filters are such common troublemakers that I tend to assume a serviceman has checked these before writing for help—that's why a mention of electrolytics is often omitted. In-circuit checks for opens and leakage are quick and easy to make by scoping the ripple and measuring the DC voltage across the suspected filter.

'Round We Go

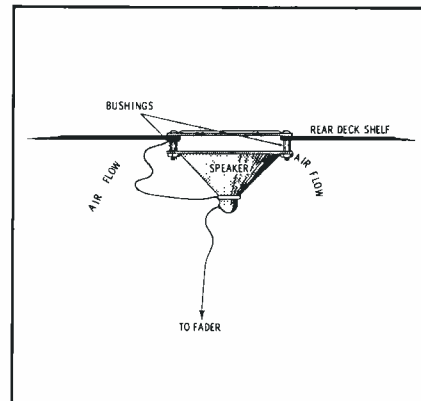
I seem to be going around in circles with a Bendix Model TM21CS television receiver. It was brought into the shop to correct vertical rolling, even with the vertical hold control at one end of its movement. I have checked and substituted about all the resistors and capacitors in the multivibrator section and the output circuit with no results. The grid of the 6W6 reads -35 volts instead of -22 volts, and the 6SN7 grid reads -150 volts instead of -96 volts. Any help will be appreciated.

E. H. UNDERWOOD

Bluefield, West Va.

Since this is a multivibrator, any component in the oscillator and output stages can affect the frequency. In this Bendix set (PHOTOFACT Folder 213-2), this includes the integrator components and

those connected between the cathodes of the sync phase inverter and the oscillator. Be sure to check variable controls. If they have changed value, they will have considerable effect on the frequency. Check resistors R104, R105, and bypass capacitors C95 and C2B. Be sure that the B+ and boost voltages have not changed.



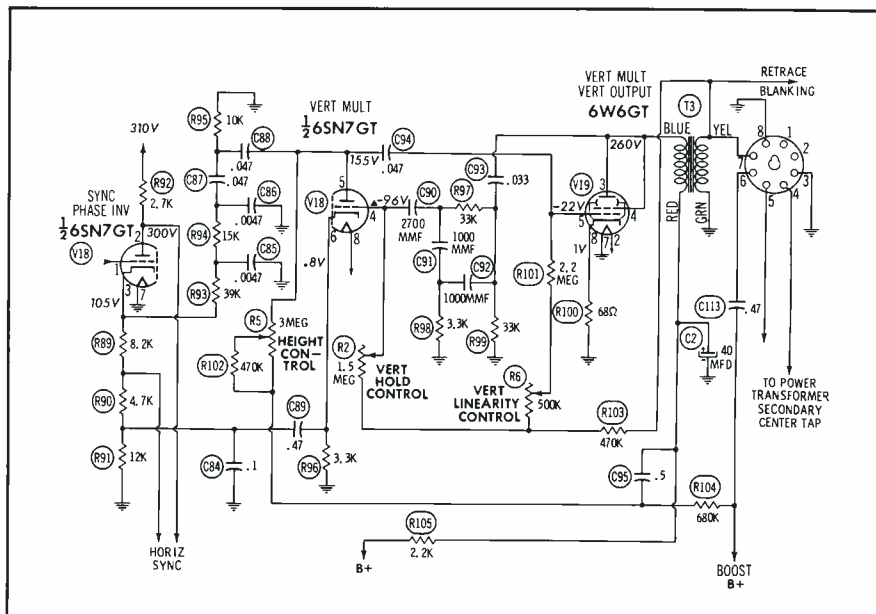
Speaker Saver

I have found many rear-deck auto speakers with cones damaged by the rush of compressed air produced when the trunk lid is slammed shut. I'm sure many other technicians have observed the same problem. Here is an installation technique I use to protect the speaker and, as a bonus to get better sound quality. When mounting the speaker to the deck, I use four bushings to provide ½" or more of space between the speaker and the rear-deck shelf. This space provides a vent for the air in the trunk. When the speaker is mounted this way, the trunk acts as a speaker enclosure, and better sound results.

AL C. HART

Griffith, Ind.

This sounds like a good idea that should save a lot of callbacks on speaker installations. Thanks, Al, for the suggestion. ▲



UHF & VHF Signals

(Continued from page 33)

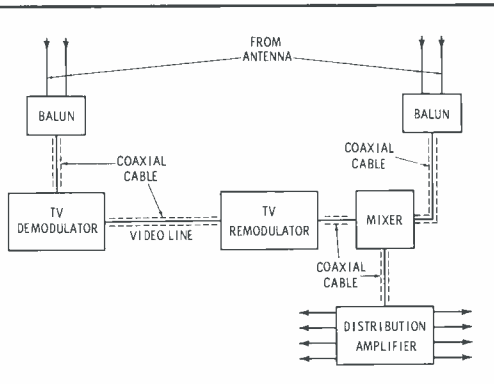


Fig. 5. Output of remote TV receiver may be relayed to distribution system on video basis.

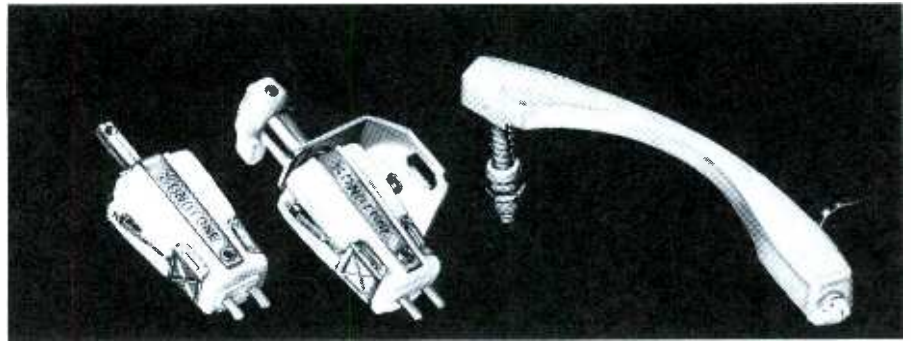
Fixed-tuned UHF-to-VHF converters for commercial use cost around \$115 each. A typical unit, for example, can be tuned to receive any UHF channel and to deliver its output on a VHF channel. Since it provides from 6 db to 10 db of gain, it doubles as a UHF-signal booster.

TV signals can also be transmitted on a video basis, a practice common in some large hotels several years ago but no longer popular because of cost and the need to modify the receivers. However, one advantage is that the transmission losses through coaxial cable at video frequencies are only a fraction of the losses at VHF.

