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PHOTOFACT

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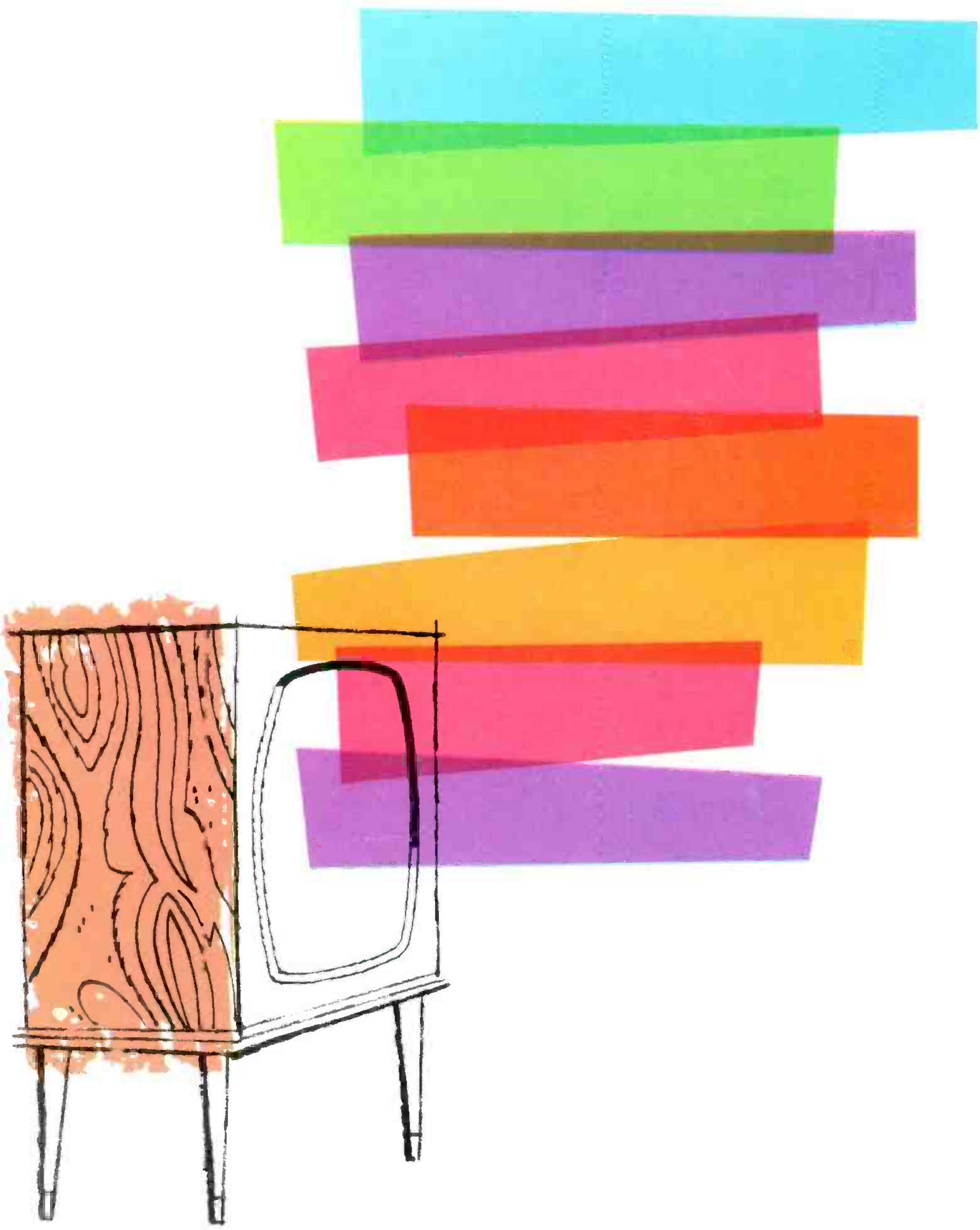

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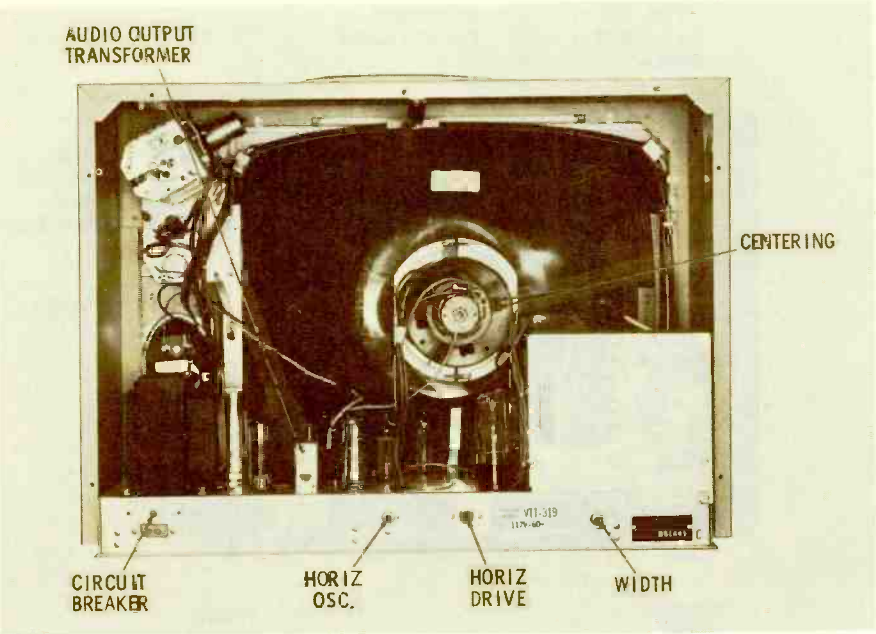
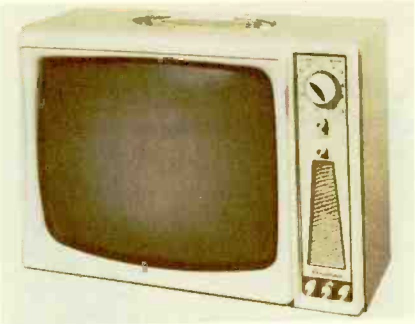




Andrea Model VTT319

The above photo is of a 19" portable from Andrea Corp. It shouldn't be necessary to recheck your tube caddy when you're called to service this one, since simplicity and sound design seem to have been the manufacturer's goal, rather than the introduction of new circuits and tubes.

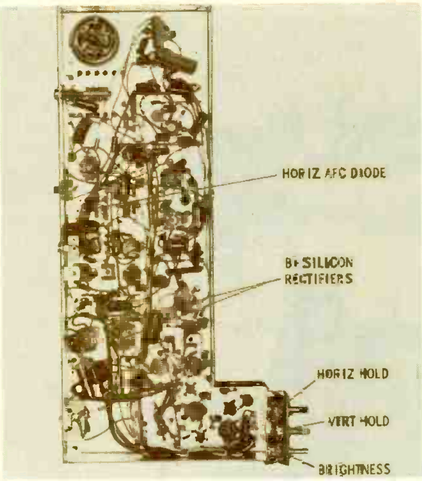
The horizontally mounted chassis is not drastically different in either physical or electrical design from other models of recent years. The chassis is completely hand-wired and is laid out in such a manner that circuit tracing is comparatively easy. The tubes are common types. First and second video-IF amplifiers are 6BZ6's; third video-IF amplifier and video detector are combined in a 6AS8; video output and sync amplifier in a 6CX8; sync separator and AGC keyer in a 6AW8A. Two 6CG7's are used, one as a horizontal multivibrator and the other as a sync phase inverter and vertical multivibrator; the vertical output stage—a 6EM5—serves as the other half of the vertical multivibrator. The sound section has a 6AU6A, 6DT6, and 6BQ5 functioning respectively as sound-IF amplifier, audio detector, and audio output.

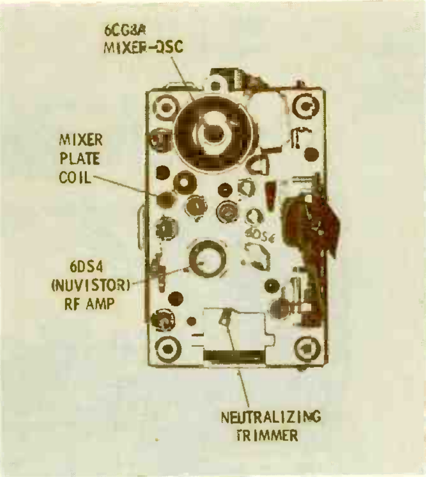
The low-voltage power supply uses a power transformer, with two silicon rectifiers connected as a full-wave voltage doubler. Protection for these rectifiers and the entire B+ circuit is provided by a circuit breaker. As additional protection for the horizontal sweep circuit, a .25-amp slow-blow fuse is located under the high voltage cage.

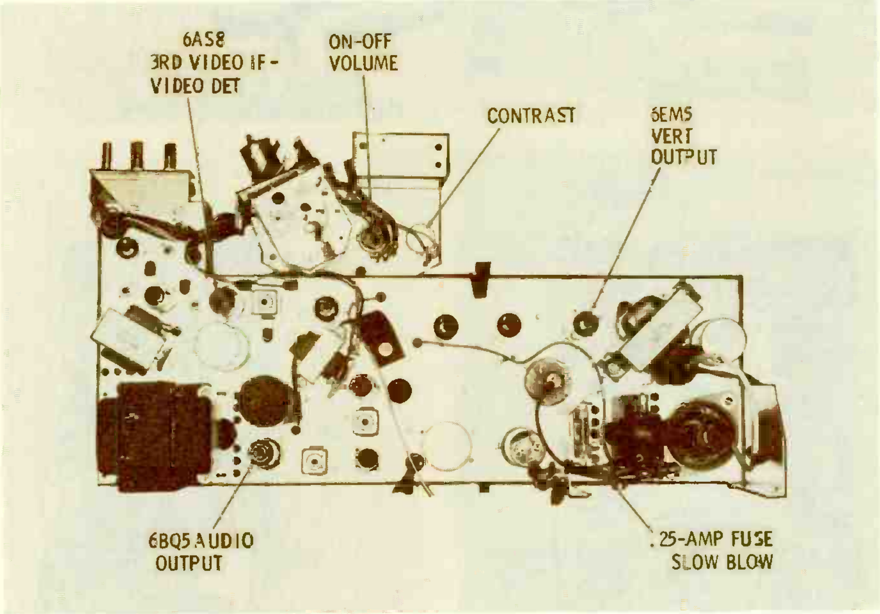
The VHF tuner is a turret type using an extremely high-gain 6DS4 *nuvistor* as the RF amplifier along with a 6CG8A mixer-oscillator. Check points in the tuner are provided either by feed-through bypass capacitors or test terminals protruding through the top of the tuner. This tuner has conventional fine tuning and individual oscillator slugs for each channel; they are accessible by removing the channel-selector and fine-tuning knobs.

Located on the rear of the chassis is the horizontal drive control, width coil, and horizontal stabilizer coil. The vertical linearity and height controls are mounted on top of the chassis and are accessible by removing the rear cover. The volume, contrast, vertical hold, horizontal hold, and brightness may be adjusted from the front.

The horizontal AFC diode is a dual selenium soldered beneath the chassis. For replacement of this component it is necessary to remove the chassis from the cabinet.







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Arvin
Model 63K19

This 16" portable uses a 16AUP4 picture tube, and is equipped with built-in antenna and an earphone jack. This is Arvin's first television receiver for several years and was imported from Japan. The circuitry is very similar to that found in many American-made sets.

The horizontal-sweep section uses a 12BH7A as oscillator and AFC. This tube and its associated components are mounted on the one and only printed-circuit board. The remainder of the circuits are hand-wired and all use Japanese components.

The wrap-around chassis layout is divided into four separate sections. Viewed from the rear, the upper layer contains the horizontal oscillator, with the horizontal sweep section located just to the right. The lower layer holds the sync, vertical sweep, and audio amplifier-output circuits. The left side contains the remainder of the audio stages and the video circuits.

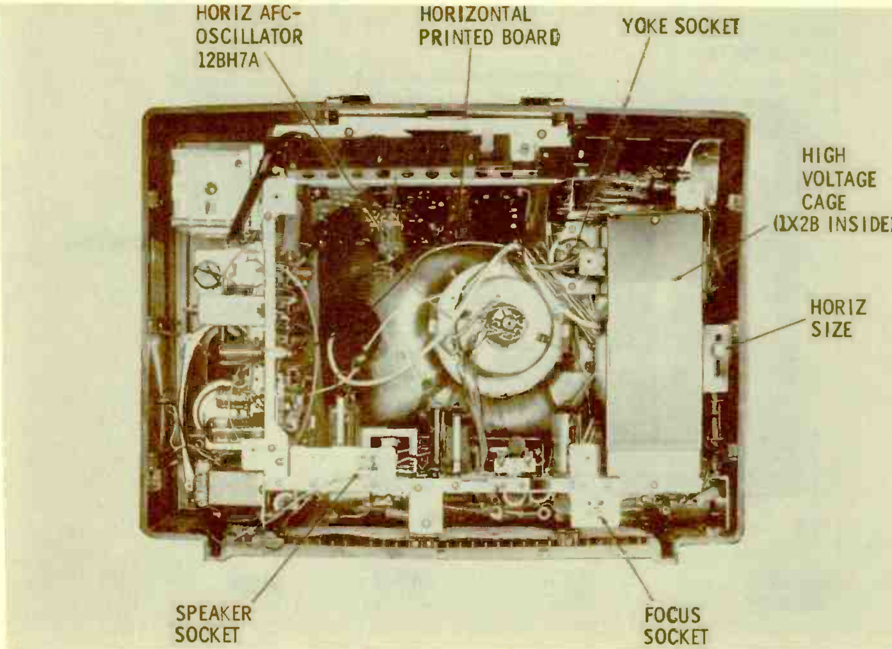
The transformerless power supply uses two silicon rectifiers (1N1764 or equivalent) protected by a 2-amp fuse, to develop the 280 volts B+. The series filament circuit has a 55-ohm, 20-watt dropping resistor.

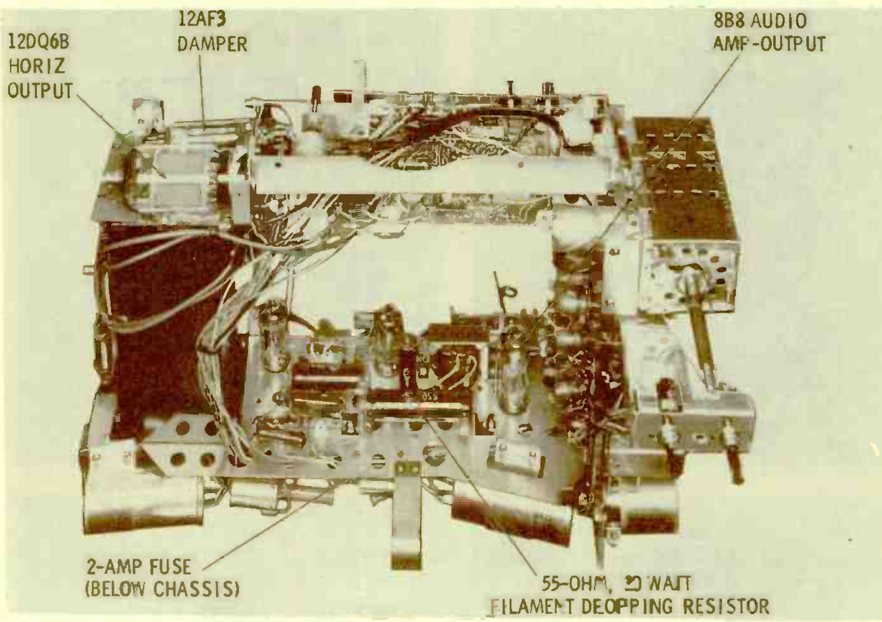
The horizontal circuit is loaded with adjustable coils—four of them, to be exact. The main horizontal oscillator coil is used for the horizontal hold, but a waveform coil is also available to improve stability. Proper adjustment requires an oscilloscope; set the slugs for equal peaks of the waveform at the center-tap of the oscillator coil. Adjustment of horizontal size and linearity is also accomplished by use of separate coils.

Three crystal diodes are used. A 1N60 follows the three 3BZ6 video-IF amplifiers and serves as the video detector; it is located under a shield covering the final IF transformer. The remaining two diodes are used in the ratio detector.

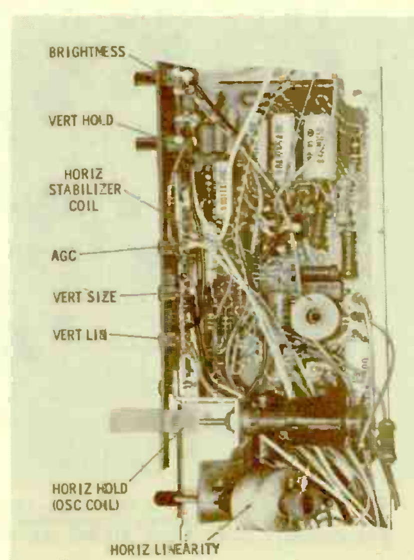
Mounted on the printed circuit board is a dual- and triple-section control assembly. The dual section contains the brightness and vertical hold; the AGC, vertical size, and vertical linearity are in the triple unit.

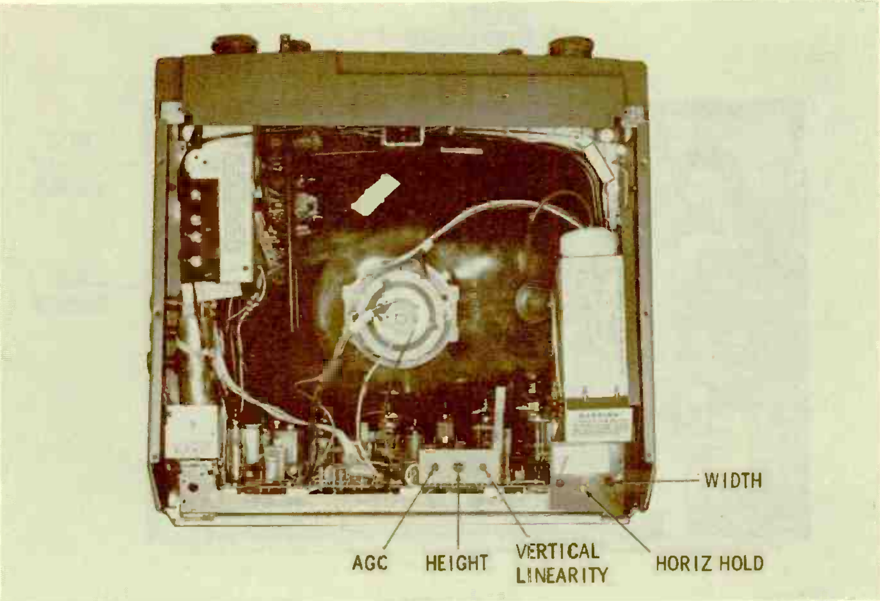
This set is without any of the compactrons that are fast becoming popular; all the tubes are common types that have been around for quite some time. The exception is the 8B8 which is used in the audio output stage.

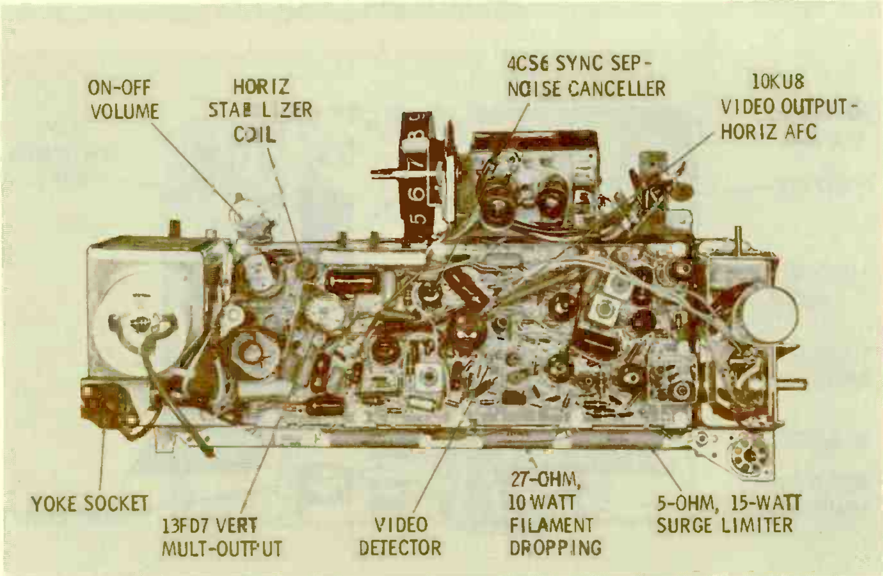




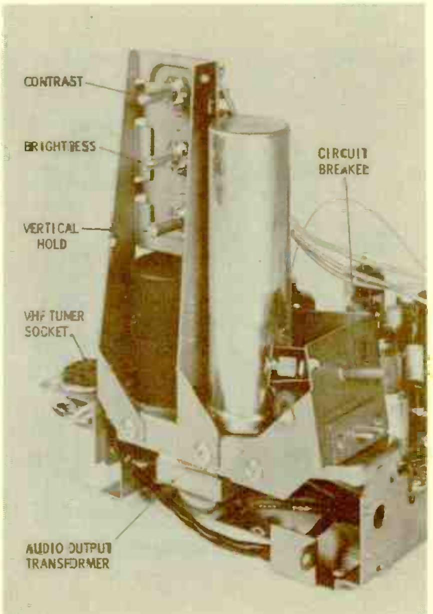
HAND-WIRED VIDEO AND SOUND IF SECTION








BOTTOM VIEW OF ONE AND ONLY PRINTED CIRCUIT BOARD



Sylvania
Model 19P35
Chassis 571 Series

Quite a change, both physical and electrical, might be a good way to describe this lightweight 19" Sylvania portable. This receiver uses a bonded 114° picture tube, and is equipped with a built-in monopole antenna and earphone jack. This chassis fits snugly inside the cabinet and the minimized depth and width give the cabinet a very "portable" appearance. Only one printed circuit board is used, with practically all the components mounted on it.

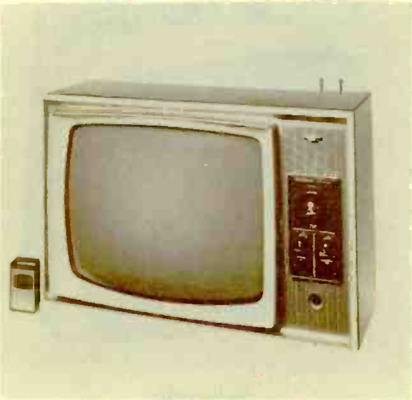
Two interconnecting plugs and sockets are used. The socket located directly behind the high voltage cage is for the yoke. The second socket, located on the opposite end of the chassis, is for the cable running to the VHF tuner, on-off switch, and volume control. Both sockets are visible in the photos.

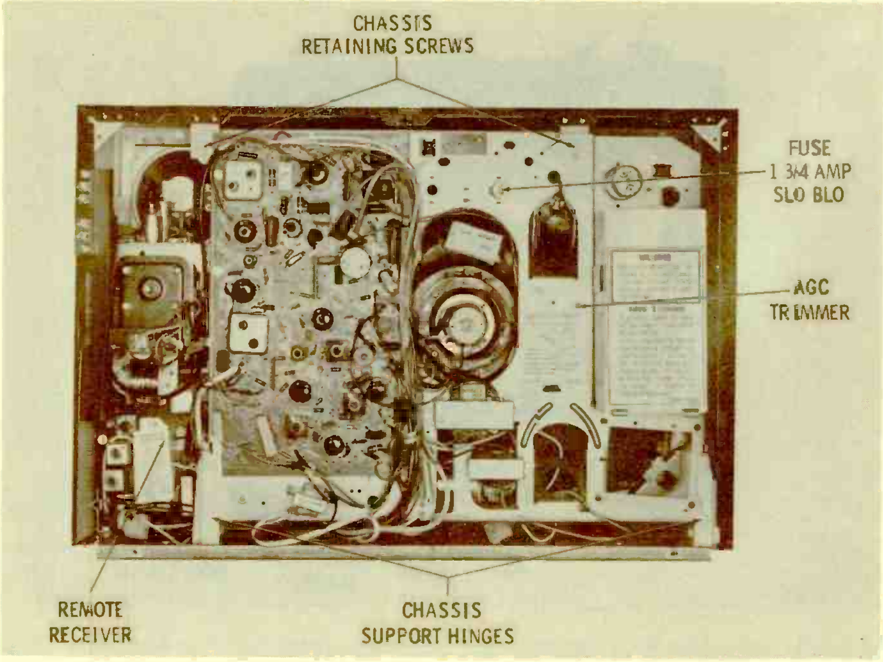
The two-stage video-IF strip consists of frame-grid IF amplifier tubes, a 4EH7 and 4EJ7. A 3GK5 RF amplifier and 5HG8 mixer-oscillator are used in the tuner; these also are frame-grid tubes. The audio section uses the pentode portion of a 5KD8 as a sound IF amplifier and has changed from last year's ratio detector to a 4DT6 quadrature detector. Some unfamiliar tube types are used: 4CS6 sync separator and noise canceller, 13FD7 vertical multivibrator-output, 8FQ7 horizontal multivibrator, 17GJ5 horizontal output, and 17AY3 damper. The last two mentioned are novar types.

The only signal-type diode used is a 1N295 video detector. A 10KU8 (dual-diode pentode) serves as horizontal AFC (no selenium diode for AFC in this set) and video output.

The low-voltage power supply consists of two silicon rectifiers, functioning as a half-wave voltage doubler, furnishing 285 volts B+. Protection for these rectifiers is afforded by a circuit breaker and a 5-ohm, 15-watt surge-limiting resistor. This transformerless chassis has a 450-ma series filament string with a 27-ohm, 10-watt dropping resistor.

The main operating controls are located on the side of the chassis and are mounted on a bracket, which is attached to the tuner. Those controls on the rear of the chassis are vertical linearity, height, AGC (these three all in one compact unit), horizontal hold, and width. Also on the rear of the chassis, located on the high voltage cage, is a tube-placement chart showing tube types and functions along with a diagram showing the filament circuit path.





Westinghouse Model H-P3433 Chassis V-2443-3

Shown here is an *Instant-On* 19" portable by Westinghouse, equipped with a remote-control receiver. This chassis is very similar to last year's comparable model. The chassis is hinged on the bottom corners and will swing down for servicing, giving access to the rear of the printed-circuit board and to components mounted on the rear of the chassis pan. The vertical chassis will swing down into a horizontal position when the four screws—one each in the upper and lower left- and right-hand corners—are removed.

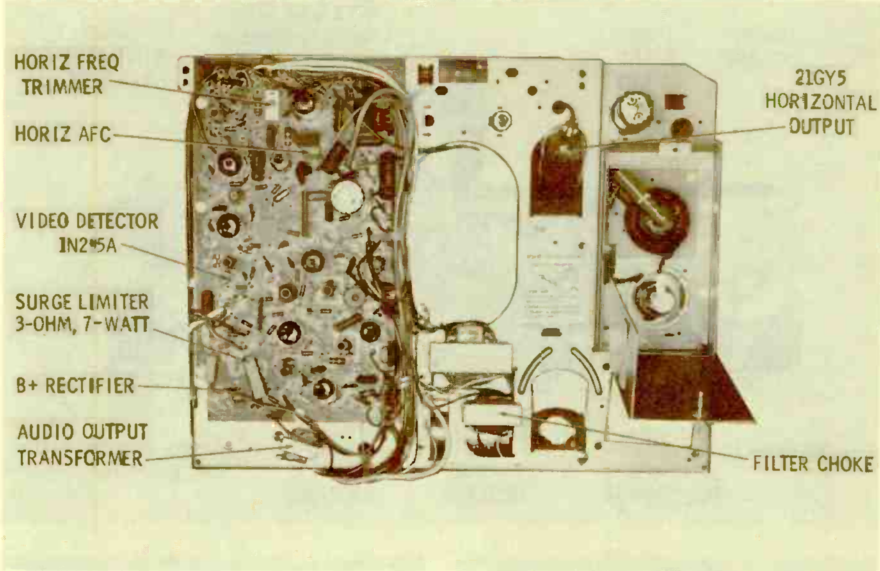
No warmup time is required in this receiver, because a diode in the series filament string keeps the filaments always hot. When the power switch is off, the filaments receive pulsating DC supplied by the diode; when the receiver is turned on, one section of the switch places a jumper across the diode and the filaments operate from normal AC line voltage.

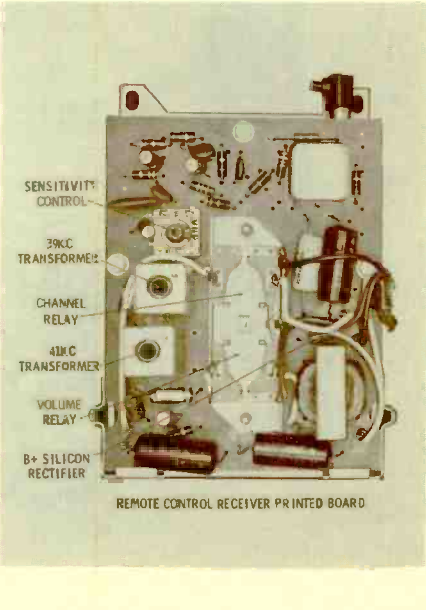
All operating controls, such as contrast, volume, brightness, vertical hold, and horizontal hold are located on the front of the receiver. The vertical linearity and height may also be adjusted from the front simply by removing the knobs from the hold controls and inserting a screwdriver into the hollow shaft.

Trimmers are used again this year for AGC control and horizontal frequency adjustment. The low-B+ tube lineup is exactly the same as that used last year, including the 114° 19CMP4 picture tube.

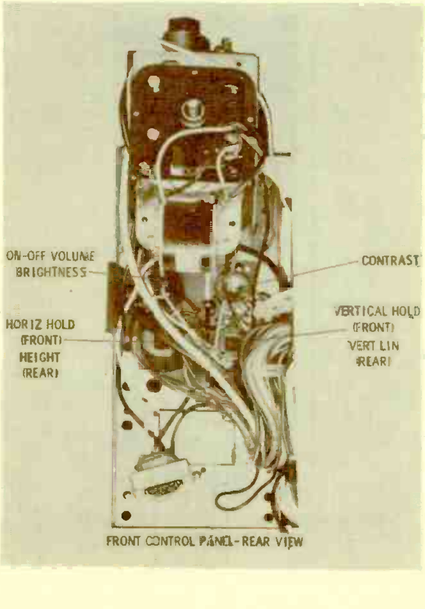
The input plug is polarized as a safety measure with this "hot" chassis. A single silicon rectifier develops B+ for this receiver and is protected by a 3-ohm, 7-watt surge-limiting resistor and a 1¾-amp slow-blow fuse. Other semiconductors include a 1N295 video detector and a common-cathode dual selenium for horizontal AFC.

The remote receiver is all-transistor, and has its own power supply consisting of a step-down power transformer and a silicon rectifier to supply the negative 13 volts for transistor operation. Four of the six transistors are used as 40-kc amplifiers; the remaining two are relay drivers, one each for volume (which operates at 41 kc) and channel (operating at 39 kc). The remote receiver uses a different B-minus system than the TV chassis and the two chassis should never be connected together.





REMOTE CONTROL RECEIVER PRINTED BOARD



FRONT CONTROL PANEL-REAR VIEW

See PHOTOFACT Set 590, Folder 2

See PHOTOFACT Set 590, Folder 2

Mfr: Philco **Chassis No.** 12N51

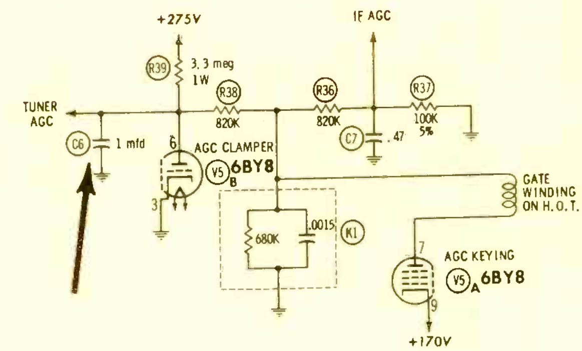
Card No: PH 12N51-19

Section Affected: Pix and sound.

Symptoms: Picture intermittently overloads and pulls; buzz in sound.

Cause: AGC filter C6 in tuner shorting intermittently.

What To Do: Replace C6 (1 mfd).



Mfr: Philco **Chassis No.** 12N51

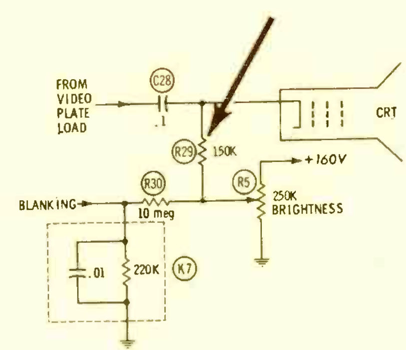
Card No: PH 12N51-20

Section Affected: Raster.

Symptoms: Brightness level low with set cold; becomes normal as set warms up.

Cause: CRT cathode resistor open; heals when set warms up.

What To Do: Replace R29 (150K).



Mfr: Philco **Chassis No.** 12N51

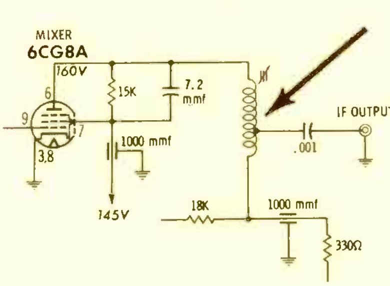
Card No: PH 12N51-21

Section Affected: Pix and sound.

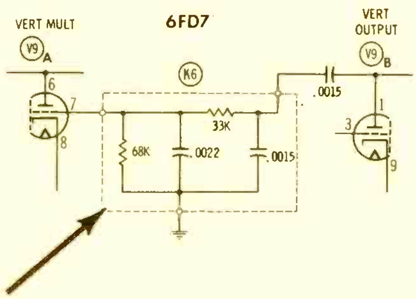
Symptoms: No pix or sound; raster okay.

Cause: Mixer plate coil open.

What To Do: Repair or replace mixer plate coil (located on tuner); Philco part No. 32-4629-14.



See PHOTOFACT Set 590, Folder 2



See PHOTOFACT Set 590, Folder 2

Mfr: Philco **Chassis No.** 12N51

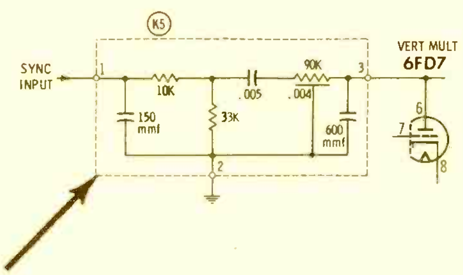
Card No: PH 12N51-22

Section Affected: Raster.

Symptoms: No vertical deflection.

Cause: Capacitor in component pack shorted, shunting feedback signal to ground.

What To Do: Replace entire component pack K6; Philco part No. 30-6539-1.



Mfr: Philco **Chassis No.** 12N51

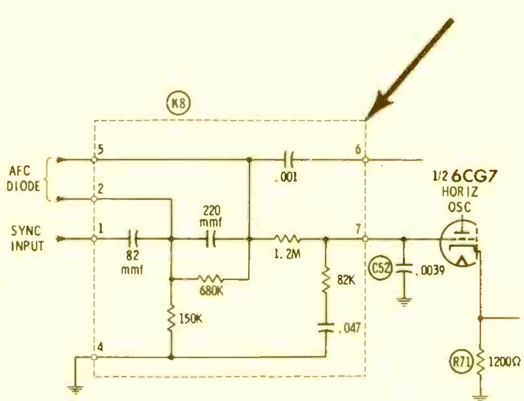
Card No: PH 12N51-23

Section Affected: Pix.

Symptoms: Vertical sync unstable; horizontal okay.

Cause: Leakage in vertical integrator network K5.

What To Do: Replace entire K5; Philco part No. 30-6030-9.



Mfr: Philco **Chassis No.** 12N51

Card No: PH 12N51-24

Section Affected: Raster.

Symptoms: Raster starts to come on but disappears as set warms up.

Cause: Resistor open in grid circuit of horizontal oscillator.

What To Do: Replace component pack K8.

See PHOTOFACT Set 557, Folder 1

Mfr: TraVler **Chassis No.** 23K6180F

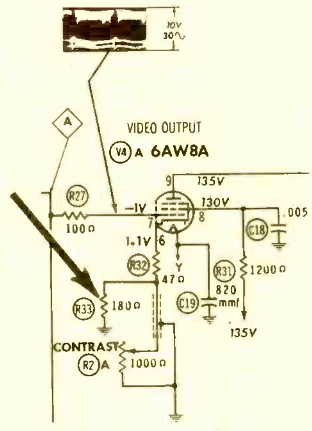
Card No: TR 23K6180F-1

Section Affected: Pix.

Symptoms: Contrast always maximum; no control.

Cause: Cathode bias resistor overheated and carbonized to very low value.

What To Do: Replace R33 (180 ohms); also V4A (6AW8A).



Mfr: TraVler **Chassis No.** 23K6180F

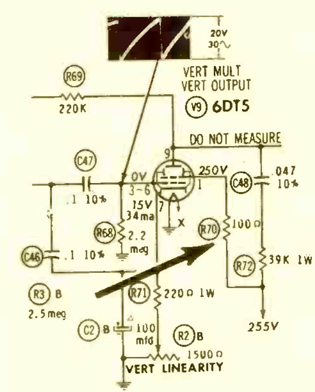
Card No: TR 23K6180F-2

Section Affected: Raster.

Symptoms: Vertical sweep collapses; streaks and flashes in raster; voltage fluctuates at pin 1 of V9.

Cause: Screen-grid resistor in vertical output circuit overheated.

What To Do: Replace R70 (100 ohms).



Mfr: TraVler **Chassis No.** 23K6180F

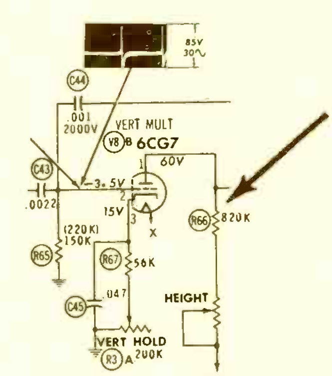
Card No: TR 23K6180F-3

Section Affected: Raster.

Symptoms: Height insufficient.

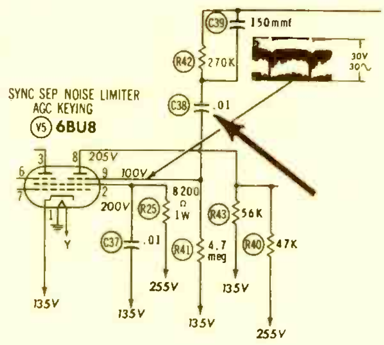
Cause: Vertical Multivibrator plate-load resistor increased in value.

What To Do: Replace R66 (820K).



