



PF Reporter™

PHOTOFACT

the magazine of electronic servicing



IA 2L 1104 1200
WM. M. DAVIS
RAD. & TV SERV.
118 RIVERSIDE AVE.
CANON CITY, COLO.

- Radar Maintenance is Easy
- Finding and Keeping CB Customers
- Linear Sweep for Flat CRT's
- Voltage Division and How It Works
- Plus many more





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.



Circle 1 on literature card



**Delmonico
Model UHF-19**

The 19" Delmonico portable shown above is a Japanese-manufactured set with built-in dipole antenna, earphone jack, and carrying handle. The hand-wired chassis uses a 19EMP4 picture tube and is housed in a plastic cabinet. The switch-type VHF tuner uses a 4GK5 as the RF amplifier, and a 7GS7 functions as mixer and oscillator. The tube-type UHF tuner has a 2N-112 operating as its oscillator, and either a 1S543 or 1S750 signal diode acts as UHF mixer.

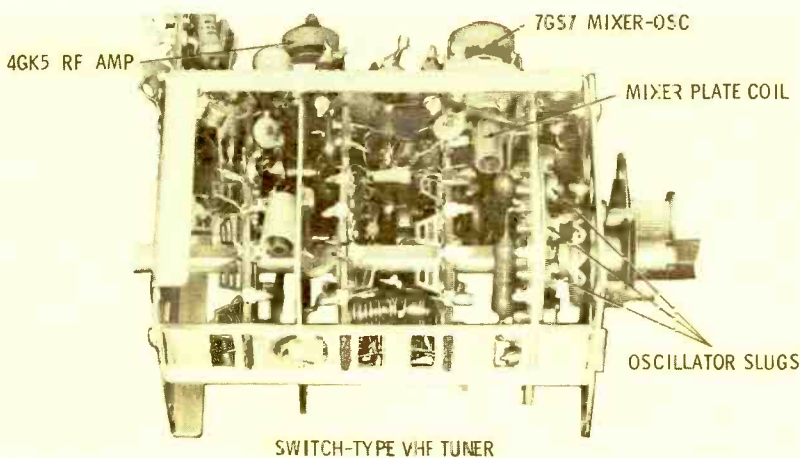
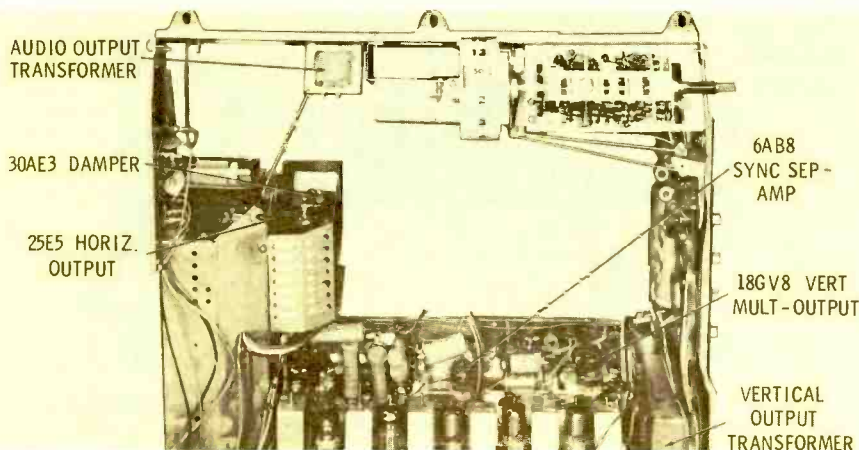
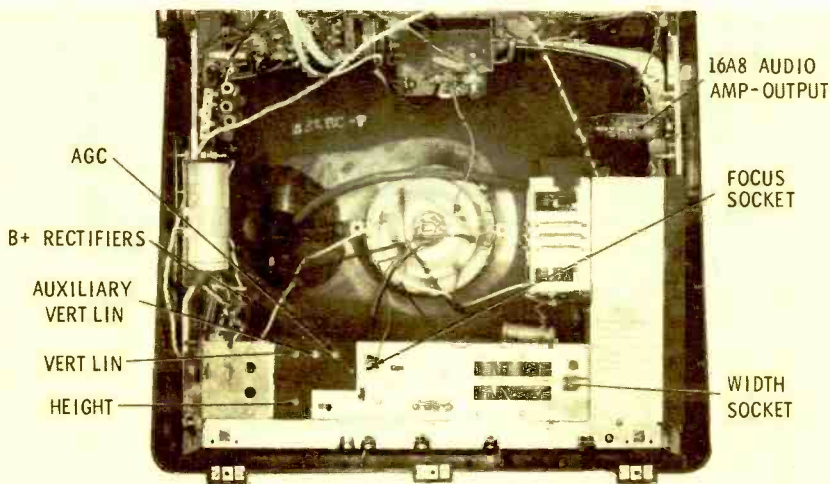
This transformerless receiver receives its B+ from two silicon rectifiers connected as a half-wave voltage doubler. Silicon protection is afforded by a 4.7-ohm, 8-watt resistor. A 2-amp pigtail fuse is located in the AC line and is mounted beneath the chassis; thus, it is necessary to remove the chassis to replace the fuse. The series-parallel filament circuit has a tapped 30-watt dropping resistor—one leg using 81 ohms, the other 126 ohms. The only tubes common to both branches are the UHF oscillator and the picture tube.

Several unfamiliar tube types are used in this receiver. Among these are: 16A8 audio amplifier/output, 6AB8 sync separator/amplifier, 18GV8 vertical multi-vibrator/output, 25E5 horizontal output, and 30AE3 damper. Also, it would be a good idea to check your tube stock for the 1S2 used as the high-voltage rectifier.

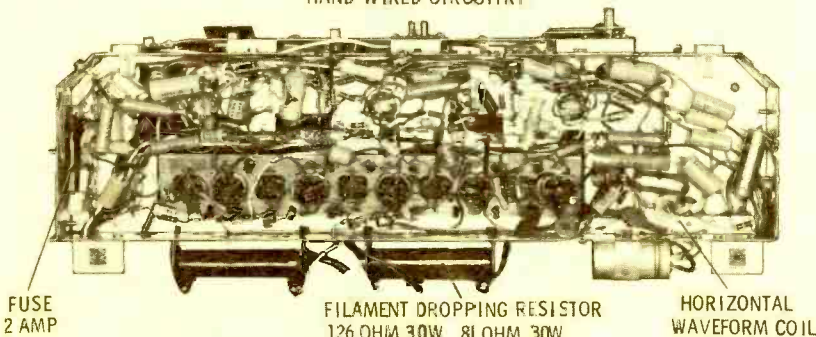
Focus can be varied by connecting the CRT focus anode (pin 4) to either of three B+ voltages or to boost. Width is adjustable by connecting the horizontal-output screen grid to either of three connections on the width socket. Each connection provides a different resistance in the screen supply. Normal adjustment of horizontal hold is accomplished by the oscillator coil; however, the waveform coil is also tunable in case additional adjustment is necessary.

Located on the rear of the receiver are the vertical-linearity, auxiliary vertical-linearity, AGC, and height controls. Mounted on the side of the receiver are the on-off-volume, brightness, contrast, and vertical-hold controls.

Each individual VHF-oscillator slug is adjustable; simply remove the channel-selector and fine-tuning knobs and rotate the fine-tuning rotor until the oscillator slug and the hole in the rotor coincide.



HAND-WIRED CIRCUITRY



PF REPORTER, February, 1965, Vol. 15, No. 2 PF REPORTER is published monthly by Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis 6, Indiana. Second-class postage paid at Indianapolis, Indiana, 1, 2, & 3 year subscription prices; U.S.A., its possessions, and Canada: \$5.00, \$8.00, \$10.00. Other countries: \$6.00, \$10.00, \$13.00. Current single issues 50c each; back issues 65c each.



**Emerson
Model D2011
TV Chassis 120744G
AM-FM Chassis 120730
Amplifier Chassis 120716**

This Emerson combination consists of a 23" television set, a four-speed stereo phonograph, an AM-FM radio, and a stereo amplifier. The TV section uses a total of 14 tubes including the picture tube and VHF tuner. The UHF tuner is transistorized—using an NPN transistor as the UHF oscillator and a 1N82 mixer diode.

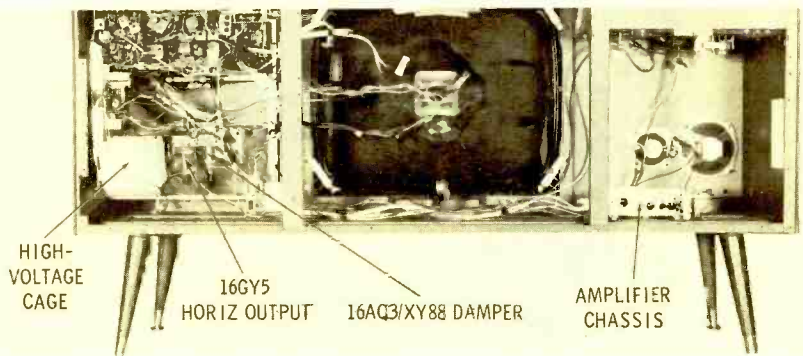
The low-voltage section of the TV chassis uses a single silicon rectifier which is protected by a 1.2-amp chemical fuse and a 5-ohm, 7-watt surge-limiting resistor. The series filament string has a 48-ohm, 20-watt dropping resistor.

The stereo amplifier and AM-FM radio chassis derive their B+ from a single selenium rectifier located on the amplifier chassis. Selenium protection is afforded by a 6-ohm, 2-watt resistor.

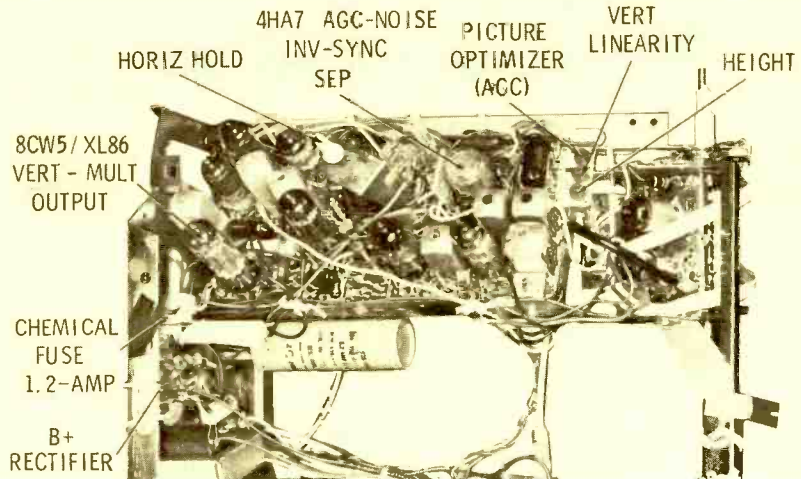
This same TV chassis is also used in 16" and 19" models. The 23" model shown here uses a 23FKP4 picture tube; 19" models use either a 19DNP4 or 19-EHP4, and either a 16ANP4 or 16BRP4 may be found in the 16" receivers. Other tubes worth noting are the 8CW5/XL86 found in the vertical-output socket, the 16AQ3/XY88 damper. The horizontal output may be either a 16GY5 or a 13-GB5/XL500. The functions of AGC keying/sync separator may be performed by a 4HA7 or 4HC7—both of which are compactrons with dual triode sections. Some models may use a 6K11 or 6Q11 in this application; both of these latter compactrons have three triode sections and the additional section is used as a noise inverter, in which case three resistors and one capacitor are added to the circuit. The sound-IF amplifier/horizontal-oscillator may be a 4B1.8 or 5GH8.

Channel-selector, fine-tuning, brightness, contrast, and vertical-hold controls are at the top of the receiver. Horizontal hold is accomplished by adjusting the oscillator-coil slug, and is accessible from the rear. Height, vertical-linearity, and picture-optimizer (AGC) controls are all together in one triple-section printed unit; these controls may be adjusted from the rear of the receiver.

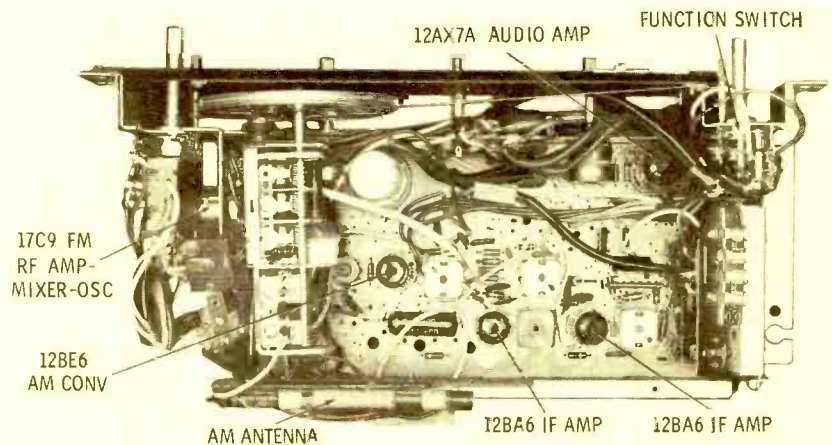
The video detector is a 1N295 diode located beneath a removable shield covering the final IF transformer. Horizontal-AFC action is provided by a dual diode connected so its cathodes are common.



HIGH-VOLTAGE CAGE
16GY5 HORIZ OUTPUT
16AQ3/XY88 DAMPER
AMPLIFIER CHASSIS

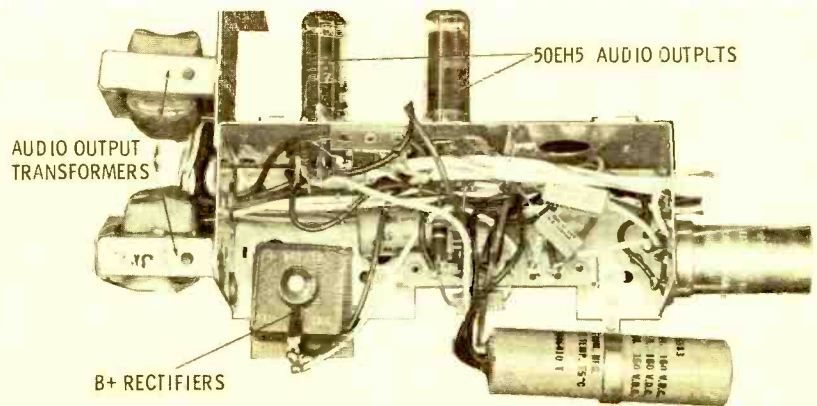


4HA7 AGC-NOISE INV-SYNC SEP
PICTURE OPTIMIZER (AGC)
VERT LINEARITY
HEIGHT
8CW5/XL86 VERT-MULT OUTPUT
CHEMICAL FUSE 1.2-AMP
B+ RECTIFIER



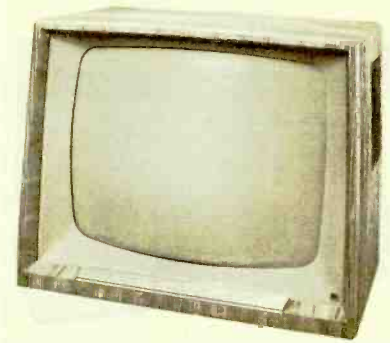
12AX7A AUDIO AMP
FUNCTION SWITCH
17C9 FM RF AMP-MIXER-OSC
12BE6 AM CONV
AM ANTENNA
12BA6 IF AMP
12BA6 IF AMP

TOP VIEW — AM-FM RADIO CHASSIS



AUDIO OUTPUT TRANSFORMERS
50EH5 AUDIO OUTPLTS
B+ RECTIFIERS

BOTTOM VIEW — AMPLIFIER CHASSIS



**Grundig
Model TV59T50**

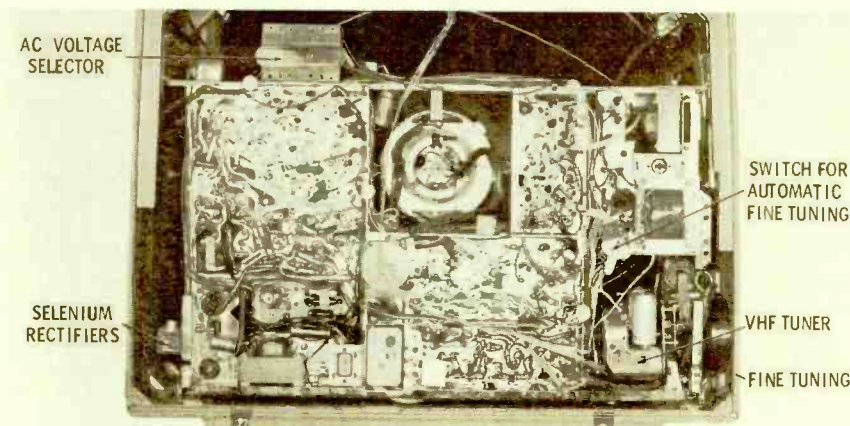
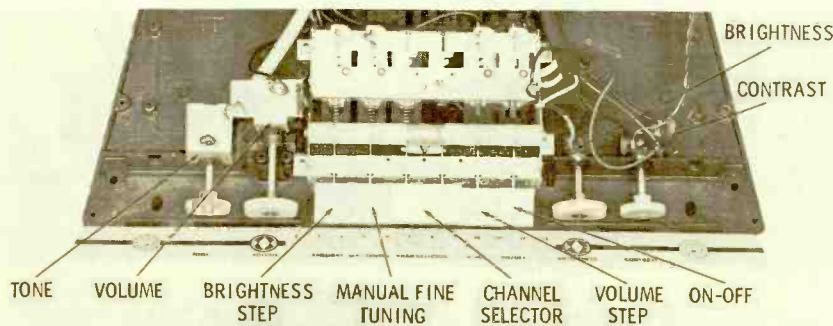
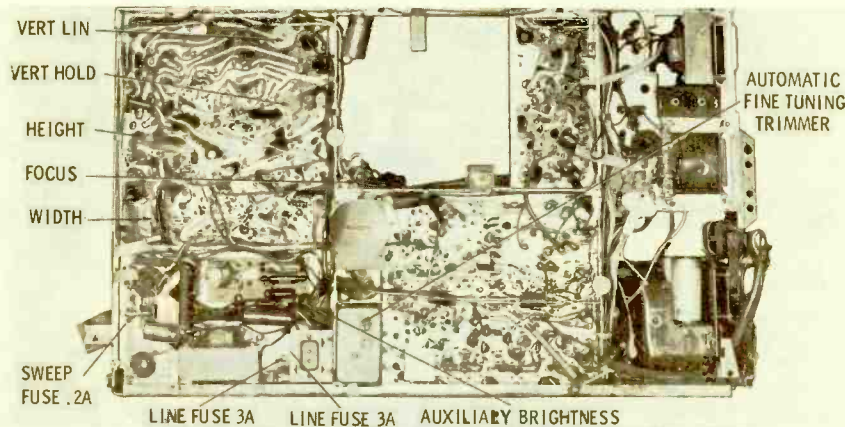
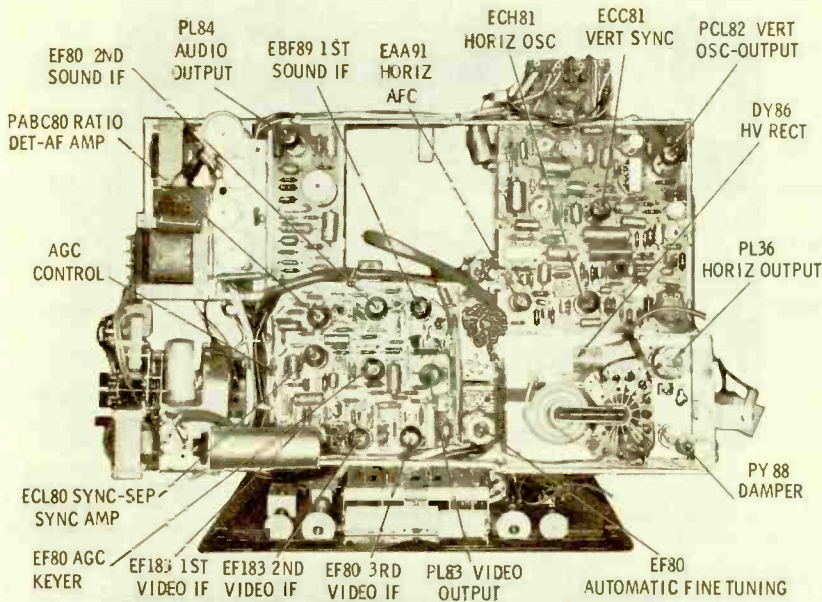
The photo above shows an import from Germany. The Grundig trade name has been seen in this country on radios and tape recorders previously, but this is the first German television to be marketed in the U. S.

Four individual printed boards are used: one of the two larger boards is devoted to the horizontal- and vertical-sweep circuits, and the other to video, sync, AGC, and sound networks. The PL84 audio-output tube and its associated components are mounted on a separate board. The fourth board consists of an automatic fine tuning circuit using an EF80. A sample of the video-IF signal (taken from the video-detector input) is coupled to the control grid of this tube and used to control the VHF oscillator; much the same as in horizontal-AFC circuits.

The low-voltage power supply consists of two selenium rectifiers protected by two 3-amp fuses—one in each side of the AC line. A voltage-selector plug is provided for operating the receiver on either 117 or 220 volts AC. The line fuses are each 2-amp units when 220 volts is used. A third fuse (.2 amp) is found in the cathode circuit of the PL36 horizontal-output tube. This fuse protects against overload in the horizontal-output stage.

A multipushbutton selector-switch assembly provides the following functions: on-off, two-step volume level, two-step brightness level, manual or automatic fine tuning (depress for manual operation), and channel selection. In this same assembly are the tone, brightness, volume, and contrast controls.

Tube functions and types are as follows: (American equivalents are in parentheses) first and second video-IF amplifier EF183 (6EH7), third video-IF amplifier EF80 (6BX6), video output PL83 (15A6), first sound-IF amplifier EBF89 (6DC8), second sound-IF amplifier EF80 (6BX6), ratio detector/AF amplifier PABC80 (9AK8), audio output PL84 (15CW5), AGC keyer EF80 (6BX6), sync separator/sync amplifier ECL80 (6AB8), vertical-sync amplifier/cathode follower ECC81 (12AT7), vertical oscillator/output PCL82 (16A8), horizontal AFC EAA91 (6AL5), horizontal oscillator ECH81 (6AJ8), horizontal output PL36 (25E5), damper PY88 (30AE3), and high-voltage rectifier DY86 (1S2).





**Zenith
Model M2231LU
Chassis 14M27**

This deluxe 19" portable is equipped with a Space Command 300 remote-control unit, a clock-timer assembly, and a built-in dipole antenna for VHF reception. Connections for an external UHF antenna are provided. The chassis is physically the same as ones used in previous years, and the circuitry is similar; the use of compactrons, however, has led to fewer tubes in this chassis.

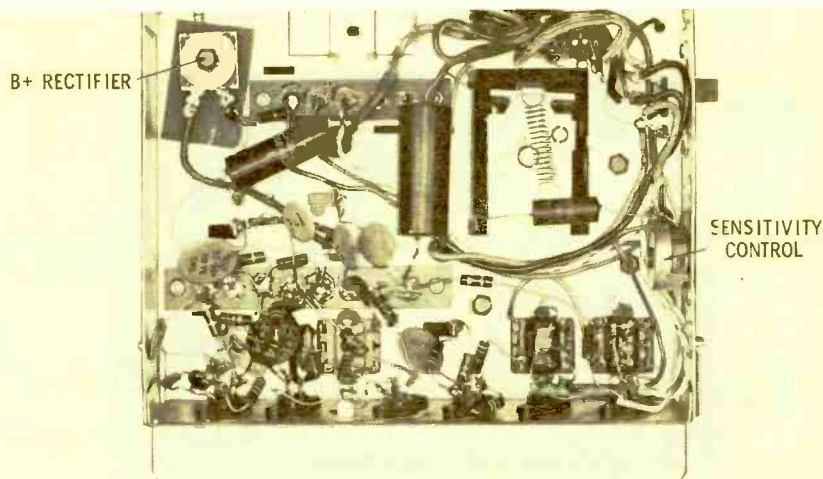
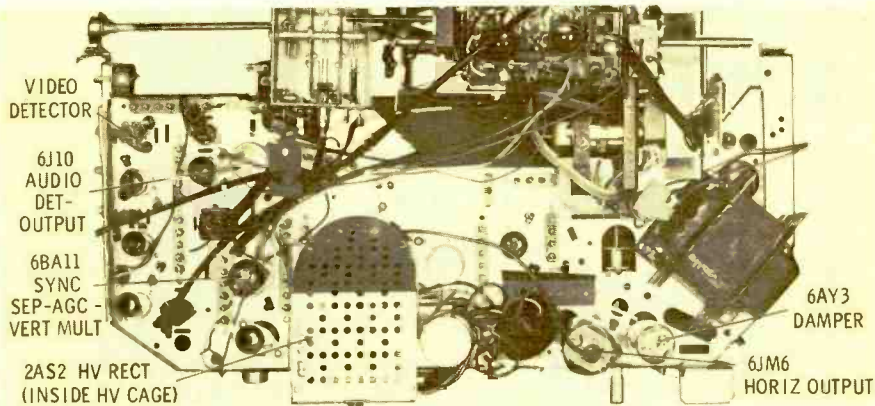
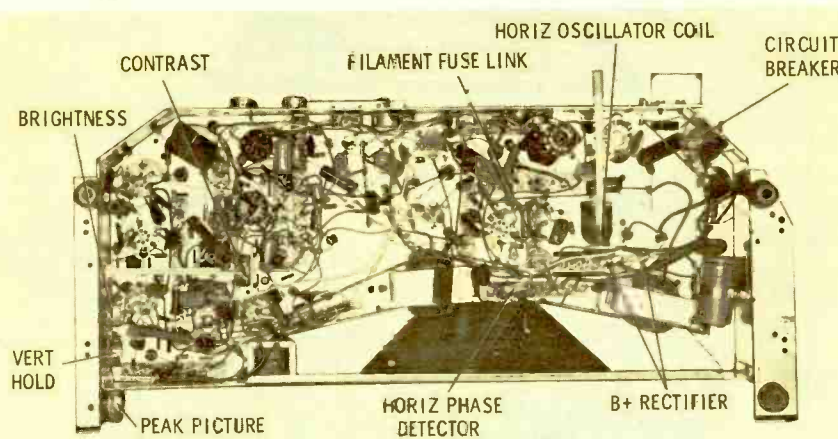
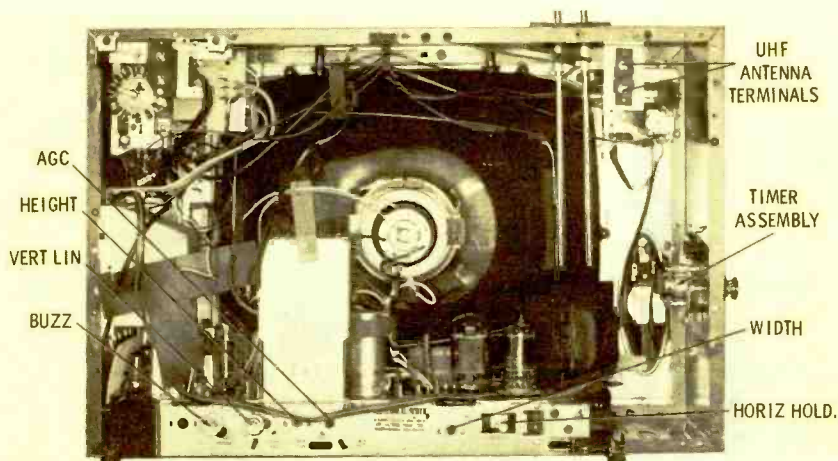
A 12-pin compactron, 6BA11, functions as sync separator/AGC keyer/noise limiter/vertical multivibrator. A second compactron, the 6J10, serves the purpose of audio detector/output. Another tube worth mentioning is the 6KD8 (sometimes a 6GH8) used as horizontal AFC/oscillator. The sweep circuits use a 6GK6 vertical output, 6JM6 horizontal output, 6AY3 damper, and 2AS2 high-voltage rectifier. The picture tube may be either 19CXP4 or 19DP4, but these two types are not directly interchangeable.

The television low-voltage power supply consists of a power transformer and two silicon rectifiers connected as a full-wave voltage doubler. Along with the entire power supply, these silicons are protected against shorts and overloads by a circuit breaker in the primary winding of the power transformer. The parallel filaments are similarly protected by a 1½" piece of copper wire—the filament fuse link.

The hand-wired, transistorized, remote-control unit has its own selenium rectifier. In this subchassis, rectifier protection is not provided. The UHF tuner uses a transistor oscillator with the transistor located inside the tuner shield.

The viewer may use the timer assembly to turn off the set at a predetermined time. The three positions on the timer switch are marked on-hold, off, and timer.

On the rear of the TV chassis are adjustments for width, horizontal hold, AGC, height, vertical linearity, and buzz. Controls mounted on the side of the chassis include picture peaking, contrast, vertical hold, and brightness (all of these controls are noted in the accompanying photos). Focus may be varied by connecting the jumper from pin 6 of the CRT to B+, boost, or ground; the focus connections will not normally need to be changed unless the CRT is replaced.



BOTTOM VIEW REMOTE-CONTROL CHASSIS — HAND WIRED

See PHOTOFACT Set 608, Folder 1

Mfr: DuMont Chassis No. 120591A, 592B, 593A, 650C, 657A

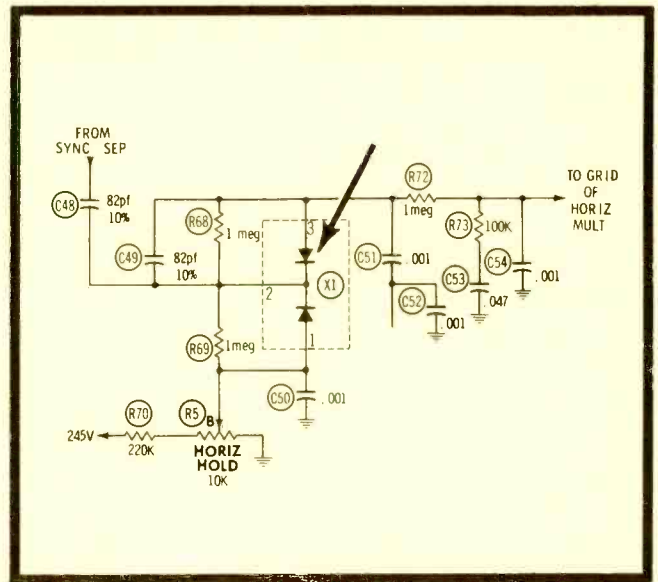
Card No: DM591A-1

Section Affected: Horizontal sync.

Symptoms: Hold control at end of range; loses sync with noise interference.

Cause: Phase detector unbalanced.

What To Do: Replace X1.



Mfr: DuMont Chassis No. 120591A, 592B, 593A, 650C, 657A

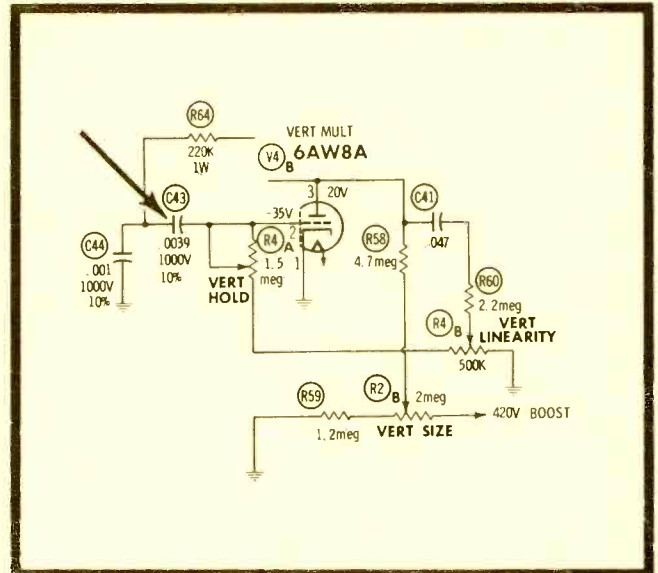
Card No: DM591A-2

Section Affected: Vertical sweep.

Symptoms: Vertical hold control at end of range; possible vertical jitter.

Cause: Vertical feedback capacitor changed value.

What To Do: Replace C43 (.0039 mfd—1000V).



Mfr: DuMont Chassis No. 120591A, 592B, 593A, 650C, 657A

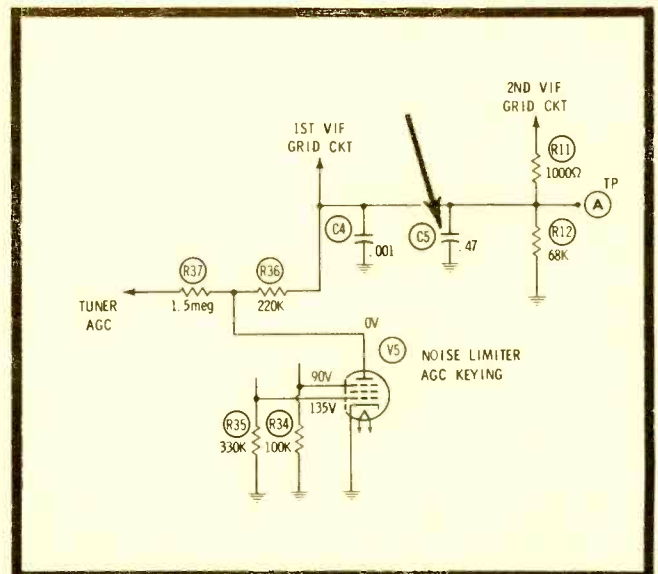
Card No: DM591A-3

Section Affected: Vertical sweep.

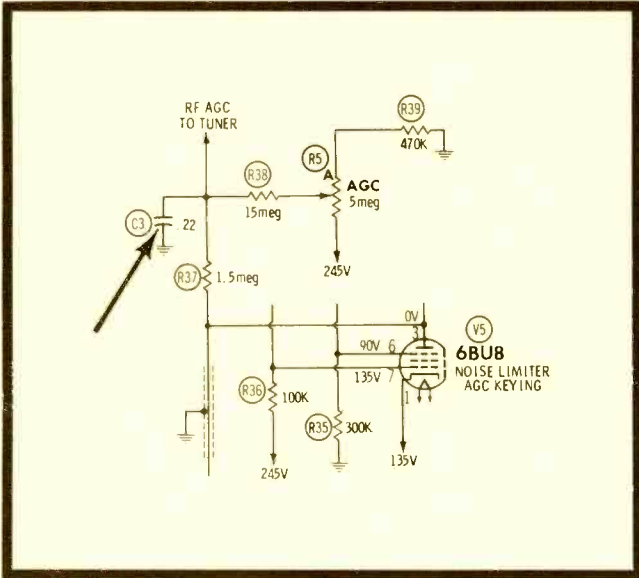
Symptoms: Critical vertical hold; vertical jitter.

Cause: IF AGC bypass capacitor open.

What To Do: Replace C5 (.47 mfd).



See PHOTOFACT Set 608, Folder 1



See PHOTOFACT Set 608, Folder 1

Mfr: DuMont Chassis No. 120591A, 592B, 593A, 650C, 657A

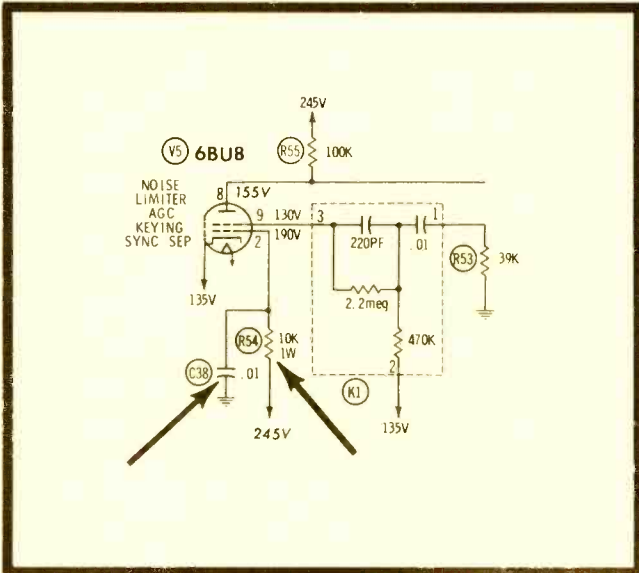
Card No: DM591A-4

Section Affected: Pix and horizontal sync.

Symptoms: Black shaded bar on left side of raster; critical horizontal sync.

Cause: Tuner AGC bypass capacitor open.

What To Do: Replace C3 (.22 mfd).



Mfr: DuMont Chassis No. 120591A, 592B, 593A, 650C, 657A

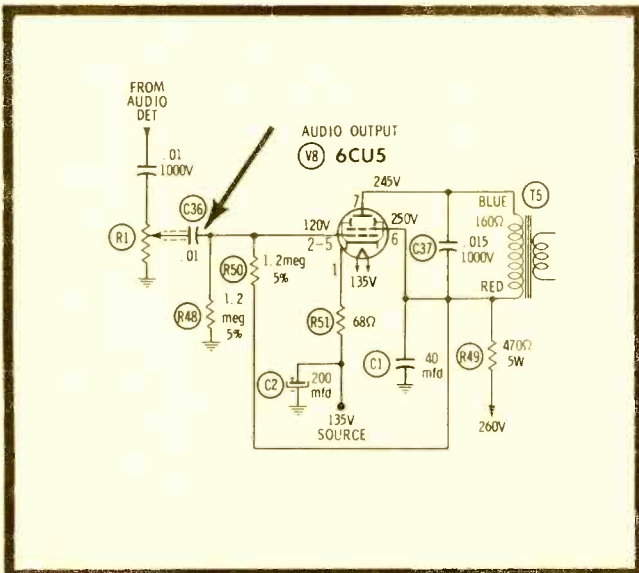
Card No: DM591A-5

Section Affected: Sync.

Symptoms: No vertical or horizontal sync; missing or low voltage on screen grid (pin 2) of V5; screen grid resistor burns.

Cause: Sync separator screen bypass shorted.

What To Do: Replace C38 (.01 mfd) and R54 (10K—1W).



Mfr: DuMont Chassis No. 120591A, 592B, 593A, 650C, 657A

Card No: DM591A-6

Section Affected: Sound.

Symptoms: No audio; loud hum.

Cause: Audio coupling capacitor shorted.

What To Do: Replace C36 (.01 mfd).

See PHOTOFACT Set 705, Folder 3

Mfr: Philco Chassis No. 14N50

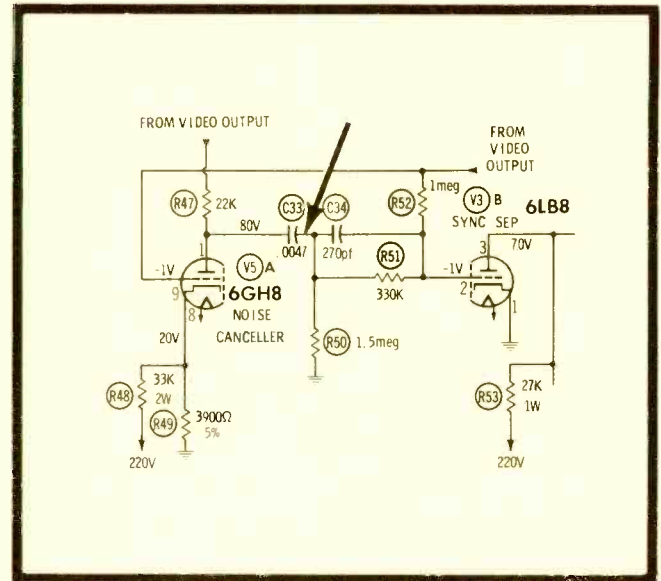
Card No: PH 14N50-1

Section Affected: Sync.

Symptoms: Poor vertical sync; horizontal pulling; voltage on grid of V3B is positive.

Cause: Leaky coupling capacitor from noise inverter to sync separator.

What To Do: Replace C33 (.0047 mfd).



Mfr: Philco Chassis No. 14N50

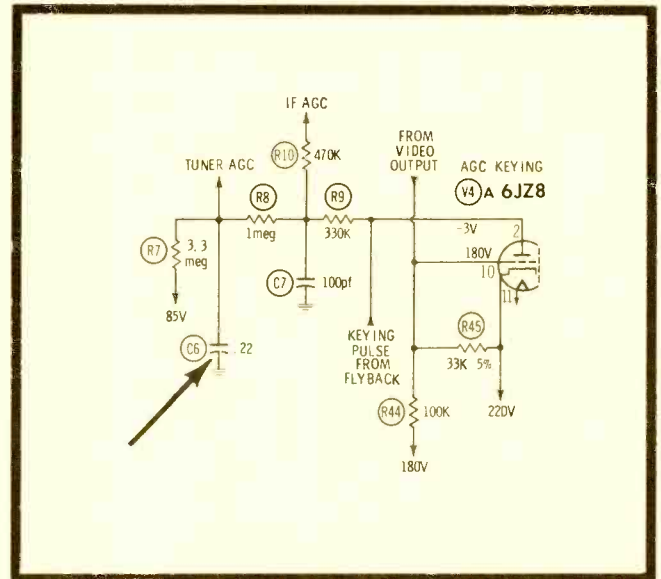
Card No: PH 14N50-2

Section Affected: Pix and sound.

Symptoms: Receiver operates normal on weak signals, but overloads on medium to strong stations; contrast control has little effect in reducing contrast.

Cause: AGC filter C6 shorted.

What To Do: Replace C6 (.22 mfd).



Mfr: Philco Chassis No. 14N50

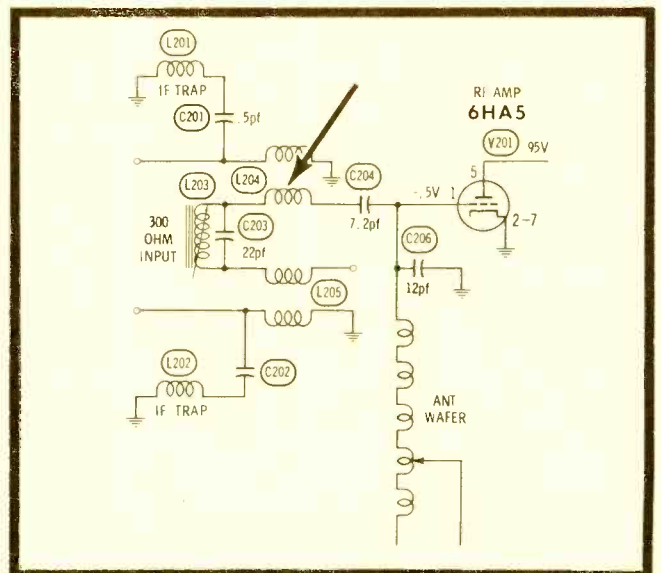
Card No: PH 14N50-3

Section Affected: Pix.

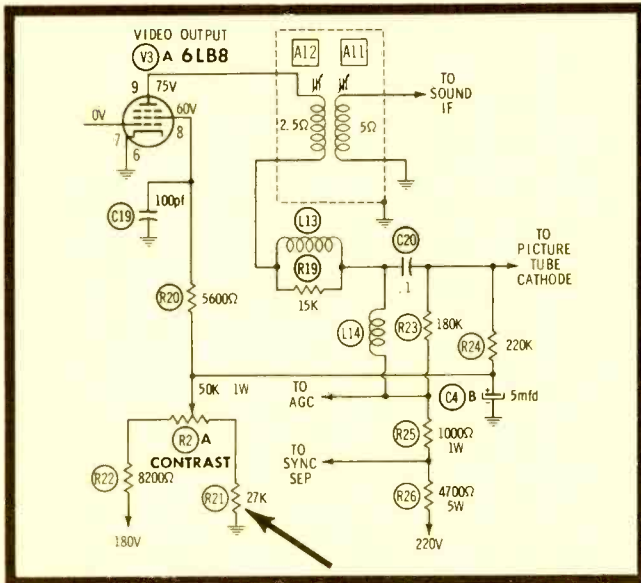
Symptoms: Oscillation in picture indicated by erratic horizontal lines; unstable sync; symptoms are minimized when antenna leads are shorted.

Cause: Antenna balun coil open.

What To Do: Repair or replace antenna balun coil (located on tuner); Philco part #32-4725-5.