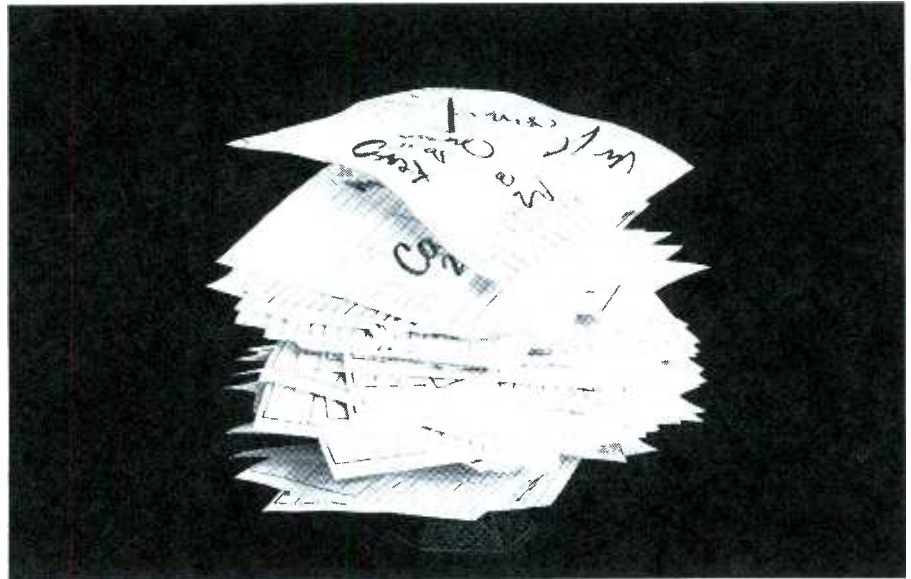
When it is necessary to install the TV antenna at a considerable distance from the TV sets, the arrangement shown in Fig. 5 can be used. Off-the-air signals are fed to a special type of TV receiver. Its composite video and 4.5-mc sound-IF signal are fed through coaxial cable to a remodulator which delivers an RF signal on one of the VHF channels. The VHF signal may be fed to the TV receivers directly through the distribution system or, when off-the-air signals on other channels are also fed to the receivers, through a mixer as shown in the diagram.

Conclusion

Application of the general information contained in this article should assist service technicians in updating most antenna distribution systems. Don't let the increased earnings of the growing UHF market pass you by; get going on UHF. ▲



How to turn crystal



into gold

You can strike it rich with the new Sonotone line of crystal cartridges. It offers direct replacements for "Ronette," "Vaco" and "BSR" models with typical Sonotone quality.

Here are the extras you get—New improved crystal elements for longer pickup life. Mono ("14T") and stereo ("20T") models. High output voltage. Modern turnover type for LP, 45 and 78 rpm records. Available with or without mounting brackets or turnover knobs to fit most arms.

Oh yes, they come in a slim, lightweight plastic tonearm, too. You have a choice of the mono ("14T") or stereo ("20T") cartridge. It's easy to install because it's prewired. It has a shielded cable, spring mounting post and a plated finger lift. It's complete with arm rest and all necessary hardware. Get details today. Write:

SONOTONE
audio products

Sonotone Corp., Electronic Applications Div., Elmsford, New York
Cartridges • Speakers • Microphones • Headphones • Hearing Aids • Batteries

Circle 41 on literature card

Master Antenna Systems

(Continued from page 31)

Sets connected beyond the short or open circuit will have weak, snowy signals. Sets connected between the head end and the short will have smeared pictures, and the signal levels will vary over wide ranges from tap to tap. Such a defect can be verified by connecting an ohmmeter across the cable input, which is usually located near the head end or at a splitter. Since the cable is terminated in a resistance of 75 ohms, any reading less than 75 ohms indicates a short in the cable; readings in excess of a few hundred ohms indicate an open circuit. From this point on, troubleshooting is a matter of opening the cable, usually at taps, and checking continuity both ways until the defect is isolated. The final step is a physical inspection and replacement of the defective cable segment.

Ghosting, Smearing, Snow at Random Points

These mixed symptoms indicate a bad mismatch and consequent heavy internal reflections. The most common cause is an open terminating resistor, which can be located by the technique just described. A short circuit near the end of the line produces the same effect.

It is important to realize that a short or open circuit on one branch of a splitter has only a small effect on other branches; this can be a clue to the nature of the fault.

Cable Deterioration

Sometimes the signal levels at tap-off units near line ends are too low, but the amplifier output levels are normal. These situations are usually caused by deterioration of the coaxial cable itself. Organic materials used in the outer jackets of coaxial cables made more than 7 or 8 years ago would sometimes migrate from

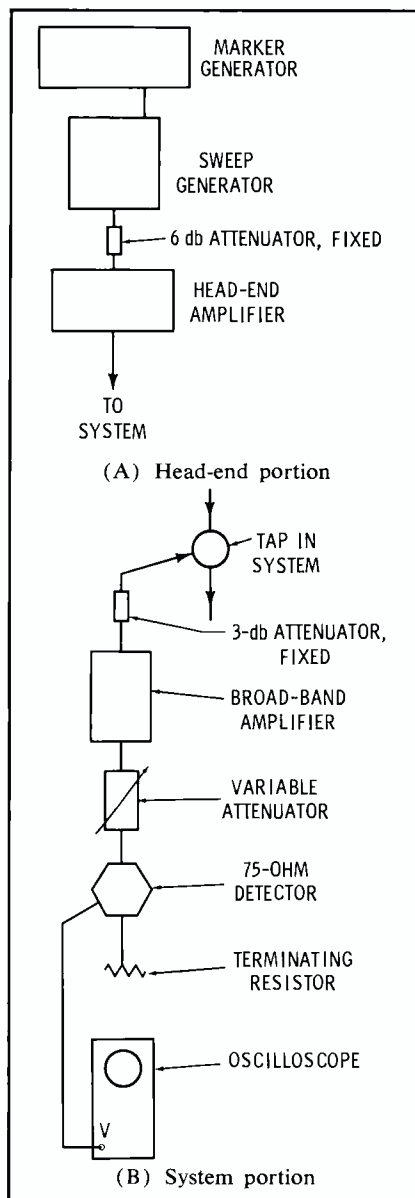


Fig. 3. Setups used for MATV sweep tests.

the jacket to the inner polyethylene dielectric, contaminating it and increasing cable losses. This fault often takes years to become apparent. When it does, two courses of action are open to the technician. He may rewire the system using noncontaminating cables, or he may use more powerful amplifiers to "brute-force"

Table 2

- | |
|--|
| A. Sweep generator: Broadband, capable of sweeping 50 to 108 mc and 170 to 220 mc; output impedance 75 ohms; response essentially flat across the two bands. |
| B. Marker generator: 50 to 220 mc. |
| C. Oscilloscope: With variable-phase, 60-cycle, sinusoidal horizontal sweep. |
| D. Detector: 75 ohms impedance. |
| E. Terminating resistor: 75 ohms. |
| F. 75-ohm attenuator: Variable in steps not greater than 3 db. |
| G. Broadband amplifier: 20 db minimum gain, with response flat from 54 to 108 mc and from 174 to 216 mc. |
| H. Attenuator pads: Fixed, 3 db and 6 db. |

the system. The first alternative is the best, of course, but in some cases economic considerations dictate the second course.

Color Distortion or Loss

All of the previously noted troubles may cause color loss or distortion, because they involve disturbances which affect either signal strength or signal phase. Phase shifts that have no effect on monochrome sets can often utterly destroy color reception. All tap-off units used in color systems should show source impedance. This means that a set "looking" at the tap-off terminals should see an impedance of 300 ohms (or 75 ohms through a matching transformer). If it does not, any reflection from the set itself will be reflected again from the tap-off unit, and a phase-distorted signal will appear at the antenna terminals of the color set.

When a color fault appears, the first object of suspicion should be the antenna itself. The first step should be to connect the antenna leads directly to the color set. If reception is good, the distribution system should be carefully examined for defects.

Radical amplifier misalignment, producing bad tilts in response across a single channel, can cause color loss or shift, but the tilts must be on the order of 6 db to be noticeable. Single-channel amplifiers can easily become sufficiently misaligned to produce tilts of such magnitude.

