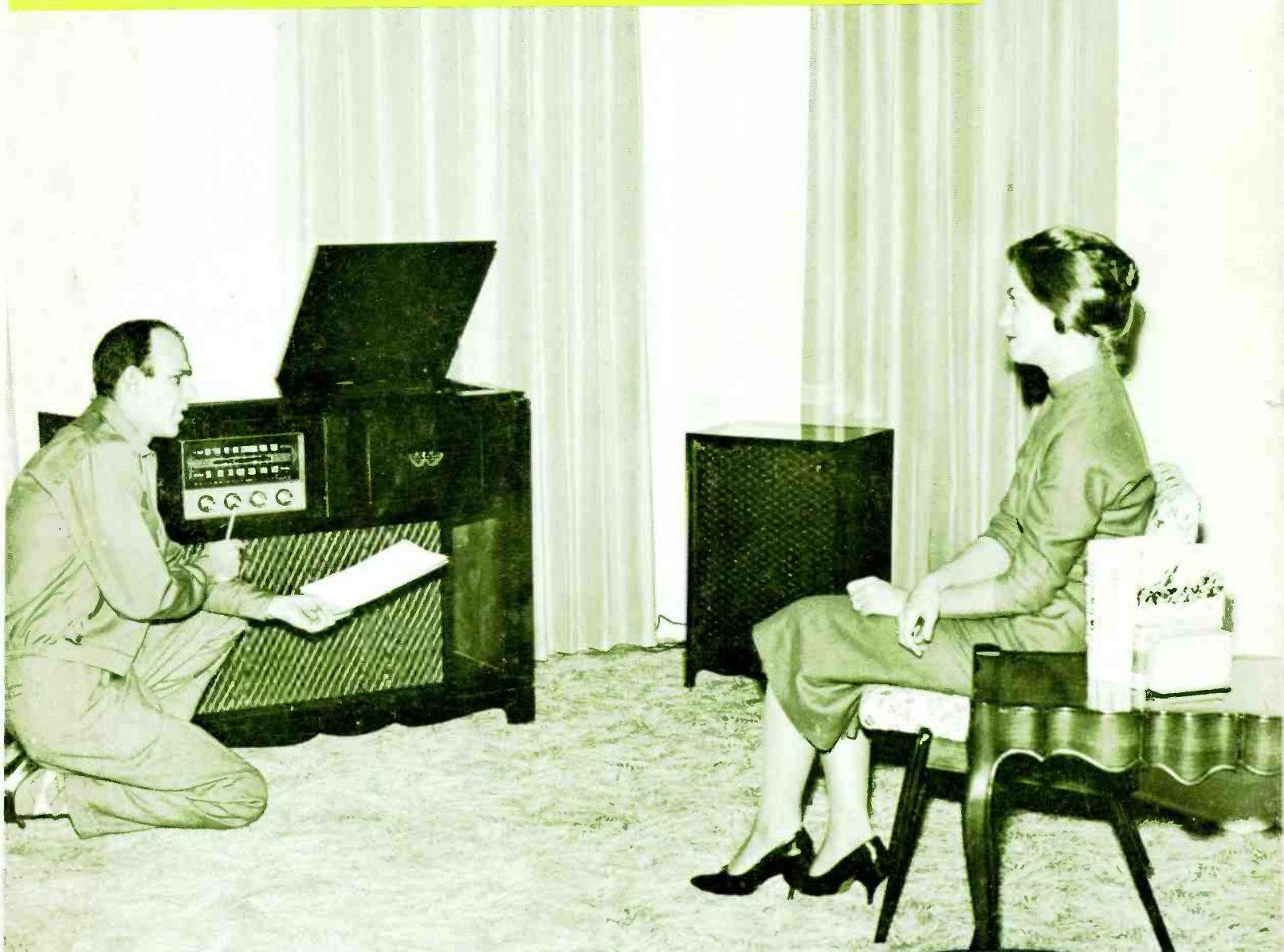


DECEMBER, 1959 35 CENTS



# Hi-Fi REPORTER<sup>®</sup>

including **Electronic Servicing**



*Customer  
Satisfaction From Hi-Fi*

- Large Current Electron Tubes
- Temperature Compensating Capacitors
- Servicing TV Portables

1A 8H 635 1260E  
 WM M DAVIS  
 118 RIVERSIDE AVE  
 CANON CITY COLO

**now...**

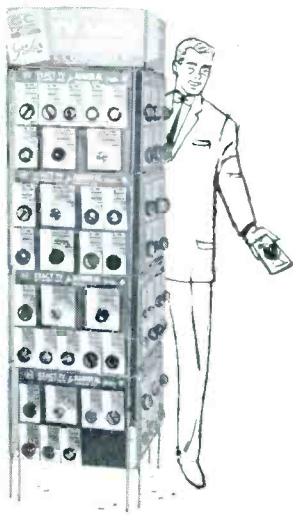
**make your customers happy**



**...make more money!**



# with NEW G-C EXACT TV REPLACEMENT KNOBS



- 97 KNOBS TO CHOOSE FROM
- COVERS ALL 8 POPULAR TV MAKES
- REPLACEMENTS FOR ON-OFF, VOLUME, FINE TUNING, CHANNEL SELECTOR
- MODERN SKIN-PACK—PRICE-MARKED FOR YOUR TRADE

Whenever you run across a broken or missing knob on your TV service calls, you can supply an exact replacement that makes your customer happy, gives you extra money on that call. Your nearby G-C jobber is now showing the complete G-C TV Knob line . . . with each knob skin-packed, clearly identified, and marked with list price for the set owner's information. It's another great service for you from G-C and your G-C jobber.

WRITE today for your free G-C Catalog . . . other literature too.

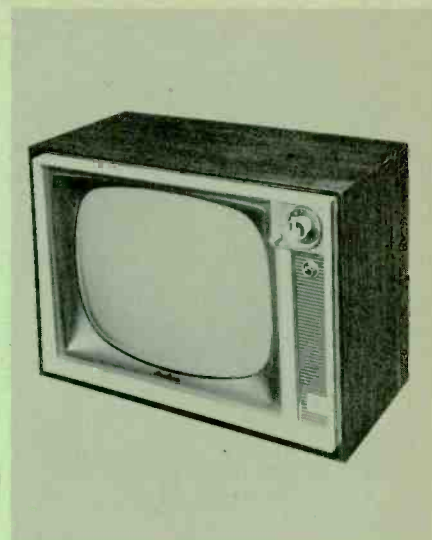
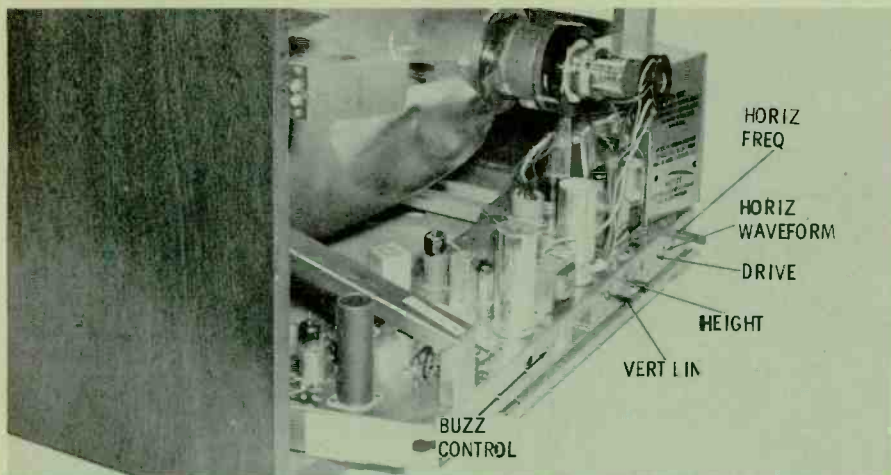


## G-C ELECTRONICS CO.

Division of Textron Inc.

West Plant: Los Angeles 18, California

Main Plant: ROCKFORD, ILLINOIS, U. S. A.



### Airline Model WG-4082A

Modern features of this 21" table model include one of the new *Hot-Rod* VHF tuners and a push-type on-off switch. The safety glass can be removed from the front by taking off the top trim strip, which is held by two screws.

The major portion of the chassis, which is all hand-wired, mounts horizontally at the bottom of the cabinet; however, front controls, tuner, and picture tube are supported by brackets attached to this section. You'll find a 4" x 6" oval speaker positioned directly below the control panel at the front of the cabinet. Service adjustments are across the rear as shown in the photo.

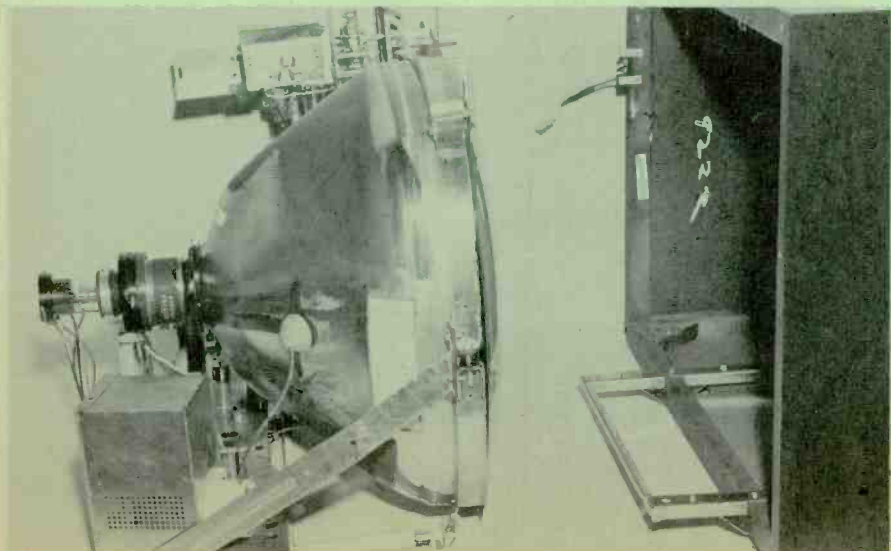
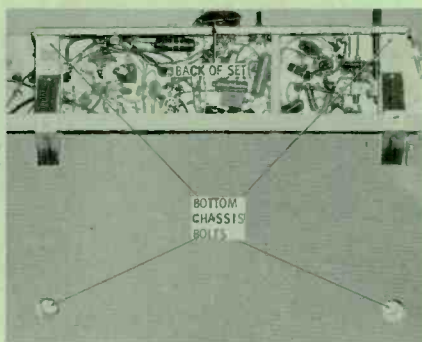
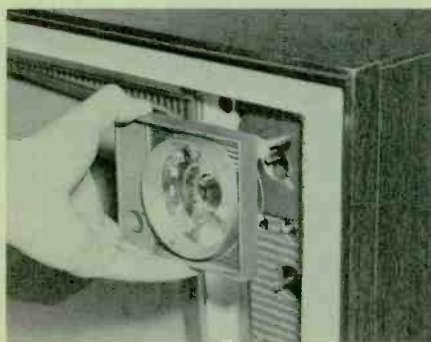
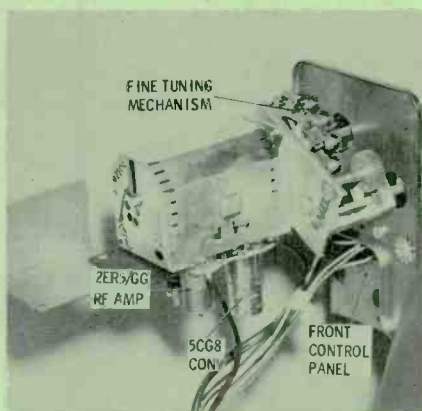
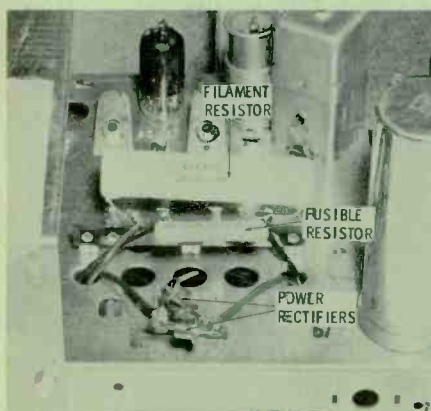
The "hot" chassis is powered by two silicon rectifiers in a voltage-doubler circuit which produces approximately 270 volts. These units are soldered to a small terminal strip on top of the chassis near the left side. Behind the rectifiers you'll find two "sugar-coated" resistors soldered to another, longer, terminal strip. The large 20-watt unit is a 52-ohm dropping resistor connected in series with the filament string, while the smaller one is a 7.5-ohm fusible type protecting the power supply from B+ overload.

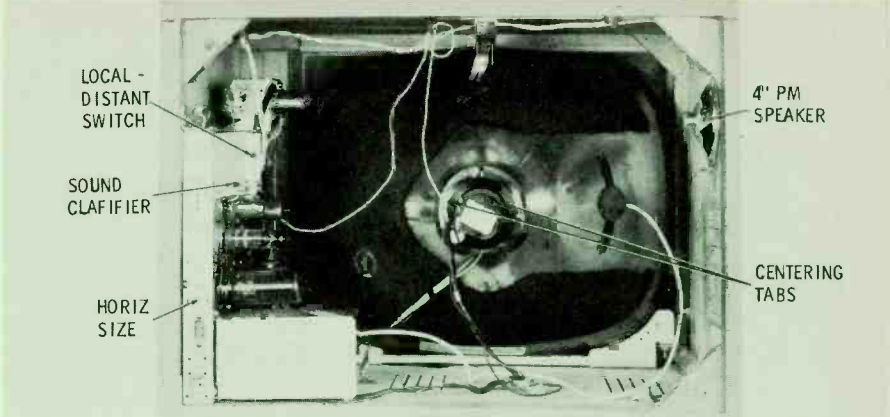
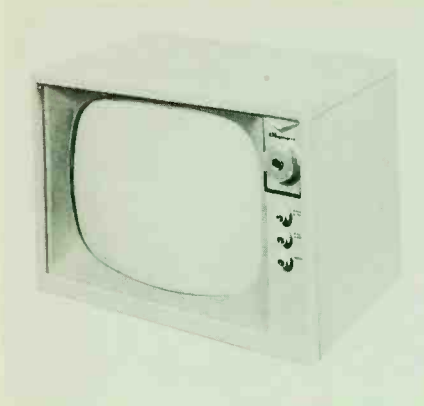
The small tuner is mounted to a frame assembly, which in turn is attached to the front control panel. A set-and-forget fine-tuning arrangement is provided for each channel, and is adjusted with an operator's knob on the front. Aside from those shown in the tuner, the only new tube you'll find in this chassis is an 8BQ5, which is used in both the video and audio output stages.