See PHOTOFACT Set 705, Folder 3



See PHOTOFACT Set 705, Folder 3

Mfr: Philco Chassis No. 14N50

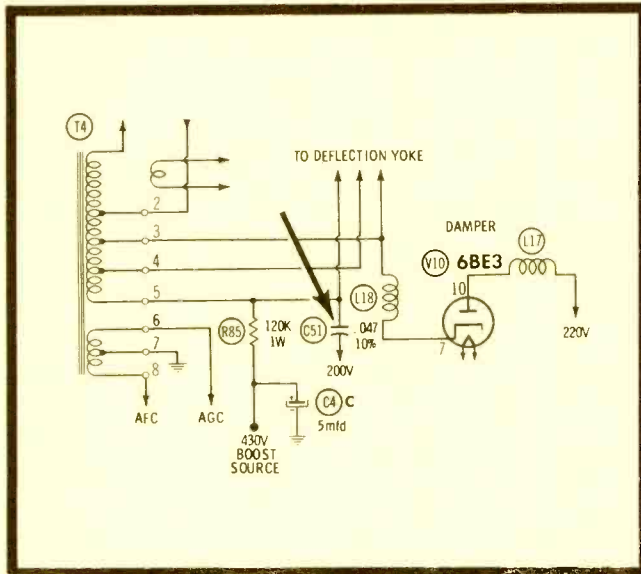
Card No: PH 14N50-4

Section Affected: Pix and sound.

Symptoms: Sound and picture "cut off" below 1/3 setting of contrast control; upper 2/3 of control works normally.

Cause: Contrast control range is too great.

What To Do: Remove 27K resistor R21 and replace with a jumper wire.



Mfr: Philco Chassis No. 14N50

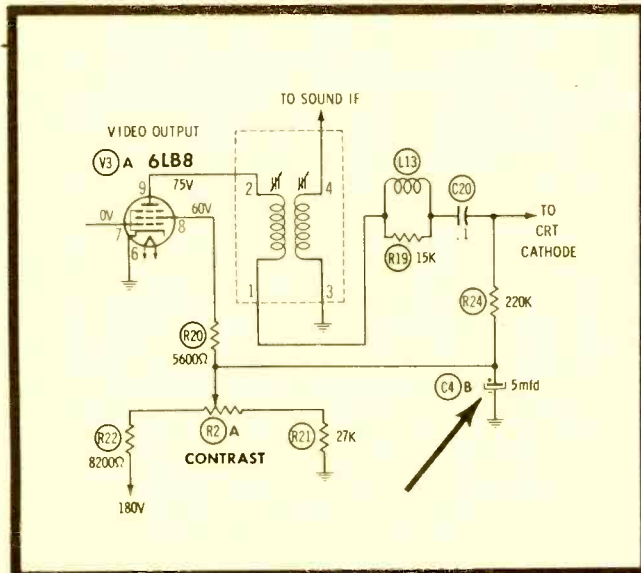
Card No: PH 14N50-5

Section Affected: Pix and raster.

Symptoms: Insufficient width; dim picture; low boost voltage.

Cause: Leakage in boost filter capacitor.

What To Do: Replace C51 (.047 mfd).



Mfr: Philco Chassis No. 14N50

Card No: PH 14N50-6

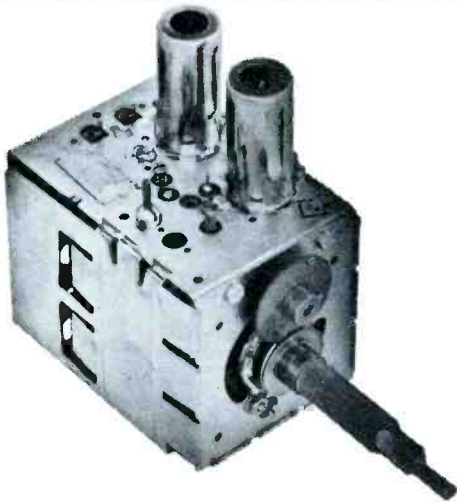
Section Affected: Pix and sync.

Symptoms: Intermittent vertical sync; poor picture quality.

Cause: Open capacitor C4B in screen circuit of video output stage.

What To Do: Replace C4 (5-5-100 mfd—400-250-25 V).

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

PF Reporter™

PHOTOFACT

the magazine of electronic servicing

VOLUME 15, No. 2

FEBRUARY, 1965

CONTENTS

Previews of New Sets	1
Delmonico Model UHF-19 Emerson Model D2011, Chassis 120744G Grundig Model TV59T50 Zenith Model M2231LU, Chassis 14M27	
Video Speed Servicing	5
Service hints on Dumont Chassis 120591A, 592B, 593A, 650C, 657A, and Philco Chassis 14N50	
Letters to the Editor	13
The Electronic Scanner	20
Color Parts Guide	22
Symfact: Video-AGC-Sync (Takeoff Network)	27
See what happens to voltages and waveforms when troubles occur.	
Tracking Adjustments for AM and FM	32
Approach alignment jobs with a clear head.	
Waveforms Save Analysis Time	34
A pictorial presentation of composite video signals.	
Linear Sweep for Flat CRT's	36
Shop Talk—A discussion of rectangular-shaped picture tubes.	
Radar Maintenance is Easy	38
Servicing Industrial Electronics—A closer look at one phase of marine electronics.	
CATV Revisited	42
Answers to some of your questions about cable systems.	
Filter Buzz	50
Voltage Division and How It Works	52
Quicker Servicing—Brush up on basic analysis of R+ distribution networks.	
Finding and Keeping CB Customers	58
Dollar and Sense Servicing—A behind-the-scenes view of successful business practices.	
Variable Line Transformer As a TS Aid	64
These case histories may affect your servicing procedures.	
The Troubleshooter	70
Notes on Test Equipment	74
Lab reports on Hickok Model 727 Stereo FM Generator and SENCORE Model CR128 CRT Tester.	
Book Review	80
Product Report	84
Free Catalog and Literature Service	88
Monthly Index on free literature card	

publisher

Howard W. Sams

editor

Forest H. Belt

managing editor

George F. Corne, Jr.

associate editors

James M. Moore

Allen B. Smith

Norman D. Tanner

consulting editors

William E. Burke

Joe A. Groves

C. P. Oliphant

research librarian

M. D. Bishop

production manager

Robert N. Rippy

circulation manager

Pat Tidd

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

Hugh Wallace, advertising sales manager

midwestern

PF REPORTER, 4300 West 62nd Street,

Indianapolis, Ind., AXminster 1-3100

eastern

Gregory C. Mcsefield

Howard W. Sams & Co., Inc., 3 West 57th Street,

New York, N. Y., MUrray Hill 8-6350

southwestern

C. H. (Jake) Stockwell

C. H. Stockwell Co., 4916 West 64th St.,

Missian, Kansas, RAndolpn 2-4417

western

G. R. Holtz

The Maurice A. Kimball Co., Inc.

2550 Beverly Blvd., Los Angeles 57, Calif.

DUNKirk 8-6178; and 580 Market Street,

Room 400, San Francisco 4, Calif. EXbrook 2-3365

Address all correspondence to

PF REPORTER, 4300 W. 62nd Street

Indianapolis, Indiana 46206



Copyright © 1965 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 Lectradex.

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

ABOUT THE COVER

Increased activity on the inland waterways demands new standards of accuracy for navigation and ranging in pleasure craft. The Raytheon Model 1500 radar installation shown on this month's cover is typical of low-cost marine installations that provide an interesting and profitable servicing field. See page 38 for an introduction to marine radar servicing.



Have you tried new **QUIG**[®] connectors?

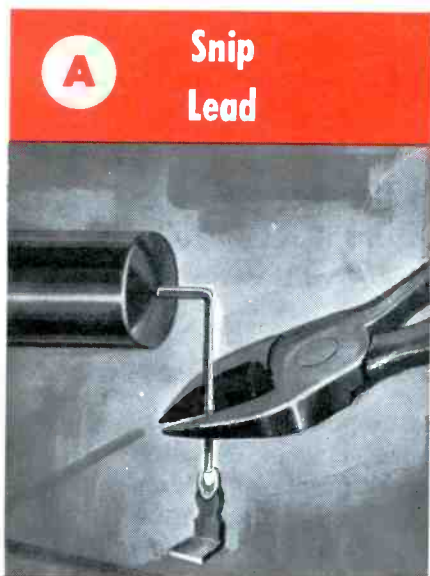
Not just another wire spring connector!
The 3-in-1 QUIG is brand new and different . . . Copperweld wire inner core, a layer of flux, and an outer jacket of solder . . . all you need is heat!
Makes one-handed soldering possible!

Once again, Sprague helps the TV-radio service industry by solving two increasingly serious problems . . . parts replacement in those "inaccessible" chassis nooks, such as crowded tube sockets, as well as soldering onto the delicate circuitry of printed wiring boards.

Mechanically sturdy and electrically reliable, the revolutionary QUIG provides fast, expertly-soldered connections as easy as A-B-C!



Ten times actual size



***NOBODY ELSE HAS QUIG CONNECTORS...
YOU GET 'EM ONLY FROM SPRAGUE PRODUCTS!***

QUIGS are now being packed with Sprague Atom[®] Capacitors *at no extra cost to you!* Whenever you need tubular electrolytics, insist on pre-packaged Sprague Atoms from your parts distributor and you'll automatically get your QUIG component connectors . . . the biggest boon to the service technician since the soldering gun!



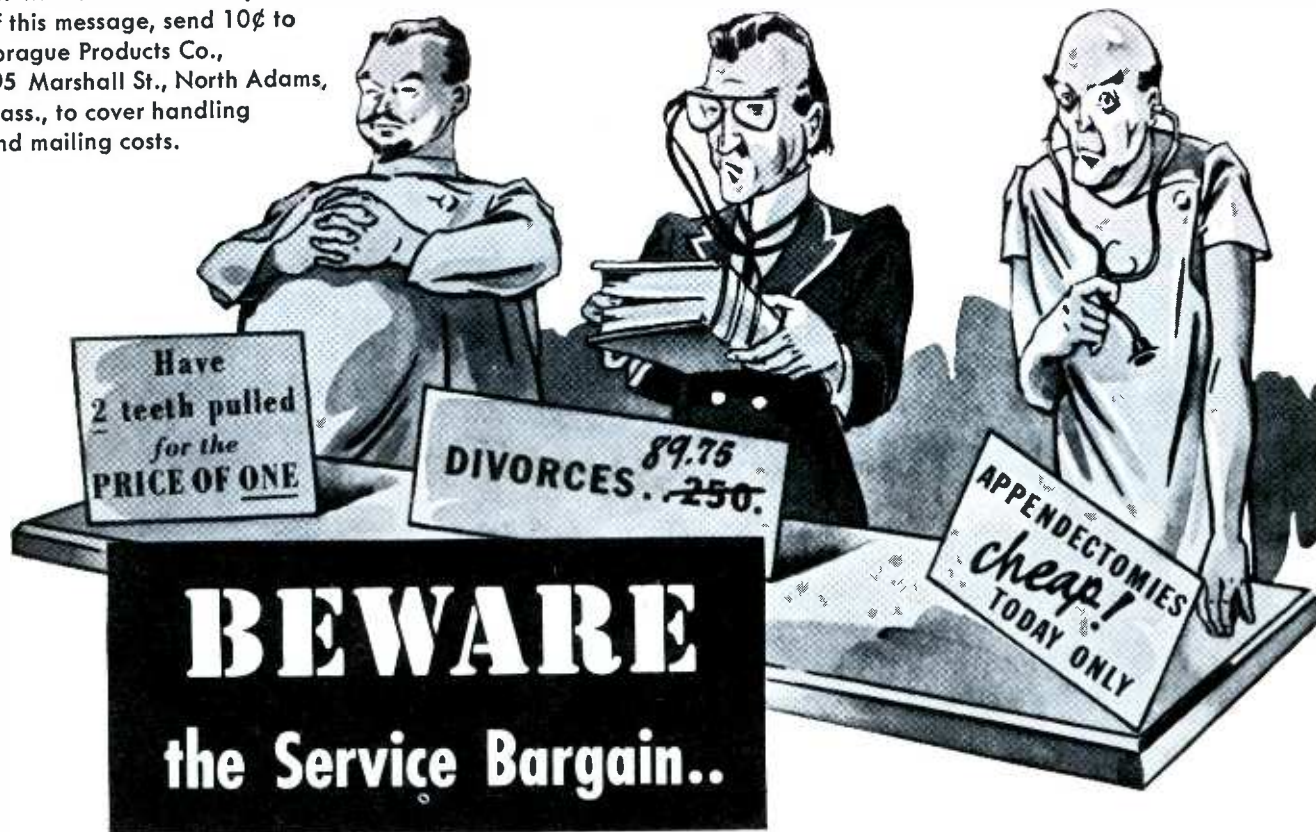
WORLD'S LARGEST MANUFACTURER OF CAPACITORS

65-1104

Circle 3 on literature card

February, 1965/PF REPORTER 11

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.



You'll never see your doctor advertise a special sale on appendectomies . . .
You'll never see your lawyer announce cut-rates for divorce cases . . .
You'll never see your dentist hold a "2-for-1" sale on extractions . . .
AND You'll never see the day when you can take your TV set in for a service "bargain" and be sure you're getting a square deal!

"Bargains" in home electronic service are as scarce as the proverbial hen's teeth! Here's why—

The expert service technician, just like other professional people, must undergo years of study and apprenticeship to learn the fundamentals of his skill. And a minimum investment of from \$3000 to \$6000 per shop technician is required for the necessary equipment to test today's highly complex sets. Finally, through manufacturer's training courses and his own technical journals, he must keep up with

changes that are developing as fast as they ever did in medicine, law, or dentistry. Those best equipped to apply modern scientific methods are almost certain to be most economical for you and definitely more satisfactory in the long run.

Unfortunately, as in any business, there will always be a few fly-by-night operators. But patients, clients, and TV set owners who recognize that you get only what you pay for, will never get gypped. "There just ARE no service bargains" . . . but there is GOOD SERVICE awaiting you at FAIR PRICES!

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

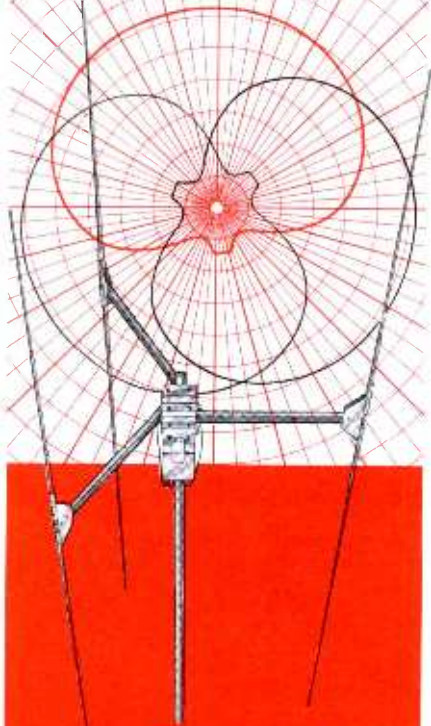
YOUR INDEPENDENT TV-RADIO SERVICE DEALER

63-124-63

Circle 4 on literature card

Revolutionary!

**Change the Pattern
of Your Whole
Base Station Business**



The unique new all-electronic
sector-phased Omni-Beam
CB base antenna . . .




THE SCANNER
Model **M-119**
PAT. PENDING

- Instantaneous scan
- All electronic three-sector beam—no mechanical rotator needed
- Extremely compact—easy to assemble
- 7.75 db directional gain—23 db front to back ratio
- Costs 30% less than old-fashioned rotator driven beam arrays

Contact your Antenna Specialists
representative for full details.

**the
antenna
specialists co.**

12435 Euclid Ave., Cleveland, Ohio 44106

Stripes of Quality  Circle 5 on literature card

Letters to the Editor

Dear Editor:

As an ardent reader of your magazine who is a rated pilot, I'd like to call your attention to the frequency range of omni stations noted in the article on aircraft radios in the December 1964 PF REPORTER. The author lists 112 to 117.9 mc as the band of frequencies used for omni stations; in fact, the actual limits are 108 to 117.9 mc. In the 108- to 112-mc segment, omni stations operate on even tenths-of-megacycles, while ILS systems operate on the odd tenths.

Another small point—the author says that a pilot may “determine his bearing from a ground station within two degrees,” when to be absolutely accurate he should have said, “bearing to or from an omni ground station.”

W. W. HENSLER

Indianapolis, Ind.

With three pilots (some recent, some not so) on our staff, our faces sting a bit for not having caught those inaccuracies. Just goes to show that editors are bothered by gremlins, too.—Ed.

Dear Editor:

While recently rereading the item called “Death Stalks the Rooftops,” I wondered if *ungrounding* the antenna wouldn't keep lightning from striking the system. I realize that if lightning struck a grounded system, it would be bypassed to ground with little damage to the set or the house. Being grounded, however, was what caused the problem that almost killed that technician mentioned in the article. Since lightning is electricity, wouldn't it avoid an ungrounded antenna altogether? Using this logic, I and other technicians in this area have stopped grounding antenna systems. Let us know if we are off in our reasoning.

ROBERT P. NEAL

Wadsworth, Illinois

Gosh yes, Bob, your theory is wrong—and dangerous! Two factors are important to remember: Lightning will strike the highest point of least resistance to ground—after all, a house built from wood is not grounded, but it does present a lower resistance to lightning than does the atmosphere and is often struck; and, the passage of charged air past an ungrounded antenna system will build up a static charge that will actually attract a charge of lightning. In an ungrounded system that is struck, the tremendous charge is just let loose in the system possibly to burn up the set, the house, and anyone in it. Remember, too, that when we speak of grounding an antenna, we mean the mast. We recently heard of one technician who was grounding one side of the lead-in! We urgently recommend that you return to those installations you mentioned and ground them properly. For further information on safe and sane installations, see “Antenna Systems Can Be Safe” in the August 1964 issue of PF REPORTER.—Ed.



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 6 on literature card

February, 1965/PF REPORTER 13

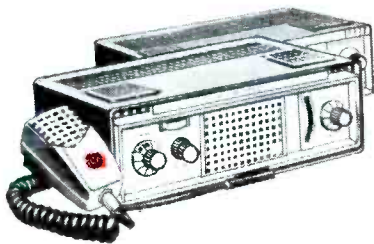
FREE from RCA!



WIN ONE OF BRAND-NEW 1965

Plus over 100 additional prizes awarded in

EACH GRAND PRIZE CHEVY-VAN LOADED WITH THESE RCA PRODUCTS



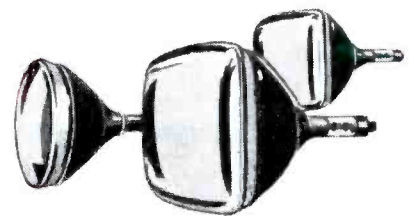
A.

A pair of new RCA Mark-Nine CB radio units for fastest shop-to-truck communication in your neighborhood.



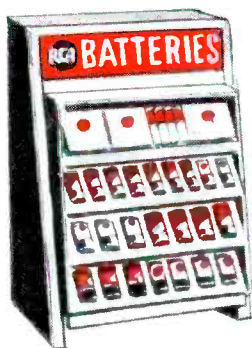
B.

An RCA Treasure Chest Tube Caddy fully loaded with the fastest selling RCA replacement receiving tube types.



C.

One RCA Colorama picture tube and two popular RCA Silverama black-and-white replacement picture tubes.



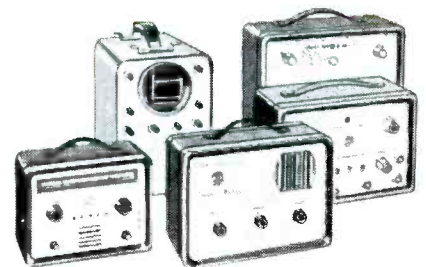
D.

A colorful, attractive counter merchandiser fully stocked with RCA transistor radio batteries.



E.

Two complete kits of RCA's "Top-of-the-Line" replacement transistors for entertainment-type equipment.



F.

Five RCA popular and versatile test instruments:
RCA WR-64A Color Bar/Dot/ Crosshatch Generator
RCA WO-33A Super-Portable 3" Oscilloscope
RCA WR-69A Television/FM Sweep Generator
RCA WR-99A Crystal-Calibrated Marker Generator
RCA WR-70A RF/IF/VF Marker Adder



THESE NINE CHEVY-VANS !!!

nine separate regions of the United States!

ADDITIONAL PRIZES INCLUDE:



18

SECOND PRIZES:
RCA Victor Color TV Sets



27

THIRD PRIZES:
RCA Victor Black-and-White Portable TV Sets



72

FOURTH PRIZES:
RCA Victor Portable Transistor Radios

RCA's 1965 Regional Sweepstakes is for Radio/TV/Hi-Fi Service Dealers and Technicians EXCLUSIVELY!

NO JINGLES TO WRITE—NOTHING TO GUESS—NOTHING TO BUY! Simply pick up and fill out an entry blank and official rules at your RCA Distributor.

Enter as often as you like. Each entry must be submitted and mailed separately. See your Participating RCA Distributor right away.

This offer not made in states and localities where restricted or prohibited, such as Wisconsin and Florida.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.



The Most Trusted Name in Electronics



Model
LPV-VU18
List
\$69.95

Description
18 Active Cells
VHF—upto 175 miles
UHF—upto 90 miles
FM —upto 75 miles



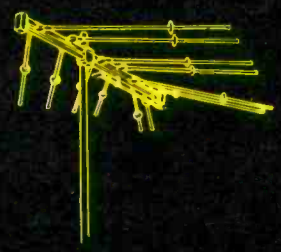
Model
LPV-VU15
List
\$59.95

Description
15 Active Cells
VHF—upto 150 miles
UHF—upto 90 miles
FM —upto 60 miles



Model
LPV-VU9
List
\$39.95

Description
9 Active Cells
VHF—upto 100 miles
UHF—upto 40 miles
FM —upto 40 miles



Model
LPV-VU6
List
\$27.50

Description
6 Active Cells
VHF—upto 75 miles
UHF—upto 25 miles
FM —upto .30 miles



Model
LPV-VU12
List
\$49.95

Description
12 Active Cells
VHF—upto 125 miles
UHF—upto 65 miles
FM —upto 50 miles

Licensed under one or more of U.S. patents 2,958,081, 2,985,879, 3,011,158, 3,108,280, 3,150,376 and additional patents pending in U.S.A. and Canada. Produced by JFD Electronics Corporation under exclusive license from the University of Illinois Foundation.

Who Says You Can't Have Everything You Want in a TV Antenna?—

VHF? UHF? FM Stereo? Single Down-lead?

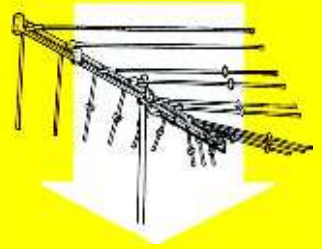
You most definitely can—when you install the remarkable new

JFD LPV-VU LOG-PERIODIC

FEATURING THE CAP-ELECTRONIC DIPOLE

Copyright 1964 by JFD

The World's first all-channel VHF/UHF/FM/Stereo antenna (with single Down-lead) is here. (And only JFD has got it!)



You can't satisfy today's complex VHF/UHF/FM reception needs with yesterday's antennas. Today's "VU" TV sets call for a single all-powerful all-band antenna that delivers the signals you need for picture-perfect reception on all channels 2 to 83—plus FM Stereo.

That's why smart installers and dealers are switching to the new JFD LPV-VU. This newest antenna advance from the JFD Champaign, Illinois R&D Laboratories, teams (1) the acclaimed JFD Log-Periodic concept with (2) a totally new antenna design principle—the capacitor-coupled electronic dipole.

Result? More driven elements than ever before possible for the most efficient performance ever on VHF, UHF, FM/Stereo—from one antenna, with one lead-in.

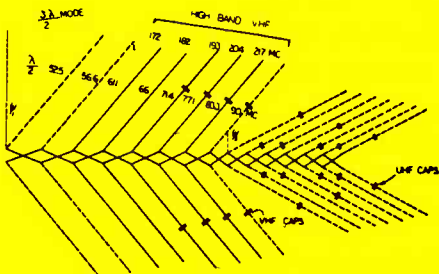
And you can choose from five gold alodized LPV-VU Log-Periodics to satisfy every location, any budget: model LPV-VU-18, LPV-VU-15, LPV-VU-12, LPV-VU-9 and LPV-VU-6.

New from JFD—another outstanding advance in dipole design, the capacitor-coupled electronic dipole!

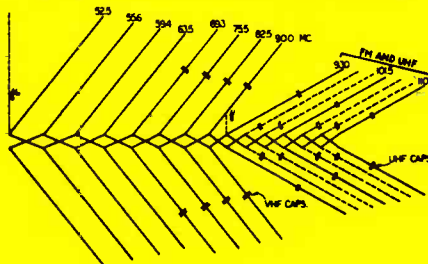
By introducing parallel plate capacitors into predetermined positions along the dipoles, and by precisely adjusting the value of each capacitance:



1. More dipoles are made to resonate on the high VHF band with a corresponding increase in gain.



2. Higher mode operation in UHF band achieves higher gain on channels 14 to 83—equal or better than that of parabolics. Improves FM stereo performance.
3. More uniform gain across each band, with narrower beamwidths. High front-to-back ratios greatly improve ghost rejection—insure excellent color fidelity.

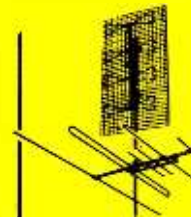


PLUS...

1. Patented frequency independent Log-Periodic design maintains same high performance efficiency regardless of station or band tuned in.
2. Only one downlead needed. A JFD AC80 splitter, included with each LPV-VU, permits you to tie directly into VHF, UHF and FM set inputs.
3. New low-impedance twin crossarms function as crossed feeder harness. Step up gain and improve signal transfer.

LPV-VU OFFERS NEW MECHANICAL ADVANCES, TOO!

- Twin square aluminum crossarms.
- Stainless steel terminals.
- Oversized unbreakable Celanese "Fortiflex A" insulators.
- Solid aluminum bus bar transformers.
- Tubular crossarm supports on larger LPV-VU's.
- Double U-bolts with 4 serrated-gripping profiles for 6-inch gripping span.
- Electrically conductive gold alodizing.



INSTALLER BEWARE!

Don't spoil your VHF reception!

Addition of a separate UHF antenna to a present VHF installation may cut the VHF signal being delivered to your set. Incoming signals from a VHF transmitter may be scattered from the UHF antenna. Scattering produces less signal and multiple signals which cause ghosts.

SO WHY USE TWO WHEN ONE LPV-VU WILL DO?

Install the all-channel JFD LPV-VU and get the best VHF and UHF from one antenna with one down-lead!

A SPACE-AGE PRODUCT OF THE WORLD'S GREATEST TV/FM ANTENNA LABORATORIES



This newly completed laboratory, located on a ten acre site in Interstate Research Park, in Champaign, Illinois (home of the University of Illinois) marks a milestone in antenna history. It is dramatic proof of JFD leadership in antenna technology. Its fully staffed and equipped engineering staff, under the supervision of Dr. Paul E. Mayes, is blazing new trails in antenna design. This priceless know-how is built into each LPV-VU you sell.

The JFD LPV-VU is adapted from the geometrically derived Log-Periodic antenna formula developed by the Antenna Research Laboratories of the University of Illinois.

JFD

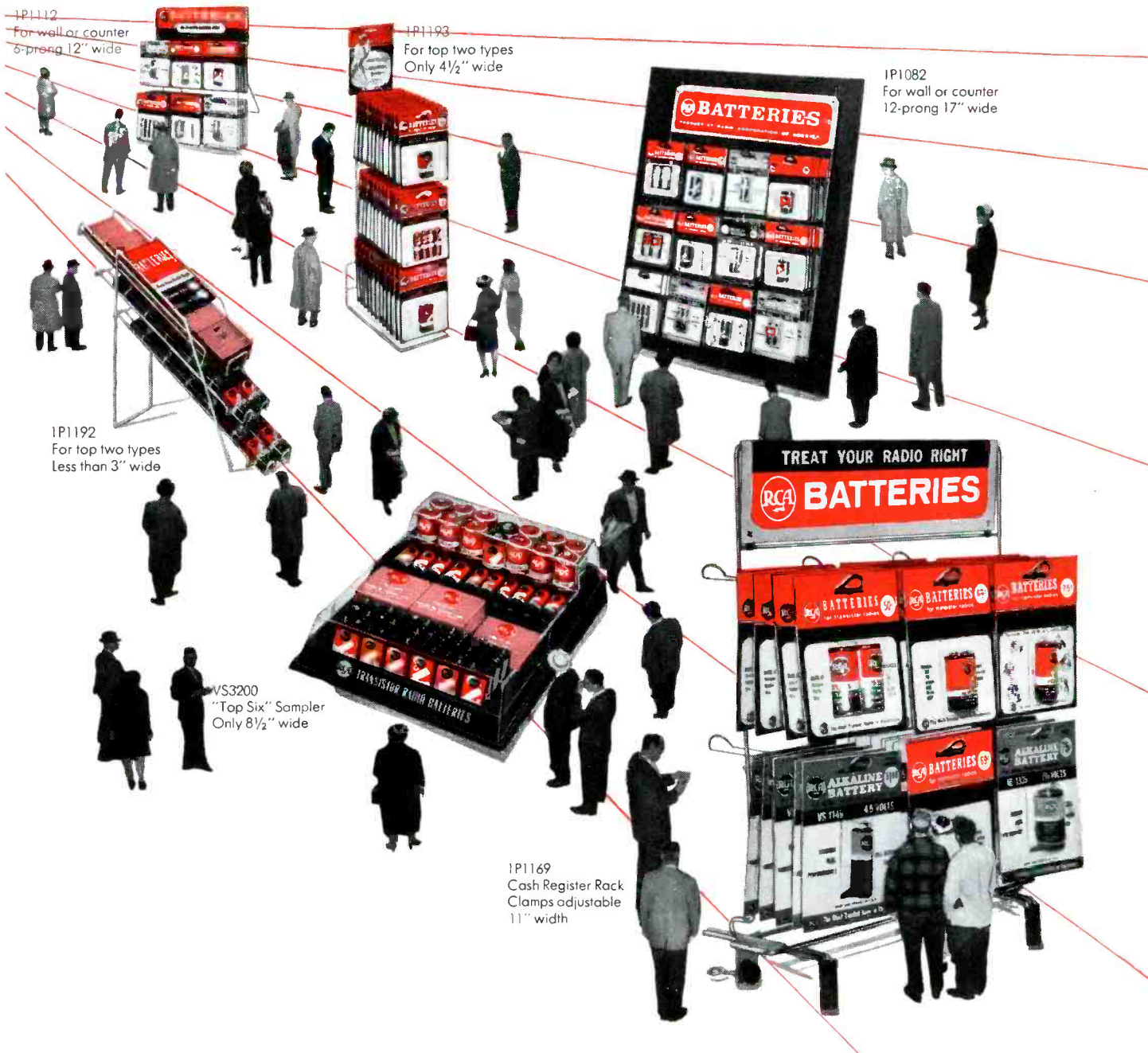
JFD ELECTRONICS CORPORATION

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, Canada

SEE YOUR DISTRIBUTOR. WRITE FOR BULLETIN 806 FOR COMPLETE DETAILS.

Circle 7 on literature card

www.americanradiohistory.com



IP1112
For wall or counter
6-prong 12" wide

IP1193
For top two types
Only 4 1/2" wide

IP1082
For wall or counter
12-prong 17" wide

IP1192
For top two types
Less than 3" wide

VS3200
"Top Six" Sampler
Only 8 1/2" wide

IP1169
Cash Register Rack
Clamps adjustable
11" width

Want your radio battery business to grow?

1. PICK THE BRAND NAME PEOPLE ASSOCIATE WITH RADIO—RCA.

With a small-ticket item such as batteries you want each sale to be final—sealed with customer satisfaction. That's the only way to keep the customer coming back. That's the only way to keep the profit in the till. To sell with confidence, rely on the name your customers have come to look to for quality and dependability—RCA.

With over 70 million transistor radios in use today and with other battery-operated devices sprouting in all directions, batteries can ease the squeeze on profits and more than rate the little space they require.

Advertised over Network TV on Walt Disney's "Wonderful World of Color"

1P1161
Revolving Rack
Only 11" wide

RCA BATTERIES
FOR ALL LEADING TRANSISTOR RADIOS



1P1183
Deluxe Merchandiser
25" wide



1P1139 "Top Drawer"
Full-Line Merchandiser
Only 11" wide



1P1160 "Low-Boy"
For transistor types
Only 11" wide



Then take these two simple steps today.

2. PICK THE PACKAGE BEST SUITED TO YOUR NEEDS.

How do you want your batteries—blister-packed or regular? With RCA Batteries you have your choice. With attractive pricing either way. How much space can you afford to allocate to batteries? Is it 4 inches? Or 2 feet? You can surely meet your needs from this wide selection of attractive, practical RCA battery merchandisers.

And every battery...every merchandiser...proudly and clearly displays the RCA name, your assurance of satisfied customers. Get the most out of the booming battery business with the name people associate with radio: RCA. For details, contact your Authorized RCA Battery Distributor, or RCA Electronic Components and Devices, Harrison, N.J.



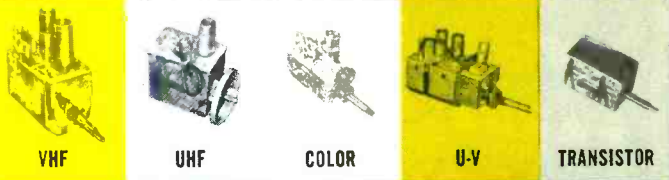
The Most Trusted Name in Electronics

COMPLETE TUNER OVERHAUL

ALL MAKES — ONE PRICE

995

ALL LABOR AND PARTS
(EXCEPT TUBES & TRANSISTORS)*



COLOR TUNERS

GUARANTEED COLOR ALIGNMENT — NO ADDITIONAL CHARGE

Simply send us the defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint. Your tuner will be expertly overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.

UV combination tuner must be single chassis type; dismantle tandem UHF and VHF tuners and send in the defective unit only.

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

And remember—for over a decade Castle has been the leader in this specialized field . . . your assurance of the best in TV tuner overhauling.

Pioneers of TV



Tuner Overhauling

CASTLE

TV TUNER SERVICE, INC.

MAIN PLANT: 5701 N. Western Ave., Chicago 45, Illinois

EAST: 41-90 Vernon Blvd., Long Island City 1, N.Y.

CANADA: 136 Main Street, Toronto 13, Ontario

*Major Parts are additional in Canada

Circle 8 on literature card



The Electronic Scanner

news of the servicing industry

More '65 Color



The new 1965 color TV line, in which **Zenith Sales Corp.** introduces six key models "designed to broaden further the rapidly accelerating consumer demand for color television sets." will be launched by a powerful advertising and merchandising program. The 19 models include four different consoles, a table model, and a console, all in the under-\$500 bracket. Highlights of the line include automatic Color

Clarifier (Zenith's automatic degaussing), and transistorized "Space Command 600" remote control system that now gives the viewer control of color hue in addition to the usual remote controls without increasing the number of pushbuttons on the hand-held unit.

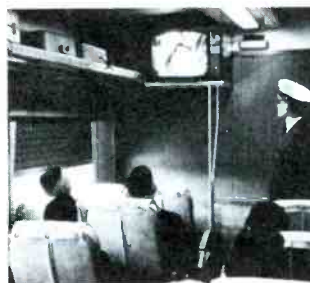
Laser Communications

Space technologists indicate that a communication system using lasers, optical detectors, and modulation devices can provide two-way telemetry, voice, and down-TV from distances of the order of 50 million miles. Feasibility and competitiveness of such a system with microwave communication was established in the initial study phase of NASA's Deep Space Optical Communication Program.

Researchers narrowed the search for an optimum deep-space communication system to two types: pulse-position modulation using a gallium-arsenide diode, and PCM polarization modulation employing a CW gas laser. For an immediate communication system, the researchers then concluded that the practical problems of implementing a PPM system eliminated it in favor of the PCM system. The latter can be reliably implemented with existing system components.

While component development is rapidly expanding, the results of this study favor the use of an earth-based receiver system utilizing incoherent (quantum-counter) detection at frequencies in the visible portion of the spectrum. However, technicians advise additional study of coherent reception. Earlier theoretical studies showed that good system performance with coherent reception in the infrared portion of the spectrum is possible from a synchronous satellite with a microwave or optical link to earth. A definite decision can be reached only through increased knowledge of atmospheric effects on coherent reception and improved detection techniques for IR.

TV on Trains



For the first time in railroad history, passengers will be able to watch television on the way to their destinations. Black-and-white television sets have been installed in all coach, lounge, and recreation cars on the Atlantic Coast Line "Florida Special" which began its 77th season between New York and Florida in December. Olympic sets were chosen for

the installation. Tests indicate that reception is extremely good throughout the route of the "Special." Passengers on test runs greeted the innovation with enthusiasm. Each television set is mounted on an overhead shelf at ceiling height in the special cars, and is connected to the train's television antenna system.

•Please turn to page 24

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 . . .



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

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

Circle 9 on literature card

February, 1965/PF REPORTER 21

COLOR-PARTS



GUIDE

Listed here are many of the resistors, capacitors, sweep components, and miscellaneous items needed to repair color TV receivers. The majority of these close-tolerance components are seldom used in black-and-white servicing, so it may be necessary to update your replacement stock to handle the demands of color servicing. Resistors designated "G" are used mainly in demodulator circuits and should be replaced by glass-type units; those with "Th" indicate thermistor type.

The manufacturer's part number is listed for all sweep-circuit and miscellaneous components. Check the appropriate

PHOTOFACT Folder or have your distributor consult Counter-Facts to determine an exact replacement for these components.

In addition to the items listed here, you'll probably want to stock a few 750-ma silicon rectifiers, as well as some 1N60 and 1N64 signal diodes. Depending on how much color servicing your shop handles, you can decide which items listed here are most practical for you to keep in stock. You also may find it advantageous to keep on your shelf certain of the special controls and coils used in color receivers. It's a good idea to keep color parts separated from normal stock.

	Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
Motorola Chassis TS-908 TS-912 WTS-907	1	pf			2 mfd	350 V	5	ohm	25 W	Boost Rectifier 48D66653A03 (TS-908) Circuit Breaker 80C66390A08 (TS-908, WTS-097) 80C66390A09 (TS-912) Convergence Rectifier 48C66037A10 (TS-908) 48D66037A03 (TS-908) 48C66653A02 (TS-912) 48D6653A02 (WTS-907) Crystal 3.58 mc 48C66865A01 (TS-908, WTS-907) 48C66865A02 (TS-912) Delay Line 24D66855A02 (TS-908, WTS-907) 24D66855A03 (TS-912)
	2.2	pf	NPO	1000 V			(Th)26.5	ohm	Cold	
	3.9	pf	NPO				52	ohm	25 W	
	5.6	pf	N150				(Th)110	ohm	Cold	
	10	pf	N750				(G)390	ohm	1 W 5%	
	12	pf	N150				550	ohm	20 W	
	22	pf	N150	2000 V			(Th)900	ohm	Cold	
	56	pf	N150				1800	ohm	15 W	
	68	pf	N150				(G)3900	ohm	2 W 5%	
	100	pf	N750	3000 V			15	meg	2 W	
	130	pf	N1500	2000 V			22	meg	2 W	
	130	pf		6000 C			47	meg	6 KV	
	260	pf	N2200	3000 V			270	meg	22KV	
	270	pf		2000 V						
	470	pf		2000 V						
	560	pf		2500 V						
	680	pf		3000 V						
	800	pf								
	.001			2000 V						
	.0015			1400 V						
.002			2000 V							
.003			1000 V							
.0033			2000 V							
.005			1000 V							
.01			2000 V							

	Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
RCA Chassis CTC7 thru CTC16	1.3	pf			2 mfd	350 V	3.6	ohm	1 W	Boost Rectifier 113391 (CTC15, 16) Circuit Breaker 106541 (CTC7) 109835 (CTC11, 12, 15) 113950 (CTC16) Convergence Rectifier 105064 CTC7, 9, 10, 11, 12,) 113321 (CTC15) 113392 (CTC15) 114013 (CTC16) Crystal 3.58 mc 105330 (all chassis) Delay Line 105253 (CTC7, 9, 10) 109837 (CTC11, 12, 15, 16) Focus Rectifier 113397 (CTC15)
	1.5	pf	N3300		40 mfd	25 V	3.8	ohm		
	4	pf	NPO				(Th)79	ohm	Cold	
	5	pf	N1500				(Th)120	ohm	Cold	
	6	pf	NPO				270	ohm	3 W 5%	
	7	pf	N150				910	ohm	18 W	
	10	pf	NPO				1250	ohm	18 W	
	15	pf	NPO				1500	ohm	3 W 5%	
	18	pf	NPO				1600	ohm	10 W	
	22	pf		1000 V			1800	ohm	3 W 5%	
	33	pf	N150				2700	ohm	7 W 5%	
	47	pf		4000 V			3000	ohm	7 W 5%	
	56	pf		6000 V			(G)3900	ohm	1 W 5%	
	68	pf		4000 V			4300	ohm	5 W	
	82	pf	NPO				6800	ohm	7 W 5%	
	100	pf	N1500	3000 V			13	K	7 W	
	120	pf	N750				16	K	7 W	
	120	pf	N1500	4000 V			(G)22	K	2 W 5%	
	130	pf	N2200	6000 V			39	K	4 W 5%	
	150	pf					(G)47	K	1 W 5%	
	180	pf		1000 V			110	K	5%	
	220	pf	N750				(G)270	K	1 W 5%	
	270	pf		2000 V			1.5	meg	1 W 5%	
	330	pf					2.2	meg	5%	
	390	pf					2.4	meg	5%	
	470	pf	N750							
	560	pf	N3300	2500 V						

Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
	.680	pf	5%			2.7	meg	5%	
	.750	pf	5%			3.9	meg	5%	
	.001	N2200	10%			6.8	meg	5%	
	.0027		10%			8.2	meg	5%	
	.0082					10	meg	5%	
	.01					22	meg	2 W 5%	
						47	meg		
						66	meg	6 KW	
						100	meg	1 W 5%	

Fixed Capacitors				Electrolytics		Resistors			Miscellaneous
Zenith Chassis	.22	pf	10%	200 mfd	25 V	11	ohm	20 W	Circuit Breaker
25LC20	.47	pf	10%	80 mfd	475 V	1000	ohm	50 W	85-763 (25LC20, 26KC20)
25LC30	.62	pf	10%	4 mfd	450 V	14	K	7 W	Convergence Rectifier
25MC30	.62	pf	10%	4 mfd	450 V				212-25 (all chassis)
26KC20	2	pf	10%	50 mfd	450 V	30	K	5 W	Crystal 3.58 mc
27KC20	3	pf	10%	40 mfd	450 V	1.5	meg	1 W 5%	103-28 (25LC20, 26KC20, 27KC20, 29JC20)
29JC20	5	pf NPO	10%	40 mfd	450 V	18	meg	2 W	103-71 (25LC30, 25MC30)
	6	pf NPO	10%	4 mfd	150 V	22	meg	2 W	Delay Line
	7	pf NPO	10%	80 mfd	375 V				S-62358 (25LC20, 25LC30)
	12	pf N1500	5%	80 mfd	375 V				S-65296 (25MC30)
	13	pf NPO	5%	4 mfd	450 V				S-53443 (27KC20, 29JC20)
	20	pf N080	10%	4 mfd	450 V				S-59190 (26KC20)
	27	pf N750	10%	50 mfd	450 V				
	36	pf N220	5%	40 mfd	25 V				
	47	pf N075		4 mfd	150 V				
	47	pf N750	5000 V 10%	50 mfd	450 V				
	47	pf N1500	6000 V	40 mfd	450 V				
	53	pf NPO		40 mfd	25 V				
	56	pf N750	10%	4 mfd	150 V				
	75	pf N1500	6000 V 10%	90 mfd	475 V				
	90	pf N1500	6000 V	4 mfd	450 V				
	100	pf NPO	5%	4 mfd	450 V				
	100	pf	3000 V 10%	4 mfd	450 V				
	130	pf N750	10%						
	150	pf N750	10%						
	150	pf N1500	6000 V						
	220	pf	3000 V 10%						
	300	pf N750	2000 V 5%						
	470	pf	1000 V 0%						
	.01		1000 V 0%						
	.015		1000 V 0%						
	.0033		2000 V 0%						

Brackets indicate one unit.