If color reception directly from the antenna is bad, the antenna may need repair or replacement; more likely, however, it needs reorientation. The antenna should be turned, while the set is tuned to a color program, until reception is optimum and fine tuning is not critical.

Sometimes an antenna that has always performed well on color suddenly shows color faults. When everything appears to be normal, check to see whether other antennas have been erected nearby or new buildings put up within a block or two. Both can cause multipath color distortion.

General Analysis of MATV Systems

Application of the general principles outlined above is dependent on knowledge of the physical layout and wiring plan of the system. With-

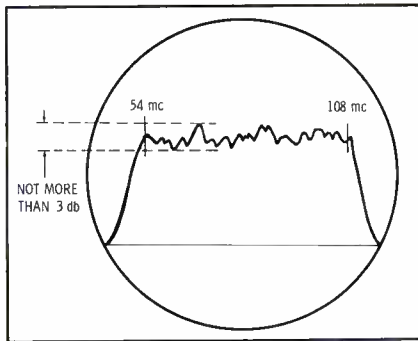


Fig. 4. Typical system swept-response pattern.

out this knowledge, servicing can be only hit or miss and will often introduce more troubles than it cures. It is therefore necessary either to obtain a wiring diagram or to trace out the system. Tracing can often be done by deductive methods. For example, if one branch is removed from a splitter, the absence of signals from a number of sets shows what portion of the system is fed from this leg. In this manner, a sketch of the layout can be prepared and cable lengths estimated.

Overall System Test

It is sometimes necessary to make an overall system test to determine the cause of vague but annoying troubles. Such tests are performed in the same manner as that used in the sweep alignment of any broadband amplifier, except that the entire system is included and its cumulative effect on the signals can be determined. A list of required equipment is given in Table 2.

Fig. 3 is a block diagram of the hookup for the sweep test. The sweep generator is connected through a 6-db pad to the input of the head-end amplifier and is set to cover either the low or high VHF band—not both at once due to the harmonic relationship of these bands. The marker generator is connected to the sweep-generator marker input.

The first step is to set the output level of the sweep generator. The best method is to connect the detector to the amplifier output and connect the oscilloscope to the detector. A sweep pattern of the signal fed through the amplifier can be "framed" on the oscilloscope by adjusting the phase control of the 60-cps sinusoidal sweep. The sweep generator output is increased until the response curve flattens out on

top due to clipping. The sweep generator output is then reduced until the waveform shows no flattening. This test indicates the maximum undistorted amplifier output, which should be determined to be within specifications before going further.

To continue the test, the equipment indicated in Fig. 3B is taken to one of the system extremities and connected as shown. The variable attenuator should be set for 3 db of attenuation. A curve similar to that shown in Fig. 4 should appear on the oscilloscope. The jagged response may be surprising at first; it is the result of numerous small discontinuities. The important thing is that no excursion should exceed 3 db within a single 6-mc channel.

An overall tilt of the curve may be apparent (for example, a 6-db tilt between 54 and 88 mc), but the only significant tilts are those within a given channel. The AGC of the television receiver compensates for differences in level between channels.

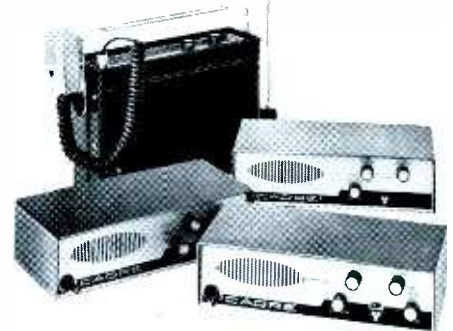
Deep dips in the curve are caused by bad reflections (standing waves) in the system. The source of the reflections can be located by opening the defective branch at the half-way point, terminating the line at this point, and retesting. In this way, it can be determined whether the defect is in the first or last half. By repeating the same test on the suspected half-section, the location of the defect can be determined quite closely. Its exact position can then be found by physical inspection.

Never use 300-ohm twin-lead in these tests. If the tap-off has a 300-ohm output, use a matching transformer of high quality with a very short 300-ohm lead to the tap. It is practically impossible to avoid erroneous curves when more than a few inches of twinlead is used.

Conclusion

The TV service technician should be familiar with TV master antenna systems so that he can deal with them properly when the need arises. The theory of operation of these systems is not complex, and the repair and maintenance procedures are relatively straightforward. Servicing of MATV systems can make a significant contribution to the total profit from your business. ▲

solid state reliability...



Cadre (CB Transceivers)

Solid state circuitry means that Cadre CB receivers can be bounced over rough roads in mobile installations; and can take plenty of rough use at base stations and in portable field use.

Solid state circuitry means that Cadre transceivers draw about as much power as an electric clock. Not only do auto or marine batteries last longer, but when batteries get low, Cadre solid state transceivers operate where others might not.

Reliability is only one reason why Cadre solid state CB transceivers are your best buy. Performance is another part of the story—plenty of transmission punch on 5 crystal-controlled channels—long distance reception with the dual conversion superhet receiver. And unwanted noise and adjacent channels are effectively suppressed.

FOUR POWERFUL SOLID STATE 5-WATT, 5 CHANNEL MODELS for every possible application—base station, mobile, field. New Cadre 510-A—AC/DC 23 channel manual tuning \$199.95. Cadre 515 same as 510-A less manual tuning \$185.00. Cadre 520 DC only with battery cable and mounting kit. For mobile and portable use from 12 volt batteries \$169.95. Cadre 525, model 520 in portable pack carrying case with built-in battery/power supply, recharger, AC cord and telescoping antenna for complete field portability. \$249.95.

FULL POWER, 1.5 WATT HAND HELD RECEIVER CADRE C-75 Solid state throughout. Two crystal-controlled channels. Sensitive receiver, powerful transmitter one watt output to antenna. \$99.95. Cadre C-60 New 100 milliwatt hand-held transceiver, 2 crystal-controlled channels. 70 mw output to antenna. \$59.95.

CADRE INDUSTRIES CORP.
COMMERCIAL PRODUCT DIVISION □ ENDICOTT, NEW YORK □ AREA CODE 607, 748-3373. **Canada:** Tri-Tel Assoc., Ltd., 81 Sheppard Ave. W., Willowdale, Ont. **Export:** Morhan Export, 458 B'way, N. Y. 13, N. Y.

Circle 34 on literature card

August, 1964/PF REPORTER 71

Musical Instruments

(Continued from page 35)

In a spacious room there is not much difference in tone quality between sounds picked up from different directions. But in the tightly enclosed space in a musical instrument, or when the microphone is close to the instrument, even rotating the microphone without moving it can make a dramatic difference in the sound.

Tone Control

Once the best positioning and mounting have been attained, the tonal balance may be thin or perhaps bass-heavy, even though the tonal quality is acceptable. Either defect can be offset by suitable use of the tone controls.

Due to efforts to keep them simple, tone controls are somewhat restricted in what they can do. A full tone control has provision to boost or cut the bass or treble at either end of the response curve, but it usually does not vary the frequency where the boost or cut begins.

If the sound is too shrill when you try to get a brilliant effect, the treble boost is probably beginning at too low a frequency. This can be cured by substituting smaller-valued capacitors for C3 and C4 in the treble-control circuit (Fig. 5). If you cannot get enough solid bass without its sounding boomy, the bass boost is starting at too high a frequency. Replacing the capacitors (C1 and C2 in Fig. 5) with ones of higher values should restore the sound quality.