To pull the chassis for bench servicing, you'll discover it's not only necessary to remove the channel selector and fine-tuning knobs, but also the channel-indicator trim piece. This can be taken off by pulling straight out as pictured. You can then pull off the brightness, range, and vertical-hold control knobs that are partly covered by the piece.

After disconnecting the antenna and speaker leads, remove the 5/16" hex-head screw securing the tuner bracket to the cabinet, plus the four bottom chassis bolts pointed out in the photo.

The entire chassis, including tuner and picture tube, can now be slipped back and off the bottom rails. The rail assembly remains in the cabinet as shown.





**Olympic Model TY134  
Chassis HY**

Here's a new table model with 21" picture tube and VHF tuning you may be running into shortly. The set incorporates only 11 receiving tubes, plus a 90° CRT and two rectifiers. Cleaning the safety glass is no real task if you know where to start. First, remove the channel selector and fine-tuning knobs, and also the name plate which is secured by only one Phillips-head screw. Then, take out the screws holding the top trim strip, and the glass can be tilted out and removed.

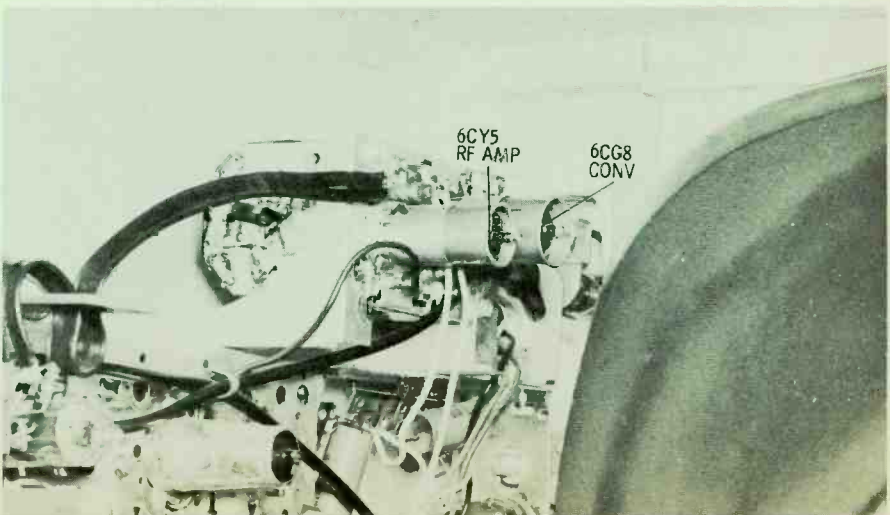
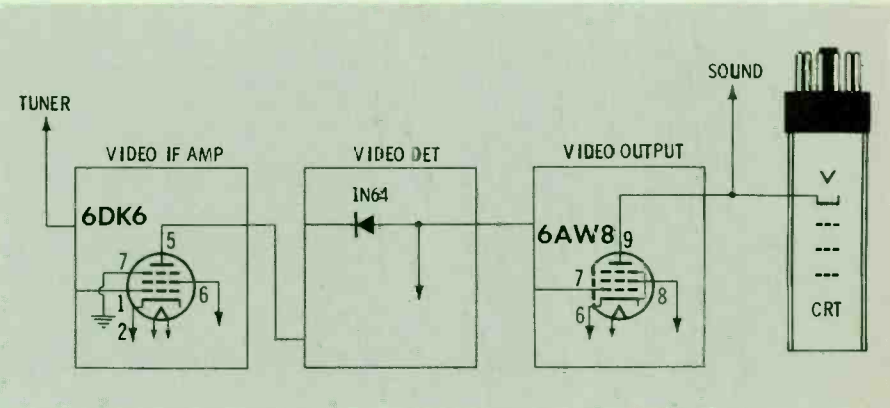
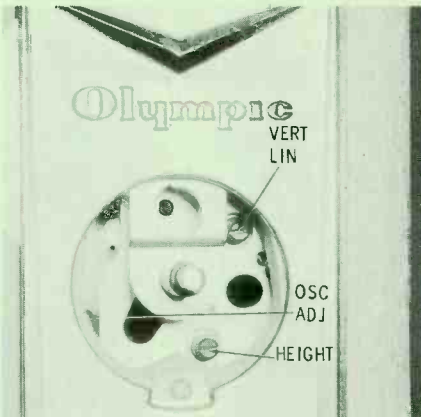
The hand-wired chassis is of conventional horizontal style; however, it has been upended and mounted vertically along one side of the cabinet. The low-voltage supply utilizes a power transformer and 5U4GB rectifier, and the 6CU5 audio output tube is used as a B+ voltage divider. Among the service adjustments on the rear, you'll notice one labeled SOUND CLARIFIER, which is actually a slug adjustment for the quadrature coil in the sound detector stage. The horizontal size control may also be a little misleading, since it is really a trimmer capacitor located in the grid circuit of the horizontal output tube, and varies the amount of drive signal utilized.

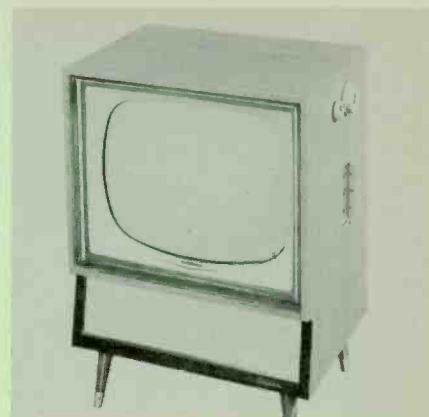
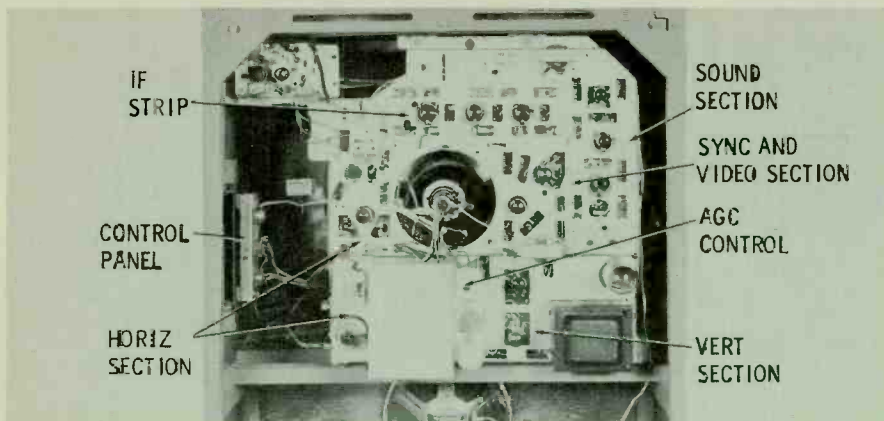
Don't search all over the chassis for the vertical sweep adjustments; merely pull off the tuning knobs to expose the linearity and height controls pointed out in the photo. The tuner oscillator adjustment is also accessible with these knobs removed.

On top of the chassis near the sound detector coil, you'll find an unusual looking plug inserted in a 9-pin miniature tube socket. This socket is a power connection for sets incorporating an additional radio chassis. If you are called upon to service one of the sets with a radio, and want to power the TV chassis by itself, you must use this shorting plug or some sort of substitute.

An interesting circuit feature of this receiver is its one-stage of IF amplification. The simplified diagram will give you an idea of the total circuitry between the tuner and picture tube. The lonely IF stage employs a 6DK6 with both grid and plate circuits tuned to 44.5 mc.

The VHF tuner is a small turret type attached to the chassis near the top of the cabinet. Both tubes have captive telescoping shields; therefore, you may find it difficult to orient the pins when making a tube substitution so far forward in the cabinet.





## RCA MODEL 21T9266 Chassis KCS124C

This 21" *Ashley* console is equipped with VHF tuner, 8" PM speaker, and an all-wood cabinet. Knobs for channel tuning, contrast, and volume with push-pull on/off are located on the right near the top edge of the cabinet. Directly below these controls is a small compartment housing the brightness and hold controls. The safety glass can be removed from the front by taking off the trim strip across the top of the mask.

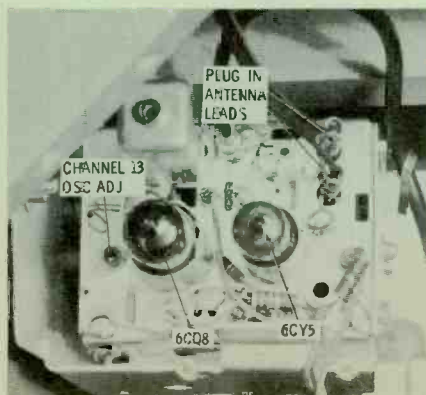
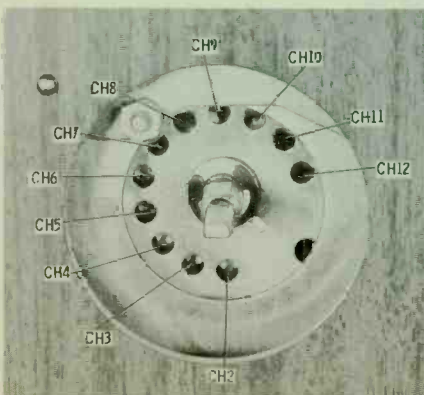
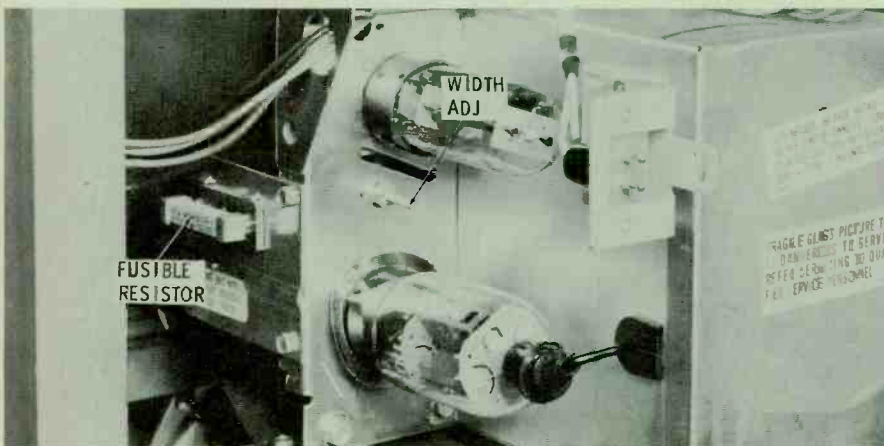
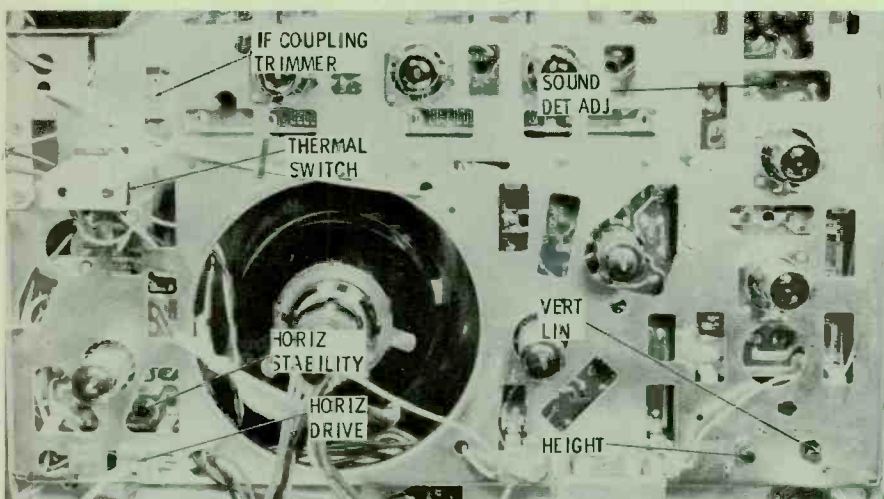
The transformer-powered chassis is a vertically-mounted assembly that fills most of the upper cabinet area. Five separate printed boards are employed, with tubes mounted on the exposed side and circuit components on the opposite side. Most of the tubes are of familiar types, except the 6DS5 output tube in the audio section and the 6EM5 in the vertical section.

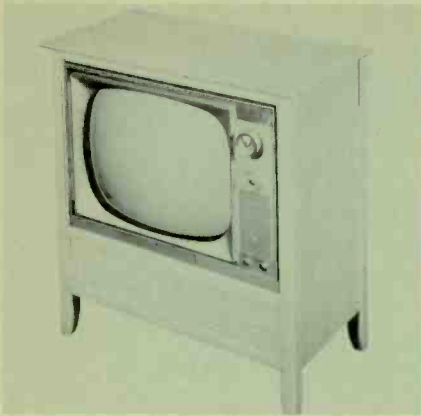
Taking a closer look at the well-perforated chassis, note the locations of various service adjustments. Horizontal stability, the waveform adjustment of a modified *Synchroguide* circuit, is accessible from either side of the chassis and requires a hex-shaped tool. The frequency coil in this particular circuit is fixed, and therefore will require no adjustment. Up toward the tuner, you'll notice a thermal switch device protruding from the chassis. The function of this unit is to protect the power supply from overload caused by excessive B+ current. The resistive element of the device is connected in series with the primary of the power transformer. The switch, however, is in series with the B+ line, and opens whenever the heat produced by the resistor reaches a certain predetermined level.

You'll find the width-coil adjustment between the damper and horizontal output tubes. In this same vicinity, but positioned on the side of the chassis, is a fusible resistor. This plug-in component is rated at 9-ohms and protects the power supply in the event of excessive drain by either sweep circuit.

To adjust the oscillator frequency of the switch-type tuner, merely remove the channel-selector and fine-tuning knobs to expose the slugs for channels 2 through 12. As shown in the photo, they are positioned in a semicircle around the tuning shaft.

You'll find it necessary to remove the back of the set to adjust the oscillator slug for channel 13, which is located on the tube side of the tuner as pictured.





**Zenith Model D2464L  
Chassis 17D20**

This new 21" console highlights an audio system with tone controls and four individual speakers. The base of the cabinet houses a 6" x 9" oval speaker and two electrostatic tweeters. Another oval unit measuring 5" x 7" is located behind the grille of the control panel. Most of the service adjustments, including focus and *fringe-lock* controls, are behind the trap door beneath the front of the picture tube.