Sweep Components

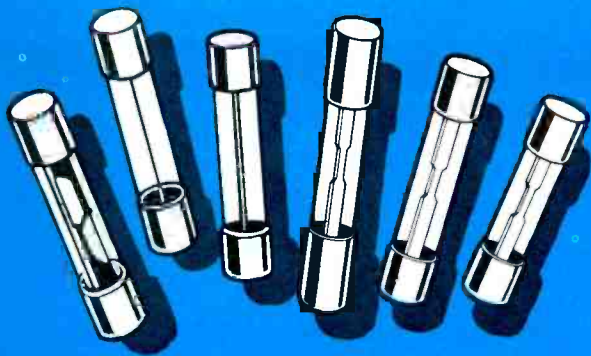
Motorola	
Focus Coil	24P65127A93 (TS-908) 24P65132A55 (WTS-907)
Horiz Linearity Coil	24P65131AC6 (TS-908)
Horiz Output Transformer	24D66876A02 (TS-908) 24D66876A03 (TS-912) 24D6756-A03 (WTS-907)
Vertical Output Transformer	25D66761AC2 (TS-908) 25D66761A03(-E) (TS-912) 25D66761A01 (WTS-907)
Yoke	24D67215AC1 (TS-908) 24D66872A01 (TS-912, WTS-907)

RCA	
Focus Coil	109264 (CTC10, 11, 12) 13640 (CTC15) 13979 (CTC16)
Horiz Linearity Coil	105196 (CTC7, 9, 10, 11) 112875 (CTC12, 15) 14006 (CTC16)
Horiz Output Transformer	106359 (CTC7, 9) 109221 (CTC10, 11) 112820 (CTC12) 113382 (CTC15) 113992 (CTC16)
Vertical Output Transformer	106360 (CTC7, 9) 109263 (CTC10)

Sweep Components

RCA Continued	
	109850 (CTC11) 112821 (CTC12) 113390 (CTC15) 114047 (CTC16)
Yoke	106305 (CTC7, 9) 109457 (CTC10, 12, 15, 16) 109845 (CTC11)

Zenith	
Focus Coil	S-53551 (27KC20, 29JC20)
Horiz Linearity Co	S-59194 (25LC20, 25LC30) S-62016 (25MC30) S-53754 (27KC20, 29JC20) S-59102 (26KC20)
Horiz Output Transformer	S-58518 (25LC20, 25LC30, 26KC20) S-65739 (25MC30) S-58518 (26KC20) S-53620 (29JC20)
Vertical Output Transformer	95-2109(-C) (25LC20) 95-2139(-A) (25LC30, 25MC30) 95-2050 (26KC20) 95-1905(-D) (27KC20, 29JC20)
Yoke	95-2067 (25LC20, 25MC30, 26KC20) 95-1974 (27KC20) 95-1793 (29JC20)



BUSS quick-acting Fuses

"Quick-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. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

crease in demand for color television receivers, together with a peak year in black-and-white set sales; a tremendous increase in imports of black-and-white receivers and tape recorders.

2. Encouraging indications that defense contractors, either experiencing or anticipating a decrease in military procurement, may be finding outlets in the expanding industrial electronics market or in new civilian public works programs.

3. Evidence that the industry may end the year with a more favorable balance of trade, but with some of its major markets severely pressured by imported products.

Year-end estimates of factory sales show heaviest increases scored by consumer products and industrial electronics. The government market, although somewhat diminished by defense cutbacks, held its own, while the replacement-components segment reversed the dropoff in sales experienced in 1963. In statistical summary, 1964 factory sales in the four major product areas look like this:

(In billions of dollars)

Market	1963	1964*
Consumer Products	\$ 2.58	\$ 2.86
Industrial Products	3.06	3.43
Government Products	8.94	9.37
Replacement Components	.59	.62
Total	\$15.17	\$16.28

*EIA Estimates

In the consumer products area, sales of television receivers—both color and b-w—and of products in the "other category" are responsible for a 12% increase over 1963 sales, and worked to offset a leveling in sales of radios and phonographs. Sales of color TV sets, which reached a substantial 1.4 million units last year, are no less impressive than those of b-w receivers, which moved to 7.9 million—the highest level since the 7.7-million-set boom year of 1955. Value of the total 9.3 million TV sets sold at the factory was \$1.32 billion, compared with \$1.08 billion in 1963.

Stimulated sales of devices in the "other consumer products" category—tape recorders, electronic boating aids, educational

BUSS: the complete line of fuses ...

Scanner (Continued from page 20)

See in the Dark



Light-amplifying tubes that make it possible for soldiers to see in the dark without revealing their presence will be produced for the U.S. Army by The Machlett Laboratories, Inc., a subsidiary of Raytheon Co. The image-intensifier tubes permit soldiers to see objects hidden in light levels far below the threshold of normal human vision. Developed by Machlett,

the new tubes intensify the natural low-level night illumination to present a bright image, thus providing the soldier with fire power and mobility at night comparable to that of daylight.

State of the Industry

For you technicians who want to know where your industry stands and where it's going, here are some significant facts and statistics we've gleaned from a paper by Dr. Harper Q. North, president of Electronic Industries Association. The figures represent factory prices, but they'll give you an idea of the trends taking place. Continuing a year-by-year expansion which began 14 years ago, factory sales of the electronics industry should rise to \$17 billion by the end of 1965. This compares with \$16.3 billion for 1964 and \$15.2 billion in 1963—a healthy gain for any industry. Electronics business has nearly trebled in a single decade.

In a preliminary analysis of this year's state of the industry, the EIA Marketing Services Departments and Requirements Committee have identified these trends, working both for and against the industry's progress:

1. A long-anticipated and (to some) surprisingly strong in-



All Types Available
for Every
Application

BLOCKS for BUSS FUSES

Single pole, multiple pole, small base, full base, molded base, laminated base, porcelain base for fuses from 1/4 x 5/8 inches up. Also signal fuse blocks and special blocks of all types.

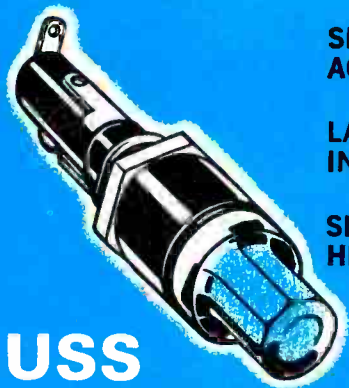
Tell us what you need or ...

BUSS

Write for BUSS
Bulletin SFB

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

Circle 10 on literature card



**SIGNAL
ACTIVATING**
•
**LAMP
INDICATING**
•
**SERIES
HKA**

BUSS FUSEHOLDERS

FOR 1/4 x 1/4 INCH BUSS GLD FUSES, 1/4 TO 5 AMPS.

When fuse opens, indicating pin completes a circuit that lights indicating lamp in holder and makes contact on external signal circuit. External signal can be an audible alarm or another lamp mounted at a distance, or it can operate a relay.

BUSS

Write for BUSS
Bulletin SFB

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

The domestic electronic components market, its growth rate severely blunted by imports during the past several years, is expected to gain slightly from \$3.72 billion in 1963 to \$3.79 billion, aided by increases in sales of semiconductors from \$583 million to \$612 million. Sales of replacement components showed a \$30 million rise to \$620 million.

A noteworthy trend is the increasingly heavy demand for silicon transistors, which pushed total sales of transistors to a record \$303 million, compared with \$296 million in '63. A decade ago, silicon transistors were outsold by germanium types at a ratio of about 65 to 1. By 1963 the ratio was 5 to 1, and the gap is expected to close further this year. Rapid yearly growth in sales of integral-circuit packages—including microelectronic devices—continued, with volume climbing to \$225 million from the \$155 million recorded for 1963.

Sales of electronic tubes, on the decline for the past five years because of pressure from imports, dropped off again—from \$274 million in 1963 to \$260 million. Similarly, sales of power and special-purpose tubes moved downward from \$311 million to \$250 million.

Efforts to encourage electronics manufacturers to find markets overseas may show a healthy increase of the industry's share in the balance of trade. Based on data for the first eight months of this 1964, total electronics exports should have increased by 7% over the \$846 million for 1963, while imports remained close to \$307 million. The influx of goods from abroad continues to have heavy impact on segments of the electronics industry, particularly in the consumer products area where imports rose from \$107 million in the first eight months of 1963 to \$113 million during the same period in 1964. Imports of television sets climbed steeply from \$13.3 million in the 1963 January-August period to \$17 million in '64, while imports of tape recorders rose from \$19.7 million to \$26.5 million.

The rises shown here indicate that the electronics industry parallels—indeed, leads—the general business and economic growth of the country. ▲

... of unquestioned high quality

kits, door controls, electronic ovens, to name a few—helped boost the total value of these sales by \$45 million, moving from \$705 million in 1963 to \$750 million.

Unit sales of radios were up—home models to 10.6 million, auto sets to 8.2 million—but total dollar value remained just below 1963's levels, reflecting the inroads of imported products. Sales value of home radios was \$172 million, compared with \$177 million in 1963, while auto sets approximated \$205 million, compared with \$206 million. Phonographs sales declined to \$415 million from the \$417 million 1963 volume.

In terms of percentage increase, the industrial electronics segment leads the industry in annual expansion, as it has for the past several years. The industrial electronics industry ended the year with sales of \$3.43 billion as against \$3.06 billion the year before. As in the past, the most vigorous gain was in sales of computing and data-processing equipment, moving to \$1.38 billion from \$1.25 billion. Sales of industrial control and processing equipment climbed from \$244 million in 1963 to \$270 million; test and measuring devices from \$280 million to \$300 million; communications, broadcast, commercial sound, and navigational aids from \$935 million to \$1.07 billion; nuclear-electronic equipment from \$47 million to \$55 million; and medical, scientific, educational, and other industrial equipment from \$314 million to \$365 million.

Substantial gains appeared in such specific product areas as video-tape recorders, closed-circuit television, electronic machine tools, and switching equipment for telephone and communications systems. Particularly noteworthy is the impressive rise in sales of Citizens-band transceivers and accessories—up an estimated 18 percent to \$39 million. The value is nearly double that of sales in 1960.

The federal government remains by far the heaviest consumer of electronic products and, despite reductions in defense spending and other economy moves, EIA expects it to remain so for many years to come. Expenditures, however, will show a year-by-year leveling. Calendar year expenditures should reach \$9.37 billion in 1964, compared with \$8.94 billion in calendar 1963.

GMW FUSE
and HWA
FUSEHOLDER

FUSE SIZE
ONLY .270 x .250
INCHES

BUSS
VISUAL
INDICATING



Sub-Miniature FUSE-HOLDER COMBINATION

For space-tight applications. Fuse has window for inspection of element. Fuse may be used with or without holder.

Fuse held tight in holder by beryllium copper contacts assuring low resistance.

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. DIVISION, McGraw-Edison Co., St. Louis, Mo. 63107

Circle 10 on literature card

February, 1965/PF REPORTER 25

NO ONE CAN GUARANTEE YOUR FUTURE



— **NOT EVEN YOU!**

WE KNOW 156 MEN WHO DID THE NEXT BEST THING

They Became a Part of the Lafayette Associate Store Program

Business can be a funny proposition. You're an independent businessman, like those other 156 men. Then one day you discover competition has become too big and too tough to take on by yourself. You want to fight back—launch new advertising campaigns, expand your line, send out sales literature, mail out catalogs, do something to keep the business going. But it's just too much for one man alone.

You need the know-how and support of a large corporation . . . the advantages you get as a franchised dealer in the Lafayette Radio Electronics Associate Store Program. This program enables you to own your own store in America's fastest growing chain of retail electronics centers. You enjoy every benefit of this 44-year-old organization, while you maintain your financial independence through ownership.

If you have a basic knowledge of radio, TV or electronics, you owe it to yourself to investigate the Lafayette Associate Store Program.

This Is What We Offer You:

1. **Business Stability** — Lafayette has been in business 44 years. You'll cash in on this established reputation.
2. **Product Diversification** — You can sell everything Lafayette offers . . . hi-fi stereo, citizens band, tape recorders, radios, tools, and much more. You'll attract more customers than you ever thought possible.
3. **Advertising Support** — Year 'round advertising, publicity, public relations and promotional campaigns have established Lafayette and its franchised dealers as America's Hi-Fi and Electronics Centers.
4. **Protected Territory** — Yours will be the only franchised Lafayette Radio Electronics Associate Store in your marketing area.
5. **Marketing Guidance** — We'll help you set up a complete operation to build a successful future, and maintain it. We will always be available to help you in any way possible.

We are looking for a limited number of men who want to become a part of the Lafayette Associate Store Program . . . men who are willing to invest \$10,000 to \$30,000 to make a new business career for themselves.

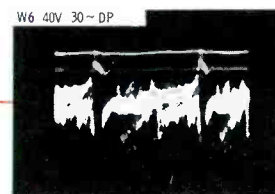
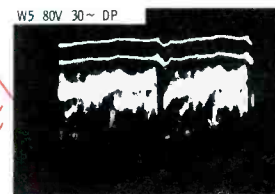
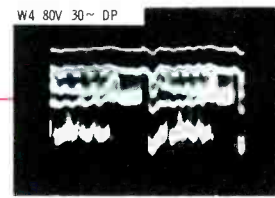
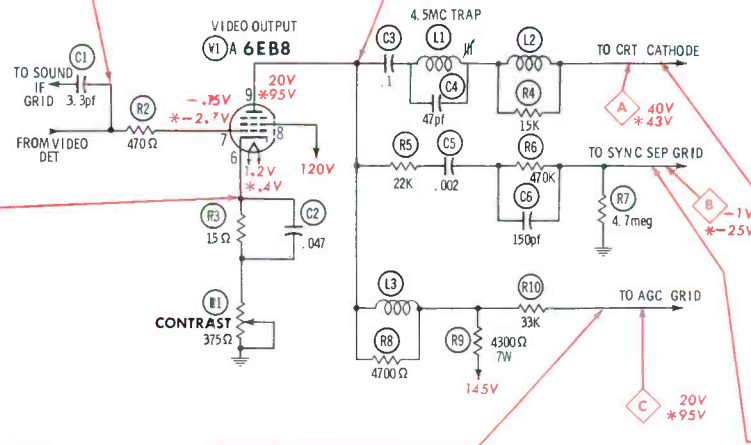
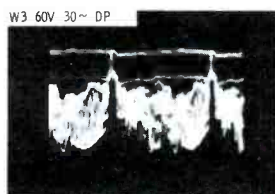
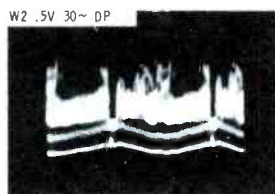
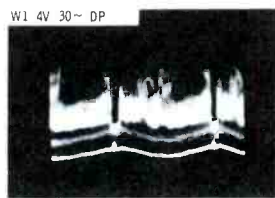
Mail the coupon for complete information without obligation.



Lafayette Radio Electronics Corporation Dept. ASPFB-5 111 Jericho Turnpike Syosset, L. I., N. Y. 11791		
Mr. Robert Laub: Please send me full information on how I can own my own profitable business. I understand there is no obligation.		
Name		
Address		
City	State	Zip



Takeoff Network



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 to produce normal picture and sound. DP (direct probe) usable at all points throughout the circuit.

Normal Operation

Takeoff networks for AGC, sound, sync, and video shown here (from Magnavox Chassis U47-05-00) are typical of modern receivers. Here, sound takeoff is from grid of video-output stage; sometimes it's from plate, like other three. Gain of output tube is determined by contrast potentiometer which controls bias on stage. Signal strength at antenna terminals and amplification of video IF stages (controlled by AGC voltage) are responsible for amplitude of signal at takeoff point. Plate circuit of V1 has three individual parallel takeoff paths. Negative-going video signal to CRT cathode is coupled through C3, C4, L1, and L2. L1-C4 also traps 4.5-mc sound signal, keeping sound hash out of picture. Proper adjustment of L1 can be checked by connecting 4.5-mc signal (from signal generator) to grid of V1; connect scope to CRT cathode and adjust L1 for minimum deflection on scope. High frequencies of video signal are peaked by L2 and R4. Video is coupled to sync separator through C5 and C6. Negative bias for sync-separator grid is developed by R7 — strength of signal determines amount of bias. Video signal for AGC-keyer control grid is supplied through peaking coil L3 with shunt resistor R8. DC voltage for plate of V1 is fed through R9; voltage for AGC grid is via R9 and R10. Screen of V1 is tied directly to B+ source (some sets use screen-supply resistor, and screen voltage is clue to whether tube conduction is normal—especially in receivers using parallel paths from plate and screen to B+ sources.)

Operating Variations

- Pin 6** DC voltage is determined by position of contrast control. With signal, voltage varies from .1 to 2 volt; without signal, ranges from .5 to 3 volt—normal is .4 and 1.2 volt.
- Pin 7** Without signal, voltage remains constant regardless of contrast setting. With signal, its strength helps determine DC voltage. Normal is -2 to -2.8 volts, more negative on strong stations.
- Pin 9** Without signal, DC voltage from 20 to 115 is determined by contrast setting. Normal reading with signal, 95 volts, may increase to 110 with strong station.
- A** DC here changes only slightly with contrast setting or signal amplitude. CRT cathode voltage is determined mainly by brightness control (not shown on this schematic).
- B** Negative voltage remains constant without signal. Changing setting of contrast control, thus amplitude of signal, varies DC from -5 to -30 volts when station is received.
- WAVEFORMS** Amplitude of W1 is determined by signal strength at antenna terminals. All others depend on both signal strength and contrast.

Sync Loss

Both Vertical and Horizontal

SYMPTOM 1

C5 Open

(Sync-Coupling Capacitor — .002 mfd)

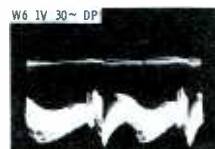
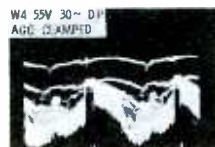


Picture shows complete loss of sync—both vertical and horizontal. Can't be stabilized at any setting of vertical- or horizontal-hold controls; suggests trouble in sync separator. Considering takeoff point, however, AGC or video defect could be responsible.

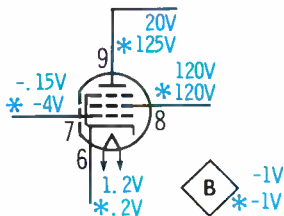


Waveform Analysis

Video signal (W4) at plate of V1 is low in amplitude and distorted—offers no real clue because, with picture out of sync, AGC stage is affected, causing abnormal signal at plate of video-output tube. Signal in W4 becomes almost normal with AGC line clamped (notice sync pulses are okay); proves signal path is normal to output tube. The very small signal seen at W6 is real clue to trouble spot—normal W6 is 40 volts p-p.



Voltage and Component Analysis



Without signal, voltages on V1 are normal, so defects are unlikely in components supplying operating voltages for output tube. Valuable voltage clue is obtained from with-signal reading at point B—only -1 volt (normal is -25 volts). Voltage at B (grid of sync separator) remains constant, suggests signal isn't reaching this point; throws suspicion on signal-coupling components between video output plate and sync-separator grid. C5 leaking would give similar symptom, but voltage at B would be positive and would change with signal.

Best Bet: Scope, bias box, and VTVM.

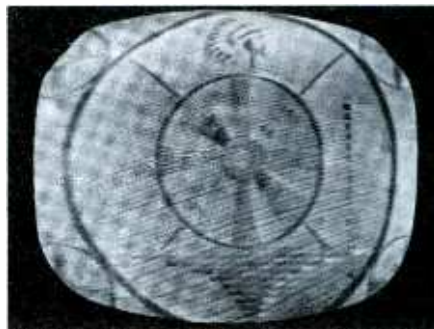
Video Weak

Contrast Control Works

SYMPTOM 2

C3 Open

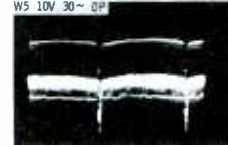
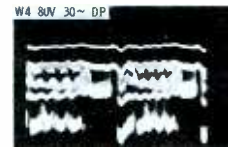
(Video-Coupling Capacitor — .1 mfd)



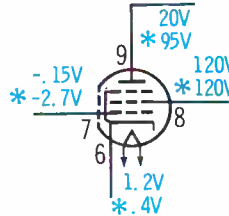
Symptom gives some indications of defective picture tube. Video is extremely weak and has virtually no contrast, although contrast control is operative. Sound and sync circuits seem to be functioning normally. Video-output stage or CRT is most likely responsible.

Waveform Analysis

Signal shape and amplitude of W4 are normal—sign that preceding stages are not at fault. CRT cathode signal (W5) is only 10 volts p-p (normal is 80 volts p-p), proving reduced amplitude is reason for weak picture—thus CRT isn't causing trouble. Defect must be somewhere in signal path between plate of V1 and cathode of CRT. Absence of normal signal at junction of C3 and L1 points definitely to open C3 or break in printed-circuit board.



Voltage and Component Analysis



Information gained from voltages on V1 is of absolutely no assistance—all readings are normal, with or without signal. Checking voltage at point A also proves to be of no help—normal reading is found. Open capacitor in signal path is often extremely difficult to locate with voltage and/or resistance measurements. Leaky C3 would cause decreased range of brightness control, and could be detected by increased voltage at point A. If C3 were shorted, symptom would be no raster, as excessive voltage would cut off picture tube.

Best Bet: Scope finds exact source of trouble.

No Picture, No Sound

SYMPTOM 3

Insufficient Width

R10 Open

(AGC Grid Resistor — 33 K)



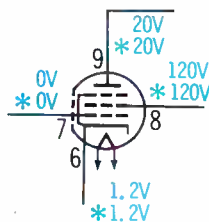
Screen is blank on all active or inactive channels. No sound can be heard from speaker; no snow is present on vacant channels. Width is reduced slightly—raster is in about 1/2" on each side. Exact source of trouble is questionable; however, video trouble seems likely.



Waveform Analysis

Restoration of picture and sound is first concern. Loss of signal in W1 (see accompanying normal W1) hints that IF strip is inoperative. Valuable clue is gained from fact that W1 is normal until raster appears; W3 is abnormal and remains so. This suggests that IF stages operate okay until AGC voltage is developed by keying pulse from flyback. Constantly abnormal W3 suggests trouble is between grid of video stage (W1) and grid of AGC tube.

Voltage and Component Analysis



Without signal, all voltages on V1 are normal; same readings are obtained when active station is tuned in. Voltage readings strongly indicate signal is missing on grid, since voltages don't vary. Best voltage clue is 0-volts at point C. Width reduction is explained by fact that AGC control grid is floating and screen grid is connected to boost. Screen grid tends to act as positively biased control grid, thus causing tube to conduct extremely hard. Screen current is greatly increased; boost voltage is therefore loaded; causing narrow picture.

Best Bet: Scope, followed by voltage checks.

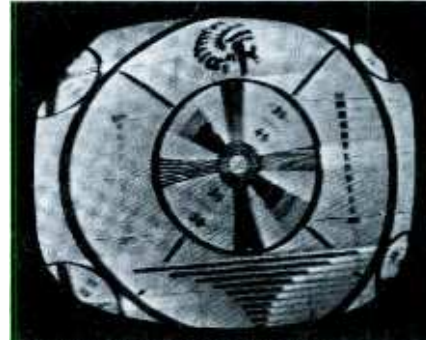
Contrast Lowered

SYMPTOM 4

Smearred Video

L1 Open

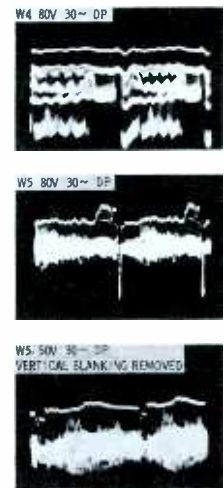
(4.5-mc Trap Coil)



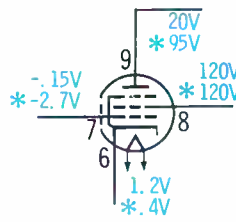
Contrast control is operative; however, even at maximum setting, contrast is insufficient. Equally important, picture is smeared. Trouble could be caused by defect in either video-IF or output stage. Most logical point to begin troubleshooting is at video-output tube.

Waveform Analysis

Signal at plate of V1 (W4) is normal; so, amplification and response of video output and preceding stages are probably okay. W5 is of primary importance in locating trouble; it contains only high-frequency video information and negative vertical-blanking pulse. Another W5, taken with blanking pulse disconnected from CRT grid, shows only high-frequency components of video signal. Scope isolates trouble to path between V1 and CRT.



Voltage and Component Analysis



All voltages on V1 are normal, with or without signal; therefore, meter isn't really useful in locating defective component. With L1 open, low frequencies of video signal and sync pulses are not permitted to reach CRT cathode; this range of frequencies just can't pass through 47-pf capacitor. Negative blanking pulse in waveform at CRT cathode is result of vertical-blanking pulse being coupled from grid to cathode capacitively inside the picture tube. Loss of low-frequency video signal is reason for video smear and weak contrast.

Best Bet: Scope and circuit analysis.

Video Overloaded

Buzz in Sound

R9 Increased in Value

(Plate-Supply Resistor —
4300 ohms, 7 watt)

SYMPTOM 5

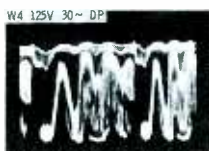
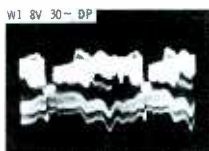
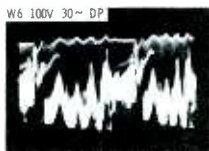
Symptom
Analysis



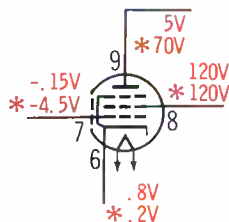
Problem looks typical of overloaded picture caused by AGC defect. Adjusting contrast control improves condition, but evidence of trouble is present even at minimum setting. Clamping AGC line helps, but doesn't restore picture completely to normal operation.

Waveform Analysis

Increased amplitude and compressed sync pulses in W6 don't suggest trouble—only prove that IF stages are operating at high gain. Remember that clamping AGC line won't help if trouble is in non-AGC-controlled stages (third IF or video output). W1 is doubled (now 8 volts p-p); clamping AGC returns W1 to normal, throws suspicion to video stage. Amplitude of W4 is increased, but not in proportion to W1—gain of V1 is reduced.



Voltage and Component Analysis



Voltage measurements prove most helpful in locating this defect. With or without signal, cathode and plate both have decreased readings. Decrease in plate voltage could mean tube is drawing excessive current; accompanied by decreased cathode voltage, however, means low plate current. All this points to increased value of R9. Above-normal negative grid voltage, with signal present, is caused by high amplitude of grid signal. If R9 were open, CRT would display only raster—no video. Resistance checks pin 9 to B+ isolate R9.

Best Bet: Voltage and resistance checks are adequate.

Sync Unstable

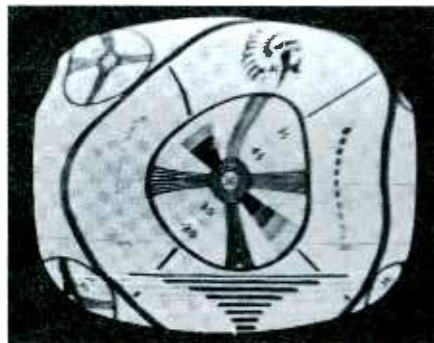
Both Vertical and Horizontal

C6 Open

(Sync-Shaping Capacitor — 150 pf)

SYMPTOM 6

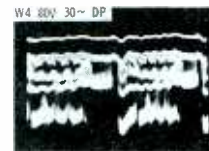
Symptom
Analysis



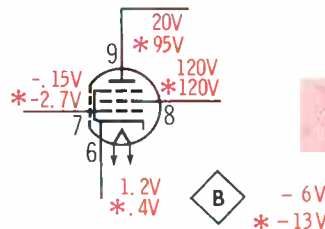
Horizontal and vertical sync both are quite erratic. Picture remains stable for short periods, then drops out of sync; sometimes horizontal bending occurs with picture in sync vertically. Symptom seems to indicate horizontal sync is affected more drastically.

Waveform Analysis

With picture in sync, W4 is normal, both in content and amplitude; proves preceding stages and video-output tube are functioning properly. Input to sync separator (W6) is very distorted (see accompanying normal W6); amplitude is reduced and sync pulses are extremely compressed. Horizontal-sync pulses are almost entirely missing. Scope proves trouble precedes sync-separator grid; therefore, must be somewhere in sync-takeoff network.



Voltage and Component Analysis



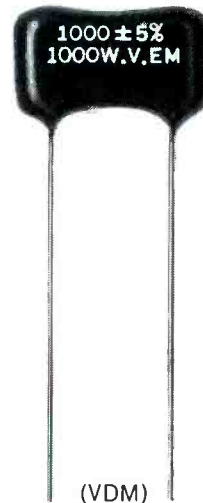
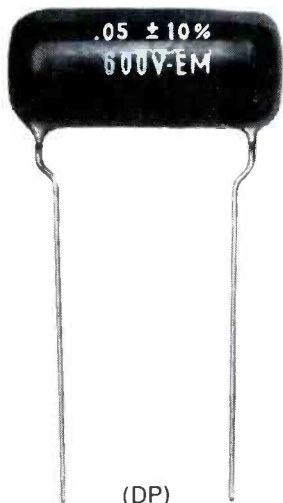
All voltage readings on V1 are normal; only abnormal indication is at point B—reads -13 volts with signal, -6 volts without signal. Decreased negative voltage with signal suggests trouble in coupling network at sync-separator grid or change of value in R7. Open C6 is difficult to isolate with meter. Capacitor-substitution box can quickly locate defect. Practically any defect in sync-takeoff network can be found with scope. Good rule for any sync-circuit troubleshooting is: scope first, then meter, then component substitution.

Best Bet: Scope followed by component substitution.

Eliminate Call-backs!

Every time you make a call...service a circuit...change a component—you bet on the parts used. Make sure the odds are in your favor with Elmenco Dipped Mylar—Paper (DP) & High Voltage Dipped Silvered Mica (VDM) capacitors. Over 100 million are in use now, because Elmenco capacitors give missile quality at commercial cost. Whether for radio-TV repairs, or critical industrial circuitry, reliable, dependable, rugged Elmenco capacitors eliminate profit-killing call-backs and customer complaints.

when you specify **ELMENCO** capacitors



Elmenco capacitors operate at 125° C without derating, are completely moisture proof, and are up to 50% smaller than comparable types. You can substitute values in a capacitor, but never virtues. Ask for Elmenco, and be sure you get it. **LOOK FOR THE "EM"**



Elmenco capacitors are immediately available from all authorized Arco distributors throughout the U.S.A. They're stocked in depth at reserve warehouses serving authorized Arco distributors. Call your Arco distributor today!

ARCO

electronics inc.

A LORAL SUBSIDIARY

COMMUNITY DRIVE, GREAT NECK, N.Y. 11022 516-487-0500

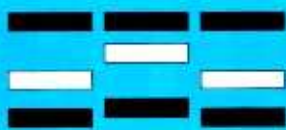
DURING
ELECTRONIC SHOWCASE



SEE US AT BOOTH N-35
NEW YORK HILTON HOTEL

Circle 11 on literature card
www.americanradiohistory.com

TRACKING ADJUSTMENT



For AM and FM

by Philip R. Powell

Tune-in on this "clear" course
for correct alignment.

Customer complaints of station mixing and fading are among the toughest auto-radio repairmen face. The repairman has to judge his customer to determine if a legitimate complaint actually exists. Often it is very difficult to pin down the complaint to anything tangible, and a road test can, in some cases, be too time-consuming to result in anything near a profitable repair job.

The big question is: Why are there more complaints of this type each year? There are two answers:

1. The number of AM broadcast stations on the air has increased tremendously. With so many signals being transmitted, a sensitive receiver must be in perfect alignment to prevent station mixing.
2. With the introduction of FM radios in automobiles, fading occurs when the receiver is in the 25-mile fringe area of reception. Defective tuned circuit components or poor alignment shows up quickly under these conditions.

Initial checks for mixing or fading should begin with the car antenna. Tune the radio off station and whip the antenna mast. If even the slightest noise is generated, check for loose connections or poor grounds, and replace the antenna if necessary. A check for leakage between the center wire and the shield using an ohmmeter is also useful, but a megohmmeter is required if the test is to be conclusive.

One item that *must* be checked on a complaint of this type is the antenna trimmer (AM receivers). This adjustment is often overlooked by both the factory and the installing automobile dealer. Fig. 1 illustrates a "hidden" location of this adjustment on some current models; removing the tuning and dummy knob exposes an entrance hole



Fig. 1. Correct adjustment of antenna trimmer will improve reception.

through the dash of the automobile. Most models have the antenna trimmer located on the back of the receiver, usually close to where the antenna plugs in.

The adjustment is made by tuning the receiver to a very weak station, or noise, in the range of 800 to 1400 kc. The trimmer is then set for maximum signal or noise. A definite peak should be obtained with the screw neither extremely loose nor tight. This adjustment should be made with the antenna at its usual height and 30" is a good height. This adjustment is also a secondary check as to whether the

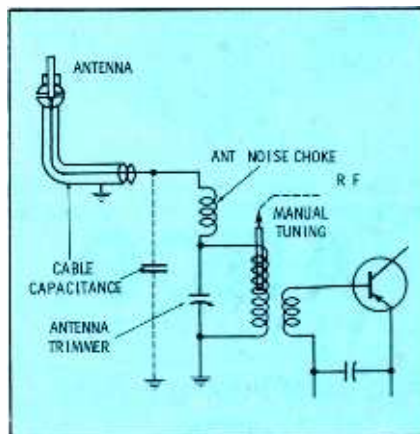


Fig. 2. Antenna coil circuit is most efficient when trimmer is peaked.

antenna is good. Any antenna that does not peak may need to be replaced. (By the way, antenna-trimmer adjustments are not made on FM, but a 30" antenna height gives best performance.)

You are probably wondering why such a simple adjustment can have such a marked effect on station mixing and fading. Fig. 2 illustrates that the antenna and cable capacitance (no two antennas are equal) is part of the resonant antenna coil circuit. If the antenna trimmer is not adjusted correctly, one of the five tuned circuits in the receiver is thus rendered useless. To make matters worse, there is always the possibility that it may be misadjusted to accentuate the very station that is interfering with your listening enjoyment.

AM IF Alignment

If the receiver sensitivity is near normal and no obvious defects are apparent, alignment can be a good troubleshooting technique. There are those who still refuse to use test equipment for alignment, preferring a station signal instead; but with broadcasting conditions being what they are today, this is not wise except for very cheap, low-sensitivity receivers.

The modulated IF signal from a generator can be connected to the antenna jack, provided the receiver is not completely out of alignment. Turn the receiver dial to the high end, and connect an AC voltmeter to the speaker voice coil. Using a weak generator signal (.5- to 1-volt reading on the meter, with volume control turned up), align each IF coil. Touch up each coil several times until no further improvement can be realized (the sequence is not important). Carefully note the sharpness of the peak; a broad characteristic is a good tipoff to

trouble. Replace any coil whose action is erratic, does not peak, or does not produce a *sharp* peak.

FM IF Alignment

FM IF alignment does not have to be complicated. Fig. 3 (point A) shows where to connect a DC voltmeter for a dependable output indication. An accurate unmodulated 10.7-mc signal can be connected to the antenna jack, with the generator output adjusted for a reading of *not more than 1 volt* on the meter. The AFC is grounded out, and the manual tuning is set to the high end of the dial.

Working toward the antenna, adjust the ratio detector *primary* and each IF coil for a peak reading. Be sure to keep the signal level below a 1-volt reading. FM IF coils should peak very sharply in automotive receivers, so be on the lookout for offenders. Defective coils can be accurately spotted by this alignment check, even though they are practically impossible to detect by resistance readings (except, of course, a completely open winding).

After the IF adjustments have been made, the radio detector *secondary* will have to be adjusted for zero with a DC meter connected at point B in Fig. 3. When the adjustment is rocked back and forth, the voltage should swing positive or negative on each side of the zero point. Failure to achieve exact zero will result in distorted sound.

Tuner Adjustments

AM Tracking Checks

Tracking is a term used to indi-

cate the accuracy of a receiver's alignment at various points on the dial. A perfect receiver would have the antenna, RF, and oscillator circuits exactly coinciding for all stations across the dial. In reality, the three tuned coils are never exactly the same in every radio, so some error is bound to exist.

The three tuned circuits, shown in Fig. 4, usually have coils that are wound in a special manner to spread the stations out on the upper half of the AM dial. Since they are wound with more wire on one end of the coil, proper tracking is more difficult to achieve.

Fig. 5 illustrates by the use of "phantom" pointers the locations where each tuned circuit reaches resonance. When the circuits are "out of track," this spreads out a portion of the dial, allowing adjacent stations to interfere. The following steps must be taken to determine if the tuner is tracking:

1. Connect the modulated signal generator to the receiver antenna jack through the dummy antenna recommended for the set. A dummy capacitor is usually used to stimulate the loading effect of an antenna connected to the input circuit.
2. Connect an AC voltmeter across the speaker for an output indicator.
3. The oscillator slug setting is usually set up at some standard slug depth—see Fig. 6. For example, $1\frac{3}{8}$ " from the back of the slug to the rear of the coil form is commonly specified as a starting point. This is measured

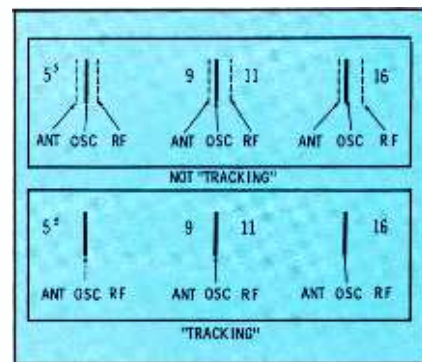


Fig. 5. Adjacent stations interfere when radio circuits aren't tracking.

with the dial tuned to the extreme high frequency end. The slug depth should be checked before alignment, since the alignment you do may have to be completely redone if you later discover the oscillator slug has been tampered with.

4. With the receiver tuned to the high frequency stop, set the signal generator for 1615 kc (varies on some models). The volume control should be set at maximum. Using a weak signal, tune the oscillator, RF, and antenna trimmers for maximum. All circuits should now be tuned exactly to 1615 kc.
5. Move the signal generator dial to 600 kc. Manually tune the receiver to the generator signal using the output meter as an aid. Readjust the generator output if necessary to keep the signal weak.

The receiver is now on 600 kc; but, unless tracking is perfect, the antenna and RF circuits are prob-

•Please turn to page 83

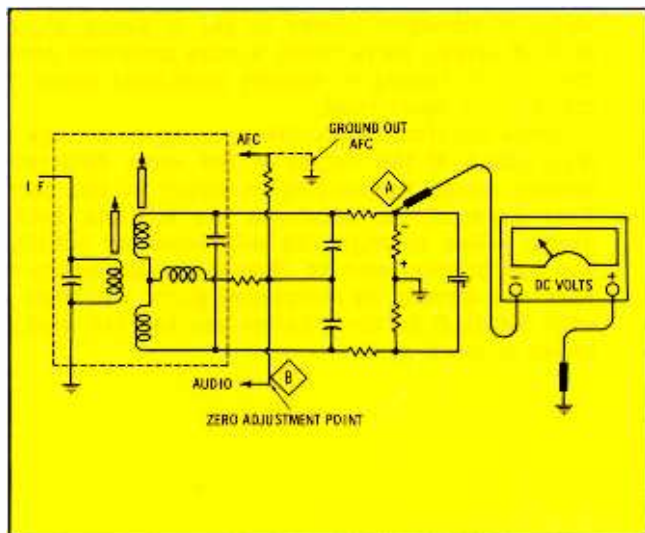


Fig. 3. Connect VTVM to detector output during alignment.

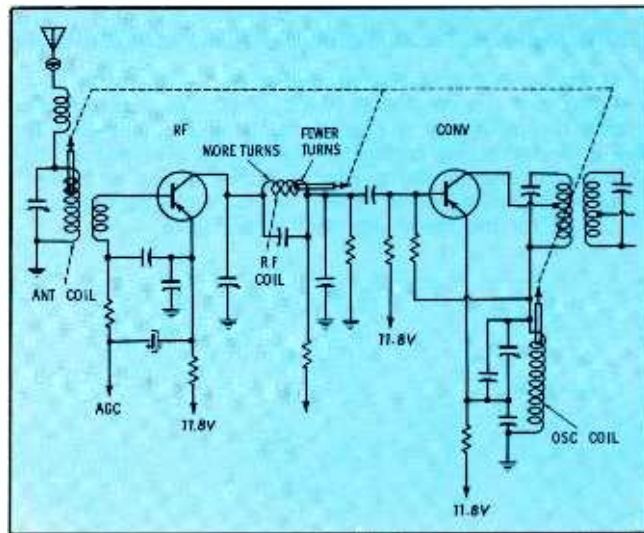
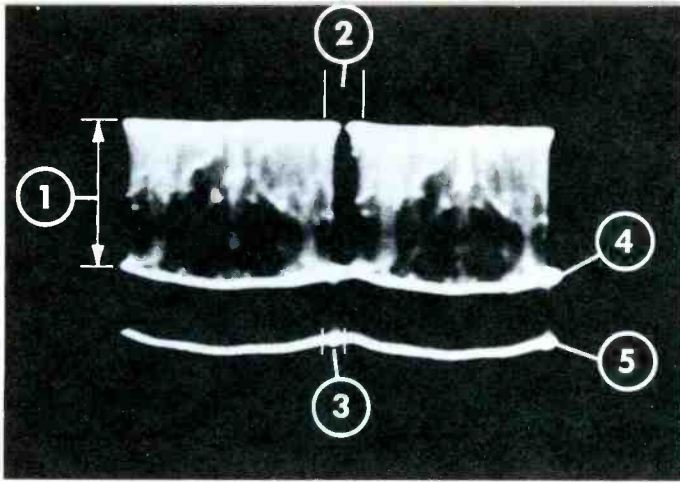
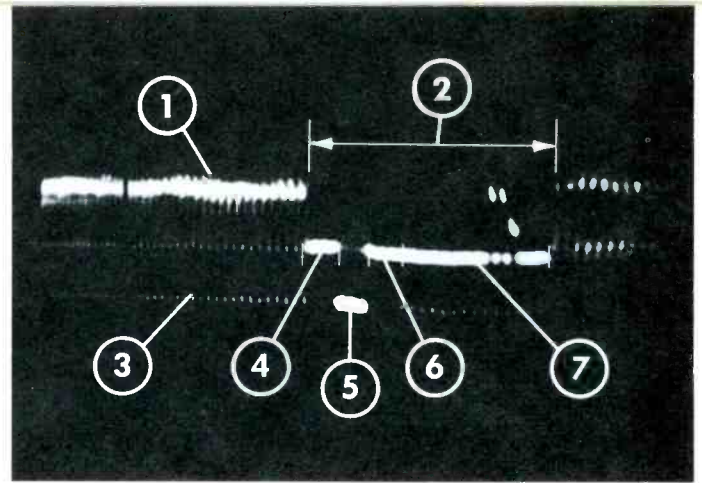


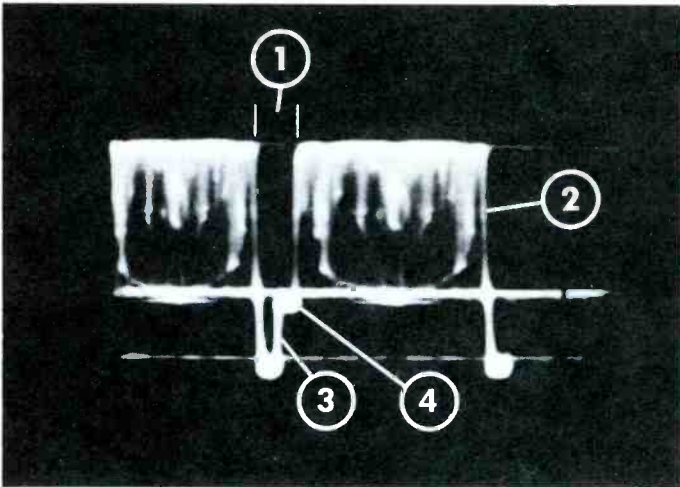
Fig. 4. Align antenna, RF, and oscillator for good tracking.



This is the normal vertical-rate composite waveform showing the various individual components that make up the video signal. (1) video region—top is white level, bottom is black level; (2) vertical-blanking interval; (3) vertical-sync-pulse tip; (4) bright trace from horizontal-sync pedestals; (5) bright trace from horizontal-sync-pulse tips. Sweep frequency of the scope is set at exactly 30 cps.



Same composite signal, except sweep rate is 60 cps and horizontal gain is expanded to show vertical-sync-pulse area. (1) Video region; (2) time of vertical-blanking pulse; (3) horizontal-sync-pulse tips; (4) leading equalizing pulses; (5) tips of serrated vertical-sync pulse (serrations not visible); (6) trailing equalizing pulses; (7) horizontal-sync pulses present during the vertical-blanking period.



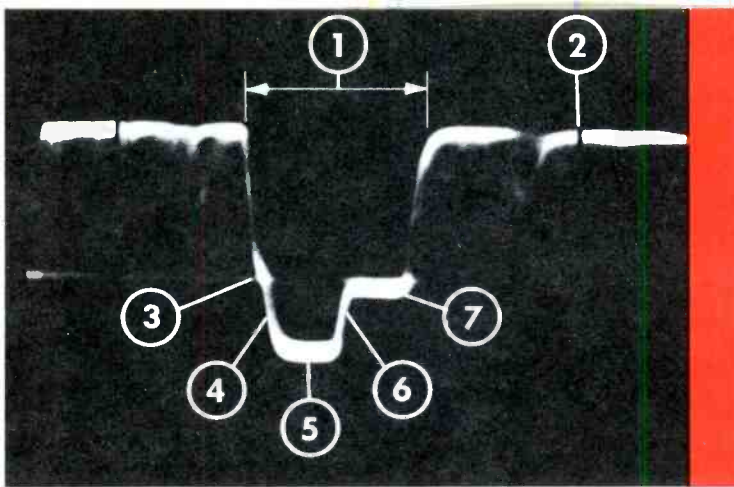
The scope's sweep frequency has now been changed to 7875 cps to present two horizontal fields so we can examine the horizontal components. (1) Horizontal-blanking interval; (2) video information; (3) horizontal-sync pulse; (4) back porch of the horizontal-sync pulse. For this waveform, as for others in this series, the scope is synchronized internally, and sync level is set for the steadiest, most stable trace.