The controls will seem to have no effect if the treble is already too high in frequency or the bass is too low. In such a case, the treble controls need larger-valued capacitors, or the bass controls need smaller-valued ones.

Matching

Input connections produce mostly matching problems. The amplifier must have enough gain to handle the range of input voltages provided, but not so much that distortion occurs. Too little gain—resulting in inadequate volume—means either the gain of the amplifier must be increased or a more sensitive microphone or pickup used. In a feedback amplifier a little more gain can be obtained with reduced feedback.

If there is so much gain that the amplifier output is distorted, the

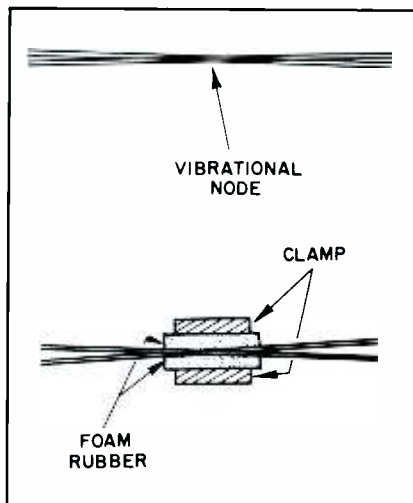


Fig. 4. Place clamps so they do not interfere with the natural vibration in the instrument.

input signal must be cut down. With a ceramic pickup or microphone, a capacitor across the input circuit is sufficient. For other types, a fixed resistance pad is needed in addition to the normal controls.

Not only the voltage level from the pickup, but the impedance as well, must match that of the amplifier. For a magnetic pickup or microphone, the amplifier input resistance should be 100,000 ohms or more. For a crystal or ceramic pickup, the input resistance—which may be a fixed resistor or a volume-control potentiometer—should be at least 2 megohms to avoid bass loss.

If the amplifier input circuit cannot conveniently be changed to this high input impedance (sometimes such a change results in hum from the input tube), and if the output voltage of the crystal or ceramic pickup is excessive, a lower value of input resistance may be used—provided a suitable capacitor is connected across it. The capacitor attenuates the whole frequency range

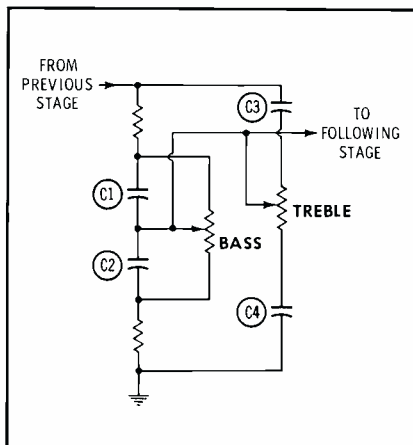


Fig. 5. A typical network used to provide boost or cut of bass or treble frequencies.

of these transducers to keep the lower resistance from attenuating the bass only.

Hum

Hum can be a problem in any installation. First check the pickup or microphone housing to make sure it has a good ground connection to the amplifier. Then do the same for the cases of the volume and tone controls and any metal panel they may be mounted on. If the hum is still there, look for unshielded wires or resistors. If proper shielding is not feasible or does not remedy the situation, the circuit impedance may be too high for the amplifier input. Try lower-valued controls, all the while watching that the tone quality is not degraded as a result.

Acoustic Feedback

Installing an amplifier in the same cabinet with the speaker can cause a host of troubles. It is normally impractical to house the amplifier elsewhere, so you will just have to make the best of the situation. At worst, the speaker will feed sound waves to some tube electrodes, building up an acoustic howl that can only be cured by turning the volume down (or disconnecting the speaker in extreme cases). Turning the bass or treble control down may stop the howl—but at the expense of tonal quality. In milder cases the speaker may be on the verge of howling and upset the musical quality, even though no howl is actually heard.

Try to find the tube most susceptible to vibration, by tapping each one gently while listening to the speaker. When you find the culprit, replace it with an equivalent but more rugged type designed to reduce microphonics. If no such substitute exists, try several tubes of the same type but different manufacturers.

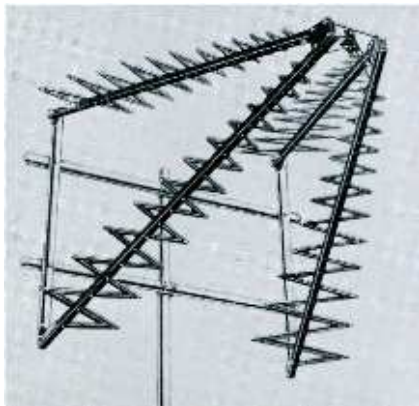
Conclusion

Servicing electronic musical instruments follows established practices for audio amplifiers and associated equipment. Where microphones or pickups are used, there is little difference—from a servicing standpoint—between the instrument and a public-address or other audio system. Once you understand the peculiarities of these instruments, you should have no trouble servicing them. ▲



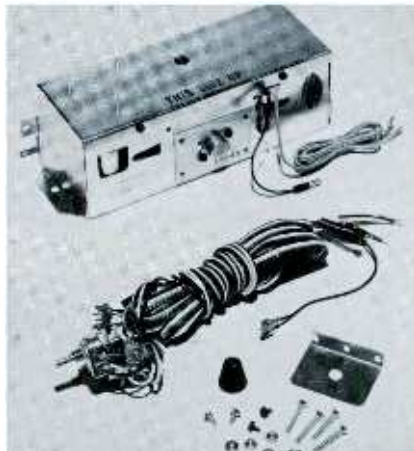
Product Report

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



UHF Antenna (118)

A new Log-Periodic antenna, known as the "Zig-A-Log," is designed for reception on channels 14 to 83. The JFD Model LPV-ZU20 has a gain of $16.5 \pm \frac{1}{2}$ db with respect to a half-wave dipole and a VSWR of less than 1.8:1 across the entire UHF-TV band. List price of the antenna is \$37.50.



Auto Reverberation (119)

An all-transistor reverberation kit from Cleveland Electronics can be used with 12-volt, negative-ground car radios. Two models are available, the RU-101 and the RU-104. These units are identical except that the RU-101 includes a 6" x 9"

rear-seat speaker and grille. Power output of 2 watts and current drain of .7 amp are typical for both models.



Low-Cost Electricity (120)

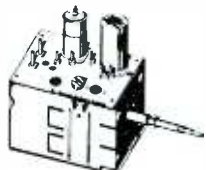
A new solid-state power inverter, the Galaxy Model 50-205, changes the DC output of a 12-volt storage battery to filtered AC at 117 volts. This Terado unit provides 140 watts of continuous output. A manual control permits changing frequency and output voltage. Housed in a heavy-gauge copper-clad base with carrying handle, the Model 50-205 sells for \$32.50.

100 Watts (121)

This booster amplifier provides 100 watts of output between 25 and 40,000 cps with less than 5% distortion. Because of the isolated secondary windings of the output transformer, two or more units may be connected in series to provide

TV TUNERS

Rebuilt—Exchanged



\$950*
Plus
Shipping
Charges

All Makes—All Models

- Includes all parts except tubes
- 90 day full warranty
- All tuners cleaned, lubed, repaired and aligned with crystal controlled factory equipment to factory specifications, by factory trained technicians.
- 1 day service

Give model number of set and complaint. Include tubes, shields, cover and all parts, broken or not.