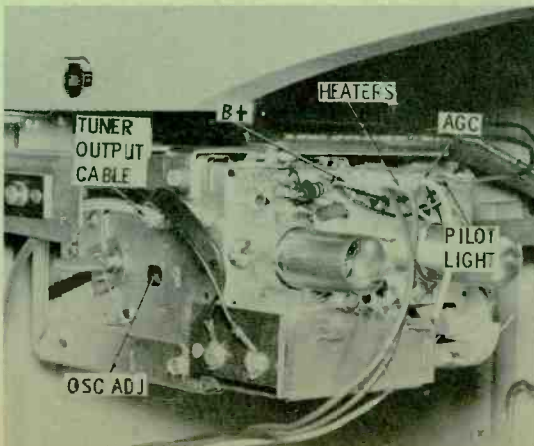
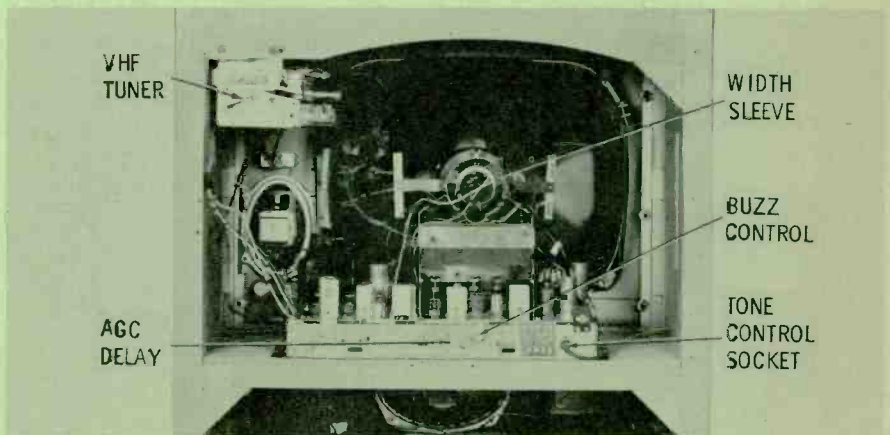
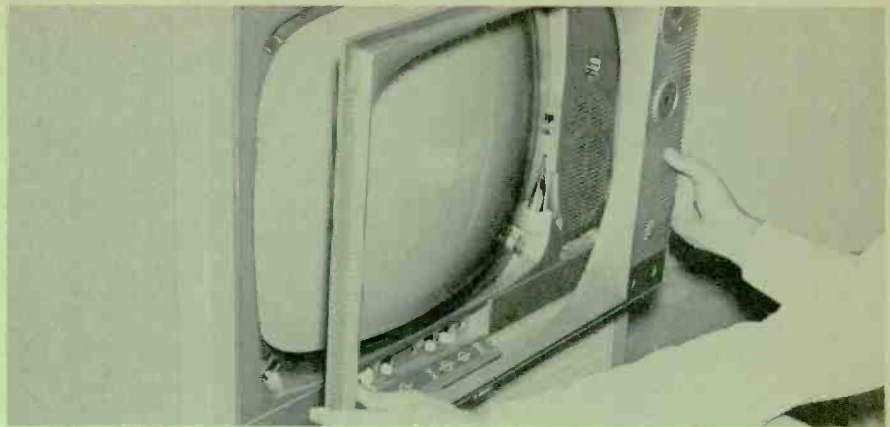
The safety glass and mask assembly is removed as follows: First, remove the front control knobs and two 1/4" hex-head screws inside the service adjustment compartment. The mask may now be removed as illustrated. Proceed by taking out the screws holding the glass at each corner. It's best to support the glass with one hand while removing these.

With the rear cover off, you'll find a transformer-powered, hand-wired chassis that employs a 5V3 rectifier. An alternate for this tube is the 5AU4. Other recent tube types used include a 6EB8 serving both video and sound circuits, a 6BQ5 in the audio-output stage, a 6CK4 vertical output, and a 6GH8 horizontal oscillator.

You can't help but notice the power transformer with its large cooling fins extending down through the chassis. Right beside it, near one corner of the chassis, you'll see an "N" type fuse which is connected in series with the main B+ line of the set. This is a slow-blow unit rated at 700 ma. The only other fuse is a 1 1/4" length of #24 wire used in the parallel filament circuit. Incidentally, when removing the chassis from the cabinet, watch out for the screen shielding stapled to the mounting shelf.

It's interesting to note that the *Bull's Eye* tuner is mounted separately up in one corner of the cabinet. When removing the chassis, it isn't necessary to pull the tuner, too. All leads are of a plug-in nature and can be easily reached, as evidenced in the photo. Although the oscillator adjustment is located at the rear of the tuner, you can make the setting for each channel without removing the back cover.

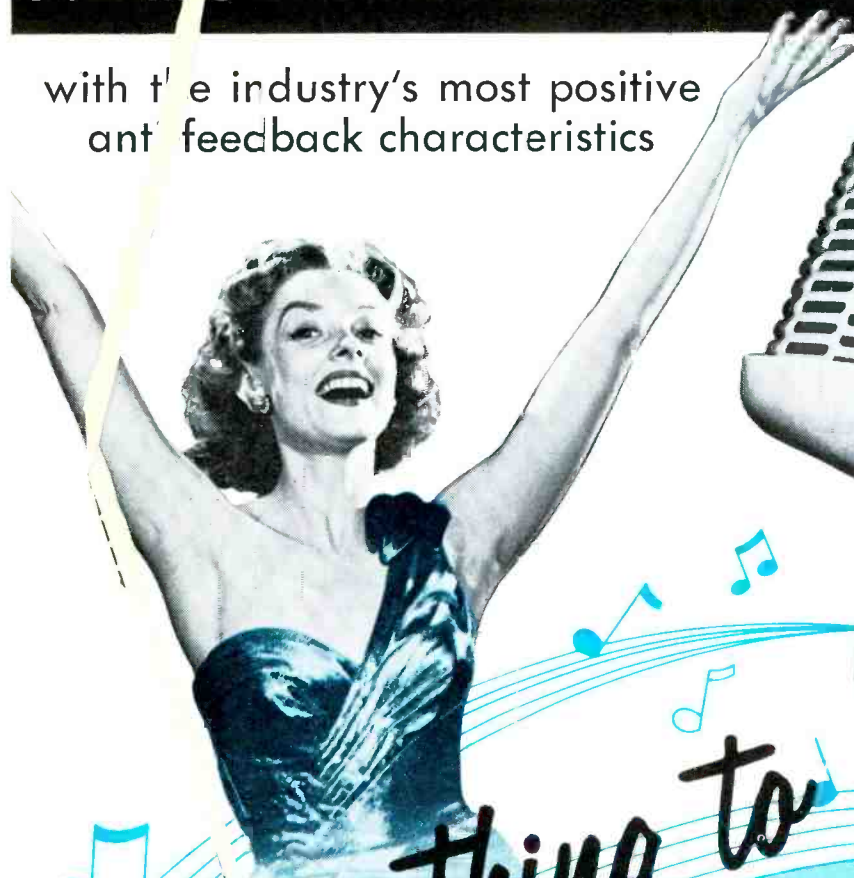
The channel indicator is unique in that the center disc is counterbalanced and, although free to turn, stabilizes with the indicator window at the top as the selector is rotated. The operating channel number is illuminated by a pilot bulb.



# ASTATIC 77

## DYNAMIC CARDIOID MICROPHONE

with the industry's most positive  
anti-feedback characteristics



*Something to  
Sing about*

#### LIST PRICES

Model 77  
(Illustrated)

Chrome Finish, \$82.50;  
Gold Finish, \$92.50.  
Model 77L (Head only),  
Chrome Finish, \$72.50;  
Gold Finish, \$82.50.  
Model G-77 (Complete  
with G-stand),  
Chrome Finish, \$97.45.

When you're looking for the ultimate in cardioid microphones, consider these advanced features of Astatic's Model 77 and see if you don't agree that no other manufacturer has SO MUCH TO SING ABOUT—the most positive anti-feedback characteristics ever achieved. -18 db; exclusive Mylar diaphragm that is pop-proof and blast-proof, retains like-new flex properties for more years; an exclusive sintered bronze method of acoustic phase shifting that creates the industry's top directional characteristics; -52 db output and exceptionally flat response through 30 to 15,000 cps.

Do one thing for your own satisfaction. On your next installation, make a direct comparison of the Astatic 77 with any other cardioid. We'll guarantee—when anyone mentions the word "cardioid" again, you'll sing the praises of this incomparable Astatic instrument.

THE  
**Astatic** CORPORATION, CONNEAUT, O-110

IN CANADA: CANADIAN ASTATIC LIMITED, TORONTO, ONTARIO  
EXPORT SALES: ROBURN AGENCIES INC. 431 GREENWICH ST., N. Y. 13, N. Y., U.S.A.

FROM What  
You HEAR

GO BY BRAND  
—GO BUY ASTATIC

SINGING SOUNDS BETTER WHEN THERE'S AN ASTATIC MICROPHONE ABOUT

Send 10c to Sprague  
for window-size blow-  
ups of this message.



# EVERY DAY IS INDEPENDENCE DAY



FOR YOU AND YOUR  
**★ INDEPENDENT ★ ★**  
TV SERVICE DEALER



Your independent TV Service Dealer is in business for himself because he too wants to exercise his independence just as you do. You purchased your TV or radio set where you wanted to . . . when you wanted to . . . and at the price you decided was right.

Your TV service dealer is also an independent in the things he buys in his day-to-day work. He buys his repair parts where he can get the highest quality and the best service. And, he trained himself in his own way, on his own time, at his own expense to be able to do this in the very best way for YOU.

He has no crutch to support him . . . no "home office" to mother him along. He stands or falls on what you think of him and his work. He has to do good work to keep your business . . . and he knows it!

We're lucky in these United States that every day is Independence Day. Independent buying, selling, and servicing is the very lifeblood of American business. Let's keep it that way.

**THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,  
DISTRIBUTORS' DIV. OF SPRAGUE ELECTRIC CO., NORTH ADAMS, MASS. FOR**

**YOUR INDEPENDENT TV-RADIO TECHNICIAN**



**publisher**

Howard W. Sams

**general manager**

Mal Parks, Jr.

**editor**

Verne M. Ray

**associate editors**

Leslie D. Deane  
Thomas A. Lesh  
Joe A. Groves

**consulting editors**

William E. Burke  
Robert B. Dunham  
George B. Mann  
C. P. Oliphant  
Paul C. Smith

**art director**

Don W. Bradley

**advertising & editorial assistants**

Georgeanna Caldwell  
Paula Distelhorst

**production manager**

Robert N. Rippy

**circulation fulfillment**

Pat Tidd, Mgr.  
Ann Mathews, Ass't.  
Constance McCawley, Ass't.

**photography**

Robert W. Reed

**advertising sales offices**

**Midwestern**

John Grace, PF REPORTER  
2201 East 46th Street, Indianapolis 6, Ind.  
Clifford 3-6441

**Eastern**

Cliff Landis  
Corning Glass Building,  
717 Fifth Ave., New York 22, N. Y.  
Murray Hill 8-6350

**Western**

The Maurice A. Kimball Co., Inc.  
2550 Beverly Blvd., Los Angeles 57, Calif.  
Dunkirk 8-6178; and 681 Market Street,  
San Francisco 5, Calif. Exbrook 2-3365

Address all correspondence relating  
to circulation and editorial to PF  
REPORTER, 2201 East 46th Street,  
Indianapolis 6, Indiana



Copyright © 1959 by Howard W. Sams & Co., Inc. PF REPORTER is a trademark of Howard W. Sams & Co., Inc. No part of PF REPORTER may be reproduced without written permission. No patent liability is assumed with respect to use of information herein. Acceptance of advertising does not in any manner signify the products, policies and services so advertised have been approved, endorsed or recommended by this magazine.



**PF**  
PHOTOFACT

**REPORTER**®

including Electronic Servicing

VOLUME 9, No. 12

DECEMBER, 1959

**CONTENTS**

<b>Previews of New Sets</b>		<b>1</b>
Covering Airline WG-4082A, Olympic TY134, RCA 21T9266, and Zenith D2464L.		
<b>Video Speed Servicing</b>		<b>5</b>
Service hints on the GE M4 chassis and Magnavox No. 25 series.		
<b>Letters to the Editor</b>		<b>14</b>
<b>Analyzing FM-Detector Circuits</b>	Stan Prentiss	<b>22</b>
Across the Bench—Knowledge to help you troubleshoot ratio detectors and discriminators.		
<b>Large-Current Electron Tubes</b>	Allan Lytel	<b>26</b>
Fundamentals of thyratrons and ignitrons, and their use in industrial control circuits.		
<b>Servicing TV Portables</b>	Joe A. Groves	<b>28</b>
How to save analysis time on these special "breeds."		
<b>Customer Satisfaction From Hi-Fi</b>	Alan Andrews	<b>30</b>
Audio Facts—Beginning of a series to help you in your relationships with hi-fi enthusiasts.		
<b>Audio Troubles Can Be Tricky, Too!</b>	Calvin C. Young, Jr.	<b>32</b>
Quicker Servicing—A report on an unusual case of sound distortion.		
<b>Isolating Color TV Troubles by Symptoms</b>	Warren J. Smith	<b>36</b>
Part 2—Tracing chroma troubles to specific stages and components.		
<b>Dollar &amp; Sense Servicing</b>	Thomas A. Lesh	<b>40</b>
<b>Tips for Techs</b>	John A. Comstock	<b>42</b>
<b>Temperature-Compensating Capacitors</b>	George D. Philpott	<b>48</b>
Where and why they're used, plus hints on making replacements.		
<b>Notes on Test Equipment</b>	Les Deane	<b>52</b>
Lab reports on RD Instruments Model 1715 square-wave generator, Vis-U-All V1003 tube checker, and Waterman S-16-A CRAFTSCOPE.		
<b>The Troubleshooter</b>		<b>60</b>
<b>Coming Next Month</b>		<b>72</b>
<b>Product Report</b>		<b>80</b>
<b>Free Catalog &amp; Literature Service</b>		<b>88</b>

1959 Subject Reference Index

Check 67K on Literature Card

**ABOUT THE COVER**

Helping customers to obtain the best performance from their hi-fi systems is a growing part of the serviceman's job. While we can't guarantee that all your customers will be as charming as the lass on this month's cover, we can guarantee that you will be charmed by the "Audio Facts" series starting on page 30 in this issue.