See PHOTOFACT Set 557, Folder 1

See PHOTOFACT Set 557, Folder 1



See PHOTOFACT Set 557, Folder 1

Mfr: TraVler **Chassis No.** 23K6180F

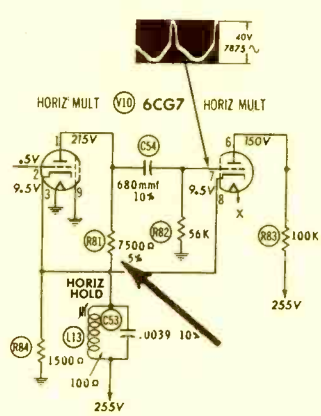
Card No: TR 23K6180F-4

Section Affected: Sync.

Symptoms: Horizontal tearing; vertical rolling; voltage at pin 9 of V5 is too high.

Cause: Leaky coupling capacitor from video output to sync input.

What To Do: Replace C38 (.01 mfd).



Mfr: TraVler **Chassis No.** 23K6180F

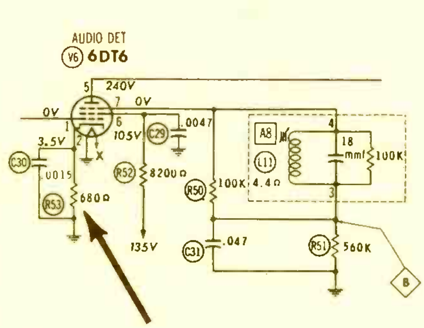
Card No: TR 23K6180F-5

Section Affected: Sync.

Symptoms: Horizontal frequency out of range; possible blooming and squegging.

Cause: Horizontal multivibrator plate resistor changed value.

What To Do: Replace R81 (7500 ohms, 5%).



Mfr: TraVler **Chassis No.** 23K6180F

Card No: TR 23K6180F-6

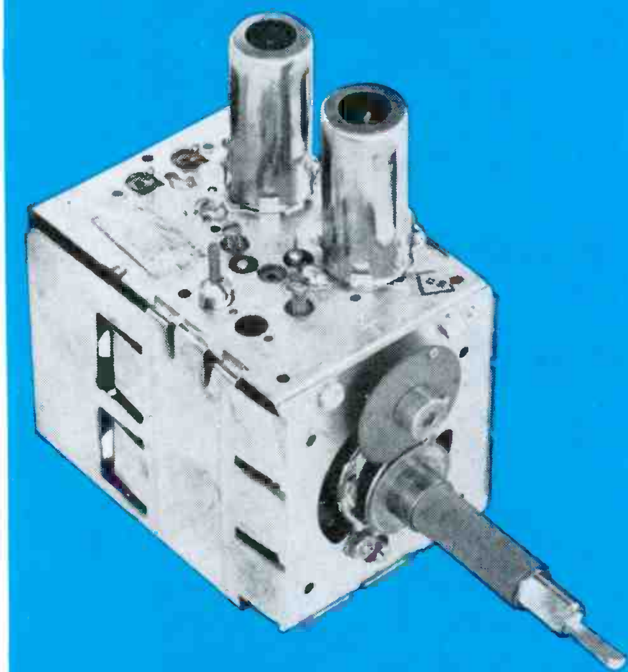
Section Affected: Sound.

Symptoms: Weak sound; then none. Voltage at pin 2 of V6 first too low, then too high.

Cause: Audio detector cathode resistor overheats and increases in value.

What To Do: Replace R53 (680 ohms).

TUNER REPAIRS



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PF REPORTER

including Electronic Servicing

VOLUME 14, No. 5 *MAY, 1964*

CONTENTS

ABOUT THE COVER

From all indications, more color receivers are now in operation than ever before. Naturally, more sets will cause an upswing in your color repair business. These are good reasons why we continue to present meaty color-servicing articles—like the one starting on page 46.

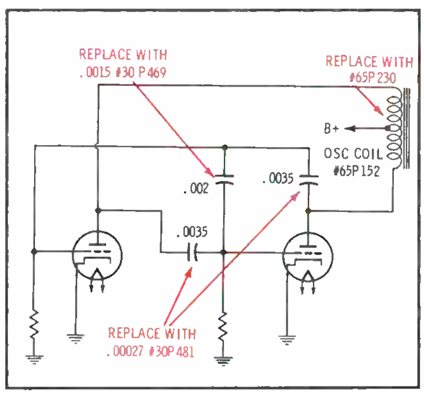
Letters to the Editor

Dear Editor:

Remember your *Troubleshooter* item "If I Could Erase . . ." on page 62 of the August 1963 issue? Recently I had a somewhat similar problem in a Webcor Model 2207. An inquiry to Webcor brought the information shown in the accompanying schematic. The bulletin was issued because of numerous reports of erase-head failure. Webcor suggests replacing the components indicated whenever trouble is encountered with an erase head. I believe the same information could apply to the unit you discussed in *The Troubleshooter* column.

RONALD HOPLEY
Pittsfield, Mass.

Thanks, Ron. I'm sure our readers will be happy to get this information. —*Ed.*



Dear Editor:

Does anyone know a good use for leftover ion traps? I've been saving them since the new straight-gun picture tubes came out. Now I wonder what to do with them.

BILL WHITE
Princeton, Fla.

The small magnet can be removed and used to help attain good purity in color sets when the set's own magnets won't quite do the job. One shop we know of uses them to hold clippings on a metal bulletin board. Any other readers have ideas?—Ed.

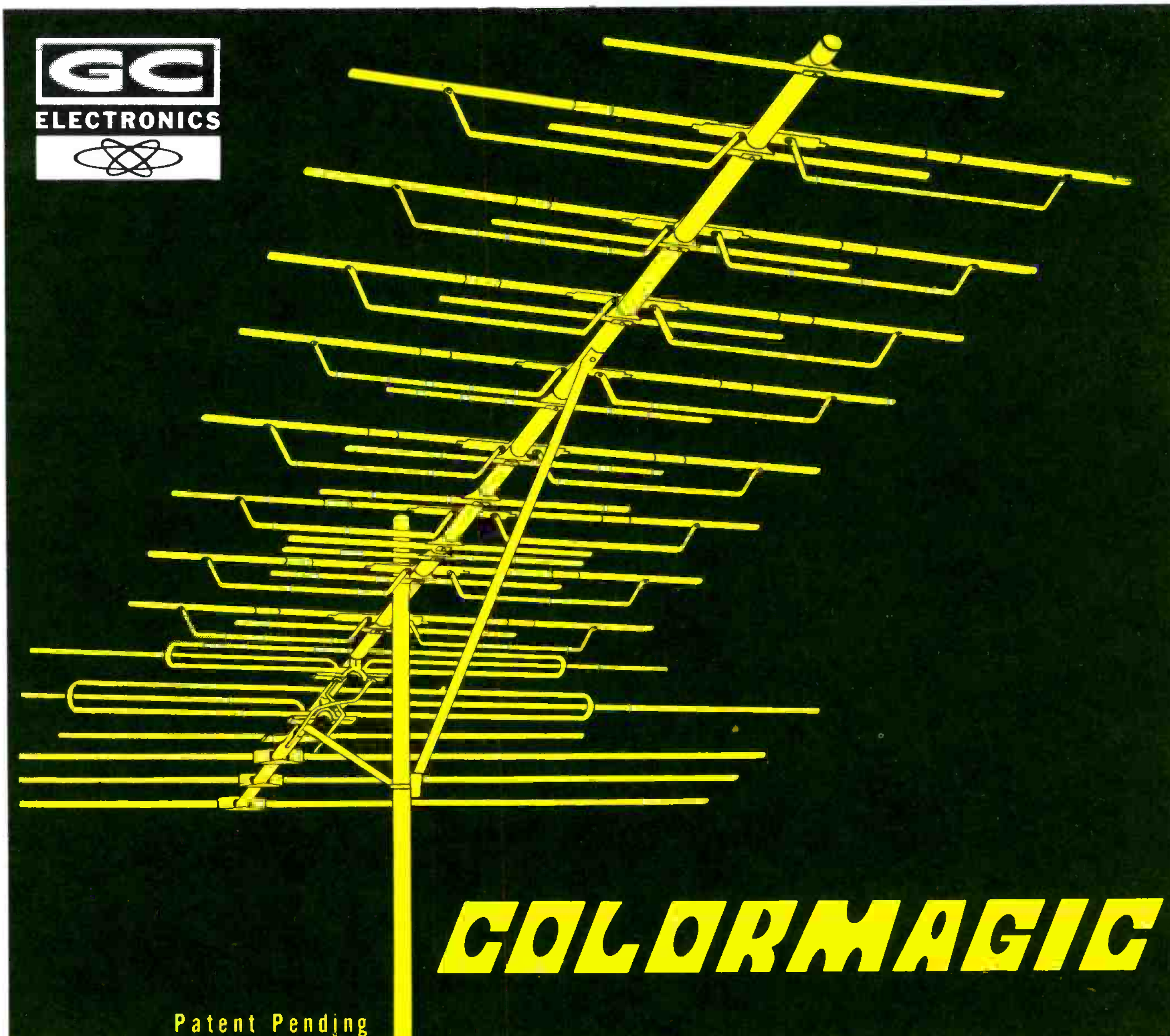
Dear Editor:

I couldn't help chuckling over V. W. Hodge's comments on the ten-second scope artist (January *Letters*). Apparently you agreed it was fast, not knowing you have a five-second scope artist on page 48 of the same issue.

TED CIZMAN
East Hartford, Conn.

We knew about it, Ted. And if you ever watched author Lemons work, you'd agree that he is, indeed, a scope artist. He's a perfect example of what self-training and common sense can accomplish in the field of servicing.—Ed. ▲

GC ELECTRONICS



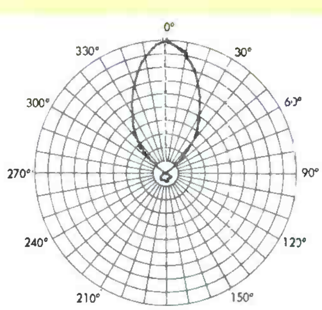
FHR

FUNDAMENTAL HARMONIC RESONANCE...GC'S EXCLUSIVE DESIGN PROCESS! Colormagic elements resonate on the fundamental harmonics within both the high and low bands. Colormagic FHR outperforms the average second harmonic TV element by producing a tight, laser-linked directivity of signal...higher gain! It's in the elements!

GC "GOLD-GUARD" anodizing process guards against pitting, chipping, rust and corrosion...makes the Colormagic series the best protected, all-weather line available!

GC "SOLID-SEMBLED" construction insures quick, easy installation...rigid-lock elements snap securely into place!

Compare! Colormagic Antenna Systems offer pencil-point polar patterns...laser-linked directivity ...flat plateau response curve... no traps or peaks...excellent for color or black & white TV reception.



15 All-New Colormagic Combo-Couplers permit cross-direction reception of UHF-VHF-FM antenna combinations...each unit encased in high-impact polystyrene case...supplied with stainless Steel mounting strap. Complete sales program available.

See your GC Distributor! He'll fill you in on this "prestige" package. *CONSIDER THE ELEMENTS INVOLVED!* ...then GO COLORMAGIC! If not stocked locally, write us for name of Distributor nearest you.

GC ELECTRONICS CO.
Division of Textron Electronics, Inc.

Western Plant: 3225 Exposition Place, Los Angeles 18, Calif.
MAIN PLANT: 400 S. Wyman St., Rockford, Ill., U.S.A.

Circle 6 on literature card

The Electronic Scanner

news of the servicing industry

Plant Opening

A new 125,000-square-foot magnetic products plant in Camarillo, Calif. has been placed in operation by the **3M Company.** Equipped to produce 3M's entire line of audio, instrumentation, and video tapes, the plant has facilities capable of increasing the division's total production by nearly 50%. The Camarillo installation will be the largest of the company's three domestic plants and will employ from 200 to 300 persons when production is increased to capacity. It now has a work force of 50.

Company Purchase

Callins Industries, Inc. of Greenfield, Tennessee has been acquired by **Whitehall Electronics Corp.** The purchase, effective as of November 30, 1963, was disclosed by Fred Callins, president and founder of Callins, and Lee D. Webster, chairman of the board of Whitehall. Callins Industries specializes in the manufacture of miniature and subminiature low-voltage capacitors used in all types of transistorized electronic equipment. Whitehall, a partner company of Electro-Science Investors, is the parent firm of Texas Crystals Co. of Fort Myers, Florida, Aero Corp. of Lake City, Florida, and Master Mobile Mounts of Los Angeles, California.

Moving Day

The entire manufacturing force and equipment of **Standard Grigsby, Inc.,** wholly owned subsidiary of Standard Kollsman Industries, Inc., has been moved to the parent firm's Aurora, Ill. plant. Sales, engineering, purchasing, prototype, short production runs, and all administrative offices and officers will be moved to Standard Kollsman's corporate offices and plant at Melrose Park, Ill. The present plant in Arlington Heights, Ill. will be sold. The move will increase production efficiencies, as over 30,000 square feet of production space and the latest production equipment will be provided.

Managerial Appointment

Lee R. Zemnick has been named manager of the Community Systems Division of **Jerrold Electronics Corp.,** according to Robert H. Beisswenger, Vice President and General Manager. Mr. Zemnick's responsibilities include engineering and selling Jerrold's CATV equipment and systems — particularly the "Turn-Key Systems."

Still Going Strong

The Electronic Marketing Division of **Essex Wire Corp.** established by Essex late last year, is the exclusive national agent for the long-established catalog lines of "Chicago" and "Stancor" transformers. More than 2,000 types of Chicago-Stancor catalog transformers will be stocked for immediate delivery through authorized Stancor distributors.

Tape Promotion

With every 7" reel of Type 2431T Audiotape from the dealers of **Audio Devices, Inc.,** the tape purchaser will receive, for one additional dollar, a 55 minute, four-track stereo recording of the works of such composers as Gershwin, Porter, Arlen, Berlin, Loewe, and Rodgers. The album, "The Melody Lingers On," is attractively packaged in a startling box of orange and magneta.

There's more profit in <u>your</u> hands with ITT tubes

Yes, you can pocket extra profit when you stock ITT receiving tubes . . . with full confidence that you are giving your customers the finest replacement tubes money can buy.

Your customers will appreciate it, too, because they know ITT's international reputation for quality and leadership in electronics.

ITT can provide this "extra value" of finest quality at higher profit margins because ITT products are available from 154 factories and laboratories in 24 countries. Brands without these world-wide resources cannot offer you these advantages.

Ask your local distributor about ITT tubes. He'll give you *extra profit* details.

ITT Distributor Products Division, International Telephone and Telegraph Corporation, Box 99, Lodi, New Jersey.

Circle 8 on literature card

ITT

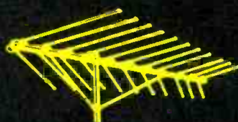
NEW FROM JFD

The Dramatic Products and You Need for Full Profits in

Nineteen months ago JFD made history

Now meet the new TV antennas, converters, and

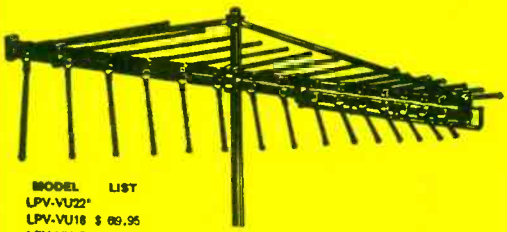
*MODEL	LIST
LPV17	$59.95
LPV14	49.95
LPV11	39.95
LPV8	29.95
LPV6	21.95
LPV4	14.95



Today begins the JFD 1964-1965 campaign of sales events and product introductions!

Exciting new Log-Periodic antennas from the JFD Antenna Research and Development Laboratories with the engineering advances to help you make the sales **others can't** in the complex new VHF/UHF/FM age.

NEW FROM THE NOTED JFD CHAMPAIGN, ILLINOIS LABORATORIES— NEW LOG-PERIODIC LPV ANTENNAS FOR ANY AND ALL BANDS . . . EVERY RECEPTION NEED!



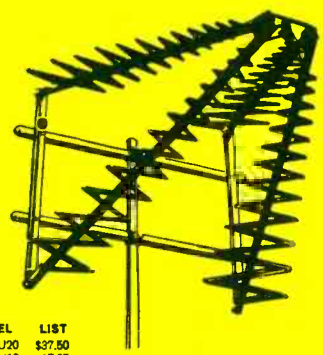
MODEL	LIST
LPV-VU22*	
LPV-VU18	$ 69.95
LPV-VU15	59.96
LPV-VU12	49.96
LPV-VU9*	

*to be announced

Model LPV-U15 (suburban-fringe) shown

NEW! THE FIRST COMBINATION VHF/UHF/FM ANTENNA —THE LOG-PERIODIC ALL-VU - WITH SINGLE LEAD-IN

Tomorrow's antenna today. The most advanced application of the Log-Periodic formula—receives all FCC authorized television channels (VHF 2 to 13 and UHF 14 to 83) plus all FM/FM Stereo frequencies. This is the first single all-channel antenna using a single down-lead to achieve this performance break-through! (So advanced it includes VHF-UHF Splitter to provide separate lead-ins to today's VHF, UHF, and FM stereo set terminals.) Available in five gold alodized aluminum models.

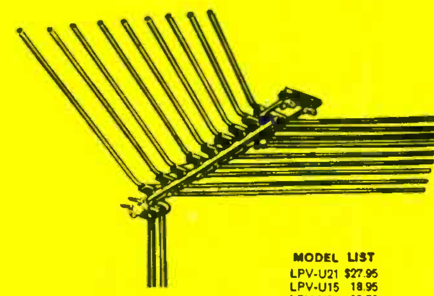


MODEL	LIST
LPV-ZU20	$37.50
LPV-ZU10	17.95

Model LPV-ZU20 (deep fringe) shown

NEW! LOG-PERIODIC ZIG-A-LOG FOR "PROBLEM" UHF AREAS

This exotic all-new UHF series obsoletes bulky parabolics and wind-prone stacked bowtie-reflectors. Packs more long-distance pick-up sensitivity per element. Another ahead-of-the industry antenna advance that puts you in command of new UHF antenna business in your town. In two gold alodized aluminum models.



Model LPV-U9 (local and suburban) shown

MODEL	LIST
LPV-U21	$27.95
LPV-U15	18.95
LPV-U9	12.50
LPV-U5	6.95

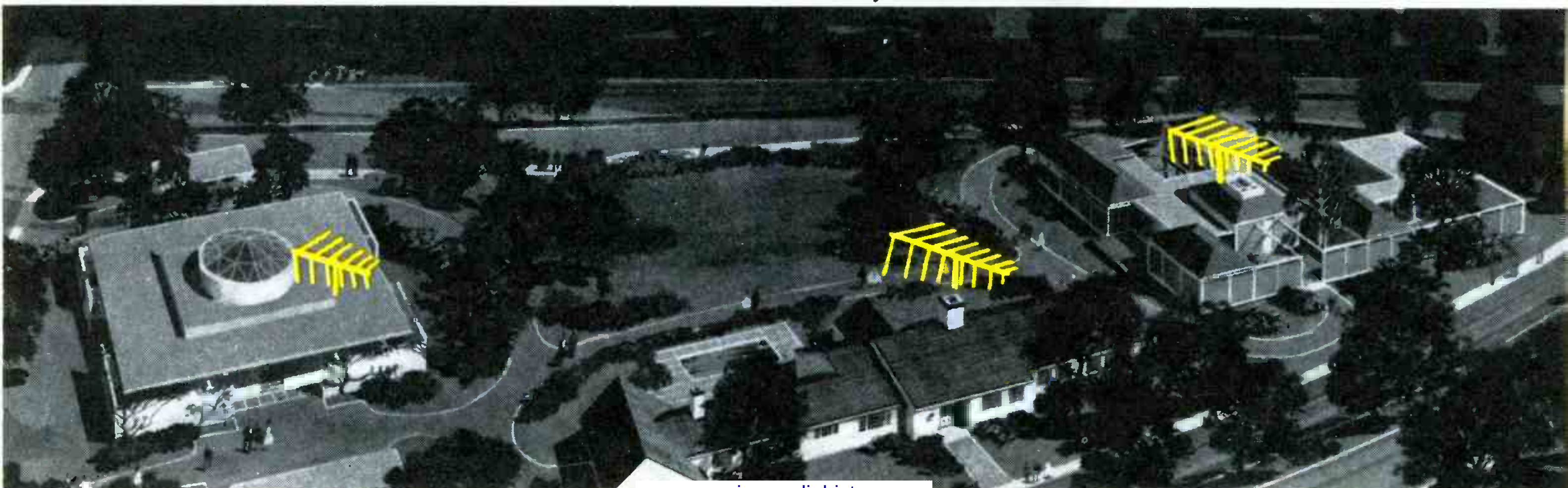
NEW! LOG-PERIODIC LPV FOR UHF CHANNELS 14 TO 83 (PLUS VHF 7 TO 13)

Developed by the same team of scientists and engineers that broke tradition with the JFD VHF Log-Periodic LPV. Delivers the high-gain, ghost-free signal needed in complex UHF for best channel 14 to 83 reception—plus channels 7 to 13. Available in four gold alodized solid aluminum rod, models—

BACKED BY EXCLUSIVE EXHIBITION AT THE NEW YORK WORLD'S FAIR HOUSE OF GOOD TASTE!

In 1964 and 1965, JFD puts the prestige and drawing power of the biggest attraction of all time behind every JFD Log-Periodic LPV TV/FM antenna you sell—the New York World's Fair!

This powerful new marketing force will be at work building record Log-Periodic LPV Sales and Profits for you!



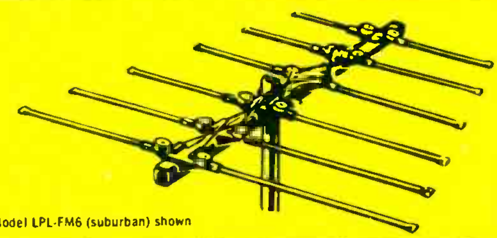
Promotions Today's VHF, UHF, FM Markets!

with the revolutionary Log-Periodic LPV antenna*... amplifiers that will make new history for JFD dealers and distributors!

All-new precision engineered UHF converters, antennas, TV amplifiers for VHF, UHF and FM that are as powerful as they are saleable.
Backed up by the greatest promotion ever—the JFD World's Fair Festival!
This is the kind of **extra**-ordinary product and promotion support **you** can expect as a member of the creative JFD marketing team.

Selected by HGT NEW YORK WORLD'S FAIR HOUSE OF GOOD TASTE

Unisphere presented by United States Steel
© 1961 New York World's Fair 1964-1965 Corporation

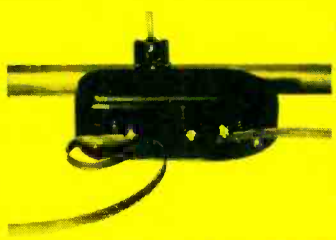


Model LPL-FM6 (suburban) shown

MODEL	LIST
LPL-FM10	$49.95
LPL-FM8	39.95
LPL-FM6	29.95

NEW/ THE FIRST FM/FM STEREO LOG-PERIODIC

Makes even smallest high-fi system pour forth FM sound as it was never heard before. Features unique new Log-Periodic LPL dipole that outperforms FM antennas twice the size. Another new antenna breakthrough through JFD engineering leadership. Available in three area-engineered gold alodized aluminum models. Model LPL-FM8, for 28% more gain, model LPL-FM10 for 52% more gain than the best 10 element yagi.



MODEL	LIST
VF2	$39.95
VF1	34.95
FM1	34.95
UH1	39.95
NV2	$39.95

NEW! ANTENNA AMPLIFIERS FOR VHF, UHF AND FM

All-new solid state circuitry for drift-free, distortionless amplification—extra reliability. Mounts on any antenna crossarm for up to 16 db of additional noise-free gain. Uses printed circuitry that is sealed against weather effects. AC power supply, located at set, also serves as multi-set coupler. "OFST" Offset Free-Space Terminals insure maximum signal transfer. Fully warranted. Available in VHF, UHF, and FM/FM stereo models. In both transistor and Nuvistor models.

MODEL	LIST
CR2-J	39.95
CR1-J	29.95

Model CR2-J (channels 14 to 83) shown

NEW! UHF CONVERTERS

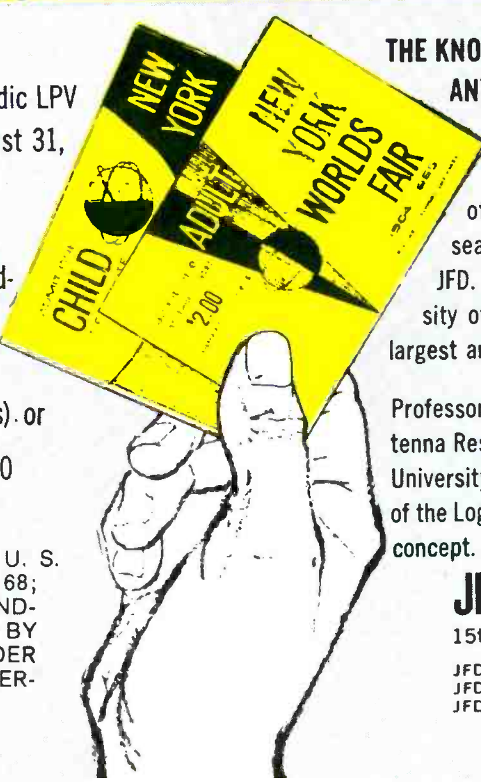
The first all-transistorized UHF converter. Lower noise, higher reliability, excellent 300 ohm impedance match—outperforms any tube-type converter. Absolutely drift-free because of its heat-less solid state circuitry. Instant start-up. Consumes less power than conventional tube-types. Elegantly styled. Dial light illumination on UHF channel scale for convenient tuning. Only 6" X 7" X 2½". In two models

PLUS!—

Every JFD VHF, UHF or VHF-UHF Log-Periodic LPV you buy between March 1, 1964 and August 31, 1965 earns you valuable JFD Fair Festival Certificates which you can:

1. Trade in for FREE World's Fair Adult Admission Tickets (worth 150 points) or..
2. Trade in for FREE 3-day, 2-night Fair Week-ender holiday (worth 3,000 points). or
3. Redeem for $1.25 cash for each 150 points, from JFD.

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



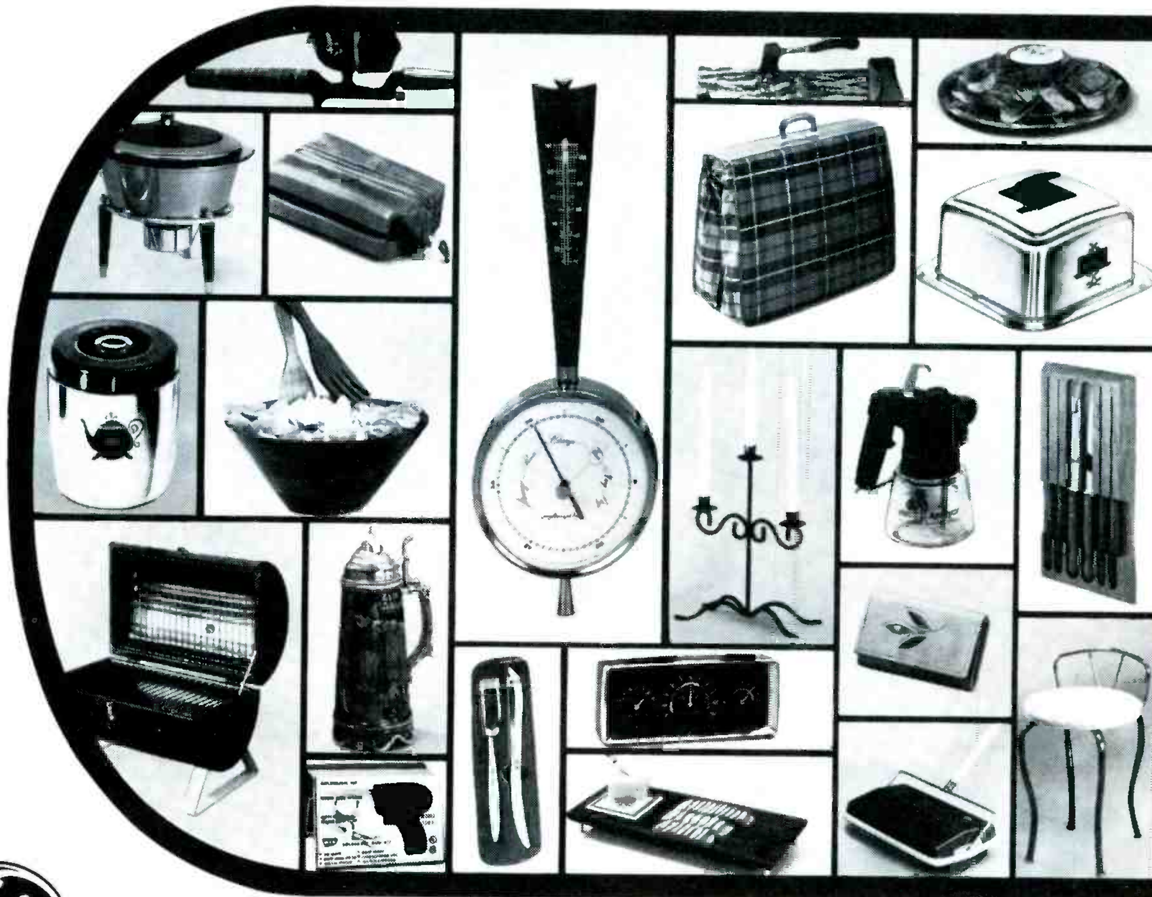
THE KNOW-HOW OF THE WORLD'S NEWEST AND FINEST ANTENNA LABORATORIES IS BUILT INTO EACH JFD LPV ANTENNA YOU SELL!

The Log-Periodic concept is the result of six years of intensive electronic studies at the Antenna Research Laboratories of the University of Illinois and JFD. Located in Champaign, Illinois (home of the University of Illinois), the vast new JFD research center is the largest and most complete of its kind.

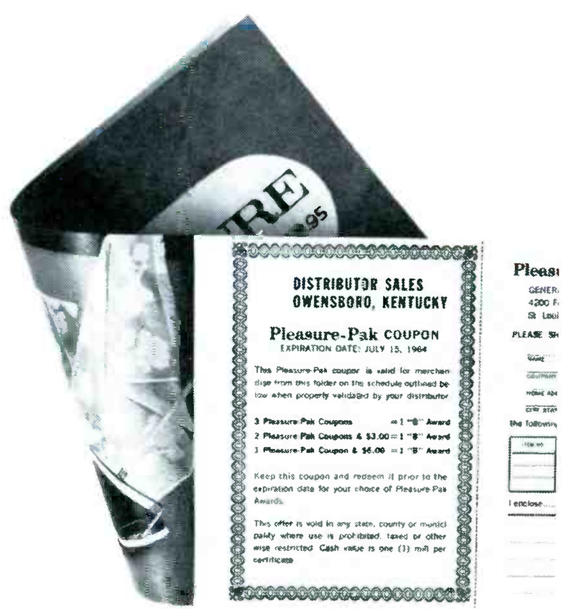
Professor Paul Mayes of the Antenna Research Laboratories of the University of Illinois, the originator of the Log-Periodic V-dipole antenna concept.

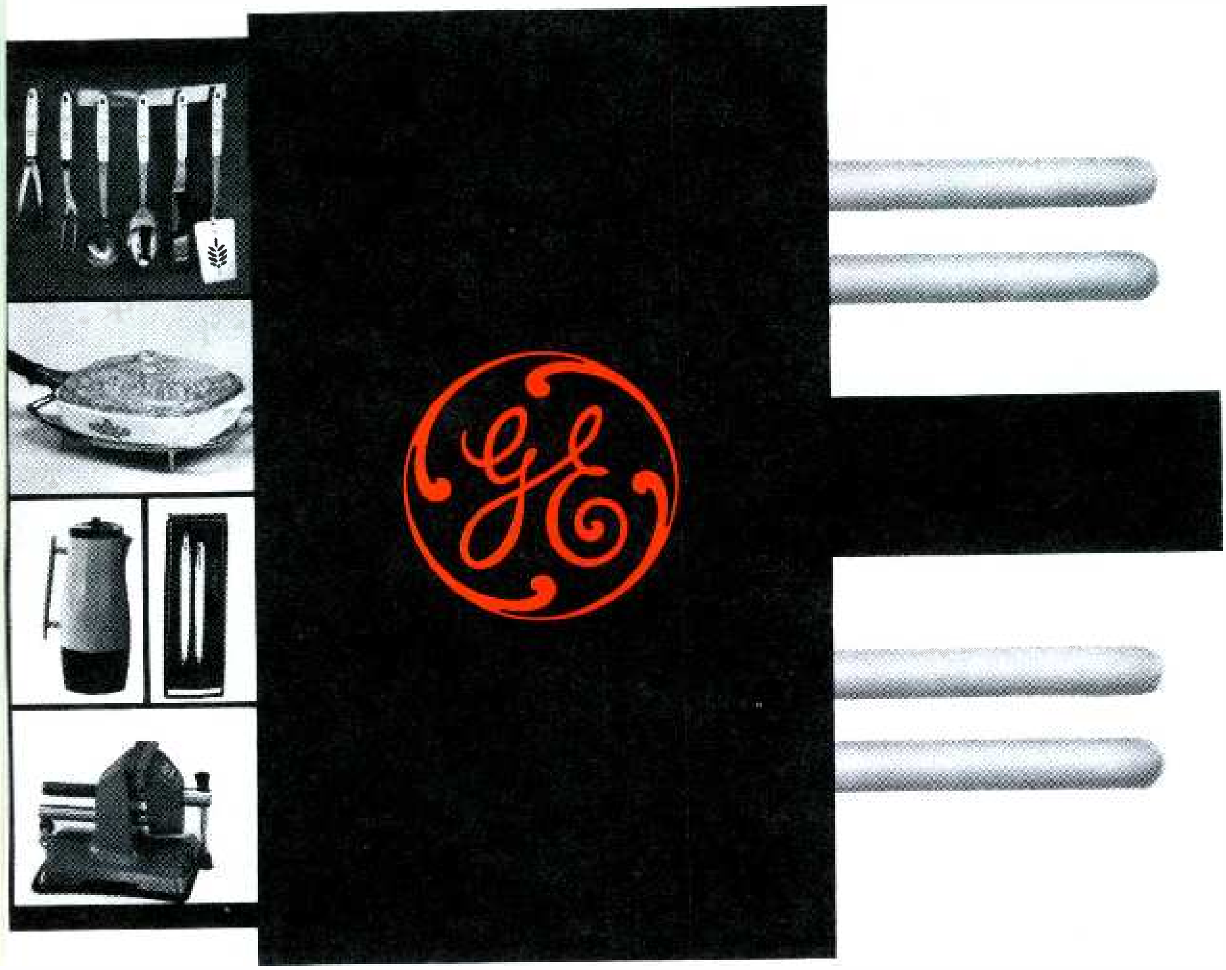
JFD ELECTRONICS CORPORATION
15th Avenue at 62nd Street, Brooklyn, N. Y. 11219

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



pleasure pak



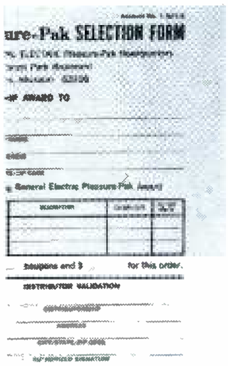


Get in on General Electric's Pleasure Pak program

The purchase of General Electric tubes makes you eligible to receive valuable merchandise during G-E's Pleasure Pak program. Imported musical steins, luggage, barbeque grills, tools, sporting equipment, carving sets and tableware and many other things can be yours at a tremendous discount or *even free*. All of these are well-known brand name products or special items that are not normally for sale.

Make your own selections from G-E Pleasure Pak books

You're not limited to just one or two items. General Electric Pleasure Pak books contain 48 handsome "prizes," accurately illustrated and described. When you buy G-E tubes, you earn one of these books. Then it's *your choice* of the merchandise inside.



Ask your G-E distributor how to earn Pleasure Pak books

Your General Electric receiving tube distributor has a supply of Pleasure Pak books. The back cover of each book is a certificate redeemable for the merchandise shown in the book. Ask your distributor how to get them. The Pleasure Pak program is limited to April and May, 1964. Better stock up on G-E tubes NOW!

Progress Is Our Most Important Product

GENERAL ELECTRIC

Circle 10 on literature card

The Troubleshooter

answers your servicing problems

Rolling Picture

I have an RCA Chassis KCS128 with vertical trouble and I have to call for help. When the receiver is first turned on, I get poor vertical deflection plus rolling at a rapid rate. Deflection is short—about 4" at top and bottom, at first. After a minute or so, the picture stops rolling and expands to normal. In an hour or so, the bottom of the picture begins to creep up. I have used a signal substitutor along the vertical section and have substituted almost every component with no hint as to the trouble.

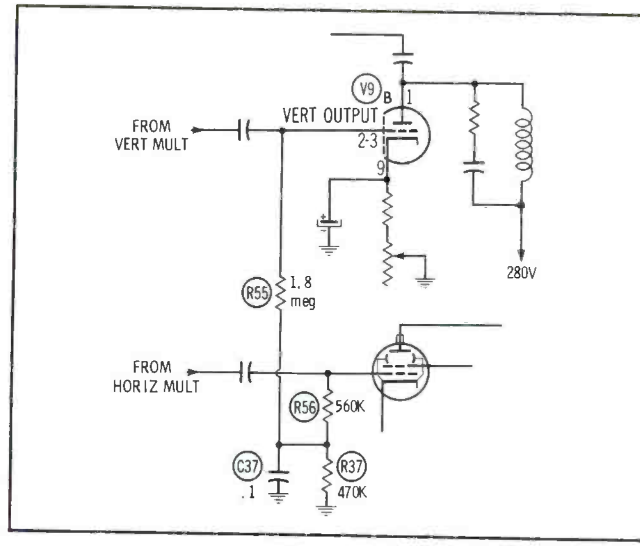
Austin D. Miller

Bronx, New York

This chassis is covered in Photofact *Folder 461-1. A look at the schematic leads me to believe the cause of your trouble is the printed control board labeled R6. This is a triple unit containing the AGC, height, and vertical linearity controls. This unit sometimes becomes intermittent after a period of time, with the height being affected first. The replacement units now available from your local parts distributor are an improved version designed to minimize failures of this type.*

Hot and Cold

I have a Philco Model G4242M which has been in and out of my shop since the set was purchased. It has had the same trouble every time. The picture rolls vertically until the set has warmed up—normally 20 to 30 minutes. Then it's fine. I have tried everything I could think of, including Philco change bulletins, without success. I have changed tubes and checked waveforms until I'm at the end of my rope.