WAVEFORMS

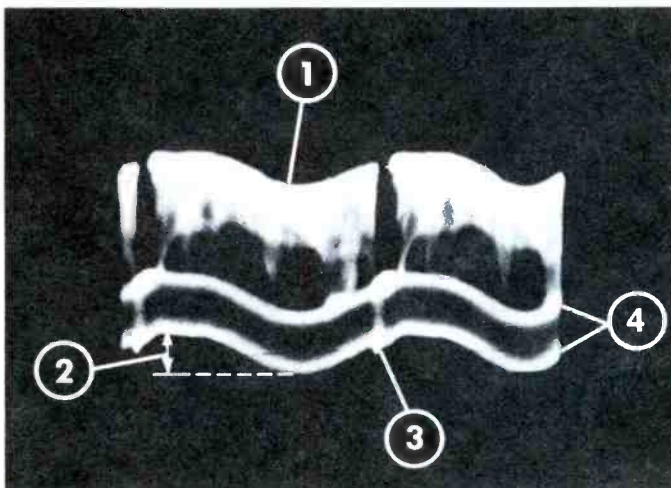
Save Analysis Time

Last month we presented a practical and useful series of waveform photos to aid in sweep alignment of TV IF stages. We're taking a more analytical approach this month, hoping to provide additional useful information at a basic level.

These waveforms were taken, using an average shop-type scope, at the output of the video detector with various sweep frequencies as noted in the captions. They represent the waveforms you will find, both with proper scope settings and with incorrect settings, so you can quickly learn to observe the composite waveform and identify its component parts. You must know what **SHOULD** be there before you can tell what's distorted or missing.

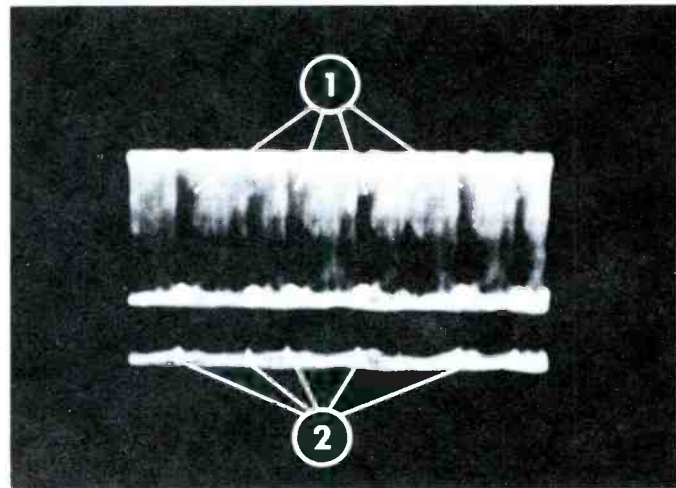
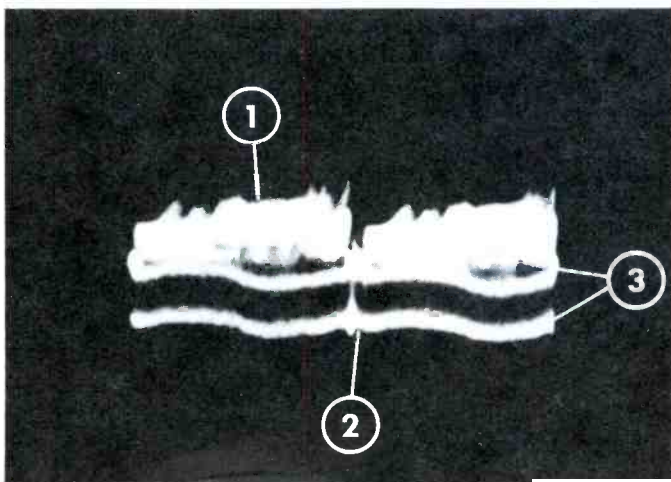


Same as photo 3, except that sweep is 15,750 cps, to obtain one field, expanded to show the horizontal-sync pulse. (1) Horizontal-blanking interval; (2) video region; (3) front-porch notch; (4) leading edge of sync pulse; (5) sync-pulse tip; (6) trailing edge of sync pulse; (7) back porch. Some scopes may give greater or lesser definition of the pulse, but all components of the composite signal can be identified.



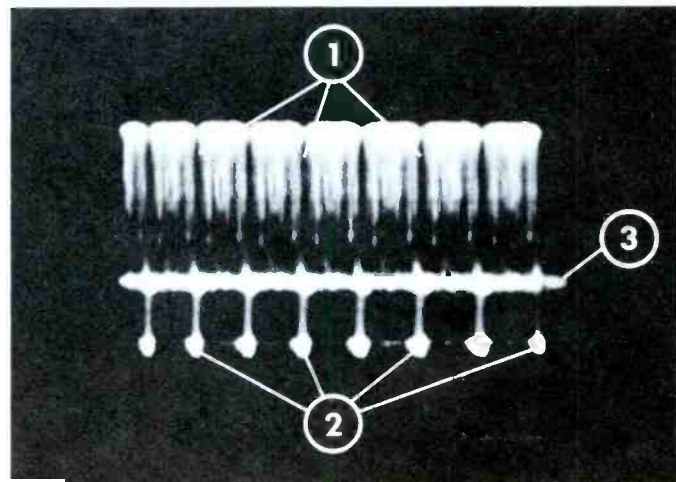
This signal waveform was taken under the same conditions and with the same scope settings as in photo 1, except that excessive 60-cps hum is present. (1) Video information; (2) maximum excursion of 60-cps distortion; (3) vertical-sync-pulse tips; (4) horizontal-sync-pulse pedestal and tip traces. Hum of this level would cause objectional distortion on the receiver's picture tube. The hum would appear as bars.

This waveform might be obtained where trouble exists in the front-end of the receiver. Snow (noise seen as hash or grass in waveform) indicates RF problem. (1) Low-level video information indicates poor signal-to-noise ratio; (2) vertical-sync pulse is down in the noise level—may cause rolling; (3) horizontal-sync pulse is also in noise, but picture should hold horizontally. Sweep frequency is 30 cps.



If you see something like this when scoping for a vertical-rate trace to check the vertical components of the composite waveform, the answer lies in selecting the correct sweep frequency. Waveform was obtained using a slower-than-normal sweep frequency. Remember: 30 cps for two vertical fields, 60 cps for one field. (1) Vertical-blanking pulses; (2) sync-pulse tips at random intervals on lower trace.

Wrong sweep frequency will cause as much grief in trying for a horizontal-rate display as in the vertical display shown in photo 6. This unsynchronized display was obtained at a sweep rate of approximately 1700 cps. Remember: Use a sweep frequency of 7875 cps for two horizontal fields, 15,750 cps for one. (1) Horizontal-blanking pulses; (2) sync-pulse tips; (3) indefinite pedestals.



CRT'S

LINEAR SWEEP FOR FLAT'S

The "flat-face" or bonded-shield CRT offers many advantages over the conventional rectangular, curved-face tube. From the consumer's standpoint, the bonded-shield CRT reduces glare and reflection, increases contrast, permits easier cleaning of the screen, and provides a more uniform, larger image area.

The conventional rectangular CRT uses a separate safety glass that has a number of disadvantages, not the least of which are the two additional surfaces which collect dust and require periodic cleaning. A comparison between the conventional tube and the bond-shield CRT is shown in Fig. 1. The conventional tube (Fig. 1A) has a total of four reflecting surfaces. In addition to dirt and dust collecting on these

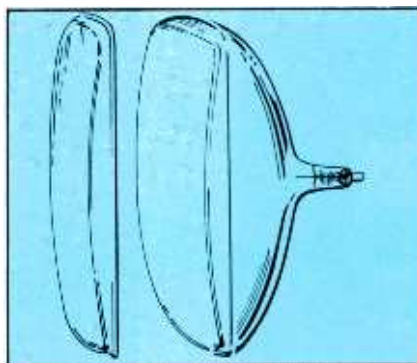


Fig. 2. Contoured-cap shield is laminated to the CRT face using epoxy resin.

surfaces, the picture contrast is diminished by reflected light. The bonded-shield CRT, with special construction for the safety glass, has at best only two reflecting surfaces (Fig. 1B) which do not per-

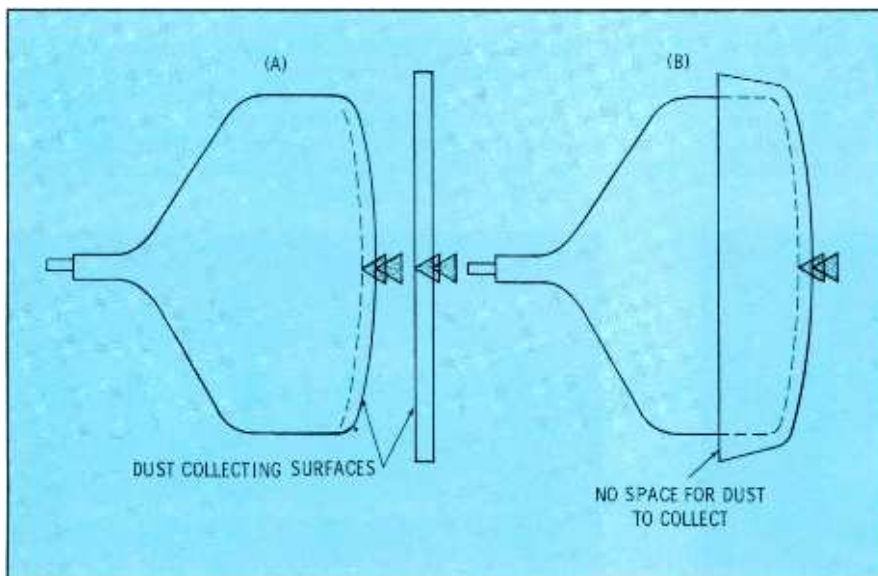


Fig. 1. Bonded-shield CRT's eliminate two dust-collecting surfaces from tube.

mit dust to collect, reducing glare and increasing contrast. Four basic types of these tubes are available.

Construction

The bonded-shield (contoured-cap) picture tube shown in Fig. 2 uses a permanently bonded wrap-around glass panel attached to the picture tube at the factory. When this CRT is placed in a receiver, no additional safety glass is needed. A cut-away view showing the construction of the bonded-shield tube is shown in Fig. 3. The contoured glass shield is manufactured separately, with an inside contour that corresponds to the contour of the picture tube and is bonded to the CRT using a special resin. The cap becomes an integral part of the tube.

The epoxy resin used to bond the glass shield to the CRT face has the same index of refraction as the picture tube and glass cap to avoid distortion of the television image. With this type of construction, the only surface which can collect dust or dirt is the front of the wrap-around panel. Since this is exposed, and is actually the viewing surface itself, cleaning the face is a simple matter for the set owner.

Aside from eliminating the dirt problem and reducing glare, three other improvements are noticeable:

1. The CRT screen presents a larger viewing area as well as a larger viewing angle.
2. The screen is flatter, providing less curvature distortion.
3. The picture contrast is improved. When the curved screen of a conventional picture tube is fully scanned, the corners are "over-scanned" as shown by the shaded areas in Fig. 4A. Electrons striking the walls of the CRT bulb are reflected to the screen; the result is reduced picture contrast, particularly at the corners. The straighter sides and squarer corners of the bonded-shield-type CRT appreciably reduce the amount of corner-scan (Fig. 4B) improving picture contrast.

Three other similar CRT's also provide a safety shield. One type uses a bonded-on glass panel similar to the basic bonded-shield, except that it does not have a wrap-around cover glass. As shown in Fig. 3B, a glass panel fits over the front surface and is bonded to the tube. A

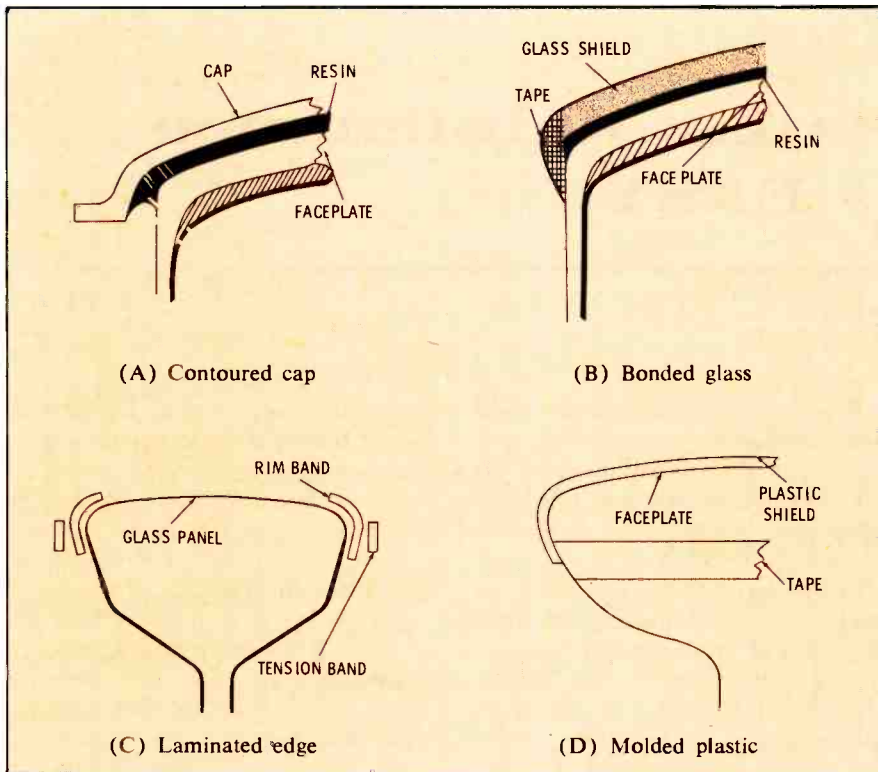


Fig. 3. Bonded-shield CRT's are built using one of the four methods shown here.

cavity is formed, usually by plastic tape, between the face-plate of the CRT and the cover glass; this cavity is filled with a laminating resin.

Another type uses a laminated fiber-glass band which is bonded to the reinforced tube bell but does not cover the front surface of the CRT. As shown in Fig. 3C, a steel band holds the glass faceplate in position behind the lip of the fiber-glass rim band.

The CRT (Fig. 3D) using a plastic-laminate faceplate is also similar to the original bonded-shield, except that a plastic rather than a glass shield is used. This laminated plastic sheet is vacuum-formed so that it completely covers the CRT face and wraps around the edges. This type of CRT is commonly used in portable TV sets where weight saving is an important consideration.

Mounting Techniques

Mounting techniques for the flat-face CRT are more or less standard, the only possible exception being that used to mount the original bonded-shield CRT. Four lugs, or ears (one at each corner of the glass faceplate), are fitted into cabinet-mounted sockets and clamped in place to secure the tube. A note of CAUTION here: when replacing this type of CRT, *make sure* that

the four lugs are properly seated before the mounting clamps are tightened. This will prevent any possibility of damage due to uneven stresses on the CRT itself.

Sweep Circuits

Sweep circuits used with conventional CRT's having convex faceplates rely on a linear sawtooth sweep waveform to obtain a linear

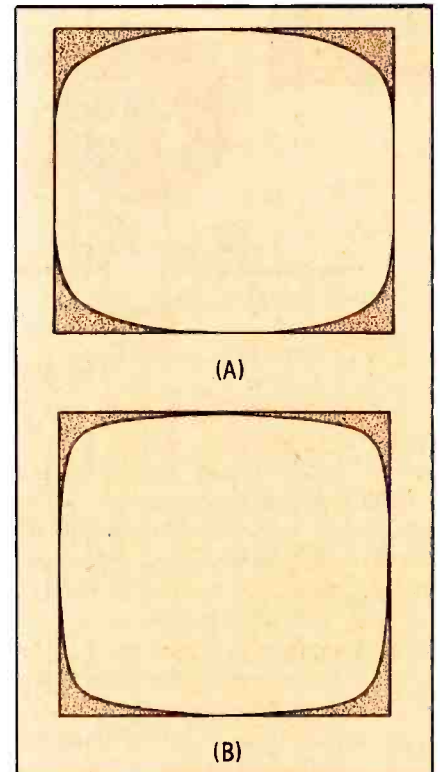


Fig. 4. Shaded areas show overscan on conventional (A); bonded (B) CRT's. sweep. However, because of the flatter face of the bonded-shield CRT, an "S"-shaped current waveform is needed to provide linear sweep through the central region of the screen. Pincushion distortion in the corners (due to the increased radius) is corrected in the yoke by shaping the coils to produce less deflection at the edges of the CRT.

•Please turn to page 81

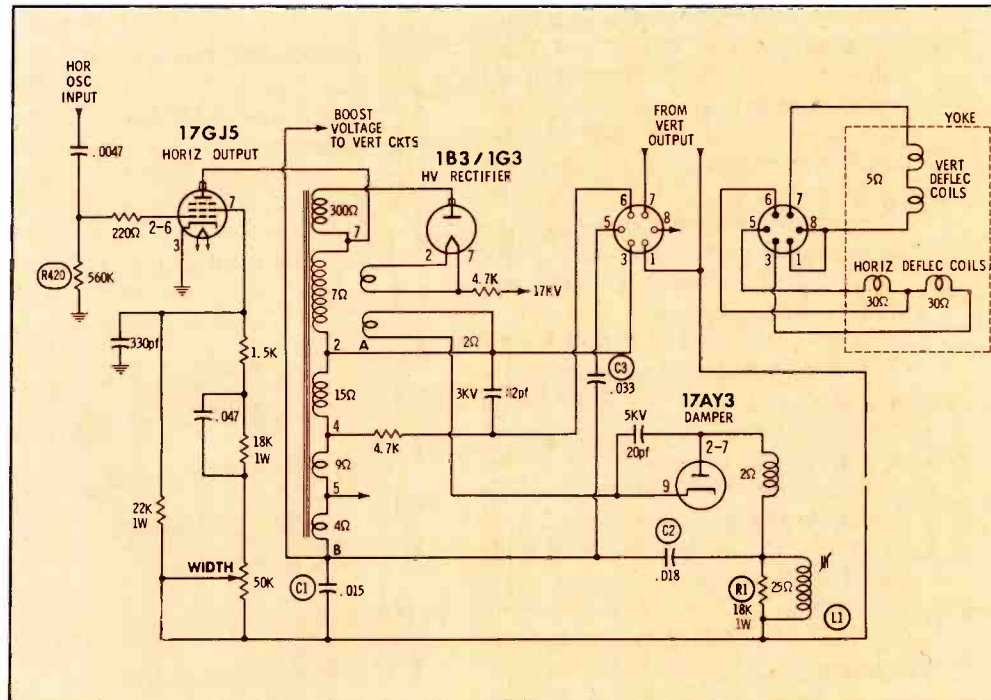


Fig. 5. Compensating network C1, C2, L1, and R1 provides proper sweep.



Radar Maintenance is EASY

In the search for a line which could be profitably added to the service load of any shop, certain special types of equipment are often passed by. Sometimes this is intentional; more often it results from just not being aware that a market for such service exists.

Why would a potential market for service be intentionally passed up by many technicians? The answer probably lies in the psychological "fear of the unknown." Lack of familiarity with seemingly complex circuits, lack of knowledge as to how to go after the new line of business, constitute the major facets of this "fear."

Such an orphan in the servicing field is marine electronics. A few technicians who live near oceans, lakes, or rivers have discovered a multiplicity of electronic equipment and instruments that need servicing on board the ships and boats that ply these bodies of water. Intercom systems, ship-ship and ship-shore radio-telephones, depth sounders, radio and television receivers, and radar systems are all in constant use on ocean vessels, lake tankers and ore carriers, riverboats, and pleasure yachts. This field of service is little understood, possibly because much of the equipment is not a type which a customer will carry into the service shop; but, then, neither is television, generally speaking. Service calls must be made on marine equipment, the same as on home TV sets.

Of all the electronic systems on board ships, the radar system is probably the least understood by the average TV technician, yet is in need of service as often or more often than probably any other unit on the ship. Competent radar technicians are so difficult to find that some boat companies even have to hire and train their own electronic

staff to maintain equipment on their own ships; other radar servicing is done by field representatives of the manufacturer, or by a very few large companies that specialize in marine electronics servicing.

In this series of three articles, we shall try to overcome any fear you may have of this unknown gear, replacing unfamiliarity with knowledge, by discussing (1) the ways and means of getting this service business, and from whom, (2) the technical characteristics of the equipment which the service technician is likely to encounter, and (3) how to actually go about servicing a typical marine radar system.

Where and When?

Where must these service calls be made? To answer poses the question—who uses marine radar? As the name implies, marine radar systems are installed on boats. The marine radar system is a surface-search radar which is capable of showing land, other boats, channel markers, and other "targets" in a way usable to the navigator of the boat. Therefore, radar sets are used on boats plying our inland waterways, the Great Lakes, and the Gulf and Coastal waters of our country. In addition, ships using our ports as terminals for ocean voyages almost

invariably carry radar equipment. So, to answer the question of where, we can say service calls must be made on board a ship or boat, or at any point where it is likely to dock.

Now, lets go into a bit more detail about the peculiar problems of servicing boats at these various locations. River craft, which includes commercial towboats and pleasure yachts, quite often use radar. A survey last summer of commercial boats passing a certain point on the Illinois Waterway System during a given period showed well over half the commercial boats equipped with radar systems, and a significant number of pleasure craft so equipped. This proportion goes even higher on lakes and larger rivers, especially the proportion among pleasure yachts.

In making service calls on commercial towboats, their schedules must be taken into consideration. These boats can pick up a technician at some point, he can work on the equipment while under way, and he can disembark at another dock which he finds convenient along the river. Occasionally, a river boat can be serviced while tied at some dock to discharge cargo, exchange a barge, or while in drydock for other repairs. The important consideration for the technician is meeting the schedule of the boat; the boat operator can more economically pay the technician to meet the boat's schedule, than he can pay an entire boat crew to stand by while the technician completes some repair.

The many pleasure craft that have been equipped with radar since the advent of relatively inexpensive radar systems can usually be serviced in a yacht harbor or at any docking facility, and schedules are not so important. This is not to say the yacht owner deserves less prompt



Here's a deck-mounted radar indicator.

service, but time demands on the technician are less.

On the Great Lakes, the percentage of pleasure craft that are radar-equipped is much larger than on rivers. The service-call circumstances, however, are the same as with river-based yachts, and may be handled in the same manner.

Also on the Great Lakes are found the huge fleets of ships carrying iron ore, coal, limestone, petroleum products, and other commodities between lake ports. And since the opening of the St. Lawrence Seaway, ocean-going vessels, both domestic and foreign, are becoming commonplace in lake ports. These ships are almost invariably equipped with radar systems; and more recently the trend is toward two radar systems on a ship—one large radar system, and a smaller one for emergency use if the larger one should fail in a critical situation.

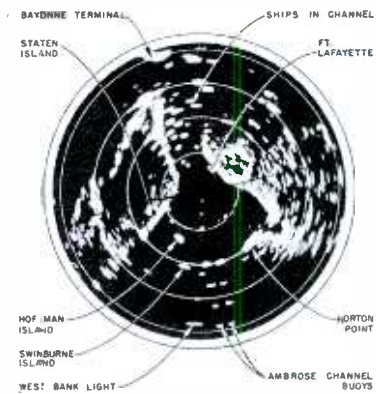
The servicing of lake and ocean ships must necessarily take place at dockside, while the ship is discharging or loading cargo. Some are dockside as little as three or four hours, while others require two or three days, sometimes even a week, to load or unload—depending on the ship, the cargo, and the dock facilities.

Who?

Who is in the market for this type of service activity? Superficially, we have already answered this question: the boats who are radar equipped. But from a practical standpoint, the answer is more involved, because the independent service technician needs to know who to see about obtaining this service business, and which boats and ships are in need of service facilities. Here's a bit of background about the business as it exists today.

Radar systems are installed in commercial boats under two general plans—leasing and purchasing. The major manufacturers of marine radar systems have developed plans for leasing their equipment to users. This was prompted by two important considerations. The first involves the bookkeeping and tax people; the second concerns servicing.

Frequently a ship-owner prefers to own his radar equipment, and almost all pleasure-craft installations are owned by the user. In these



Radar paints map of New York harbor.

cases, the owner must either arrange with independent service people at points where his boats visit, or he must use personnel provided by the manufacturer. Often, either of these are too few and too far to take care of servicing needs promptly. The answer would be *competent* (I stress that word as it is the key to the service problems of these customers) service technicians at any point not covered by the manufacturer (and at some points that are).

Finding Business

The following suggestions are offered for any service technician who is interested in looking into ma-

rine radar servicing activity and its possibilities:

- (1) Find out if the major manufacturers of marine radar systems have a service facility at or near your location (see List of Manufacturers—Table 3).
- (2) Contact the manufacturers to determine if they are interested in providing service at your location. Some manufacturers are interested in establishing service agents at key locations to take care of servicing needs of their customers in the area.
- (3) Make a survey of the boats touching (or passing) your location; then contact the owners to determine if they would be interested in using competent service facilities if such facilities were available. Many are interested. Owners of commercial vessels are listed in marine directories published by companies specializing in compiling such data. Typical are: Inland River Record, 121 River Ave., Sewickley Pennsylvania, and Marine Engineering/Log, 30 Church St., New York 7. Ocean vessels and

Table 1. Tubes used in radar systems

Notes:		
Where quantities are not shown, item is magnetron or cathode-ray tube, not recommended to carry in stock unless service volume warrants.		
Quantities are recommended tube-caddy stock for one technician, and are for a guide when all popular makes are serviced.		
RA—Raytheon	RCA—RCA Service Co., Radiomarine Division	
SP—Sperry-Piedmont		
* Industrial types available from distributors—see text.		
2 OA2*	2 6AG7	10KP7A RCA
1 OB2*	5 6AK5	10WP7 RA
2 OC3*	2 6AL5	
2 OD3*	1 6AN8	2 12AT7
	2 6AQ5	5 12AU7
2 1B3GT	2 6AS6, RA, RCA	2 12AX7
1 1B24A RA, RCA	2 6AS7, RA, RCA	12DP7A RCA
1 1B35 RA, RCA	2 6AU5	1 12DQ6
2 1V2	2 6AU6	
2 1X2A/B	1 6AW8A	16ADP7 RA, RCA
	1 6BG6G	
2 2D21W*	2 6BQ7A	1 KU-99/3C45 RA
2J42 RA	5 6CB6	1 721B/BL696 RA
2J55 RA	1 6CD6G	725A RCA
2J70 RA	2 6D4*	2 807*
1 2K25 RA	2 6EW6	2 866A*
2 2X2A*	1 6J4*	1 1641/RK60 RA
	2 6J6	1 5642 SP
2 3B24W RA	2 6L6G	1 5651*
2 3B29 RA	1 6SH7GT	1 5670*
	2 6SJ7	1 5687*
1 4C35A RA	1 6SL7WGT*	1 5692*
1 4PR60 RA, RCA	5 6SN7WGT*	1 5704 RA
	1 6X4	1 RK6043 RA
3 5R4GY*	2 6Y6GT/G	1 8013A RCA
2 5U4GB	5ADD7 SP	
2 5Y4G	7ABP7 RA	
2 5Y3GT	7BP7A RA	
	7MP7 RCA	

Table 2. Tools for servicing radar

Screwdrivers	Miscellaneous
Setscrew	Allen wrench set
Stubby standard	Bristol wrench set
Stubby Phillips	8" crescent wrench
Regular Phillips	Misc. alignment tools
Regular standard	Neon tester bulb
Long standard	AC-DC soldering iron
Nut Drivers	Flashlight and spare batteries
Set of 3/16 through 7/16	1/4"—drive ratchet set, with
Stubby—1/4, 5/16, 3/8	sockets to 5/8", and std.
Long—1/4	and flexible extensions
Pliers	Klystron tuning tool*
Diagonal cutters	Fuse puller
Long chain nose	
Snipe nose	
Gas-type	
Channellocks	

* RCA has a tool which combines the klystron tuning tool with a tool for removing crystals from their special mounting in the RCA sets.

lake boats are best contacted through their agents, and in transportation guides. Pleasure yachts are now almost all registered by number with the Department of Conservation in their state.

- (4) Contact harbor-masters, tug operators, ship stores, and ship hardware dealers to discover what boats frequent your area; these businessmen can usually help you contact the captains, owners, or operators of the ships.
- (5) Pleasure-craft owners are easily contacted through the yacht harbors they use, through local yachting clubs, and units of Power Squadrons and the Coast Guard Auxiliary. When arrangements are made with a manufacturer for handling their service agency in an area, the manufacturer usually refers all pleasure-craft service requests to the agent as well as those for commercial service.

Now, suppose you have made the necessary inquiries, and have come to the conclusion this would be a profitable addition to the services your shop presently offers. Your next question should be, what do I need to perform this service, in addition to electronic parts I already stock, and equipment I already have? You will need: a technician with a Second (or First) Class Commercial FCC License with radar endorsement; a stock of special-purpose tubes of certain types (listed in Table 1); a set of tools (listed in Table 2), some of which are special for radar systems; a volt-ohm-milliammeter and a good portable oscilloscope; and service man-

uals for the radar systems you will be servicing.

The technician need only be a conscientious, courteous person with a good grounding in electronic fundamentals, experienced in troubleshooting electronic gear, willing to dig into a piece of equipment to locate trouble, and capable of doing a neat, practical job of completing a repair. His radar experience need not be extensive, but a knowledge of radar circuits must be acquired. Of course, he must have the necessary license and endorsement, but the endorsement is simple enough to get; he must merely pass a short test covering Element 8 of the FCC commercial examination.

The special-purpose tubes listed in Table 1 are usually available from any supply house specializing in industrial-type tubes. Those types are marked with an asterisk (*). The tubes best obtained from the radar manufacturer are accompanied by the initials of the manufacturer. Recommended caddy quantities are given, but the technician must be guided by the equipment he services most. The remainder are common receiving types found in



Radar indicator near pilot's position.

any electronic supply store.

Tools listed in Table 2 are commonly found in any television service caddy, with the exception of some of the heavier tools used for mechanical work on radar systems.

The test instruments listed, the VOM and scope, are all that are needed for 99% of the service jobs encountered. The few other troubles that occur (we shall mention a few in Part 3) are best left to manufacturer engineers for servicing under controlled conditions with special equipment. The scope, while not absolutely necessary, can be a great time-saver on certain service jobs.

Service literature is provided by all manufacturers of radar systems. Service manuals are very complete on most equipment, and well worth their nominal cost. Binders of schematics alone are available from some manufacturers for certain models, and are handy to carry along after the technician is thoroughly familiar with the adjustment and tube-changing instructions found in the more complete service manuals.

Pricing

Having equipped ourselves with the necessary tools, supplies, knowledge, and some potential customers, how do we go about pricing our new service so we can realize a profit? Among TV and radio technicians, the most-oft-repeated misconception about the commercial marine electronic servicing field stems from this question. In most cases, this misunderstanding is the result of being unaware of billing procedures used in commercial servicing.

For comparison, we shall take an example from television service billing practices. The customer phones for a service call, wanting his television set repaired. The technician has a fixed charge, the "service-call charge," which applies no matter where the specific location of the call (except in some large cities). This charge, if the technician expects to survive, is sufficient to cover the following items: an average amount of time to travel to and from the call, an average amount of car mileage covered to and from the call, and an average amount of time to complete the repair or decide to

• Please turn to page 79

Now you can quickly locate defective capacitors affecting the performance of electronic circuits —and prevent costly call-backs!

CAPACITOR TESTING IN-CIRCUIT/OUT-OF-CIRCUIT IS QUICK AND EASY



NEW B&K CAPACITOR ANALYST

for TV, Radio, Transistor Radio, Auto Radio, Hi-Fi, and other electronic equipment

Unique new B & K development puts the measurement of capacitors and electrolytics on a practical basis—picks up all defects that will affect performance—turns lost time into profit dollars.

Servicemen are aware that capacitors and electrolytics are second only to receiving tubes in creating the most servicing problems.

The new B & K Capacitor Analyst enables you more easily to measure capacitance and leakage resistance—detect both opens and shorts—both in-circuit and out-of-circuit. In-circuit leakage resistance test can be made on low-voltage circuits such as transistor radios, or on higher voltage circuits. Checks capacitor value from 25 pfd to 100 mfd.

Tests electrolytic capacitors by unique circuit (Pat. Pend.) which determines how well the electrolytic does the job of storing electrical energy and returning it back to the circuit. Detects marginal electrolytics that should be replaced. Also predicts life expectancy of any electrolytic capacitor rated 3 volts or more.

Model 801 Capacitor Analyst is attractive, rugged, and easy to use.

NET, \$99⁹⁵

*Ask Your B & K Distributor for Details,
or Write for Bulletin No. 108-R*



B & K MANUFACTURING CO.
DIVISION OF DYNASCAN CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.

Circle 12 on literature card

February, 1965/PF REPORTER 41

CATV REVISITED

Report: Current happenings in the wired industry

by Allen B. Smith

It's practically impossible these days to pick up a trade or business publication covering any phase of radio or television without finding prominent mention of CATV or of pay TV. Charges and countercharges "statistical analyses," "absolutely unbiased reports," and "expert opinions" fill the pages, and the result appears little short of total confusion. Contradictory statements in most areas of discussion suggest several things to most of us: There may be partial (sometimes it seems complete) misrepresentation on many subjects by opposing factions; there may be unintentional misrepresentation through failure to consider all facets of the situation—it has been said that confidence and authority are what you feel before you completely understand the issue; or, maybe nobody knows what the problems are or cares what the solutions may be unless they are to his advantage.

Realistically, we have to recognize that CATV systems provide a service required by some and desired by many. We must concede this fact because since 1950, more or less in spite of itself, CATV has grown into an industry that grosses nearly \$1 billion a year! This kind of growth simply is not possible unless the service fills a need. The efforts of the STV pay-TV system on the West Coast indicate that unless the public is ready to accept an idea, no amount of money spent on promotion will ensure success. The ultimate demise of the STV venture may be attributed to the California state referendum that held STV to be against the public interest; but, the fact is, STV's widely publicized attempt to sell the public on pay TV, whatever its merits, was in very shaky condition long before the No-

vember ballot dealt the final blow. The public, in California at least, doesn't appear ready for that kind of TV. CATV, on the other hand, has grown tremendously, not only in areas served inadequately by local stations, but in local-station areas as well.

The July 1963 issue of PF REPORTER carried an article devoted primarily to the technical aspects of CATV systems, their reasons for being, and some situations the serviceman might experience if a cable company came to his town. Since that time, several rather thorny questions have arisen among service technicians. In the true sense, most servicemen are not too impressed by most of the questions tossed back and forth between broadcasters and CATV people, or between CATV and pay-TV groups, or even by

many of those questions often discussed in much heat by CATV representatives and various manufacturers of antennas, towers, and accessories. The serviceman wants to know what a local CATV system means to him in the everyday operation of his shop, and how it will affect his financial statement. No matter how you look at that final question, it's a serious one, and a tough one to answer.

As a matter of fact, there is no *single* answer, because CATV systems vary in many ways, and so, of course, do service technicians. To clear the air a bit, however, let's examine some of the most widely encountered questions asked by shop owners who learn that a cable system has been franchised for operation in their area:

1. *I'm a serviceman who also sells television receivers. What can I expect?* This usually depends on what sort of a signal area you're in. In deep fringe areas where there is only a moderate distribution of sets, you will undoubtedly see your set sales rise. This is particularly true if you take advantage of proven merchandising methods and sell your sets convincingly. On the other hand, if CATV service merely supplements existing services, the quality of the picture delivered by the cable will greatly influence whether or not there will be a greater demand for receivers. A cable system with technical faults can be a headache for you as well as for its technical people. A first-class cable-delivered signal will undoubtedly boost sales (particularly of color)—new sets to take advantage of the improved signal, low-priced and used sets for family room or den, and those high-priced color sets for many who have been waiting long



MIRACLE WORKER

in professional TV service shops

PINPOINTS ANY TV TROUBLE FAST! UPS YOUR PROFIT!



FLYING SPOT SCANNER

transmits B&K patterns or your own pictures onto TV screen

It's like having your own TV station! You can inject your own TV signals at any time, at any point—and quickly solve tough dogs, intermittents, any TV trouble, as you watch the generated test pattern on the raster. Checks any and all circuits in any stage throughout the video, audio, r.f., i.f., sync and sweep sections of the TV set. No external scope or waveform interpretation is needed. And if you wish, you can transmit your own slide-pictures.

Makes Color TV Servicing Easy, Too.

Generates white dot, crosshatch and color bar patterns for convergence. Generates crystal-controlled keyed rainbow color display to check color sync circuits, check range of hue control, align color demodulators. Demonstrates correct color values.

Saves time and work for the "pro." Makes servicing easier and faster for the beginner technician.

Most valuable instrument in TV servicing.

Net, \$329.95



*Profit with a B&K Service Shop
See your B&K Distributor
or Write for Catalog AP21-R*

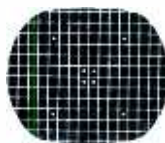
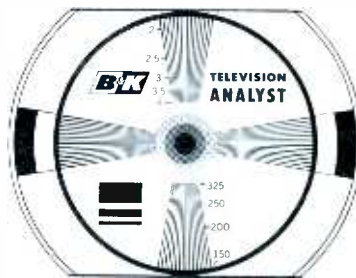
B & K MANUFACTURING CO.
DIVISION OF **DYNASCAN CORPORATION**
1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 123 Grand St., New York 13, U.S.A.



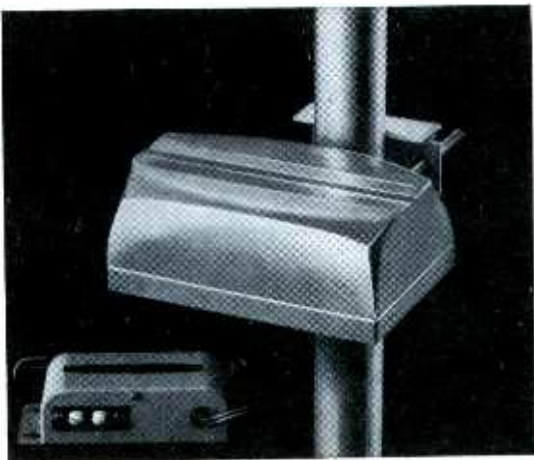
DELUXE B&K

MODEL 1076 B&W and COLOR TELEVISION ANALYST

*with Crystal-Controlled Keyed Rainbow Color Display
and Highly-Stable Horizontal Oscillator Sync*



"Costs a bit more than 1 transistor VHF amplifiers."



"It should—it has two transistors."

"Fine, but is it worth the difference?"

"You bet, when you measure the couple extra dollars against the many hours of superb TV reception you will enjoy."

"Tell me more."

"The new Blonder-Tongue Vamp-2 outperforms all home VHF amplifiers on the market, tube or transistor. Brings in sharp, clear pictures."

"But, what's the real advantage of two transistors?"

"More signal power, lower noise for snow-free reception."

"But, I hear transistor units can overload from strong local TV stations?"

"Not this one, that's where the extra transistor pays off."

"I've got two sets."

"The Vamp-2 delivers strong signals to two sets. It has a built-in splitter. Great for color TV. List \$38.95."

"Supposing I don't want to lay out the few extra dollars for the Vamp-2?"

"Simple solution. The new Blonder-Tongue Vamp-1... the best one-transistor model on the market. Lists at \$25.50."

(This message was paid for out of the gross profits of BLONDER-TONGUE, 9 Alling St., Newark 2, N.J.)



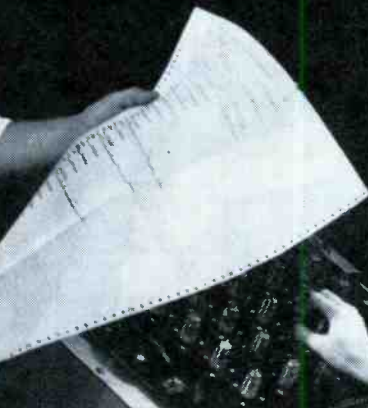
enough.

2. *If those set owners who hook up to the cable have trouble, and it is the fault of the cable system, will they bring me in on a service call I can't very well charge for?* Probably. A lot can be done to keep your temper down, however, and most CATV operators try to educate their customers to recognize where the trouble lies. Most cable technicians are interested in keeping their system operating efficiently. That's what *they* get paid for.

3. *I've heard there are often sync problems when sets are hooked up to the cable. Is that so—and if so, what do I do about it?* Yes, there can easily be sync problems, especially in deep fringe areas. With a very weak signal available at the antenna terminals, the AGC system is, for all practical purposes, out of the circuit—RF and IF sections work wide open. The standard input signal from a cable tapoff is 1000 microvolts, a strength that will (or should) pull the AGC into vigorous action. If the set's AGC system is functioning properly, there will probably be no sync problems. With AGC difficulties, however, you can expect a handful of malfunctions. See articles in these recent issues of PF REPORTER for tips and suggestions on troubleshooting AGC systems: January, March, and September 1964.

4. *What can I do if I find I'm spending too much time on unprofitable calls—calls where there's nothing wrong with the set?* This is a situation that requires a bit of old-fashioned diplomacy. First of all, as mentioned before, keep in mind that the cable folks are usually trying to keep a good signal on their system. Remember, too, that unless the set owner also called the cable office about the trouble, they may not be aware of it. So, call the chief technician and tell him how the situation looks from your standpoint. Unless he is completely unreasonable, you should be able to reach an amicable solution. It never hurts to get to know (on a personal basis) people with whom you must often deal. If you can't get satisfaction from the technical people, see the manager on a businesslike basis. You're both businessmen trying to keep a customer happy. See if you can't do it cooperatively.

Circle 14 on literature card



STAR
SPECIAL TUBE ANALYZING RECORDER



How "Computerized Testing" helps assure the reliability of RCA Receiving Tubes

This engineer is studying final test results of another production run of RCA Receiving Tubes. Nothing surprising here . . . except for one thing: the production run had been completed only hours before!

A few years ago, a thorough quality evaluation of a day's production run of a certain tube type took days, even weeks. But now, at RCA, it's done automatically, with computers, the same day.

Computers in conjunction with the Special Tube Analyzing Recorder (STAR) accumulate and store test data on every receiving tube type we make.

Sample tubes from the production lot are individually analyzed on STAR. As many as 60 tests may be made quickly and automatically on each tube depending on the type. Test

results are recorded simultaneously on a test sheet and on punched cards. The computers compare the results with predetermined standards, make "accept" or "reject" decisions and then add the results to the historical record of the tube type.

Thus, in a mere half-hour of running time each night, a full day's receiving-tube output can be evaluated before it is released for shipment. Equally important, the test data for any day's production of a particular tube type together with the historical record for that tube type are on the desks of the production, qual-

ity-control and design engineers the following morning. With these data, the engineers can evaluate performance, analyze trends and quickly initiate any corrective measures necessary to assure the consistent quality of RCA Receiving Tubes.

"Computerized testing" is one more reason why you can depend on RCA receiving tubes for your TV-Radio-Hi-fi service jobs. RCA receiving tubes are available from your local Authorized RCA Tube Distributor.

**RCA Electronic Components
and Devices, Harrison, N. J.**



The Most Trusted Name in Electronics

it's here! most advanced color TV test instrument ever developed



- OBSOLETES ALL OTHERS
- ELIMINATES ALL GUESSWORK

LECTROTECH V7*

A sensational new color generator with 4 major Lectrotech exclusives . . . plus all of the time-proven standard features . . . in one compact, portable unit. For the first time you can install and service color TV completely, accurately and faster! Here are the facts:

EXCLUSIVE—COLOR VECTORSCOPE—Until now, available only in \$1500 testers designed for broadcast. Accurately measures color demodulation to check R-Y and B-Y plus all 10 color bars for color phase angles and amplitude. A must for total color and those hard to get skin tones.

EXCLUSIVE—SELF-CALIBRATING — Adjust timing circuit without the use of external test equipment. No need to return unit to a factory for adjustment.

EXCLUSIVE—DIAL-A-LINE — Now, you can adjust horizontal line to any width desired from 1 to 4 lines wide.

EXCLUSIVE—SOLID STATE RELIABILITY — Only two tubes are used in combination with fully transistorized diode-rectifier circuit.

PLUS— the V7 produces all Crosshatch, Dots, Vertical only, Horizontal only and Keyed Rainbow Patterns. RF at channels 3, 4 or 5. Video Output (Pos. and Neg. adjustable) for signal injection trouble-shooting. Red-Blue-Green Gun Killer. All transistor and timer circuits are voltage regulated to operate under wide voltage ranges. Lightweight, compact — only 8¼" x 7½" x 12½". Net..... **189.50**



V6 Complete color bar generator with all the features of the Lectrotech V7 except the Vectorscope. Only **99.50**

See your distributor or write for details before you buy any color generator.



LECTROTECH, INC.