*Practical Repairs

VALLEY TV TUNER SERVICE

5641 Cahuenga Blvd. PO 9-4730
North Hollywood, California

Circle 42 on literature card

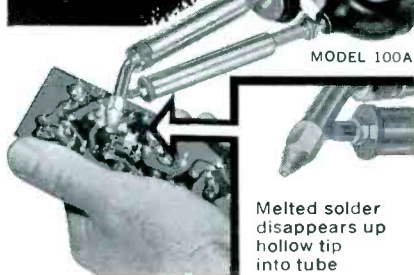


service faster with Fast-Fax

Raytheon Fast-Fax puts tube data for 600 types right at your fingertips. Stays up-to-date with "pop-in" supplements (including new types in '65 sets). Operates as an interchangeability guide and inventory control. See it at your Raytheon Distributor. You'll wonder how you ever got along without it. Fast-Fax. Only \$3.95.



Save Time on PC Board Repairs!



MODEL 100A

Melted solder disappears up hollow tip into tube

The ENDECO Desoldering Iron Removes Soldered Components in seconds . . . without damage!

Endeco melts solder, then removes it by vacuum • Leaves terminals and mounting holes clean • Resolders too • One-hand operation • Temperature controlled for continuous use • Ideal for use with shrinkable tubing • 4 tip sizes • Quickly pays for itself in time saved • Only \$18.75 net.

SEE YOUR DISTRIBUTOR OR WRITE



ENTERPRISE
DEVELOPMENT
CORPORATION

1102 E. 52ND • INDIANAPOLIS, IND. 46205

Circle 43 on literature card

only SWITCHCRAFT offers a low-cost molded closed-circuit jack



NEW!

SWITCHCRAFT

4 LEAF CLOVER JAX* MOLDED PHONO JACK

Only Switchcraft's all-new "4 Leaf Clover" phono jack offers you a low-cost connector with closed-circuit and all these other "lucky" features:

- Exclusive! Tip spring with shunt forms DUAL contact around pin of phono plug upon insertion.



REAR VIEW

PLUG OUT

PLUG IN

- Lower in cost . . . higher in reliability.
- High-impact plastic molded body for extra ruggedness.
- Special nickel silver springs for maximum life, dependability.

Available in four models: open circuit, grounded or ungrounded; closed circuit, grounded or ungrounded. Mounts on 3/4" centers.

WRITE FOR CATALOG NO. C502-

SWITCHCRAFT®

5573 N. Elston Ave., Chicago, Illinois 60630
*Patent Applied For.

Circle 44 on literature card



output voltages of 230 volts, 460 volts, etc. at any output wattage level. The **Bogen MO100A** can thus be used to provide inexpensive industrial power for unusual voltage-frequency-wattage applications.



Indoor Antenna (122)

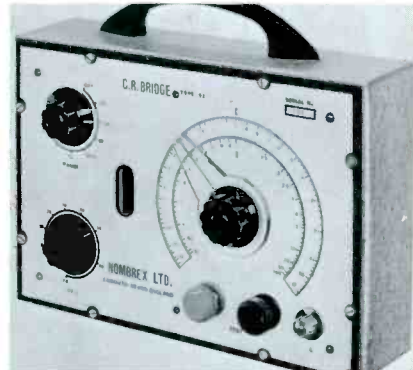
The VU-82 is an indoor antenna for reception on all TV and FM channels. Two separate antennas, each with its own transmission line, are built into one assembly. A dipole with 96" non-tarnish elements is used for VHF TV and FM; elements arranged in a stacked superturnstile design provide UHF reception. An electronic tuning circuit matches the 300-ohm impedance of the antenna to the TV set and adjusts the electrical length of the VHF elements to the wavelength of the channel in use. This **Channel Master** unit is priced at \$14.95.



Electronic Service Bag (123)

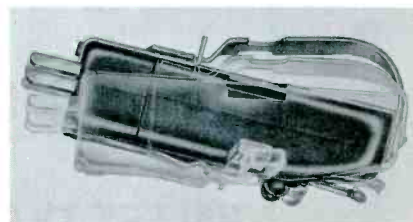
A genuine-leather tool bag, manufactured of top-grain cowhide by **K. Leather Prod-**

ucts, Inc., is divided into two parts. The upper section can hold large tools, meters, instruments, etc. The lower section has three sliding metal trays with numerous compartments for small articles. The bag is available in black or ginger and measures 11½" x 17" x 5¼".



All-Transistor Test Instruments (124)

Two new, all transistor units—an RF signal generator, Model 27 and a C-R bridge, Model 62—have been introduced to the United States by **Path Products Corp.** of Yonkers, N.Y. Manufactured in England under the Nombrex label, this test equipment offers compactness, light weight, stability, and portability. The Model 27 is factory wired and calibrated, covers frequencies from 150 kc to 350 mc in 8 overlapping bands, and operates from a standard 9-volt transistor-radio battery. This makes the unit completely self-contained and suited to a service technician's tube caddy. The Model 62 C-R Bridge will check capacitors in the range from 1 mmf to 100 mfd for value, power factor, and leakage; the resistor bridge covers the range of 10 ohms to 100 megohms.



Retractable Cartridge (125)

Three new stereo ceramic cartridges, all offering new safety features to protect records and needles, have just been released by **Sonotone**. One of these, the 21TR, solves the problem of record damage and needle destruction from acci-

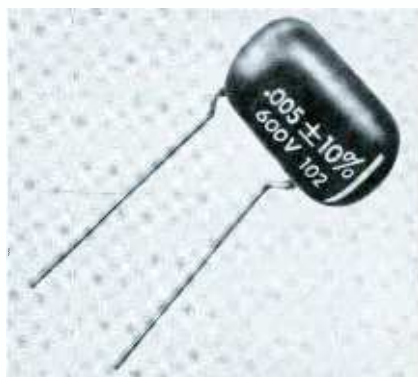
dental knocks and bumps of the tonearm. This retractable cartridge uses a pressure-balance technique; when sudden pressure is applied to the tonearm while it is in a playing position, the cartridge pivots, lifting the front portion into the tonearm and thus cradling the needle away from the record. The other two cartridges, the 22T and 23T, offer snap-mounting brackets. All three can be replaced in a matter of minutes, without using tools.

Circuit Breakers (126)

A compact kit (Stock No. CB-200) contains an assortment of 10 **Colman Electronics** breakers—5 different types that cover 97% of the replacement needs for



television receivers. Printed on the inside of the lid is a guide which lists 89 part numbers that may be replaced from the kit. The price of the assortment is less than the cost of the circuit breakers when purchased separately.



Tubular Bypass (127)

New tubular bypass capacitors recently announced by the Distributor Division of the **Aerovox Corp.** combine Mylar®, tissue, and a solid impregnant to present a unit with protection against moisture and mechanical damage. The coating will not crack, soften, or flow within an operating-temperature range of -55°C. to +125°C. A capacitance tolerance of ±10%, low power factor, and high insulation resistance, are extra features of the Type DBE capacitor. Units are available for 200, 400, and 600 volts DC.



Mobile VHF Antenna (128)

Wide-spaced driven elements produce high forward gain and front-to-back ratio to make the Model 71 by **Antennacraft** an excellent antenna for mobile homes. All-aluminum construction and high-impact plastic insulators insure years of good performance. This all-channel VHF antenna can be raised for viewing or folded for traveling in a matter of minutes. ▲

Winegard

Dealer of the month

No. 23 of a series

Welton Oakes says: "Winegard Colortrons have solved our reception problems in all trouble areas."