**Merry Christmas from the Entire Staff**

WHERE WOULD YOU GET **ANY**  
AND **EVERY** ANTENNA REPLACEMENT  
FOR PORTABLE AND TOTEABLE SETS?

# JFD<sup>\*</sup>

## OF COURSE!



Model TA359 List, \$4.50  
Exact Replacement for RCA,  
Motorola, Magnavox, 1956-7-8  
Portable TV Sets



Model TA362 List, \$9.75  
Exact Replacement for GE  
Designer and Hotpoint "Flair"  
1958 Portable TV Sets



\*Beginning with set 467 in December,  
JFD Exact Replacement Antennas will be  
listed in SAMS PHOTOFACT folders for  
your service reference.

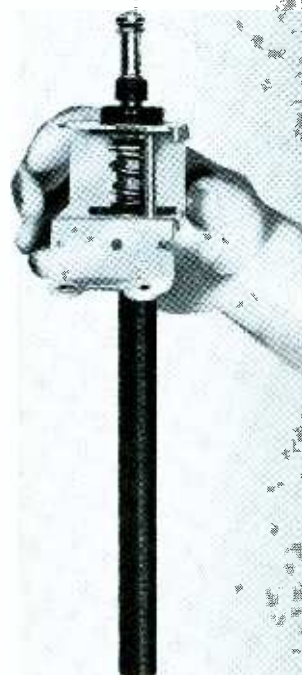
Model TA369 List, \$8.25  
Exact Replacement for RCA  
1960 Portable TV Sets

Only when you buy a JFD Exact Replacement  
Antenna do you get the original unit that JFD  
supplies to manufacturers for their TV port-  
able or "tote-able" sets. And when you  
install a JFD Exact Replacement Antenna  
*you* make a *full* profit on the sale and the  
installation—bring customers back to *your*  
shop because only you are equipped to  
replace a broken antenna.

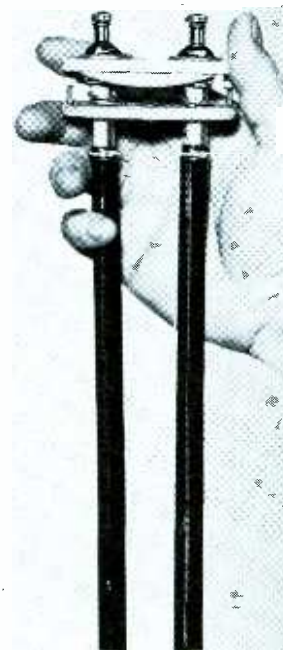
Only \$11.95 puts you back in profitable  
indoor antenna business. That's all it costs  
for the No. PA500 JFD Exact Replacement  
Antenna Merchandising Kit that gets you  
started in this new multi-million dollar  
service market.

**Remember, next to receiving tubes,  
the antennas of portable and "tote-able"  
sets require the most frequent replacement.**

**See your JFD distributor today for your PA 500  
kit and any and every antenna replacement  
need.**



Model TA370 List, \$6.25  
Exact Replacement for  
Admiral 1959-60 Portable  
TV Sets



Model TA360 List, \$7.65  
Exact Replacement for GE,  
Hoffman, Hotpoint & Emerson  
1957-8 Portable TV Sets

**Pioneers in electronics since 1929**  
**JFD ELECTRONICS CORPORATION**

6101 Sixteenth Avenue Brooklyn 4, New York

**JFD CANADA LTD.**  
51 McCormack Street  
Toronto, Ontario, Canada

**JFD INTERNATIONAL**  
15 Moore Street  
New York, N.Y.

**1**  
**number one** of a series of  
 Cornell-Dubilier  
 50th Anniversary Deals!

CDE

MINIATURIZED  
**MYLAR**



**FOR THE PRICE OF PAPER**

You read it right! Now you can get C-D's miniaturized 100% Mylar\* film-wrapped capacitors at prices you'd normally expect to pay for paper-dielectric types! And these C-D Mylars—with their epoxy-anchored leads—are the universal types you use daily, especially for hard-to-get-at repairs. Not a dust-collector in the assortment!

**HERE'S THE DEAL:**

Quantity	Type No.	Capacitance (mfd.) ±10% Tolerance	Voltage (DCW)
10	WMF6S1	.01	600
10	WMF6S22	.022	600
10	WMF6S47	.047	600
10	WMF6P1	.1	600

All 40 pieces for only ~~\$140~~ **\$870**  
 (dealer net)

**HERE'S THE PACKAGE:**

Typical of the quality C-D builds into every capacitor in their complete line, the assortment's sturdy, space-saving, clear plastic container fits easily into your tool kit. And, when the box is empty, it's perfect for holding small tools and parts you want at a moment's notice.

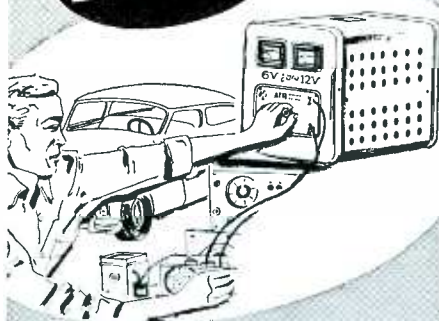


**HERE'S HOW TO GET IN ON IT:** First in a Series of C-D 50th Anniversary Deals, this limited-time offer is designed to save you money...help you do your job better, easier...keep your customers happy! Get the whole story—and the deal—from your C-D Distributor. Call him today! Get in on Cornell-Dubilier's 50th Anniversary Sales Celebration. (Also ask about C-D's complete capacitor line for industrial electronic maintenance.)

\*Du Pont Reg. T.M.

**CDE** **CORNELL-DUBILIER ELECTRIC CORPORATION**  
 Affiliated with Federal Pacific Electric Company

# ATR



## "A" BATTERY ELIMINATORS



For  
Demonstrating and  
Testing Auto Radios

TRANSISTOR OR VIBRATOR OPERATED  
6 Volt or 12 Volt!

New Models . . . Designed for testing D.C. Electrical Apparatus on Regular A.C. Lines. Equipped with Full-Wave Dry Disc Type — Rectifier. Assuring Noiseless, Interference-Free Operation and Extreme Long Life and Reliability.

TYPE	INPUT A.C. Volts 60 Cycles	D.C. OUTPUT		SHIP. WT.	USER PRICE
		VOLTS	AMPERES Cont. Int.		
610C-ELIF	110	6	10 20	22	\$49.95
		12	6 12		
620C-ELIT	110	6	20 40	33	66.95
		12	10 20		

**SEE YOUR JOBBER OR WRITE FACTORY**

✓ NEW MODELS ✓ NEW DESIGNS ✓ NEW LITERATURE

• "A" Battery Eliminators • DC-AC Inverters • Auto Radio Vibrators



AMERICAN TELEVISION & RADIO CO.  
Quality Products Since 1931  
SAINT PAUL 1, MINNESOTA, U. S. A.

## Letters to the EDITOR

Dear Editor:

Bravo for Mr. John Standen from Cleveland!

If Mr. R. J. Dennis can brag of a well-equipped shop, it seems to me he's degrading the TV service industry — because any well-equipped shop with a good technician should make enough income not to have to work somewhere else. If Mr. Dennis can't find enough service work to keep himself busy all day, it must be the result of poor business ethics. And what happens when Mrs. Jones wants her TV repaired, and Mr. Dennis is busy at his regular job? That, in itself, is poor business ethics.

I, for one, started as a part-timer, but it certainly was not because I wanted to. I started on my own only after being turned down by every full-time shop. They just couldn't hire me because of the business they had lost to part-timers.

After having a TV station in our area for just a little over three years, our TV Association — of which I am President — has a list of 20 of these part-timers. They earn their livings mostly underground (in the mines), and hardly a week goes by that at least one of them doesn't come into our shop with sets they can't repair.

So while you can see that I'm not against the spare-timer who is forced into it, I'm definitely against those who believe spare-time servicing is the thing to do.

ZE MAD JACQUES LATOUR

Conrad Radio-TV Centre  
Timmins, Ontario

Dear Editor:

The full-time TV and radio serviceman operating a shop must pay for a business license and abide by other laws covering his business. I wonder how many part-timers obey these same regulations. I agree with the letter from Mr. John Standen.

DON MARSHALL

Marshall & Holl  
San Mateo, California

Dear Editor:

I like your magazine, and side with the letters you are receiving from part-timers.

I started as a part-time serviceman myself — mainly because no one else would hire me. I tried to get a job with several different TV service businesses, but most of them didn't want me or wouldn't pay enough for me to live on.

So I started working on my own in addition to my regular job. I finally made the business big enough to let me quit my other job. Now I run my own full-time Radio-TV service.

DELVIN IRELAND

Ireland Electronics  
Star, Idaho

Dear Editor:

Being a rather recent entrant into the radio and TV field (about 3 years), I read with considerable interest "Letters to the Editor" in the October issue. I am a part-time serviceman and would like to give my point of view.

First of all, by working part time, I and others have a chance to put profits back into the business, to make stock inventories more complete and up-to-date, and to build up a good supply of test equipment — all of which is quite a job.

I try to keep abreast of the new developments in the electronics field and perform my service work to the best of my ability.

Some day in the near future, I would like to operate full-time, but to do so without more practical experience and a sizable investment in equipment and stock would be a poor business venture.

FRED HOFFMAN

Trenton, New Jersey

Dear Editor:

I can't see why anyone that knows a tube from a light bulb would want to knock your fine magazine and its editor.

I am a part-time serviceman, but I spend 40 hours or more a week in electronic servicing, nights and weekends. I have over \$5,000 in parts alone, over \$700 in textbooks, over \$1500 in test equipment. I work for cash, buy for cash, and sell for cash. My labor charge is \$1.00 per hour more than most full-time servicemen get in my town.

W. LEE TERRELL

Newnan, Georgia

Dear Editor:

I would venture to say that the vast majority of part-timers are merely starting on this basis, with full intention of building up the business to a full-time potential as soon as possible. This is my own intention, and I know that many other full-timers started out this very same way!

Most of us part-timers have spent just as much time and money getting our education in this field as Mr. Standen has, and we have also spent every bit as much money to obtain adequate stock and equipment.

When I hear that we part-timers are taking away a full-timer's bread and butter, I can only say that we can't be blamed for that — since a satisfied customer will most certainly not look elsewhere for service.

To he who thinks I would be angry if someone were to take away my factory job, I say baloney — since this factory job is just a stepping stone to my ultimate goal, and he is entirely welcome to that factory job if he wants it!

To you, the editors of PF REPORTER, I take off my hat. I firmly believe that you have the finest publication of its kind to be found anywhere. Keep up the good work.

KEITH WOLFMAN

Milwaukee, Wisconsin

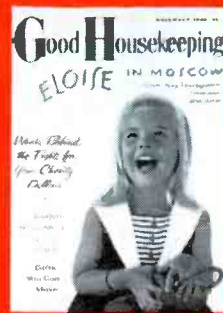
• Please turn to page 20

put this poster



on your window . . . . . so that

readers of  
this magazine  
will know  
you're featuring



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

**HARMONY**  
CBS ELECTRONICS

Portable Hi-Fi Stereo with Console Sound

for Christmas

The December issue of Good Housekeeping magazine carries to your customers the exciting Christmas gift story of budget-priced Harmony stereo portables.

**Never before a Christmas sales opportunity like this**

The five decorator-styled, advance-engineered Harmony portables have been awarded the Good Housekeeping Guaranty Seal . . . respected by over 40,000,000 women buyers. These convenient portables with big console sound are all priced under \$100\* at retail. This means trustworthy quality and unbeatable value that anyone

can be proud to give . . . and an unprecedented Christmas sales opportunity for you.

**See your distributor now**

Place your order now. Order enough to avoid disappointing last minute Christmas shoppers. And order plenty of Harmony Line Folders, RPA-289, to leave on service calls. Get the Harmony Window Poster, RPA-299, and the Dealer Helps Booklet, RPA-290, and use them to start planning your profit-making Christmas promotion.

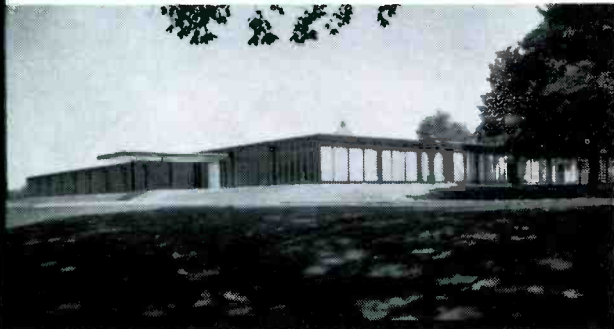
\*Slightly higher in West and South

**CBS ELECTRONICS**, Danvers, Massachusetts, U.S.A.

A Division of Columbia Broadcasting System, Inc.

RECEIVING, INDUSTRIAL AND PICTURE TUBES • TRANSISTORS AND DIODES • AUDIO COMPONENTS • PHONOGRAPHS

# CBS LABORATORIES LEADER IN RESEARCH AND DEVELOPMENT



Pioneered in the creation of a practical color television system  
 Put on the air the world's first color TV broadcast  
 Developed airborne, guidance and electronic countermeasure systems  
 Produced revolutionary color television microscope  
 Co-operated with CBS Electronics in engineering improved electron guns and screens for color TV  
 Designed closed-circuit color TV for medical use  
 Also a leader in acoustics, recording, solid state physics, semiconductor, vacuum tube and advanced electronic systems research and development

CBS Laboratories, Stamford, Conn.

# CBS ELECTRONICS LEADER IN TUBE QUALITY AND DEVELOPMENT

Producers of receiving tubes top-rated by leading radio and TV set makers  
 Manufactured first practical color picture tube, CBS-Colortron  
 Introduced first Bantam GT receiving tubes  
 Originated first Bantam Jr. subminiature tubes  
 Pioneered the first rectangular picture tube  
 Designed first receiving tubes rated for Continuous Television Service

CBS Electronics, Danvers, Mass.



## CBS DIVISIONS WORK TOGETHER FOR YOU...

The CBS family habit of being first helps guarantee you the quality of performance that only leadership can deliver. This leadership is your further assurance that:

- CBS tube quality cuts your call-backs.
- CBS tube quality insures your customers of dependable performance.
- CBS tube quality guarantees profits for you.

Ask for the leader with the top-rated name your customers know and trust. Ask first for CBS.