Dutch Meyer

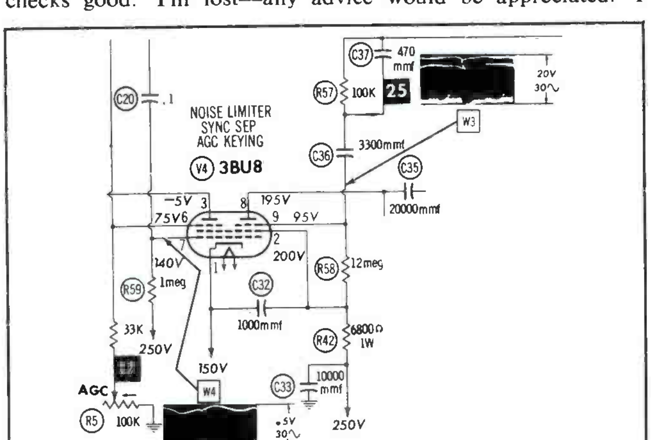
Missoula, Montana

This sounds like a thermal problem. Normal troubleshooting procedure for troubles of this type is to hold a soldering iron near various frequency-sensitive components (such as unit K4) while noting the effect on the picture. An alternate method to use after the set has warmed up is to use a freeze spray on suspected components. There is one slightly interrelated factor in this particular circuit. Bias for the vertical output is taken from a voltage divider in the horizontal-output grid circuit. Slow buildup of horizontal drive could be your problem. Elimi-

nate this suspect by disconnecting R55 from the voltage divider and using a bias box as a substitute. For the voltage to use, measure the output of the voltage divider before disconnecting R55 and while the set is operating perfectly.

'BU8 Revisited

I have an Admiral Model PL17F31B in my shop for repair. The trouble is a horizontal tearing which starts at the top and drifts about halfway down the screen. At times, the top of the picture "christmas trees." The horizontal lock control is very critical and the hold control has very little range. Waveshapes, resistances and voltages are all normal except on the 3BU8 stage. Pin 9 on this tube measures 55 volts, but according to PHOTOFACT Folder 471-1 it should be 95 volts. Pin 8 sometimes reads 250 volts, but at other times reads normal. I have substituted parts in the sync-separator circuit and can find nothing wrong. The horizontal phase-detector circuit also checks good. I'm lost—any advice would be appreciated. I



must fix this set since it belongs to my commanding officer.
SGT. JAMES MANSER

New York, New York

You are probably right in checking for trouble in the 3BU8 circuit. The intermittent 250-volt reading at the plate indicates that the sync section of this tube is being cut off at these times. The reason is probably tied in with the unusually low DC voltage at the screen grid (pin 9). This should go less positive when signal is applied, but not as low as 55 volts. It is unlikely that trouble exists in the line from the video amplifier. Faults here would tend to increase the pin-9 voltage instead of decreasing it. Check for leakage from pin 9 to ground. There is also a possibility of trouble in the noise-limiter circuit at pin 7, since this control grid is common to both stages. Too much bias on this grid will tend to cause erratic conduction. The September and October 1962 Symfact *gives a lot of information on this circuit.*

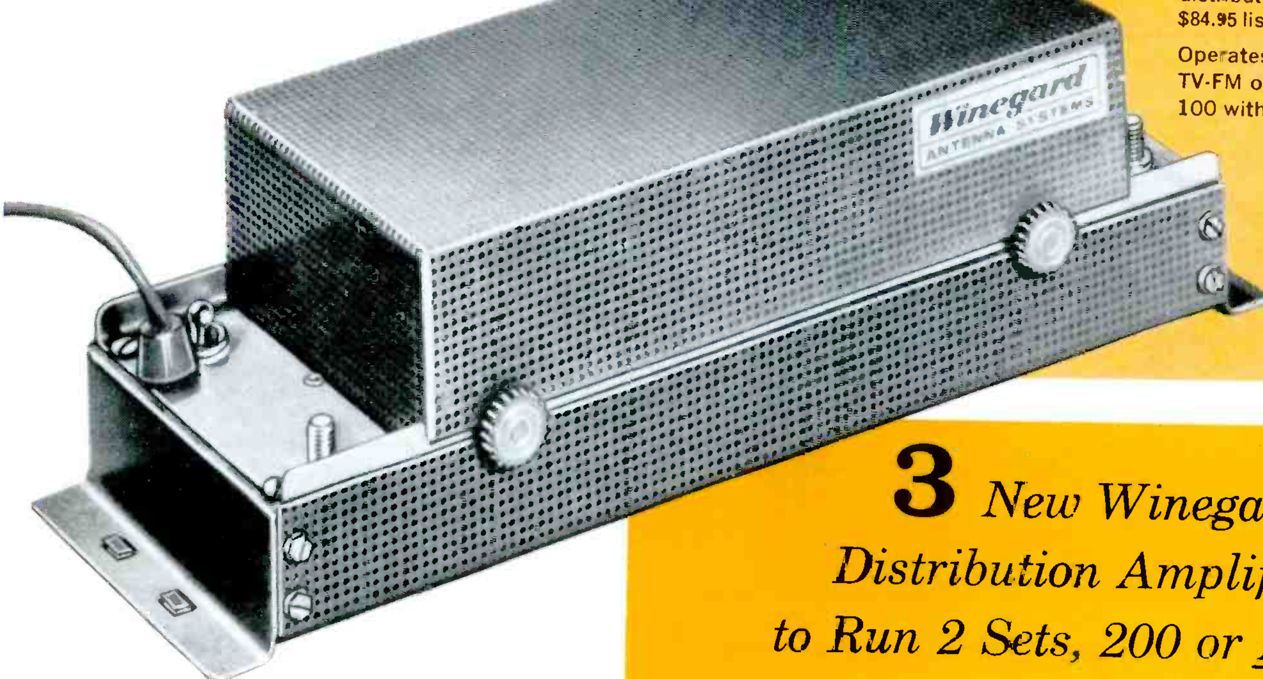
Pulley Pulling

Our problem is an RCA record changer Model RP20502 that will not come up to proper speed. We know the idler wheels need to be changed, but how do we get them off without "goofing up the works?" Visual observation fails to show how to remove them. Can you also give replacement part numbers?
ED KARL

Tacoma, Washington

The RCA Model RP 205 02 changer is covered in PHOTOFACT *Folder 358-10. There are three ways idler pulleys can be fastened. They can be mounted on a plate by means of a spindle extending through the plate and held by a spring clip. Another type slides down over a post and is held in place by a spring clip on top. The third type, which I think you'll find in the RCA changer, also slides down over a post but is held in place by an internal snap-ring. A firm upward pull will release this type. Replacement also requires a firm push. Part numbers for the various replacement idler pulleys will be found in the* PHOTOFACT *Folder.* ▲

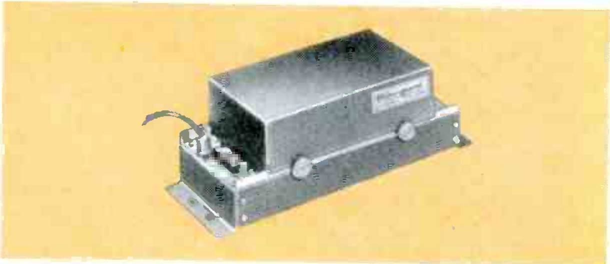
NEW TV and FM distribution designed specially



MODEL A-430
4-tube, 30 DB GAIN
distribution amplifier
$84.95 list

Operates 1-50
TV-FM outlets,
100 with preamp.

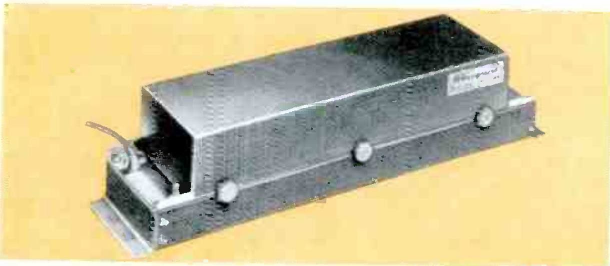
3 *New Winegard Distribution Amplifiers to Run 2 Sets, 200 or MORE*



MODEL A-215
2-tube, 15 DB GAIN / general purpose TV-FM Amplifier
$44.95 list

■ Provides 15 DB gain for home systems, small motels or apartment buildings. Drives up to 20 TV-FM outlets or line tap-offs . . . up to 40 with preamp. 30 volts AC is available by preamp switch at input jack to operate Colortron or Stereotron antenna directly from A-215 without extra power supply.

SPECIFICATIONS—Tubes: two 6HA5. **Gain:** +15db. **Bandpass:** 50-110MC, 170-220MC. **Response:** flat, ±.25db per 6 MC channel. **Noise Figure:** 3.7db lo-band, 5db hi-band. **Max. Signal Input:** 350,000 micro-volts. **Max. Signal Output:** 2V. **Input Impedance:** 75 or 300 ohm. **Output Impedance:** 75 or 300 ohm. VSWR input and output better than 1.5 to 1. Two C-59 75 ohm connectors supplied. Blue Baked enamel perforated steel cabinet, 2⅞ x 9¼ x 3⅜". AC cord. **Switches: On-Off;** power to pre-amplifier. AC fuse. 117V 60 CPS 14 watts.



MODEL A-845
8-Tube, 45 DB GAIN / Distribution Amplifier $159.95 list

■ For large hotels, motels, hospitals, schools and apartments. Operates 1-150 TV outlets, 300 sets with preamp. 30 volts available by switch at input jack for operating Colortron or Stereotron preamplifier directly from A-845 without extra power supply.

SPECIFICATIONS—Tubes: Six 6HA5; two 6DJ8. **Gain:** +45db. **Bandpass:** 50-110MC, 170-220MC. **Response:** flat, ±.25db per 6 MC channel. **Noise Figure:** 3.7db lo-band, 5 db hi-band. **Max. Signal Input:** gain control at max., .008V per band; gain control at min., .025V. per band. **Max. Signal Output:** 3.2V. **Separate Hi and Lo Band Gain Controls:** 0-10db; Separate hi and lo band tilt controls 3-6db. **Input Impedance:** 75 ohm. **Output Impedance:** 75 ohm. VSWR input and output better than 1.5 to 1. Blue baked enamel perforated steel cabinet. 2⅞ x 14½ x 3⅜". AC cord. **Off-On** switch. AC fuse. 117V. 60 CPS 48 watts.

A COMPLETE LINE OF WINEGARD MATCHED DISTRIBUTION SYSTEMS . . .

ANTENNAS

Colortron All-Channel Antennas GOLD ANODIZED 4 models $24.95 to $64.95. Finest TV antennas made.

De Luxe Yagis GOLD ANODIZED Broadband and cut-to-channel. Amplified or non-amplified. High gain, rugged construction, channels 2 to 13, low band and hi band.

Stereotron FM Antenna Model SF-8 $23.65 most powerful FM antenna, gold anodized.

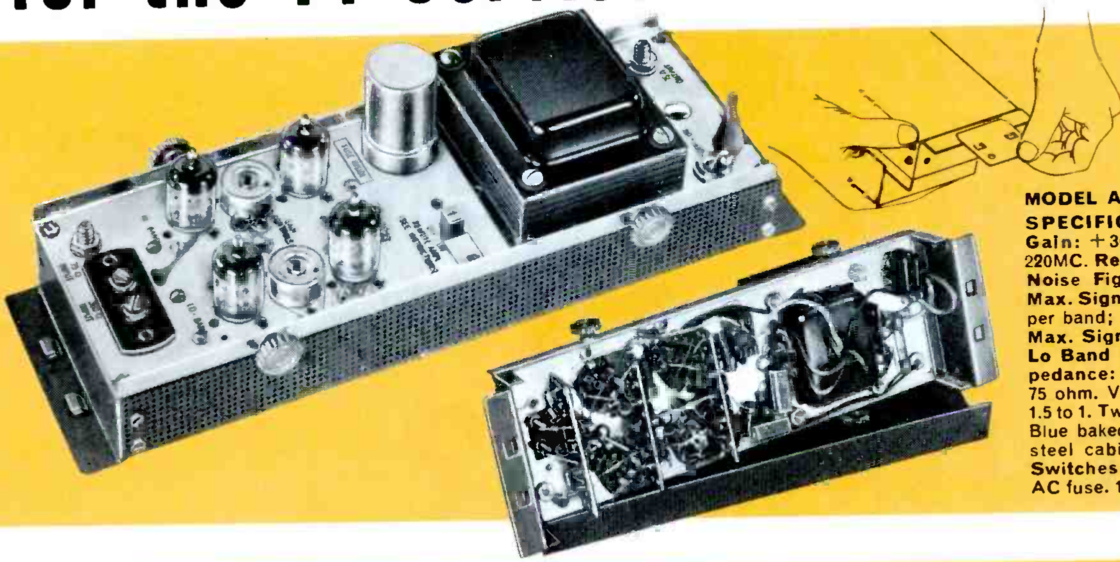
ANTENNA PREAMPLIFIERS

Colortrons—twin nuvistors 300 ohm Model AP-220N, $39.95. 75 ohm Model AP-275, $44.95 Drive 1-6 sets

Red Head RD-300 transistor preamplifier Drive 1-6 sets $29.95

Stereotron Preamplifier for FM. Twin Nuvistors Model AP-320, 300 ohm $39.95 Model AP-375, 75 ohm $44.95

system equipment by WINEGARD for the TV Service Technician



Exclusive wall hanger bracket for instant removal of amplifier.

MODEL A-430

SPECIFICATIONS—Tubes: four 6HA5. **Gain:** +30db. **Bandpass:** 50-110MC, 170-220MC. **Response:** ±.25db per 6 MC channel. **Noise Figure:** 3.7db lo-band, 5db hi-band. **Max. Signal Input:** gain control at max., .02V. per band; gain control at min., .1V per band. **Max. Signal Output:** 2V. **Separate Hi and Lo Band Gain Controls:** 0-10db. **Input Impedance:** 75 or 300 ohm. **Output Impedance:** 75 ohm. VSWR input and output better than 1.5 to 1. Two C-59 75 ohm connectors supplied. Blue baked enamel fully ventilated perforated steel cabinet, 2⅞" x 11" x 3⅜". AC cord. **Switches:** OFF-ON; power to preamplifier. AC fuse. 117V. 60CPS 25 watts.

BEST DISTRIBUTION AMPLIFERS MADE—HERE'S WHY

- **DESIGNED FOR COLOR AND FM STEREO**
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  Only amplifiers made that use all high transconductance, low noise triodes—no pentodes.
- **EXTENDED BAND PASS —**
  Allows cascading without clipping in end channels.
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Winegard equipment has been engineered for the busy technician who doesn't have the time to do a lot of pre-planning and experimental work on the job. If you have been installing distribution systems, you will appreciate the way the engineering has been done in the factory to eliminate time on the job. If you haven't installed distribution systems, now you can get into this interesting, exceptionally profitable work in your area.

Every component of a Winegard distribution system is designed to match perfectly, from the antenna to the set . . . for installations in homes, apartment buildings, schools, hospitals, motels, hotels, trailer courts.

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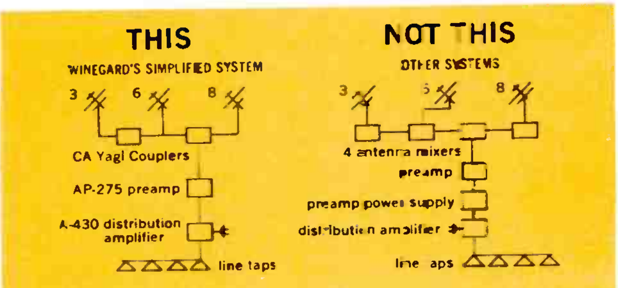
Example Winegard's Simplified System

For instance, an apartment house with 20 outlets, fringe area—stations 50 and 30 miles away—channels 3, 6 and 8 in 3 different directions.

Note the Winegard system uses only 4 major components to simplify the installation yet gives better performance as against other systems' use of 7 components.



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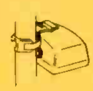
ANTENNA COUPLERS

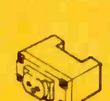
EC-230 Amplified 2 set Color Coupler Transistorized amplifies signal, $17.95, 10 set, 6 set, 4 set and 2 set couplers for 2 to 10 TV or FM sets.



Yagi Couplers—Couple any combination of Winegard cut-to-channel or broadband yagis.

TV-FM Coupler — couples TV and FM antennas, also can be used to split TV-FM signals.

LINE TAP-OFFS, TV/FM OUTLETS, LINE DROP TAPS, SPLITTERS



Flush or surface mount line tap-offs, 75 and 300 ohm models.

TV-FM outlets for both flush and surface mount Complete with outlet plugs—10 models

Line Drop Taps—Drop branch lines from trunk lines. Split line 2 or 4 ways.

- Matching Transformers, . .
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- Attenuation Pads,
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Circle 12 on literature card

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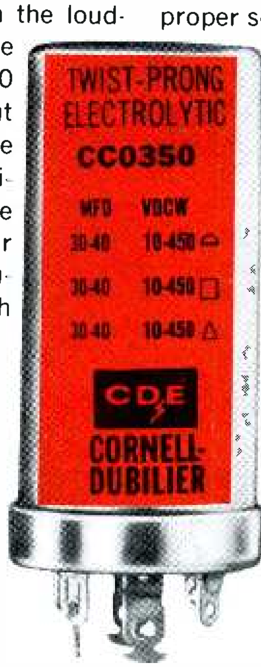
What is an "exact replacement?" To CDE it's the proper capacitor to do the job intended—available when you need it. To others, it means number matching by the service technician—matching the numbers on the old unit with those of the replacement—without regard to availability or cost. CDE's new Twist-Prong line is based on our service-oriented definition.

Matching numbers may be fun, but there comes a time when it's a losing game. In Twist-Prongs the growth in ratings used in original equipment has been phenomenal. Even the loudest advocates of number matching have to hedge. One advertises over 1700 "exact replacements"—catalogs about 1200—and, of that 1200, lists possible alternates for 297 "if the listed capacitor is not available." Then, there's the problem of popular and "less popular items"—or, you're lucky if your distributor has the number you're trying to match in stock.

To Cornell-Dubilier, the availability of a proper replacement to do the job intended is most important. That's why we've designed a complete new Twist-Prong line for the professional electronic service technician. It's a line that recognizes the broad tolerances inherent in electrolytic manufacture and widely recognized throughout the industry—a fact you've used repeatedly in making replacements. It's a line that enables your distributor to have a complete stock so units will be available when you need them. It's an "exact replacement" line in the proper sense of the word.

Only the CDE Twist-Prong line is designed to make your job easier. A new Twist-Prong Replacement Guide and Cross Reference details manufacturers recommended in-stock replacements for every current Twist-Prong rating. The line is listed, too, in the new CDE Replacement Component Selector. Ask your distributor for copies today and end the old fashioned matching numbers game.



CDE CORNELL-DUBILIER

INNOVATION WITH RELIABILITY

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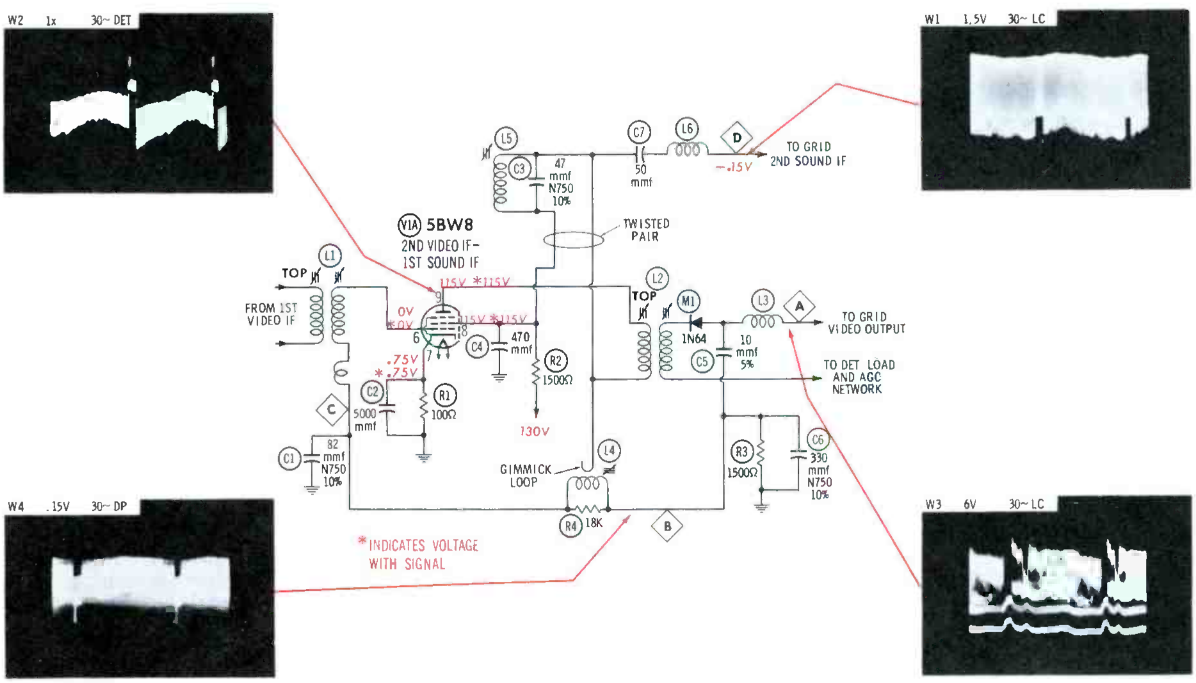
PF REPORTER Symfact™

Reflex Sound IF

Video and Sound in One Tube



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

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

Normal Operation

Unusual sound takeoff and amplifying arrangement (from Muntz J-series chassis) is called *reflex* sound-IF system. Intercarrier sound signal is developed by video detector M1 as usual. However, instead of being coupled directly to conventional sound-IF amplifier, 4.5-mc carrier is coupled through C5, tuned circuit L4-C1, and secondary of L1 to grid of V1A, which was video-IF amplifier "first time around." In reflex path, low-value C5 passes only 4.5-mc portion of video-detector output, rejecting lower-frequency video signals; L4 and C1 are series-resonant to 4.5 mc, passing this signal efficiently; secondary of L1 presents low impedance to 4.5-mc signal, being designed to resonate at video IF. V1A then amplifies frequency-modulated sound signal. Tuned circuit L5-C3 is portion of plate load, in series with L2 primary. Winding of L2 offers impedance only to video-IF components, so sound-IF carrier is developed across L5-C3 and coupled to second sound IF by C7. Wire gimmick is connected to same signal takeoff point as C7 and capacitively couples signal to L4 in reflex loop, making circuit regenerative and improving gain for 4.5 mc. Other components serve various functions: C1 helps keep 40-mc video-IF signals out of reflex line as well as resonating with L4; extra (tertiary) winding on L1 controls bandwidth of transformer and minimizes unwanted video-IF regeneration; C6 helps decouple, but also affects level of 4.5-mc signal entering reflex circuit from video detector. B+ is series-fed through R2, L5, and L2.

Operating Variations

PIN 9 Presence or absence of signals have little effect on DC voltages at this pin, or at any other point in this stage. Waveform amplitudes, however, depend considerably on both signal strength and setting of AGC control switch. Demodulator probe must be used to check waveforms at this point; probes will naturally indicate video modulation on IF signal rather than sound signal (which is FM). Designations .1x, 5x, etc., indicate waveform amplitudes as compared with normal 1x amplitude of W2.

B At this point, video detector has already demodulated video-IF signal, so detector probe isn't needed. Amount of video signal passed by small-value C5 is not great—only .15 volts peak to peak, with direct probe. Low-cap probe would be better, but would attenuate signal so much (10:1) as to render it difficult to see on scope.

D Waveform here is interesting to compare with others. For example, look first at W4. Signal permitted on reflex line by C5-R3-C6 consists mainly of sound carrier (note RF shading) but video can't be kept out entirely. Further around reflex path, notice W2—plate load is developing mainly video, with sound IF not so noticeable. Look lastly at W1, taken in the plate-load circuit but *below* video-IF tuned circuit: Characteristic appearance of W4 reappears in W1, inverted and minus sync tip; notice also amplitude of W1 is at least 10 times that of W4.

Sound Weak, Garbled

SYMPTOM 1

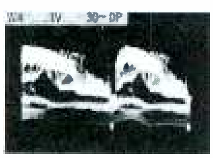
Contrast Severely Reduced

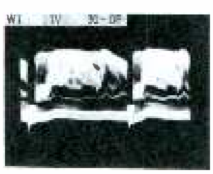
C3 Open

(4.5-mc Load Capacitor—47 mmf)

Symptom Analysis

Almost no sound, even a maximum volume. Noise and hum level very high in sound. Fine tuning can be adjusted to improve sound somewhat, but picture is almost lost. Tune for better picture, sound disappears. Ringing ghost can be varied considerably by fine tuning.

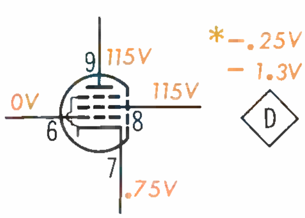




Waveform Analysis

Appearance of W3 is okay, but amplitude is considerably reduced, even with fine tuning set for best possible picture. When fine-tuned for best sound, video reduces to only .1 volt. Sound-IF information is missing from W4; only video shows, at reduced amplitude. W1 so small that direct probe is needed to view; again, strong video indicates poor action of reflex system. Trouble must be in some section affecting 4.5-mc sound signal.

Voltage and Component Analysis



Very few voltage clues available; tube pins show same as during normal operation. DC voltage at point D is higher than normal, but this is not significant clue. L5-C3 normally forms parallel-resonant load for 4.5-mc signal. With C3 open, L5 is no longer proper load and plain video shows up in all waveforms in reflex path, instead of 4.5-mc IF. High hum level is caused by sync pulses making their way around reflex path. Conclusive test is to try aligning L5; naturally, if it won't peak, C3 or L5 is faulty. Replacing C3 furnishes final proof.

Best Bet: Scope will isolate this trouble quickly.

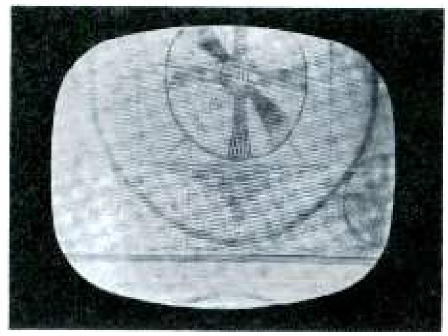
Picture Weak

SYMPTOM 2

Audio Affected Somewhat

R2 Increased in Value

(1500-ohm Plate Supply Resistor)

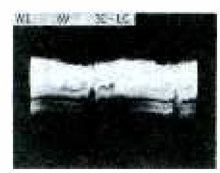


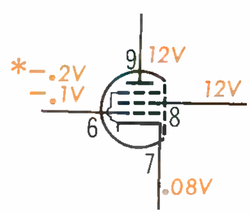
Symptom Analysis

Most noticeable symptom is washed-out video signal. Video almost takes on appearance of AGC trouble—picture seems as if it might turn negative. Sound seems almost normal, except that volume control must be set higher than usual. Buzz is quite noticeable in sound.

Waveform Analysis

W3 is greatly reduced; at some settings of fine tuning, W3 may reverse polarity. W2 is only one-tenth normal amplitude; offers proof trouble is in V1A or prior stage. Some video showing in W1, explaining buzz. W1 is also much lower in amplitude than normal. Considering that all waveforms are reduced in amplitude and 4.5-mc waveform (W1) appears nearly normal in shape, logical conclusion is: Trouble common to both functions.





Voltage and Component Analysis

Voltage clues are highly significant in this symptom. Tube will obviously not amplify with plate voltage reduced to 10% of normal. R2 is supply resistor for V1A, and thus is common to both video IF and sound reflex. Video-IF signal can be considered "first through," so is affected more seriously than sound. R2 in this case increased almost to 150K; at 300K, video would be lost completely and very little sound would be audible. Negative-appearing video might lead to suspecting AGC, but clamping has no effect, so that idea is discarded.

Best Bet: VTVM is sufficient, but scope helps.

No Picture, No Sound

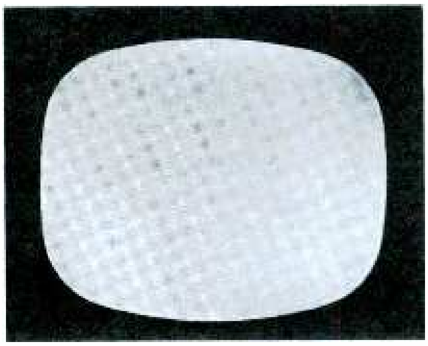
SYMPTOM 3

No Snow

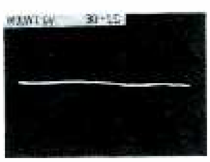
C4 Open

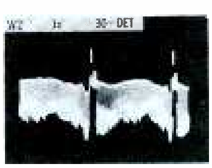
(Screen Bypass—470 mmf)

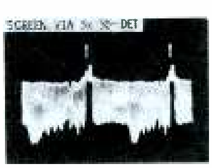
Symptom Analysis



Raster is okay, with normal brightness operation. No video is visible at any setting of contrast control. Shaded bars may appear, caused by stage oscillation. *Note:* Vertical oscillator needs strong sync; therefore vertical sweep may also collapse occasionally.



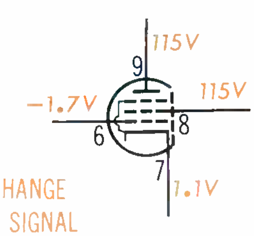




Waveform Analysis

Complete absence of W3 and W1 indicates V1A isn't passing signal; however, W2 appears normal in shape and amplitude. Confusing clues, but they do pinpoint trouble between V1A and points A or D. More scoping turns up waveform at screen of V1A; C4 should eliminate this signal almost entirely. High amplitude of screen waveform is proof that C4 is totally ineffective. IF waveform can't reach points A or D, nor can video reach M1.

Voltage and Component Analysis



*NO CHANGE WITH SIGNAL

Increased grid and cathode voltages are only clues offered by VTVM. Negative voltage at grid points to open L1 or possible oscillation in tube. Open bypass capacitor fails to keep low end of output load at RF ground. Main result is that tuned circuits (plate load) cannot pass signal on; byproduct could be oscillation. Another way to look at this symptom is to consider that, with bypass open, screen acts same as plate; signals are thus conducted straight to power supply. Neither L2 nor L5 will respond to alignment attempts.

Best Bet: Scope does the full job.

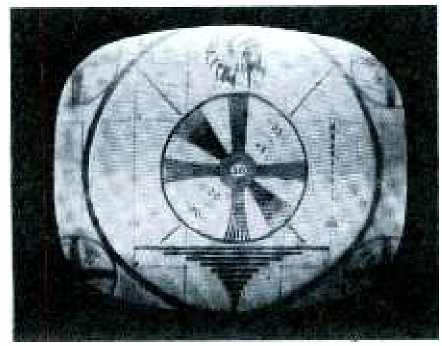
Sound Weak, No Distortion

SYMPTOM 4

Picture Okay

C7 Leaky

(Sound-IF Coupling Capacitor—50 mmf)

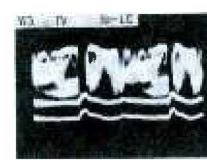


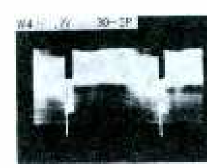
Symptom Analysis

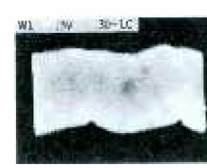
Picture is normal on all channels. Contrast and brightness controls operate normally. Volume is very low, even with control turned wide open, but sound is not distorted. Lack of buzz in sound would indicate trouble is in audio stages, but tests there offer no clues to fault.

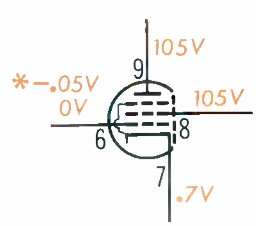
Waveform Analysis

W3 is approximately normal, or a little higher in amplitude. Tracing signal around reflex path reveals W4 equally well defined and increased a bit. View of W1 isn't so encouraging, however: Amplitude is reduced to one-third usual value, but most significant clue is total lack of any sync pulses in 4.5-mc signal. Sync pulses aren't important to operation of sound-IF circuits, but fact that they are missing indicates a fault that could block low frequencies.









Voltage and Component Analysis

Leaky capacitor accounts for reduced voltages at screen and plate; B+ is dropped slightly by increased current through R2. Indeed, if fault lasts long, or C7 becomes more leaky, smell and sight of smoke will lead to faulty component—R2 will burn, and C7 is most likely cause. One cause for reduction in sound level is positive voltage reaching grid of following tube; upsets limiting action of second sound-IF stage. If L4 or L5 were misaligned, effect on waveform W1 would be similar, but DC voltage would remain about normal.

Best Bet: Scope offers most significant clue.

Picture Washed Out

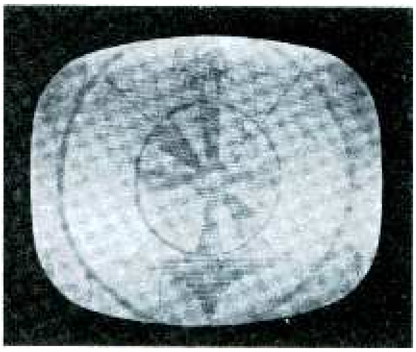
SYMPTOM 5

Sound Also Reduced

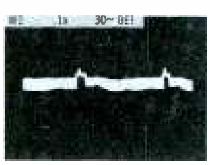
L5 Open

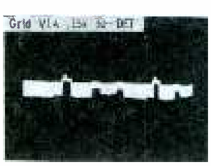
(4.5-mc Load Coil)

Symptom Analysis



Picture is weak and washed out, even on local channels. Weak stations produce little or no sound or picture. Sound is reduced on all stations and has considerable buzz, indicating IF-circuit trouble. High contrast setting produces near-normal picture, but buzz persists.

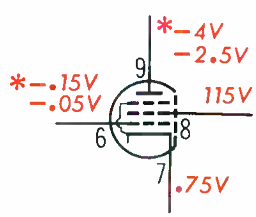




Waveform Analysis

W3 appears normal except that amplitude is only 20% of usual. Greatly reduced W2 is indicative of poor amplification in V1A; signal at point B is less than 10% of normal. Checking waveform at grid confirms this indication; amplitude is greater at grid than at plate. Going one step further, test at point D would reveal almost no 4.5-mc signal in W1—mostly video there. Further analysis of waveforms tells nothing; time to switch to VTVM.

Voltage and Component Analysis



Obvious payoff is voltage check of tube operating potentials. Missing plate voltage is dead giveaway. Since screen voltage is normal, R2 is ruled out as suspect. Trouble could be open L2 or L5; ohmmeter check will verify which. Age, corrosion, poor soldering practice—all could cause this fault. Cause of buzz in sound is explained earlier: Video can get into sound-IF circuit when 4.5-mc tank circuit is no longer tuned; sync pulses cause buzz. Examination of waveform at point D shows video and furnishes conclusive proof of this.

***Best Bet:** Scope not conclusive; VTVM tells the story.*

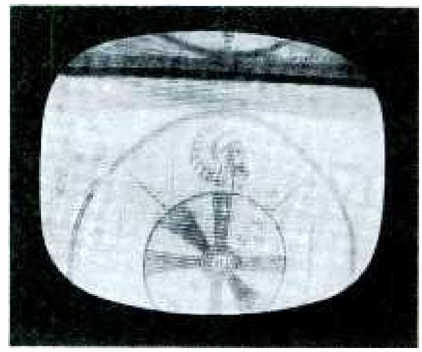
Contrast Poor, Sound Garbled

SYMPTOM 6

Vertical Hold Critical

R1 Increased in Value

(100-ohm Cathode Resistor)

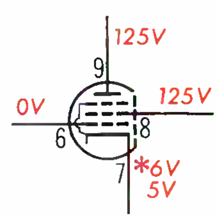


Symptom Analysis

Picture highlights are not at all distinct. Contrast is considerably reduced, and even takes on "negative" appearance of AGC trouble. Clamping AGC has no effect. Vertical sync is poor, and picture rolls intermittently. Sound distortion is severe at all volume settings.

Waveform Analysis

Examination of W3 exposes cause of sloppy sync—compression of pulses is easily visible in this waveform. In addition, amplitude is very low compared with usual 4 to 8 volts p-p. Moving back to plate of V1A, a look at W2 reveals waveshape with very low amplitude, indicating that V1A may not be amplifying. Waveform at grid of V1A verifies that V1A is inoperative; waveform is obviously okay, but is larger at grid than at plate.



Voltage and Component Analysis

Switching from scope to VTVM, now that trouble is isolated, observe plate voltage of V1A. It is almost at B+ source level; same for screen, and both indicate that tube conduction must be cut off. Check at cathode shows much higher-than-normal voltage there, ordinarily result of increase plate current. Only other explanation is that cathode resistor must be high in value. Test with ohmmeter is conclusive. R1 in this instance had increased to 15K. Could have resulted from temporary overload by faulty tube, or could be result of age.

***Best Bet:** VTVM for voltage and resistance measurements.*

NEW

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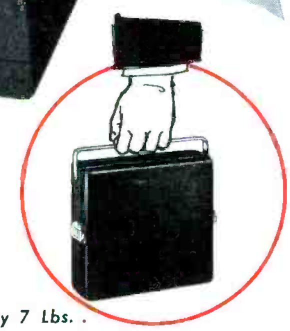

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NEW
Lower voltage checks for Nuvistors and all new frame grid tubes, as demanded by tube manufacturers, but not found on other tube checkers.

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

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

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

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

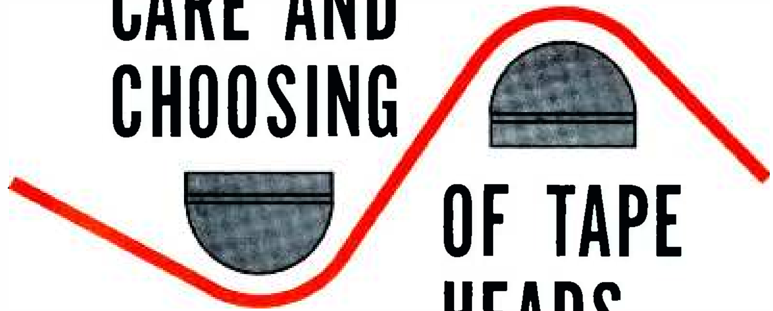
In a nut shell . . . the MIGHTY MITE III is so very popular because it checks for control grid contamination and gas just like the earlier "eye tube" gas checkers (100 megohm sensitivity) and then with a flick of a switch, checks the tube for inter-element shorts and cathode emission at full operating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

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

SENCORE 426 SOUTH WESTGATE DRIVE ADDISON, ILLINOIS

Circle 14 on literature card

CARE AND CHOOSING OF TAPE HEADS



Originally developed for military and commercial applications, modern magnetic tape recording has become one of the most popular media in home entertainment electronics. Tape recorder sales are up and setting new records each season. In many recorder-equipped homes heavy use soon causes parts wear to rear its ugly head as deposits accumulate, and friction takes its toll.

Of all the components in a tape recorder, the heads—record and playback—are victims of the highest rate of wear (with the erase head running third). Only when the heads are clean, properly maintained and adjusted, and exhibit their correct electrical properties, can a well designed machine produce good results.

Basic Theory of Operation

Magnetic tape is made of very fine particles of iron oxide applied in a thin coating to a backing of plastic ribbon. To make a recording, the tape is passed through a magnetic field, the strength of which is varied in accordance with the input signal. The minute particles of the coating are oriented to the instantaneous amplitude and direction of the field.