Winegard Salutes the Dixie Appliance Co., Kennett, Missouri and their distributor, Martin Wholesale Radio Supply, Inc. Paragould, Arkansas.

Welton Oakes, owner of the Dixie Appliance Co., has been building a service business in his present location since 1955. For all of his 9 years in business, he has been using Winegard antennas exclusively. "The installation of the best antenna for each location's specific reception problem is very important in satisfying the various needs of our customers. Winegard Colortron antennas have, through the years, helped us to do the best possible job."

Mr. Oakes uses Winegard Colortrons with power packs for all of his color installations. "We are 75 air miles from our nearest signal source in Memphis, Tennessee," said Mr. Oakes "and only the Winegard Colortron can bring in the Signal power we need out here for top notch color or black & white reception. The outstanding performance of Winegard Antennas and accessories has been proven to us and to our customers over and over again."

The confidence Mr. Oakes has shown in Winegard comes from installing Winegard Colortrons and seeing them in action. He's one more important service man who knows Winegard's standards of excellence first hand.

Winegard Co.
ANTENNA SYSTEMS

D3009-H Kirkwood • Burlington, Iowa
Circle 45 on literature card

August, 1964/PF REPORTER 75

INDEX TO ADVERTISERS

ATR Electronics, Inc.	14
Aeme Electric Corp.	44
Amperex Corp.	Cover 2
Antenna Specialists Co., The	66
Atlas Sound	60
B & K Mfg. Co.	13, 50, 63
Div. of Dynascan Corp.	
Belden Mfg. Co.	53
Berns Mfg. Co., Inc., The	52
Bussmann Mfg. Div.	18, 19
Cadre Industries	71
Castle TV Tuner Service	17
Centralab, Div. of Globe-Union, Inc.	45
Channellock, Inc.	48
Charles Engineering, Inc.	44
Clarostat Mfg. Co., Inc.	43
Cleveland Institute of Electronics	41
Delco Radio Div.	29
Enterprise Development Co.	74
Finney Co.	15
General Electric	36, 37
Hickok Electrical Instrument Co.	55
JFD Electronics Corp.	47
Jerrold Electronics	57
Littelfuse, Inc.	Cover 4
Mallory, P. R. & Co., Inc.	59
Nortronics Co., Inc., The	14
Oxford Transducer Co.	65
Perma-Power Co.	54
Philco Corp.	22, 23
Planet Sales Corp.	66
Precision Tuner Service	50
RCA Electronic Components and Devices	Cover 3
RCA Parts and Accessories	51
RCA Sales Corp.	20, 21
Raytheon Co.	73
Sams, Howard W. & Co., Inc.	49, 62, 68
Sarkes Tarzian, Inc. Tuner Service	9
Seco Electronics, Inc.	A1, A2
SENCORE, Inc.	38, 40, 42
Sonotone Corp.	69
Sprague Products Co.	11, 12
Switchcraft, Inc.	74
Sylvania Electric Products, Inc.	16
V-M Corp.	24
Valley TV Tuner Service	73
Winegard Co.	61, 75
Workman Electronic Products, Inc.	52
Xcelite, Inc.	67



FREE Catalog and Literature Service

*Check "Index to Advertisers" for further information from these companies.

Please allow 60 to 90 days for delivery.

ANTENNAS & ACCESSORIES

51. **ANTENNACRAFT**—Catalog sheet, illustrated in color, with information on connecting a UHF and a VHF antenna together using intercoupler G1483W.
52. **FINNEY**—Catalog No. 20-291 listing newly introduced FM bandpass filter that eliminates various types of FM interference.*
53. **JERROLD**—Illustrated brochure describing full line of new antenna preamplifiers and *Paralog* antennas.*
54. **JFD**—Literature and sales aids on log-periodic antennas. UHF-converter promotion kit. Literature on antenna amplifiers for VHF, UHF, and FM.*
55. **MOSLEY ELECTRONICS**—Illustrated catalog giving specifications and features on large line of antennas for Citizens band, amateur, and TV applications.
56. **TRIO**—Brochure on installation and materials for improving UHF translator reception.
57. **ZENITH**—Informative bulletins on new line of log-periodic antennas, antenna rotors.

AUDIO & HI-FI

58. **ADMIRAL**—Parts and accessories catalog listing replacement components; also includes cross reference for phono needles and cartridges.
59. **ATLAS SOUND**—New 1964 catalog No. 564 contains illustrations and specifications on PA speakers, microphone stands for commercial and industrial installations, and other new products.*
60. **CADRE**—Catalog No. BC-44-15 describing *Betacom* all-transistor intercom systems.*
61. **ELECTRO-VOICE**—Brochure describing newly announced *Featheride* ceramic stereo cartridge.
62. **JENSEN MFG.**—6-page brochure giving specifications and prices on *Delta* series 8" and 12" speakers.
63. **NORTRONICS**—Information on new three-channel head for use with 1/4" tape.*
64. **NUTONE**—Two full-color booklets illustrating built-in stereo music systems and intercom-radio systems. Includes specifications, installation ideas, and prices.
65. **OAKTRON**—"The Blueprint to Better Sound," an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.
66. **OXFORD TRANSDUCER**—Product information bulletin describing complete line of loudspeakers for all types of sound applications; including replacements for public address and intercom systems.*
67. **PERMA - POWER**—Catalog sheet on *Roving Rostrum* portable battery-operated sound system.*
68. **QUAM-NICHOLS**—New catalog listing replacement speakers for background music, public address, and hi-fi applications.
69. **SONOTONE**—Specification sheet on new stereo and mono crystal replacement cartridges.*
70. **SWITCHCRAFT**—Product Bulletin 141 describes new Q-G audio receptacles.*
71. **UNIVERSITY**—Guide to stereo high fidelity, and catalog of speakers for PA applications.
72. **WRIGHT - ZIMMERMAN**—Information sheets on complete line of pillow speakers, giving sizes and prices.

COMMUNICATIONS

73. **ATLAS SOUND**—Descriptive sheet on Model EC-10 paging and talkback speaker for commercial sound, mobile radio, lineup and Citizens band applications.*

74. **CARLOMA**—Catalog covering large line of antennas for Citizens band and amateur use.
75. **PEARCE-SIMPSON**—Specification brochures on *Companion II* and *Escort* Citizens band transceivers.
76. **PHILMORE**—Information on hand-held crystal microphone for mobile PA systems.
77. **REGENCY**—Information on newly introduced Citizens band transceivers and *Monitoradio*.
78. **TENNA**—Folder describing complete line of Citizens band antennas.