## CBS ELECTRONICS

Danvers, Massachusetts  
 Electronic manufacturing division of  
 Columbia Broadcasting System, Inc.

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

# CARTRIDGE REPLACEMENT EASIER WITH



**ONLY**  
**27**



The CBS-Ronette line makes cartridge replacement easier through simplification. Only 27 replace over 500 models. And the popular CBS-Ronette is also the exact, sure-fire replacement for over 6,000,000 CBS-Ronette cartridges alone in the U. S. A. Ask your distributor for the easier-to-replace quality cartridge . . . CBS-Ronette.

**REPLACE  
OVER**



## This 8-page Catalog Speeds Replacement

A photograph and exact-size silhouette for each cartridge provides quick identification of model number. Chart cross-references CBS-Ronette with 500 cartridges. Handy tables give pertinent technical data, illustrate and describe various bracket installations. Ask your distributor for this easy-to-use Catalog PF-285 along with your CBS-Ronette cartridges.

**CBS ELECTRONICS**

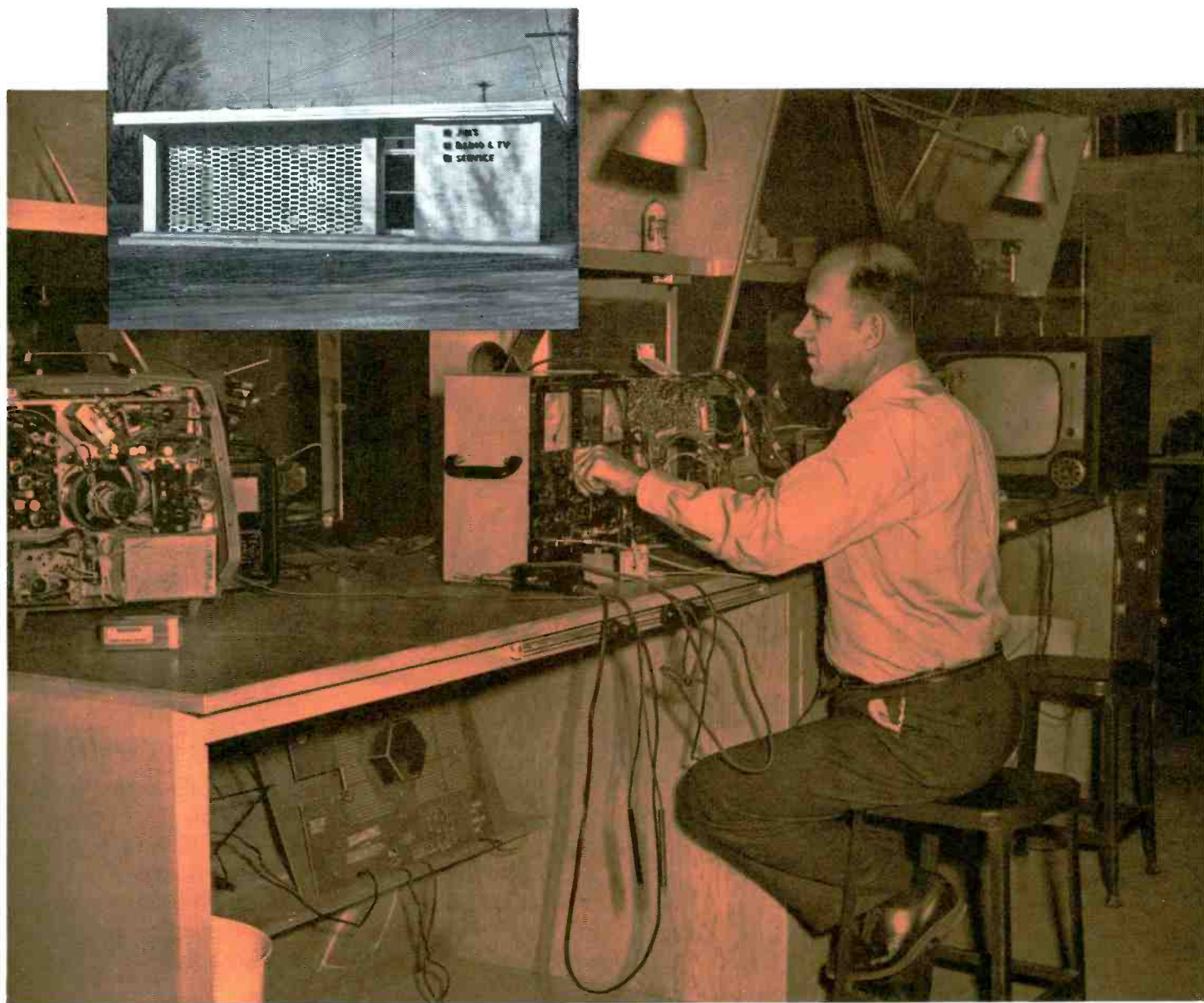
DANVERS, MASSACHUSETTS, U. S. A.

A Division of Columbia Broadcasting System, Inc.

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

*TV Technician JIM CARPENTER says...*

# “Service Is Our Only Business... That’s Why We Use Mallory



Jim Carpenter started his own business—Jim’s Radio & TV Service—in Springdale, Arkansas. Over a period of ten years it has grown from a one-man operation to a firm that employs six full-time men. Recently Jim moved to the new building shown above.

Concentrating on dependable service gave

Jim a reputation which allowed business to grow quickly. Jim and his men handle radio and television service throughout their trade area.

Jim is a Major in the active Army Reserve. He carries a commercial card and is branching out into commercial mobile work.



# Quality Parts"

"When a shop concentrates on service, it can't afford to take chances with customer satisfaction. So we depend on Mallory components. They're always consistent in quality. And I always feel 'safe' about a job when I've used Mallory components . . . there's no worry about costly, time-consuming callbacks. Mallory has been giving me the same quality



and dependability since I started in business . . . quality and dependability that I've come to take for granted."

When it comes to controls, for instance, hundreds of technicians like Jim choose low-noise, long-lasting Mallory Sta-Loc\* controls. In just 30 seconds their distributor can give them the exact replacement they need . . . of any of over 30,000 combi-

nations. No need to wait days for out-of-stock controls. What's more, Sta-Loc design lets you replace the line switch by itself, without unsoldering control connections.

Whatever your service needs, Mallory provides the widest selection of quality components at sensible prices. And every Mallory component is service-engineered to assure long, trouble-free life.

\*Trademark



*Put an end to callbacks  
with these quality  
Mallory products...*



**Gems**—5 rugged, moistureproof, Mallory "Gem" tubular capacitors in an easy-to-use dispenser that keeps your stock fresh and clean—easy to find—no more kinks in lead wires. They're your best bet for outstanding service in buffer, by-pass or coupling applications.



**RMC Discaps**—are a product of the world's largest producer of ceramic disc capacitors. Long the original equipment standard, Mallory RMC Discaps are now available for replacement. They come in a handy 3" x 5" file card package . . . easy to stock, simple to use.

Registered Trademark of Radio Materials Company, a P. R. Mallory & Co., Inc. Division.



**FP Electrolytics**—The Mallory FP—the original 85°C capacitor—now has improved shock-resistant construction and leakproof seal. Its etched cathode construction—standard in all FP's—assures hum-free performance. High ripple current ratings fit the toughest filter circuits.



**Silicon Rectifiers**—New Mallory design gives far longer life, lower forward voltage drop and reverse leakage current than conventional types . . . exceeds the requirements of military humidity tests. In convenient kits for replacement of selenium rectifiers in radio and TV.



**TC Tubular Electrolytics**—provide the same high quality and performance characteristics that are found in all Mallory components. They are now available in the handy twin pack.



**"IT'S A WEBSTER CARTRIDGE, SIR  
— EVEN BOWSER  
CAN TELL THE DIFFERENCE"**

Well... it only goes to prove Websters give customers a lot more than they expect from a phonograph cartridge. You can tell a convincing performance story — no need to get technical either. Take the Webster Stereo-Ceramic, for example. It plays the new stereo discs with exceptional brilliance and depth — standard LP's and 78's with higher fidelity than ever before! And, that's just one... all Webster cartridges are star performers. Recommend and install them every time. It pays!



**look for it at your jobber —  
NEW WEBSTER SERVICE CENTER**

When you see this modern cartridge merchandiser, you know you'll get fast, efficient service. Quick-reference chart assures accurate replacement for nearly every phono cartridge.

**ELECTRONICS DIVISION  
WEBSTER ELECTRIC**  
our **50**th year  
**RACINE · WIS**

franklin adv. Y 137

## Letters

(continued from page 14)

Dear Editor:

Hooray for your explanation to John Standen. Mr. Standen does not seem to believe in the right of every American to engage in free enterprise.

Here in Beckley, two of the best equipped shops, including everything needed for color TV work, are operated on a part-time basis. My own shop includes a PHOTOFAC Library and \$2300 worth of test equipment.

I and a few other part-time men of my acquaintance are often called for advice on the dogs. Does that sound like incompetence?

JOHN J. KODAK, JR.

Beckley, W. Va.

Dear Editor:

I was both surprised and pleased to see my letter printed in your October issue.

To be sure, there are many well-qualified part-time servicemen. My wish is that we could make this field attractive enough for them to make it their full-time occupation.

Too, I wish that there were some way of impressing members of our trade with the thought that it takes more than a knowledge of electrons to be an asset to the industry. It is regrettable that more of us don't realize the benefits that could be accrued if only we could be one strong voice.

PF REPORTER is truly the best publication in our industry. The technical articles are all very well written and attractively illustrated. May your publication enjoy even greater success in the future.

JOHN STANDEN

Wind-A-Meer Radio & TV Service  
Cleveland, Ohio

Dear Editor:

I find myself using back issues of PF REPORTER more and more for reference as I run into "dogs" and new circuits. However, I would subscribe to your magazine even if I weren't in the service business. It is excellent!

EUGENE M. VESTAL

Donie, Texas

*The guy who wisecracks that even the "fibs" are biggest in Texas gets his subscription cancelled. By the way, if you weren't in the service business, you couldn't subscribe to PF REPORTER.—Ed.*

Dear Editor:

This is to thank you for your immediate telegraphic response to my S.O.S. for a PHOTOFAC listing on a "dog" portable television receiver. The TV service industry as a whole should be made aware of the fact that your organization stands behind them, whether big or small, with a helping hand.

ELLIOTT J. DULLEA

Maple Shade TV Service  
Maple Shade, N. J.

**Hold that line  
against callbacks**



Just one callback throws your profits for a loss on the next three service calls. But you can tackle any service job and make big gains in profit territory, when you back your line with Tung-Sol Blue Chip quality. Made to industry's top standards, Tung-Sol tubes are best for every replacement — radio, tv or hi-fi. Tung-Sol Electric Inc., Newark 4, N. J.

*Tell your jobber you'd rather have*

**ts TUNG-SOL®**

*Blue Chip Quality*

**TUBES • TRANSISTORS • DIODES**

# ANALYZING

## FM-DETECTOR CIRCUITS

Browsing through some of the 1959-60 TV schematics, I noted that most of the current crop of sets are using some type of quadrature-grid sound detector — with the locked-oscillator variety (6DT6) leading the gated-beam type (6BN6) in popularity. However, the time-proved dual-diode types of sound detectors are far from obsolete. Several manufacturers (for example, Sylvania and General Electric) are clinging to the ratio-detector circuit, while Philco, Emerson and Muntz have included a discriminator (the original FM detector circuit) in many recent models — among them Philco's new transistorized portable TV.

Of course, you'll find a ratio detector or discriminator in the great majority of television sets made during the past several years. These dual-diode circuits have operated reliably year after year; but sooner or later, as a set ages, its sound section is likely to require service. When the performance of an FM detector begins to fall off, the cause often cannot be revealed by ordinary voltage and resistance

checks—so the serviceman needs to understand how this type of circuit works before he can restore it to "like-new" condition.

Both types of dual-diode sound detectors have the same basic purpose—converting *frequency* variations of the incoming signal into the *amplitude* variations that comprise the audio output signal—and they both accomplish this job in a similar manner. However, there are some key differences to keep in mind.

One characteristic of a discriminator (you might call it a drawback) is its tendency to respond to variations in *amplitude*, as well as *frequency*. In a TV set, such amplitude modulation is mainly in the form of buzz, hum, and random noise similar to radio "static." To keep this AM "trash" out of the audio channel, it must be removed from the signal somewhere ahead of the discriminator stage. For this purpose, a *limiter* stage is usually placed just ahead of the discriminator. This is often a sharp-cutoff pentode such as a 6AU6, operated at low plate and screen voltages so

that peaks of the input signal will drive the tube into saturation and cutoff. (This action levels off both positive and negative peaks, effectively removing AM from the signal.) Two sound IF stages are generally required ahead of a discriminator—one for sound IF signal amplification, and the other for limiting.

The ratio detector's most notable feature is its built-in ability to suppress most of the AM "contamination," and therefore no limiter is needed. Thus, a set having this type of circuit can generally get along with just one sound IF stage.

The intercarrier type of TV sound system has been used so widely for the past eight or ten years as to be considered almost universal. Therefore, you can expect nearly all television sound detectors to be tuned to a "center" frequency of 4.5 mc, which is standard for intercarrier circuits. Of course, modulation will cause the frequency at any given instant to vary by as much as 25 kc above or below the center frequency.

### Discriminator Action

In a typical discriminator circuit (Fig. 1), sound IF signals are coupled from the primary to the secondary of input transformer L1 in two different ways — capacitively through C3, as well as inductively across the transformer windings. The two signals applied to the secondary differ in phase from each other, and the phase angle between them constantly changes with the frequency of the input signal. This fact is fundamental to the circuit's operation, because the phase-shifting action causes the current through the diodes to vary in such a way as to develop an audio output signal.