1737 Devon Ave. • Chicago, Ill. 60626 • Area 312 465-2622

Circle 16 on literature card

5. On multichannel systems, how much of a problem is adjacent-channel interference? Once again, that depends in large part on the system and in the condition of the set. Some systems, because of inadequate engineering preparation or faults that have worked in later, do cause interference between closely spaced channels. Understandably, too, a receiver that has been used for receiving only widely separated channels may tune sloppily and allow interference. In the first situation (but first make sure that the system is causing the trouble), get out that diplomat's hat, and see your friendly chief technician. In the second case, tell the customer what the problem is and sell him a complete and accurate realignment. See articles in the following issues of PF REPORTER for helpful tips and techniques: September 1962, February and March 1963, and March and July 1964.

6. Since the signal level on the cables themselves are high, can the system radiate and interfere with sets not connected to the cable? Anytime you deal with RF at the higher frequencies you may have radiation problems. The FCC sets maximum allowable radiation limits, and these are generally sufficient to avoid a problem, if adhered to. The tapoff units and drop cables (to the individual houses) are generally the greatest offenders where excessive RF leakage exists, and since channel translating (changing the frequency of an incoming signal to another channel for cable use) can cause interference to block off-the-air signals in sets not connected to the cable, you'll undoubtedly be called in sooner or later to explain why Gunsmoke's Doc has Dr. Kildare's nurses in his Dodge City offices. Once again, the answer is cooperation. If that doesn't work, you can always get a field-strength meter, map the interference pattern, and call the FCC.

7. What about tube replacement? I hear that the strong signal fed to a customer's set lets a lot of marginal tubes go unnoticed. Well, that may be true, but there is still some question as to what the overall effect on tube replacement will be. At first it was thought by many servicemen in areas now served by CATV systems (and by local distributors, too)

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



Now your Sylvania Distributor can put you in The Yellow Pages

The Yellow Pages are the first place people look when they want to buy. Studies show that 90% of all telephone subscribers consult their Yellow Pages when they want to find a local source for products and services. It's a fact: your potential customers let their fingers do the walking when a TV set needs professional servicing.

Here's a special program that means more customers and extra profits for you. Our ads appear in your local Yellow Pages, directing customers to you. Your Sylvania distributor can show you how your own listing may be part of the Sylvania ad.

The new Sylvania Trade Mark Heading will be seen—it's big, attractive, and descriptive. It tells

customers that you sell the dependable line of radio and TV tubes, including famous SILVER SCREEN 85® and *color bright* 85® picture tubes.

Your Sylvania distributor has full particulars on how you can share in this program designed especially for you. Check with him today.

Electronic Tube Div., Sylvania Electronic Components Group.

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

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

Circle 17 on literature card

February, 1965/PF REPORTER 47

SERVICE MASTER... EVERY TOOL YOU NEED 99% OF THE TIME



complete 23-piece kit for radio, TV,
and electronic service calls

2 HANDLES:

shockproof plastic.
Regular 4" length
... 2" Stubby. Inter-
changeable. Patented
spring holds snap-in
tools firmly in place.



9 NUTDRIVERS:

High Nickel chrome
finish, $\frac{3}{16}$ " to $\frac{1}{2}$ "



3 STUBBY NUTDRIVERS:

$\frac{1}{4}$ ", $\frac{3}{16}$ ", $\frac{3}{8}$ "



EXTENSION BLADE:

Adds 7". Fits
both handles.



3 SCREWDRIVERS:

Two slotted...
 $\frac{3}{16}$ ", $\frac{3}{32}$ "
#1 Phillips



2 REAMERS:

$\frac{1}{8}$ - $\frac{3}{8}$ ", $\frac{1}{4}$ - $\frac{1}{2}$ "



ADJUSTABLE WRENCH:

6" thin pattern,
1" opening



LONG NOSE PLIER:

"Cushion Grip",
2 $\frac{1}{4}$ " nose

DIAGONAL PLIER:

"Cushion Grip"
hand-honed
cutting edges

ROLL UP KIT:

Durable, plastic-
coated canvas.
Compact, easy-
to-carry.

Ask your distributor to show you kit 99 SM



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

Circle 18 on literature card

48 PF REPORTER/February, 1965

that tube sales were down because of the reason you mention—and they probably are, a bit. There's no question that sales *are* down, but sales are down all over the country, even in areas not served by CATV systems! Manufacturers generally attribute the fact to increased material reliability and tubes with longer lives. Improved circuit design in newer sets also puts less strain on many previously marginal tubes. So, in answer to your question, the strong CATV signal may allow a few front-end and IF tubes to get by; but, go after the rest as you should, and you'll probably not notice the difference. Picture tubes? No reason why sales shouldn't continue exactly as without CATV.

8. Well, I'm sure going to notice a loss in antenna, tower, and accessory item business. You sure are, and that is an inescapable fact. But selling and installing antennas is only one part of service-selling. Any good businessman must recognize the fact that, in the business world, practically nothing remains constant. Customer demands change as often as women's styles, and often for no more reason. The operator of any successful service shop knows that the way to meet competition is to try his best to get out in front; so, if you're in any area in which there will soon be a CATV system, act first—before it arrives. Determine what percentage of your antenna and tower business you *might* lose, then lay plans to develop an additional service (hi-fi and stereo, perhaps, or CB, or ham gear, or test equipment) to make up the difference. Who knows? You may not see all your antenna business evaporate, anyhow. How about FM antennas, CB antennas and towers, business-radio installations, etc?

Certainly, the answers presented here touch on only a few of the many questions that arise daily in areas where CATV cables are being strung. There is no doubt, however, that cable systems are here to stay. That they will grow and flourish in almost all geographical areas is an inescapable fact of life. If you see CATV in your future, you may now have a slightly clearer view of what to expect. But, don't forget that the greatest ally a small businessman can find is that sometimes elusive thing called ingenuity. ▲



INJECTORALL

THE NEEDLE DOES THE JOB!



TUNER CLEANER AND LUBRICANT with... INJECTOR NEEDLE

The leak-proof
steel Injectorall
Needle lubricates
where you need it
... you can reach
hard-to-get at
Wafers without
pulling Tuners
apart, or even
removing Chassis.

The BEST CLEANER
on the market today!

INJECTORALL CO.
Great Neck, N.Y. 11024

Circle 19 on literature card



WORLD'S FINEST 5-CORE SOLDER

ERSIN MULTICORE

NEW EASY DISPENSER PAK ONLY 50¢

BUY IT AT RADIO-TV PARTS STORES
MULTICORE SALES CORP. PORT WASHINGTON, N.Y.

Circle 20 on literature card

INTRODUCING **Jerrold COLORAXIAL™ Program** **COAX IS A MUST FOR COLOR TV**



← **THIS**
NOT
THIS →



Commercial installations have proved that coaxial download is *essential* for predictable, consistently good color TV pictures. Coax loss doesn't increase in wet weather, while twinlead loss goes up as much as six times. Coaxial cable can be run anyplace, even next to metal, without mismatch. Coax doesn't deteriorate with age. It won't pick up ignition noises or other interferences. In a word, for satisfactory color reception, even in "ideal" reception areas, your customers need coax.

And now, new Jerrold COLORAXIAL antennas

and kits give you a perfect home-installation package for every color-reception need. With COLORAXIAL, you can offer the whole system, from coaxial antenna to indoor matching transformer, or adapt an existing 300-ohm antenna for coax operation. Listed below are all the COLORAXIAL components packaged individually and in kits, for easy, low-cost conversion. Ask your Jerrold distributor for COLORAXIAL brochure, or write *Jerrold Electronics, Distributor Sales Division, Philadelphia, Pa. 19132.*

CAX-16 • COLORAXIAL COLORGUARD

COLORAXIAL Antenna for metropolitan and suburban reception areas. Prematched to 75-ohm coaxial cable; complete with fitting. No outdoor matching transformer required—only an indoor Model T378. List \$11.95

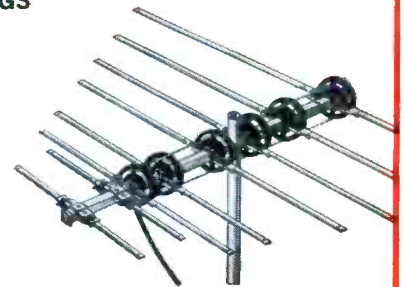
K-CAX-16 • COLORAXIAL Antenna Kit. Everything you need for complete installation—a CAX-16 Antenna, antenna tri-mount with 5-ft mast, 50 feet of coax cable with fittings, and T378 indoor matching transformer. List \$29.95



COLORAXIAL PARALOGS

PAX-40 • COLORAXIAL Antenna for difficult suburban areas. Prematched to 75-ohm coaxial cable; complete with fitting. No outdoor matching transformer required—only an indoor Model T378 needed. List \$22.95

PAX-60 • COLORAXIAL Antenna for suburban to semi-fringe areas. Prematched to 75-ohm coaxial cable; complete with fitting. No outdoor matching transformer required—only an indoor Model T378 needed. List \$32.95



CAT-2 • COLORAXIAL MATCHING TRANSFORMER KIT

One TO-374A mast-mounting matching transformer for any 300-ohm antenna, and one T378 set-mounting matching transformer, complete with bracket and mounting strap. List \$8.20

COLORAXIAL matching transformers are also available individually: TO-374A, list \$4.95; T378, list \$3.25



COLORAXIAL CABLE

CAB-50 • 50 feet of sweep-tested RG-59/U 75-ohm coaxial cable complete with F-59A fittings attached, plus weatherboot. List \$9.50

CAB-75 • 75 feet of sweep-tested RG-59/U 75-ohm coaxial cable complete with F-59A fittings attached, plus weatherboot. List \$11.50



**JERROLD
 ELECTRONICS**

A subsidiary of The Jerrold Corporation

Filter Buzz

A most puzzling type of buzz originates in equipment having multi-section filters in which cathode and B+ filters are contained in the same electrolytic unit. The defect is AC leakage from one filter section to another. The only sure way the trouble can be detected is through scope tracing, for the hum or buzz caused by this condition appears with a distinctive trace that is easy to remember.

A typical example of such a cir-

cuit is presented in Fig. 1. The filter section C1C can have AC leakage to either section C1A or C1B. The positive-going ripple peak feeds the output-tube cathode, is inverted and amplified in the tube, and becomes negative at the plate. The dip seen on the plate-supply ripple waveform in Fig. 2A is the result of mixing the positive cycle of ripple with this simultaneous negative excursion from the tube. Fig. 2B shows the pulse developed

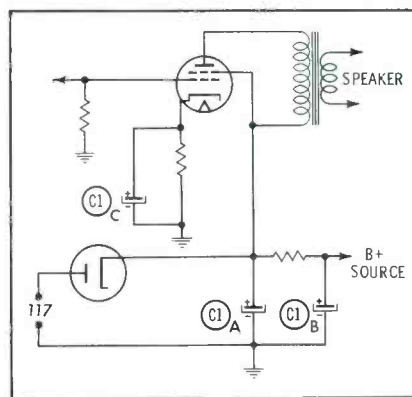
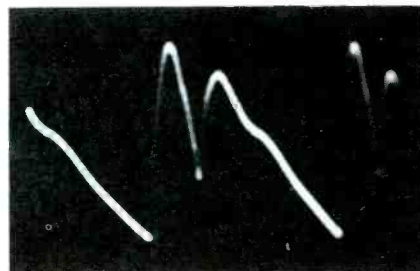


Fig. 1. Many audio output tubes have electrolytic bypass in cathode circuit.

at the cathode filter C1C. Fig. 2A reveals severe intersection leakage, while Fig. 2C shows a milder amount. The hum or buzz from the speaker may be almost equal in either case, due to the harsh shaping of the waveform.

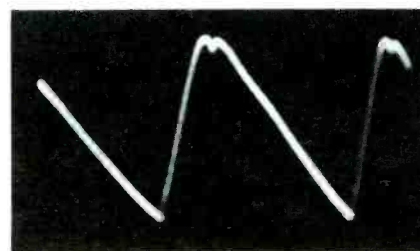
The waveforms shown in Fig. 2 are found in equipment using B+ derived from a half-wave rectifier, and the waveforms have a 60-cps frequency. When it arises in full-wave rectifier systems, the traces look identical but are at a 120-cps frequency. This particular type of trouble can be encountered in virtually every kind of electronic equipment that receives power from AC lines. ▲



(A) Plate—severe



(B) Cathode—severe



(C) Plate—mild

Fig. 2. Different degrees of leakage.



- Tests TV and Radio Tubes —both old and new
- Tests all Novars
- Tests Nuvistors, 10-pin Tubes, and 12-pin Compactrons
- Tests Voltage Regulators, Thyratrons, Auto Radio Hybrid Tubes, European Hi-Fi Tubes, and Many Industrial Types

B&K PROFESSIONAL QUALITY AT LOW COST

**Model 600 Compact Portable Dyna-Quik
Makes Tube Testing Quick, Accurate, Profitable!**

It's amazing how quickly you can accurately check out tubes on every call—sell more replacements, and make more money—with this up-to-date, low-cost professional quality tube tester.

Checks for all shorts, grid emission, leakage, and gas. *Checks* each section of multi-section tubes separately. *Checks* tube capability under simulated load conditions. Rejects bad tubes, not good tubes. Quickly reveals tube condition, saves customers, stops call backs, increases servicing profit.

Exclusive adjustable grid emission test. Sensitivity to over 100 megohms. Phosphor-bronze socket contacts. Complete tube listing in handy reference index. Handsome, sturdy leatherette-covered carry-case. Size 8½" x 11" x 4½". Net, \$74.95



QUICK, DIRECT, ERROR-FREE READINGS WITHOUT MULTIPLYING

Model 375
VTVM
Net, \$89.95



Model 360
V O Matic
Net, \$59.95

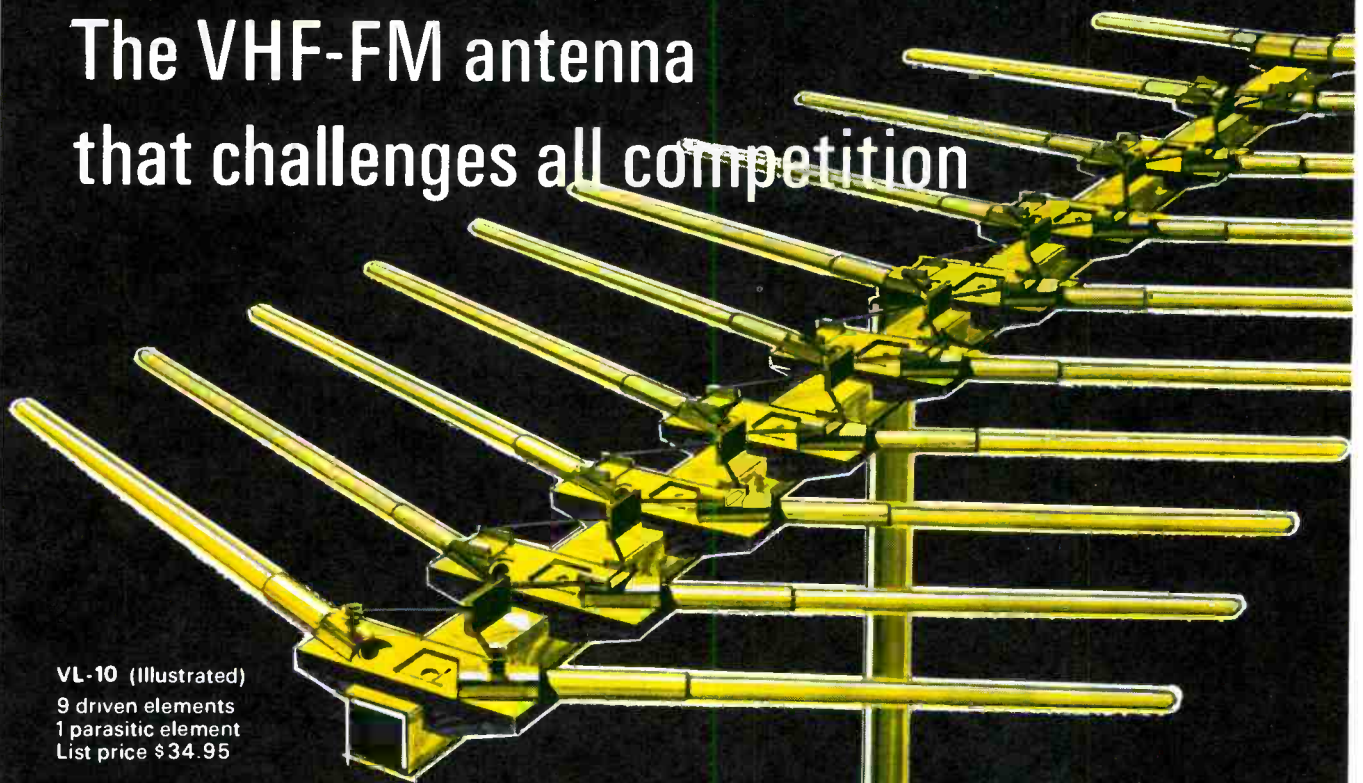
See Your B&K Distributor or Write for Catalog AP21-R



B & K MANUFACTURING CO.
Division of DYNASCAN CORPORATION
1801 W. BELLE PLAINE • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

Circle 21 on literature card

The VHF-FM antenna that challenges all competition



VL-10 (Illustrated)
9 driven elements
1 parasitic element
List price \$34.95

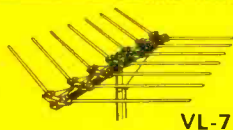
NEW **FINCO**[®] *Swept Element* "COLOR-VE-LOG" VHF-FM ANTENNA

Finco's Color Ve-Log challenges all competition on color or black and white reception and stands behind this challenge with a "Guarantee of Supremacy". The swept element design assures the finest in brilliant color and sharply defined black and white television reception – as well as superb FM monaural and stereo quality. FINCO precision-engineered features make these advanced-design antennas indispensable to good home sight-and-sound systems. And, of course, they carry the famous unconditional guarantee from the leading manufacturer in the field – FINCO. Promote the Color Ve-Log Antennas with pride, sell them with confidence, and profit handsomely.

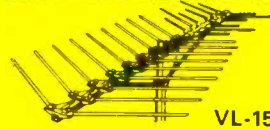
Featuring Finco's Exclusive Gold Corodizing



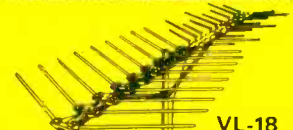
VL-5
5 element VHF-FM
5 driven elements
List price \$16.95



VL-7
7 element VHF-FM
7 driven elements
List price \$23.95



VL-15
15 element VHF-FM
9 driven elements
6 parasitic elements
List price \$46.95



VL-18
18 element VHF-FM
9 driven elements
9 parasitic elements
List price \$54.50

The FINNEY Company • 34 W. Interstate Street • Bedford, Ohio

Write for color brochure #20-307, Dept. 310

Circle 22 on literature card

**a new money-making,
traffic-building tube tester**

for you or your customer!



**THE ALL NEW SENCORE TC131
SEMI-AUTOMATIC TUBE CHECKER**

After thousands of requests here is the "counter/bench" version of the famous Sencore Mighty Mite Tester; designed for the ultimate in tube checking thoroughness and operational simplicity! Designed for two-way use — as a professional shop tester and customer self-service unit. Tests over 2500 tubes — including Nuvistors, Compactrons, 10-pins, Novars, Magnovals and foreign tubes with a big 6-inch meter for easy reading. Semi-automatic; simply turn function control to any test and watch lighted arrow on meter automatically stop on right scale. User can't go wrong — no guess work — everything is read right on the meter (no tricky neon lights to misread); only 3 set-up controls. Easy to read, speed-indexed set-up cards make every test fast and sure. Like the famous Mighty Mite, the TC131 uses 100-megohm grid leakage sensitivity to spot those "tricky" tubes other testers miss; tests inter-element shorts and makes cathode emission tests under full operating levels. A real profit maker as a counter checker or self service tube seller in your shop . . . and it's only

\$129⁹⁵

See your distributor about the big TC131 trade-in deal.

professional quality — that's the difference!

SENCORE

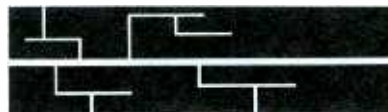
426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

Circle 23 on literature card



QUICKER SERVICING
by Robert Glover

VOLTAGE DIVISION



and how it works

Articles about simple resistive voltage dividers generally remind the service technician of his knowledge of basic theory. In this article, we hope to cover the operation of resistive voltage dividers with an eye to understanding ways in which voltage division is accomplished sometimes without resistors. We should be able to help you recognize several apparently complicated circuits for what they really are—simple voltage dividers.

Simple Resistive Dividers

Voltage dividers that use resistors must have at least two; it is the voltage dropped by or developed across each resistor that is thus divided. The voltage being divided by resistors can be either AC or DC. Let's assume the voltage we're considering is DC.

It would be very nice if a circuit always appeared on the schematic in its most recognizable form. However, if it did, there would be no need to learn to pick out the little rascal when it's in disguise. For example, in Fig. 1, we see three forms of the same resistive circuit. The one easiest to recognize is, of course, Fig. 1A. The various configurations of this divider do not alter its primary function. The same 250-volt potential—applied between points A and C—is felt across both R1 and R2, in all three versions.

As you may remember from Kirchoff's law, the sum of the voltage drops across each resistor in a series resistive circuit is equal to the total applied voltage. The 250 volts we have chosen as the applied potential must be divided between R1 and R2, or else Professor Kirchoff

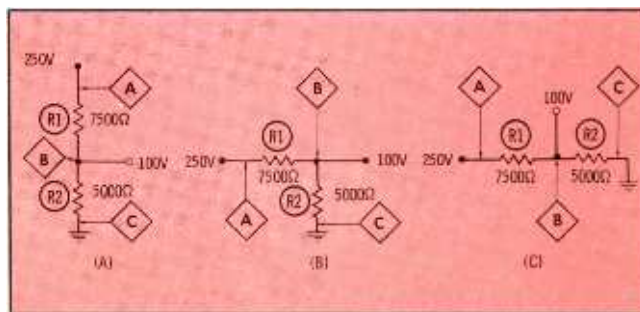


Fig. 1. Simple voltage dividers look alike, drawn differently.

hoff has been kidding us for quite a few years. We assure you—he hasn't.

Since we've taken the liberty of applying 250 volts across the two resistors, we might as well stipulate what voltage will appear at point B, also. This will be 100 volts, measured between points B and C. Notice, if you will, that the 100 volts appears between B and C in any of these three circuit arrangements.

So far, we have two resistors, with 250 volts applied across both, and a 100-volt tap between them. So what? Don't panic; an explanation is on the way—the resistors have been given values. You'll notice that R1 is 7500 ohms and R2 is 5000 ohms. Kirchhoff has served his purpose for now, so enter Dr. Frederick Ohm and his law. Ohm's law can be one of our best helps in the troubleshooting department. In fact, we can apply this law to almost any troubleshooting problem—if we know how. Our ultimate goal is to learn how, so . . . back to our voltage divider.

Ohm's law is stated as: E (applied voltage) equals I (current) times R (a resistance). This equation may be stated in different ways to find any one of the unknown factors. We're certain you recall that, in a series resistive circuit, current is the same through every one of the resistances (another of Kirchhoff's conclusions). Well now, that does make our voltage divider seem more understandable doesn't it? We don't have to assume a current value now—we can calculate it. Let's apply Dr. Ohm's law, changing it around to make I the unknown quantity. We thus find (by dividing 12,500 ohms into our 250 volts) that the total current flowing in the circuit is .020 amp, or 20 ma.

Now, can you say how much current flows through R1? How much through R2? Right! According to Kirchhoff, the same as the total—20 ma. Is it possible to prove that the voltage between points B and C actually is 100 volts? You bet your boots it is! Just multiply the current through R2 by the resistance value. The current—.020 amp—multiplied by the resistance—5000 ohms—equals, of course, 100 volts.

We can approach this in a different way and arrive at the answer to other unknown quantities. As an example, let's suppose we didn't know the current flow in the circuit, nor the value of R2. Remember that the sum of the voltage drops in a series resistive circuit is equal to the total applied voltage? If so, the difference between 250 volts and 100 volts is 150 volts. Since 150 volts is the drop across R1, all we have to do to find the current flowing through R1 is divide 150 volts by 7500 ohms. Figure it out. If your answer is 20 ma, you're right. Okay, we still don't know the value of R2; but we do know that 20 ma is the current through the series resistors, and we do know what Kirchhoff said about current in series resistors. Therefore, here's what we now know about R2: The voltage drop across it is 100 volts, and 20 ma of current is flowing through it. Calling Dr. Ohm! By dividing 100 volts by 20 ma, we derive an answer of 5000 ohms. There it is—the value of R2!

Complex Dividers

There you have it—the simple resistive voltage divider. Uh-oh, did I say *the* simple resistive divider? Any divider is simple if you understand it. For an example, take a look at Fig. 2. Looks harder, doesn't it? Is not

at last...
instant color patterns
at your finger tips...
zero warm-up time



THE ALL NEW SENCORE CG135 DELUXE TRANSISTORIZED COLOR GENERATOR

The big push is on in Color TV. Equip yourself now with the new, solid state Sencore CG135 and cash in on the zooming volume of new service business as Color-TV booms! Instant, service-ready RCA standard color bars, cross-hatch, white dots and individual vertical and horizontal bars enable you to set up or trouble-shoot more Color TV sets per day; earn top money in this fast growing service field. It's an analyzer too: Color gun interruptors, unmodulated video for chroma circuit trouble isolation and unmodulated sync pulses to keep Zenith receivers in sync for this test, make color trouble shooting a snap. Sturdy all-steel construction for rugged, heavy duty in the field or shop. Another Best Buy in profit-building service instruments from Sencore at

\$149⁹⁵

COMPARE THESE FEATURES: SEE WHY THE CG135 IS IN A CLASS BY ITSELF

- Solid state construction employs high priced GE "Unijunctions" to develop six "jump out proof counters" that guarantee stable patterns at all times with no warm-up
- Standard RCA licensed patterns as shown on schematics throughout the industry
- Handy universal color gun interruptors on front panel
- Lead piercing clips insure non-obsolence
- CRT adaptors optional
- Crystal-Controlled 4.5mc Sound Carrier Analyzing Signal to insure correct setting of fine tuning control
- RF output on Channel 4 adjustable to Channel 3 or 5 from front of generator when Channel 4 is being used
- No batteries to run down; uses 115 V AC
- Less than one foot square, weighs only 8 lbs.

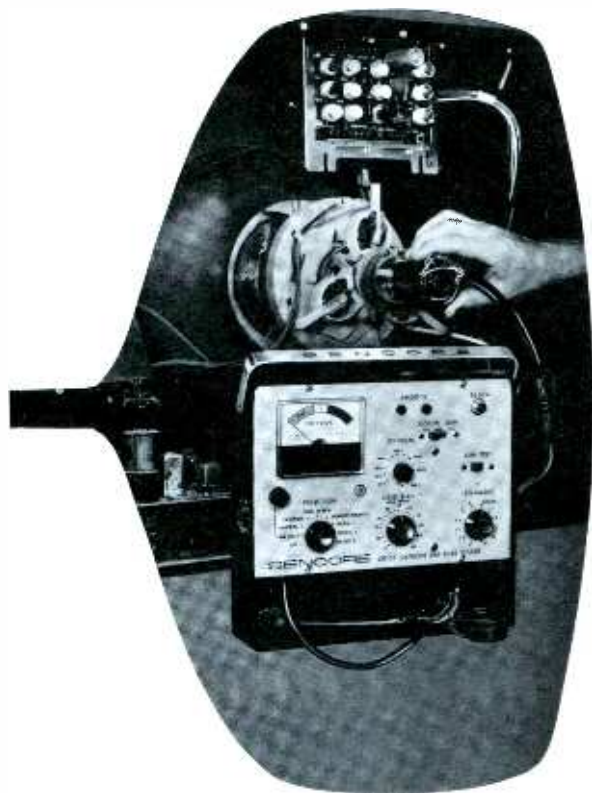
professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

Circle 24 on literature card

top money maker in
the service business



NEW IMPROVED SENCORE CR133 CRT CHECKER & REJUVENATOR

The new, improved CR133 CRT Checker is designed to test all present picture tubes—and it's ready for future tubes too! Two plug-in replaceable cables contain all sockets required. The compact, 10 lb., CR133 checks CRT emission, inter-element shorts, control grid cut-off capabilities, gas and expected life. Checks all tubes: conventional B&W, new low drive B&W, round color tubes and new rectangular color picture tubes. Exclusive variable G2 Volts from 25 to 325 Volts insures non-obsolence when testing newly announced "semi-low" G2 CRT tubes. New Line Voltage Adjustment insures the most accurate tests possible. Uses well-filtered DC for all checks to avoid tube damage and reading errors. Color guns are individually tested as recommended by manufacturers. Exclusive automatically controlled rejuvenator applies rejuvenation (ACR) voltage as required by individual tube condition; precisely timed to prevent over-rejuvenation or tube damage. The ACR feature is most useful for color tube current equalization to insure proper tracking. Hand-wired and steel-encased for protection of meter and panel in truck or shop, the new improved CR133 is only . . .

\$89⁹⁵

The famous CR128 CRT Checker and Rejuvenator is similar to above, but with a three position G2 slide switch and without Line Voltage Adjustment at \$69.95

professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

Circle 25 on literature card

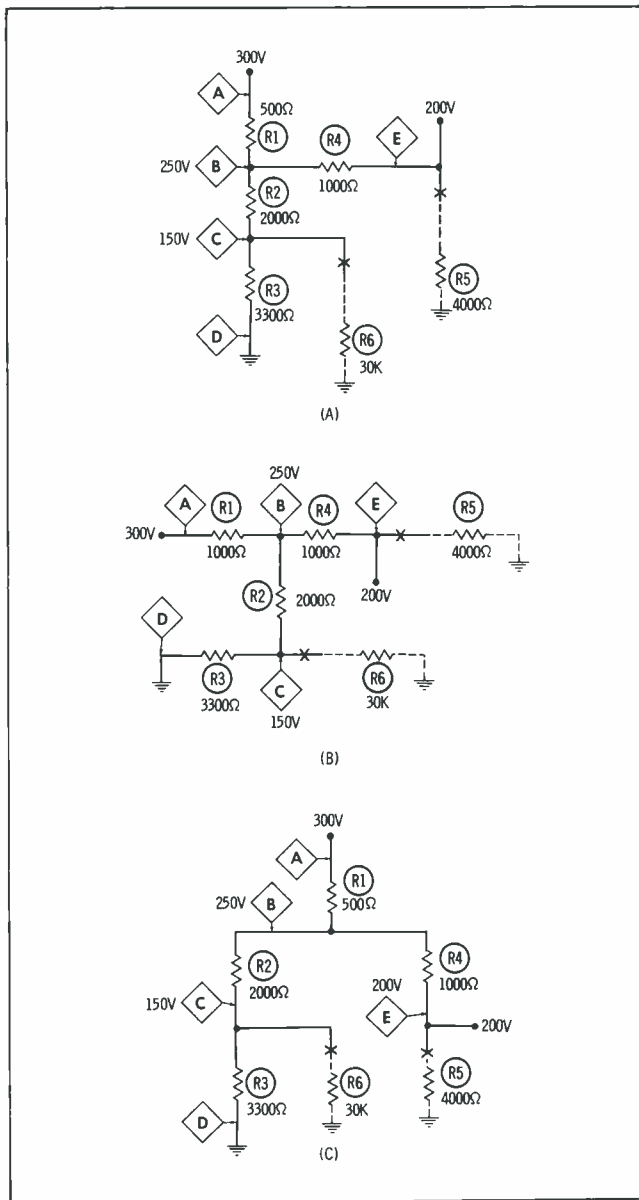


Fig. 2. More complicated voltage dividers can be laid out in different ways on schematics, but they are really simple.

so (Old Chinese proverb.) What say we tackle this one? Let's pretend it's a power-supply divider and that 300 volts is dropped across (or applied to) series resistors R1, R2, and R3. From the power supply, we expect this circuit to draw 100 ma of current. This simply means that, using Ohm's law, we find the actual circuit resistance from point A to point D is 3000 ohms. This is fine information, but we're talking about voltage dividers. Right?

Let's take a look at the full picture presented by Fig. 2. What is the purpose of R5 and R6? These are "phantom resistances." (We've met Professor Kirchhoff, Dr. Ohm, and now—*The Phantom Resistance!*) Phantom resistance is a term applied to the circuit loads (tubes, resistances, etc) that are supplied from any branch of a power-supply voltage divider. In making computations using Ohm's law for troubleshooting, the phantom resistance must be taken into account if an accurate analysis is to be made. Remember—the resistances in dotted lines in Fig. 2 are not actual resistors, but only values of the loads present across the 200-volt and 150-volt supply points (E and C).

We've drawn this divider in various ways just as we did the one in Fig. 1. In Fig. 2C, we have drawn it in the way that is probably easiest to understand. Here you can see what we actually have is a pair of series and parallel resistive legs. Note that the voltage at point B is 250 volts. R1 has dropped 50 volts, leaving 250 of the original 300 volts developed across the two legs of a parallel circuit—R2-R3-R6 and R4-R5. We can think of this voltage as applied to both legs.

What do we know of parallel resistive circuits? Well, we know from Kirchhoff that current is divided between two legs of a parallel circuit in inverse proportion to the resistance in each leg. Basically, this means the higher the resistance, the lower the current through that leg. When the resistances in both legs of a parallel circuit are equal, current flow in each is also equal. There's a formula that says: To find the total resistance of a parallel circuit containing two legs or branches (such as we're talking about in Fig. 2) multiply their resistances and then divide that answer by their sum. In Fig. 2C, then, we will consider the parallel circuit formed by R3 and R6 as one resistance with a combined value: 3300 ohms times 30K (9.9 megs), divided by the sum of 3300 ohms and 30K (33.3K), for a net of approximately 3000 ohms.

As we mentioned before, 50 volts (300 - 250) is dropped across 500-ohm resistor R1. The total current flow is thus proven to be 100 ma. It's easy from here to figure the current value that is flowing in the right leg. Subtract the 200-volt indication at point E from the 250 volts at point B. This gives the voltage drop across R4, from which we can compute the current through R4 to be 50 ma. As the current is the same through all resistances in a series circuit, we know 50 ma also flows through R5. What does this tell us? That our phantom resistance R5 (the load) draws half the total current supplied from the main feeder at point B. As we'll soon see, it could also suggest that, if the phantom resistance drops in value due to some trouble (short), R4 might overheat and burn out or change value.

We now can stand on our "right" leg, but how about the left? It does appear a bit more complicated. In truth, however, it isn't, for we've already shown how to combine R3-R6 into effectively one resistance. Old Professor Kirchhoff stated (in one way or another) that the sum of currents through resistances in parallel is derived by adding the currents in each branch. We already know the sum, for it's flowing through R1. The difference between this total current (100 ma) and that in the right leg (50 ma) is what's left to go down the left leg—by coincidence in this case, also 50 ma.

In order to cover this divider completely, we'll go on to describe the last bit of resistive parallelism in it. We'll calculate currents in the two "sub-legs" we previously combined—R3 and R6. (We think that this is a most interesting part and you may, too.)

The 250 volts at point B applies to both legs, and current of 50 ma is flowing through R2. Figuring the voltage drop of 100 volts across R2 leaves 150 volts applied to R3 and R6. Here, however, we have a split in current at point C that just can't be equal, because bleeder resistor R3 and phantom resistance R6 aren't of equal value. Feast your eyes on those resistor values. We can figure current in them either of two ways. Let's

**just in time for the
fm and uhf boom!
an all transistorized
field strength meter.**



THE ALL NEW SENCORE FS134 FIELD STRENGTH METER

Once again, you can turn to the roof tops for a fast dollar in antenna installations. But this time, you can do it the easy way. No more running up and down ladders, locating cumbersome AC extension cords, lugging heavy tube operated field strength meters on the roof, or worse yet, getting the shock of your life from the AC line as you hold onto a soil pipe. Here is a new portable field strength meter to fill your every need in VHF, UHF or FM antenna installations. Many customers want all antennas on one mast thus creating interaction. Here is where the FS134 goes to work. You can optimize antenna location and orientation in seconds. Just connect the antenna, tune in the station and adjust. Self-contained speaker blasts forth the sound from the TV or FM station to insure that you have the exact signal that you are looking for. The FS134 is so light weight (only 9 lbs.) that you can take it with you up the chimney if necessary. Get rid of the assistant at the other end of the transmission line and the needless "yelling" back and forth. Get the FS134 today . . .

\$199⁵⁰
only

COMPARE TO ANY OTHER FIELD STRENGTH METER AT TWICE THE MONEY

- Sensitivity . . . 5 microvolts on VHF and FM, 15 microvolts on UHF
- Input impedance . . . 300 ohms or 75 ohms with plug-in transformer
- 500 KC band width
- Powered by easy to get "C" cells
- 4 inch meter with 2 percent accuracy calibrated in DB and microvolts.

professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

Circle 26 on literature card

February, 1965/PF REPORTER 55

add an fm-stereo service center
with this one new
sencore unit!



THE SENCORE MX129 FM STEREO MULTIPLEX GENERATOR & ANALYZER

FM-Stereo growth continues to mount and is fast becoming as big a field as Color TV. This means more FM-Stereo service business for you, now and in the future. Is your shop equipped? It can be — completely and economically — with the MX129, the FM-Stereo "Service Center in a Case." The instantly stable, 19-Transistor, crystal controlled MX129 is the most versatile, most portable (only 7½ pounds), most trouble free and efficient multiplex unit on the market — just like having your own FM-Stereo transmitter on your bench or in your truck. Powered by 115 volts AC, it produces all signals for trouble shooting and aligning the stereo section of the FM receiver . . . can be used to demonstrate stereo FM when no programs are being broadcast. Self-contained meter, calibrated in peak to peak volts and DB, is used to accurately set all MX129 controls and as an external meter to measure channel separator at the FM-Stereo speakers. **NO OTHER EQUIPMENT IS REQUIRED.** **\$169⁵⁰** only

SIGNALS AVAILABLE FOR ALIGNMENT, TROUBLE SHOOTING AND ANALYZING:

- FM-RF carrier with composite multiplex audio signal with 38kc suppressed carrier, 19kc pilot and 67kc SCS signals
- Multiplex signal formed by 60 or 1000 cycle internal tones or any external signal
- Full control over left and right channel amplitude (modulation)
- External 67kc SCA signal available for trap adjustment
- Composite signals available for signal injection FM detector

professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

Circle 27 on literature card

examine both. As in the two main legs, we can subtract the current in one leg from the total to learn what is flowing in the other branch, but how do we get the first? We've got to know the applied voltage and the resistance values, or we can use the current flow through both legs and the ratio of resistances.

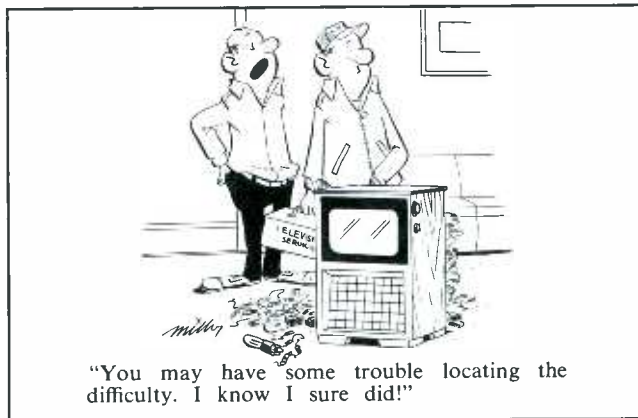
For a practice run, let's assume we don't even know the total current flow, but only that 150 volts is applied. Picking R6 we divide 30K into 150 volts. The answer is 5 ma of current through R6. If we knew the total current flow in R3 and R6, the value of the current flowing through R3 could be determined by subtracting current in R6 from the total. For our practice, we don't, so we have to divide 3300 ohms into 150 volts, for an answer of approximately 45 ma—close enough for practical purposes. Thus, R3 draws 45 ma, while our phantom resistance (actually the load circuits) is drawing only 5 ma of the total coming through resistor R2.

That's a power-supply type of voltage divider we've looked at—one that supplies these voltages: 300, 200, and 150. If this were used in a piece of electronic equipment, other voltage divider networks might (and probably would) be used to drop a few other volts here and there as needed. Some might not draw enough current to consider at all, while others could be very important to the choice of accompanying components. For example . . . take the case of wattage. Lend an ear (an eye, actually) and we'll explore the watts aspect of resistive dividers.

What's Watt With Power

When we speak of power being used, we call it dissipation. Power dissipation is measured in . . . guess watt? Right you are! A *watt* is defined as a unit of electric power required to do one joule of work in one second. It is also: The power expended when one amp of current flows through one ohm of resistance, and this is the part that concerns us. "Joules" will therefore be dropped in favor of the second definition, which is expressed in three formulas: P (in watts) equals E (in volts) times I (in amps); P (in watts) equals I (in amps) squared and then multiplied by R (in ohms); and, P (in watts) equals E (in volts) squared and then divided by R (in ohms). Voltage divider resistors for power supplies are generally rated for power dissipation.

Heat is generated whenever current flows through a resistor. The heat is radiated into the air surrounding the resistor, and is thus dissipated. If more heat is gen-



erated in a resistor than it is designed to dissipate, the resistor becomes very hot. You can see from the $P = I^2R$ relationship that too much current could easily over-heat a resistor.

Thus, if a circuit being supplied voltage from a divider network were to develop a short, the load (phantom) resistance would drop to near zero and current would shoot up to a high value. The divider resistor through which the circuit is being supplied would become very, very hot and dissipate its little ol' self right into oblivion. A burning resistor thus points out the importance of selecting resistors for a voltage divider in accordance with power requirements.

In normal divider service, a certain amount of current flows through a resistor at all times. This generates some heat; but, if the resistor is selected properly, the normal heat will be hardly noticeable even if you touch the resistor body directly. To maintain this desirable low temperature, a "safety margin" must also be allowed.

Let's figure the power rating for R1 in Fig. 2. The actual voltage across this resistor is 50, and its resistance is 500 ohms. Using our number-three formula for power, we divide 2500 volts (50 volts squared) by 500 ohms. This gives us an answer of 5 watts. What do you think would happen if we put a 5-watt resistor in the circuit? It would feel warm during normal operation. And if a short occurred? That's right; before the fuse could blow, R1 would very probably be a cinder. To allow for the extra margin of safety, and to keep the unit normally cool, R1 should be at least a 7.5-watt resistor. An engineer usually designs at least a 50% safety margin into his creations; however, someone who repairs this equipment may not be quite so discreet. If you, as the service technician, find a burned-out resistor, check the schematic or calculate the power rating required for a margin of safety in the replacement.

Conclusion

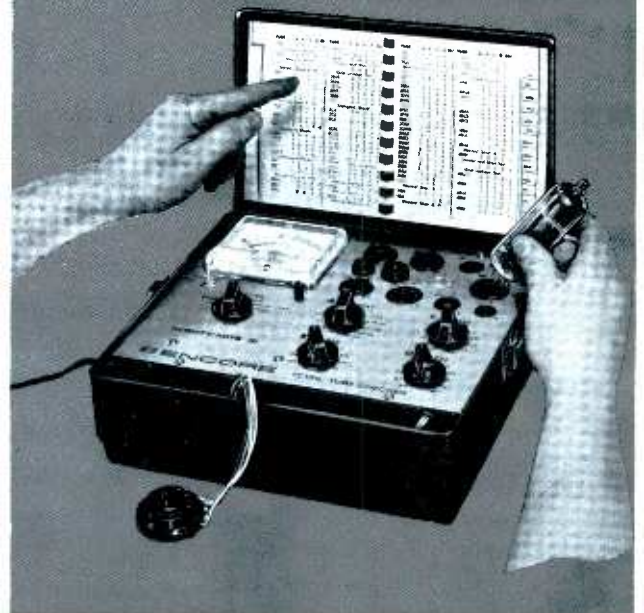
Certainly, after traveling through the voltage divider as we have, we must draw a conclusion. As you must realize, there are many different ways to draw conclusions (just as there are ways to draw voltage dividers), but we prefer to draw the most simple one. So, we will.

The ability of a service technician to recognize a complex (or seemingly so) arrangement of resistors on a schematic as a voltage divider, which he now understands, can be quite an asset toward deciding what the circuit should be doing. What, then, is our basic conclusion? It is: An understanding of the action of resistive dividers, plus an ability to know one when you see it, will enable you quickly to evaluate whether strange meter readings you find are abnormal for the circuit or are caused by a malfunction in another circuit.

Practice. Go over schematics and try to pick out as many applications of voltage dividers as you can. Draw them in simple form and compare them with the way they appear on the schematic. Do this until they stand out as you look at a schematic and you'll have quite an edge on the type of guy who just changes components until he replaces the right one. ▲

america's most popular tube tester

... because it
finds the
"tough dogs"
others miss!