COMPONENTS

79. **BELDEN**—Catalog No. 864 showing complete line of wire and cable products for use in electronics applications.*
80. **BUSSMANN**—Bulletin SBCU on Buss Fustat Box Cover Units offers simple, low-cost way to protect workbench tools, soldering irons, drills, and the like against damage and burnout. Units fit standard outlet or switch boxes; have fuseholder, plus a plug-in receptacle, switch, and pilot light.*
81. **CENTRALAB**—8-page catalog listing *Fastatch II*, exact replacement controls and accessories.
82. **CHEMTRONICS**—Colorful catalog giving applications and prices of chemical service aids.
83. **CLEVELAND**—Literature on auto reverberation kits and audio distribution speakers.
84. **CORNELL-DUBILIER**—*Twist - prong* electrolytic reference, 4-page rotor brochure, 20-page TV-TM reception booklet, and capacitor assortment kit brochure.
85. **EQUIPTO**—Catalog No. 328 gives descriptions, unit listings, and prices on V-grip shelving equipment.
86. **GC ELECTRONICS**—24-page supplement No. FR-65-S listing newly introduced products.
87. **PERMACEL**—Bulletin describing line of plastic tape and plastic parts box.
88. **ROBINS INDUSTRIES**—Condensed catalog No. S-645 on all types of switches and pilot lights.
89. **SOLITRON**—16-page high voltage silicon rectifier catalog; 8-page varactor diode catalog.
90. **SPRAGUE**—Latest catalog C-616 with complete listing of all stock parts for TV and radio replacement use, as well as *Transfarad* and *Tel-Ohmike* capacitor analyzers.*
91. **STANDARD KOLLSMAN**—Booklet on replacement tuners for RCA TV receivers, including information on special trade-in allowances.
92. **TRIAD**—Replacement guide for color-TV flybacks and vertical-output transformers.
93. **WORKMAN**—Radio-TV component replacement catalog and transistor-replacement cross-reference chart.*

SERVICE AIDS

94. **CASTLE**—How to get fast overhaul service on all makes and models of television tuners is described in leaflet. Shipping instructions, labels, and tags are also included.*
95. **PRECISION TUNER**—Literature supplying information on complete, low-cost repair and alignment services for any TV tuner.*
96. **YEATS**—The new "back-saving" appliance dolly Model 7 is featured in a four-page booklet describing feather-weight aluminum construction.

SPECIAL EQUIPMENT

97. **ACME ELECTRIC**—Complete specifications and applications for control-type magnetic amplifiers with capacities from 5-1000 watts and voltage ranges from 24-160 volts.*

98. **ATR**—Descriptive literature on selling new, all-transistor *Karadio*, Model 707, having retail price of \$29.95. Other literature on complete line of DC-AC inverters for operating 117-volt PA systems and other electronics gear.*
99. **GREYHOUND**—The complete story of the speed, convenience, and special service provided by the Greyhound Package express method of shipping, with rates and routes.
100. **OAK**—Bulletins on transistorized FM and UHF tuners.
101. **TERADO**—Booklet on *Trav-Electric*; a self-contained 60 cycle AC power source.
102. **VOLKSWAGEN**—Large, 60-page illustrated booklet, "The Owner's Viewpoint," describes how various VW trucks can be used to save time and money in business enterprises; including complete specifications on line of trucks.

TECHNICAL PUBLICATIONS

103. **CLEVELAND INSTITUTE OF ELECTRONICS**—"Pocket Electronics Data Guides" with handy conversion factors, formulas, tables, and color codes. Additional folder, "Choose Your Career in Electronics," describes home-study electronics training programs, including preparation for FCC-license exam.*
104. **RCA INSTITUTES**—64-page book, "Your Career in Electronics," detailing home study courses in TV servicing, communications, automation, drafting, and computer programming; for beginners and experienced technicians.*
105. **HOWARD W. SAMS**—Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics; including special new 1964 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

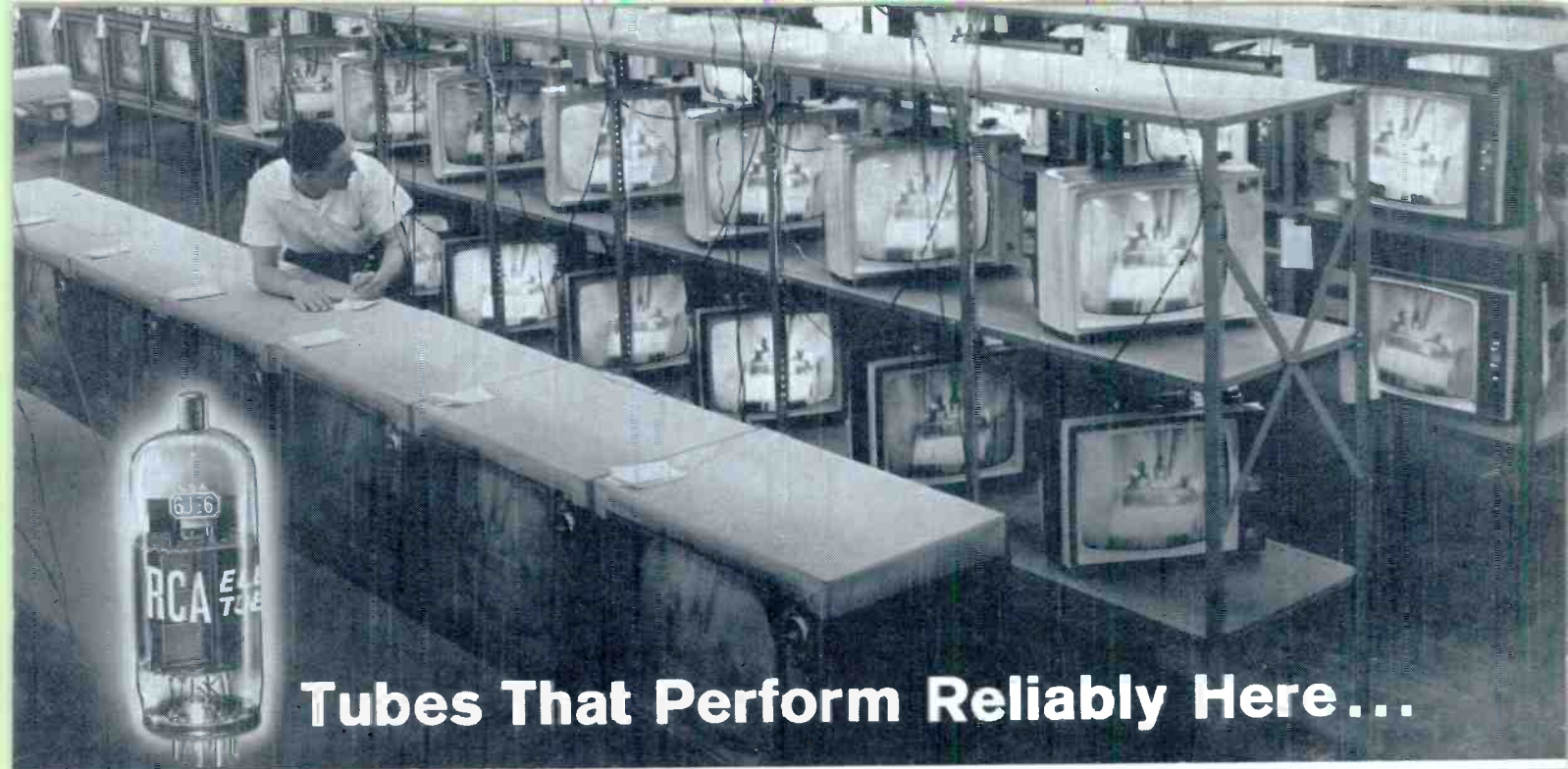
106. **B & K**—Catalog AP-21R describing uses for and specifications of new Model 1074 Television Analyst, Model 1076 Television Analyst, Model 850 Color Generator, Model 960 Transistor Radio Analyst, new Model 445 CRT Tester-Rejuvenator, new Model 250 Substitution Master, Model 375 *Dynamatic* VTVM, Model 360V-O-Matic VOM, Models 700 and 600 *Dyna-Quik* Tube Testers, and Model 1070 *Dyna-Sweep* Circuit Analyzer.*
107. **HICKOK**—Complete description and specification information on newly introduced equipment—Model 662 installer's color generator; Model 580 portable tube tester; Model 727 multiplex generator; Model 235A portable field strength meter.*
108. **JACKSON**—Complete catalog describing all types of electronic test equipment for servicing and other applications.
109. **SECO**—8-page brochure giving specifications and prices for Models 88, 98, and 107B tube testers; also catalog on color bar generator.*
110. **SENCORE**—Question-and-answer bulletin on new Model MX-129 *Multiplex Analyzer* and Model CR-128 Picture Tube Tester-Rejuvenator.*
111. **SIMPSON**—Latest series of VOM's is described in test-equipment bulletin; also information on line of automotive test equipment.