• Please turn to page 64

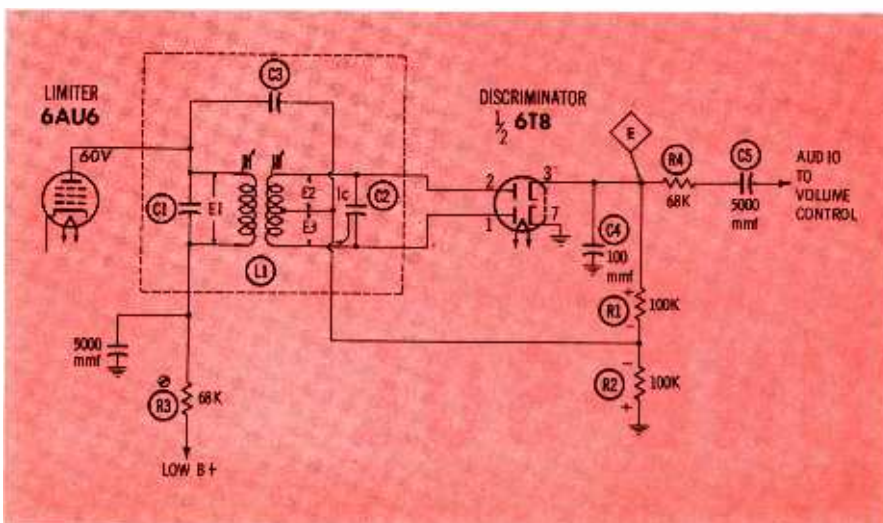
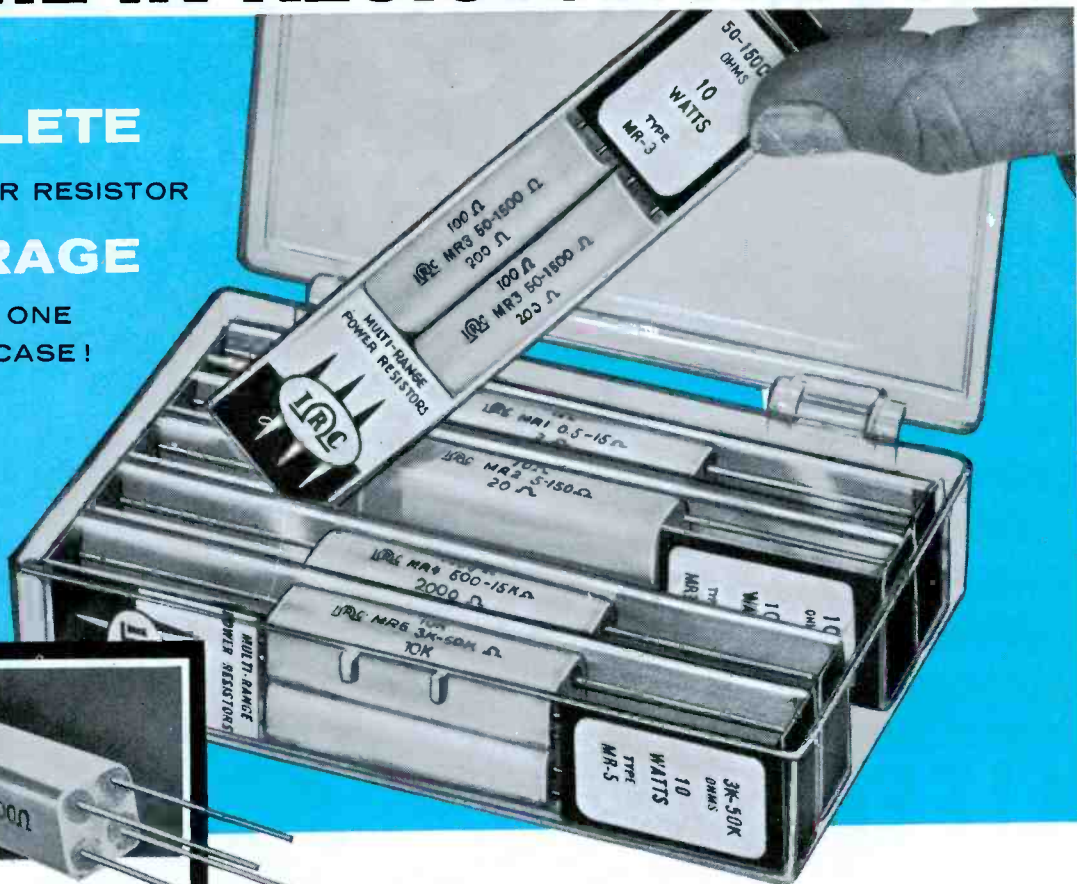


Fig. 1. Discriminator output signal appears across resistors R1 and R2.

# 1ST TIME IN RESISTOR HISTORY

**COMPLETE**  
10-WATT POWER RESISTOR  
**COVERAGE**  
IN JUST ONE  
POCKET CASE!



**HERE'S THE SECRET!**

*With the new IRC*

**MULTI-RANGE RESISTOR**

ONLY **5** TYPES  
COVER  
**200**  
VALUES

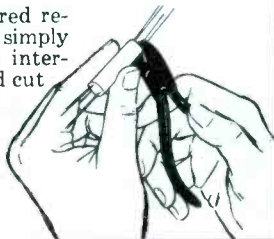
10-watt ranges from 1/2 to 50K ohms

The first new approach to power resistors in 25 years. 4 separate elements sealed in a single, steatite case. Axial lead design speeds replacement. Steatite case provides superior insulation.

**QUICK, SIMPLE TO ADAPT!**

Only 10 basic terminal interconnections... all with axial leads. Connection diagrams in each Handy-Pak.

For the required resistance value, simply solder desired interconnection and cut off unwanted terminals.



New! Compact! Efficient!

## IRC MULTI-RANGE RESISTOR KIT!

ASSORTMENT #55

CONTAINS **5** HANDY-PAKS

10 Type MR Resistors

**\$6.60**  
dealer net

Here's super-convenience on power resistors. Have complete 10-watt coverage right at your fingertips... in a stock so compact it fits in the palm of your hand. No delays for odd values... no costly inventories of slow-movers.

- Kit gives complete 10-watt coverage of 200 values.
- Contains 5 Handy-Paks—2 of each Type MR resistor—10 Multi-Range units.
- Rigid, clear-plastic box with hinged lid.
- Measures only 5 1/4 x 1 1/4 x 3 1/2".

Available Now From Your  
IRC Distributor. Order  
Yours Today!

**INTERNATIONAL RESISTANCE CO.**

Dept. 364, 401 N. Broad St.,  
Philadelphia 8, Pa.

In Canada: International Resistance Co.,  
Ltd., Toronto, Licensee



# Winegard TV get BIGGEST

These  
leading TV  
stars are  
appearing in  
Winegard  
national  
ads in

**LIFE**

BETTER HOMES & GARDENS  
FARM JOURNAL



★ Steve Allen



★ Ward Bond

LORETTA YOUNG

You'll see

"THE  
*Loretta Young*  
SHOW"

NBC-TV SUNDAYS 10P.M.

Best  
with the new

**Winegard**  
GOLD TV ANTENNA

FREE BROCHURE tells why best  
reception is Guaranteed:

Get the facts about the revolutionary, new patented  
Winegard Color'Ceptor TV antenna. POWERFUL,  
cuts snow, ghosts, gets more channels. Gives your  
black and white or color TV picture new life—  
Write TODAY for free brochure or  
www.americanradiohistory.com

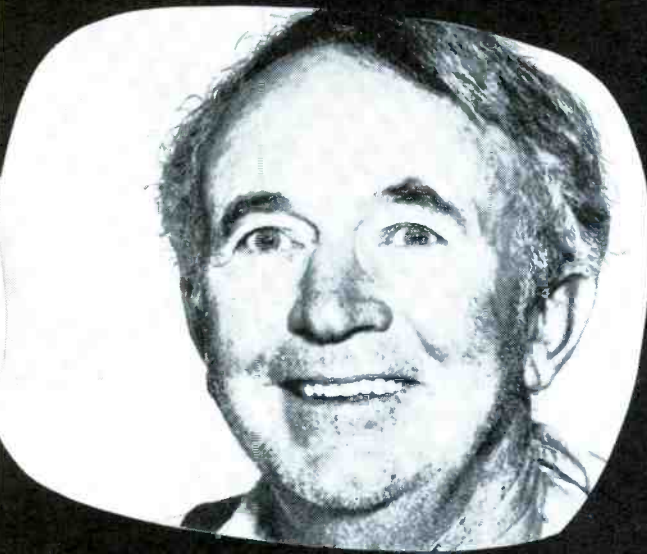
## Compare what you get— Get what's best for you!

You've got to sell every day, every month, all year—  
AND THAT'S EXACTLY THE WAY WINEGARD ADVERTISES, month in, month out, all year, non-stop, in big space, in the big magazines, featuring the biggest TV shows and stars. No one-shots. No bull. No brag. No baloney. But cash-on-the-line for the industry's longest, stongest, national campaign—backed by the industry's most dynamic local *dealer tie-in sales material*, all FREE. Examine the backing you get, get what's best for you!

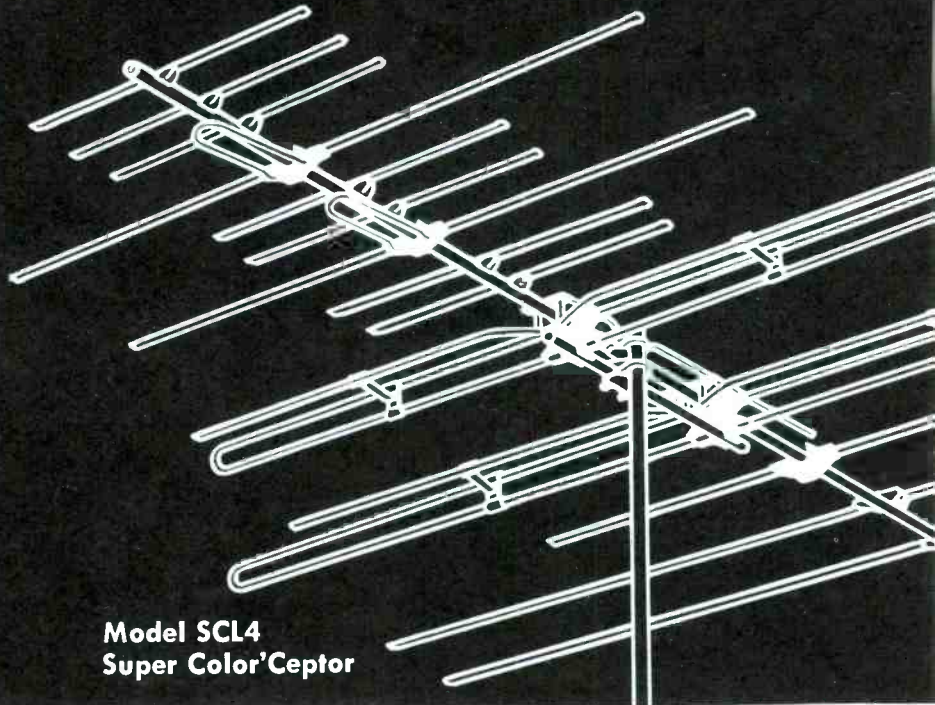
Call your Winegard Distributor now, or write  
Winegard, 3009-12 Scotten, Burlington, Iowa

Ask your distributor about  
Winegard's generous dealer  
co-op advertising plan.

# Antenna Dealers Advertising Backing



★ *Walter Brennan*



Model SCL4  
Super Color'Ceptor

PAT. NO. U.S. 2700105 - CANADA NO. 511994

**WINEGARD HELPS PUT YOUR NAME ON EVERY  
HIGHWAY ENTERING YOUR TOWN**



### FREE GIANT ROAD SIGN

With every Color'Ceptor antenna you buy, you get a *Free* promotion buck. Use your promotion bucks to get the sales aids that will help you most.

Metal Road Sign, Illuminated Window Sign, Metal Store Front Sign, Silk Wall Banner, Balloons, Shirt Emblems, Truck Decals, Full Color Postcards and Mailing pieces, Gold Anodized display pole.

**And who offers  
the best of all  
TV antennas—  
PROVED—  
GUARANTEED?**

Leading Consumer Research Organization Confirms what the World Already Knows—

**It's Winegard  
COLOR'CEPTOR!**

**SELL THE LINE  
THAT REALLY HELPS  
YOU SELL!**

# *Winegard*

**Feature the Leader and BE one!**

# LARGE-CURRENT

## Getting acquainted with thyratrons

Tubes used in industrial electronics for the control of large currents function somewhat differently from low-power types. Gas-filled, hot-cathode tubes are widely used instead of vacuum tubes because of their greater efficiency in heavy-duty applications. The gas within the tube ionizes during normal operation; thus, the voltage drop across the tube is low in value and independent of plate current. By contrast, a vacuum tube has a considerable internal voltage drop, and its plate voltage changes as the plate current fluctuates. (This is often a disadvantage in industrial electronic circuits.)

### Thyratrons

In principle, thyratrons are merely gas-filled triodes, but their construction is quite different from that of ordinary vacuum-type triodes. The grid in a gas-filled tube must be arranged so as to prevent *all* electron flow when the tube is biased into cutoff. A minute amount of current can be tolerated in a vacuum tube while it is in the cut-off state, but even a very small electron flow in a thyatron is sufficient to ionize the gas and drive the tube into full conduction.

Fig. 1 illustrates a thyatron with a tubular grid structure. The grid is designed to serve also as a cathode shield. In this way, it completely controls electron flow, helps contain the cathode heat, and also shields

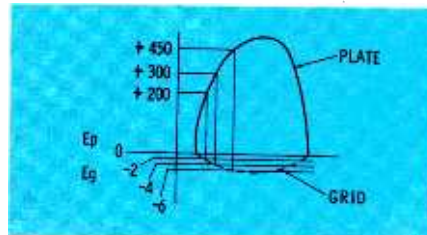


Fig. 3. Critical grid-voltage curve.

the cathode from external stray fields. This type of grid structure results in a heavy grid current.

Some thyratrons use *shield-grid* construction, as shown in Fig. 2. Note that a separate shield grid surrounds not only the cathode but also the control grid. Less current flows from cathode to control grid, and the tube is also more sensitive to changes in control-grid voltage. The shield grid in a small tube is usually tied to a base pin. If this grid is at cathode potential, the shield-grid thyatron and the simple triode thyatron have about the same grid-voltage and plate-voltage relationship. But, if the shield grid is made more negative than the cathode, the control grid must then be driven slightly positive to cause conduction.

In a thyatron, the grid controls a very large plate current—in some cases as much as 40 amperes—but not in exactly the same way as in a vacuum tube. For any given value of plate voltage, there is some definite value of grid voltage required to prevent conduction. The higher the plate voltage, the greater this nega-

tive grid voltage must be. For example, if the plate voltage of a certain thyatron were increased from 200 to 450 volts, the grid voltage would have to shift from  $-2$  to  $-6$  volts to keep the tube cut off (see Fig. 3). The points on the grid-voltage curve in this figure are called *critical values* — the minimum voltages required to prevent the thyatron from firing (conducting). In most cases, it can be assumed that the thyatron will fire when the grid potential is zero (or slightly positive), provided the plate is positive with respect to the cathode.