THE NEW SENCORE TC130 MIGHTY MITE III TUBE TESTER

New in looks and compactness, updated with many exclusive features. The MIGHTY MITE tester, long America's most popular tube checker because it has the versatility and reliability professional servicemen demand! The MIGHTY MITE III checks them all — more than 2,500 tubes plus picture tubes, including the new frame grid tubes (has four extra sockets for latest tubes). It's fast and thorough, checks for control grid leakage, then, with the flick of a switch, tests for interelement shorts and cathode emission at full operating levels. Uses costly moving coil meter for high sensitivity (100 megohms) to find those "tough dog" tubes other low-sensitivity testers miss. In versatility, reliability, portability and operating simplicity, the TC130 is **\$74⁵⁰** your best buy in tube checkers at

COMPARE THESE MIGHTY MITE III FEATURES:

Lower voltage for Nuvistors and all frame grid tubes • Unique circuit tests for inter-element shorts, each and every element • Checks cathode emission at full operating levels • Checks control grid leakage at 100 megohms sensitivity, like "eye tube" testers. Speed-indexed set-up cards greatly reduce look-up time • Simplified panel layout speeds checks, prevents errors • Burn-out proof, stick-proof meter • Sturdy, all-steel case, rubber feet • Styled for modern, professional look

professional quality — that's the difference!

SENCORE

426 SOUTH WESTGATE DRIVE • ADDISON, ILLINOIS

Circle 28 on literature card

February, 1965/PF REPORTER 57

Users of Citizens-Band equipment spent more than \$50 million last year for new equipment and service. If you're not getting your share of this market, and plan to, the first thing you should do is get on the air yourself. Unless you are already using CB Business Radio in your service vehicles, you should install CB gear at your shop and similarly equip your trucks. Stop and think a moment. If *you* don't have enough faith in CB gear to use it, why should you expect a customer to buy from *you*? Besides, when you get on the air you'll learn something about the Citizen's Radio Service, and thus be able to talk your customer's language.

Who Uses CB — and Why?

To sell and/or service CB gear, it's important to understand what motivates the user. To get the facts, we went to an expert—Mike Weber, of Coston Radio-TV, in Cincinnati. Since adding CB sales and service in 1959, Mike has seen this phase of his business grow until today it provides a sizeable percentage of his total income.

Coston's sells and services black-and-white and color TV, AM, FM, and FM-stereo radios, phonographs, auto and transistor radios, CB and ham gear. They have found, through sometimes bitter experience, that there are some product lines that don't mix well. While radio and TV repair or service shops are naturals for CB service, they aren't necessarily equipped for a profitable sales program. Then, too,



To sell equipment, display where the customer can see and examine features.

finding and keeping CB customers



By Thomas R. Haskett

sometimes the CB crowd is more a "bargain basement" type, in contrast to the "luxury" crowd that usually buys color TV. It's usually not wise to have a single showroom for both color TV and CB equipment, because you're not selling both products to the same types of people. This is not, however, always true of service. And, if you do any ham business, you may find that CB'ers and hams don't get along too well. Such conflicts can be the source of some embarrassing moments.

Generally speaking, there are two basic types of CB users. The majority of those on the band seem to enjoy being on the air simply for the fun of it. They form clubs and associations, do volunteer Civil Defense work, organize emergency and safety networks, rescue stranded motorists, and enjoy being of service to others. While the activities of this large group may be limited by new CB rules, it would be a mis-

take for any service dealer looking for CB sales to look down his nose at CB'ers. Mike Weber has always respected them, treated them as he would any other customers, and tried to encourage responsible operation. As a result, these people return to get their TV's and car radios fixed—many even become hams and buy their rigs from Coston's. The outstanding feature of this type of CB user is that he is constantly on the alert for something new and better in equipment. He is a natural for accessory sales—tone squelch, beams, hand-held portables, etc. He wants his equipment to be in top shape. Although a few of this type are "do-it-yourselfers," most don't know beans about electronics, and if you treat them squarely, they will be glad to let you do their service. In many areas, there is a real need for a full-time service shop that handles nothing but CB work.

The other type of CB user employs his equipment in his business or professional life, as an adjunct to other activities. Examples: Doctors, lawyers, private policemen, trucking firms, etc. These users don't go in much for gadgets or gimmicks; they are usually interested only in effective communication. However, they want reliability; and, since they are seldom able to make their own repairs, they are willing to pay for it. By making a good sale you usually get followup service business. This type of customer generally needs his radio to continue his business profitably, and



Always service what you sell. An efficient shop insures a good CB income.

a guy could get **hurry** this way



...we
wouldn't
want it
to be
YOU.

All electronic manufacturers say they love their dealers.

But do they? In embracing you, manufacturers often squeeze too hard. They squeeze you right out of the profit picture, in fact.

How?

By selling to national mail-order catalog houses and their captive discount chain stores. To tube-checkers. And to other outlets that by-pass you, the dealer.

We won't spell out any names, mind you. But just pick up an A----d catalog, for example, and look at the antennas (Pages 420-430). Or look at the rotators in the

L-----e catalog. (Page 414). Or the picture and receiving tubes in the O----n catalog. Or the booster and other TV products in the R---o S----k catalog. (Pages 247-255).

You'll see that all these catalog houses sell the same products you sell—for approximately the same prices you pay for them.

You're entitled to an honest profit, of course. But how can you compete when your own prices must seem excessive by contrast.

Poor you. Your business—not to mention your profits—is cut right out from under you.

Many dealers are happy excep-

tions, of course. Dealers who handle Channel Master products, for example.

It's dead against Channel Master's policy to sell to any outlet that by-passes the dealer, or that sells to consumers at dealer prices. This way we protect your business and let you reap a full profit. The highest in the industry, by the way. We feel that the very least we owe the dealer who sells our product is a decent living.

We think it's just plain good business to support the firm that supports you. What do you think?

he will stick with the shop he trusts.

Finding Customers

It almost goes without saying that you must advertise, but the importance of advertising should be emphasized. If you already have an ad schedule, your existing copy should be revised to include a line like this: "We sell and service CB gear." Or, you may want to take separate space in the phone book's yellow pages for CB alone. Don't overlook billboards, car cards, and local radio stations. Most importantly, affiliate with the local CB club. Take an ad in their newsletter. Make an appearance at their field days and at informal get-togethers. Take along handbills, product information, and a few small prizes. Perhaps once or twice a year you can give away a complete rig or other major equipment. Do as much promotion as you can. (If you are a franchised dealer, investigate the possibility of having the manufacturer share the cost of such promotional prizes.) Keep

your shop name on the list of every CB user you can. Remember, when you sell or service one CB user and satisfy him, he'll tell others about it. Since he often tells them on the air, the word gets around fast.

It's no secret that the large mail-order houses offer CB equipment at low prices. Just as the small corner grocery must employ different tactics to compete with the large super-



Demonstrate and sell accessories to give yourself a broader base for sales.

market, your shop must offer something more than the mailorder houses. By stocking the CB gear you sell, you can offer immediate delivery. You should establish a reputation for reliable, fairly priced service, and have a good trade-in policy. Not too surprisingly, there is a good market for used CB gear. The club-type CB'er is a most likely prospect for upgrading his equipment. Many of these people buy relatively inexpensive units at first. As they get on the air and their enthusiasm mounts, they want more sophisticated rigs. You can profitably take the old one in trade and sell a new one. For example, Mike reports he can't keep enough \$300 rigs in stock right now, because most of the customers in his vicinity demand these newer, more versatile outfits. Many of his time-plan sales are of used gear.

Keeping Customers

Coston's sales volume of used equipment is almost as high as for

**ALL NEW
SENCORE
component
substitutor**



All your favorite Sencore Substitution Time-Savers in One Compact Unit

A complete range of carbon resistors, wire wound power resistors, capacitors, electrolytics, and universal selenium and silicon rectifiers.

Imagine, all of these hard to locate parts at your finger tips for on the spot substitution. Say goodbye to messy, crumpled parts, unnecessary unsoldering and soldering of components for testing purposes only. Save valuable servicing time and be sure, by substituting.

NEW . . . each section operates independently with a value close enough for every substitution need. Components in each section are isolated from chassis and from the other sections. For example, a complete power supply can be constructed using the RC121 Components only.

NEW . . . dual electrolytics provided. A new circuit enables you to substitute up to 25 single electrolytic values or 9 duals. Exclusive surge protector provides protection on both singles and duals for both you and the circuit.

You save space and money. Equivalent Sencore substitution pieces purchased individually (H36, PR111, RS106, ES102) cost you \$54.00

RC121 (all hand wired, all American made) only 3995
RC121K (Kit) 27.95

Now in stock at your Sencore Distributor. See him today!

SENCORE
ADDISON 2, ILLINOIS

Circle 30 on literature card

Want faster parts action? Mail this coupon.



Things move fast when you order parts from Philco. Your Philco Distributor's experienced parts specialists have only one job—to get that part out to you, and fast. Fast parts service means money to you, and your Philco Distributor never forgets it!

He stocks direct replacement parts for just about every model Philco TV, radio, phonograph and record-changer ever made—plus a wide range of national brand components and accessories for all makes and models such as Sprague Capacitors, Eveready Batteries, Rembrandt Antennas, G.C. Products, Semitron Transistors, Speco Components, Sencore Test Equipment, Colormagic Antennas.

If by chance he's out of a part you need, Philco's Lifeline Emergency Service goes into action. Your requirement is quickly transmitted to Philco's new National Parts Depot at Bedford, Indiana—and your part is on its way to you by air within 24 hours or less.

If you're not getting this kind of fast, complete parts service, don't you think you ought to be? Just mail the coupon and start doing business with your nearest Philco Parts Distributor.

YES, Philco, I want faster, complete parts service! Tell the nearest Philco Parts Distributor to send me information about special Philco Parts offers, prices and facts. And tell him to hurry!

Name _____

Address _____

City _____ Zone _____

State _____

Mail to: Philco Parts & Service Department
P. O. Box No. 3635
Philadelphia, Pennsylvania 19134

PARTS & SERVICE DEPARTMENT

PHILCO
A SUBSIDIARY OF *Ford Motor Company*

new equipment. Trade-ins are overhauled and guaranteed for 30 days and seldom remain on the shelves for long. Customers find bargain deals almost irresistible and keep coming back to the shop. When they need service or products, they think of Coston's.

Mike says that, when he first began selling CB equipment, he tried to stock too many lines. He now feels that was a mistake, as he was unable to order very many units from any one manufacturer, and hence didn't receive volume discounts. Moreover, the various brands confused the customer, and

often the same equipment could be purchased somewhere else at a different price. He now stocks a single brand and cites the advantages of volume-buying discounts, a wide price range to fit every pocketbook, dependability and good reputation, and—most important—an exclusive franchise in his area. Since no other dealer in the market can handle the same equipment line, Coston's prices can be firm. The shop can guarantee quality without being undersold.

Mike recommends keeping new and used equipment in separate areas of the store. He usually protects new gear with plastic covers

and doesn't allow demonstrations of stock items—the radio-equipped service vehicles are his best demonstrators, anyway. All new equipment remains bright and shiny; when a customer purchases one of these items, he is assured of fresh-from-the-factory condition. Mike doesn't recommend allowing used gear to be taken home overnight by the customer, either, as this encourages wear and breakage and often makes the item more difficult to sell at a profit. Customers are usually impressed by a firm policy that insures the quality of what they buy.

A good service policy is also essential to keeping CB customers. We asked Mike how he handles user-mangled equipment brought in for service. "We don't touch it," was his reply. Coston's policy is to take any job, large or small, provided there is a reasonable chance it can be repaired. "We've found," he continues, "that undoing a layman's mistakes is too time-consuming for us and too expensive for the customer. We point this out and encourage the customer to let us fix it *first* next time. In most cases, it works." There is a fine line between refusing to service a butchered set and insulting the customer. You have to be careful to let people know that you're on *their* side. It's a free country; if they want to, they can fix their own set—that's fine. But, unless they're an expert, they may get into difficulty. You, on the other hand, are an expert and guarantee your work.

Conclusion

If we have talked much of sales rather than service in this article, it's because today's market is changing considerably. Today's CB market is more and more a sales market and less a service business. Equipment is more rugged, better built, and it lasts longer than, for example, ham gear of 15 years ago. While some shops will undoubtedly continue to exist on service alone, they may soon become the exception rather than the rule. If you plan to offer CB service, you would do well to consider selling, too. In CB, at least, sales and service complement one another. ▲

**For your fine work...
choose
the
finest**

CHANNELLOCK
Little Champ
Highest Quality
Precision Pliers

You'll like the superb quality of CHANNELLOCK Little Champ pliers. Specially designed for delicate bench work. Ideal for use in electronics work, model making, jewelry and watch repair and hundreds of other fine operations. Drop forged from tough, high grade steel. Precision made in every detail. High polished to a jeweler's finish. Dipped blue plastic cushion grip handles. Ask for them by name . . . CHANNELLOCK Little Champ.

CHANNELLOCK, INC. Meadville, Pennsylvania
Formerly Champion Drill and Tool Co.

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

Circle 32 on literature card

GOOF- PROOF

VOM



Here's the most foolproof volt-ohm-milliammeter ever made. Protection approaches 100%. It's the VOM you will want to have on hand where inexperienced people are running tests . . . or will reach for yourself on those days when you're all thumbs. The 260-5P will save you all kinds of headaches from burned out meters and resistors, bent pointers, and inaccuracies caused by overheating.

Combined Protection You Won't Find In Any Other VOM

1. Reset button pops out to indicate overload.
2. You cannot reset circuits while overload is present.
3. Protective circuit does *not* require massive overloads which can cause hidden damage to the instrument.
4. All ranges are protected except those not feasible in a portable instrument—1000 and 5000 volts DC and AC; 10 amp DC.

SIMPSON 260-5P

ONLY \$78.95

Write for Bulletin 2066

Ranges—The 260-5P has the same ranges and takes the same accessories as Simpson's famous 260-4 volt-ohm-milliammeter.

Simpson
INSTRUMENTS THAT STAY ACCURATE

Representatives in Principal Cities
...See Telephone Yellow Pages

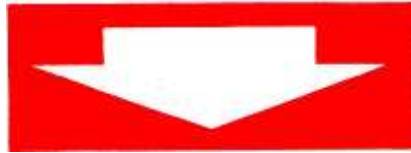


SIMPSON ELECTRIC COMPANY

5209 W. Kinzie Street, Chicago, Ill. 60644 • Phone: (312) ESTebrook 9-1121
Export Dept.: 400 W. Madison Street, Chicago, Ill. 60606 Cable, Amergaco
In Canada: Bach-Simpson Ltd., London, Ontario
In India: Ruttonsha-Simpson Private Ltd., International House,
Bombay-Agra Road, Vikbrali, Bombay

WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT

Circle 33 on literature card



VARIABLE LINE TRANSFORMER as a TS AID

by George F. Corne, Jr.



Obscure DC faults can often be isolated with AC instruments. Here's how.

Most technicians have their own choice methods of locating intermittent troubles in electronic equipment. Similarly, by experience they have found means for a quick, thorough before-delivery checkout—to prevent callbacks. Now, far be it from us to discourage any proven methods. However, it sometimes becomes expedient to try new ones, in hopes of finding ways more suitable to specific circumstances. The troubleshooting system we'll discuss here—using a variable line transformer (VLT)—isn't applicable to all repair jobs, but it is to most of them.

Usually, line transformers (isolating types included) have some means of selecting taps to control the output voltage; most are switch- or slider-controlled. This "variable" feature makes the instrument useful in many applications.

We've selected for discussion several servicing jobs in which we've used a variable transformer, including troubles in both radios and television sets. From these examples, you'll get a general idea of the troubleshooting versatility of

this low-cost item, and you'll probably think of other similar uses for it.

Power-Supply Checkout

We recently worked with a Westinghouse Chassis V-2233-2 that had a hum problem. In fact, the hum was so severe that only a partial raster was visible on the screen. The trouble was found (by bridging) to be an open "B" section of filter capacitor C1 (see Fig. 1). After a new unit was installed, the B+ source was within tolerance (275 volts DC at point A), and the receiver presented a fairly decent picture.

Receivers using this chassis are more than ten years old and, as with similar "oldies," a few preventive callback checks should be made after all evident troubles are cured—for instance: checking components visually, running all tubes through a tester, and checking the action of all controls. During the process, we replaced a few resistors, capacitors, tubes, and the height

control. Then we put our variable line transformer to work in search of hidden troubles.

Line voltage in our lab runs close to the standard 117 volts AC, and this was the voltage to which we set our variable. As we mentioned, the operation of the set was okay at this value (see photo in Fig. 2). However, lowering the input voltage to 100 volts produced the condition shown in Fig. 3. The raster shrank in both directions, vertical and horizontal sync became critical (needing continual readjustment), and the picture took on a washed-out appearance. Reducing the AC input to 95 volts caused the video to disappear, and the raster naturally shrank further.

Now, what conclusions can we draw from these conditions? First, operation should remain satisfactorily stable with an input of 100 volts AC—that is, such drastic changes in set operation shouldn't occur. (Most TV receivers are designed to operate in the range from 100 to 125 volts; some as low as 90 volts.) Sync, sweep, and video were all affected, indicating trouble in the power supply. Following are the B+ voltages we measured at point "A" at different input voltages: 275 volts DC at 117 volts AC; 230 volts DC at 100 volts AC; and 200 volts DC at 95 volts AC.

This simple test suggested that the power supply was operating on the borderline, and further troubleshooting was in order before the set was returned to the customer. Actually, the trouble was simple to find: both 5U4's were weak under load, although they checked good on a tester. In the process, we found another possible trouble spot in the power supply. When we checked the condition of R1 (a high-wattage, surge-protecting resistor), we found

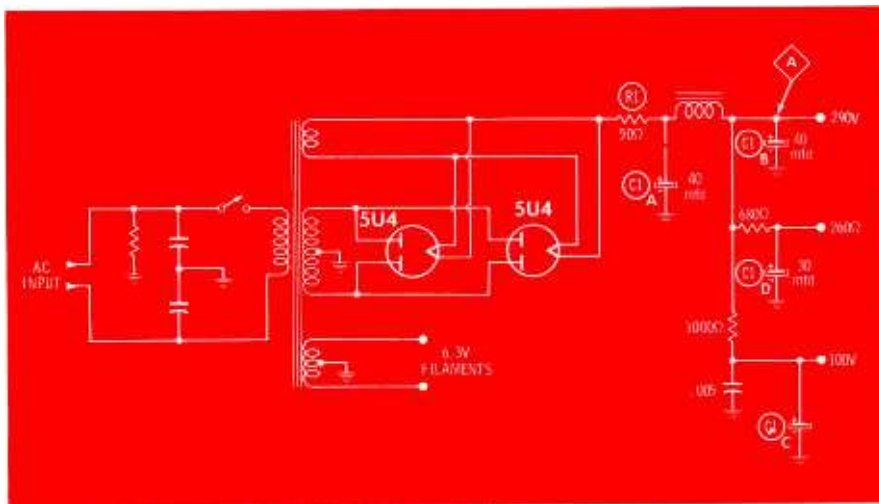
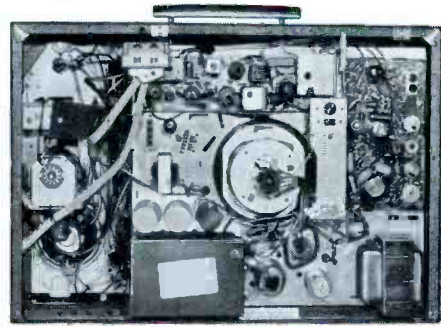
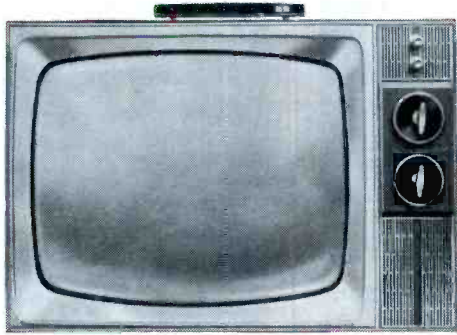


Fig. 1. Some older TV receivers have 5U4's connected in parallel.

If you sell or service TV sets



can we interest you in making a few extra dollars?



New RCA Stratomaster—
for both VHF and UHF channels.



New RCA Stratoscope—
for VHF channels only.

If you're in the TV business, why not include these two natural profit makers in your line? These RCA indoor TV antennas are styled so smartly they virtually sell themselves. And they work so well they keep customers sold on you!

SMART STYLING. An instant selling point. The first indoor antennas you can recommend with pride as a decorative asset to any interior.

EXCELLENT PERFORMANCE. These RCA indoor antennas are designed by the same RCA engineers who develop antennas for satellites and space. They include (a) an automatic signal-phasing device to pull in the strongest, sharpest picture possible with an indoor antenna, (b) a channel selector switch to block out ghosts and interference, (c) super-fine tuning, (d) telescoping 45-inch arms turnable in any direction without moving the base.

and they're advertised nationally in **POST** and **TV GUIDE**
for immediate customer recognition and acceptance.

ORDER FROM YOUR RCA DISTRIBUTOR. AND HURRY...SO YOU'LL
HAVE THEM IN STOCK WHEN CUSTOMERS START ASKING FOR THEM.

RCA PARTS AND ACCESSORIES, DEPTFORD, N. J.



The Most Trusted Name in Electronics

TV TUNER REPAIR



Includes
ALL
makes
ALL
parts
ALL labor

\$9.50

THAT'S RIGHT:

Each tuner thoroughly cleaned, broken and defective parts replaced, all channels realigned and air checked.

WARRANTY:

1 full year against defective workmanship and or parts failure (except tubes).

COSTS:

\$9.50 ea. UHF or VHF and \$14.50 UHF/VHF COMBO. Includes all parts except tubes.

Distributor write for price structure.

PLEASE NOTE:

Ship all broken parts and include model and chassis number. Replacement tuners available at minimum cost.

Open account on approved credit.

FOR FAST EFFICIENT SERVICE
SHIP TO:



QUALITY TUNER SERVICE

5142 West 25th Street
CHICAGO 50, ILLINOIS
Area Code 312 652-7600

Circle 35 on literature card

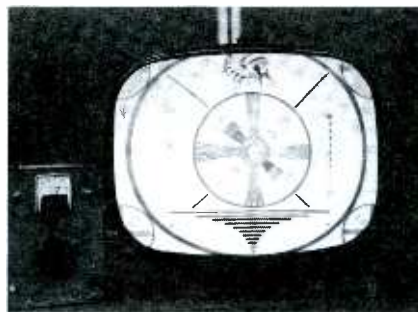


Fig. 2. Operation in Westinghouse receiver okay at 117 volts input.

it to be low in resistance, measuring only 15 ohms. Changing R1 probably prevented a future call-back, too. We made another final check on the receiver after replacing the tubes and R1. Here are the results, measured at point "A" in Fig. 1: 300 volts DC at 117 volts AC; 275 volts DC at 100 volts AC; and 250 volts DC at 95 volts AC. The supply would now operate well with any input voltages likely to be encountered in the home.

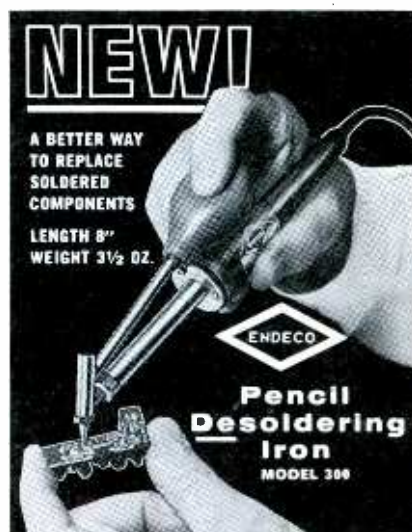
This final test using a variable transformer isn't limited to locating power-supply failures. Assume, for instance, poor video had been the only symptom when AC power was reduced or that only vertical sync had become critical. If this were the case, borderline operation in the affected stage would be indicated.

Width and Arcing Problems

If your service business includes calls to rural or thinly populated areas, you'll find your variable transformer valuable in many instances. As an example, assume you return a set after repair, and it operates normally—except for a small amount of black showing on both sides of the screen. You know that in the shop the width was good. What policy do you follow? Your first check under these conditions should be of the line voltage available in the home—especially in rural locations. You'll probably find it is lower than your shop supply.

On the other hand, say the set develops arcing in the high-voltage cage on delivery, and you know it wasn't present on the shop bench. Here, *high* line voltage could be causing the trouble.

There's a simple solution to both of the above problems: A line check using your VTVM in the home, and a test of the set using your variable



Now—remove miniature soldered components in seconds—without damage

Hollow tip fits over connection; vacuums all solder for easy removal of component. Leaves terminals and mounting holes clean. Then, with 360° contact, it resolders even faster and better than regular irons. Handles miniature and standard components in printed circuit boards and conventional wiring. Self-cleaning. All parts replaceable. 40 watts, 115-v. 5 tip sizes. Pays for itself in time saved. \$9.95 net East of the Rockies.

Larger model available. See your distributor or write:

ENTERPRISE DEVELOPMENT CORPORATION
1102 E. 52nd • INDIANAPOLIS, IND. 46205

Circle 36 on literature card

TRIO[®] Model CB-4 COLOR-BRITE

ALL-CHANNEL
UHF TV ANTENNA



Proved by independent
engineering research,

DOLLAR-FOR-DOLLAR
the MOST
POWERFUL UHF ANTENNA TODAY!

COMPARE COSTS!*

CORNER REFLECTOR (6 db gain) \$7.50 to \$10.00

STACKED CORNER REFLECTOR (9 db gain)
\$17.00 to \$25.00

16 ELEMENT YAGIS, STACKED, (9 db gain)
\$22.95 to \$25.00

TRIO COLOR-BRITE (10 db gain!)
Just **\$11.95**

*Based on average advertised list prices for antennas of comparable construction.

TRIO[®] Manufacturing Company
Griggsville, Illinois

Circle 37 on literature card

HICKOK GIVES YOU

Speed, Accuracy and Profit, Plus Obsolescence Protection IN AN ALL NEW, NO-COMPROMISE MULTI-SOCKET TUBE TESTER!



100% G_m TESTS . . .
*No Emission Tests,
No Compromise!*

**MULTI-SOCKET
SPEED . . .**
*No Compromise
In Accuracy!*

**NEW
HIGH-SENSITIVITY
LEAKAGE AND
GAS TESTS!**

**OBSOLESCENCE
PROTECTION**
*Realistic, Practical
No Compromise!*

MORE PROFIT
*Because You'll Sell
More Tubes . . .
Sell Them
Honestly!*

MODEL 799

Mustang

\$199⁹⁵

From the laboratories of the world's leading tube tester manufacturer comes the model 799 "Mustang"—a completely new tube tester. Built to put profit in your pocket, the "Mustang" checks *more* tubes, checks them *faster* and checks them *honestly*.

Multi-socket tube testers used to have two serious drawbacks: circuit limitations made them obsolete overnight and, at best, no more than 10% of their tests were actually mutual conductance. But the Hickok "Mustang" doesn't compromise: it delivers *honest* mutual conductance tests. And a unique circuit approach, together with an

easily replaceable accessory socket panel, makes it "circuit ready" for any possible new tube types.

A solid state power supply gives increased accuracy and dependability. An all-transistorized gas and leakage test circuit sets a new standard of reliability for spotting "tricky" tube defects that can "chew up" your profit.

We call it the "Mustang" because it uses fresh, new engineering ideas and because it gives you a real opportunity to break into new profits.

See it at your Hickok distributor or write for circular TT799.

HICKOK

THE HICKOK ELECTRICAL INSTRUMENT CO.

10566 Dupont Avenue, Cleveland, Ohio 44108

Represented in Canada by Stark Electronics, Ajax, Ontario

Internationally by Hughes International, Culver City, California

Circle 38 on literature card

February, 1965/PF REPORTER 67

transformer in the shop. If you're servicing sets in an area where line voltage may be high or low (sometimes, the amount or direction will depend on the time of day), take a line reading in the home before you take the chassis to your shop. Then, on the bench, adjust your transformer to duplicate the value you read on your VTVM in the home—and proceed to service the receiver. Before final delivery, vary the voltage at least 5 or 10 volts on either side of the normal-operation value, and you'll be reasonably sure of operation within the spread encountered in the home. Borderline cases of many faults can be detected

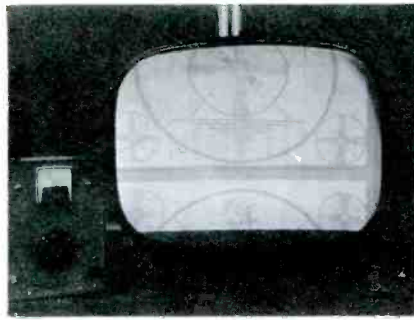
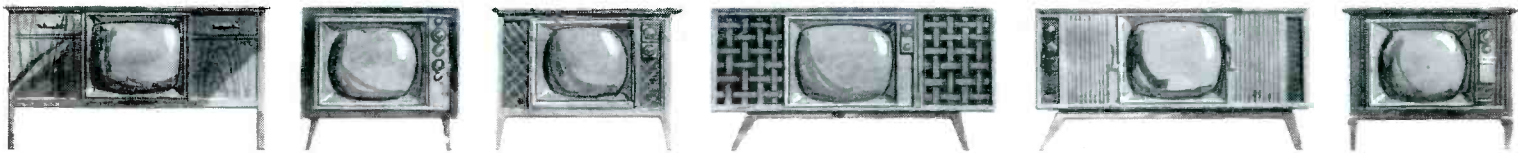
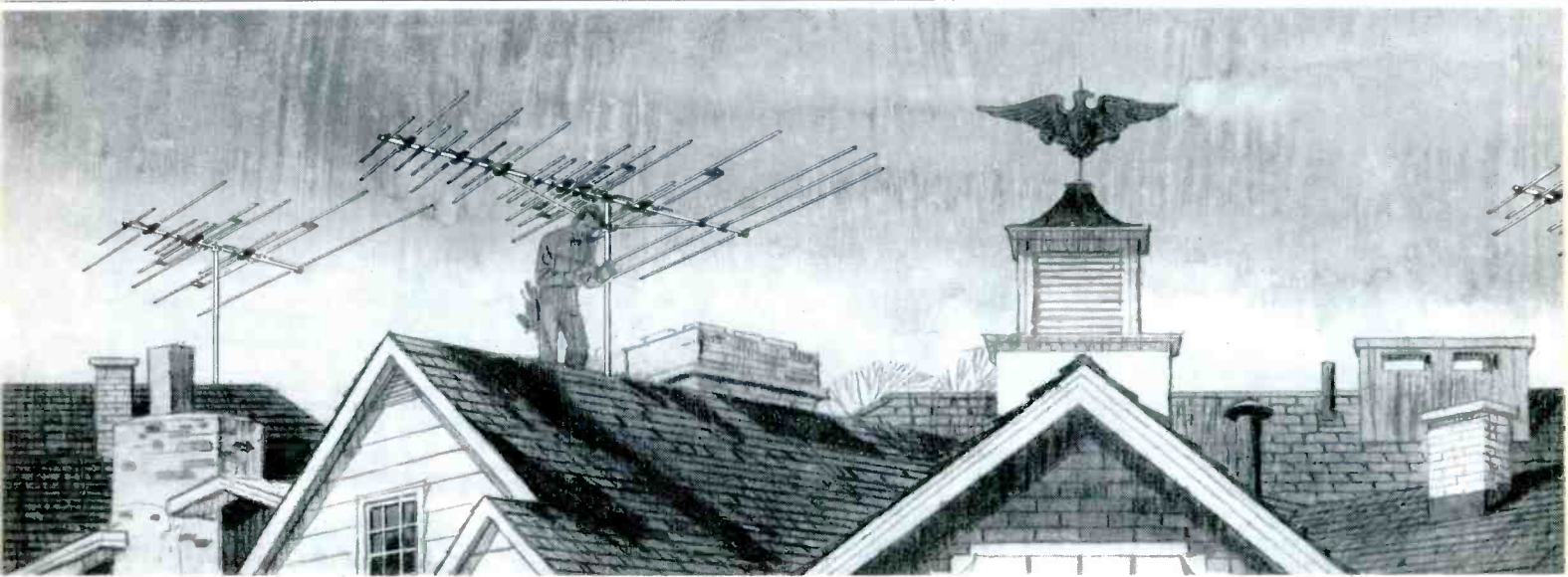


Fig. 3. Trouble in several forms appeared with 100-volt power source in this manner.

Repeat Tube Failure

Here's an interesting case, ex-

perienced by a technician reader of ours, that demonstrates another use for your variable line transformer. A call was made on an old Capehart for a no-raster complaint. A new output tube in the horizontal section restored operation. However, two weeks later the technician was on a return trip—for the same condition. The new tube was defective? Probably, for another new one again brought a raster. The technician let the receiver play for about ten minutes, and then took a look at the output tube, checking to see if it was running hot. It wasn't, so he deduced the first tube had failed of its own accord. On



Why are most Color Television Sets

BECAUSE EXPERIENCED COLOR TV DEALERS KNOW THAT WINEGARD COLORTRONS ALWAYS DELIVER THE BEST COLOR PICTURES POSSIBLE!

And it's just plain, common sense . . . when a man invests \$400-\$1000 or more in a color TV set, he expects—and deserves—the finest possible color reception!

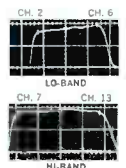
Most people who demand the finest in color TV reception choose Winegard Colortron. Here's proof:

Look on top of the largest retail stores in the country . . . they demonstrate their sets connected to Winegard antennas; or look on the homes of the famous TV and movie stars in Hollywood; or on the studio buildings of all three major TV networks; even atop the Whitehouse in Washington. Wherever the best color is seen, you'll see a Winegard Colortron . . . it's the TV antenna made for color.

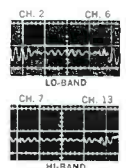
What's behind Colortron's Superior Performance? Balanced Design! Just what is Balanced Design? It's the perfect combination of high gain, accurate impedance match, complete band width, and pinpoint directivity . . . and only Colortron has it!

For example:

Gain and Bandwidth—A superior color antenna must have high gain and complete bandwidth. But the response must be flat if it is to be effective. Peaks and valleys in the curve of a high gain antenna can result in acceptable color on one channel and poor color on another. *No all-channel VHF-TV antenna has more gain with complete bandwidth across each and every channel than Colortron.* Look at the Colortron frequency response in this oscilloscope photo. Note the consistently high gain on all channels. Note the absence of suck-outs and roll-off on end channels. Note the flat portion of the curve . . . there is less than 1/2 DB variance over any channel.



Impedance Match—the two 300 ohm "T" matched Colortron driven elements have far better impedance match than any antenna using multiple 75 ohm driven elements. The Colortron transfers maximum signal to the line without loss or phase distortion through mismatch. The oscilloscope photo here shows the Colortron



the *next* repeat call, several days later, he pulled the chassis for bench work!

On the bench, operation of the output stage was normal, and he could find no reason for the repeated tube failure. Here was the final solution. He found the line voltage in his shop was between 112 and 118 volts; in the home, it averaged 118 to 124 volts. With an input voltage in this latter range, he noticed the plates in the tube took on a slight reddish glow, indicating excessive plate current. To prevent similar failures, he installed a low-cost line-voltage regulator (\$3.50) in the home. Here too, the

VLT had come in handy for troubleshooting.

Other Applications

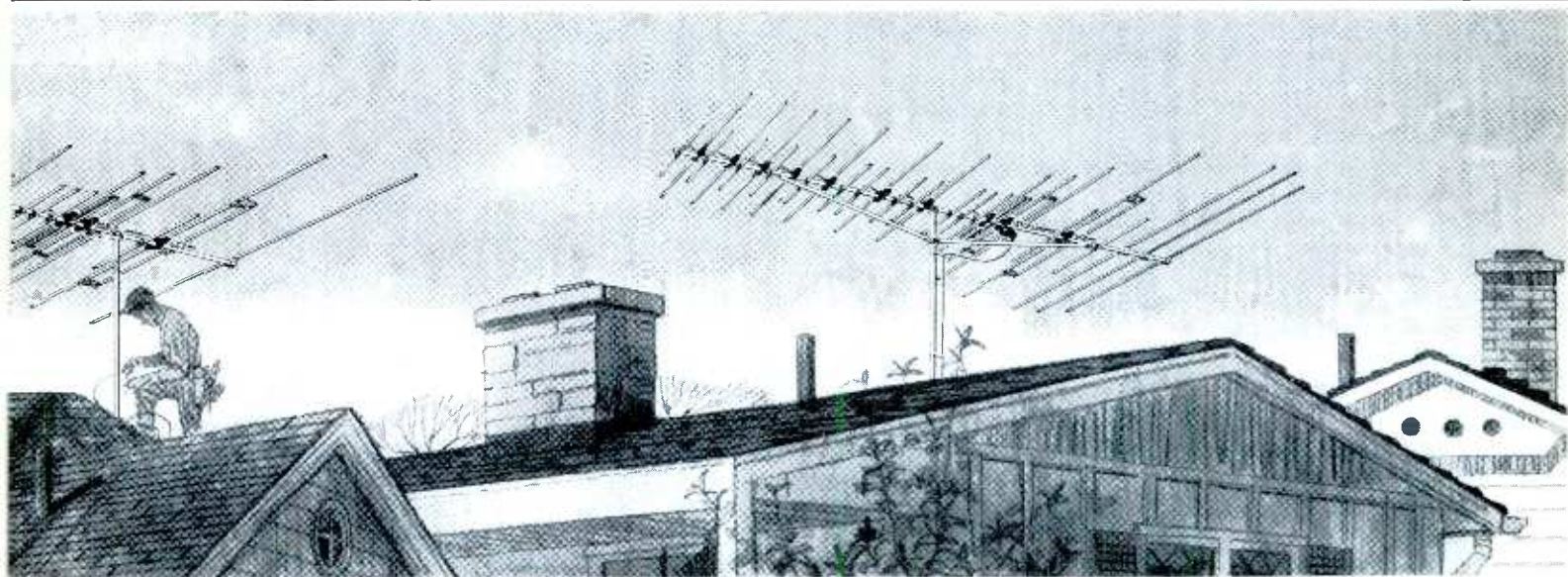
There are a few more cases in which the VLT can be useful:

1. When servicing tube-type portable radios, reduce the line voltage to approximately 90 volts. If the radio stops playing, substitute the oscillator tube (usually a 1R5), the B+ rectifier, the input filter, and the filament dropping resistor, in that order. Replace whichever brings the set back to life. Otherwise the radio will soon be back.
2. When thermal problems are

evident, regardless of equipment, increase the line voltage slightly. This action will usually cause components to run a bit hotter, making the defective ones easier to locate.

Conclusion

We've suggested only a few of the ways to troubleshoot with a variable line transformer, selected to start you thinking of instances where, had you checked the receiver with different values of input voltage, your job might have been easier. The VLT can have a useful place in your servicing procedures . . . why not make it a habit? ▲



connected to Winegard Antennas?

VSWR curve (impedance match). No current VHF-TV antenna compares with it across all 12 channels.

Directivity—An antenna with sharp directivity and good signal-to-noise characteristics is necessary for perfect color. Extraneous signals, picked up at the back and sides, produce objectionable noise and ghosts in black and white reception. But in color TV, they frequently ruin reception. *Winegard Colortron has the most ideal directivity pattern of any all-channel VHF antenna made.*

The Unsurpassed Performance of Balanced Design is Matched Only by the Colortron's Unsurpassed Construction!

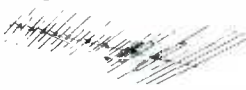
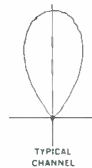
Colortron has been engineered for maximum strength, minimum weight and minimum wind loading. The result is a streamlined,

lightweight antenna that stays stronger longer. Colortrons have even been wind tested to 100 m.p.h.

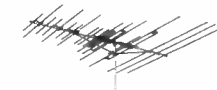
Advanced-design snap lock hardware makes Colortron the easiest antenna to install. Winegard Colortron also has the finest *Gold Anodized finish* of any TV antenna made.

Winegard Helps You Sell . . . With *More* National Consumer Advertising *Than All Other Brands Combined!* Look for Winegard . . . on AFL Football over ABC (over 1,500,000 viewers per game) . . . in Life Magazine (over 13,000,000 readers per issue) . . . in Parade (the big Sunday supplement with 21,000,000 readers per issue).

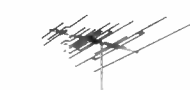
This is the Season for TV buying . . . The season for you to stock up on Winegard Colortrons. Remember . . . over 2,000,000 Color TV Sets will be sold this year and *the antenna made for color TV* is Winegard Colortron. Order today!



COLORTRON ANTENNA
Model C-44 • Gold Anodized • \$64.95



COLORTRON ANTENNA
Model C-43 • Gold Anodized • \$51.90



COLORTRON ANTENNA
Model C-42 • Gold Anodized • \$34.95



COLORTRON ANTENNA
Model C-41 • Gold Anodized • \$24.95



3009-C KIRKWOOD • BURLINGTON, IOWA

Circle 39 on literature card

www.americanradiohistory.com



The Troubleshooter

answers your servicing problems

Negative Picture

Can you please help me out? I have an Olympic Chassis GB which has a faint negative picture. All tubes from tuner to picture tube are okay. I have checked the 1N64 video-detector diode, contrast control, and am using a test CRT. Sound is normal except there is a slight audio buzz; however, my main concern is how do I correct the negative picture?

J. J. CIERESEWSKI

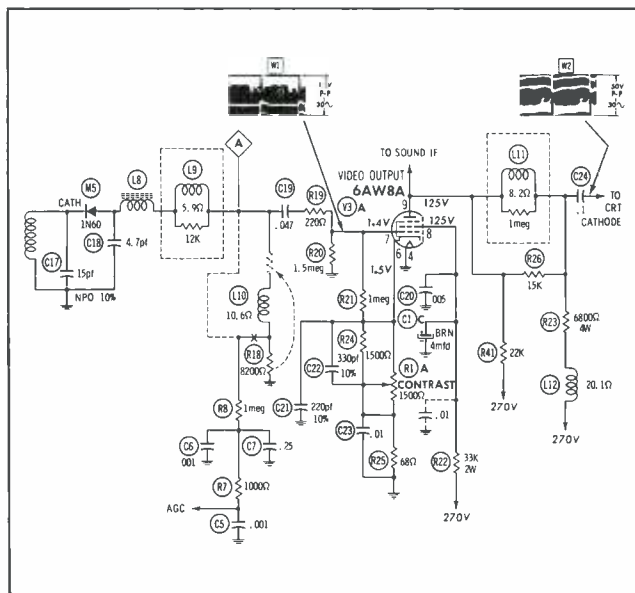
Wyandotte, Mich.

This chassis is covered in PHOTOFAC T Folder 415-1. I'd suggest that you recheck the installation of the video-detector crystal; to insure it is properly connected in the circuit. Also, be sure you make a check of the video-detector load circuit, which consists of L10 and R18.

Make sure the tuner is on the correct channel. I've seen several sets that produced a negative picture simply because the oscillator was off the operating frequency so far that the signal was inverted in the tuner stages. This is a rare occasion and perhaps is not the case here, but it is worthwhile to check the positioning. Have you checked waveform W1 on the grid of the video-output stage? If the inversion is being caused by the tuner or one of the IF stages, you'll find a positive-going signal here, rather than the normal negative. This would also be true if the

diode was reversed.

Make a detailed check on the following components in the AGC circuit, to be certain one of them is not defective and causing the problem through the AGC line to the tuner. Especially check R7, C5, R8, and C7. What are the voltages on the grids of the first and second IF stages? It would be well to make a complete voltage check on the grids, the cathodes, the screens, and plates in these stages. To eliminate possible open decoupling caps for the plate in the screen circuits, bridge the bypass capacitors with known good units. Normally, if a bypass capacitor opens, you'll have an oscillation appearing on the screen. This is a common occurrence in the



BETTER RECEPTION MEANS MORE SALES!

Many of your customers will be viewing color and UHF TV for the first time in the immediate months ahead. Don't jeopardize performance by installing inferior antenna equipment. The picture produced in your customer's set can produce either a good or bad image of you in the area.

Take the practical and profitable approach — Eliminate indoor antennas and out-moded outdoor antennas by installing a new Antennacraft CHANNEL-SPANNER, Model 570, which fully covers the UHF-VHF and FM bands.

Both UHF and color require a professional installation to assure snow-free, ghost-free pictures. Antennacraft's CHANNEL-SPANNER has been designed to do just this. It is designed and constructed by professionals for the professional installation.

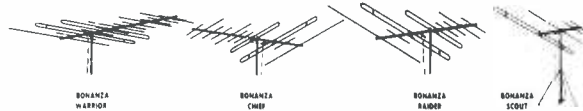
Specifically, Antennacraft's CHANNEL-SPANNER is designed to produce snow-free, ghost-free pictures to the far edge of the UHF class B signal area.* At the class B distance, maximum signal response will be obtained from VHF and FM stations, and good picture quality will be obtained throughout the medium fringe areas.

*Upon request, Antennacraft will supply radiation patterns of the TV transmitters in your location.

new!
CAN MEAN EXTRA PROFITS FOR YOU!

and with **ANTENNA-CRAFT** antennas, reception is at its BEST!

ANTENNA-CRAFT
CHANNEL-SPANNER
FOR CHANNELS 2 TO 83
UHF - VHF - FM



A complete line of antennas available. See your distributor for information.