Recording

To accomplish the above effect on the tape, the head must produce

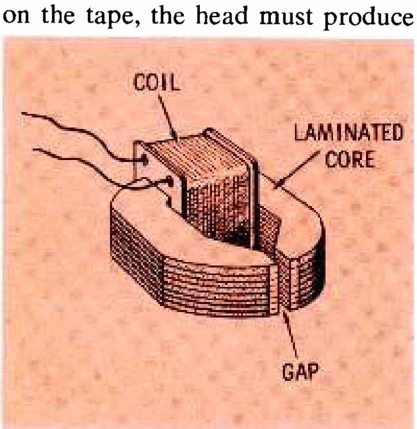


Fig. 1. The internal construction of a typical laminated recording and playback head.

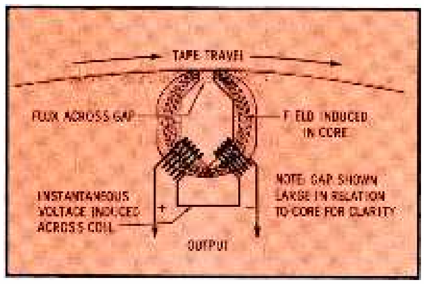


Fig. 2. Action in a typical reproduce head.

and control the magnetic field. The recording head is basically a miniature electromagnet consisting of a core, a separation called the gap, and a coil of wire (Fig. 1). When a segment of tape is opposite the gap, the signal to be recorded and a high-frequency bias signal (used to maintain linearity of the oxide layer) are applied to the tape by the magnetic field. However, it is just as this segment of the tape *leaves* the gap that the field is effectively removed and the magnetization becomes fixed. The actual sound recording, therefore occurs at the *trailing edge* of the gap. You can see that the gap in the recording head must be wide enough to permit easy application of the bias to the tape as the magnetic field is applied. Gap width in recording heads varies from about 160 mils (.160") to 300 mils.

Playback

Playback is almost the direct opposite of recording. The recorded tape carries within its oxide coating a magnetic pattern directly proportional to the original input signal. When the tape is passed over the gap in the playback head (Fig. 2), a voltage is induced in the coil.

To insure high-frequency response, the gap of the reproduce head is made small—the narrower the gap, the higher the frequency response. There is a point, however, where improvement in response is overshadowed by loss in output—so a compromise is made. Gap widths of playback heads range from 40 to 250 mils.

In a great many machines, the functions of "record" and "playback" are combined in one head. Compromises are made between frequency response, gap width, and output. One help is the use of laminated cores; the laminations reduce core losses at high frequencies, permitting a larger gap to be used.

Erasure

The head used for erasing the tape is similar to the record/playback head. A main difference is the common use of a double gap, wider than the others, to permit a good transfer of erase flux to the tape for complete saturation; this obliterates any previous recording. Since the frequency of the erase current is four to six times the highest recorded audio frequency it cannot be heard and the tape is essentially quiet. Thus, there is a direct relationship between erase head efficiency and the noise level of the tape—the residual noise must be as low as possible.

Selection of Heads

When choosing a head for either replacement or original installation, there are several factors to consider. These fall into two large categories—electrical and mechanical charac-

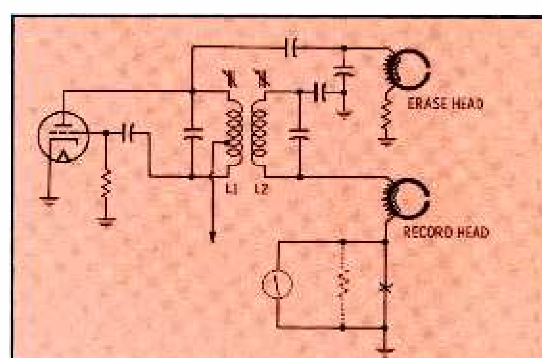


Fig. 3. In this circuit the slugs in coils L1 and L2 are adjusted for proper bias current.

Maintenance and proper selection are important considerations

by Stuart N. Soll

teristics—and include impedance, gap width, track width, and mounting.

Electrical Characteristics

While the basic considerations in choosing record/playback heads and erase heads are the same, there is a difference in relative importance. Impedance of r/p heads may be in some cases noncritical, while a small variation in erase-head impedance may spell the difference between proper operation and incomplete erasure. In both cases the heads must be chosen for proper track arrangement.

The simplest tape recorders employ half-track r/p and erase heads, often mounted together or even in the same housing. More versatile machines offer half-track record/playback and quarter-track playback in stereo. More advanced units have various combinations of stereo record and playback in various track widths. The important point to keep in mind is that *the erase head must match the "record" function* in track arrangement. Thus, a machine with quarter-track recording must have a quarter-track erase head.

Record/Playback Head

When replacing a head it is best to choose one which matches as closely as possible the impedance of the original. This is specially true in machines which have no bias adjustment. Heads are available in three approximate ranges—high impedance (3K and up), medium (1K to 3K), and low (less than 1K). Select a head at least within the same range as the original. After the replacement has been chosen there are two electrical adjustments which should be checked—bias and record current.

Bias—A common result of low bias current in the record head is distortion of the high-amplitude passages of the input signal. On the other hand, higher-than-normal bias causes a reduction in high-frequency response during recording.

If the head is carefully selected to match the original, or at least approximate its specs, bias should be no great problem. Ideally, proper bias is that which will afford maximum recorded signal at about 500 or 1000 cps. This is checked by measuring the playback level from a tape recorded by the head in question.

Measure the bias by placing a 100-ohm 1-watt resistor in series with the ground return lead of the record head. With a sensitive VOM or VTVM, measure the voltage across the resistor while the machine is in the record function. Now check the specification sheet for the new head. If the bias current measured is within about –10% to +20% of the spec, satisfactory performance will probably result. If the bias is less than 90% of that called for, or if operation is faulty, an adjustment is necessary. This is accomplished quite easily in machines with bias controls—just vary the control while watching the meter. Where there is no bias control, the adjustment involves altering the capacitance (Fig. 3) or coupling (Fig. 4) between the bias oscillator and the record head. This should be attempted only where it is absolutely necessary.

Audio Current—The other electrical adjustment for the record head is audio current. The recording level indicator of the tape machine may require resetting since the optimum audio current for the new head may be different from that of the one replaced. This can be done in two ways. You can approximate maximum level by making a series of recordings with a 1-kc input signal supplied by an audio oscillator. Increase the level on each succeeding run until distortion is noted on playback. Then reduce the voltage output of the generator by about 80% (–12 db). Leaving the input level control in the same position, adjust the recording-level indicator to 0 vu, 100%, or "Normal."

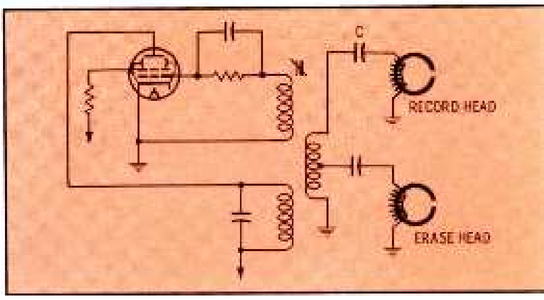


Fig. 4. Here, the value of C may be altered slightly to obtain the correct bias current.

You can also make the audio current adjustment according to the head specs. Disable the bias collector and insert the 100-ohm 1-watt resistor in series with the head as before. Feed a 1-kc signal into the recorder and set the generator level so the current through the resistor corresponds with that indicated by the manufacturer's spec. Hold the input constant and adjust the indicator to show "normal."

Both methods result in normal recording level occurring about 12 db below maximum tape saturation. Remove the resistor from the circuit and re-energize the oscillator.

Erase Head

In replacing an erase head, try to obtain as closely matched a substitute as possible. This will eliminate the necessity of adjusting erase current, which can be a problem in some recorders. While more erase current than necessary may damage a head through over-heating, too little will cause incomplete erasure of recorded signals.

Determine the oscillator frequency

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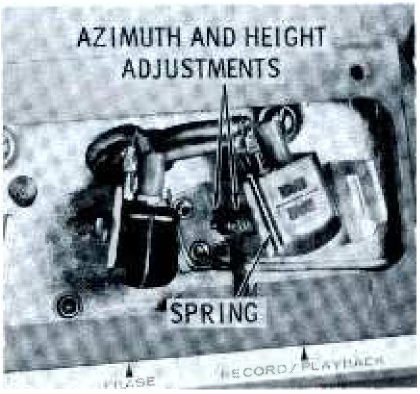
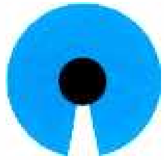
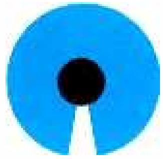


Fig. 5. A typical side-mounted head assembly.

Fig. 6. These heads are mounted together by means of the same machine screws and nuts.



CURING BLINDNESS



in FM Tuning Eyes

A microscopic view of indicators and their operation.

by Patrick M. Craney

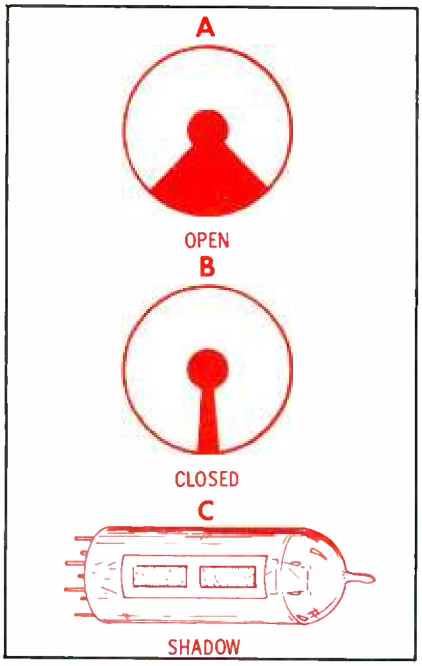


Fig. 1. The patterns of tuning-eye indicators.

Tuning-eye tubes are back, and have they changed! Remember the pre-war 6U5/6G5 (Fig. 1A) with the round green eye that opened and closed as radio stations were tuned? The modern trend in tuning-eye tubes is to have a narrow elongated eye (Fig. 1C), even though there are some of the older types still around.

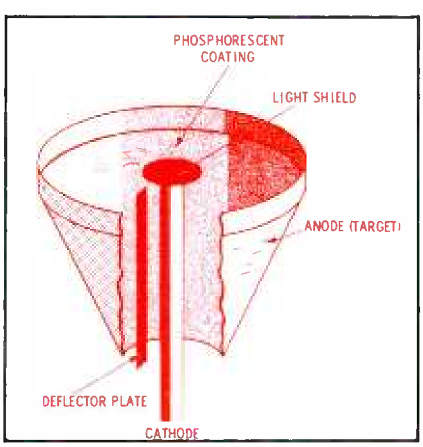


Fig. 2. Construction of 6U5/6G5 indicator tube.

What's the difference between the operation of the two types? First let's look inside the 6U5/6G5 and see how it operates. As shown in Fig. 2, the tube consists essentially of a cathode and an anode (target); there also is a deflection electrode situated so as to prevent electrons from striking a certain portion of the anode. In Fig. 3 the deflector is tied to the plate of the triode section, and AVC voltage is impressed on the triode grid. The more AVC voltage there is present, the less the triode conducts, and the higher the deflector voltage becomes. As the deflector voltage nears that of the target voltage, the repulsion of electrons lessens, and the "eye" begins to close (Fig. 1B).

Fig. 4 illustrates the internal construction of the EM86 tuning indicator; a simplified schematic using it is shown in Fig. 5. The operating principle is similar to that of the 6U5/6G5, even though the electrode arrangement is quite different. In the old tube the anode itself is coated with a chemical that glows when it is bombarded by electrons; in the new tube, however, the chemical is deposited inside the envelope right on the glass.

The exploded view (Fig. 6) of the new type of tuning-eye tube illustrates the action of both the triode and the tuning-eye section. The electron stream leaving the cathode is affected by the surrounding grid.

Circuit action can be followed by referring back to Fig. 3. When no AVC voltage is present on the triode grid, maximum plate current flows in the triode. The IR drop across triode load resistor R5 is maximum, and the voltage on pins 7 and 9 is at its minimum. This low voltage on the deflector makes it more negative than the anode. The anode can therefore attract the electrons in the beam, pulling them away from center and "opening" the eye.

As signal increases (a station is tuned in), the AVC voltage builds up, and the voltage on the triode grid becomes negative; the triode plate current is reduced, and the deflector voltage rises toward B+.

The electron stream is subjected to a different electrostatic field set up by the deflection electrodes, and is accelerated. The anode can no longer pull the beam outward and the shadow in the center (where no electrons strike the target) becomes narrower. The relationship between anode voltage and deflection-electrode voltage determines the eye opening, and this relationship is determined by the action of the AVC voltage on the triode. Although the grid surrounding the cathode slightly reduces the electron flow toward the target, the phosphor coating is sensitive enough that little difference in illumination is noticed. The major effect is that of beam deflection.

Tuning-Eye Circuits

There are various ways used in FM tuners to actuate a tuning-eye tube. No matter which type of circuit delivers the control voltage to the tube, the voltage must be directly proportional to the signal strength. The weaker the signal, the lower the voltage; the greater the signal strength, the higher the control voltage must go. The only tuner stages

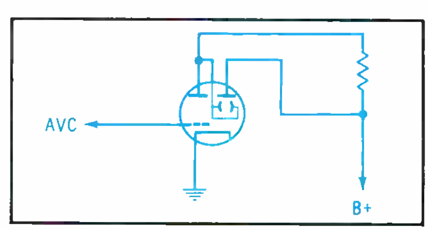


Fig. 3. Control and eye tubes in same envelope.

with this type of DC voltage levels high enough to operate a tuning-eye tube satisfactorily are the limiter and the FM demodulator.

Limiter

Two variations of tuning-eye circuits are shown in Fig. 7. The dotted line shows the eye tube being driven by the limiter input voltage; the dashed line shows it being driven by the discriminator output voltage. In the limiter circuit, when the incoming signal is maximum, the voltage drop across grid resistor R1 is also maximum, and the negative voltage is connected to pin 1 of V3 through isolating resistor R4. This negative voltage drives the control triode nearer cutoff; the rising plate voltage coupled to the control electrodes brings their potential close to that of the anode, thus allowing the eye to close. R4 and C4 form a decoupling network to prevent audio from causing the eye tube to flicker.

Discriminator

If the tuning-eye circuit is actuated by the discriminator, the control-tube grid is connected, as shown by the dashed lines, to the discriminator DC output. When the IF signal across the discriminator transformer makes pin 1 of V2 positive, current flows through the tube, L3, R2, ground, and back to cathode pin 2. A pulsating negative DC voltage thus appears across R2. The opposite-polarity signal excursion flows from cathode pin 3, through the tube, L2, and R3, and back to the cathode; for all practical purposes, this pulsating DC is dissipated in R3. The negative pulses across R2 are filtered by R3-C3 and R4-C4. The AVC voltage thus developed is applied to the grid of the control triode. Thus, when a strong RF signal is received by the tuner, the discriminator output voltage rises in a negative direction and drives the control tube nearer to cutoff.

Ratio Detector

In some FM tuners, the FM demodulator is a ratio detector (Fig. 8). The negative DC control voltage for the tuning-eye indicator is developed similarly to that in a discriminator.

When the IF signal is negative on pin 1 of V1, it is positive on pin 2. This causes both halves of the tube to conduct in series with each other through R2, R3, R4, and R5. The negative voltage for AVC develops at the junction of R2-R3 and is applied to V2 through R6. Since V1 acts as a half-wave rectifier, no conduction takes place when the input voltage reverses in polarity. C5 removes the audio that may be developed by ratio-detector action.

Troubleshooting

There is very little that can go wrong with a tuning-eye tube or circuit. It is a rare problem that a tube won't cure.

Of the other troubles that do occur, the most frequent is traced to the triode load resistor. Since control of the eye depends directly on the IR drop across this resistor, the eye will not respond correctly to changes in signal voltage if the resistance changes. If the resistor increases in value, the eye will open too wide and fail to close properly. If the resistor changes to a lower value, the eye will not open nor-

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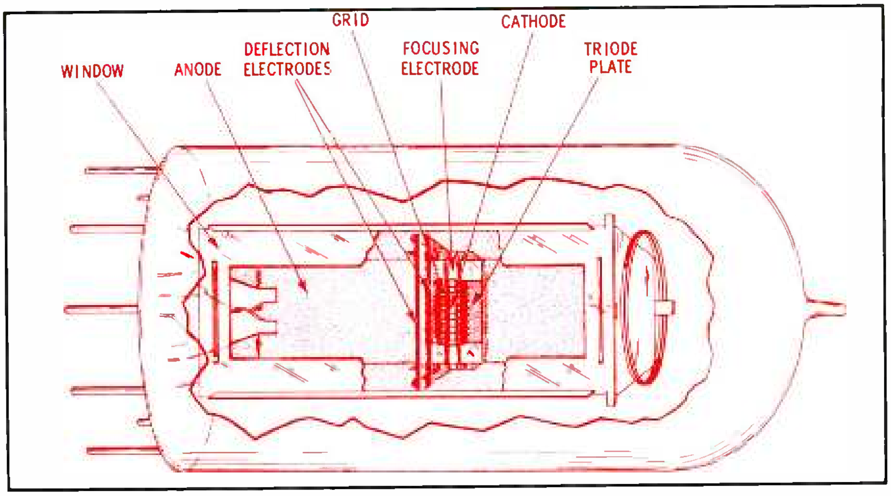


Fig. 4. Cutaway view of the EM86 tuning-eye tube showing respective electrodes in perspective.

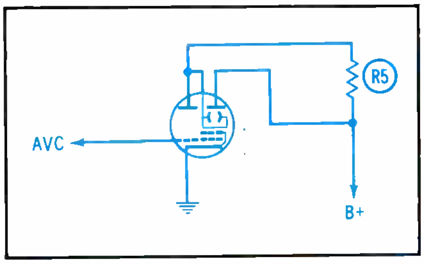


Fig. 5. Schematic of EM86 tuning-eye tube.

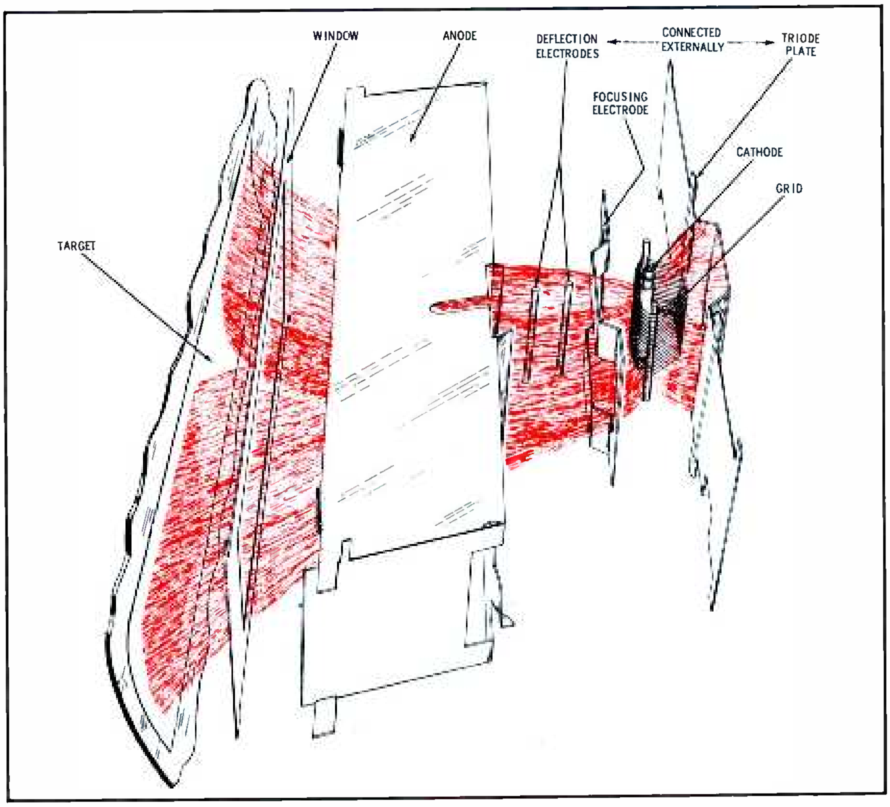
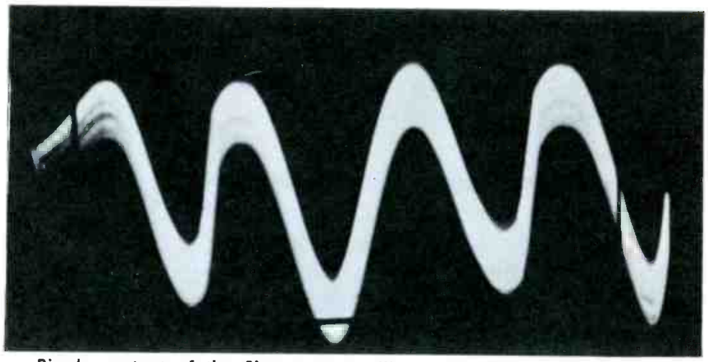
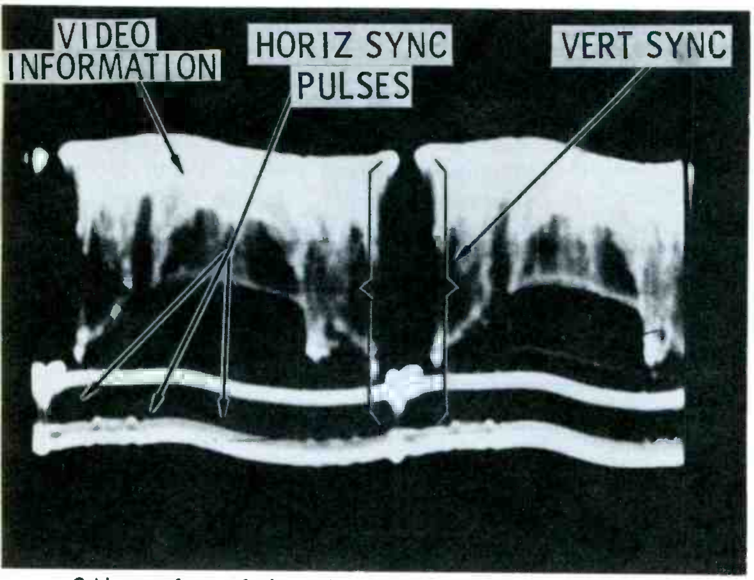


Fig. 6. Exploded view of the EM series of indicator tubes, showing principle of operation.



Ripple content of the filter output will reveal any excessive hum or distortion on B+ which may show up as video or audio troubles.

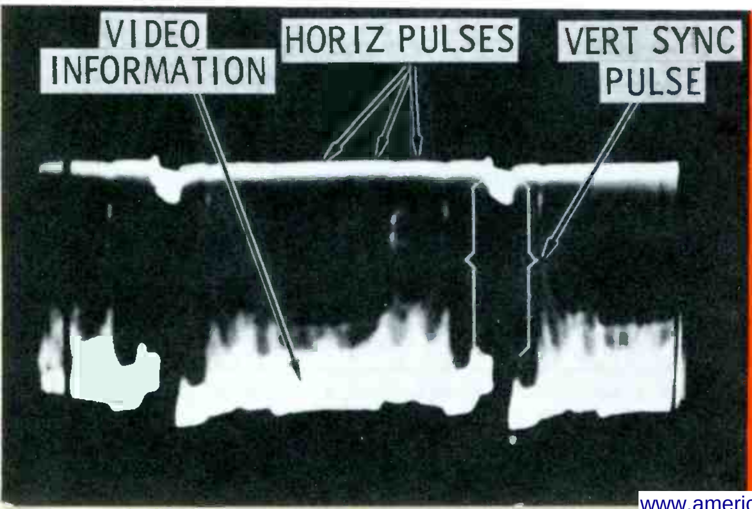
TV Waveforms save Analysis Time



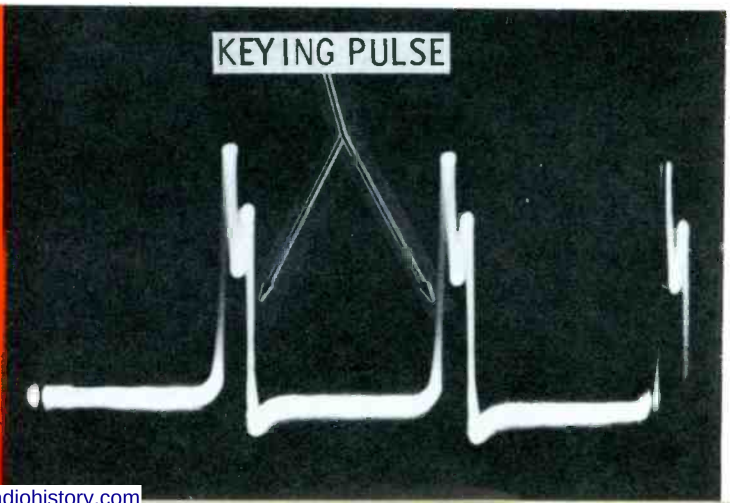
Grid waveform of the video output tube is an accurate indication of the circuit action in the IF amplifiers and tuner stages.

. . . if you don't believe it, try it! Instead of relying solely on your voltmeter, which can tell you only what the DC voltages are and not what the circuit is actually doing, use your scope. Get into the circuit and "see" what is going on. You will be pleasantly surprised at how fast you can spot certain "dog" troubles by noting waveforms. We do not suggest that you scope every stage in the receiver—just a few key check points. By doing so, you can observe the actual shape of video, audio, sweep, and sync signals. You can determine what, if anything, is wrong in each portion of the TV receiver by familiarizing yourself with these key waveforms and learning to identify them on sight.

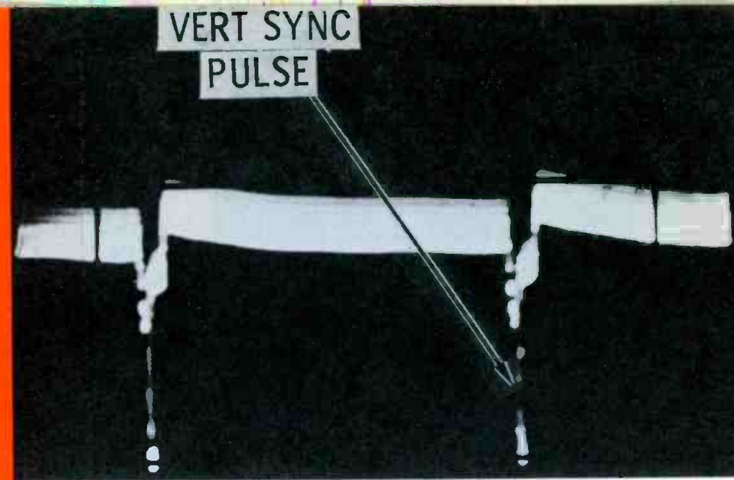
If sync separator input doesn't closely resemble this waveform, trouble may be indicated in the IF's, video stage, or the AGC line.



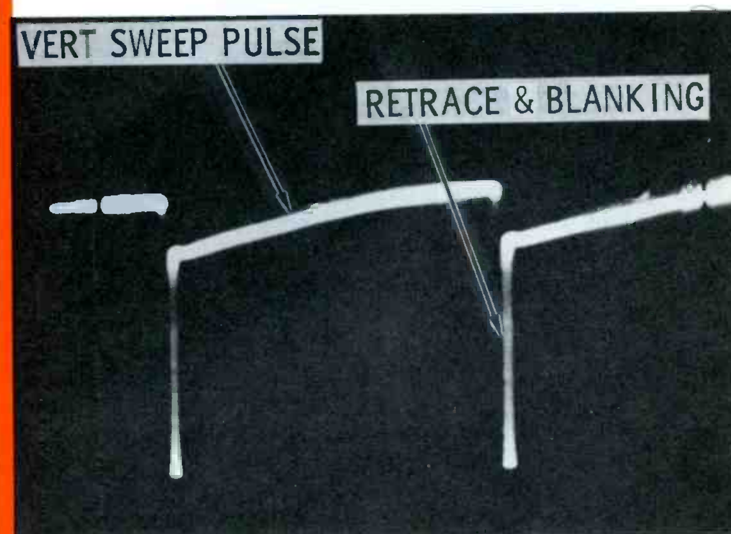
Spikes and distortion are permissible on AGC keying pulses so long as the fundamental frequency remains stable at 15,750 cps.

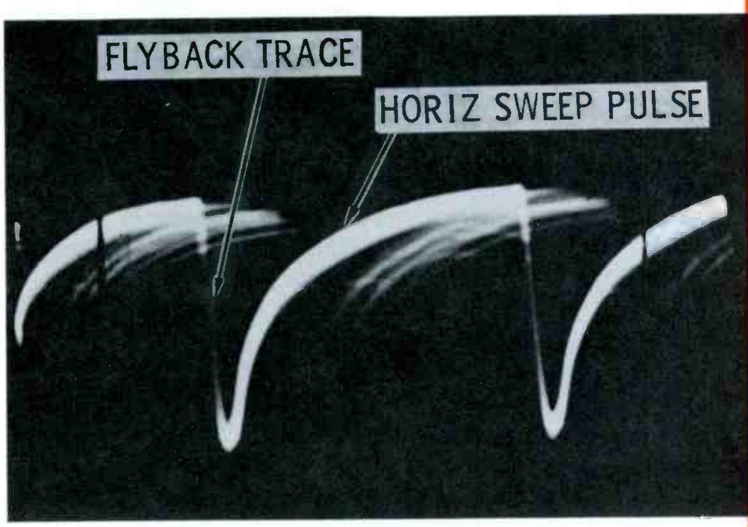


With the oscillator tube pulled, or the output grid grounded, this waveform will denote properly operating sync stages.

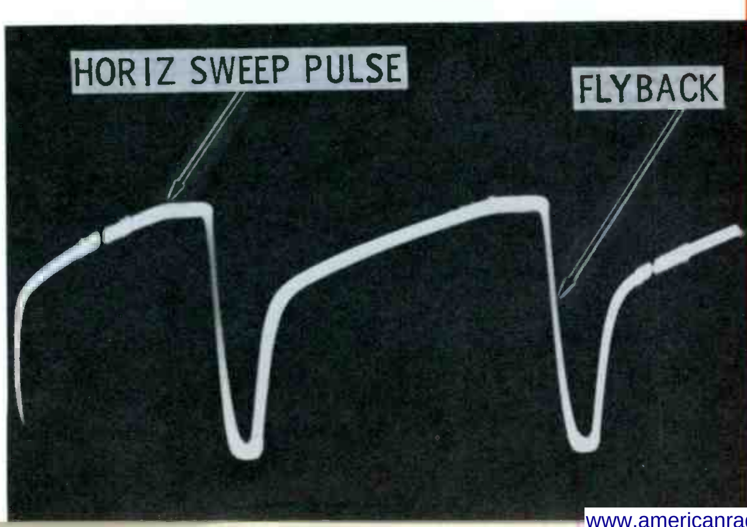


Yoke-input signal shows condition of vertical stages and transformer. Sweep, retrace, and blanking should be distinguishable.





The phase-detector output signal is a composite of AFC signal fed from horizontal output, mixed with station sync signals.



If there is no high voltage, check the grid drive to the horizontal output tube. No drive means a defective multivibrator.

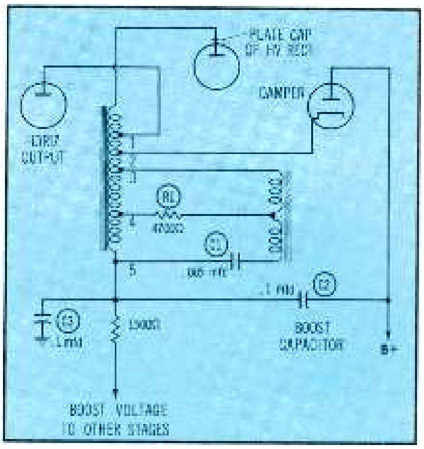


Fig. 1. Schematic shows essential components involved in developing boost from flyback.

There are several key facts that the serviceman must know about a circuit to avoid wasting time making unnecessary tests. He learns to look for these pointers as soon as he unfolds the schematic. The cathode connection of the audio output, for example, tells whether or not the set uses "stacked" B+, and his testing procedure is arranged accordingly. Another essential fact is whether or not there is keyed AGC. Often it is important to know if the CRT is DC-coupled to the video-output stage.

It is just as important to notice which stages are supplied with boost voltage. Failure of the boost voltage can be responsible for symptoms appearing in any of the stages that depend on this voltage for power or for keying pulses. An understanding of how boost voltage is generated is essential to servicing the circuit, so with the aid of Figs. 1 and 2 let's view the operation of the circuit.

Fig. 1 is a popular deflection and boost circuit. Fig. 2 shows only the bottom section of the flyback winding, which is the secondary of the autotransformer, redrawn with a generator inserted in series with the winding to represent the voltage induced from the upper section.

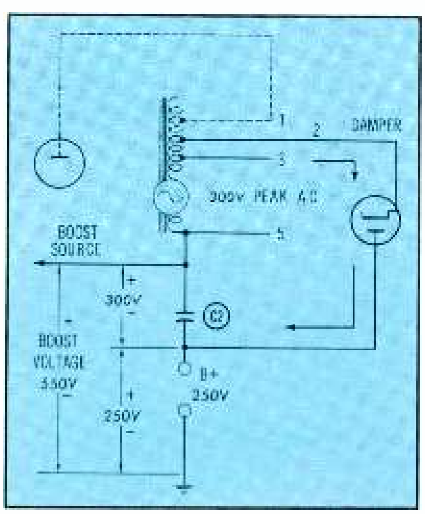


Fig. 2. Equivalent circuit explains boost.

During the sweep time, current flows upward through the secondary and through the damper diode. Assume that 300 volts peak AC is induced in the secondary. After a short instant, C2 will become charged to 300 volts, because it is connected essentially across terminals 2 and 5 through the low resistance of the damper diode. With the bottom end of C2 connected to B+, the voltage across the capacitance is in series with 250 volts DC. The voltage from terminal 5 to ground is therefore equal to the sum of the induced 300 volts and the B+—a total of 550 volts DC.

Fig. 3 shows the block diagram of a portion of a newer-model receiver with autotransformers in the vertical and horizontal outputs. In this design even the brightness control uses the boost voltage. In color sets, voltage derived from boost may be used in the burst amplifier, blanking amplifier, color-killer stages, and convergence circuits.

Although very few models use the boost voltage in all circuits possible, you can never be sure where it *is* being used until you study the schematic. The case histories which follow illustrate how easily you can be fooled.

Vertical Foldover

Fig. 4 shows the symptom which occurred in a receiver using the circuit of Fig. 5. Because of the appearance of the screen, the technician immediately suspected the vertical cathode bypass capacitor. However, substitution of a new capacitor for C18 did not help, and the resistance from cathode to ground with the capacitor disconnected was normal, indicating that the cathode resistors were not defective.

Next, coupling capacitor C12 was replaced with no success. The components in the waveshaping and feedback network (R20, R21, R22, R24, C15, and C19) were all replaced to no avail, and out of desperation C10 and C11 were also substituted. When there was still no change in the raster, the technician, convinced that the trouble was in the vertical-output stage, changed the output transformer. But when he turned the set on again, the symptom was still there.

All of these tests might have been avoided by a little study of the schematic before jumping to the conclusion that all vertical linearity and foldover problems are caused by failures in the vertical-output circuit. It is very common to find boost voltage fed to the vertical oscillator through the height control. When an autotransformer is used at the output, a jumper within the yoke often connects the vertical winding to the low side of the horizontal winding, thus feeding boost voltage to the vertical output tube.

A good place to begin analysis of any kind of distorted vertical sweep is at the grid of the output tube.

FOOLED by POOR BOOST

When the linearity is affected, a scope can indicate the shape of the oscillator output signal. When only the vertical size is affected (no change in linearity), a VTVM will indicate the amount of drive voltage present. In the case of the defect illustrated in Fig. 4, both instruments pointed to a defect in the drive signal; this led to DC meas-

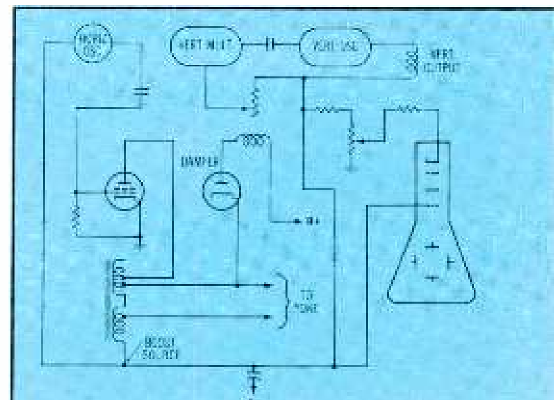


Fig. 3. Many circuits in an ordinary television receiver may depend on boost for power.

urements at the plate of the multivibrator (pin 6 in Fig. 5) where the voltage was found to be low. The next step was to check the DC voltage at the junction of R15 and R30, which was also low. The full 480 volts was found at the end of R19 nearest the autotransformer; R19 had increased in value because of leakage through C13.

When you see that the entire vertical section is fed from the boost and that the symptom involves foldover combined with loss of vertical hold, it is easy to isolate the trouble to those components common to the oscillator and output sections.

Blooming and HV Loss

Fig. 6 shows the circuit which produced the blooming pictured in Fig. 7. After the set had been

A troubleshooting analysis of the extra power supply.

by Edward F. Rice

played for approximately an hour, the brightness began to increase slowly, and the width began to shrink. This process continued until the condition of blooming shown in Fig. 7 was reached; then the raster went out completely, leaving no trace of high voltage at the 1B3 plate cap.

The usual steps to cure blooming were taken—the horizontal-output, oscillator, and damper tubes were changed. Although the 1B3 is the most common cause of blooming, it was not suspected in this case since there was no high-voltage AC

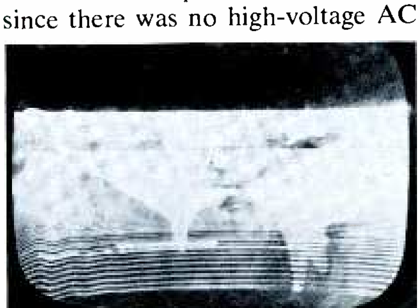


Fig. 4. Unusual symptom was boost problem.

at its plate cap after the raster went out. Next the technician monitored the grid bias on the horizontal output tube as the blooming became worse. The drive voltage remained steady at –25 volts even after the high voltage disappeared. The screen-grid voltage also remained constant.

With this information the technician finally concluded that the defect was in the damper and flyback circuits. Monitoring the boost voltage revealed that it dropped slowly from 560 volts, reaching about 260 volts at the time the high voltage went off. Boost capacitor C1 was replaced, but there was no change in the symptom. The values of the brightness control and series resistor R40 were both checked and found to be normal.

The problem was finally solved by replacing R1, the damping resistor in series with the yoke center tap. Much time could have been saved if the technician had noticed that the boost voltage is applied to the brightness control, causing a positive voltage to reach the cathode of the CRT. Without this current flow through the brightness control, the CRT cathode is practically at ground potential, and brightness reaches maximum. The reduced boost voltage also leads to reduced horizontal output, which in turn causes the high voltage to be reduced. This further contributes to the symptom. Thus the blooming that appeared to be the main symptom was merely a side effect of the gradual decrease of boost.