Once the tube fires, it cannot be cut off again by simply making the grid voltage more negative than the critical value. To bring tube current to a halt, the gas in the tube must be deionized by greatly decreasing the potential difference between plate and cathode. The simplest means of doing this is to use AC for the plate-supply voltage, so that the negative alternations will cut off the tube and permit the grid to regain control.

Three basic methods are used to enable the grid to control the firing of the tube. These are (1) changing the phase relationship between the AC grid and plate voltages, (2) changing the value of the DC grid voltage about which the AC signal alternates, and (3) using a waveshape other than a sine wave on the grid to act as a trigger.

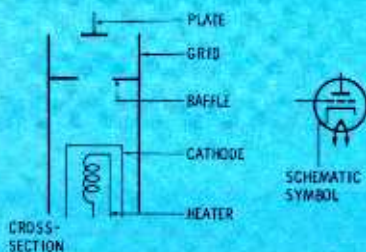


Fig. 1. A single-grid thyatron.

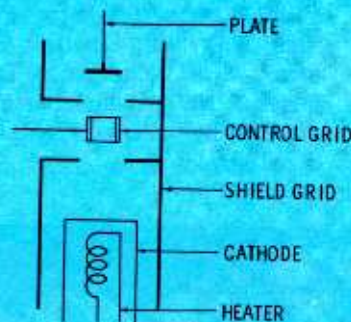


Fig. 2. Thyatron with shield grid.

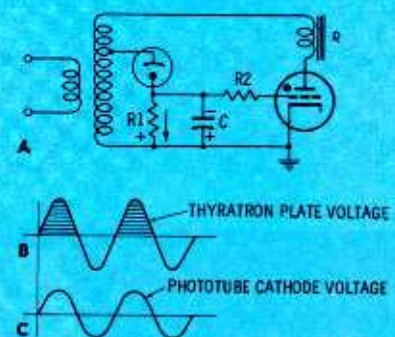


Fig. 4. Photoelectric thyatron control.



# ELECTRON TUBES

## and ignitrons . . . by Allan Lytel

An example of a thyatron control circuit is shown in Fig. 4 where a phototube and a thyatron are used with an AC power supply. An AC voltage (Fig. 4B) is applied to the thyatron plate, and the tube conducts only when the plate is positive. The phototube cannot conduct while its cathode is positive (which is at the same time the thyatron is conducting).

When the phototube is dark, it will not conduct if its cathode is negative. The grid of the thyatron then remains at ground potential, and the thyatron fires on the positive alternations of plate voltage. The resulting plate current energizes relay R.

When light hits the phototube, this unit acts as a rectifier, conducting on alternate half-cycles of input voltage when the cathode is negative with respect to the anode. The current through the phototube charges capacitor C to the peak value of the AC voltage applied to the phototube.

This charge keeps the grid voltage of the thyatron below cutoff. As long as light shines on the cathode, the phototube holds the thyatron grid negative enough to prevent thyatron conduction and keep the relay open. Interruption of the light removes the grid bias (since the capacitor discharges through R), fires the thyatron, and closes the relay.

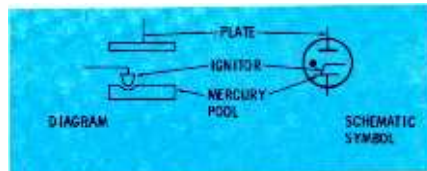


Fig. 6. Elements inside an ignitron.

### Ignitrons

An ignitron is a gas-filled diode used to control large currents from 40 to 10,000 amperes. There are many different ignitron types, most of which bear little physical resemblance to small vacuum tubes. Ignitron diodes can rectify very large AC currents, since they are able to carry steady loads of several hundred amperes. However, their greatest use is in the handling of heavy surge currents of several thousand amperes for short times, as in an AC switch. In effect, the ignitron replaces a mechanical switch; but it operates with little maintenance and has no moving parts.

The drawing in Fig. 5 shows the construction of an ignitron. A heated cathode is used, but a pool of liquid mercury takes the place of a solid filament. The unit is surrounded by a jacket through which water is circulated for cooling purposes.

A small, tapered piece of boron carbide is used as the starter or ignitor, and touches the mercury pool as illustrated in Fig. 6. Although the boron carbide and mer-

cury are in contact, there is a small resistance (100 to 500 ohms) between them because of the physical nature of the materials. When a current of about 40 to 50 amperes flows through this junction, it develops an arc which frees a large supply of electrons and allows the tube to conduct from cathode to plate. After conduction starts, the ignitor circuit is turned off. The anode keeps the cathode in operation with very small current flow.

The action of an ignitron as an AC switch can be understood from Fig. 7, an elementary circuit of a welding control. When terminal A of the power supply is positive, the tube cannot conduct. When A is negative, the cathode is negative and the plate is positive. Conduction from the cathode mercury pool to the ignitor is now possible if the ignitor switch is closed. This conduction starts the mercury arc and causes the tube to begin operating as a half-wave rectifier. Controlling the switch action will permit control over the current flow through the transformer to the welding arc.

An actual circuit is shown in Fig. 8. Two ignitrons are connected back-to-back or anode-to-cathode. The copper-oxide rectifiers prevent harmful current flow from ignitor to mercury pool in both tubes. (Normal ignitor current is from the mercury pool to the ignitor.) When

*\*Please turn to page 70*

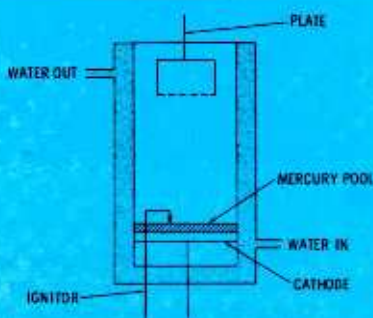


Fig. 5 Cross-section of an ignitron.

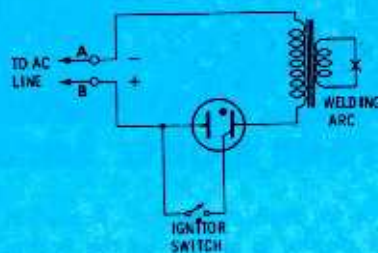


Fig. 7. Simplified ignitron circuit.

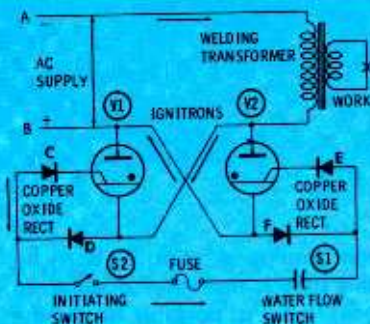


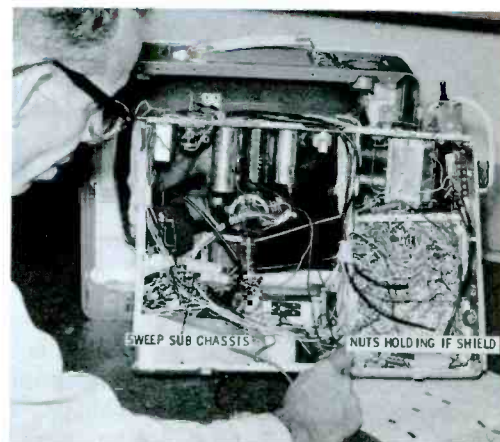
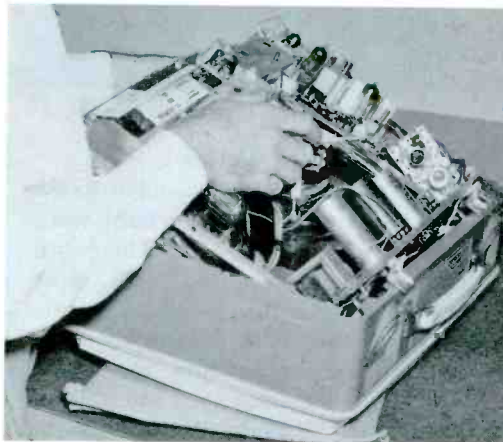
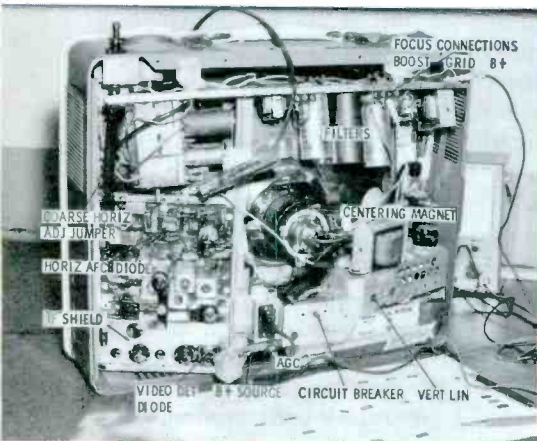
Fig. 8. Circuit using two ignitrons.

Portable TV's are a special breed. Because of their low initial cost, owners are reluctant to pay the usual service charges—and yet, in many instances, the compact design of portable sets increases service time. Thus, the problem facing the serviceman is how to effect minimum-cost repairs.

This does not mean you should reduce your hourly service rate; however, you should take every advantage of set design to make the most effective use of your time, talent, and equipment. For example, having the customer pickup and deliver the set saves him the usual fee for this service. Additional savings will result if the set can be repaired in the cabinet (even if you make the pickup and delivery).

To help you with this last point, we've analyzed four different portable designs to show you how their specific features can be used to advantage in cutting servicing time. These hints, combined with your own ingenuity, will go a long way toward having portable owners return to you for all their work.

# SERVICING



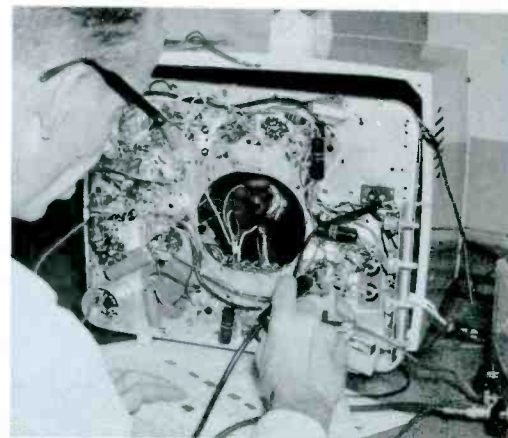
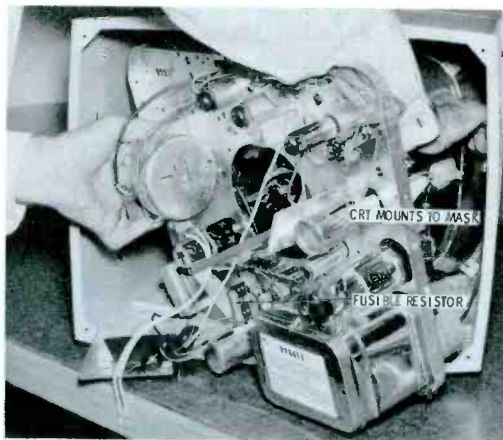
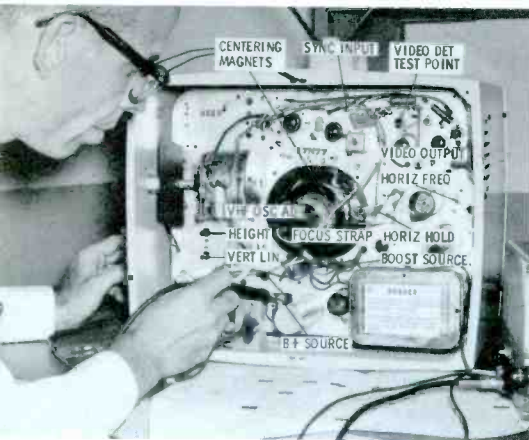
## ADMIRAL MODEL PL17F31B

Removal of the rear cover on this set permits waveform analysis in all except the vertical circuit, and voltage measurements in all except the video IF and deflection amplifier circuits. The IF strip is covered by a shield which must be removed from the bottom. Components are

located so that most of them can be replaced without disassembling the set.

In the event the chassis does have to be removed, there are just four easily-accessible plug-in connections, and 7 chassis bolts. Tilting the chassis as shown permits it to be easily slipped out.

Bottom shields have been removed, exposing the entire printed board for circuit tracing. The nut indicated is one of two which hold the IF shield on top. Removing three metal screws permits the sweep subchassis to swing back, and makes servicing easier.



## TRUETONE MODEL 2DC3030A

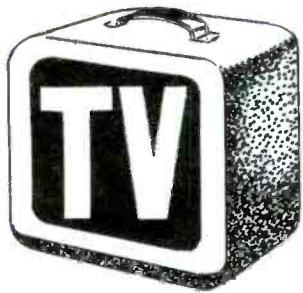
Although equipped with a carrying handle, this style is more like a standard table model than a portable (note the conventional vertical chassis). B+ and boost voltages as well as video output and sync input signals may be checked

prior to chassis removal. A plug-in fusible resistor is hidden by the probe.

Disconnecting the HV lead from the front, to which the CRT is mounted, can be removed to service the chassis in the

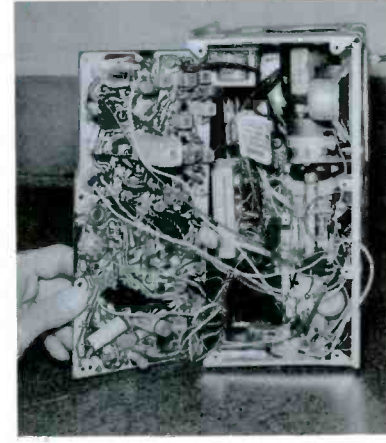
cabinet. The forward screw securing the handle also holds the cabinet front.

Once the conventionally-wired chassis is removed, circuit tracing and component replacement require no special techniques, but a HV lead is needed.