Circle 40 on literature card



6 NTSC
Standard Colors

Standard
Alignment Signals

Horizontal Bars

Vertical Bars

Crosshatch

White Dots

A COLOR BAR GENERATOR YOU CAN TRUST!

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

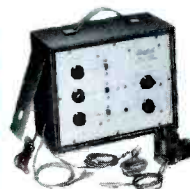
Based on the same designs as Hickok's famous Model 656XC NTSC color bar generator, the NEW Model 661 is literally the answer for progressive service technicians who recognize the opportunities in color TV service but have been stopped by the cost of equipment. *The 661 is not a compromise—there are no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

can expect the same kind of performance standards from the new 661 that have established Hickok's reputation with leading Color TV manufacturers as COLOR-APPROVED.

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

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

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



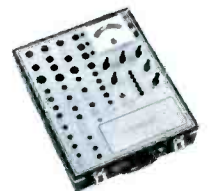
662
Installer's
Color Generator



677
Wide-band
Oscilloscope



800A
Switch-type
Tube Tester



799
"Mustang" multi-
socket Tube Tester



615
Sweep &
Marker
Generator



691
Marker-adder

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, California

Circle 41 on literature card

February, 1965/PF REPORTER 71

KIT or ASSEMBLED!



Either Way, These HEATH Instruments Are Your Best Buy!

Heathkit IM-21 Laboratory AC VTVM!

• 10 voltage ranges—0.01 to 300 volts RMS full scale • ± 2 db, 10 cps to 1 mc • 10 megohm input impedance for high accuracy • Calibrated DB scale • VU-type ballistic damping of meter movement.

Kit IM-21, 5 lbs...\$33.95 Assembled IMW-21...\$52.95

Heathkit IM-11 VTVM... World's Largest Selling VTVM!

• 7 AC (RMS & Peak to Peak), 7 DC, 7 Ohms ranges • Wide frequency response ± 1 db, 25 cps to 1 mc • Easy-to-read $4\frac{1}{2}$ " 200 UA meter • 1% precision resistors • Single AC/Ohms/DC probe with switch.

Kit IM-11, 5 lbs...\$24.95 Assembled IMW-11...\$39.95

Heathkit IM-13 "Service Bench" VTVM!

• 7 AC, 7 DC, 7 Ohms ranges • Separate 1.5 & 5 v. AC scales • ± 1 db, 25 cps to 1 mc • Large 6" 200 UA meter • Tilts to any angle • 1% precision resistors • Single AC/Ohms/DC probe with switch • Mounts anywhere.

Kit IM-13, 7 lbs...\$32.95 Assembled IMW-13...\$49.95

Heathkit Variable-Voltage Regulated Power Supply!

• Ideal for design & development • B+, Bias & Filament voltages • DC output variable 0-400 volts, 125 ma max. • Output varies less than 1%, no load to full load • Ripple less than 10 mv • Voltage & Current Panel Meters.

Kit IP-32, 16 lbs...\$56.95 Assembled IPW-32...\$84.95

Heathkit "Extra-Duty" Wide Band 5" Oscilloscope!

• Professional styling & features • 5 MC bandwidth, ideal for color servicing • Rise time 8 microseconds or less • Sweep range 10 cps to 500 kc plus 2 switched preset frequencies • Push-pull vertical & horizontal output.

Kit IO-12, 24 lbs...\$76.95 Assembled IOW-12...\$126.95



FREE CATALOG

Fully describes these and over 200 other different and exciting Heathkits at savings of 50% or more! Fill out the coupon below and send for your FREE copy today!



HEATH COMPANY, Dept. 25-2
Benton Harbor, Mich. 49023

Please send my free 1965 Heathkit Catalog.

Enclosed is \$____, plus postage. Please send model(s)_____

Name _____ (Please Print)

Address _____

City _____ State _____ Zip _____

TE-132

last video IF stage; if the stage isn't properly decoupled, it tends to break into oscillation, producing a rash of bars on the screen of the CRT.

Voltage Checks Are Impossible

I have a Crosley TV Chassis 431, covered in PHOTOFACT Folder 263-6, in for repair. The customer stated the set had been to another shop for repair, but when it was returned it didn't work. I turned the set on and found it was completely dead. The volume control made a frying noise and R78 read 450 ohms. After replacing both these components, the tube filaments came on but the plates of M1 and M2 became very hot, as did R78. There was sound but not raster. There apparently has been trouble with this same problem before, as both the rectifiers have been replaced with high-density type units.

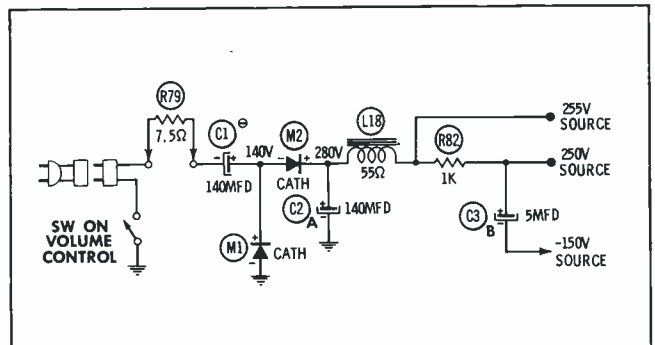
R79 checks okay, as does L18. The resistance readings are far from normal on the 25L6 (V9). Ohmmeter checks of C1, C2, and C3 indicate these filters are normal. There is a definite disadvantage to this type of problem, as voltage measurements can't be taken without burning out a number of components. Can you possibly advise me how to best find the trouble? One other note: This set was equipped with a 200-mfd capacitor for C1 rather than the 140 mfd shown in PHOTOFACT. Could this be the cause for overload?

ERVIN LAY

Portland, Ore.

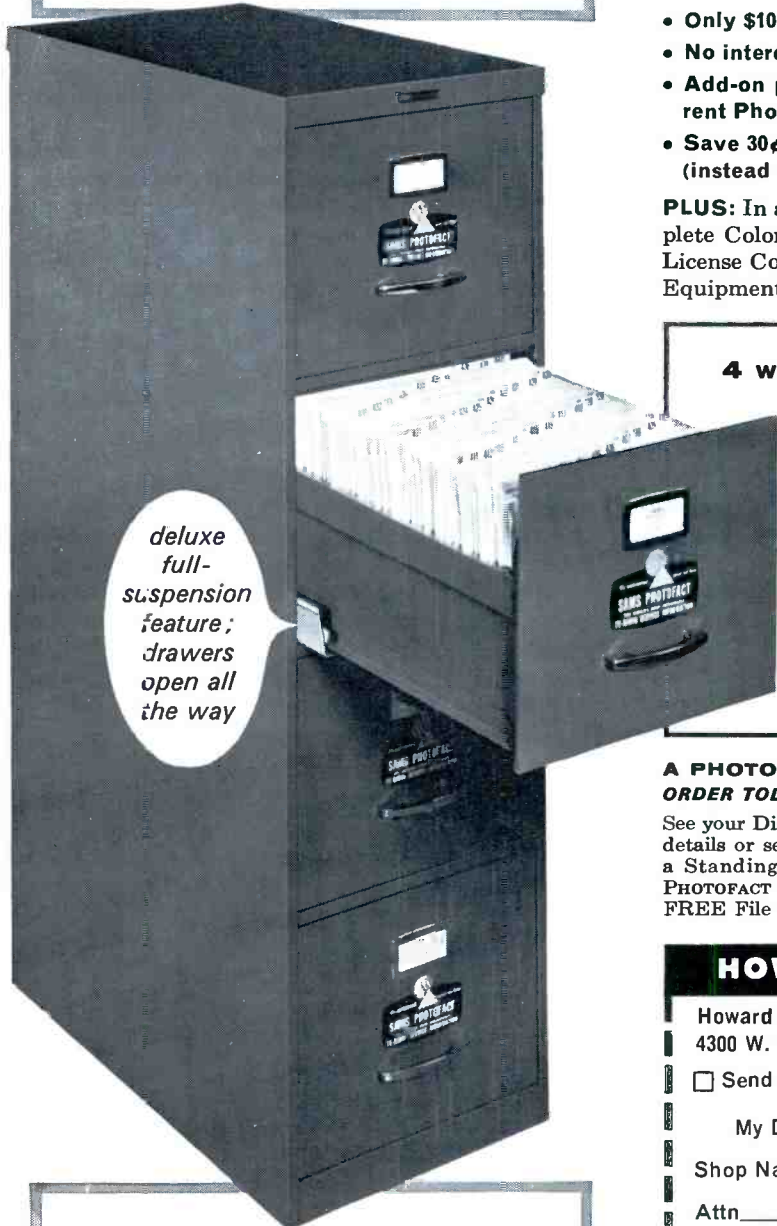
The voltage doubler capacitor used in this chassis may be 140 mfd or 200 mfd, as the note on the schematic in PHOTOFACT Folder 263-6 indicates. If you have traced the wiring in the chassis and are satisfied the diodes are connected properly, the following procedure should isolate a defective (shorted) component.

1. Take the load off the power supply by disconnecting L18 from the 250V and 255V lines.
2. Turn the chassis on; if the condition of overheating rectifiers persists, either C2 is shorted or you have connected something wrong.
3. Should the rectifiers run cool and B+ increase, connect the 255V line in the circuit, leaving the 250V line disconnected. If the diodes begin to heat, and B+ decreases, you have a short in the circuits fed by the 255V line, and a component by component check of these circuits must be made; assuming the rectifiers run cool and B+ remains constant, the 255V leg is "OK."
4. Disconnect all leads from the negative terminal of C3.
5. Reconnect the 250V line (R82). Observe the results; do the diodes seem to be heating? Is B+ dropping? If so, make a component by component ohmmeter check of circuits fed from the 250V source. If the diodes remain cool and B+ constant, the 250V line is "OK."
6. If the 255V and 250V lines check out, the trouble has to be in the -150V line. Start with C3 and proceed to check all components relative to the circuits fed from the -150V line, paying particular attention to the divider network in the cathode of V9 (25L6). Check multisection filters and bypass electrolytics for leakage from positive terminal to positive terminal, in addition to checking from positive to negative terminals. ▲



NOW! get this **BIG BONUS** with your purchase of a **PHOTOFACT® Library!**

FREE! this deluxe new **Four-Drawer FILE CABINET** (with full-drawer suspension) worth \$55.00—available only with your purchase of a **PHOTOFACT LIBRARY** consisting of **200 SETS** plus valuable Free extras!



Offer for Limited Time Only—Act Now!

boost your earning power—own and use the world's finest TV-radio service data

Now, more than ever, it pays to own a PHOTOFACT Library—the time-saving troubleshooting partner guaranteed to help you earn more daily. Now, you can start or complete your PHOTOFACT Library the special Easy-Buy way, and get absolutely FREE with your purchase, the deluxe 4-drawer File Cabinet worth \$55.00, plus valuable extras described below!

OWN A PHOTOFACT LIBRARY THE EASY-BUY WAY:

- Only \$10 down • 30 months to pay
- No interest or carrying charges • Prepaid transportation
- Add-on privilege of a year's advance subscription to current Photofact data, on the same Easy-Buy contract
- Save 30¢ per Set—special \$1.95 price applies on Easy-Buy (instead of regular \$2.25 price)

PLUS: In addition to the deluxe File Cabinet, you get a complete Color TV Servicing Course, 2nd Class Radiotelephone License Course, Transistor Radio Servicing Course, and Test Equipment Guide!

- #### 4 WAYS TO SELECT YOUR PHOTOFACT LIBRARY
1. Complete your present PHOTOFACT Library
 2. Order a PHOTOFACT "Starter" Library—200 Sets (Sets 401-600—coverage from 1958 to 1963—only \$12.66 per month).
 3. Order by brand name and year—see the handy selection chart at your distributor.
 4. Order a complete PHOTOFACT Library—get FREE File Cabinets to accommodate the entire library, the Courses listed above, plus an 8-volume Set of "101 Ways" Test Instrument books worth \$18.50.


A PHOTOFACT LIBRARY PAYS ITS OWN WAY—ORDER TODAY AND GET THE FREE BONUS EXTRAS

See your Distributor for PHOTOFACT Easy-Buy details or send coupon today! Ask also about a Standing Order Subscription to current PHOTOFACT and Specialized Service Series—FREE File Cabinet also available!

GET THE DETAILS NOW

HOWARD W. SAMS & CO., INC.

Howard W. Sams & Co., Inc. Dept. PFF-2
4300 W. 62nd St., Indianapolis, Ind. 46206

Send full information on Easy-Buy Plan 

My Distributor is: _____

Shop Name _____

Attn _____

Address _____

City _____ State _____ Zip _____

Why doesn't
everybody
stock

Jensen[®]
SNAP-IN
CARTRIDGES?



If you've been shying away from profitable cartridge replacement business because of the cost and conniptions of cumbersome inventories, let Jensen get you back on the right "track." Here's how:

- Less inventory
- Complete coverage
- Superior performance
- Respected, accepted brand name

Why doesn't everybody stock Jensen Snap-In Cartridges? Give 'em time. Soon they will.

SPECIAL K-1964 DEAL

Write for details on special Dealer Starter Kit K-1964—12 brackets and 6 interchangeable cartridge bodies which will replace 80% of all basic cartridge requirements.

World's finest phonograph needles, cartridges, drives, accessories

Jensen[®]
INDUSTRIES, INC.
301 Interstate Rd., Addison, Ill.

In Canada: A. T. R. Armstrong,
P.O. Box 244, Islington, Ontario

Circle 44 on literature card



Notes on Test Equipment

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

by Allen B. Smith

Compact Multiplex



Fig. 1. Compact, battery-powered FM stereo generator is fully transistorized.

The all-transistor FM-stereo generator pictured in Fig. 1 provides all signal elements required to align or service stereo receivers or adaptors. The Hickok Model 727 generates its own 1000-cps audio signal, and individual left- and right-channel signals are obtainable. The 727 incorporates a 100-mc RF oscillator/FM modulator that feeds a separate RF-output jack. Other signals developed by this 12-transistor, battery-powered unit are the 19-kc pilot, the suppressed 38-kc carrier, and the 67-kc SCA signal.

A functional block diagram is shown in Fig. 2. Let's examine the

circuit arrangement a little more closely to understand what actually happens in each section to provide the necessary outputs.

A crystal-controlled 19-kc oscillator is used to generate the 19-kc pilot signal. Due to the stringent stability requirements for both phase and frequency of the pilot signal, an accuracy of ± 2 cps is maintained in the oscillator circuit. Output from the oscillator is coupled to a 19-kc amplifier stage; signal amplitude is determined by the setting of a chassis-mounted 19-kc level potentiometer.

The collector circuit of the 19-kc amplifier is tuned to 19 kc and applied to a pair of doubler diodes, for developing the 38-kc sine wave, and to the base of an emitter-follower stage. Output of the emitter follower is applied to the 19-kc position of the FUNCTION switch and to the composite adder circuit. Amplitude of the 19-kc pilot applied to the adder circuit is adjustable by a second chassis-mounted 19-kc level control.

The 38-kc output of the doubler is applied to an amplifier whose output is a sinusoidal 38-kc signal which is coupled to the AM modulator stage. A second input to this modulator stage is the 1000-cps audio signal generated by the 1000-cps oscillator and

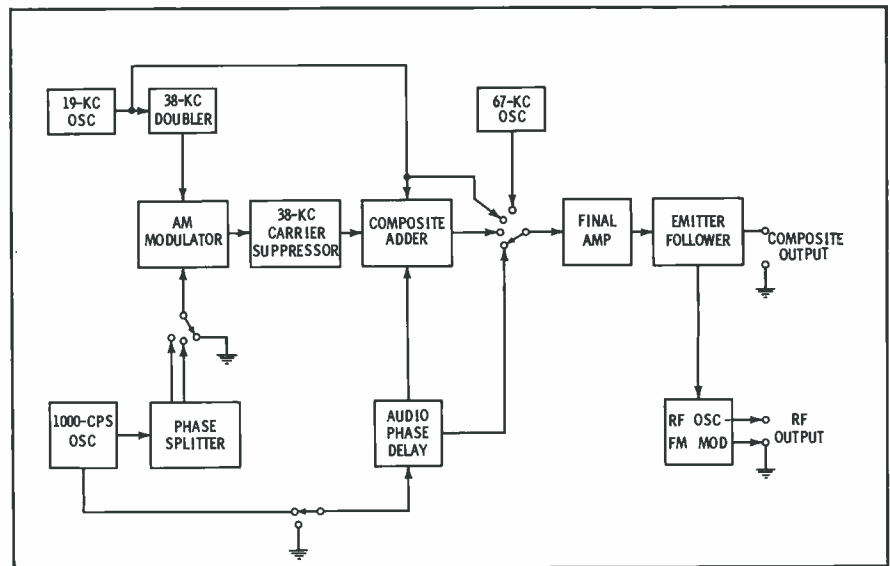
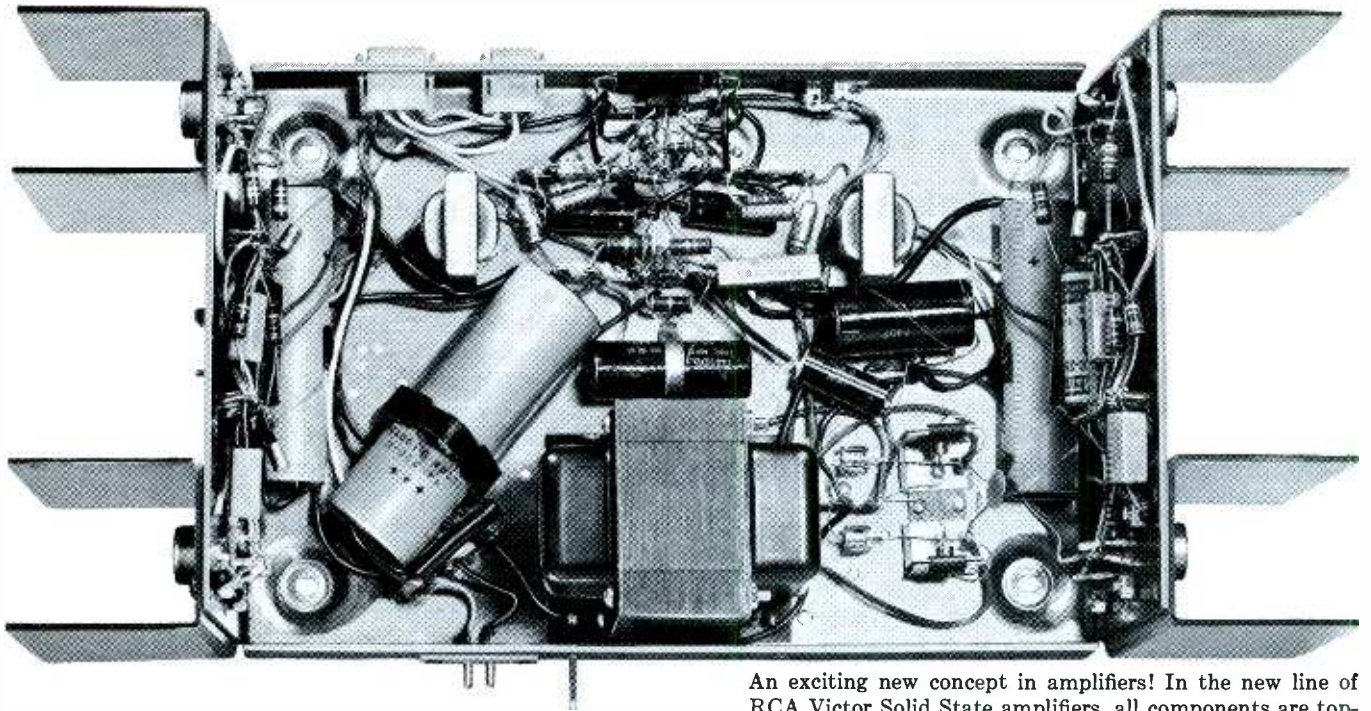


Fig. 2. Signal components are mixed together in the composite-adder stage.



An exciting new concept in amplifiers! In the new line of RCA Victor Solid State amplifiers, all components are top-mounted. This helps dissipate heat, makes servicing easier.

...another advance from RCA Victor for better performance, easier service!

It takes an advanced system of highest quality components to make a top-performance home entertainment instrument. Short cuts or shortcomings anywhere along the line make it difficult for you to get top performance out of a set—and top performance, not excuses, is just what a service customer expects for his money.

For your peace of mind . . . and

profits . . . it's good to know that every RCA Victor instrument is a fully engineered, fully integrated, fully tested system of advanced components. Add your know-how to this kind of engineering excellence and you're sure of one thing: satisfied customers every time!

An RCA Data Service subscription, including the service industry product information digest, "Plain

Talk and Technical Tips," is available from your local RCA Victor distributor.

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


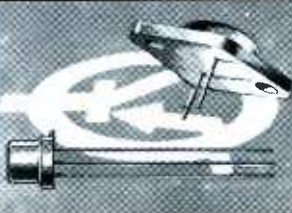

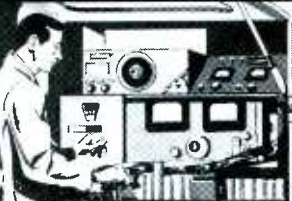


The Most Trusted Name
in Electronics

Tmk(s)®

4 ways to increase your income

RCA Institutes, Inc. offers these four comprehensive home study courses especially designed to help build your income immediately!

 <p>COLOR TV Add Color TV Servicing to your skills with this up-to-the-minute home training course and take advantage of the growing profit potential in this area! Train under the direction of RCA...experts in Color TV</p>	 <p>TRANSISTORS You get the necessary background for semiconductor technology including characteristics of tunnel diodes, rectifiers and other solid state devices. Transistor trainer also available.</p>
 <p>AUTOMATION ELECTRONICS Trains you for the many applications of automation electronics in industry and government including Photoelectronics, Digital Computer Techniques, Synchros and Servomechanisms, Automatic Control Systems, and many more!</p>	 <p>MOBILE COMMUNICATIONS Trains you to service and maintain 2-way radio communications on land, sea, and air! Gives you the technical foundation for space communications!</p>

Take advantage of RCA's Liberal Tuition Plan. You only pay for lessons you order, and have no long-term obligations. Licensed by New York State Education Department. Approved for Veterans.

RCA INSTITUTES, INC.

A Service of Radio Corporation of America
350 West Fourth Street, New York, N. Y. 10014



The Most Trusted Name in Electronics

SEND THIS COUPON NOW FOR COMPLETE FREE INFORMATION

RCA INSTITUTES, INC. Home Study School, Dept. PF-25

350 West Fourth Street, N. Y., N. Y. 10014

Without obligation, rush me free information on the following RCA Home Training Course: COLOR TV TRANSISTORS MOBILE COMMUNICATIONS

AUTOMATION ELECTRONICS

Name _____ Age _____

Address _____

City _____ State _____ Zip _____

CANADIANS—Take advantage of these same RCA courses at no additional cost. No postage. No customs. No delay. Send coupon to: RCA Victor Company, Ltd., 5581 Royalmount Ave., Montreal 9, Quebec.

coupled through a phase splitter to the AUDIO selector switch. Either the left or right signal can be chosen by this switch. The selected audio signal is impressed upon the 38-kc carrier in the modulator stage.

The modulated 38-kc carrier is fed to the carrier-suppressor stage where the L and R sidebands are developed. These sidebands, along with the 19-kc pilot and the L + R (1000-cps audio), are then fed to the composite-adder stage. You will notice in Fig. 2, the L + R signals goes through an audio phase-delay circuit before reaching the adder stage. This phase-delay circuit consists of an audio-phase control adjusted to assure the proper phase relationship between the L + R and L - R signals. The MONO position of the function switch provides an L + R output directly from the phase-delay circuit.

With the function switch in STEREO position, a composite stereo-output signal is obtained. The 19-kc position provides a 19-kc pilot-signal output, and the 67-kc position selects the 67-kc signal from the internal 67-kc oscillator circuit. The desired output, selected by the function switch, receives additional amplification in the final-amplifier stage before it is coupled to the emitter-follower output stage. Emitter-follower output is available as a composite stereo signal at the AUDIO COMPOSITE output jack. This signal is used when the generator output is connected directly to the input of the FM stereo receiver.

An RF OUTPUT jack (100mc) is provided on the front panel. The RF signal consists of the composite stereo signal and a 100-mc RF signal. The RF output is used when the 727 is connected to the antenna terminals of an FM receiver.

Our lab experience with this unit left us convinced it is most suitable for troubleshooting or aligning any stereo receiver. We were equally impressed by the size, weight, and compactness of the Model 727 generator. As it is powered by a 22.5-volt battery, it requires no warm-up period.

An accessory plug-in, 117-VAC, 60-cps power supply is available in case continuous operation is desired. This supply may be interchanged with the battery supply in only a few minutes.

For further information, circle 62 on literature card

Hickok Model 727 Specifications

RF Output:

100 mc adjustable ± 250 kc by RF fine-tuning adjust; output level 500 uv.

Composite Stereo Output

From 0 to 4 volts peak-to-peak, variable; contains either full stereo signal left or right-channel composite), monophonic signal (L-R only), 19-kc pilot carrier, or 67-kc signal.

Internal Signals:

1000-cps audio sine wave to modulate L and R channels.

Channel Separation

35 db.

Front-Panel Controls and Switches:

Two rotary switches—FUNCTION, AUDIO; one variable resistor; composite attenuator; three toggle switches: POWER, L + R ON and OFF, and 19-KC PILOT OFF, 5%, and 10%; output jacks—AUDIO COMPOSITE and RF OUTPUT.

Size (HWD):

8½" x 11" x 5".

Weight:

6 lb.

Power Source:

22.5-volt dry battery (not supplied with the unit). Use Burgess No. 4156, Eveready No. 76), or equivalent.

Price:

\$140.00

Time-Saving Tester



Fig. 3. Six CRT sockets accommodate most currently manufactured types.

Since the television set's CRT is the final and most obvious point at which the picture can be degraded, it is important to have some sure method for determining the merit of the tube. If the testing method also offers corrective measures for common faults, so much the better. The SENCORE Model CR128 CRT Tester—Fig. 3—fulfills these requirements and will perform quickly and easily in the hands of any service technician who will spend an hour or so learning its various capabilities.

Circuitry of the Model CR128 can be divided into three general categories: that required for the SHORTS test; that required for the EMISSION test and meter readout; and, the RC circuit used in the four corrective functions. Fig. 4 shows the simplified schematic of the voltage-divider/neon-indicator circuit used to indicate interelectrode shorts. The approximate voltages applied to the various elements are also shown. Operation (in the SHORTS position of the FUNCTION switch only) is simple and straightforward: with the indicated voltages applied, any leakage path caused by direct shorts, gas, or high-resistance paths will cause sufficient current to flow through one 8.2-megohm resis-

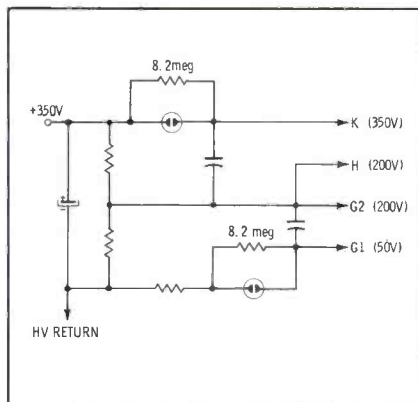


Fig. 4. Resistive voltage divider with neon indicators serves as short-finder.

tor or the other to generate a voltage drop that will light the associated neon indicator.

Meter readout for beam current is made under static conditions with a fixed, predetermined voltage applied to G1 and K, and a voltage on G2 selected by the G2 switch as determined from the setup chart for the CRT under test. The meter is in series with the voltage fed to G2 and is shunted by a diode for protection.

The simplified schematic shown in Fig. 5 shows the power supply for the Model CR128 tester, a conventional voltage tripler, and the special RC charging circuit comprised of a 500-ohm resistor and a 125-mfd capacitor. Capacitor C1 is the source for the rejuvenation, short removal, and welding pulse. The REJ pushbutton is spring loaded, so whenever it is not depressed it provides a charging path for the capacitor. At all times, then, the capacitor is charged until the pushbutton is depressed. When REJ is pushed, the capacitor may discharge through any one of four paths as determined by the FUNCTION switch: RMV SHTS, REJ 1, REJ 2, or REJ 3. A separate section of the FUNCTION switch provides four filament voltage conditions, one for each corrective

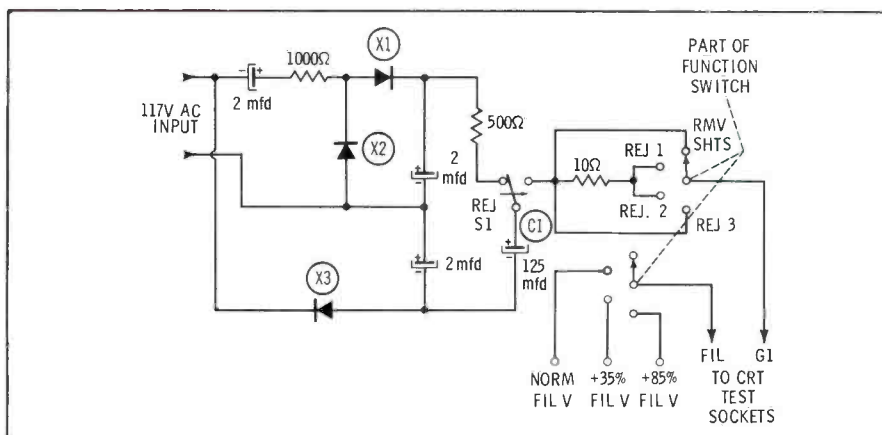


Fig. 5. Rejuvenation, short-removal and welding circuits, with power supply.



PF Reporter

HERE'S HOW SYMFACT HELPS YOU:

Symfact troubleshooting in all TV circuits

Each Symptom chart in SYMFACT presents in easy-to-see form each and every possible change that can possibly occur in the circuit as a result of component failure. A symptom photo shows exactly how the CRT screen looks; actual photos of the waveforms indicate what to expect when using your scope for troubleshooting; a labelled partial schematic portrays changes in DC operating voltages; and thorough explanations tell how and why the component failed and what other components might cause similar symptoms. Every SYMFACT now contains six of these symptom charts for each circuit covered.

ACT NOW subscribe (or renew your present subscription) and receive FREE — SYMFACT Vol. 1, as well as up to three extra issues if you include payment with your order.

- Start my new subscription with your next issue.
- Yes, renew my subscription to PF REPORTER.

39 BIG ISSUES — ONLY \$10.00

If you include payment with order . . . you will receive:

- 39 issues for \$10.00
- 26 issues for \$8.00
- 13 issues for \$5.00

OR IF YOU PREFER:

- 36 issues \$10.00 24 issues \$8.00
 - 12 issues \$5.00 Bill me
- Please check your Business Classification
- Independent Radio Owner, Mgr.
 - TV Serviceman Employee
 - Retailer with Service Department
 - Industrial Elect. Service Mgr.
 - Service
 - Other (Specify occupation and title)

Above rates apply only in USA, its possessions and Canada. Add \$1.00 per year for other countries.

Name _____
Please Print

Firm _____

Address _____

City _____ State _____ Zip Code _____

Printed in U.S.A. SP M/5380/864

FREE OFFER

WITH
150 POPULAR DBE
±10% DIPPED MYLAR*
PAPER BYPASS CAPACITORS
*Registered Dupont T.M.

AEROVOX AKU-102 KIT

KIT CONTAINS:

10 ea. .001	600V	50 ea. .01	600V
5 ea. .0022	600V	5 ea. .022	600V
5 ea. .0033	600V	20 ea. .047	600V
5 ea. .0047	600V	20 ea. .05	600V
10 ea. .005	600V	20 ea. .1	600V

... packaged 5 each in See-Thru plastic bags.



PLUS famous UNGAR #270 DE-SOLDERING KIT

Complete with Instruction Manual and two extra tips.

This labor-saving unit is offered FREE. The cost of this kit is less than the price of the capacitors alone! Makes work on printed circuits as easy as hand wired units.



only
\$27.95

Special Dealer Net With Ungar Kit

Send for more information Today—and the name of your nearest Authorized AeroVox Distributor



**AEROVOX
CORPORATION**

Distributor Division, New Bedford, Mass.
Circle 46 on literature card

78 PF REPORTER/February, 1965

function. In the RMV SHTS position, the pulse from C1 is applied directly to G1 with the filament voltage removed from the CRT; in REJ 1 position, the pulse is fed through the 10-ohm resistor to G1 with normal filament voltage on the CRT; in REJ 2 position, the pulse passes through the same resistor to G1, and filament voltage is increased by 35%; and, in REJ 3 position, the pulse is fed directly to G1, while the filament voltage is increased by 85%. Each successive function provides increased stimulation of emission in the tube being rejuvenated.

A full set of instructions for operation of this instrument is provided, and we recommend that close atten-

tion be paid to the several precautionary notes. The instructions are easily understood and will help the technician realize maximum benefit from the tester.

Understandably, the number of tube faults that can be corrected by any method of rejuvenation is limited, but in cases where improvement can be obtained, the Model CR128 should do it. The unit operates quickly and reliably for determining what to expect from a CRT in terms of brightness and contrast, and, to a limited extent, what life remains in the old bulb. As can any reliable tester, it can save a great deal of time by establishing, at the outset of troubleshooting, the merit of the CRT. ▲

SENCORE Model CR128 Specifications

CRT's tested:

All presently manufactured TV types—both color and black-and-white.

Tests performed:

Interelectrode shorts; beam-current flow (emission); control-grid action and cutoff point; life test.

Corrective functions:

Rejuvenates cathode; removes cathode-to-control-grid shorts; welds open cathodes.

Price:

\$69.95

Controls and Indicators

Function:

Selects SHORTS, EMISSION, GRID CHECK, REMOVE SHORTS, REJ 1, REJ 2, or REJ 3.

Grid Bias:

Applies variable voltage to control grid to determine grid action and cutoff point.

Filament:

Selects proper filament voltage as shown on chart for each CRT under test.

G2:

Selects reference voltage for grid 2 to establish correct meter indication.

Life Test:

Provides means for estimating reserve-emission capability.

Color Gun:

Selects RED, GRN, or BLU color-CRT gun for separate evaluation; either of two color-CRT sockets can be used.

Shorts:

Two neon lamps indicate interelement leakage and/or gassy tube.

Rej:

Pushbutton switch to discharge 125-mfd capacitor through grid circuit of CRT for corrective functions.

Meter:

Shows tube emission capability in terms of BAD, ?, or GOOD.

For further information, circle 63 on literature card

PRECISION TUNER SERVICE

P. O. BOX 272

1210 S. WALNUT ST.

BLOOMINGTON, IND.

EDISON 99653

7.95
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 47 on literature card

Radar Maintenance

(Continued from page 40)

bring it to the shop for repair. The charge is based on known costs, and allows a margin of profit to be made from the day's service calls.

This cannot be done in commercial servicing, at least not when it is as involved as marine servicing usually is. First of all, time is sometimes wasted when a boat fails to meet its schedule to or from a certain point. The technician cannot be expected to take this loss; if he does, he is very soon out of business. The miles traveled often vary widely, depending on exact conditions of meeting the vessel. Other costs occur, such as bridge tolls, taxi fares, meals on the road, etc. And the time actually spent repairing the system always varies. This last item deserves more comment.

In the case of the television example, if the set is not done in a predetermined time, the set goes to the shop where it is subjected to bench service procedures. The radar system, on the other hand, cannot be taken to the shop for bench service, so every job becomes a field repair. This sometimes complicates things, even as it would if applied to all television service calls, but with the radar system there is no alternative.

Therefore, it is necessary that marine service be charged on a portal-to-portal basis, and an hourly rate be charged from the time of leaving the shop until the time of return.

Table 3. List of major radar manufacturers.

Bendix-Pacific Division
Bendix Aviation Corp.
8211 Lankershim Blvd.
North Hollywood, California

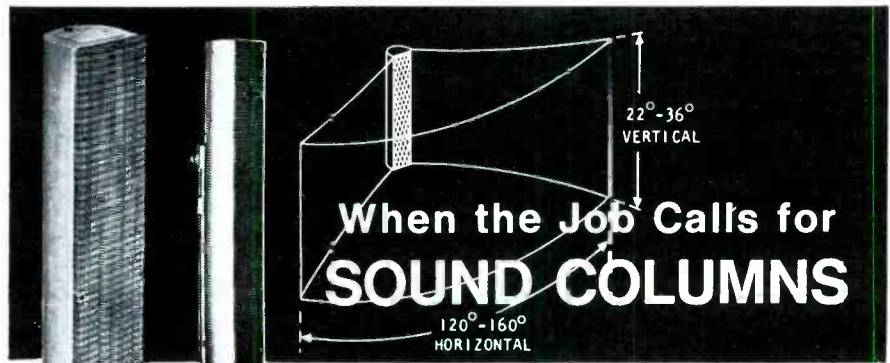
Decca Radar, Inc.
386 Park Avenue, S.
New York 16, New York

Raytheon Company
Marine Radar Division
Newton, Mass.

RCA Service Company
Radiomarine Service
4265 Duncan Avenue
St. Louis, Missouri

Sperry Gyroscope Co.
Division of Sperry-Piedmont
3807 West 150th Street
Cleveland 11, Ohio

Note: Addresses are of service divisions of the various manufacturers, to whom inquiries about service can be directed.



When the Job Calls for
SOUND COLUMNS

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.

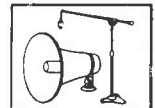
ECONOMY—You can afford better coverage at "Columair" budget prices. C-46 (Six 4" speakers, 20 watts), \$37.50 Net. C-66 (Six 6" speakers, 40 watts), \$57.00 Net. SS-4 Stand, \$13.50 Net. MK-1 Kit, \$1.20 Net.

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 PF3-12



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

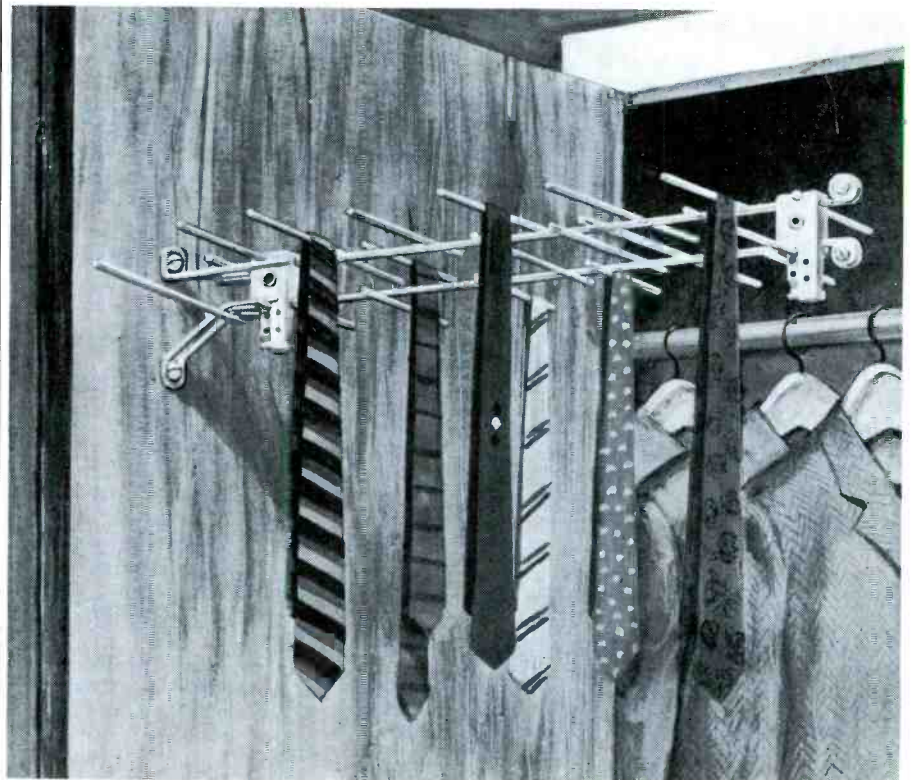
Canada: Atlas Radio Corporation, Toronto



THIRTY YEARS OF LEADERSHIP IN COMMERCIAL SOUND

Circle 48 on literature card

The Golden Dart is the world's finest outdoor UHF antenna. It uses the Periodic design principle to deliver peak performance on all channels. For the finest indoor UHF antenna, use the Blonder-Tongue Golden Arrow. Blonder-Tongue, Newark, N.J. 07102



nearly everybody uses the Blonder-Tongue UHF Golden Dart

Circle 45 on literature card

Some marine technicians prefer to charge one rate when traveling or waiting for a boat, and another, higher rate for the time actually on board and working on the radar system. Some charge a premium for hours before or after regular shop hours, while others charge a straight hourly rate.

In determining a fair hourly rate, the shop owner must use the same

methods he uses in determining an hourly rate for other work, considering his costs for manpower, overhead, and a fair rate of profit. Another factor worthy of consideration is the cost of stocking special-purpose tubes and special parts. This cost occurs because there is very little, if any, markup or profit margin in special items of this nature; therefore a normal profit cannot be

made, even though the items represent substantial investment of capital. So this cost must be borne by the overhead of the service establishment, and must be included in determining what to charge for service labor.

Hourly rates vary over the country, ranging from \$5.00 per hour to as much as \$12.00 per hour for straight time. Some servicers add a premium for overtime, and there are many different methods for determining what constitutes overtime. Others charge a lower rate for travel or waiting time, as mentioned before.

Here is a typical example showing one operator's system of charges; this same schedule has proven acceptable in several areas: \$7.00 per hour is charged from 8 AM to 5 PM on weekdays. \$10.50 per hour is charged for other time except Sundays and holidays; for these latter, \$14.00 per hour is charged. Travel or waiting time is charged at a straight \$7.00 per hour, no matter when it occurs. Car mileage is charged at 12¢ per mile, portal to portal. Any other expenses incurred during the trip or job are charged to the customer at cost.

The system outlined works well in the areas where it is being used, but it is only a guide; the individual shop owner must determine his own plan. Once adopted, the plan should be explained thoroughly to all customers, to alleviate any possible misunderstanding over billing procedures.

Sometimes questions arise as to the charging of travel and waiting time. It is rare that a customer will pose this question, for the delays caused to his ship by NOT having the radar serviced at a convenient point, in a convenient manner, would far outweigh the bill he will receive from the technician who provides such prompt service. A more likely customer complaint would stem from *lack* of adequate service, caused either by incompetence, or by a technician who just plain wasn't there when and where service was promised.

In this first part of this service, we have considered the problems of who, what, when, where, and why; in the second and third parts we will talk about an even more important aspect of servicing marine radar systems—HOW? ▲



March 22-26, 1965

ELECTRICAL-ELECTRONICS

- ◆ Exhibit hours (4 days): Monday & Thursday, 9:45 a.m.-9 p.m.; Tuesday & Wednesday, 9:45 a.m.-6 p.m.
- ◆ Technical sessions (5 days) 10 a.m.-5 p.m. (Hilton, Tuesday to 10 p.m.)
- ◆ 80 subject-organized technical sessions presenting 400 vital "breakthrough" papers.

◆ Over 1000 Exhibits using 140,000 running feet of display units in N.Y. Coliseum & N.Y. Hilton.

◆ Gala IEEE Banquet on Wednesday, March 24, 1965 at 6:45 p.m. in Grand Ballroom, N.Y. Hilton.

◆ Registration: \$2.00 IEEE Members, \$5.00 Non-members. High School students admitted Thursday afternoon only, \$2.00 if accompanied by an adult (not over 3 per adult).



NEW YORK COLISEUM and the NEW YORK HILTON

Buses every few minutes

Circle 58 on literature card

BOOK REVIEW

Basic Electronics; Bureau of Naval Personnel; Dover Publications, Inc., New York, New York; 459 pages, 6½ x 9¼, paperback, \$2.75. This republication of Navy Training Course NavPers 10087-A has not been changed from the Navy version except for the omission of a list of training films. Nineteen chapters include fundamentals of electron tubes and transistors, tuned circuits, amplifiers, oscillators, transmission lines, transmitters, receivers, and an introduction to radar. The last two chapters serve as an introduction to computers. An appendix lists electronic color codes and symbols. An 8½-

page index is also included.

The reader must already have an understanding of basic electricity if he is to comprehend this text. A knowledge of basic algebra and trigonometry is needed to thoroughly understand some sections. Line drawings, schematics, charts, graphs and waveform drawings are used throughout to supplement the text.

The introduction urges the reader to study the book with pencil and paper and to refrain from skimming the text. This is excellent advice if the aspiring technician is to get the most from the volume.

Flat CRT's


(Continued from page 37)

Since this type of correction is made at the expense of focus, the yoke is never fully focus-corrected and the remainder of the correction is accomplished by small pin-cushion magnets mounted on the yoke.

In the vertical-sweep circuits, the required yoke-current waveform is determined primarily by the characteristics of the vertical-output tube and the output-transformer impedance at high currents; final shaping of the grid-drive waveform is achieved through the selection of circuit components as in conventional sets.