Unstable Horizontal Sync

The circuit in Fig. 8 developed into a rather confusing set of circumstances and was considered to be quite a "dog" around the shop for a while. The set was brought in with no high voltage. Since the tubes had been checked on the service call, the first test was to measure the drive voltage at the grid of the horizontal-output stage, which turned out to be normal. The screen voltage of the stage appeared to be somewhat low; it measured about 100 volts DC. This suggested that excessive screen current might be reducing the voltage at the screen-grid terminal.

The boost voltage was measured at terminal 2 of the flyback trans-

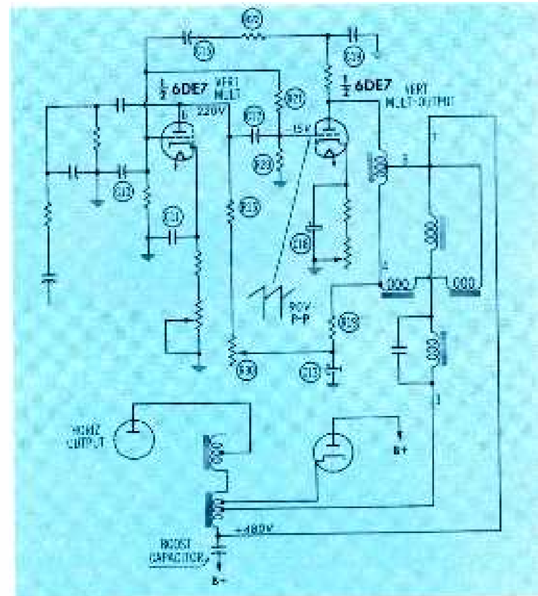


Fig. 5. Circuit that was responsible for the weird display illustrated in photo of Fig. 4.

former and was found to be only a few volts. The ohmmeter indicated that terminal 2 of the flyback transformer was practically grounded, and the repairman was reaching for the flyback catalogue when he spotted C29. When one end of this capacitor was disconnected, the high voltage returned. The capacitor was replaced and the set was turned on.

The raster appeared, but when a station was tuned in there was no horizontal sync. The blanking bar could be made to stand up vertically by carefully adjusting the hold control, but continuous adjustment was required to keep the picture on the screen. The boost voltage was checked again, just to make sure, and it was normal. Until now this

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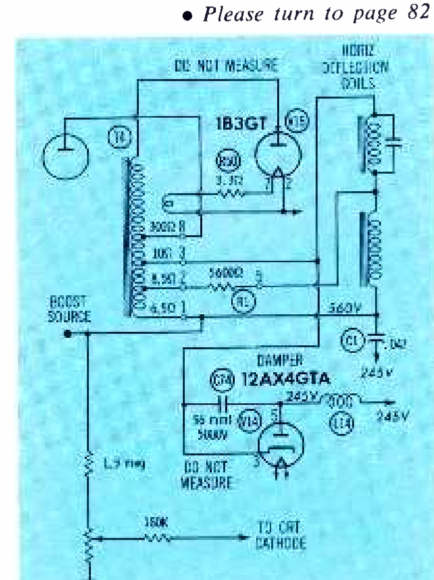


Fig. 6. Circuit in which brightness control and CRT depend on boost action for voltage.

IMPROVING RETRACE BLANKING

Circuits and components to help eliminate *those lines.*

by Thomas A. Lesh

Vertical retrace lines on a TV screen—the slanting traces seen in Fig. 1—are usually a sign of trouble. However, in some of the oldest receivers still in service, these traces simply indicate the lack of a retrace-blanking circuit. Many early sets rely on only the blanking pulses in the video signal to suppress the retrace lines, and careless adjustment of the brightness and contrast controls could prevent thorough blanking action. Servicemen are still receiving occasional requests to install more efficient blanking networks in these sets; they can do the job easily if they understand a few basic requirements of blanking circuitry.

As a rule, only two to four components need to be added, forming a coupling circuit to feed a sample of the vertical sweep signal to the picture tube. The retrace pulses in this signal ordinarily should have an amplitude ranging from 20 to 100 volts peak to peak, and the portions of the waveform between pulses should be free from video "hash" to prevent modulation of the CRT beam. The coupling circuit must also eliminate the sawtooth slope from the vertical sweep waveform, so no shading effect will be introduced into the background brightness of the raster. In most cases, these requirements are not at all difficult to achieve.

Fig. 1. Retrace lines indicate ineffective vertical blanking system in older receiver.

The blanking waveform is applied to either the cathode or the grid of the picture tube—whichever does *not* receive the video signal. Since the object of blanking is to cut off the CRT during vertical retrace time, the blanking signal should contain negative pulses if fed to the grid, or positive pulses if fed to the cathode.

Pulse Sources

Usually, the most convenient source for a blanking signal is at one of the secondary terminals of the vertical output transformer. There are cases, however, in which this point is unsuitable, and an alternate connection must be made. When negative pulses are required, an adequate signal can often be obtained from the RC network in the plate circuit of the vertical oscillator or discharge stage; for positive pulses, the plate circuit of the vertical output stage is sometimes a satisfactory source. The design of the blanking network can be modified as necessary for minimum loading at each of these points.

Output Transformer

The isolated-secondary type of vertical output transformer, commonly used in early-model receivers, is relatively easy to work with because pulse waveforms of opposite polarities are usually present at the two secondary terminals. The first step is to scope across both leads to find the pulse polarity. In order to supply the pulse, one winding lead will have to be grounded; the other terminal may then be connected to the CRT through an RC coupling circuit.

In the simplest case—grounded-grid CRT circuitry—the blanking network shown in Fig. 2A may suffice. Again, be sure the correct side of the secondary is returned to ground. C1 merely couples the signal, and the pulse voltage developed across R1 is applied to the grid. If results are not satisfactory, one or more additional components may have to be added. For example, some receivers use extra parts such as R2 and C2 (Fig. 2B) for added isolation and waveshaping.

To avoid exceeding the maximum voltage ratings on the picture tube, it's advisable to apply pulses no stronger than necessary to accomplish blanking. If the available pulse waveform has too much amplitude,

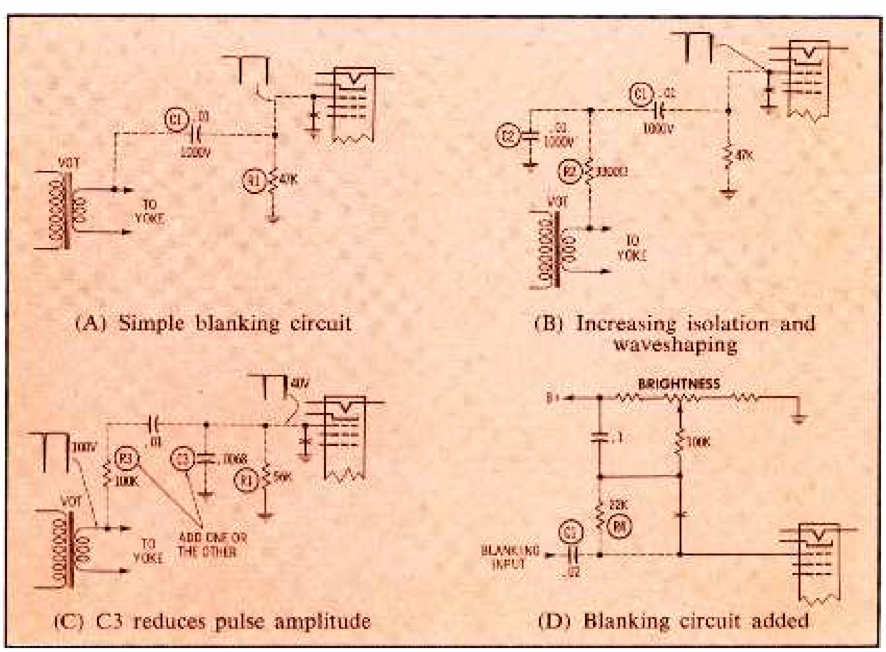
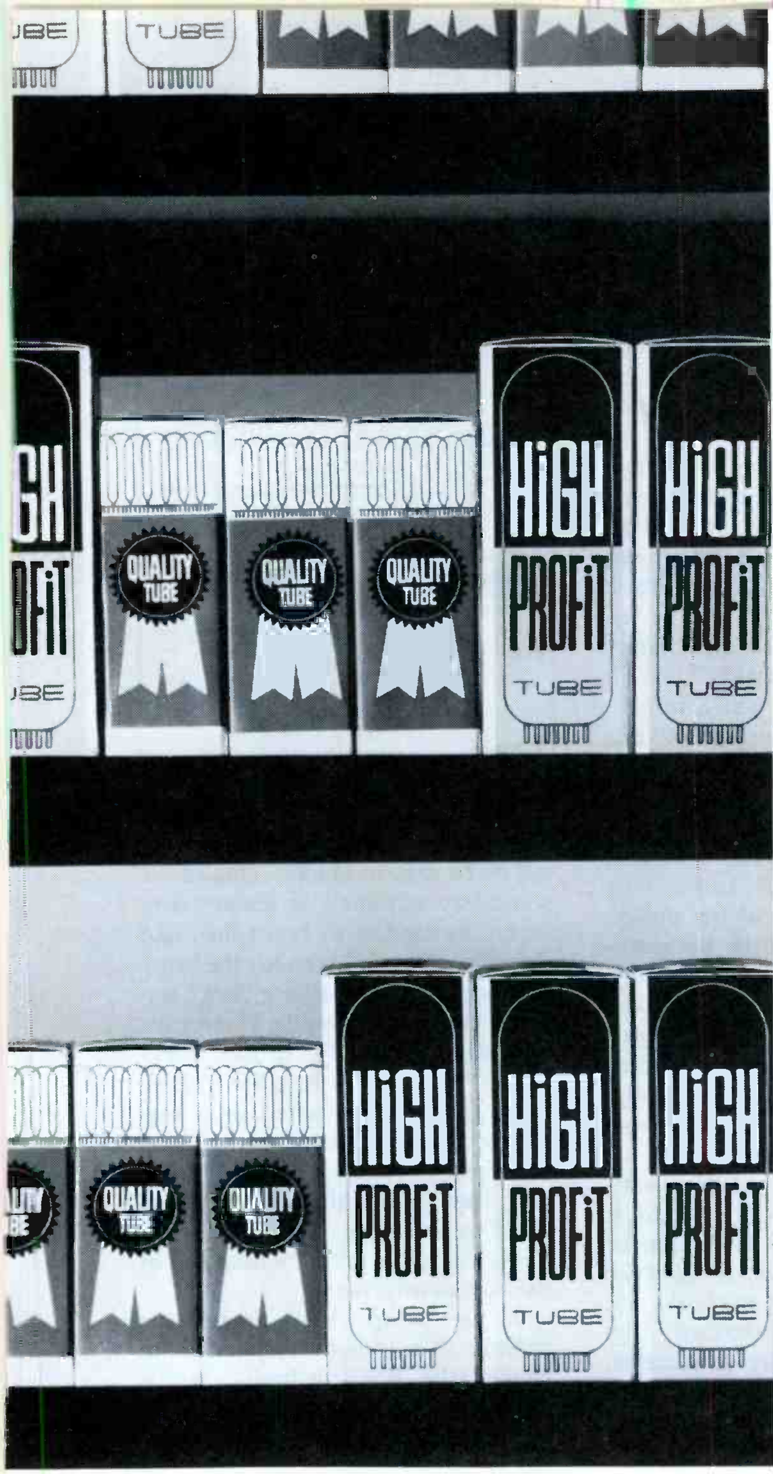
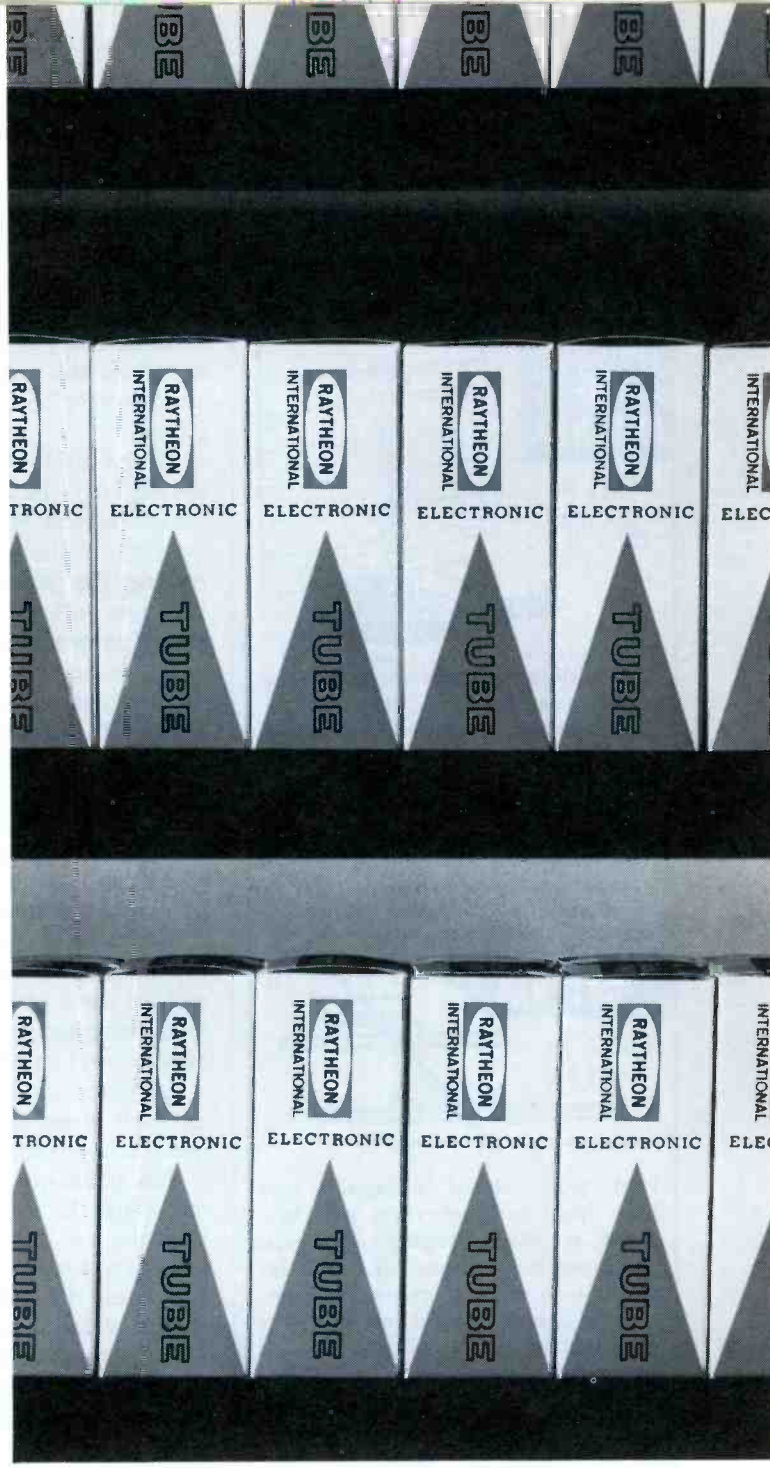


Fig. 2. Blanking pulses can be obtained from secondary of the vertical output transformer.





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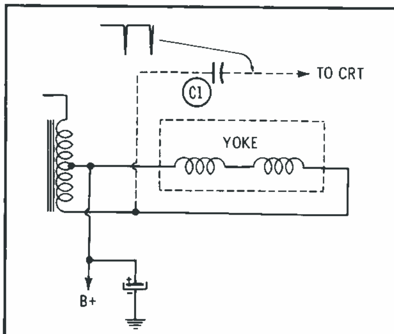
a capacitor like C3 (Fig. 2C) can be added to reduce it to a safe value. C1 and C3 act as a capacitive voltage divider, and the value of C3 can be "juggled" until exactly the desired proportion of the signal voltage is developed across it. Adding fairly high-value series resistors such as R3 is another way to reduce the pulse amplitude, with considerably less loading of the yoke circuit.

If the grid was originally connected to the brightness-control circuit instead of to ground, blanking can still be added, without disturbing the action of the control. One precaution: If the grid is bypassed to ground or B+ via a large-value capacitor (as in Fig. 2D), it may be necessary to add a resistor such as R4 between the grid and this capacitor, to prevent losing most of the pulse signal. On the other hand, if C1 and the bypass capacitor can be made almost equal in value, the latter will cause only moderate attenuation of the pulses. As we pointed out in the last paragraph, this reduction in amplitude may be desirable, to keep the pulses from being too strong. If the brightness control is *unbypassed*, adding a capacitor similar to that in Fig. 2D will protect the control from possible damage by the pulses.

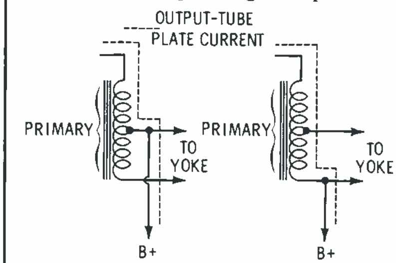
The technique of feeding a positive pulse to the CRT cathode is basically no different from that of feeding a negative pulse to the grid; the required blanking networks are similar to those just described. Fig. 2D is most generally applicable, since the brightness control is commonly located in the cathode circuit.

Autotransformer

When an autotransformer is used to drive the vertical yoke windings,



(A) C1 couples negative pulse



(B) Changing feed point

Fig. 3. To obtain negative pulses from autotransformer, make connection at proper lead.

a suitable blanking waveform may not be so easy to obtain. One of the secondary terminals is always connected to the B+ or boost line, and therefore is at AC ground; the pulse polarity at the remaining "hot" terminal may or may not be correct for blanking. Typically, if the center tap is "hot," it has negative pulses. Some receivers are wired as in Fig. 3A to make a negative blanking waveform available for the CRT grid, but sets not equipped with blanking are more likely to have the B+ connection at the bottom tap of the autotransformer.

If the sweep circuit is not too critical, it is sometimes possible to change the B+ feedpoint to the other secondary terminal. This alteration does not reverse the sweep, but it does change the operating conditions of the transformer; only the upper portion, instead of the

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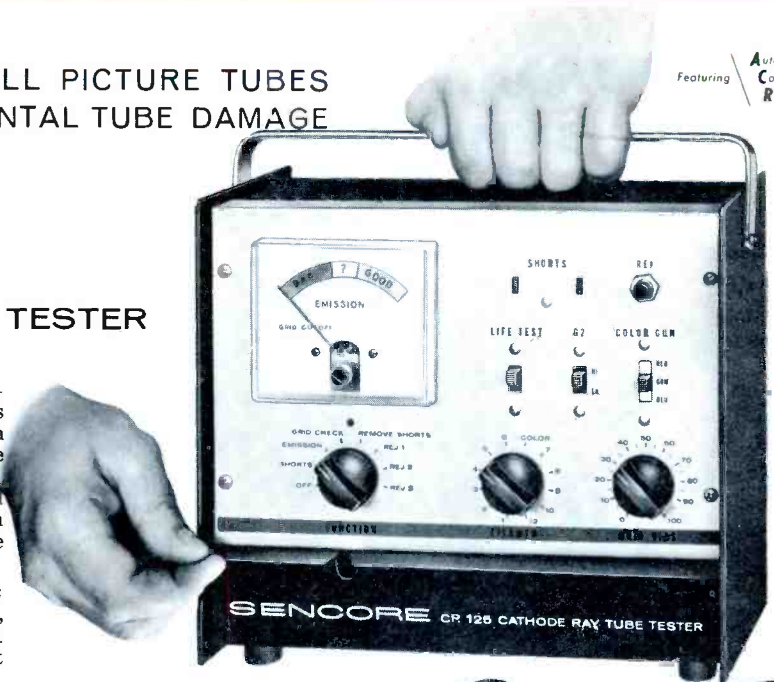

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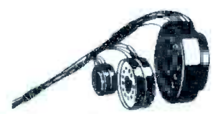

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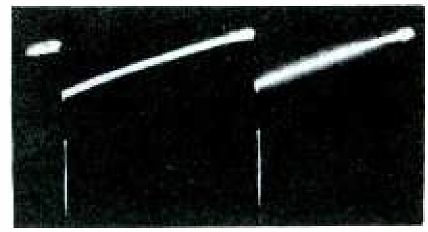

Fig. 4. Type of pulse that makes spike is most effective for feeding to the CRT for blanking.

whole winding, acts as a primary (see Fig. 3B). Some circuits can be adjusted to compensate for this shift in operation, but others cannot. Therefore, it may be easier to look elsewhere for a blanking pulse.

Vertical Drive Circuit

Although the signal fed to the grid of the vertical output tube is basically a sawtooth, it often contains a sizable negative-pulse component (see Fig. 4). If so, this pulse can usually be routed to the CRT grid in such a manner as to produce effective blanking. The main problem is to tap into the drive-signal forming circuit without changing its RC characteristics enough to distort the vertical sweep. Adding a blanking network may necessitate slight changes in the values of other resistors and capacitors in the area between the vertical discharge and output stages.

Some original circuits include one

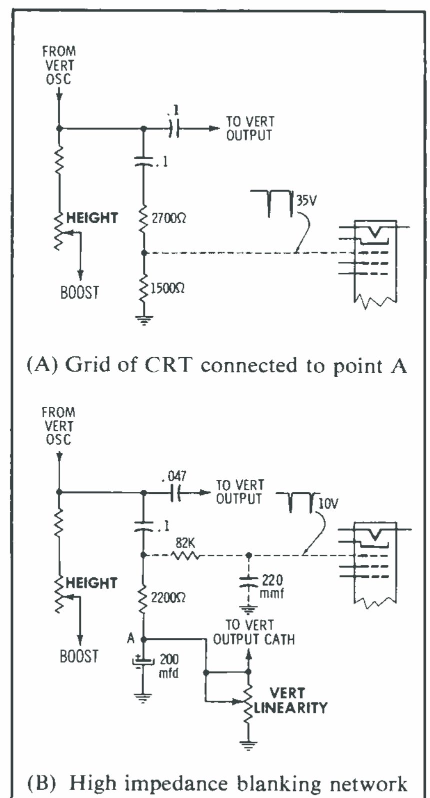

Fig. 5. Blanking pulses can be obtained by tapping into the vertical waveshaping circuit.

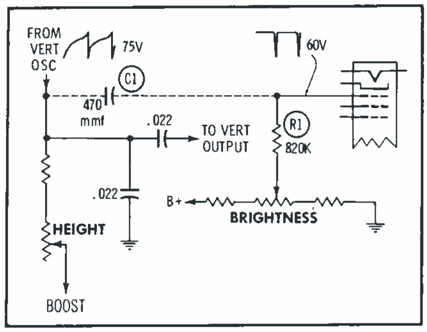

Fig. 6. C1 and R1 filter out the sawtooth.

or more resistors in series with the sawtooth-forming capacitor between the oscillator plate and ground. The purpose of the resistor is to develop the pulse portion of the drive waveform; thus, it is an excellent source of blanking pulses. Since the resistor can also serve as a grid return for the CRT, a simple direct connection can sometimes be made to the grid—as in Fig. 5A. In other cases, an RC coupling circuit similar to C1-R1 in Fig. 2A may be preferable; or, for minimum loading, a higher-impedance blanking network like that in Fig. 5B may fill the bill. Incidentally, as this last figure shows, a low-resistance connection to ground through the cathode circuit of the output stage is a satisfactory ground return for the CRT grid—if special precautions are taken to isolate the grid from the parabola-shaped ripple waveform present at the cathode.

Lacking a convenient resistor as a blanking-pulse source, you can sometimes tap in directly at the plate of the vertical oscillator. However, to avoid picking up the sawtooth component of the drive signal, you may need to use a high value of CRT grid resistance and a rather small retrace-coupling capacitor, as in Fig. 6.

Vertical Output Plate

If you need *positive* blanking pulses (Fig. 7), and can't obtain them easily from the vertical output transformer, you can make use of those at the plate of the output tube (Fig. 8). These extremely strong pulses (500 to 1000 volts) must be divided down to a small fraction of the available amplitude; for this purpose, you can arrange your coupling circuit as a capacitive voltage divider, using values approximately as given in Fig. 6. It's fortunate that the C1-C2 ratio shown in Fig. 8 gives the desired division of the sig-

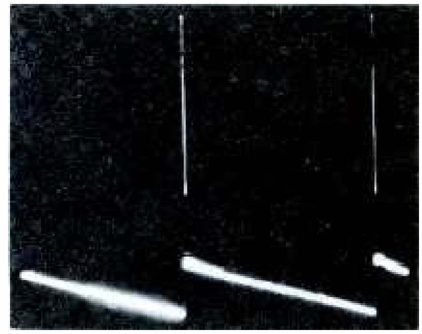

Fig. 7. The sweep pulse at the vertical output tube is a source of positive blanking pulses.

nal, for C1 must be small enough to minimize loading of the vertical circuit, and C2 must be large enough to provide some bypassing of the cathode for video and hum. R1 is mainly an isolating resistor.

In combined vertical multivibrator-output circuits, some point in the feedback network may be usable as a blanking-pulse source. This can be a tricky proposition, though; unless the blanking network is carefully blended into the design of the feedback circuit, it can cause distortion of the multivibrator waveform and lead to vertical instability.

Conclusion

The blanking circuits in this article are intended only as general guidelines to the theory of developing circuits to fit individual circumstances. Experimenting with different component values and circuit hook-ups will pay off in more effective blanking.

Remember that you're dealing with sharp pulses that will place fairly heavy stresses on components in and around the blanking circuit. Therefore, use new parts with generous ratings, and avoid feeding excessively high-amplitude pulses to the CRT. Finally, check to make sure the vertical sweep and the picture quality have not suffered from the addition of blanking. If everything is okay, you can be proud of having made a change that allows the set to operate better than when it was new. ▲

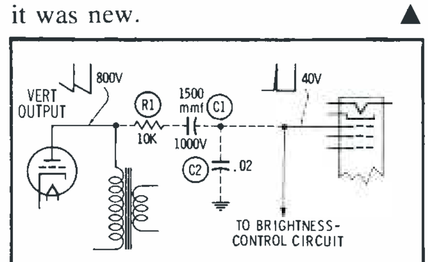

Fig. 8. The pulse in Fig. 7 will be properly shaped by resistor R1 and capacitors C1, C2.

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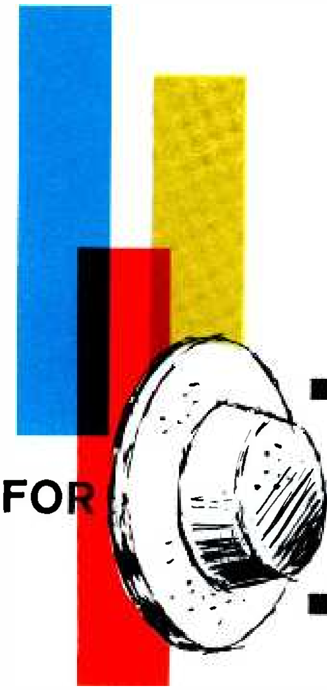
by Carl Babcoke



CURES FOR COLOR HUE TROUBLES

Most TV viewers seem to grow accustomed to the shortcomings of their black-and-white receivers, and such things as ghosts, smear, or dim pictures are eventually taken for granted. They see an acceptable picture as they want to see it, not as it really is. I doubt, however, if these same viewers would ever tolerate a color set that shows a picture in which the skin color of their favorite TV performer is wrong. Of course, the exact color of many objects is unimportant (who cares if a painted wall is light blue or aqua?). But what Western fan would tolerate for long a green-faced Adam Cartwright riding over hills covered with purple trees? Other defects, such as smeared lipstick or pale color would be minor in comparison.

Yet, the difficulty in locating the source of these and similar hue troubles is not nearly so great as their importance might indicate. A few examples from our own experience may help to clarify this point.

For several years, I serviced all the color receivers myself; but color servicing has increased so much that we now route color calls the same as black-and-white calls—on the basis of location. If the outside man gets stuck on a set, he merely calls the shop technician for help. This has necessitated a continuing on-the-job training program for our whole force, and we hold a short session in the shop once a week. These short meetings are quite varied in format and range all the way from a short lecture or demonstration about color sets to open sessions where the men tell of recent experiences.

Phase and Saturation

We were talking on demodulators one day recently, and I explained that correct tint depended on proper phase, and that phase was *not* some supercomplicated subject that could be understood only by vector analysis. Vector diagrams offer the engineers a powerful tool, but as practical servicemen we don't consider phase in that way. The sine wave we see on an oscilloscope is one form of vector graph, but it is uncalibrated. A ghost is merely a second signal that has been delayed and so arrives "out of phase" with the main signal. (When the horizontal oscillator locks in with the blanking bar in the middle of the picture, this is a good illustration of correct frequency and wrong phase.)

In color demodulators we are interested only in the instantaneous voltage of each of two separate sine waves; one from the chroma sidebands (color information) and the other from the local 3.58-mc oscillator (demodulator phase information). A change in the *amplitude* of either signal will give a comparable change in the amplitude of the output signal (amount of color or color saturation), while a change in the *phase* of either will produce a different color hue (or tint) on the screen.

Correct Hue

At our next session, I demonstrated how to use a keyed color-bar generator to check the performance of a set, particularly for proper operation of the hue control and correct crossover of the color bars.

When the bar pattern is viewed with only one color gun activated, it is easy to see that the vertical bars of color vary in intensity from bright down to the same intensity as the space between the bars, then with even less brightness until the remaining bars are dark. The crossover point is the particular color bar, out of the ten, that is the same intensity (or brightness) as the space (background) between the bars. It is best located by numbering the bars starting from the left (with all color guns on); when you spot the bar you wish to examine, switch off the other two guns. Red crossover should occur at the sixth bar, green at the seventh bar, and blue at the third and ninth bars. The hue control moves all three colors (the entire spectrum, actually) from side to side as it is turned, but we usually set it so the third bar is maximum red, with the control at midrange. The second bar corresponds closely to skin color, and the hue control should be able to change this bar from cyan to magenta. Some deviation from these perfect conditions must be expected, but they should not exceed one half-bar.

I also demonstrated to the group how to set the 3.58-mc oscillator to its correct frequency. First, ground the reactance-tube control voltage (most color chassis have a special test point for just this purpose) and then adjust the reactance coil for a "zero beat" condition where the bars float slowly across the screen

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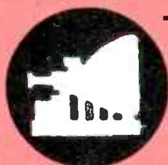

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upright (rather than in diagonal stripes). The bars should lock in with solid action when the grounding clip is removed. This made a good demonstration and the men left with a little more confidence.

Problems and Cures

The next day Herb called in and said, "This set has the color in stripes. What shall I do?" I reminded him we had just covered the method of setting the 3.58-mc oscillator to eliminate the stripes of color. Herb replied that the color was in sync when a signal from the color-bar generator was used, and that the stripes on the network color show were only a little different in tint than the rest of the picture, especially on anything yellow or orange.

"You had better trust the color-bar generator, Herb, for these particular stripes are caused by a bad head on the video tape recorder at the station." With this assurance and the evidence of the good bar pattern, Herb was able to convince the owner the set wasn't causing the trouble, and thus completed the call. I decided to discuss this and similar transmission troubles with Herb and the other technicians.

A picture is sometimes worth many words, so I dug out a copy of a bulletin which had been issued by the engineers of all three networks and AT&T. I showed our men the pictures of several possible video-tape-recording defects, and how they looked on the screen of a color set. These defects included zig-zag vertical lines, horizontal stripes of different hue or saturation, and many others. A good serviceman should be able to recognize color picture defects that do not originate in the receiver. I suggested they call the shop on suspected transmission problems, to see if the same symptoms were present on our shop color monitor. This would eliminate second-guessing in the customer's home.

All Green

George was the next to encounter a hue problem in his call on a Zenith 29JC20 chassis. The screen showed green faces on colorcasts, regardless of hue control adjustments. Tube replacement in the color circuits did not change the symptoms so George brought the chassis to the shop.

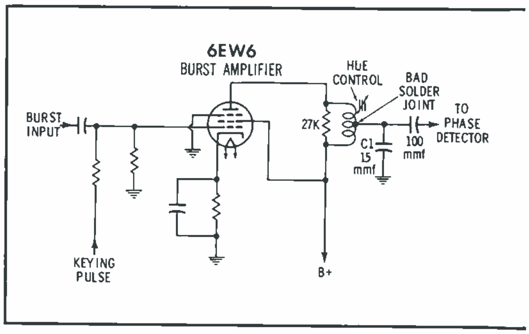

Fig. 1. In Zenith color receivers, hue control is adjustable coil in plate of burst amplifier.

Using a keyed-color-bar generator as the signal source, we scope-traced the chroma signal right up to the grids of the 6JH8 demodulator tubes; the 3.58-mc oscillator signal on the deflector plates also seemed normal. The burst signal was okay at the grid of the 6EW6 burst amplifier, but was weak at the plate; and little or no burst was arriving at the input to the phase and killer detectors. A close visual examination of the 6EW6 plate circuit (Fig. 1) revealed an open solder joint in the center tap of the hue control (a coil in this chassis). This open connection changed the phase of the burst, because C1 no longer tuned the hue coil. A hot iron corrected this problem, and a check with the color generator proved the receiver was now operating normally.

No Blue

A dealer for whom we handle color service called us frantically one morning with the report that both his new color demonstrators had no blue in the color picture, only red and green. He had a potential customer coming in that afternoon to watch a color show, and so he asked us if we could check the sets immediately. This sounded as though some typical trouble might be involved here, since both sets were acting the same way.

My best shop man and I both went to check these sets, hoping for a quick repair. The moment we got the back off the first set and connected a cheater cord, we let out a sigh of relief; the filament in the 6GY6 Z-demodulator tube was not lit. A new tube brought the blue into that set, so we turned our attention to the next.

Thoughts of a similar trouble left us when a new 6GY6 did not help this set at all. We decided we would do some testing with our VTVM


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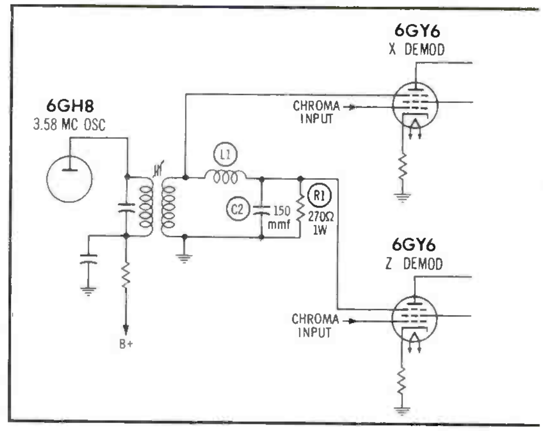

Fig. 2. L1 and resistor-capacitor network R1-C2 shift phase of signal fed to Z demodulator.

before taking the chassis to the shop. The plate, screen, and cathode voltages were okay on both the X and Z demodulators. We had just decided to stop checking further, when John found that the X demodulator had 10 volts of AC on the suppressor grid but the Z demodulator had none. We didn't know whether this was significant or not, since high-capacitance probes sometimes kill the oscillator. To check this reading, we turned the receiver off and set our meter to the ohms scale. At the suppressor of the X demodulator, we checked less than an ohm to ground; at the suppressor of the Z demodulator, the reading was 270 ohms. It was then obvious from the schematic (Fig. 2) that L1 must be open. This choke is one element in the low-pass filter that changes the phase of the oscillator signal applied to the Z demodulator. We verified this diagnosis by hooking a small clip lead across the choke and obtaining the bar pattern shown in Fig. 3. This is typical of the pattern that results from an oscillator signal of the same phase being applied to both demodulators simul-

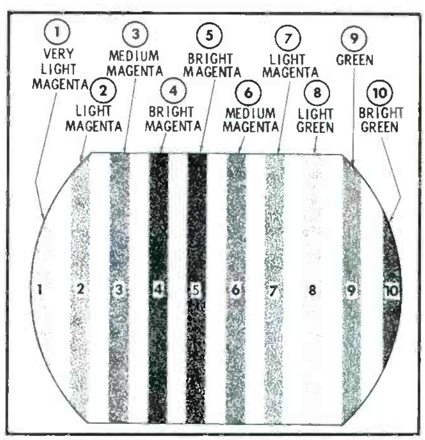

Fig. 3. Color-bar pattern produced when signal of same phase is fed to both demodulators.

 Circle 26 on literature card

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NEW! CA122

COLOR CIRCUIT ANALYZER

A simple approach to a complex problem

A must for color . . .

a money maker for black and white TV servicing

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

The CA122 offers more for less money:

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

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

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

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

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

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

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

You'll pay more for other color generators only.

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NEW! PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

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

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

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taneously. A shorted choke would give this same bar pattern, for example.

John drove me back to the shop, and went on to the distributor for a new choke and then back to the dealer's showroom to complete the repair. He pulled the chassis only part-way out and propped one corner on a chair. With the aid of a flashlight resting on the floor, he was able to unsolder the old choke and reinstall a new one without disconnecting all the cables or pulling the tuner.

Color-Bar Hints

The first Tuesday we had a repaired color set in the shop, I showed the men color-bar patterns of simulated defects—such as what happens with a dead 3.58 oscillator, no horizontal blanking, defective X or Z demodulators, etc.

This particular demonstration happened to be on a set with an RCA CTC11 chassis. The bars on the screen were all a weak but uniform magenta (reddish-blue) when the 6GH8 color oscillator tube was removed from its socket. They were surprised at this because they really expected *no color.* However, the chroma signal was detected by demodulator-tube overload and the resulting signal came out as blue and red bars of the same intensity on all parts of the screen. Why no green? Because the green is made by adding the R-Y to a B-Y signal of opposite phase; thus, wherever red and blue bars appeared, the green gun was biased to cutoff.

Some information can be applied to other models, and some cannot; as I soon found out. About a week later, I was checking an RCA CTC12 chassis in a customer's home for a no-color condition. Black-and-white operation was normal. I remembered that the color killer on this model was noise immune and therefore would eliminate the color completely if the color oscillator were out of sync. When I turned the killer control fully counterclockwise, I got a faint hint of color. The color-bar generator supplies more color than does the average color program, so I attached it and was surprised to find *green* bars, exactly like the purple ones on the set I had used in my demonstration. Bars that are all of the same brightness can develop only if the generator pulses are all the same phase or if the receiver oscillator is dead. But why weren't they purple, like before? The color control worked okay but the tint control had no effect at all. While pondering how this could happen, I plugged in a new 6GH8 oscillator tube and got a normal color pattern just as soon as it warmed up.

After I got back to the shop, I carefully compared the CTC11 and CTC12 circuits and found that the 3.58-mc signal in the CTC11 is fed to the cathodes of the demodulators; in the CTC12 the signal goes to the suppressor grids. Thus the two oscillator signals are opposite in phase, but the chroma signal goes to the grids in both cases. Consequently, we have required our men to memorize this little rule:

CTC7 through CTC11—dead oscillator makes all color bars purple.

CTC12 and CTC15—dead oscillator makes all bars green.

Poor Registration

George brought in an RCA CTC7 chassis because of bad vertical sync, and also remarked that the color was not too good, which might be caused by the set's location. John, our ace bench man, repaired the sync problem and then started to check the color. The fourth bar, which is about 50% red and 50% blue (or magenta) showed a blue border on the left side of the bar and a red border on the right, with the displacement being almost ½". The ninth bar (cyan) showed green on the left and blue on the right. John switched to crosshatch and found that misconvergence was not enough to account for this bar displacement. Back on color bars, we noticed the bars were not very sharp and the crossover points were not clear. He tried to adjust the third bar for blue crossover, but the phase adjustment would not move the bar enough without losing most of the blue amplitude.