TOOLS

112. **ACME LITE**—Descriptive bulletin on line of *Magniflex* fluorescent lamps.*
113. **BURNS**—Data on unique 3-in-1 picture-tube repair tools, on *Audio Pin-Plug Crimper* that enables technician to make solderless plug and ground connections, and on new-style *ION* adjustable "beam bender" for CRT's.*
114. **ENTERPRISE DEVELOPMENT**—Time-saving techniques in brochure from *Endeco* demonstrate improved desoldering and resoldering techniques for speeding up and simplifying operations on PC boards.*
115. **GREENLEE**—Catalog on line of punches that cut holes in radio and TV chassis the easy way.
116. **LUXO LAMP**—Catalog on line of "touch-and-stay-put" lamps.

TUBES & SEMICONDUCTORS

117. **SEMITRONICS**—New updated 16" x 20" wall chart CH10 lists replacements and interchangeability for transistors and diodes.



Tubes That Perform Reliably Here...



Work Well Here

At top, you're looking into the RCA Receiving Tube Reliability Laboratory—a most important factor behind the exceptional reliability of RCA receiving tubes, and one more plus-value that you have in RCA tubes.

Here in two-hundred TV sets of all sizes—black-and-white and color—samples of each week's production of RCA receiving tubes are subjected to extensive tests under actual field conditions. The operating conditions for the TV sets vary from low-line to high-

line voltages. And the sets are regularly cycled on and off to check the effects of heating and cooling on the tubes.

The Tube Reliability Laboratory reveals—and allows us to eliminate—problems that do not show up under normal production life testing. It also permits us to conduct pre-production tests of new tube designs to make certain that the RCA standards of quality will be fulfilled before the new tubes are marketed.

Testing in the Tube Reliability Lab-

oratory enables us to verify the consistent high quality of RCA receiving tubes—to maintain uniformity of characteristics from tube to tube and throughout life. It is another example of the care we take to assure that RCA receiving tubes give **RELIABLE PERFORMANCE** where it really counts—in your customers' sets.

SEE YOUR AUTHORIZED RCA DISTRIBUTOR FOR TOP-QUALITY RCA RECEIVING TUBES

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics

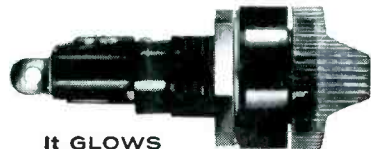
In Electronic Circuits . . .

ALL AROUND

NEW MICROFUSE

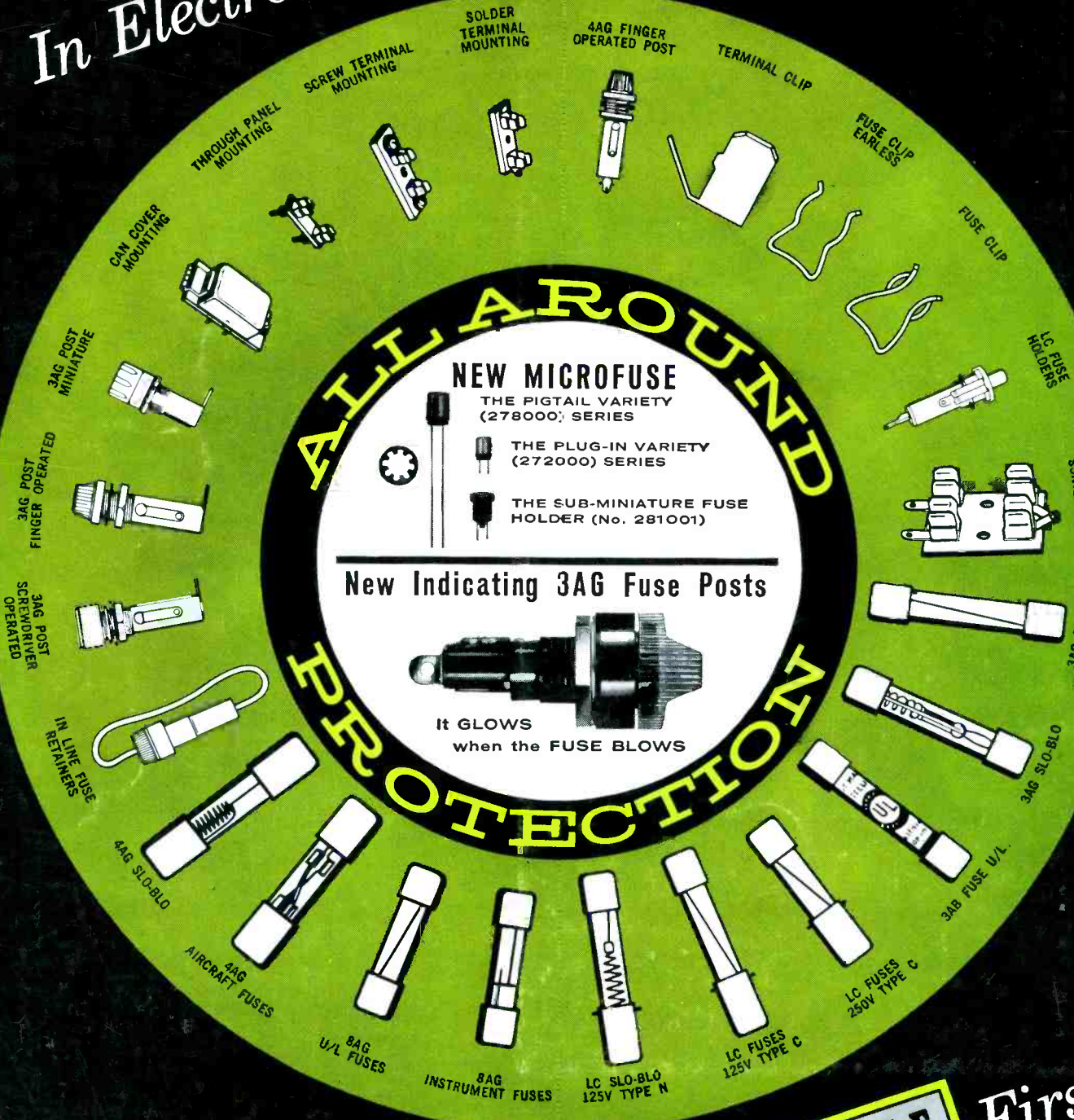
- THE PIGTAIL VARIETY (278000) SERIES
- THE PLUG-IN VARIETY (272000) SERIES
- THE SUB-MINIATURE FUSE HOLDER (No. 281001)

New Indicating 3AG Fuse Posts



It GLOWS when the FUSE BLOWS

PROTECTION



It's **LITTELFUSE** First!
 DES PLAINES, ILLINOIS

Circle 46 on literature card