As far as the horizontal-sweep circuits are concerned achieving good horizontal linearity becomes somewhat more difficult, since most methods used to generate the sweep "stretch" the left side of the screen. This distortion is corrected in the horizontal-sweep circuit shown in Fig. 5 through the addition of a linearity circuit—C1, C2, L1, and R1.

Fig. 6 illustrates the development of the "S"-shaped deflection waveform. Keep in mind that these are waveforms of current in the yoke, not voltage waveforms. Fig. 6A shows the ideal "S" waveform; 6B shows the sawtooth sweep waveform normally found in sweep circuits used with conventional rectangular CRT's. Note that this latter waveform tends to be exponential at the left and slightly flattened out at the right to accommodate the sweep to the face of the CRT and yoke windings. The exponential change is the result of RL discharge of the yoke current through the damper circuits; the flattening is caused by general circuit losses. Insertion of a .033-mfd capacitor in series with the yoke (C3, Fig. 5) introduces the parabolic current shown in Fig. 6C. The combination of this parabolic current with the sawtooth in Fig. B results in the waveform of Fig. 6D. Note that the addition of this "parabolic correction" component has modified the waveform by flattening the right side as desired, but also has intensified the exponential change at the left side. This nonlinearity of the left side of the waveform would normally result in compression at the left side of the screen; but, in this instance, it is corrected for by the addition of the linearity




TYPE CTC . . . cardboard tube electrolytics especially designed for exact placement in television sets . . . one end closed . . . long insulated leads out the other end . . . sealed with high melting point wax . . . guaranteed for one year . . . individually packaged.

PLANET SALES CORP.
225 Belleville Ave.
Bloomfield, New Jersey

Circle 50 on literature card

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 51 on literature card

NOW...A NEW ELECTRONICS SLIDE RULE with complete instruction program



Here's a great new way to solve electronic problems accurately, easily . . . a useful tool for all kinds of radio-TV servicing including CB, mobile and marine radio. The Cleveland Institute Electronics Slide Rule is the only rule designed specifically for the exacting requirements of electronics computation. It comes complete with an illustrated Self-Training Course consisting of four lessons . . . each with a short quiz you can send in for grading and consultation by CIE's expert instructors.

See for yourself. You will learn how to use special scales to solve problems dealing with

reactance, resonance, inductance, AC and DC circuitry, etc. And, as an added bonus, you can use this high-quality rule for conventional computation, too.

This all-metal Electronics Slide Rule is a full 10" long and is made to our rigid specifications by a leading manufacturer of measuring instruments. Slide Rule, Self-Training Course and handsome top-grain leather carrying case . . . all yours for just \$14.95. Cleveland Institute of Electronics, 1776 E. 17th St., Dept. PF-101, Cleveland, Ohio 44114.

SATISFACTION Warranty

The Electronics Slide Rule with Self-Training Course is available only from Cleveland Institute of Electronics, and is covered by CIE's exclusive "Satisfaction Warranty". Order it now . . . use it for ten full days. Then, if you're not completely satisfied, you may return the Slide Rule with Self-Training Course and CIE will refund full payment. Patented by U. S. Patent Office Number 3,120,342.

SEND COUPON TODAY

Cleveland Institute of Electronics
1776 East 17th St., Dept. PF-101
Cleveland, Ohio 44114

Please send me your Electronics Slide Rule with Self-Training Course and top-grain leather carrying case. I'm enclosing \$14.95.

Please send descriptive brochure only.

Name _____ (Please Print)

Address _____ County _____

City _____ State _____ Zip _____

A leader in electronics training . . . since 1934

Circle 52 on literature card

circuit described previously. The fully corrected "S"-shaped waveform is shown in Fig. 6E.

Troubleshooting Tips

Standard troubleshooting techniques may be used when checking the sweep circuits associated with "flat-face" CRTs. However, special attention should be given to scope examination of the circuit waveforms to ensure that the sweep circuits are providing the proper shaping. Horizontal linearity, as mentioned earlier, is largely dependent on two things: (1) components in

the horizontal-linearity circuit; and (2) the parabolic-correction capacitor connected in series with the horizontal-yoke winding. If horizontal nonlinearity results, especially apparent at the left side, carefully check these circuit components by substitution. Also check for correct operating voltages and waveforms against the schematic diagram and note carefully any symptoms of overheating, leaky capacitors, charred resistors, and so on.

Vertical-sweep circuits merit the same careful consideration as the horizontal circuits, but be especially

New CB-10 solid state transceiver



ACTUAL PERFORMANCE:

The CB-10 is a completely transistorized, extremely compact transmitter/receiver offering five-channel operation and the highest performance levels yet achieved in solid state CB transceiver design.

Its three stage transmitter is rated for full authorized power with maximum modulation capability. The dual-conversion receiver provides excellent adjacent-channel and image rejection • A series-type noise limiter drastically cuts auto and local interference • A special jack permits use of an external paging or P.A. speaker • Receiver sensitivity is less than 1 μ v S/N ratio • Power requirement is just 1.0 amps on transmit (max. modulation) and 0.2 amps on receive.

ACTUAL SIZE:

2 $\frac{5}{8}$ inches high, 6 inches wide, 9 $\frac{1}{2}$ inches deep.

ACTUAL PRICE: **\$149⁹⁵**



"Quality through Craftsmanship"

hallicrafters

Export: International Div., Hallicrafters.

Canada: Gould Sales Company, Montreal, P. Q. 5th & Kostner Aves. • Chicago, Ill. 60624

Dealer franchises available in selected territories. Write for information.

Circle 53 on literature card

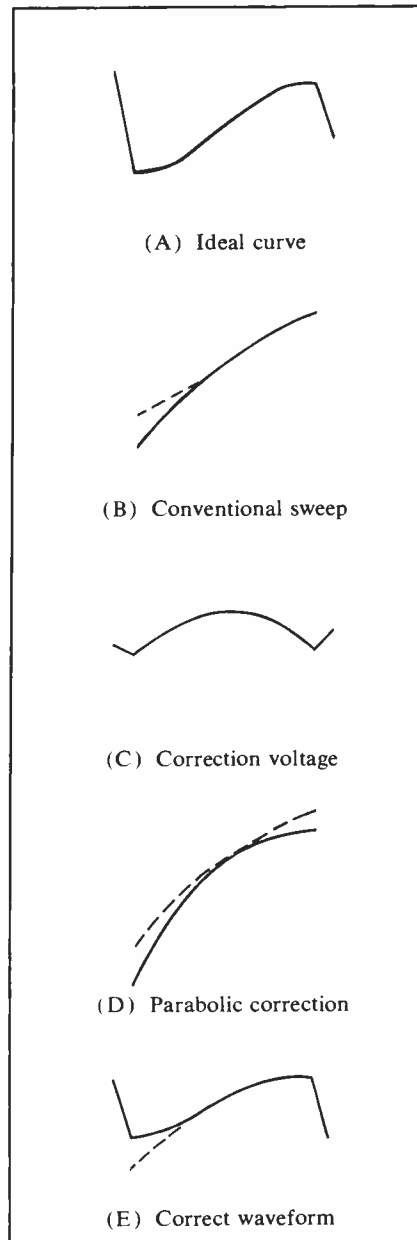


Fig. 6. Waveforms show steps in formation of the "S" curve horizontal sweep.

careful of shorted or grounded vertical-output transformer windings, leaky or shorted feedback capacitors, and shorted yoke windings.

A lack of focus throughout the raster may be caused by improper settings of the focus voltage taps or potentiometer (if used). A lack of definition in the corners of the raster may result from a defective yoke winding, local electrostatic charges, or mispositioning of the yoke pin-cushioning magnets.

Two final notes of caution: When replacing bonded-shield CRTs, be careful to (1) replace the CRT with the same type; and (2) avoid placing undue stress or pressure on CRT mountings and yoke windings, as you would with any other CRT. ▲

Tracking Adjustments

(Continued from page 33)

ably off resonance. The trimmer capacitors have not changed value; however, the inductors will cause tracking errors, as we mentioned. The antenna and RF slugs (not trimmers) must now be peaked on 600 kc. The amount of tuning required to reach the peak indicates how well they are tracking. If considerable adjustment is necessary, tracking is poor and step 4 (1615 kc trimmer adjustment) should be repeated.

The trimmers should be peaked at 1615 kc and the slugs at 600 kc, back and forth, until no improvement can be realized. Once this point has been reached, the receiver is in best possible alignment.

FM Tuner Tracking

FM tracking techniques are practically identical to AM. The output connections shown in Fig. 3 are used. The frequencies used are different, but the approach is the same. The trimmers are usually adjusted at 108.5 and the slugs at 88 mc. Proper FM tracking results in maximum receiver sensitivity, which can

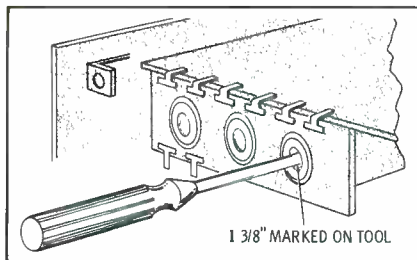


Fig. 6. Oscillator slug is usually preset as the first alignment step.

solve some customer complaints of fading in the auto radio FM fringe area. Tracking checks and/or adjustments will often help locate defective tuned-circuit components, too.

Troubles Uncovered

Open or leaky tuned-circuit capacitors show up immediately during tracking adjustments, as do open or partially shorted coils. Erratic behavior, or failure to settle down "on track," can reveal intermittent coils or capacitors that would be impossible to locate otherwise. Temperature-sensitive or otherwise defective capacitors will make it difficult to adjust the set for proper tracking, and in some cases the set will refuse to track.

Most coils are wound with a special pattern that requires that they be wired properly. If a replacement coil is soldered into the set backward, tracking will be impossible. Tracking will also be affected if some of the turns were left off of the coil during manufacture.

It is very important that the antenna trimmer be peaked, as previously described, when the radio is reinstalled in the car. The only way the antenna circuit can be adjusted precisely is with the antenna it normally uses.

Summary

Alignment and tracking checks can be a significant troubleshooting aid particularly on tough borderline radios. The larger manufacturers are now aligning AM radios with automatic equipment, which suggests the possibility of improving the alignment if a new-set customer is dissatisfied. The significance of alignment can be realized even when you satisfy a customer by merely peaking his antenna trimmer. The thorough job makes the difference between a happy and an unhappy customer. ▲

great profits



that's about the size of it

Microminiaturization has come to cartridge design in the new Sonotone Micro-Ceramic[®] Cartridge—a king-sized profit-maker in a tiny case. This remarkable new cartridge updates to 1965 performance almost any phonograph using a ceramic cartridge produced within the past 20 years.

The Sonotone Micro-Ceramic Cartridge embodies all the advantages of miniaturization and light weight. Designed for low mass, lightweight tonearms—it weighs less than 1 gram (without bracket). Superb stereo performance is assured by—high compliance; ability to track at the low forces required by today's modern record changers; excel-

lent separation and a smooth, clean response over the full audio range. To top it off, all Micro-Ceramic cartridges are equipped with the virtually indestructible Sono-Flex[®] stylus. For ease of installation, three different standard mounts are available.

Four Micro-Ceramic cartridges cover all of your replacement needs; the "27T," a high capacitance model for transistorized phonographs; the high compliance "25T" for deluxe stereo units; the "26T" and "28T" for replacement in a wide range of popularly priced phonographs.

For comprehensive Cartridge Replacement Guide, write:



Sonotone Corp., Electronic Applications Div., Elmsford, N. Y.

Circle 54 on literature card

February, 1965/PF REPORTER 83



Be a wise owl!

How to cut inventory, increase profit on picture tubes!



Save space, save dollars! Reduce your basic tube inventory to the 5 Admiral Ensigns. They replace 43 different tube types.

Each Admiral Ensign picture tube must pass rigid quality controls for finest performance.

Call your Admiral Distributor now . . . start cutting inventory cost; pocketing new profits right away!

ENSGN 17BJP4 REPLACES	17ATP4 17ATP4A 17AVP4	17AVP4A 17BUP4 17CBP4	17CLP4
-----------------------------	-----------------------------	-----------------------------	--------

ENSGN 21AMP4A REPLACES	21ACP4 21ACP4A 21AMP4	21AQP4 21AQP4A 21CUP4	21BSP4
------------------------------	-----------------------------	-----------------------------	--------

ENSGN 21CBP4A REPLACES	21FLP4 21ALP4 21ALP4A 21ALP4B 21ANP4 21ANP4A	21ATP4 21ATP4A 21ATP4B 21BAP4 21BNP4 21BTP4	21CBP4B 21CMP4 21CVP4 21CWP4 21DNP4 21CBP4
------------------------------	---	--	---

ENSGN 24CP4A REPLACES	24ADP4 24CP4 24QP4	24ATP4 24VP4 24VP4A	24XP4
-----------------------------	--------------------------	---------------------------	-------

ENSGN 24AEP4 REPLACES	24DP4A 24YP4	24ANP4 24ZP4	
-----------------------------	-----------------	-----------------	--

Be wise . . . standardize on

Admiral® ENSIGN REPLACEMENT PICTURE TUBES

Always Precision Crafted Quality
Circle 55 on literature card

Product Report

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



TV Preamp (129)

A five-transistor coaxial TV amplifier has been introduced by **Jerrold Electronics Corporation**. Designated the Model SPC-132 Super Powermate, the new pre-amp is designed to replace the "De-Snow" Model DSA-132, a tubed unit. The SPC-132 consists of two separate units. Model SPC is a boom-mounted two-transistor preamplifier. Model 132 is a combination remote power supply and three-transistor post amplifier. The SPC-132 provides 29 db gain on the high VHF band and 25 db gain on the low. Noise figure is 4.9 db on the low band and 7.9 db on the high. These noise figures include the loss in 75' of RG-59 coaxial cable between the SPC and the 132. The SPC-132 is expected to find wide application as a broadband and preamplifier for master TV antennas in motels, apartments, and commercial buildings.



CB Crystals (130)

CB crystals to fulfill most popular replacement requirements are offered by **Semitronics**. These hermetically sealed crystals have a frequency tolerance of .005% or better, are available for all 23 channels, and are fully guaranteed. They

are packaged in two-tone plastic boxes and are priced at \$2.95 each.



Junior Seizers (131)

New straight- and curved-nose Junior Seizers only 5" long are now offered by **Xcelite**. Smaller and slimmer than regular 6" Seizers, the new Seizers reach more readily into tight spots and facilitate close-quarter work involving fine wires and small components. Prices are the same as for 6" Seizers—\$5.70 for straight, \$5.90 for curved.



Capacitor/Desoldering-Tool Kit (132)

A new servicemen's kit, the AKU-102 from **The Aerovox Corp.**, consists of 150 Type DBE Dipped Bi-Electric Mylar-paper capacitors, packed five each in see-thru plastic bags. The ten most popular values are included. In addition, the kit offers an Ungar #270 De-Soldering Kit with two extra tips and complete instruction manual. The entire kit is offered to dealers at a price of \$27.95.



D-101




D-201



D-301


Auto Radio Suppressors (133)

A new line of ignition suppressors and condensers from **Duosonic**, Models D-201 and D-301, are hermetically sealed in molded bakelite, and are impervious to heat and moisture.




OHMITE
1000 OHM
1/2 WATT
RC20GF102K

Little Devil® Composition Resistors




Type AB 2-Watt Molded Pots

five ways to
stop customer
“static”




Gold-Bonded Germanium Diodes



OHMITE
BROWN

Brown Devil® Wire-Wound Resistors



OHMITE
995-5A

Series 99 Wire-Wound Resistors

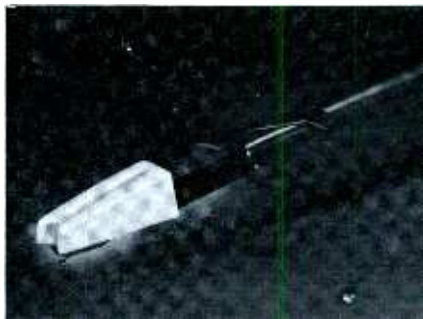
Customer “static” is hard on the ears . . . hard on profit. But you’re always safe with Ohmite quality replacements in your repair jobs. Order Little Devils in handy cabinet assortments or on Tally-Tape; all popular sizes and values. Select AB Pots from 50 ohms to 5 megohms in several shaft lengths. Choose from ninety 1N types of diodes. Get Brown Devils from 3 to 20 watts in 0.5-ohm to 100K-ohm values. Order Series 99 resistors in 1½, 2¼, 3¼, 5, 11 watt sizes from 1 to 51,000 ohms. Ask your distributor for the latest edition of Ohmite’s Stock Catalog 30.

Be right with



OHMITE
RHEOSTATS • RESISTORS • VARIABLE TRANSFORMERS • TAP SWITCHES
TANTALUM CAPACITORS • RELAYS
R.F. CHOKES • SEMICONDUCTOR DIODES

Circle 57 on literature card



Semiconductor Transducer (134)

A new stereo transducer, the “Siliconic” U-15, utilizes small silicon elements and is designed to match low-resistance inputs of transistorized amplifier circuitry, resulting in a boost in the electrical energy transferred from transducer to amplifier. The U-15 provides greater power than is normally available from ceramic or magnetic cartridges and has a frequency-response range from DC to beyond 30,000 cps. The **Euphonics** transducer is to be used with an external power source and a low-mass tone arm.



Mobile Sound System (135)

Any car or truck can be equipped for soundcasting in just 45 seconds with the new Ampli-Vox Sound Cruiser, mobile sound system from **Perma-Power Company**. The Ampli-Vox Sound Cruiser amplifier plugs into the automobile cigarette lighter socket, the speakers clamp to the roof, and the unit is ready for use. The system includes a 32-watt (EIA music power) all-transistor amplifier, a noise-cancelling microphone for intelligibility, and two weatherproof horn speakers. The amplifier is supplied with a handle for carrying or mounting under the dash. The amplifier offers frequency response of 50 to 15,000 cps, with less than 5% distortion at full output. It has a master volume control, an auxiliary (radios, tuners, records, etc.) control, auxiliary standby switch, tone control, two outputs for 8- or 16-ohm speakers, and two inputs for microphone and auxiliary. Signal-noise ratio is 80 db. The amplifier operates on 12 volts DC, with idle current of 40 ma, but can be adapted for AC or flashlight-battery operation. The two Implex horn speakers are mounted on a cartop carrier which clamps to the car. Suggested user net price is \$169.95.

new SAMS BOOKS

Understanding Electronic Circuits

by *Farl J. Waters*. A down-to-earth explanation of all the basic circuits used in most electronic equipment. Begins with basic principles applicable to all circuits, then describes the use and operating principles of amplifiers, oscillators, modulators, frequency mixers, frequency converters, limiters, detectors, FM discriminators, rectifying power supplies, pulse generators, volume controls, and automatic frequency controls. Written so clearly it takes the “mystery” out of understanding electronic circuits. Supported by many helpful illustrations. 160 pages; 5½ x 8½". **\$2.95**
Order **UEW-1**, only

Understanding Electronic Components. An ideal companion volume to the above book, by the same author. 160 pages; 5½ x 8½".
Order **UEC-1**, only. **\$2.95**

Acoustical Tests & Measurements

by *Don Davis*. Provides a solid understanding of the entire subject of acoustical measurements; based on actual field test work, using commercial equipment. Contains practical, time-saving solutions to actual problems encountered in the field; minimum math required for understanding. The author is an expert in this field, and an authority on auditorium acoustics. An invaluable book for phone company special service engineers, plant maintenance engineers, communications engineers, noise control specialists, architectural engineers, broadcast engineers and technicians, hi-fi fans and students. 192 pages. **\$4.95**
5½ x 8½". Order **ADS-1**, (softbound), only. **\$4.95**
Order **ADH-1**, (hardbound), only **\$6.95**

Amateur Radio Mobile Handbook

by *Charles Caringella*. Complete coverage of this increasingly popular ham activity; information both for the “old-timer” and the newcomer to mobile radio. Explains the design differences peculiar to battery-operated mobile equipment; explains circuitry and construction of commercially built equipment for HF-VHF ham bands. Tells you how to build mobile transmitters, transceivers, converters, modulators, etc.; gives full details on dynamos, vibrator supplies, transistorized DC-DC power units, mobile-type mikes, antennas, etc.; discusses elimination of ignition noise and other interference. Complete and authoritative. **\$2.95**
160 pages; 5½ x 8½". Order **AMH-1**, only

The Elements

by *Samuel Ruben*. A quick-reference single-volume compilation of available information covering the 103 accepted elements. Invaluable to students, lab technicians, engineers and anyone interested in the properties of the elements. Gives the following constants where applicable: Atomic number and weight, natural occurring isotopes, density, melting and boiling points, latent heat of fusion, specific heat, coefficient of lineal thermal expansion, thermal conductivity, electrical resistivity, ionization potential, electron work function, oxidation potential, chemical valence, electrochemical valence, ionic radius, valence-electron potential, electronic configuration, valence electron, crystal form. Includes periodic table of the elements arranged according to Atomic Number Z and columnal relation to the inert gases. 112 pages; 5½ x 8½". **\$1.95**
Order **TER-1**, only

Chain Saw Service Manual

Includes servicing diagrams and data for the following chain saw brands: Bolens, Canadian, Clinton, Cobra, Comet, David Bradley, Eclipse, Hoe, Hoffsco, Homelite, Indian, Lancaster, Lombard, Mall, McCullough, Mono, Partner, Pioneer, Poulan, Power Products, Remington, Root, Sears, Solo, Tecumseh, West Bend and Wright. Special section describes general operating principles and basic service fundamentals applying to all chain saw motors. A special Sams service manual prepared to meet the increasing demand for information on this subject. 176 pages; 8½ x 11". **\$3.35**
Order **CSM-1**, only

HOWARD W. SAMS & CO., INC.

Order from your Sams Distributor today, or mail to Howard W. Sams & Co., Inc., Dept. PF-2, 4300 W. 62nd Street, Indianapolis, Ind. 46206

Send me the following books:

- UEW-1 ADS-1 AMH-1 CSM-1
 UEC-1 ADH-1 TER-1

\$ _____ enclosed.

Send FREE Sams Booklist

Name _____

Address _____

City _____ State _____ Zip _____

My Distributor is _____

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

The Golden Dart is the world's finest outdoor UHF antenna. It uses the Periodic design principle to deliver peak performance on all channels. For the finest indoor UHF antenna, use the Blonder-Tongue Golden Arrow. Blonder-Tongue, Newark, N.J. 07102



nearly everybody uses the Blonder-Tongue UHF Golden Dart

Circle 49 on literature card

END TV TUNER CALLBACKS

with

CHEMTRONICS

IMPROVED
TUN-O-LUBE



Cleans Faster, Lubricates Longer!

- Will not harm plastics
- More powerful spray
- Will not detune TV tuner

SERVICEMEN: For all your chemical needs, see the Chemtronics Display at your Distributor!

CHEMTRONICS INC.

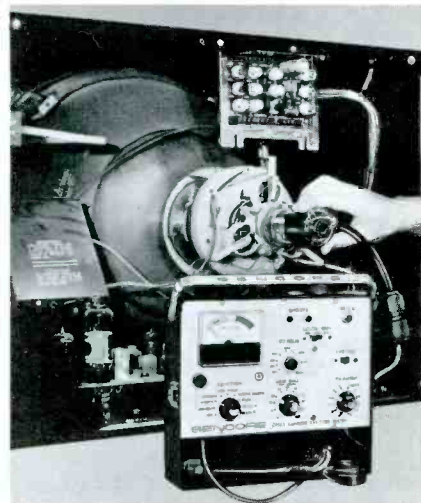
1260 Ralph Avenue, Brooklyn, N.Y. 11236

Circle 56 on literature card



Transistorized Antenna Booster
(136)

A high-gain, low-noise antenna booster, designed to help improve both fringe and metropolitan area color TV, has been announced by **The Alliance Manufacturing Co., Inc.**, subsidiary of Consolidated Electronics Industries Corp. Called "Genie-Color Booster," the new device has an "on-off" switch to bypass the unit when using an external UHF converter. The high overload factor and resistance to cross-modulation helps provide trouble-free use in any type of signal area. The new TV antenna amplifier combines an insertion gain of from 10 to 12 db, with a noise factor as low as 4 to 6 db, and includes an FM trap. List price, complete with mounting hardware, is \$42.95.



CRT Checker (137)

The new CR133 CRT Checker by **SEN-CORE** is designed to test all present picture tubes—plus future tubes, too. The 10-lb unit checks emission, interelement shorts, control-grid cutoff capabilities, gas, and expected life. Checks conventional b-w, new low-drive b-w, round color, and new rectangular color tubes. Two plug-in replaceable cables contain all sockets required. G2 voltage is variable from 25 to 300 volts, insuring non-obsolence when testing new "semi-low G2" CRT's. Automatically controlled rejuvenator (ACR) applies rejuvenation voltage as required by individual tube condition, precisely timed to prevent over-rejuvenation or tube damage. The ACR feature is most useful for color-tube gun equalization to insure proper gray-scale tracking. Price of the hand-wired, steel-encased unit is \$89.95.



CB-Marine Combo (138)

Something new in marine communications is a self-contained CB module that converts the **Pearce-Simpson** "Catalina" 68-watt marine radiotelephone to a dual-system marine/CB radio. This doubles the number of effective communications channels—a total of 11 (5 marine and 6

CB). Called the "Sea-B-Mate," the unit provides contact with home, office, or mobile CB units as well as the usual marine facilities. The cabinet is 3 1/16" wide, 6 7/8" high, and 12 1/2" deep; weighs 3 lb 11 oz; and—complete with noise-canceling push-to-talk microphone and crystals—is priced at \$89.90.

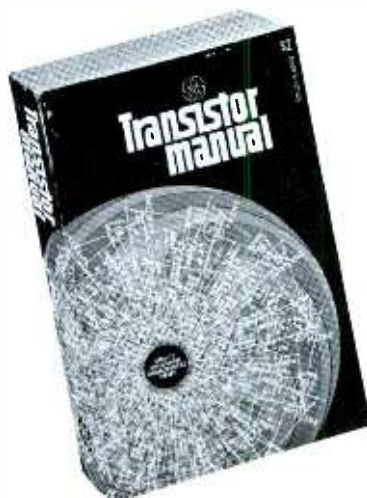


Temperature-Controlled Iron (139)

The user can now specify the temperature setting of the soldering iron he needs. These new pencil irons from **Hunter Tools** are available in seven different temperatures ranging from 450°F to 1000°F. Other features include an air-cooled handle and stainless steel jacket on the element. All are lightweight, balanced, and available in various handle colors.

New Literature

Technical Booklets You Can Buy



Transistor Manual (140)

General Electric Semiconductor Products Division has completed the seventh edition of their transistor manual. This paperback publication contains 652 pages and 20 chapters of authoritative information on transistors and diodes. Nearly 80% of the material in this latest edition is new and includes an explanation of tunnel-diode circuit applications. Oscillators, small-signal characteristics, high-frequency considerations, and logic are discussed. The manual contains a wealth of technical information on all aspects of semiconductors and is available from **General Electric Semiconductor Products Department, Syracuse, New York**, priced at \$2.00.

Winegard

Dealer of the month

No. 33 of a Series

Bob Grimes says, "We're 70 miles from our nearest TV station, that's why we install Winegard C-43's and C-44's exclusively."



Winegard salutes Davis Paint Assoc. Store, Bedford, Iowa and their distributor Mid-State Distributing Company, Des Moines, Iowa.

When Bob Grimes started his TV sales and service operation just eight years ago, he felt that a dealer should have a selection of antenna brands. "But in a short time," Bob said, "I was using nothing but Winegard."

"We're in a fringe area, 70 miles from our nearest TV station and 100 miles or more from the others. We find that Colortron C-43's and C-44's bring in the best signal possible. In the tougher locations, we add AP220T and AP220N amplifiers to keep the signal coming in strong."

"Another reason we prefer Colortron is construction. I've talked to insurance adjustors who tell us that a properly installed Colortron does an outstanding job resisting wind and ice storms and my experience has proven this to be true."

The confidence Bob Grimes has shown in Winegard comes from installing Winegard products and seeing them in action. He is one more important service man who knows Winegard's standards of excellence first hand.

Winegard Co.

Antenna Systems

D3009B Kirkwood • Burlington, Iowa
Circle 60 on literature card

February, 1965/PF REPORTER 87

INDEX TO ADVERTISERS

FEBRUARY, 1965

ATR Electronics, Inc.	13
Admiral Sales Corp.	84
Aerovox Corp.	78
Amperex Corp.	Cover 2
Antennacraft Co.	70
Antenna Specialists Co.	13
Arco Electronics, Inc.	31
Atlas Sound	79
B & K Mfg. Co.	
Div. of Dynascan Corp.	41, 43, 50
Belden Mfg. Co.	21
Blonder-Tongue Labs	44, 79, 86
Bussmann Mfg. Div.	24, 25
Castle TV Tuner Service	20
Channellock, Inc.	62
Channel Master Corp.	59
Chemtronics, Inc.	86
Cleveland Institute of Electronics	81
Enterprise Development Co.	66
Finney Co.	51
Hallicrafters Co.	82
Heath Co.	72
Hickok Electrical Instrument Co.	67, 71
IEEE	80
Injectoral Co.	48
JFD Electronics Corp.	16, 17
Jensen Industries	74
Jerrold Electronics	49
Lafayette Radio Electronics Corp.	26
Lectrotech, Inc.	46
Littelfuse, Inc.	Cover 4
Multicore Sales	48
Ohmite Mfg. Co.	85
Philco Corp.	61
Planet Sales Co.	81
Precision Tuner Service	78
Quality Tuner Service	66
RCA Electronic Components and Devices	14, 15, 18, 19, 45, Cover 3
RCA Institutes, Inc.	76
RCA Parts and Accessories	65
RCA Sales Corp.	75
Sams, Howard W. & Co., Inc.	73, 85
Sarkes Tarzian, Inc. Tuner Service	9
SFNCORE, Inc.	52, 53, 54, 55, 56, 57, 60
Simpson Electric Co.	63
Sonotone Corp.	83
Sprague Products Co.	11, 12
Sylvania Electric Products, Inc.	47
Trio Mfg. Co.	66
Valley TV Tuner Service	81
Winegard Co.	68, 69, 87
Xcelite, Inc.	48



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

64. **ANTENNA-CRAFT**—Latest literature on *Channel-Spinner*, a new broad-band, high-gain VHF-UHF TV antenna.*
65. **ALLIANCE**—Colorful 4-page brochure describing in detail all the features of *Tenna-Rotors*.
66. **BLONDER-TONGUE**—Information on both indoor and outdoor VHF-UHF TV amplifiers.*
67. **CORNELL-DUBILIER**—Replacement component selector, TV-FM reception booklet, 4-page rotor brochure, and vibrator replacement guide.
68. **FINNEY**—Catalog UVF describes new swept-element log-periodic type VHF-FM antennas.*
69. **GC ELECTRONICS**—Complete TV antenna brochure No. FR-632-G representing latest *Colormagic* antennas.
70. **JFD**—Literature on complete line of antennas for VHF, UHF, FM, and FM-stereo. Brochure showing converters, amplifiers, and accessories; also complete '64-'65 dealer catalog.*
71. **MOSLEY ELECTRONICS**—Illustrated catalog giving specifications and features on large line of antennas for Citizens band, amateur, and TV applications.
72. **MULTITRON**—Illustrated literature on FM-stereo antenna No. MA-44 and Multi-tuner Model M-11.
73. **STANDARD KOLLSMAN**—Catalog sheet on UTC-051 transistor UHF converter kit with IF amplifier.
74. **TRIO**—Brochure on installation and materials for improving UHF translator reception.*
75. **ZENITH**—Informative bulletins on universal loudspeakers and a new line of log-periodic vee-type antennas for FM and monochrome or color TV.

AUDIO & HI-FI

76. **ADMIRAL**—Folders describing line of '65 equipment; includes black-and-white TV, color TV, radio, and stereo hi-fi.*
77. **ASTATIC**—Catalog C-64 phono-cart-ridge cross-reference replacement guide.
78. **ATLAS SOUND**—Illustrated data sheet describing C-46 and C-66 sound columns, two-way wall speaker system, and bidirectional baffle speaker combinations.*
79. **GIBBS SPECIAL PRODUCTS**—Folders describing principles of sound reverberation and *Stereo-Verb* reverberation units for automobiles.
80. **JENSEN**—24-page catalog, No. 165-K, illustrates and describes speakers and speaker system kits.
81. **NUTONE**—Two full-color booklets illustrating built-in stereo music systems and intercom-radio systems. Includes specifications, installation ideas, and prices.
82. **OKTRON**—"The Blueprint to Better Sound" an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.
83. **OXFORD TRANS-DUCER**—Product information bulletin describing complete line of loudspeakers for all types of sound applications, including replacements for public address and intercom systems.
84. **PERMA-POWER**—New catalog sheet describing Ampli-Vox Model S-300 and Sound Cruiser sound system Model S-310.
85. **QUALITONE**—Information on selling diamond needles and earning free gifts.
86. **QUAM-NICHOLS**—General catalog listing replacement speakers for public address, hi-fi, and radio-TV applications.
87. **SAMPSON**—Full-color catalog pages showing new line of Waltham transistor radios, tape recorders, and portable televisions.

88. **SONOTONE**—Brochure on micro-ceramic stereo cartridge for low-mass, lightweight tonearms.*
89. **SWITCH-CRAFT**—Product bulletin No. 148 describes latest insulated "Hi-D-Jax" ¼" phone jacks.

COMMUNICATIONS

90. **COMMUNICATION PRODUCTS**—Communication systems handbook No. 664 includes base station and vehicular antennas, duplexers, coaxial cable systems, accessories, and technical data.
91. **ELTEC**—Brochure on transistorized tone and/or monitor receivers Model 600B frequency standard, signal generator, and 5-kc deviation standard.
92. **E-Z WAY PRODUCTS**—Information on communications towers for varied applications.
93. **PEARCE-SIMPSON**—Specification brochure on *Companion II, Escort*, and *Guardian 23* Citizens-band transceivers.

COMPONENTS

94. **BUSSMANN**—Bulletin SBCU on BUSS fustat box cover units that offer simple, low-cost way to protect work bench tools, soldering irons, drills, etc. against damage and burnout.*
95. **CBC INDUSTRIES**—Catalog of picture-tube brighteners; featuring new all-voltage types.
96. **IEH**—Information on replacement sockets, various types available.
97. **J-B-T-INSTRUMENTS**—General catalog 563A has information on frequency meters, elapsed-time meters, and numerous relays and switches.
98. **MILLER**—Brochures listing replacement radio IF transformers.
99. **PERMACEL**—Product specifications on plastic tapes listing types, technical data, uses, and product features.
100. **SPRAGUE**—Latest catalog C-616 with complete listing of all stock parts for TV and radio replacement use, as well as *Transfarad* and *Tel-Ohmite* capacitor analyzers.*
101. **TRW**—General catalog No. 165 covers all standard capacitors offered by company. Other technical information on tolerance, reliability, and other characteristics of capacitors.

SERVICE AIDS

102. **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.*
103. **CHEMTRONICS**—Colorful catalog No. 64 contains information on chemicals as aids to the electronics serviceman.
104. **PRECISION TUNER**—Literature supplying information on complete, low-cost repair and alignment services for any TV tuner.*
105. **YEATS**—The new "back-saving" appliance dolly Model 7 is featured in a four-page booklet describing feather-weight-aluminum construction.

SPECIAL EQUIPMENT

106. **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.*

107. **GREYHOUND**—The complete story of the speed, convenience and special service provided by the Greyhound Package Express method of shipping, with rates and routes.
108. **LECTROTECH**—Bulletins on new color TV test instrument, meter-protective devices, substitute for VTVM battery, and transistorized DC power supplies.*
109. **SETCHELL-CARLSON**—Full-line catalog for both color and b-w receivers, plus educational receivers.
110. **TERADO**—Bulletin on *Galaxy* Model 50-205 transistorized DC-AC power inverter.
111. **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

112. **CLEVELAND INSTITUTE OF ELECTRONICS**—Free illustrated brochure describes electronic slide rule with four lesson Instruction Course and grading service.*
113. **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.*
114. **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

115. **ANTRONIC**—Catalog sheet on line of test equipment and adaptors.
116. **B & K**—Bulletin No. 124-R on new Model 1240 color generator. Catalog AP-21R describing uses for and specifications of Model 1076 Television Analyst, Model 1074 TV Analyst and Color Generator, Model 700 and 600 *Dyna-Quik* Tube testers, Model 445 CRT Tester-Rejuvenator Model 960 Transistor Radio Analyst, Model 360 *I-O-Matic* VOM, Model 375 *Dynamic* VTVM, Model 1070 *Dyna-Sweep* Circuit Analyzer, and Model 230 Substitution Master.*
117. **CADRE**—Form CTC-20-2S gives specifications on *Commander* series of solid-state test equipment, including new type of color-bar generator.*
118. **DUNWELL**—Catalog sheet (CS110-1) describing portable, low-cost continuity tester for all tubes except nuvistors.
119. **EICO**—New 1965 catalog listing over 200 products including color-bar generator, oscilloscopes, and others; all available in kit form.
120. **HICKOK**—Complete description and specification information on newly introduced Model 662 installer's color generator, portable FM multiplex generator, Model 235A VHF-UHF field strength meter, and Model 800 tube tester.*
121. **JACKSON**—Complete catalog describing all types of electronic test equipment for servicing and other applications.
122. **MERCURY**—Complete catalog on line of test equipment to help the serviceman.
123. **SECO**—Data sheets on self-service tube testers and caddy-pack tube testers that carry over 200 tubes.
124. **SENCORE**—New color catalog on complete line of company products; oscilloscopes, generators, testers, and many others.*
125. **SIMPSON**—Complete 16-page brochure on entire line of electronic test equipment; also, catalog on line of panel meters.*
126. **TRIPLETT**—All new test-equipment catalog No. 46-T showing complete line of VOM's, tube testers, transistor analyzers, and signal generators.

TOOLS

127. **ENTERPRISE DEVELOPMENT**—Time-saving techniques in brochure from Enteco demonstrate improved desoldering and resoldering techniques for speeding up and simplifying operations on PC boards.*
128. **LUXO LAMP**—New catalog No. 114-2 showing illuminated magnifiers and low-voltage lights.
129. **UNGAR**—Catalog No. 763 giving information on series of soldering irons and accessories.

Color-TV servicing is profitable

GET THE MOST OUT OF IT WITH COLOR-TV TEST INSTRUMENTS FROM RCA—
PIONEER OF COLOR TV



Making last-minute convergence adjustments on a color-TV receiver with an RCA WR-64A Color-Bar/Dot/Crosshatch Generator.

(A) RCA WR-64A COLOR-BAR/ DOT/CROSSHATCH GENERATOR

Low-cost, lightweight, portable instrument that provides all essential Color-TV test patterns:

- *Color-bar pattern*: ten bars of color for checking phase and matrixing, and for automatic frequency and phase alignment.
- *Crosshatch pattern*: thin sharp lines for adjusting vertical and horizontal linearity, static and dynamic convergence, raster size, and overscan.
- *Dot pattern*: small dots to facilitate accurate color convergence.

\$189.50* with output cables

(B) RCA WR-70A RF/VF/IF MARKER ADDER

For use with a marker generator and a sweep generator. Used for RF, IF, and VF sweep alignment in color and B&W TV receivers.

- Choice of four different marker shapes
- Provides very high-Q markers of high amplitude and narrow bandwidth

\$74.50* complete with cables

(C) RCA WO-91A 5-INCH OSCILLOSCOPE

A wideband scope for checking colorburst signals and general troubleshooting.

- Dual bandwidth: 4.5 Mc at 0.053 volt rms/in. sensitivity; 1.5 Mc at 0.018 volt rms/in. sensitivity.
- Continuously adjustable sweep frequency range: 10 cps to 100 Kc

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

(D) RCA WR-69A TELEVISION FM SWEEP GENERATOR

For visual alignment and troubleshooting of color and B&W TV receivers, and FM receivers.

- IF/Video output frequency continuously tunable from 50 Kc to 50 Mc.
- Sweep-frequency bandwidth continuously adjustable from 50 Kc to 20 Mc on IF/Video and FM: 12 Mc on TV channels

\$295.00* including all necessary cables

(E) RCA WR-99A CRYSTAL- CALIBRATED MARKER GENERATOR

Supplies a fundamental frequency RF carrier of crystal accuracy for aligning and troubleshooting color and B&W TV receivers, FM receivers.

- Most-used IF and RF frequencies indicated on the dial scale
- Sound and picture carrier markers available simultaneously

\$256.50* complete with output cable and phone tip

(F) RCA WT-115A COLOR PICTURE TUBE TESTER

Designed specifically to test color-TV picture tubes, either in or out of the set. Tests each gun for emission quality, inter-electrode leakage and shorts.

- Large sensitive meter with separate 3-color scales
- Provision for accurate adjust-



FREE! You have a chance to win a new 1965 Chevy-Van... and over 100 additional prizes... in the RCA 1965 Regional Sweepstakes. For details, see page 14&15

ment of cut-off point for each gun
\$89.50* with cable, carrying case and socket assembly

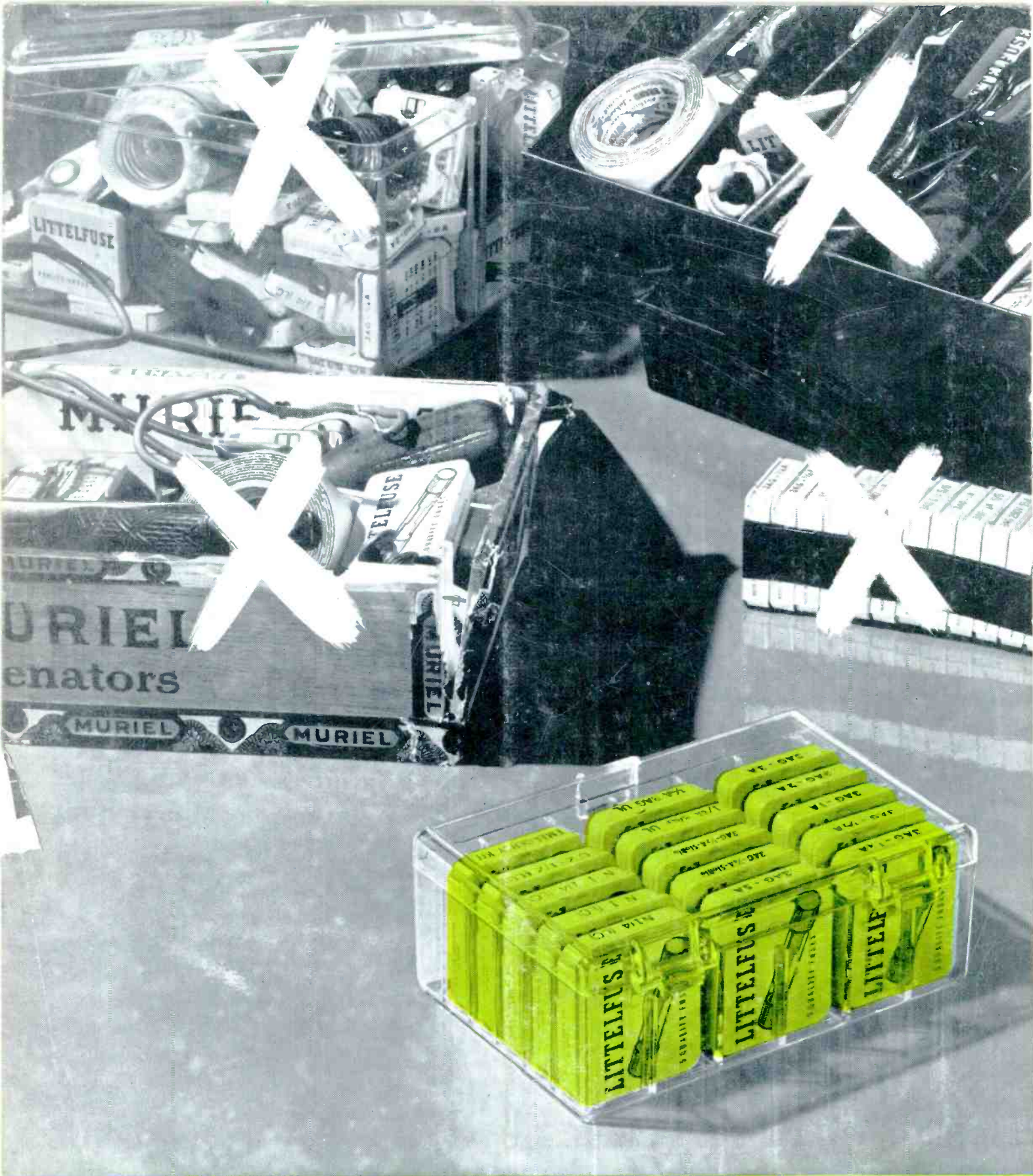
See them all at your Authorized RCA Test Equipment Distributor.

*Optional Distributor Resale Price
All prices are subject to change without notice. Prices may be higher in Alaska, Hawaii and the West.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics



Euron business advertising

THERE'S ONLY ONE RIGHT WAY

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

LITTELFUSE Des Plaines, Ill.

Circle 61 on literature card