This called for a conference over coffee cups, and these facts emerged:

1. We didn't know why the bars were displaced or wouldn't cross over.
2. The serviceman who worked on this set previously was noted for his proficiency with a slug-adjusting tool. He

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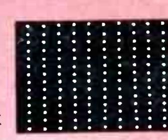
Pretuned RF output to Channel 4. Other low channels can be selected if Channel 4 is being used in your area by simple slug adjustment. Patterns are injected directly into antenna terminals, simplifying operation and saving servicing time.

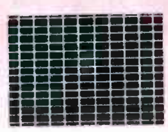
Reserved output on color bars for forcing signal through defective color circuits. The color output control is calibrated at 100 percent at the center of rotation, representing normal output. A reserve up to 200 percent is available on the remainder of rotation.

Smaller and more portable. With color receivers weighing much more than black and white TV, portable equipment becomes essential for home servicing. The CG126 weighs less than 10 pounds and measures only 11" x 8" x 6".

Ten standard keyed color bars (RCA type) that automatically provide all colors at specified NTSC phases . . . but without need of interpretation when servicing.



Stable white dots with new exclusive dot size adjustment in rear.



Stabilized crosshatch pattern for simplifying convergence adjustments.

10 thin white vertical lines for horizontal dynamic convergence adjustments . . . often missing on other generators.

14 thin horizontal lines for vertical dynamic convergence. Also missing on many high priced generators.

March into your local parts distributor and demand the CG126 Sencore color generator that sells at ½ the price of others. Don't let him switch you.

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Circle 29 on literature card

would turn anything that was not glued down.

3. The monochrome and color pictures would be displaced from each other almost ½" if the delay line were not used. This is because the chroma signal is slowed down by going through a comparatively narrow-bandwidth channel.

Could something be changing the chroma bandwidth? If so, would one color be displaced more than another? These questions could only be answered with good test equipment, and luckily we had that.

After seeing the botches that result from random turning of tuning slugs, we make it a strict rule never to turn an IF adjustment unless we are actually doing a complete alignment with full sweep equipment. But it does *no* harm to merely look at a curve; sometimes it will show up troubles other than alignment.

The overall curve from the tuner to video amplifier was good, but from the tuner to the color demodulator it was terrible. There was a peak at 3.6 mc, and nothing above that. Evidently the man had adjusted all the chroma IF's for maximum color.

John was muttering unprintable phrases by the time he brought the chroma circuit into alignment. With crossed fingers, we hooked up the bar generator and saw nice, sharp bars; the compound red-blue and blue-green bars were overlapped perfectly, and the blue bars would adjust easily to correct crossover! Three bad symptoms had been corrected with alignment alone.

Conclusion

As you can see from these examples, some hue problems are easy to remedy and some are quite hard. Learning to recognize and interpret hue troubles on the screen, deciding what circuits might be defective, and picking test instruments to use, are all valuable keys to solving these tint problems.

Plastic Repair

How many times have you wished for a glue that will permanently bond broken radio and TV cabinets, and all types of control knobs? Perhaps cracked cases aren't too hard to mend; but what about those broken plastic screw mounts? Without them, the mounting screws won't hold the chassis in place.

It's a rare radio or TV man that doesn't swear at one time or another that he'd give his eye teeth for a real good bonding agent to perform just such tasks. One that would harden to such a consistency that it would form a bond stronger than the original material.

Well, the Rawn Co. has introduced just such a bonding agent. Not only can it be molded to any shape, but it will dry, without sticking, around vaseline-coated objects. For example, to reform a mounting hole in a cabinet, the screw is first coated with vaseline; Plas-T-Pair is mixed and shaped about the mounting hole; and the screw is inserted. The vaseline prevents the glue from sticking to the metal, and the screw is simply backed out when the mixture hardens.

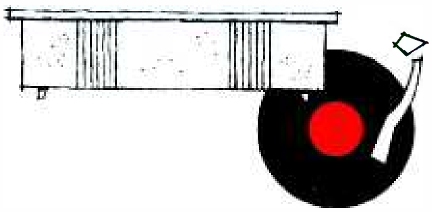
Plas-T-Pair comes as a kit consisting of powder, liquid, dispenser, sandpaper, and aluminum foil. The powder and liquid are mixed together according to the manufacturer's instructions, and either poured or pressed into place. The mixture can be poured from any container (such as a paper cup) that will allow a thick liquid to flow. The narrow-mouthed powder dispenser can be used for tight, hard-to-get-at corners; merely spread the powder around the area to be repaired, and add the liquid via the eyedropper included with the kit.

The glue dries clear; it can be sanded, drilled, and painted. It can also be polished to a high gloss with any good plastic polish. ▲

For further information, circle 66 on literature card

Circle 31 on literature card

CUSTOM STEREO SIMPLIFIED



System design and installations made easy.

by Art H. Meyerson

Installing a stereo high-fidelity system presents some special problems. For one thing, it is equivalent to working with two separate hi-fi systems. FM multiplex, stereo records and pickups, and dual amplifiers all display characteristics not found in conventional hi-fi systems. Many poor stereo installations result from improper matching of these characteristics.

In many cases the first problem is to reconcile the husband's and wife's viewpoints. Generally these do not coincide, but they can be negotiated; diplomacy usually dictates that you do as much as possible to satisfy the wife's tastes. She is conscious of room decor, so you must make the installation attractive and unobtrusive as well as functional.

Speaker Installation

While the installation of the electronic portion of the equipment is routine, speaker placement is not. There are certain standards that must be observed. Whenever possible, the speakers should face into the longest dimension of the room for best propagation of the low notes. They should be mounted at ear level (when the listener is seated), since treble tones generally follow a straight line. This does not preclude installing the speaker system so it faces into the short room dimension nor does it prevent a deviation in speaker height. However, if the speakers are to be installed at ceiling height or on a high shelf, be sure to get the customer's permission to face them downward at an angle directed toward the listening area.

Should one speaker face a doorway, the results may be disappointing. Normally, this speaker will have to be played at a higher level

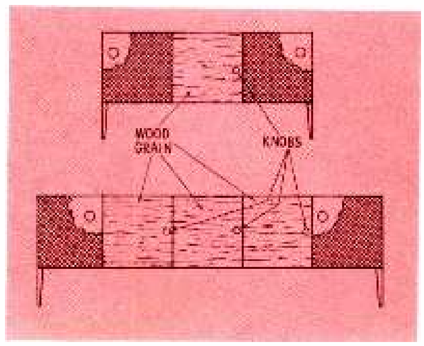


Fig. 1. Placing of tweeters for best results.

to produce an apparent balance. At best, results are usually less than satisfactory with this arrangement.

Balance between speakers is set by playing the system monophonically and adjusting the balance control until the sound seems to come from a point midway between the two speakers.

Physical Separation

The proper distance between the speakers depends on where the listener will sit. It is common to make the distance between speakers two-thirds of the distance from the speakers to the listening area. However, the listening area could be accommodated to fit the distance between the speakers; if the stereo

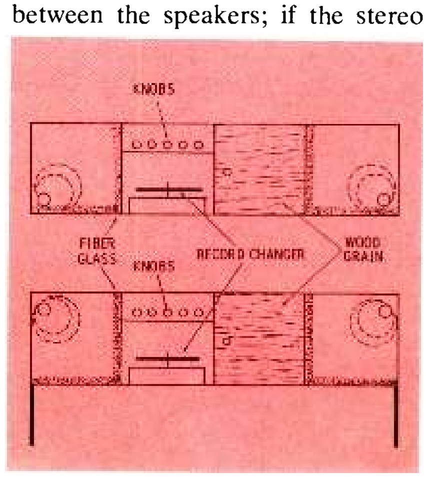


Fig. 2. Speaker location, fiberglass lining.

system is installed in a 6′ cabinet, 8′ to 10′ is a good distance from which to listen. Stereo effect can be enhanced by spreading the speakers up to 8′ apart, but care must be taken not to spread them so far apart that the sound seems to split up, leaving a "hole" in the middle. If the speakers are separated by 9′ or more, a center speaker is needed. It must operate at a level about 50% below either of the other speakers. This three-point system helps materially when listening to the system from an off-center position. The center speaker need not be capable of reproducing frequencies below about 100 cps. If a summing-type speaker tap is not provided in the amplifier, two small speakers, attached to the left and right channels respectively, may be used.

Mounting

The tweeters are an important factor in producing stereo effect. For this reason, they should be installed at the outer edges of the speaker compartment in smaller cabinets and toward the inner edges in larger cabinets (Fig. 1).

Coaxial or full-frequency speakers may also be installed off-center, depending on the circumstances. Many speaker authorities favor the off-center positioning of speakers to aid cabinet resonance.

Speakers may be installed at either the tops or bottoms of the compartments, depending on the position of the listener. When lining the cabinet with fiberglass or other padding, favor the inside walls and bottom of the speaker section, as shown in Fig. 2.

If the entire system is to be installed in a single cabinet, it is best to use a boxed, or integrated, speaker system. The entire box is then installed in the speaker compartment with foam rubber insulation. This presents a problem in box dimensions, since most speaker-system enclosures are 24″ in one dimension. The inside of a speaker compartment is usually 22½″ high and 23″ wide for a three-section, 6′ cabinet. There are two possible solutions:

One is to have a local cabinetmaker build speaker boxes of dimensions to fit inside the cabinet. Install the speakers in these enclosures according to the speaker man-be a

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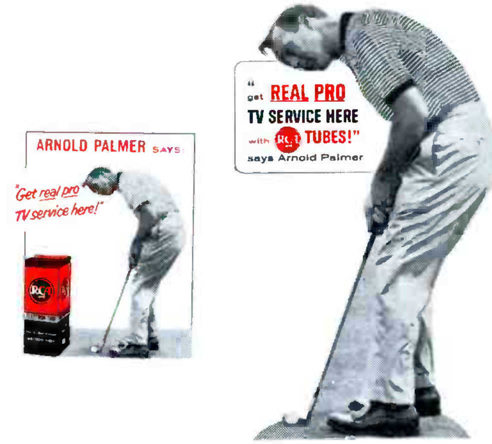

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RCA® **The Most Trusted Name in Electronics** ufacturer's recommendations. Some speaker systems come already mounted in "black boxes" (so called because they are painted black). They are made from ¾″ or ⅞″ pressed pine board (or other inexpensive material) and usually measure about 21½″ x 16″ x 15″. When these boxes are used, the back of the speaker compartment may be constructed of ¼″ plywood and a framed grille cloth may be used for the front, as shown in Fig. 3.

If a regular shelf-type speaker is to be installed in a large cabinet, one of several methods may be used. The inside wall of the speaker compartment may be moved over 1½″ to 2″ and a false wall installed in the adjoining section. This can be done by a competent carpenter. A good portion of the front may be blocked off without interfering with speaker openings. If the speaker cabinet has grille cloth, this will have to be removed and a framed grille cloth installed on the front of the hi-fi cabinet.

A hole may be cut in the bottom of the hi-fi cabinet and the speaker cabinet hung on foam rubber-covered metal cleats (Fig. 4). A 24″ speaker box will protrude about 1″ below the cabinet, so make sure the bottom skirt of the cabinet will hide it. Another point: Make the hole at least 1″ or 2″ larger than the end of the speaker box to allow for maneuvering during installation. Be sure the customer approves what you are going to do.

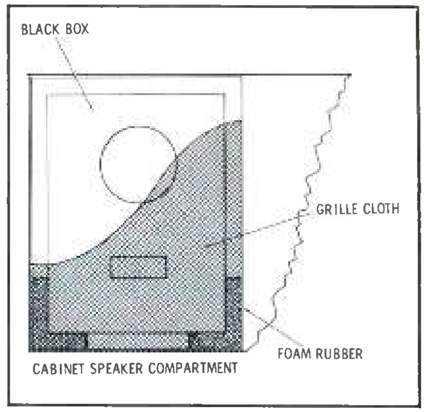

Fig. 3. Construction details of "black box."

The purpose of mounting the speaker system on foam rubber is to prevent acoustic feedback. If it is necessary to mount the speakers directly in the cabinet, be sure that ¾″ corewood or plywood is used throughout the speaker compartment, including the front and back. It may be necessary to reinforce the sides with a section of 1″ x 2″ lumber to prevent feedback. (The feedback problem is aggravated in stereo because a portion of the vertical motion of the needle is used.)

Installation Tips

At times, installation is made almost impossible by what the customer wants in the way of equipment, cabinetry, or listening area. Check everything carefully before you commit yourself. A cabinet with loose tambour doors (similar to a roll-top desk) could vibrate and

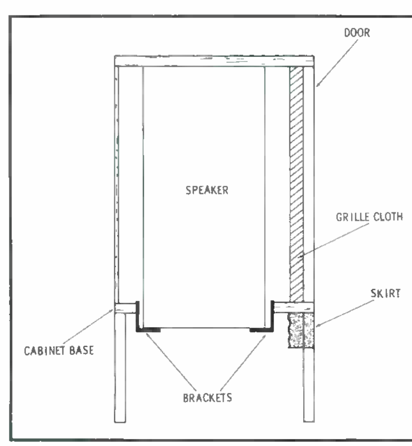

Fig. 4. Hanging black box in hi-fi cabinet.

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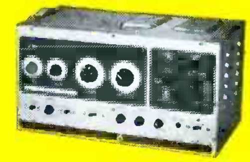

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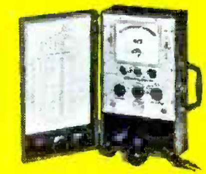

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prove to be a real annoyance. If the cabinet is to hang on a wall or to be permanently installed against a wall, be sure the equipment can be easily removed for servicing. The speakers will have to be installed from the front and the tuner, preamp, or amplifier mounted on L-shaped drawers.

An additional problem under these circumstances is adequate ventilation. Stereo systems radiate almost twice as much heat as their monophonic equivalents. Allow 8″ or 9″ for equipment height. Insulate the top with cut-up asbestos stove covers, metal side down. Be sure to louver the base on which the amplifier is mounted. It is normally unnecessary to extend the shelf to the rear of the cabinet; leave an inch or two in the rear for ventilation and to ease the problems of interconnection. Louvers may also be cut in the front panel. If the cabinet is wall hung, allow some space in the rear for ventilation, or cut long louvers in the top.

Almost nothing can destroy a cabinet or equipment as fast as heat. If it is necessary to mount an amplifier and a tuner in one compartment, always mount the tuner below the amplifier. Be sure tuners are well ventilated, or the frequency-drift problem may be insurmountable. Instruct the customer to leave the doors slightly ajar when using the equipment, to improve the ventilation.

Be absolutely sure of your dimensions. Nothing can be more embarrassing than to find the changer spindle doesn't clear the top or the changer drawer doesn't clear the door.

The wiring of a stereo system is obviously more elaborate than that of a monophonic system. For this reason it is a must that all wires be identified. For this purpose, adhesive tab markers are excellent.

Speaker Phasing

Speaker phasing is a relatively simple operation. Fig. 5 shows an easy method of checking speaker phase using a DPDT switch with 10′ color-coded leads. The switch is mounted on a small panel labeled NORMAL and REVERSE. Use a frequency-test record, and play it in the mono mode. Attach the switch to either speaker, and stand at a point midway between the two

MALLORY

Tips for Technicians

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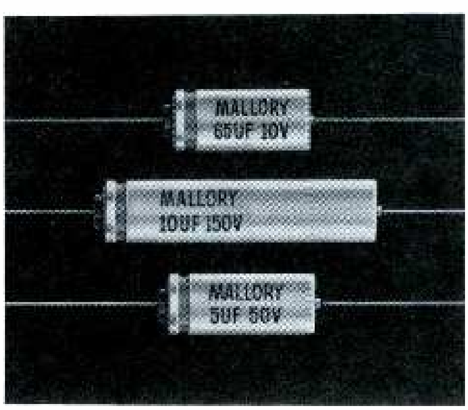

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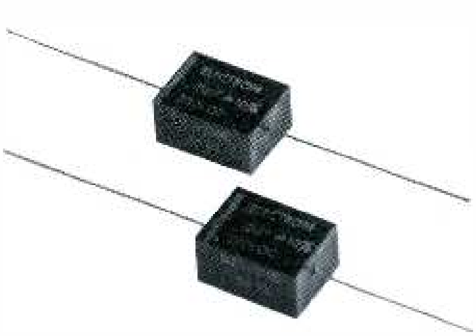


Metallized Mylar* Capacitors

Much of today's electronic gear is used in places where a shutdown because of failure can be astronomically expensive—or it could be downright dangerous to life and limb. In these places it is essential that high reliability components be used. But how does one select truly highly reliable components? The surest method is to bank on the reputation of the manufacturer and to have an intimate knowledge of types of products available.

Take the case of tubular electrolytic capacitors. The standard Mallory TC type has been used for years in literally millions of radios and TV sets with unparalleled success. But the new TPG (Tubular Premium Grade) type is engineered and manufactured to vastly more critical standards. These standards apply to the aluminum foil, to the electrolyte, the all-welded construction, safety vent, and to the extra testing required.

Then there are computer grade filter capacitors. Mallory computer grade types have proven their ability to be better than new after twenty years of continuous service. Standard ratings are available "off-the-shelf" up to 115,000 mfd.

When it comes to Mylar* capacitors one may select from dipped, molded, wrapped, and umpteen other styles. There are dual-dielectrics, plain Mylar, Metallized Mylar, etc. Mallory PVC and the all-new GEM series utilize 100% Mylar dielectric, but these are commercial types. For high reliability applications, one needs the new ELECTRON metallized Mylar type available in up to 10 mfd @ 100 WVDC. And in the smallest package by volume available anywhere. ELECTRON capacitors are metallized with *aluminum* . . . not zinc as are virtually all other types. Capacitor cartridges are sealed in pre-molded cases with high-density epoxy and the cases are rectangular to better withstand vibration and occupy minimum space.

Tantalum capacitors to meet the most extreme standards of reliability are stock items with Mallory: solid electrolyte, plain and etched foil, wet slug types and 200°C high capacity types (even radiation resistant types).

Whenever you need a truly high reliability capacitor, call your Mallory Distributor. Just ask him for a copy of the 1964 Mallory General Catalog and you'll be able to make a selection from the hundreds of types listed.

**Registered Trademark E. I. du Pont de Nemours*

Circle 37 on literature card

speakers. Now play a tone below 100 cps, and flip the switch back and forth. The correct position is the one in which the bass note is heard loudest. Normally, speaker phasing is no problem, since most speaker manufacturers code the terminals; but it is necessary to check phasing when servicing someone else's installation or where the customer has tampered with the wiring.

Hum Problems

Installing the record player under the amplifier sometimes leads to hum problems, particularly if the amplifier power transformer is mounted on the side immediately above the tone arm. The proximity of the transformer to the pickup arm may create hum that is more evident when the phono drawer is pushed back into the cabinet. In some cases, the hum may become more evident as the arm approaches the end of the record. This is because the power transformer is mounted on the left side of the amplifier. Some cartridges are shielded against this condition. Many changers short out the cartridge at rest or during the change cycle. In checking for hum, be sure the cartridge circuit is open.

Normally, hum problems are attacked by first turning up the bass and volume controls and switching in the loudness control. Check hum controls in the equipment itself; try reversing AC plugs; make sure phono-plug caps make good contact; ground or unground the motor, turntable, or tone arm; ground the entire system externally (sometimes the AC outlet plate is effective); use shielded braid to interground the entire system.

Determining Left and Right

Many hi-fi manufacturers still use A and B channel designations instead of left and right. Some do not even identify the channels in their instructions. Reading the instructions in front of the customer usually creates doubt in his mind as to your ability. For this reason it is a good idea to learn an old trick in channel identification. The quickest method is to hook up the speakers and then manipulate the balance control on program material. Turning the balance control to the left should increase the volume in the left speaker.

To check proper hookup of the cartridge, use a tone record that

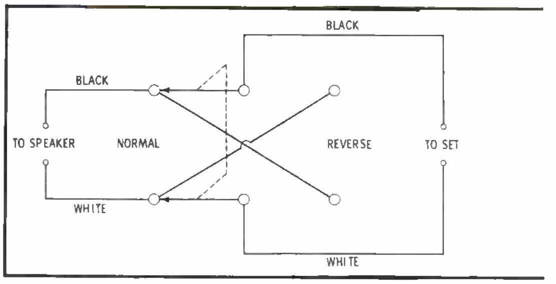


Fig. 5. Hookup for checking speaker phasing.

employs separate bands for the left and right channels. The same record can be used for phasing tests by switching the phono input to monophonic operation.

Changer Problems

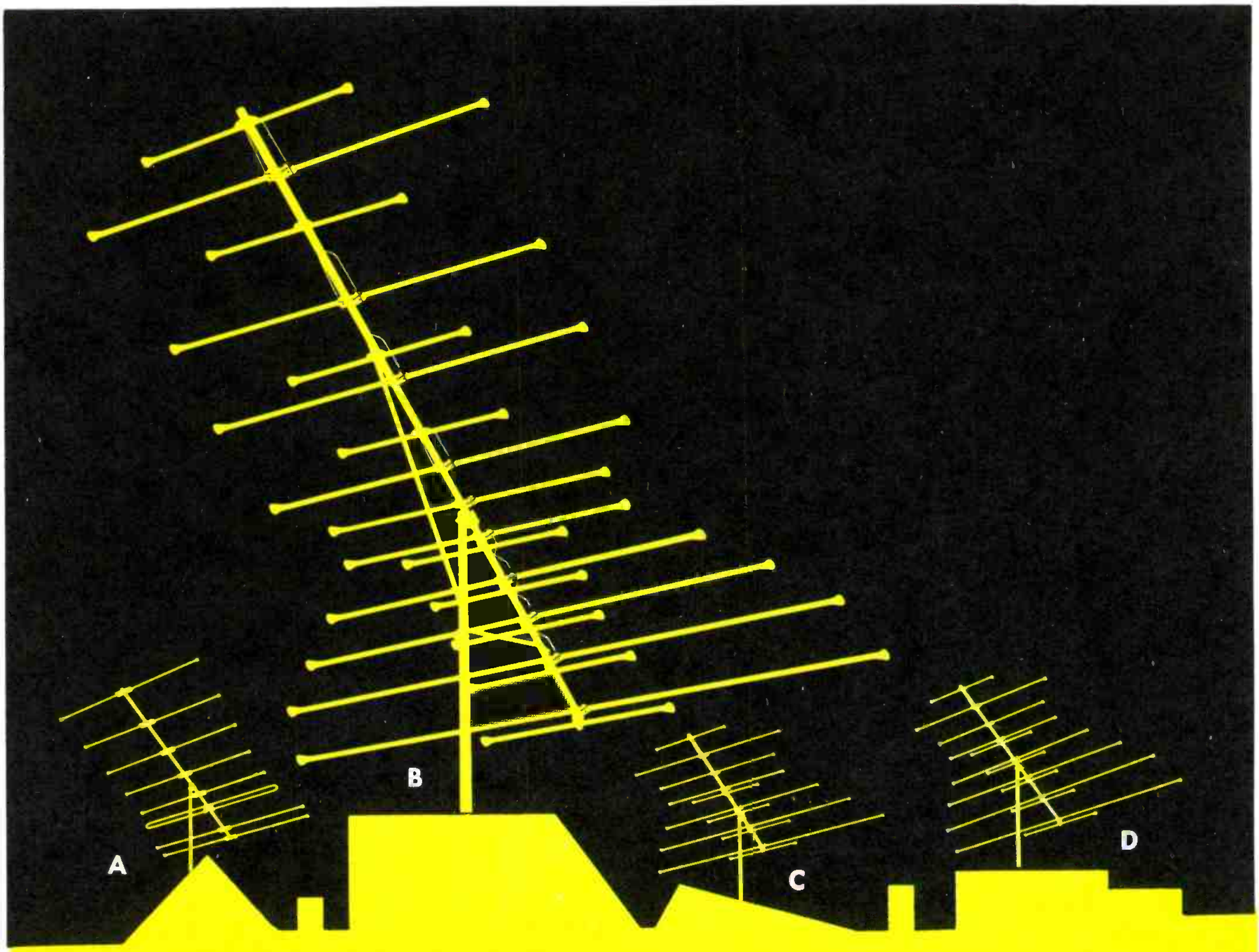
Rumble is a greater problem with stereo than with mono. If rumble is objectionable, cut in the rumble filter if the amplifier has one, or instruct the customer in the use of a lower bass-control setting. The better the record changer, the less the rumble that will be produced. When the customer complains of the rumble and feels that reducing the bass will reduce fidelity, be sure to point out to him that better performance will cost more money.

Another problem with changers in stereo installations is needle-skip due to "bouncy" floors. Part of the blame rests with the use of a spring to control needle pressure. On some changers, both spring and a counterweight are used, and this skipping tendency can be minimized by depending on the counterweight adjustment for most of the needle-pressure control. More help will come from leveling the changer for a slight tilt toward the rear of the changer.

Tuner Problems

Where stereo FM tuners are involved, the type of antenna used is very important and depends on the

"Everything was fine until it started giving the answers before he finished the question."



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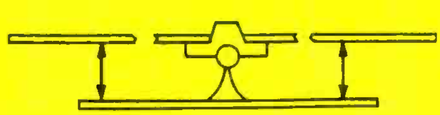

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D. RCA 300 antenna. 13 elements, for suburban and near fringe area locations.

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locality. In urban areas, an antenna can be incorporated right in the tuner design, but this may not be sufficient. Sometimes, a 52″ folded dipole constructed from 300-ohm line will help. Apartment-house antenna systems, if they do not reject FM frequencies to prevent intermodulation of TV sets, may be used with a two-set coupler. Where outside antennas are not permitted, stretching a so-called "sneak" antenna across a window will sometimes improve reception. Remember that trying all these methods require time, your most saleable commodity, and the cost should be considered when submitting your bill.

Tape Systems

Tape systems are more popular for stereo than for mono. When included in hi-fi installations, they are normally mounted on a flat platform and are generally removable for use at other locations. Input and output leads should be labeled so the customer may detach the unit simply. If wire markers are not available, white adhesive tape can be used, marked appropriately with a ball-point pen.

Matching Equipment

One of the biggest headaches in a hi-fi installation is improperly matched equipment. People will listen to well-meaning friends who consider themselves experts, or they will purchase so-called bargains. Even good name-brand components can give terrible results when improperly matched.

The cartridge should be appropriate for the changer or turntable. Changers, depending on their quality, require from 2 to 6 grams for proper tracking. The cartridge should be operated at its specified needle pressure.

Speakers that have a broad frequency response will accentuate the distortion of an amplifier whose response is not so good. Lower-priced speakers whose response falls off rapidly at low and high frequencies will sound much better with a lower-priced amplifier. This partially explains why some low-priced systems sound better than certain high-priced systems.

A wideband amplifier and speaker system will accentuate rumble produced by a low-priced changer or turntable. And a poor tuner will sound worse when used with a good amplifier and speaker.

Before and After

If the customer supplies the equipment, check it before you commit yourself. Remember that he expects miraculous sound, simply because it is stereo. And no matter how long you estimate the job will take—it'll take longer. Be sure to include in your bill all the time you've spent or expect to spend. Allow at least one hour for checking the system when completed and explaining its operation to the customer.

Bring along some records that show off the stereo effect in dramatic fashion. Recordings featuring trios, quartets, or quintets are usually better for this purpose than recordings of a full symphony orchestra. A flamenco or guitar record, with its high transients, is always a sensation.

Be sure to instruct the customer in the proper operation of the system. The sooner, and the better, he learns how to operate it, the quicker will be his appreciation of how well you have done your job. ▲

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Here's how it works: VERBA-MATIX electronically delays signal to rear speaker, creating exciting stereo effects never before possible in an automobile. AND—you have complete control over percentage of reverberation at all times!

Complete system includes: Dual-control panel, a 4 transistor amplifier, 6 x 9" rear speaker, deluxe speaker grille, mounting kit and complete instructions.

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RECEIVER EXTRAORDINARY

by 55934

My portable radio was *indeed* a most extraordinary receiver. In one month's time it netted me over $6000 in cold, hard cash, some of which came out of your pocket.

The first time I visited your shop was to have my portable radio repaired. At your suggestion, I left the radio for a few hours till you could get to it.

When I returned later that day to pick it up, I learned that the trouble had been cured by a new tube—which you supplied. However, you supplied me with something more than just a tube: I'd just paid you when a man walked in and asked if you would cash his paycheck. I remember your exact words: "Sorry, sir; I don't know you. I got stuck with a bad check once this year, and I've decided to cash checks for only those people I know." The man thanked you anyway, turned, and walked out. Then and there, I decided *you'd* get to know *me*.

What a lemon that portable radio of mine must have seemed to you. I've forgotten how many times in the next three weeks I returned it to you for some minor repair. Anyway, I was a pretty good cash customer, wasn't I? And you got to know me pretty well, didn't you? Or so you thought. As you yourself once said, our personalities seemed to click right off. We even went fishing and hit a few night spots together in my flashy convertible.

But, during the day when I was supposed to be slaving for the utilities company where I told you I worked, my *receiver extraordinary* was being "serviced" elsewhere. Indeed, many radio repairmen were getting to know me. My personality was clicking in service shops all over town.

Then, one Wednesday evening, as you no doubt loathe to recall, I walked into your place with a quartermoon smile ear-to-ear across my face. When you were through waiting on the other person in the shop, I pridefully produced a utilities company envelope, removed a letter from it, and asked you to read it.

The letter read something like this—remember?

Dear Mr. Bakke:

Congratulations!

It is my personal pleasure to inform you that the idea you submitted in last month's Employee Idea Contest has been judged best, entitling you to the top monthly award of $250.

As company president, I . . . ."

The letter (a product of my own printing press, as were the various identification cards I'd now and then displayed), went on to describe in detail how my winning idea promised to benefit the company.

Remember how happy you were for me? You read every word, then popped for Cokes and we celebrated on the spot.

You didn't know it of course, but that same letter had been read many times that day, and similar celebrations had taken place in several shops like your own. (I had Cokes running out my ears.) Then, as had many of your brothers-in-trade, you asked about the "award" check itself. I explained that I would get it on Friday along with my "regular weekly payroll check." Then I asked if you could go out with me Saturday night to help me celebrate in style. You could and would, you said. So it was all set.

I celebrated Saturday night, all right—with a lush blonde three jet-hours away. Before I left your city, however, I'd cashed 24 of the 30 "idea award" checks I'd printed ($191.33, after deductions) and 17 of the 30 "regular weekly payroll" checks (some of your brothers-in-trade lacked sufficient cash to handle both checks). I might have cashed the whole lot, except for one hunch-happy technician across town from you.

On the pretext of going to get more cash, he entered a door marked "Private" and sneakily telephoned the company in question. When he returned there was a look in his eyes that told me we'd suddenly ceased to be chums. He had my checks in one hand and a .38 Special in the other, and he approached me as a man who meant business.

"I had a hunch something was afoul, *friend*," he said coolly. "So I telephoned the utilities company to be sure. And you know what, *pal*? A girl in the payroll department says she never heard of you—*nobody* named Claude Bakke works there." He leveled the gun barrel at my midsection. "So, suppose you just follow me, nice and easy like, step by step, back into my office, where I can make one more phone —"

"Okay. Sure—sure thing," I interrupted, staring at the one-eyed menace in his hand. At that moment I could sympathize with the fly that tried to swallow a frog—the lump in my throat seemed that big. "What I mean is, maybe you'd better take another look at my checks," I managed. Then you'll see that I work for the *County Division*, which not only is a separate unit, but has its own payroll department, supervisory staff, and all."

He didn't seem to know what to make of that. He just stood there sizing me for a long, heart-trembling minute. He didn't know it—not for certain—but he had those rubber checks around my neck tight enough to choke another long prison term out of my life. But then he looked at my checks again, and I began to calm down a bit as he lowered the gun. "Okay," he said at last, but warily, "so it does say County Division."

"Sure it does," I shot at him quickly, "because that's where I work. And here's my County Division employee's pass." I reached for my billfold and pulled the pass from a celluloid insert. "It's got my photo, thumbprint, signature, name and address, and complete physical description." I offered the pass for his inspection, but he refused it. It was just as well though, because the utilities company had no County Division or anything of the kind. I'd printed that on my checks and identification for the express pur-

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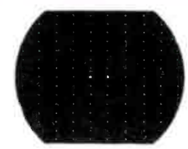
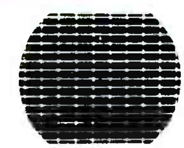
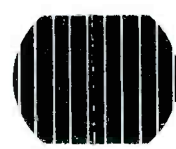


Dot Pattern

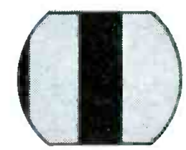


Crosshatch



Vertical Lines

Horizontal Lines



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The compact "1074" gives you a complete TV signal generating source of your own. Using the B&K *point-to-point signal injection technique*, you can isolate and pinpoint any performance problem for quick correction.

By injecting your own signals, with a visual check on the TV screen, *you can easily signal-trace and troubleshoot any stage* throughout the video, audio, r.f., i.f., sync and sweep sections of black & white and color television sets.

It becomes much easier to find and fix "tough dogs," and troublesome intermittents, as well as to solve other general TV set troubles—to the satisfaction of your customer, and to your own profit. Net, $249^{95}

Supplies complete r.f. and i.f. signals, with pattern video and tone audio. Video signals are switch selected for fast, visual troubleshooting. Provides FM modulated 4.5 mc sound channel, with built-in 900 cycle tone generator. Provides composite synchronizing signals. Provides separate vertical and horizontal plate and grid driving signals to check complete output circuit and interrelated components. Many other features.

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Circle 40 on literature card

pose of getting out of just such situations as this.

"Never mind," he said. "You don't *look* like a crook, Claude. But everything about you—your checks, your letter of congratulations, and your identification—appears just a little too pat. Besides, I've known you less than a month. Furthermore, once or twice I was nudged with the notion that your portable radio was put out of order on purpose. At least, it seemed to be. Anyway, my hunches have saved me money before, so I'm not shelling out that kind of dough until I investigate further and know for sure that you and your checks are okay. In fact—"

"Skip it," I interrupted again. For an instant I had thought everything was going my way again. But now I knew it wasn't—and I certainly couldn't let him get back on that phone to check out my County Division story! "I'll take my checks to the bank Monday," I said, "they know me there." Then I quickly changed the subject. "Anyhow, we've still got some celebrating together scheduled for tonight. Is it still a date, or will you have to investigate further on that, too?"

A mere wink of a grin flashed across his face. "It's still a date," he said, adding a sharp barb, "if you're still around. . . ." He placed the .38 on a counter and returned my checks.

That man *knew* what I was. Yet he allowed me to light a spark of doubt in his mind, and I talked my way out. One near-nab of that kind was enough for me, however. I dumped that convertible in a quick cash deal and headed for the airport, abandoning my "receiver extraordinary" and printing press equipment (new outfits of the same type cost under $300).

Ultimately, of course, I was caught in a predicament where I failed to talk my way out. As a result, I won't be visiting radio and TV service shops for some time to come (my current sentence expires late in 1970 and two other states have expressed keen interest in my future). But there are many other check cheats who, perhaps at this very minute, are planning ways to get their hands on your money. Will one of them beat you? Don't be too cocky; you swore off once, before I came along. Remember . . . ? ▲

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A. NEW! RCA WR-51A FM STEREO SIGNAL SIMULATOR

Generates signals necessary to service and maintain stereo multiplex FM receivers and adaptors. Generates... Choice of 4 FM signals—Left Stereo, Right Stereo, Special Phase Test, Monaural FM • Choice of 8 sine-wave frequencies (400 cps, 1Kc, 5Kc, 19Kc, 28Kc, 38Kc, 48Kc, 67Kc) available separately or for modulating FM signals • 100 Mc carrier tuneable ± 0.8 Mc to permit selection of a quiet point in the FM band • 19 Kc subcarrier, crystal-controlled within ± 2 cps • 100 Mc sweep signal adjustable from 0-750 Kc at 60 cps rate • Choice of 3 composite stereo output signals—Left Stereo, Right Stereo, Special Phase Test • Choice of 3 sine-wave frequencies for composite stereo signals • Crystal controlled markers for receiver if and rf alignment • Zero-center meter for checking the balance of stereo amplifier output. **$249.50***

B. RCA WA-44C AUDIO GENERATOR

Generates sine-wave and square-wave signals over range of 20 to 200,000 cps to test audio systems. Can be used to measure intermodulation distortion, frequency response, input and output impedance, speaker resonance, transient response and phase shifts. Less than 0.25% total harmonic distortion over range of 30 to 15,000 cps. **$98.50***

C. RCA WO-91A 5" OSCILLOSCOPE

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D. RCA WV-98C SENIOR VOLTOHMYST®

For direct reading of peak-to-peak voltages of complex waveforms, rms values of sine-waves, DC voltages, and resistance. Accuracy: 3% full-scale on both AC and DC, with less than 1% tracking error. Color-coded scales differentiate peak-to-peak from rms readings. New 0.5 volt full scale DC range for use with low-voltage transistor circuits. 6½" meter. **$79.50***

E. RCA WV-76A AC VTVM

Measures voltages down to 0.001 volt. Decibel scale for measurements from −40 to +40 db. Built-in amplifier which may be used separately as a preamplifier. Typical applications include: frequency response tests of preamplifiers, power amplifiers and tone control circuits, signal tracing; measurements of audio level, power level and gain; amplifier balancing applications and general audio voltage measurements. **$79.95***

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Notes on Test Equipment

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

by Stephen Kirk

New Pep for Old CRT's

Fig. 1. General-purpose tube tester and picture tube rejuvenator is also portable unit.

Today's technician, with an already overloaded tube caddy, should welcome a small portable tube tester that is rugged enough to be carried in the service truck and small enough not to get in the way.

The GC 36-540 (shown in Fig. 1) is just such a tester. Its metal case measures only 9¼" x 8" x 3¾" with the lid closed. The tester will make emission and short checks on more than 1300 tubes, including *nuvistors, novars,* compactrons, and foreign and industrial types. Also, picture tubes can be checked and reactivated.

The 36-540 uses a neon short check whose sensitivity can be varied by changing the value of the resistor across the neon bulb. The unit comes from the factory with sensitivity about 1.5 megohms. This sensitivity is ample for all shorts and for leakage of any consequence in radio and TV tubes. The short and leakage test can be made either between the grid and cathode or between the heater and cathode at the flick of a front-panel switch. The neon bulb used for short tests acts as a pilot lamp when the function switch is in the emission position.

Eight tube sockets are mounted on the front panel: octal, *novar,* compactron, *nuvistor,* two 7-pin and two 9-pin types. In addition, there are 7-pin and 9-pin straighteners.

To operate this tester it is necessary only to find the tube type number in the chart booklet furnished with the tester and set up *three* controls—an 11-position SELECTOR switch (that determines correct wiring connections); a LOAD potentiometer; and a heater VOLTS selector switch. The FUNCTION switch is set for G-K (grid-cathode) and F-K (heater-cathode) short checking and finally moved to the EMISSION position for final testing of the tube on the BAD-?-GOOD scale of the 2¼" x 3" meter.

This tester will also check or reactivate picture tubes using the standard duodecal socket, with an adapter for other types. Emission of the CRT is measured at the second anode, and because of this a separate lead must be connected to the high-voltage socket of the picture tube.

If the CRT measures low in emission, the FUNCTION switch can be moved to the REACTIVATE position; this applies a high forward bias between the cathode and grid of the CRT to increase the cathode emission. A "magic eye" lamp (GE 1829) indicates when to stop rejuvenation, to prevent damage to the tube.

DC power for tube checks and CRT reactivation is supplied by a silicon voltage-doubler circuit.

We used this compact checker to check many different radio and TV tubes. For general testing—finding out whether or not a tube will work—the emission test has considerable merit.

Although the 36-540 has no gas check, as such, the short check is sensitive enough to show up most tubes that are bothered with grid contamination or gas.

We tried rejuvenation of two different picture tubes whose emission measured low. One of these tubes responded to rejuvenation, but the other was too far gone to be recovered. The rejuvenation circuit of this small tester is essentially the same as for any CRT checker. A positive DC voltage is applied to the grid of the CRT and the heater voltage is increased. This tends to break up contamination or "glazing" that may have developed on the cathode coating. Of course no rejuvenator or reactivator can ever do a 100% job, but reactivation of this kind is the most successful. Quite often a brightener will be useful in keeping the emission of a CRT high after rejuvenation.

For further information, circle 67 on literature card

Low-Cost Color Bars

Numerous tests and color-set alignments have indicated that the Heath Model IG-62 Color-Bar and Dot Generator exceeds its published specifications. The unit is pictured in Fig. 2.

Fig. 2. This color generator produces dots, crosshatch, and vertical and horizontal bars.

The generator produces dots, crosshatch, horizontal lines, vertical lines, color bars, and shading bars. The shading bars provide four different levels of brightness so that the background controls may be adjusted accurately. Highlights and dark areas are displayed in a stationary pattern for easier adjustment than with the constantly changing picture usually transmitted by the station.

Fig. 3 is a block diagram of the IG-62. A crystal-controlled 189-kc oscillator is used as the source of most signals provided by the instrument. 189 kc is a common denominator of both 15,750 cps and 60 cps; since it is twelve times as high in frequency as the 15,750 horizontal scan, it will produce twelve vertical bars (two will be lost in blanking and overscan).

Multivibrator counters are used to step the 189-kc signal down to the other required frequencies. Fig. 4 shows a typical multivibrator as used in the IG-62, this one operates at 31.5 kc, but all are similar except for resistor and capacitor values. A multivibrator is simply a resistance-coupled amplifier with its output fed back to its input. Because of this, it will oscillate at a frequency determined primarily by the values (RC time constant) of the resistors and capacitors used and to some degree the plate voltage applied. The most salient feature for this application is that this type of multivibrator may be "locked in" by a positive signal on the grid higher in frequency than the natural oscillating frequency.

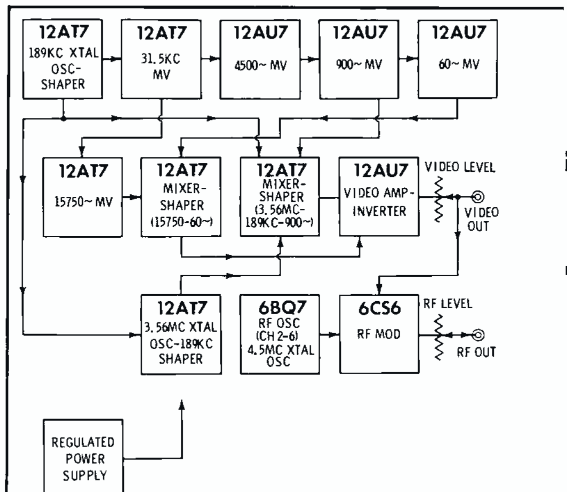

Fig. 3. Three crystal oscillators and regulated power supply for very high stability.

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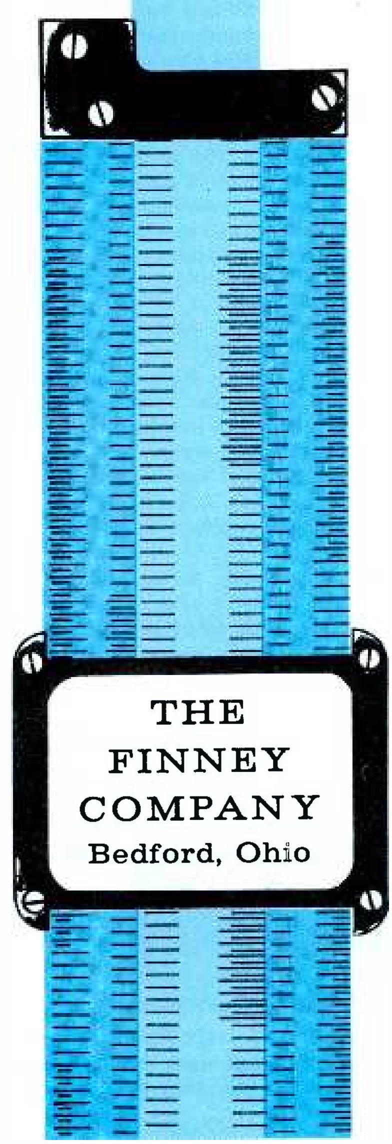

Circle 43 on literature card

This means a multivibrator can be used to develop a frequency which is a subharmonic of the driving frequency. For example, in the 31.5-kc mode, the multivibrator is adjusted to trigger on every sixth pulse of the 189-kc oscillator.

Looking back at the block diagram of Fig. 3, we see that the first count-down oscillator is the one operating at 31.5 kc. Its output is fed to two other multivibrators: one signal triggers a 15,750-cps counter and the other triggers a 4500-cps counter. The 4500-cps counter in turn triggers a 900-cps and a 60-cps counter.

The 15,750- and 60-cps counters, used for horizontal and vertical sync, are mixed and shaped by a circuit using a 12AT7, and the composite is fed to a video amplifier. Signals from the 900-cps counter (for horizontal bars), from the 3.56-mc color oscillator (see Fig. 3), and from the 189-kc oscillator are all mixed and shaped in another 12AT7 circuit, and this composite is also fed to the video amplifier.

Video, including sync, can be taken off at the VIDEO OUT jack in either positive or negative polarity, for use in signal tracing the video or sync stages—or to make convergence adjustments, if you wish. The sync and video are also fed to an RF modulator that is excited by a variable oscillator which can be tuned to any TV channel from 2 to 6 by a front-panel control. For making convergence and other adjustments, it is necessary only to connect the RF OUT cable to the antenna terminals of the set to be tested.

Color bars are produced by the offset-carrier method; that is, a crystal-controlled oscillator (approximately 3.56 mc) beats against the color set's 3.58-mc oscillator. Since this beat is at 15,750 cps, there is a complete 360° phase shift for each horizontal scanning line, which yields a rainbow of colors. These colors are then "keyed" into color stripes or bars so they can be easily identified; at the same time, the keying process modulates the color signal so it can be traced through the circuit with a scope. These color bars are presented in the order shown in Fig. 5.

It is necessary to set up the multivibrator counters after assembling the IG-62, but this involves simply putting the generator on an operating TV set and adjusting for the correct number of horizontal and vertical bars with no weaving. The adjustment point is so definite that there is no mistaking the correct position.

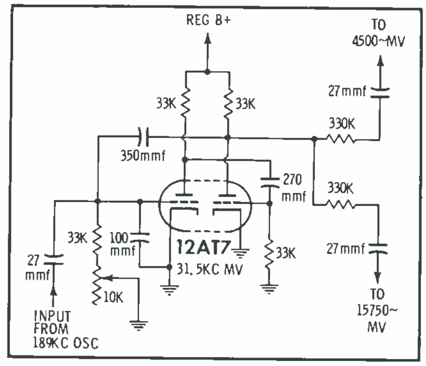

Fig. 4. This multivibrator counter circuit is typical of those in the color generator.

After setting up the unit we were anxious to try it. The first set was a new Zenith that needed convergence touchup. We set the IG-62 for dots and center-converged with the neck magnets, then switched to crosshatch for the dynamic adjustments. We used the horizontal and vertical lines separately to check convergence; although we had not been in the habit of using anything but crosshatch for making dynamic converence adjustments, we could see the advantage of having either vertical or horizontal lines both for "roughing in" and "fine" convergence. For example, when you are making an adjustment that has (or should have) primary effect on the horizontal lines only, switching the generator to horizontal lines keeps you from being distracted by movement in the vertical lines.

The next set was an RCA CTC5.

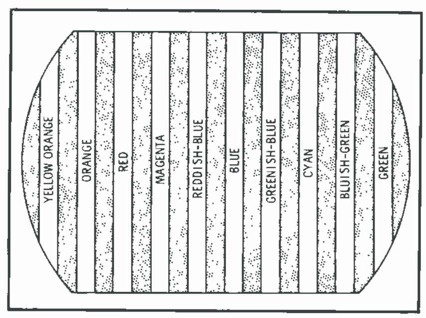

Fig. 5. This is the lineup of bar colors in the easily read bar-generator presentation.

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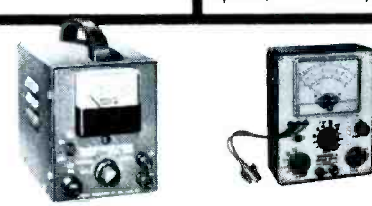

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Newer sets are somewhat easier than this one when it comes to setting background or "gray scale" adjustments. Here was our chance to try out the "shading bars" of the IG-62. It is always a problem trying to locate a "highlight" or "lowlight" in a constantly moving transmitted picture. But since the shading bars gave us a stationary pattern, it was not difficult to get the correct tracking adjustment and to check the results from low brightness to high.

We checked the video output of the IG-62 on a black-and-white set. We were able to drive a picture tube directly at the cathode and produce a weak video picture. Injecting the signal at the grid of the set's video amplifier produced overload when the IG-62's video gain control was up full. There are a number of ways that this unit could be used for signal tracing in video or sync stages.

The IG-62 also has a 4.5-mc crystal oscillator that can be turned off and on with the SOUND CARRIER switch; it can be used for checking the color set's 92-kc beat rejection (the beat between the sound carrier and the color carrier).

All in all we were satisfied with the performance of this unit, both for setup and for other service procedures. Its low price may mean that it could be the answer for the shop where only occasional color TV work is done; if carefully built, this unit can hold its own with some factory-assembled equipment.

For further information, circle 68 literature card

Easily-Read Meter

The new Model 805 VTVM manufactured by Jackson is compact (7" x 6" x 4") and features long, easy-to-read scales in three colors. The OHMS scale is in red, and the function switch selects scales of Rx1, Rx10, Rx100, Rx1K, Rx100K, and Rx1 meg. The DC-RMS-VOLTS scales on the meter are black and marked 0 to 5 and 0 to 10 in increments of .1 to .2 volt. The range switch selects voltage ranges from 1 to 1000 volts. A blue meter scale marked 0 to 14 and 0 to 28 is used to read peak to peak voltages from 0 to 2800 volts in seven ranges. Most of these features can be seen in the photograph—Fig. 6.

The 805 features a relatively new kind of meter movement called a "Taut-Band" mechanism which, as the name implies, uses no pivots or jewels and no movement springs. The meter pointer and moving coil are supported by a tight metal band clamped securely at each end, providing both support and return energy for the pointer.

The test cables for the 805 come out the side of the case; a departure from most VTVM's. This gives an uncluttered front panel, and the right-angle connectors make it easy to store the cable by wrapping it around the case. The "hot" cable is small, highly flexible coax with a plastic covering, terminated in a single probe used for all measurements. This means that no isolating resistor is used for DC measurements to minimize the effects of cable capacitance. For most testing, an isolating resistor is not necessary, but in some instances—such as checking the grid bias of an oscillator tube—some detuning would result from the added load of the instrument. If less loading is required, solder a 1-meg resistor into the circuit temporarily; this will reduce the effects of cable capacitance and have only slight effect on the voltage reading. The big advantage of the switchless probe is its convenience; simply set the switches on the meter panel and measure.

The function switch has OFF-TRANSIT, –DC, +DC, AC, and OHMS positions. Also on the front panel is an electrical ZERO knob, an OHMS ZERO knob, and a mechanical zeroing screw for the meter movement.

The circuit is a variation of the familiar 12AU7 dual-triode bridge circuit, used almost exclusively in modern VTVM's because of its excellent stability. A 6AL5 is used as a rectifier for measuring AC volts, with its output applied to a voltage divider at the input of the measuring circuit. This rectifier is used for both peak-to-peak and rms measurements by providing appropriate scales on the meter. One half of another 6AL5 is used as a halfwave rectifier for supplying the necessary operating voltages. The other half is used to balance out the contact potential (Edison effect) developed by the peak-to-peak rectifier. This circuit is shown in Fig. 7.

The basic ohmmeter circuit (shown in Fig. 8) operates much the same as in other VTVM's. A 1.5-volt internal battery is connected through a group of precision resistors (selected by the range switch when the function switch is in OHMS position) to the input of the 12AU7 tube of the DC measuring circuit. Connecting an unknown resistor between the probe and ground establishes a voltage-dividing network and less voltage is applied to the 12AU7 grid. This causes

Fig. 6. Easy-to-read scales in three colors and cable from side: features of new VTVM.

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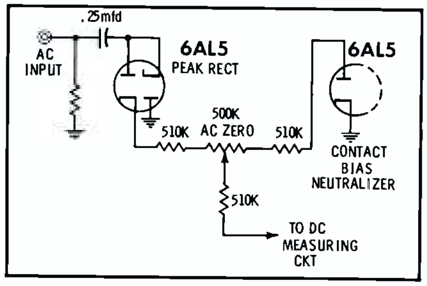

Fig. 7. Circuit for measuring the AC voltage and for neutralizing the contact potential.

the meter to read less in inverse proportion to the size of the unknown resistor. Zero ohms is at the left hand side of the meter scale.

For use where necessary, such as for aligning FM detectors, a zero-center position is available in the +DC position of the function switch by simply rotating the electrical ZERO knob until the meter pointer is at center scale. In this mode, a negative voltage applied will cause the meter pointer to swing left and a positive voltage will swing the pointer to the right.

We put the 805 *Tele-Volter* through its paces in both radio and TV servicing. The meter scales are uncluttered so there is little problem in interpreting what you read. Just two sets of numbers for the DC and AC scales provide a wide selection of ranges—1, 5, 10, 100, 500, and 1000 volts. This array of full-scale ranges is ample for anything from transistor radio servicing to color TV. In addition, an accessory high-voltage probe (Type 85HV) is available for measuring voltages to 30 kv.

The frequency range on AC extends relatively flat from 20 cps to 3 mc at 600 ohms impedance; ample for making exacting tests on audio and most video equipment. We checked the meter for accuracy on both the voltage and ohms scales and found it well within its published ratings of 3% full scale on DC, 5% on AC, and 3% on ohms—more than enough for the most discriminating service work in radio or TV. ▲

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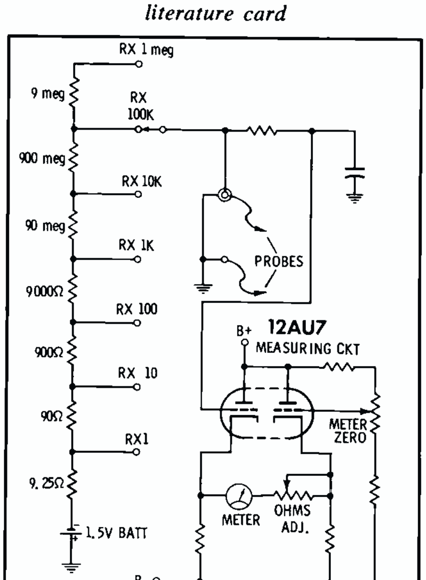

Fig. 8. Basic ohmmeter circuit uses a tapped voltage divider and single internal battery.

TARZIAN RADIO-TV TIPS

How to calculate required resistance in silicon-for-selenium rectifier replacement

■ Will silicon rectifiers used as replacements for selenium rectifiers fail in predominantly capacitative circuits? Not if you pay strict attention to the peak current limits of the replacement units, as specified by the manufacturer.

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Failure is caused by excessive inrush currents during the first few cycles after turn-on. Silicon rectifiers have extremely low impedence in the conduction region at voltages above 1.5 volts. In addition, the capacitor "looks" like a short circuit until it is charged. This combination allows extremely high currents to flow from low impedence sources such as household mains. Being small, the rectifier has so little thermal mass that failure is instantaneous.

Watch your resistance

Sarkes Tarzian F Series rectifiers are widely used in replacement applications. They carry a surge current rating of 30 amperes. With a 120 volt line, the maximum instantaneous voltage that can be impressed is 1.4 times 120, or 168 volts. You should add to the circuit a minimum surge limiting resistance of $\frac{168}{30}$, or 5.6 ohms. This will apply to doubler or half wave circuits.

For practical purposes, we can ignore the impedence of an F unit with 168 volts impressed during the conduction cycle.

Transformer sets require no additional resistance. Enough impedence is inherent in the secondary to provide limiting action. Figures 1, 2, and 3 show typical circuits and recommendations. Out best advice to you: *depend on Tarzian silicon rectifiers for dependable performance.*

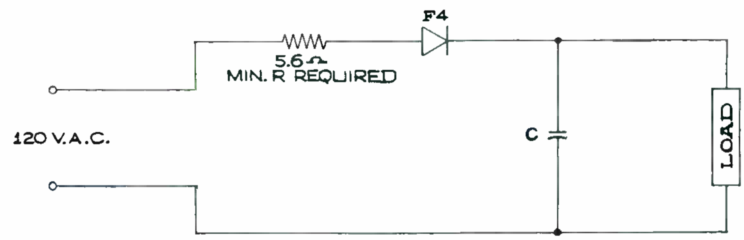


Fig. 1 Rectifier replacement—no transformer

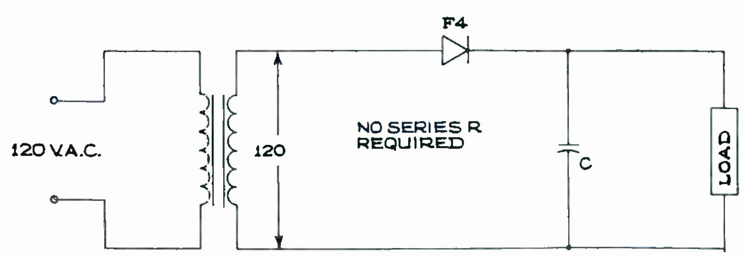


Fig. 2 Rectifier replacement—with transformer

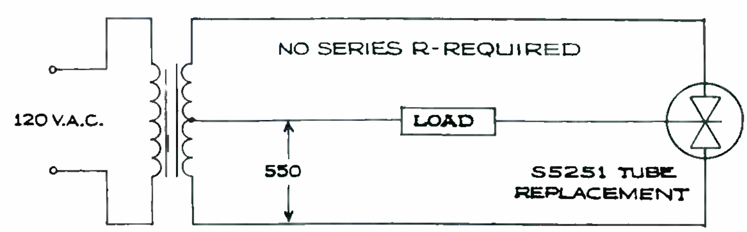
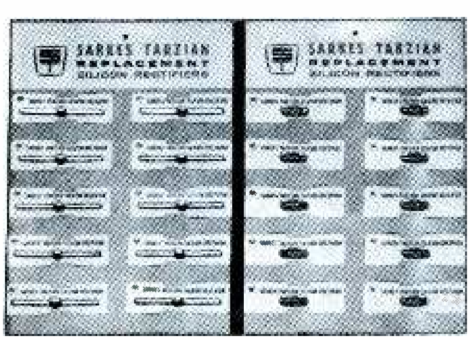


Fig. 3 Tube replacement



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STOCK GUIDE FOR TV TUBES . . .

This list omits more than 100 of the rarest TV tube types, which many shops find impractical to stock. To simplify the chart as much as possible, common radio and hi-fi tube types used in TV combinations are omitted; so are the majority of tubes used only in color sets. The Color-Caddy Guide, in the November 1963 issue, lists a tube stock especially for color technicians.

New tube types introduced this year are listed in the separate chart; to help you decide whether to stock these tubes, each listing specifies receivers using that particular type. If you're specializing in one or two brands, you'll pick new tubes listed for those sets, and stock your shelves and caddy accordingly.

In the main chart, the figures on white background suggest a caddy stock of approximately 300 tubes which should account for close to 90% of your replacement needs. As with the rare-tube listings, you may want to carry more of a particular type if it is used in receivers you service often. We've removed some of the older types, such as 6V6, 6W4, and 6BZ7, and replaced them with more current types; also included are some that appeared in last year's *new-tube* list—if they were used in sets again this year. Most-used UHF tubes are also included.

The figures on gray background are a suggested backup (shelf) stock, if you're located near a parts distributor. If you can replenish your tube supply only once a week, you may wish to stock extra of the more common types. Your volume of business will naturally determine your actual shelf stock, too. Keep in mind three main factors that will influence the demand for various tubes:

1. Relatively high failure rate of power-output and similar tubes.
2. Your specialization in certain makes of sets.
3. Average age of sets containing a particular tube type.

Temporary substitution of available types for rare types, as outlined in the Howard W. Sams book, *Tube Substitution Handbook, Vol. 7,* can also help you reduce stock requirements.

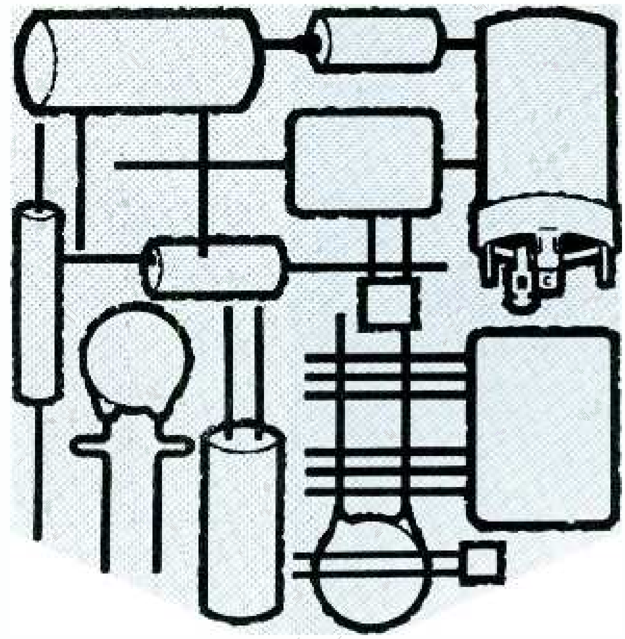
Another way to ease tube-stock headaches is to use only the latest -A or -B versions of various tubes. Types in common use are listed in the chart.

PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE
8	3	1B3GT	2	2	4BZ6	2	1	6AM8A	5	3	6CG7
2	1	1G3GT	1	1	4CB6	3	3	6AQ5A	5	2	6CG8A
2	1	1J3	1	1	4CS6	1	1	6AR11	1	1	6CL8A
3	1	1K3	1	1	4DT6	1	1	6AS5	2	2	6CM7
1	1	1S2A	1	1	4EH7	1	1	6AS8	1	1	6CQ8
2	2	1X2B	1	1	4EJ7	2	2	6AU4GTA	2	1	6CS6
1	1	2AF4	1	1	4GK5	3	2	6AU6A	2	1	6CU5
1	1	2AH2	1	1	4GM6	1	1	6AU8A	1	1	6CW4
1	1	2CW4	1	1	4GZ5	2	2	6AV6	2	1	6CW5
1	1	2CY5	1	1	4HM6	3	3	6AW8A	1	1	6CX8
1	1	2DS4	1	1	4HS8	1	1	6AX3	1	1	6CY5
1	1	2DZ4	1	1	4HT6	3	3	6AX4GTB	1	1	6DA4
1	1	2FH5	1	1	5AM8	2	2	6AY3	2	2	6DE4
1	1	2FS5	2	2	5AQ5	1	1	6B10	2	1	6DE6
2	1	2GK5	1	1	5AT8	3	1	6BA6	2	1	6DE7
1	1	2GW5	1	1	5AU4	1	1	6BC8	2	2	6DK6
1	1	3A3	1	1	5BR8	2	1	6BE6	1	1	6DN7
1	1	3AF4	3	2	5CG8	1	1	6BG6GA	5	3	6DQ6B
1	1	3AL5	1	1	5CL8A	1	1	6BH8	1	1	6DR7
2	1	3AU6	1	1	5EA8	1	1	6BJ8	2	2	6DS4
1	1	3AW3	1	1	5EW6	1	1	6BK7B	2	2	6DT6
2	1	3BN6	2	1	5FG7	2	2	6BL7GT	3	2	6EA8
1	2	3BU8	1	1	5GH8	2	2	6BL8	2	1	6EB8
5	2	3BZ6	1	1	5GM6	1	1	6BN4	3	3	6EH7
2	2	3CB6	8	3	5U4GB	3	2	6BN6	3	2	6EJ7
1	1	3CS6	2	2	5U8	1	1	6BN8	1	1	6EM5
1	1	3CY5	1	1	5V3	3	2	6BQ5	2	2	6EM7
2	1	3DG4	1	1	6AC7	5	3	6BQ6GTB	1	1	6ER5
2	2	3DK6	1	1	6AF3	3	2	6BQ7A	2	1	6ES8
1	2	3DT6	2	1	6AF4B	1	1	6BR8A	1	1	6ET7
1	2	3EH7	1	1	6AF11	3	2	6BU8	2	2	6EW6
1	2	3EJ7	1	1	6AG5	1	1	6BX7GT	2	2	6EW7
1	1	3FS5	1	1	6AG7	1	1	6BY6	1	1	6FD7
2	2	3GK5	1	1	6AH6	1	1	6BY8	2	1	6FG7
1	1	4AU6	1	1	6AK5	8	3	6BZ6	1	1	6FH5
1	1	4BL8	1	1	6AL3	1	1	6C4	2	1	6FM7
1	1	4BQ7A	2	2	6AL5	3	3	6CB6	5	3	6FQ7
1	1	4BU8	1	1	6AL11	1	1	6CD6GA	1	1	6FS5

PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE
1	1	6FV8	1	1	8EB8
1	1	6FY5	1	1	8EM5
1	1	6FY7	1	1	8ET7
2	2	6GE5	2	1	8FQ7
3	2	6GH8	1	1	8GN8
3	2	6GK5	1	1	9AU7
1	1	6GK6	2	1	10DE7
3	2	6GM6	1	1	10EG7
2	1	6GN8	1	1	10EM7
1	1	6GT5	1	1	10HF8
1	1	6GU5	1	1	11JE8
1	1	6GW6	2	1	12AF3
2	1	6GX6	1	1	12AT7
1	1	6GY6	1	2	12AU7
1	1	6HA5	1	1	12AV5GA
1	1	6HA6	3	2	12AX4GTB
1	1	6HF8	2	2	12AX7
1	1	6HG8	2	1	12B4A
1	1	6HF8	2	2	12BH7A
2	1	6HS8	2	1	12BQ6GTB
2	2	6J6	2	1	12BY7A
1	1	6JC8	3	1	12C/-CU5
1	1	6JE8	2	1	12CA5
1	1	6JT8	1	1	12DB5
1	1	6K6GT	3	2	12DQ6B
1	1	6KA8	1	1	12DT5
1	1	6KD8	1	1	12SN7GTA
1	1	6Q11(6K11)	1	1	12W6GT
1	1	6S4A	1	1	13DE7
1	1	6SL7GT	1	1	13DR7
2	3	6SN7GTB	2	1	13EM7
1	1	6T8	1	1	17AX4GT
1	2	6U8A	1	1	17DE4
2	2	6X8A	2	1	17DQ6B
1	1	7AU7	1	1	19AU4GTA
2	1	8AW8A	1	1	22DE4
2	1	8BQ5	1	1	25AX4GT
1	1	8CG7	1	1	25BQ6GTB
1	1	8CX8	1	1	25CD6GB

NEW TUBE TYPES INTRODUCED IN '64 TV

1AD2	General Electric
1N2	Silvertone
2DZ4	Admiral
	Motorola
2GU5	Admiral
3AJ8	Clairtone
3GS8	Silvertone
4JC6	RCA
4JD6	RCA
5BC3	Zenith
	Muntz
5FG7	Admiral
5HG8	Motorola
5KE8	RCA
6BD11	General Electric
6BE3	General Electric
6BF11	General Electric
6BJ3	General Electric
6DM4	Zenith
6DX8	Zenith
6GJ7	Motorola
	Zenith
6GU5	Admiral
6HA5	Curtis Mathes
	Zenith
6HB5	General Electric
6HD5	Motorola
6HK5	Admiral
6HZ6	RCA
6HZ8	Philco
6JB6	RCA
6JN8	General Electric
6JZ8	General Electric
6JV8	Admiral
6RK19	Curtis Mathes
8B8	Clairtone
8CW5	Emerson
8DX8	Clairtone
8GJ7	Motorola
8KA8	RCA
9GV8	Admiral
10AL11	Admiral
10DX8	Zenith
10EW7	Silvertone
10JY8	Philco
11KV8	RCA
12AY3	Bradford
	Truetone
12BE3	Admiral
12GT5	Airline
	Bradford
	Truetone
13CM5	Clairtone
13FD7	Philco
13GF7	RCA
13J10	Zenith
16AQ3	Clairtone
16GK6	Motorola
17DM4	Airline
17BE3	Philco
17GV5	Zenith
17JB6	RCA
21HJ5	Truetone



FM Tuning Eyes

(Continued from page 33)

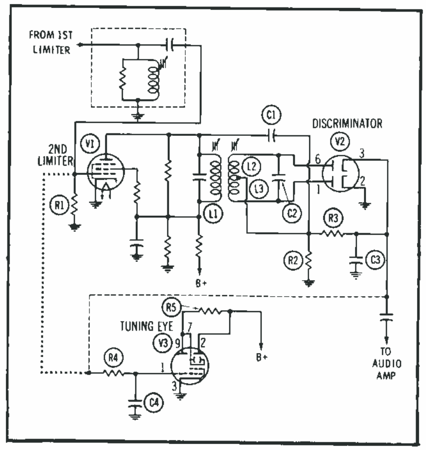


Fig. 7. Two ways of actuating tuning-eye tube.

mally. To determine if a fault is in the eye-tube circuit or in the AVC system, disconnect the control voltage and use a variable bias box connected to the triode grid to ascertain correct eye operation. If changing the control voltage from the bias box doesn't affect operation properly, check the eye tube and its associated components.

Slight audio on the grid of the control tube can cause eye fluctuations. The ratio detector is designed with a large capacitor across its output to prevent audio fluctuations. The discriminator, however, is not equipped with this large capacitance Therefore it is necessary to decouple the audio voltages before they enter the control tube. These decoupling components are suspects if flickering is a problem.

Tuning Eyes Are Useful

In all types of tuning-eye circuits, you can use the eye in place of a VTVM while performing alignment. As the signal level increases, the eye closes. When the signal decreases, the eye opens. Consequently, not only does a tuning-eye tube aid in accurately tuning in FM stations, but it also provides a built-in signal-strength meter for antenna orientation or alignment. ▲

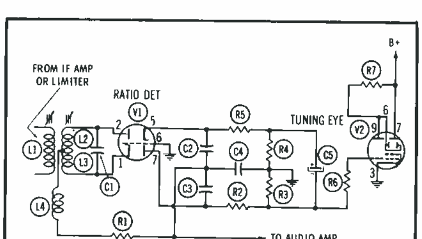
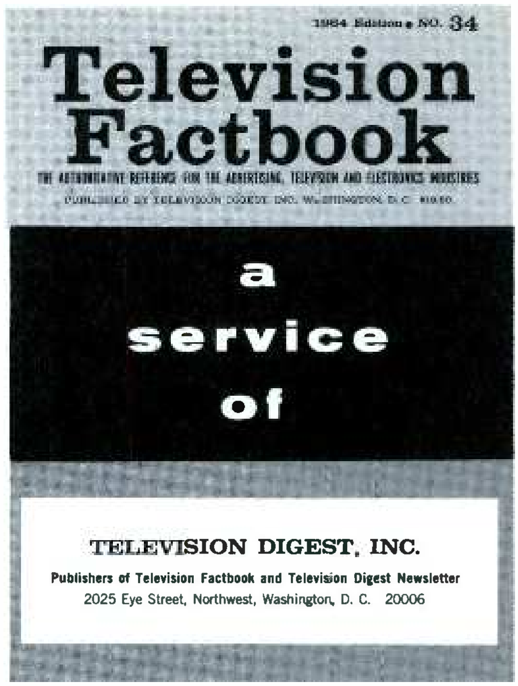


Fig. 8. Eye tube operated from ratio detector.



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Circle 52 on literature card

Poor Boost

(Continued from page 37)

had been a rather routine job.

The technician decided to concentrate on the horizontal AFC section. The first step after replacing the 6AL5 was to connect a zero-center VTVM from ground to the junction of R77 and R78. This junction is the source of the DC control voltage that keeps the horizontal oscillator in sync. When the picture is in sync, this voltage should be nearly zero. It varies 1 or 2 volts on either side of center when the horizontal-hold control is operated. In this case the voltage didn't vary; it remained about −15 volts for any setting of the hold control. It was clear that the AFC wasn't working.

Resistors R77 and R78 were checked and found to have the proper resistance. The same was true of R79. Next the sync input waveforms were checked with the scope at C77 and C78 in the sync phase-inverter stage. These traces were both normal, so the sync stage and the coupling capacitors were eliminated as suspects. This narrowed the search down to the reference line coming into the AFC at pins 1 and 2 of the 6AL5.

When a scope check was made at R79, it revealed that the reference sawtooth was missing. This signal is taken from the width coil through the phase-shifting and waveshaping network composed of C60, R41, and the C29 we'd just replaced. Thinking he had the problem solved, the technician anxiously moved the scope probe to the other terminal of C60, but there was no trace. At the junction of R41 and C29 there was still no sign of the sawtooth. Could C29 be shorted again? The DC voltage at the junction of C29 and R41 was checked; it was zero. Immediately the voltmeter probe was moved to terminal 2 of the flyback transformer, and there was the full

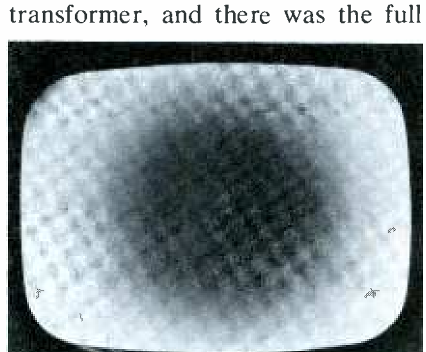


Fig. 7. Severe blooming preceded raster loss.

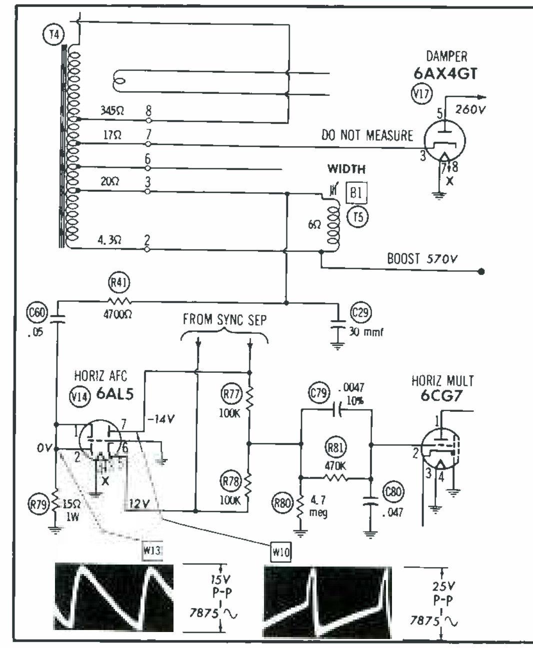


Fig. 8. Replacing component caused new fault.

570 volts. The meter was moved to terminal 3; the boost was there also. Why was the voltage missing at the junction of C29 and R41?

With the width coil connected, the resistance between terminals 2 and 3 was slightly less than 2.5 ohms (about right for the two coils in parallel). Therefore the width coil was not suspected. But after a great amount of time was spent rechecking, the width coil was finally removed for closer inspection. Fig. 9 illustrates what we found. At one end of the coil there are three solder terminals, one of which is a dummy not connected to any part of the winding. This extra terminal served a tie point for mounting C29 and R41, and a jumper was originally soldered between this tie point and one of the *true* coil terminals. When C29 was replaced, the jumper was inadvertently removed, thus disconnecting the AFC reference line from the coil.

Check the Boost

The three-dimensional effect

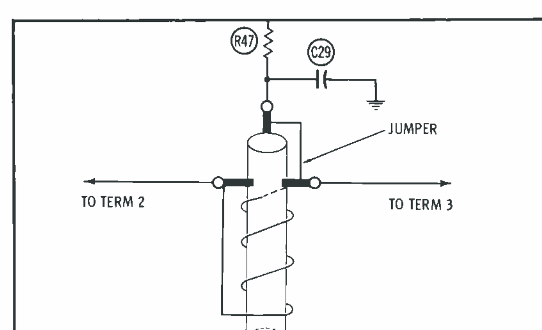


Fig. 9. The jumper was removed inadvertently.

shown in Fig. 10 was the result of a width-coil defect in a circuit in which both the vertical and horizontal oscillators were supplied from boost. The repairman lost a lot of good time and profit checking B+ filters and replacing the yoke. The receiver also used keyed AGC, and the pulses for the plate of the keyer were taken from the flyback. When he found a strange-looking waveform at the plate of the keyer, the technician wasted some more time checking out the entire AGC system.

It was finally discovered that arcing in the width coil was setting the entire flyback system into oscillation; the boost voltage contained a high percentage of this crazy ripple and conducted it to many other circuits. Thus you see that poor boost can be the cause of many symptoms, ranging from AGC and sync trouble to vertical-deflection problems and even blooming and loss of focus. Whenever your study of the schematic reveals the slightest possibility that the boost may be a source of the trouble, this possibility should be followed up. It's easy to make a quick check on the boost in the following manner:

1. Replace the horizontal output and damper tubes.
2. Measure boost voltage on the side of the boost capacitor farthest from B+.
3. If the boost voltage is normal at its source, use a voltmeter to trace the voltage across each of the components between the boost and the circuit which is not functioning properly.
4. If the boost voltage is low, check the resistance of each section of transformer winding and the deflection yoke.
5. If the resistances are normal, the cause of low boost voltage may be any of the capacitors in the system. ▲

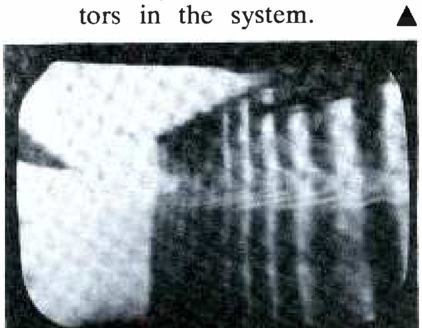


Fig. 10. Three-dimensional effect was caused by faulty width coil that affected boost line.

Tape Heads

(Continued from page 31)

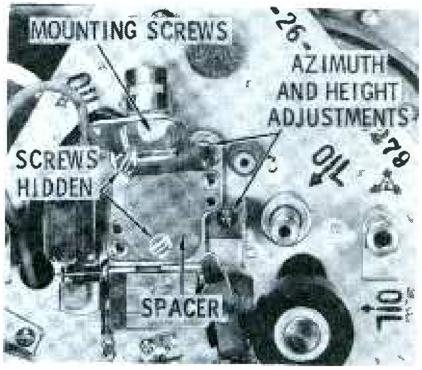


Fig. 7. Two typical bottom-mounted tape heads.

and erase voltage of the recorder. If possible, determine the proper erase current in the head circuit. Select a replacement head that properly matches this frequency and voltage. Connect the head in the circuit and insert the 100-ohm 1-watt resistor in series with the head. Measure the voltage across the resistor and compare the calculated current with that specified by the head manufacturer. In most cases the current will be fairly close; if it isn't, increase or decrease the current slightly by placing a resonating capacitor or dropping resistor in series with the head.

Mounting

As important as impedance matching is the proper mechanical positioning of the heads. Record/playback heads are available in a variety of mounting arrangements to replace most of the heads used in recorders today.

The essential part of the mounting procedure is the assurance that the gap of the head is in proper vertical position to line up with the tape. Before removing the defective head from the assembly study its position, sketch the mounting, and measure the distance from the top

Fig. 8. Example of rear-mounted playback head.

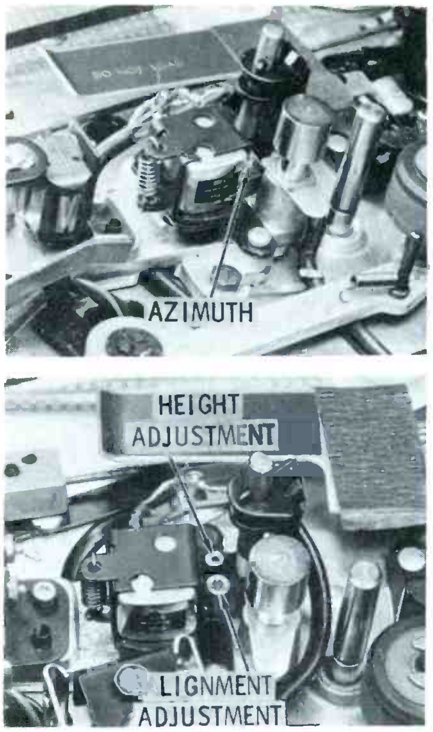


Fig. 9. A "no-mount" R/P head in its bracket.

edge of the gap to the top plate of the recorder. Use this information in mounting the new head.

Side Mount

Many heads found in recorders today are of the side-mount type. Machine screws are inserted horizontally through the heads and fastened to an "L" bracket (Figs. 5 and 6). The vertical, or height, adjustment is accomplished by sliding the head up or down in the slotted screwholes of the bracket. Position the head as well as you can by eye at this point.

Bottom Mount

Heads mounted from the bottom (Fig. 7) by means of screws or a threaded bushing are usually positioned vertically by spacers or shims between the top surface of the deck and the bottom of the head case. Since a replacement head may not be the same size as the original, the removal or addition of shims may be necessary.

Rear Mount

Some heads are mounted from the rear by means of a threaded bushing that is an integral part of the head case (Fig. 8). This bushing can be moved up and down since the hole in the bracket is slotted. In some cases it may be necessary to insert several spacers on the bushing to position the head face closer to the tape.

Circle 56 on literature card

Friction Mount

Friction mount, or "no-mount," heads do not employ screws directly in the head casing. Rather, they are inserted into a U-shaped bracket and held in place by friction and spring action (Fig. 9). The adjustments are performed on the bracket. In this case if the head fits, you are in great shape; if the head doesn't fit, it's the wrong head.

Adjustment and Maintenance

The two main adjustments for tape heads are vertical alignment and azimuth—the angular position of the gap with respect to the tape. Once the proper head is selected and installed, final positioning adjustments can be made with the use of a standard alignment tape and an audio voltmeter or VTVM.

Alignment

Thread a tape on the machine and check to see that the tape will track in the center of the head face. Adjust the vertical position of the head to the proper height by means of screws or spacers.

Parallel position—Look at the record/playback head from the side and sight along the face to the capstan and the tape. Adjust the head by resetting the mounting screws, varying the adjustment screws, or slightly altering the shape of the mounting bracket. When you are certain the record and play heads are parallel to each other and to the capstan, do the same with the erase head. The heads should now be perpendicular to the top surface of the deck and parallel to each other and the tape.

Azimuth—Thread a standard alignment tape on the machine. Connect an audio voltmeter or VTVM to the output jack and turn the volume control to maximum. Start the tape in play and adjust the head azimuth (angle between the gap and a line perpendicular to the direction of tape motion) for maximum reading on the meter. You may note several minor peaks on either side of the true peak. When the output is maximum, the head gap will be perpendicular to the direction of the tape motion.

If the machine has separate record and playback heads, you can align the record head by using the output of the already-aligned playback head in the following manner. With a recorder that has separate record and playback *amplifiers* the job is somewhat simplified. Connect your VTVM to the output of the playback amplifier, and place a .01-mfd capacitor across the terminals of the meter to eliminate from the reading whatever bias signal is picked up by the playback head. If the machine uses the same amplifier for both record and playback (as will most often be the case), connect the playback head to an external preamplifier with a low-level, high-gain input; connect the meter to the amplifier output.

Now thread a blank tape on the recorder and connect to the input an audio oscillator set at 10 kc. With the machine in the record function, set the generator for an output of about .1 volt on the VTVM. Adjust the record head azimuth for maximum reading on the output meter. Various azimuth adjustments are shown in Figs. 5 through 9.

Inspection and Cleaning

Indications of head wear and use occur in various ways. The most common sign of use is a deposit of oxide and tape lubricant on the face of the head. (Most tape manufacturers apply a lubricant to the tape to help it pass the heads, guides, and capstan.)

Cleaning

The residue can be removed from the heads with a suitable solvent such as those specially available for the purpose. Denatured alcohol can be used on some heads, while a solution of xylene and .1% *Aerosal* is recommended for others. The best rule is to follow the head manufacturer's directions. The cleaner should be applied with a cotton swab—never use any abrasive instrument or material, since the head will become damaged from even slight scratches on the face.

Inspection

When the heads are clean, inspect them for wear. A slight grooving of the face, with a widening of the gap uniformly over its entire length, indicates normal wear and proper head position. If you notice the gap has worn more at the top or bottom of the face, the head may be out of adjustment. It is then necessary to check the parallel position as described earlier. Uneven wearing of the gap can also be caused by pressure pads exerting uneven force on the head face. Check the pressure-pad assembly to be sure the pads are parallel to the face of the head.

There are now on the market heads which are designed with a face contour that follows the curve of an hyperbola. The resulting "sharpening" of the gap area improves tape-to-head contact, making pressure pads unnecessary and increasing head life.

As the head wears, and the gap widens, it becomes increasingly difficult to record high frequencies. On playback, high-frequency response seems to improve slightly at first; then, as the gap widens, the highs are lost. When normal operation cannot be restored by adjustments of the heads or bias, and the heads show definite signs of wear, it is time for replacement.

Demagnetizing

Recording and playback heads gradually build up residual magnetism from constant exposure to magnetic fields during operation. When the heads do become magnetized, you will notice an increase in noise, distortion, and a loss of high frequencies due to partial erasure. It is necessary then to demagnetize the heads; inexpensive devices are available for this purpose. Erase heads do not require this treatment.

To demagnetize the heads, remove the head cover and turn the machine off. It the tips of your demagnetizer are bare, cover them with smooth tape. Turn the demagnetizer on and bring the tips into contact with the record-head face, straddling the gap. Move the tips up and down several times the full length of the face, and then *very slowly* remove the demagnetizer. The slow removal is necessary to correct demagnetization. Now repeat the operation on the playback head.

The heads should now be properly aligned, clean, and in condition to make a good recording in a properly operating machine. While replacement is not under normal circumstances a very frequent necessity, the procedures of cleaning, inspection, adjustment, and demagnetizing should be followed fairly often. Use these hints, and offer this service—and keep your customers' tape rolling! ▲

Product Report

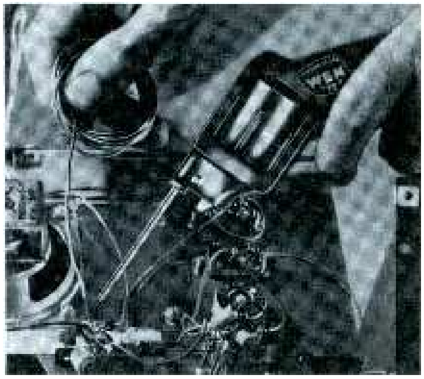
For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Unitary Speakers (70)

Seven completely new 8" and 12" high-fidelity loudspeakers from **Jensen Mfg. Co.** combine recent advances in acoustic design with added performance and convenience features. Ranging in price from $16.50 to $69.50, the new "Sigma" series speakers offer die-cast alloy housings for permanent alignment of all critical parts, high-energy Syntox-6® magnets, carefully formulated cones for excellent coupling to air, Flexair® cloth cone suspensions, low-crossover (2000-cps) tweeters, and remote high-frequency control.

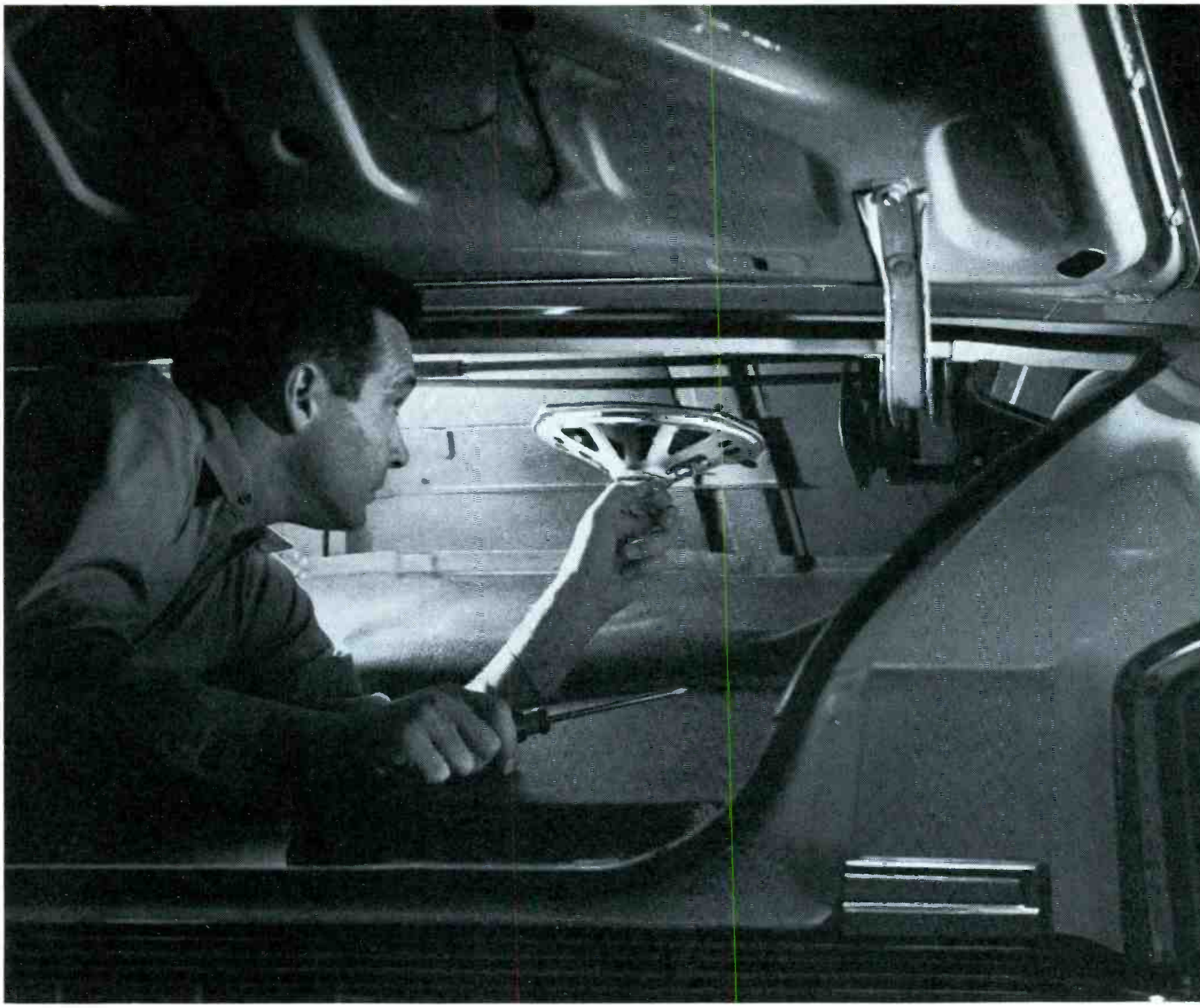
Coaxial-Cable Counter Display (71)

A compact counter display that takes up only 2½ square feet of space and yet provides a complete selection of coaxial cable especially for communications, is available from **Columbia Wire and Supply Co.** This colorful, attractive display is stocked with 12 rolls each of RG58A/U 50-ohm and RG8/U 52-ohm cable, and 8 rolls of RG59/U 73-ohm cable—in 25', 50', and 75' lengths.

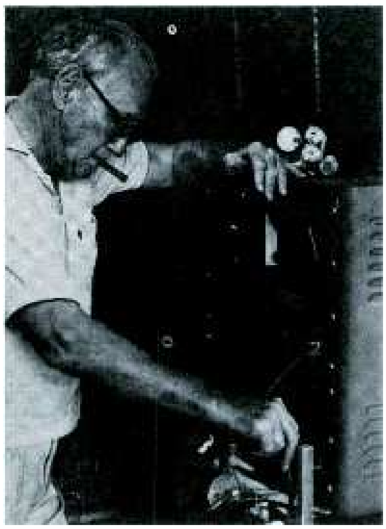


Soldering Pistol (72)

A new tool that provides unusually efficient electrical heat is the **Wen** soldering pistol. It will produce as much effective heat as a 100-watt iron from a normal rating of only 30 watts. All the heat is concentrated at the pistol's tip; no current is wasted, and yet the tip will not overheat. Compact in size and shaped like a pistol, the Wen Model 75 is 9" long, including the 3" tapered tip, 4½" high, and weighs only 1 lb. Housed in shock-resistant molded red plastic, the pistol is priced at $4.95.



THE GRAND OLD MAN OF ELECTRONICS PREDICTS...



by Hal Bergida

Ever make a service call to repair an electronic piano? Or have a customer complain that his laser system needed adjusting because his private communications system wasn't operating, or wasn't bouncing off the moon right?

Calls like these will soon become part of the everyday routine of servicemen — according to Benjamin Franklin Miessner. The winner of the 1963 DeForest Audion award from the Veteran Wireless Operators Association sees many new and amazing things in the future for servicemen.

He predicts that the old-fashioned piano tuner, once a community necessity, will turn over his duties to radio and TV technicians as Miessner's new electronic pianos replace the present instruments.

Laser beams and improved transistor circuitry will make it possible for almost anyone to own his own private communications system, capable of reaching distant planets.

Servicemen will find their services demanded more and more as laymen acquire new and more complex electronic devices for their daily living — Miessner points out.

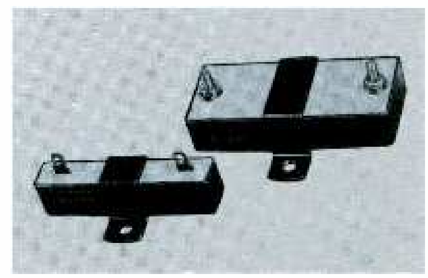
Another encouraging point he made, in an interview at his home in Miami Shores, Fla., was that today's servicemen won't have too much trouble with the new devices he sees on the horizon. He says, "TV circuits are about as complicated as I think any of the new devices will be, and today's good technicians will be able to handle them."

Although technically retired, the "grand old man" of electronics works about 12 hours a day at experiments. He is presently trying to improve his electronic piano that is marketed by Wurlitzer Co., who bought the basic patents. He has been selling such patents to manufacturers since his first invention in 1910—the "cat's whisker" detector for early crystal sets. Among his 200-odd patents are those for perfecting superheterodyne radio circuits, a photoelectric exposure meter, the automatic orientation device known as the "Electric Dog," self-aligning telescopes, anti-aircraft searchlights, and many others.

Despite all the past has meant to him, Miessner continues to look ahead in electronics and predicts, "Today's servicemen will soon be handling equipment that they now cannot even dream of." ▲

Two-Way Radio (73)

An industrial radiotelephone which contains many features not usually found in a two-way radio is being marketed by **General Radiotelephone Co.** The Model VS-2 boasts such innovations as electronic switching to eliminate relay problems, and a transistorized power supply with automatic short-circuit protection. The set will operate from either 115 volts AC or 12 volts DC. Priced at $139.95, the VS-2 comes with microphone, and is equipped with crystal for one channel.



Steel-Cased Resistors (74)

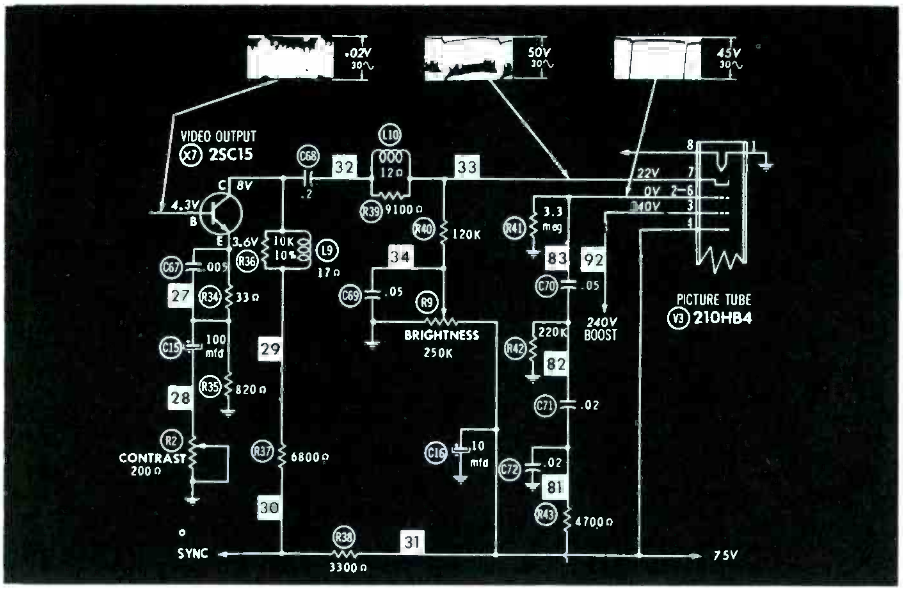
A heavy-duty, heat-sink-type resistor is now available with the resistance winding imbedded in a high-grade potting compound inside a steel casing with "L"-bracket mounting. Originally developed by **Milwaukee Resistor Co.** as a ballast resistor for transistorized ignition circuits, it can be used in other applications —especially where severe duty is required. Quick-connect terminals, standard tabs, or studs can be furnished. Sizes are 25 watts and up.

Alignment Generator (75)

This miniature battery-operated oscillator, which is factory adjusted to ±.002% accuracy and can be used for alignment of communications IF circuits and discriminators, is a product of **Texas Crystals.** The TC-3 can be used as a secondary frequency standard and as a marker generator, or as a signal source for broadcast- or marine-band alignment. Complete with battery, this 200-kc to 3-mc oscillator includes a choice of three standard-frequency crystals, and is priced at $29.95.

Coming in the June

SPECIAL TRANSISTOR ISSUE



Solid-State TV Circuits from A to Z

. . . explains modern circuits and their operation.

Techniques of Distortion-Chasing

. . . gives quick and sure methods for locating defects.

Me? Do Transistor Servicing?

. . . tips on getting into the business.

Guide to Importers

. . . a comprehensive and current list of foreign-made transistor radios and tape recorders, including brand names, suppliers, and addresses.

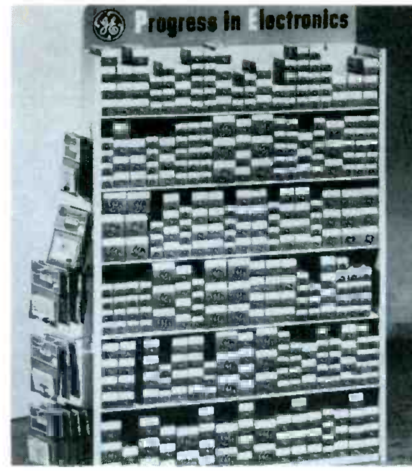
PLUS:

Testing Transistors—The Modern Way

Symfact coverage of transistor AGC circuit

Notes on Test Equipment

. . . *and others*



Tube Shelf (76)

A new tube-and-parts cabinet for radio and television service dealers and technicians is available through authorized distributors of **General Electric** receiving tubes and semiconductors. With six shelves, each 6½" deep, this cabinet (ETR-3803) measures 25" x 40", and can easily be wall-mounted using slotted holes in the back. An extra feature is the pegboard hanger holes on the sides which facilitate merchandising card-packaged semiconductors or other parts. The cabinet will hold more than 650 receiving tubes. Assembly is easy; parts snap into place without the use of nuts and bolts.

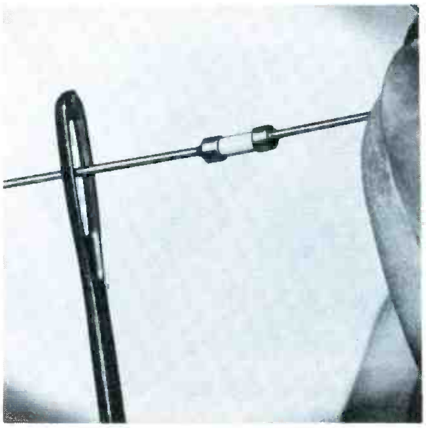
All-Cartridge Stereo Head (77)

A quarter-track stereo record/play head that will accept all cartridges now on the market is new from **Michigan Magnetics, Inc.** The head, which has a rear stud mount, has an impedance rate ranging from a high of 500 mhy to a low of 90 mhy. Available with metal or bakelite face, the O9P17 is offered with or without mounting hardware.

Single-Sideband CB Unit (78)

Two simultaneous conversations on the same channel by two separate stations without mutual interference are possible if both stations are equipped with the

Mark Products SSB-27 "Sidewinder" transceiver. This feat is made possible by utilizing the upper sideband as one channel and the lower sideband as another. In this manner, 46 channels are possible within the present 23 Citizens-band channels. A thermostatically controlled oven maintains constant crystal temperature. A four-section crystal-lattice filter rejects adjacent-channel interference and increases signal-to-noise ratio. The Mark SSB-27 is supplied with one crystal for operation on the upper and lower sidebands of channel 3. It operates on 11-15 volts DC, measures 5¼" x 12" x 11", and is priced at $229.50.



Picofuse (79)

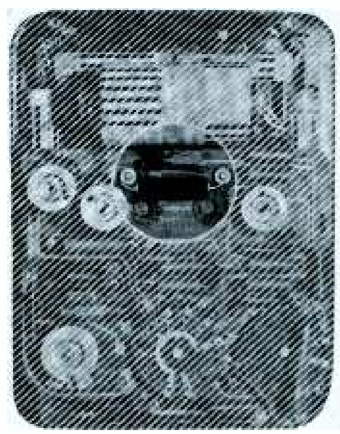
Tiny fuses only .078" in diameter and 7/32" long, and having ratings up to 5 amps with an interrupting capacity of 300 amps at 130 volts DC, are available from **Littelfuse, Inc.** Five of the new cartridge-shaped fuses weigh only one gram. The fuses are available with 2 styles of leads—axial and radial—or they can fit into diode-type mountings.

The Big Sound (80)

An 18" woofer with response down to 16 cps has been developed by **Hartley Products Co.** The 218MS speaker, featuring a mammoth 14 lb. magnet, a cast aluminum frame, and a patented tripolymer plastic cone, utilizes the Hartley magnetic suspension principle. Magnetic restoration employs a positive force for eliminating speaker hangover, resulting in improved transient response and lowered distortion. The speaker sells through hi-fi dealers at $195.00.

Let's Communicate (81)

The "Courier 1M" CB transceiver by **Electronics Communications Inc.** features a triple-conversion receiver with a sensitivity of better than .25 uv and a selectivity of 4000 cps at 6-db points. The receiver has an RF gain control and an AVC circuit which controls both the IF and RF stages. The transmitter, which is limited to a power input of 5 watts, is capable of delivering more than 3 watts output into any 50- or 75-ohm unbalanced load. Using a high-impedance microphone input, the unit features high-level plate modulation and a frequency stability of ±.005%. A relative-power output meter, an "S" meter, and a frequency-spotter circuit are standard equipment. The unit operates from 110 volts AC or 12 volts DC.



Meter Protection (82)

A novel device called "Metergard," used to prevent meter-movement burnout by overloads of up to 10,000%, is built by **Lectrotech, Inc.** "Metergard" offsets both the high cost of repairing burned-out meter movements and the inconvenience of doing without the meter. The "Metergard" is not a fuse, has no moving parts, and will cause less than ¼% change in movement accuracy. Installation is extremely simple: merely connect it across the movement terminals.

Combination Microphone-Headset (83)

A dynamic headset-microphone combination featuring a frequency response of 30-20,000 cps is a new product of **Telex, Inc.** This headset, of stainless steel construction, is rust-proof, tamper-proof, and serviceable. Foam rubber or vinyl-polyurethane foam cushions of deep-cavity design provide an acoustic seal, and are removable for washing. The headset can be worn in comfort over glasses without destroying the acoustic seal between ear cup and head. Complete

with cord, the entire unit weighs only 15 oz. and has a yoke which provides 180° cup rotation for perfect fit with single-ear monitoring.

Rotator-Booster (84)

The "Gemini," an antenna rotator mounted with a TV-signal booster, is a new innovation of **Channel Master Corp.** Both units are housed in a corrosion-proof case that mounts on the antenna mast, and are protected against moisture.

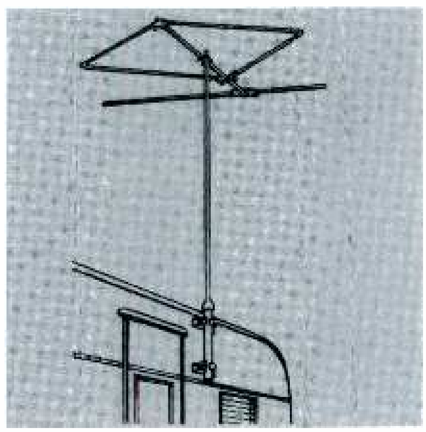
A built-in coupler in the control unit allows as many as four sets to be played simultaneously.

Work Magnifier (85)

A magnifying glass that produces excellent magnification over 48 square inches, is a new product of **Ednalite Research Corp.** Mounted on rotating pivots for individual or group viewing, this 6" x 8" glass yields a flat field with enough depth of focus that hands, tools, and chassis are all visible without distortion.

Lightweight Speakers (86)

A new series of speakers using barium ferrite magnets is being introduced by **Utah Electronics.** Altogether, there are nine models with magnet weights ranging from 3 to 10 oz; for the best possible bond, the magnetic assemblies are joined with RF-cured epoxy.



Traveling Antenna (87)

A TV antenna kit designed for quick mounting and dismounting on mobile homes is a new product of **Clear Beam Antenna Corp.** Designated the Model JR150, the antenna supplied with the kit is capable of both UHF and VHF reception. ▲

"You sure this is the right address?"

INDEX TO ADVERTISERS

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

88. *ALLIANCE*—Brochure describing *Tenna-Rotor* Model C-225.
89. *ALL CHANNEL PRODUCTS*—New catalog showing complete line of *Rembrandt* indoor antennas for VHF-UHF TV and FM stereo.
90. *ANTENNACRAFT*—Catalog sheet, illustrated in color, with information on connecting a UHF and a VHF antenna together using intercoupler G1483W.
91. *CHANNEL MASTER* — Brochure sheet describing gold medal *FM Rondo* antenna for stereo reception.
92. *CORNELL-DUBILIER*—Copy of informative booklet titled "Improved TV and FM reception." Bulletin describing line of antenna rotor systems.*
93. *FINNEY*—Brochures showing newly introduced line of amateur beam antennas for 1¼-, 2-, and 6-meter bands; includes information on combination unit for 2 and 6 meters.*
94. *JFD*—Specifications and operating information on *Transis-tenna* and newly designed, long-range LPV log-periodic TV antennas. Illustrated brochure showing entire line of indoor antennas and accessories for TV and FM. Data sheets on UHF antennas.*
95. *MOSLEY ELECTRONICS* — Illustrated catalog giving specifications and features on large line of antennas for Citizens band, amateur, and TV applications.
96. *STANDARD KOLLSMAN*—Brochure describing new UHF converter kit; built-in type designed to fit most existing VHF-only receivers.
97. *TRIO*—Illustrated sheets showing line of antennas for TV and FM reception; also includes information on *Color-Brite* line of UHF antennas for color reception.*
98. *WINEGARD*—Factfinder sheet No. 220, giving details on two-tube TV-FM booster coupler, Model BC208.*
99. *ZENITH*—Informative bulletin on new line of log-periodic vee-type antennas for FM, and monochrome and color TV.

AUDIO & HI-FI

100. *ATLAS SOUND*—New 1964 catalog No. 564 contains illustrations and specifications on PA speakers, microphone stands for commercial and industrial installations, and other new products.
101. *DUOTONE* — Catalog listing line of phonograph needles.
102. *GIBBS SPECIAL PRODUCTS*—Folders describing principles of sound reverbration and *Stereo-Verb* reverbration units for automobiles.
103. *MILLER*—Product sheet on AM broadcast tuner kit using germanium diodes.*
104. *OXFORD TRANSDUCER*—Product information bulletins describing complete line of loudspeakers for all types of sound applications; including replacements for public address and intercom systems.*
105. *PERMA-POWER*—Catalog sheet on *Diplomat;* a complete sound system in an attache case.
106. *QUAM-NICHOLS*—Brochures listing speakers used in 1955 through 1963 vintage automobiles; both front and rear seat types.
107. *SONOTONE*—4-page brochure describing three new phono cartridges.*
108. *SWITCHCRAFT*—Product bulletin No. 139 on new *Hi-D Jax* line of phone connectors for uses with all ¼" plugs.

COMMUNICATIONS

109. *CADRE*—Catalog sheet on complete line of Citizens band radios.
110. *GENERAL RADIOTELEPHONE* — Brochures describing two-way radio systems for all types of applications.
111. *PEARCE-SIMPSON* — Specification brochures on *Companion II* and *Escort* Citizens band transceivers.
112. *COMMUNICATIONS CO.*—Specifications brochure describing *Comco* Model 684 UHF-FM two-way radio.

COMPONENTS

113. *BUSSMANN*—Bulletin SBCU on Buss Fustat Box Cover Units offers simple, low-cost way to protect workbench tools, soldering irons, drills, and the like against damage and burnout. Units fit standard outlet or switch boxes; have fuseholder, plus a plug-in receptacle, switch, and pilot light.*
114. *GC ELECTRONICS*—24-page supplement No. FR-65-S listing newly introduced products.*
115. *RCA BATTERIES*—Brochure No. 1P1162, illustrating various selection of counter merchandiser display racks and promotional items on radio batteries.*
116. *ROBINS INDUSTRIES*—Condensed catalog No. 19C on all types of tape splicers and accessories.
117. *SPRAGUE*—Latest catalog C-615 with complete listings of all stock parts for TV and radio replacement use, as well as *Transfarad* and *Tel-Ohmike* capacitor analyzers.*
118. *STACO*—8-page condensed catalog on line of variable voltage transformers for all types of electronic applications.
119. *TRIAD*—Brochures on newly introduced replacement transformers for hi-fi and stereo amplifiers.
120. *WALDOM*—Wall chart on line of quick-disconnect devices for electronic wiring applications.
121. *WORKMAN*—Cross-reference charts on antenna coils, transistors, and circuit breakers; general replacement catalog No. 102.*

SERVICE AIDS

122. *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.*
123. *EQUIPTO*—16-page "Idea Book" of steel storage equipment and related items; including shelving, bins, benches, etc.
124. *PRECISION TUNER* — Literature supplying information on complete, low-cost repair and alignment services for any TV tuner.*
125. *RAWN CO.*—Product sheet and instruction bulletin gives description and uses for *Plas-T-Pair* kit; permits quick, sure repair of all types of plastic material—knobs, cabinets, etc.
126. *WILCO*—Brochures describing, and giving uses for hand cleaner, plastic cleaner, and scratch removing compounds.
127. *YEATS*—The new "back-saving" appliance dolly Model 7 is featured in a four-page booklet describing feather-weight aluminum construction.*

SPECIAL EQUIPMENT

128. *AMPROBE*—Brochures describing new series of AC ammeter chart recorders.
129. *ACME ELECTRIC*—Complete specifications and applications for control-type magnetic amplifiers with capacities from 5-1000 watts and voltage ranges from 24-160 volts.
130. *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.*
131. *GREYHOUND*—The complete story of the speed, convenience, and special service provided by the Greyhound Package Express method of shipping, with rates and routes.
132. *TENATRONICS*—Product sheet describing Model SM-751 AM-FM auto radio for installation in domestic and foreign cars.
133. *TERADO*—Bulletin on *CinePower* No. 25 portable power pack; designed for field operation of 60-cycle equipment.*
134. *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; includes complete specifications on line of trucks.

TECHNICAL PUBLICATIONS

135. *CLEVELAND INSTITUTE OF ELECTRONICS* — "Pocket Electronics Data Guides" with handy conversion factors, formulas, tables, and color codes. Additional folder, "Choose Your Career in Electronics," describes home-study electronics training programs, including preparation for FCC-license exam.*
136. *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

137. *B & K*—Catalog AP-21R describing uses for and specifications of new Model 1074 Television Analyst, Model 1076 Television Analyst, Model 850 Color Generator, Model 960 Transistor Radio Analyst, new Model 445 CRT Tester-Rejuvenator, new Model 250 Substitution Master, Model 375 *Dynamatic* VTVM, Model 360 *V-O-Matic VOM*, Models 700 and 600 *Dyna-Quik* Tube Testers, and Model 1070 *Dyna-Sweep* Circuit Analyzer.*
138. *EICO* — New 32-page, 1964 catalog of test instruments, hi-fi components, tape recorders, Citizens band, and amateur radio equipment.*
139. *HICKOK*—Complete descriptive and specification information on newly introduced equipment—Model 662 installer's color generator; Model 580 portable tube tester; Model 727 multiplex generator; Model 235A portable field strength meter.
140. *JACKSON*—Complete catalog describing all types of electronic test equipment for servicing and other applications.
141. *MERCURY*—Description and specification brochures on Model 900 Color TV Analyzer.
142. *SECO*—8-page brochure giving specifications and prices for Models 88, 98, and 107-B tube testers.*
143. *SENCORE*—Question-and-answer bulletin on new Model MX-129 *Multiplex Analyzer*, and Model CR-128 Picture Tube Tester-Rejuvenator.*
144. *SIMPSON*—Latest series of VOM's are described in test-equipment bulletin; also information on line of automotive test equipment.
145. *TRIPLETT*—Brand new test equipment catalog No. 45-T, listing complete line of testers and accessories.*

TOOLS

146. *ACME LITE*—Descriptive bulletin on line of *Magniflex* fluorescent lamps.
147. *ARROW FASTENER*—Leaflets describing Model T-18, T-25, and T-75 tackers for speeding cable and wire installations. Illustrations show methods and models used for various wire thicknesses.
148. *BERNS*—Data on unique 3-in-1 picture-tube repair tools, on *Audio Pin-Plug Crimper* that enables technician to make solderless plug and ground connections, and on new-style *ION* adjustable "beam bender" for CRT's.*
149. *ENTERPRISE DEVELOPMENT*—Time saving techniques in brochure from Endeco demonstrate improved desoldering and resoldering techniques for speeding up and simplifying operations on PC boards.
150. *LUXO LAMP*—Catalog on line of "touch-and-stay-put" lamps.

TUBES & SEMICONDUCTORS

151. *SEMITRONICS*—New updated 16" x 20" wall chart CH10 lists replacements and interchangeability for transistors and diodes.

Keep Inventories Low!
Save Time and Money!
Speed Up Repairs!

NOW, WITH ONLY 10 RCA "TOP-OF-THE-LINE" TRANSISTORS YOU CAN REPLACE OVER 1900 ENTERTAINMENT TYPES

RCA's ten new "Top-of-the-Line" transistors can solve nearly every transistor replacement problem you will encounter in your servicing of phonographs, tape recorders, battery-operated portable radios, auto radios, and other entertainment-type equipment.

With an inventory of only 10 types, the RCA SK-Series transistors can quickly, easily, and economically provide you with hundreds of replacements—over 1900 in all, including many types of foreign manufacture.

For example, if you are active in the servicing of auto radios, you will find that just three types, the SK-3008, SK-3009 and SK-3012, will speed up repairs by providing you with replacements for virtually every transistor type used in auto radios.

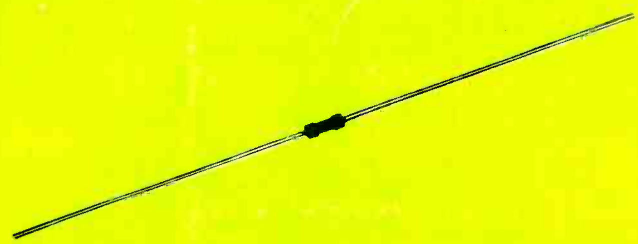
RCA Type	Application
SK-3003	pnp type, AF Driver and Output Stages (9 V Supply)
SK-3004	pnp type, AF Driver and Output Stages (15 V Supply)
SK-3005	pnp type, RF, IF, and Converter Stages of Broadcast Receivers
SK-3006	pnp type, RF, IF, and Converter Stages of FM and AM/FM Receivers
SK-3007	pnp type, RF, IF, and Converter Stages of All-Wave Receivers
SK-3008	pnp types, RF, IF, and Converter Stages of Auto Radios
SK-3009	pnp type, Audio Output Stages of Auto Radios
SK-3010	npn type, AF Driver and Output Stages of Broadcast Receivers
SK-3011	npn type, RF, IF, and Converter Stages of Broadcast Receivers
SK-3012	pnp type, Audio Output Stages of Auto Radios

Ask your RCA Distributor for your copy of the new RCA replacement wall chart. It lists in alphabetical-numerical order the more than 1900 types which the 10 RCA SK-Type Transistors can replace.

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

RCA® The Most Trusted Name in Electronics

WORLD'S smallest FUSE



THE picoFUSE

Shown actual size,
1/8, 1/4, 3/8, 1/2, 3/4, 1, 1-1/2, 2, 3, 4, and 5 amp. @ 125 volts. Interrupting capacity 300 amps DC at 130 volts. Color-coded to identify amperage rating.

Blowing characteristics:
100%—4 hours minimum
200%—5 seconds maximum

LITTELFUSE

DES PLAINES, ILLINOIS

Circle 65 on literature card