# PORTABLES

by Joe Groves



## PHILCO MODEL H2010L

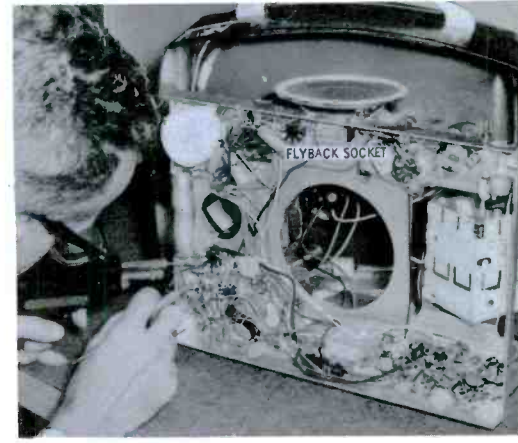
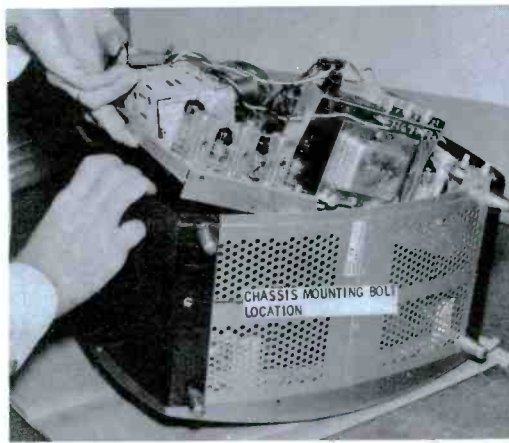
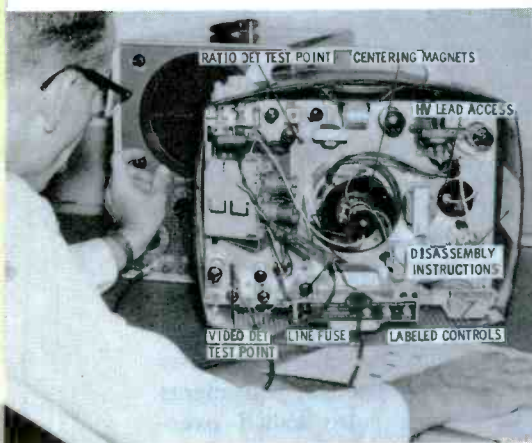
Trends toward extreme compactness are exhibited by this transistorized design. Note that the lower part of the case must be removed to reach setup adjustments. Use of printed boards permit all circuit tracing to be accomplished at this point of disassembly.

Removal of battery compartment, top, and optical system is necessary for CRT removal and access to the main chassis.

Opening the HV cage exposes the two 5642 HV rectifiers. The cage is a part of the "main chassis," and the printed-board sweep subchassis fits around it.

Hidden by the lid are the vertical hold, horizontal hold and brightness controls.

Both IF and sweep subchassis swing out for access to the printed-board components. Boards are held in place by metal screws, which also serve as ground connections to the chassis.



## SETCHELL-CARLSON MODEL P66

This conventional vertical chassis, while providing test points for only the video and audio detectors above the chassis, can be removed from the cabinet in a matter of a few minutes. Note the plug-in yoke and the chassis cutout for access

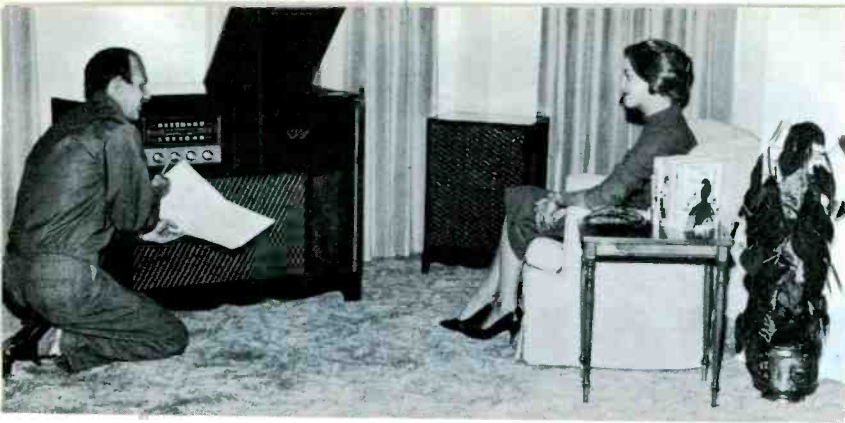
to the HV lead. The speaker mounts to the chassis.

Only one bolt need be removed, after the knobs are off and the CRT and yoke have been disconnected, to remove this chassis. Tilting the left side up as shown

allows the chassis to slide off two retaining posts holding the right side.

Troubleshooting and accessibility of components present no problems with the chassis in this servicing position. Note the special feature of a plug-in flyback.

# Customer



One of the biggest assets of any firm is satisfied customers—the kind who provide repeat business and recommend you to their friends. And one excellent way to keep customers satisfied is to be ready with expert advice on *any* problem they may have with electronic equipment.

Like many radio-TV men, you may have been steering clear of the audio field because you lack the specialized knowledge you need to deal satisfactorily with serious hi-fi fans. It's true that this branch of electronics harbors quite a few perfectionists, who may complain of equipment faults which you have difficulty in even recognizing; how-

ever, hi-fi has become enough of a mass-market item to appeal to listeners with ears no more "golden" than your own. You'll be surprised how much you can help a nontechnical person to improve the performance of his hi-fi set, just by instructing him on the proper adjustment of amplifier controls and the care of phonographs.

Yet, if you haven't been keeping pace with audio developments, you may not be well enough versed in such things as equalization, tone, and loudness controls to give accurate answers to the average customer's questions. If you're in this unfortunate state, read on for a dis-

cussion of several pertinent subjects which often come up in dealing with hi-fi owners.

## Equalizers

The program material on a phonograph record exists in the form of tiny, almost invisible ripples in the record grooves. Although its width is constant, the groove follows a snakelike path with periodic side-to-side motions. (In stereo records, cuts are also made at a downward angle into the walls of the groove.) For high notes, the groove ripples are faster (closer together) than for low notes. For louder sounds, the sideward displacement is much greater than for sounds of lower intensity.

Music is reproduced as the playback stylus (needle) rides in these grooves. As the stylus follows the pattern of "wiggles" created during the recording process, its physical motions cause electrical signals to be induced into the phono cartridge. These electrical variations comprise the audio signal to be handled by the hi-fi system.

The walls of the record grooves are not completely smooth, and whenever the stylus passes by any minute rough spots, noise signals are introduced along with the music. In making the discs, recording companies try to minimize the noise; however, enough is still present to be a potential nuisance. The high-frequency components of music, which consist primarily of notes from the higher-pitched instruments and harmonics (also called overtones) of the other instruments, have less intensity than the low frequencies; if recorded at their natural amplitude, they tend to be blotted out by noise. To remedy this problem, the "highs" in the audio signal are *pre-emphasized* during recording. In other words, the amplitude

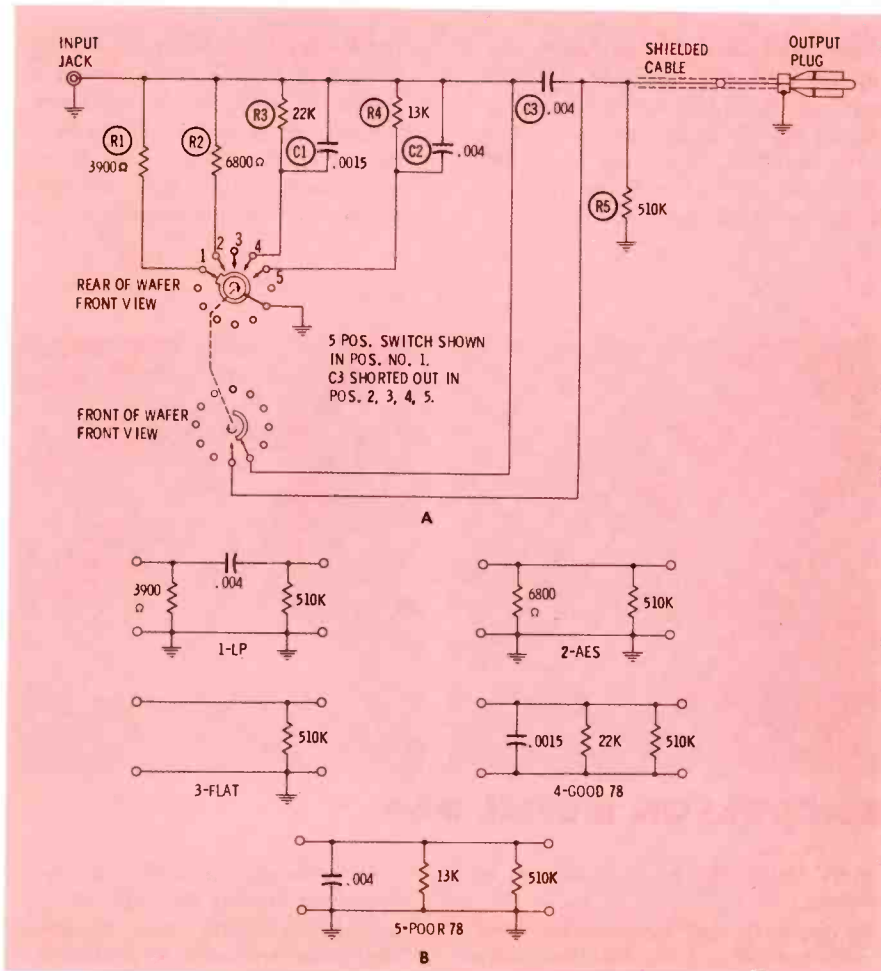


Fig. 1. 5-position equalizer. (A) Complete circuit; (B) Individual circuits.

# Satisfaction From Hi-Fi

of high-frequency signals applied to the cutting stylus is purposely increased so that the resulting groove variations are larger than the groove irregularities which produce noise. In this way, the signal overrides the noise interference. Large-amplitude, low-frequency signals cause greater side-to-side variations in the grooves, thus limiting the number of grooves and the amount of music which can be put on a disc. So, in recording, these "lows" are *de-emphasized* (reduced in amplitude) so that the grooves can be placed closer together without danger of overlapping. This enables each disc to give a longer playing time.

If played as recorded, a disc would provide insufficient strength for bass notes, and entirely too much treble and noise. Therefore, equalizers are employed in hi-fi amplifiers to reduce the high-frequency amplitude and to boost the lows, giving more natural sound. The different recording companies have been somewhat slow to standardize on how much to change the amplitudes during recording; as a result, several different recording curves have been used, especially on older records. The correct equalizer setting must be used during playback — otherwise, the balance between treble and bass may not be correct. The problem confronting the hi-fi owner is to select the proper equalization.

Fig. 1A is a schematic of a five-position equalizer. The selector switch is shown in No. 1 position, which is for the LP (long playing) recording curve. The other positions are: 2, AES (Audio Engineering Society); 3, Flat; 4, Good 78; and 5, Poor 78. The simplified diagrams in Fig. 1B show the applicable components for each of the five positions. This equalizer is a self-contained unit, but those built into preamps follow the same gen-

eral circuit design. Other equalizing circuits are also used, each for a specific recording curve.

Many records list the recording curve on either the label or the record jacket, and wherever possible the set owner should set the equalizer to the suggested position. If the correct setting is not available, then the closest one to it should be used, and the difference compensated by adjustment of the tone controls. Once a hi-fi user discovers a satisfactory combination of control settings, he may wish to note them on the record jacket for future use.

## Tone Controls

Equalizers are used to adjust amplifier response so that the most natural sound is produced from records. Additional variables are also needed, so most systems include two tone controls—one to regulate the bass, the other the treble.

A typical tone-control arrangement is shown in Fig. 2. C1, in

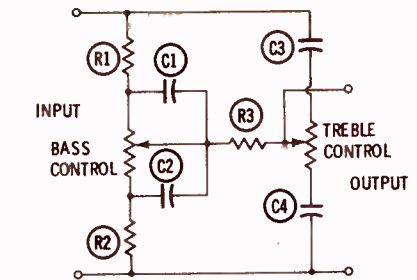


Fig. 2. Bass and treble control circuits.

series between input and output, decreases bass response, while shunt-connected C2 increases it; thus, if the control is set midway in its range, the bass amplitude is not altered. With the arm set at the "top" end of the control, C1 is shorted out, and maximum bass results. If the arm is at the bottom, C2 is shorted out and bass response is minimum. The values of R1 and R2 set the range over which bass response can be varied. For the treble control, C3 determines the treble boost and C4 the treble cut, while a "flat" condition occurs at the mid-range setting. Maximum treble is produced with the control arm all the way up, and minimum treble is obtained when the arm is all the way down.

"Bass boost," "maximum treble," etc., are relative terms, since our ears respond to sounds in relation to other sounds. An example of how this is put to use is the tone con-

• Please turn to page 75

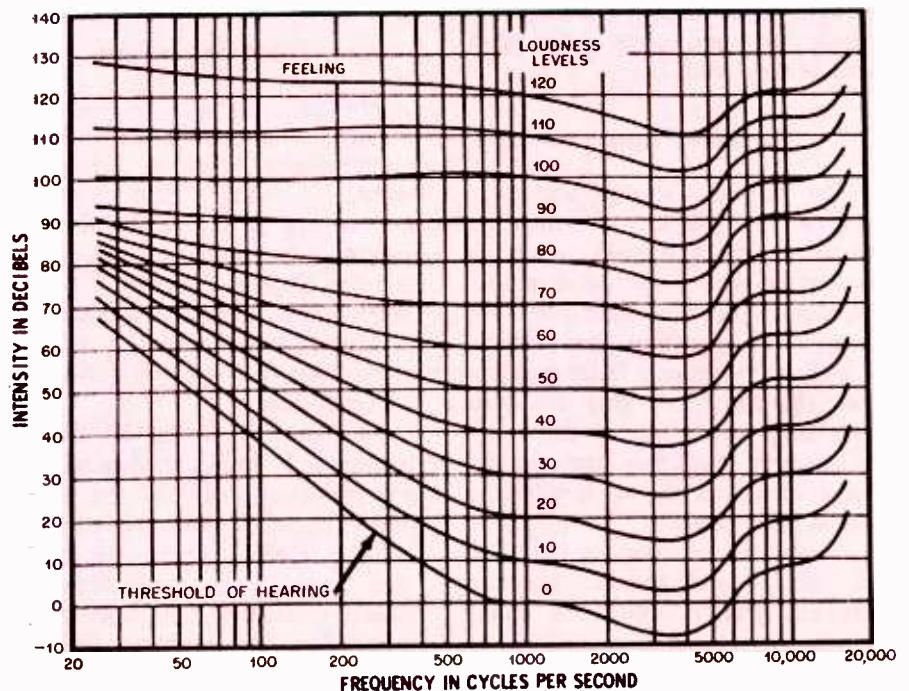
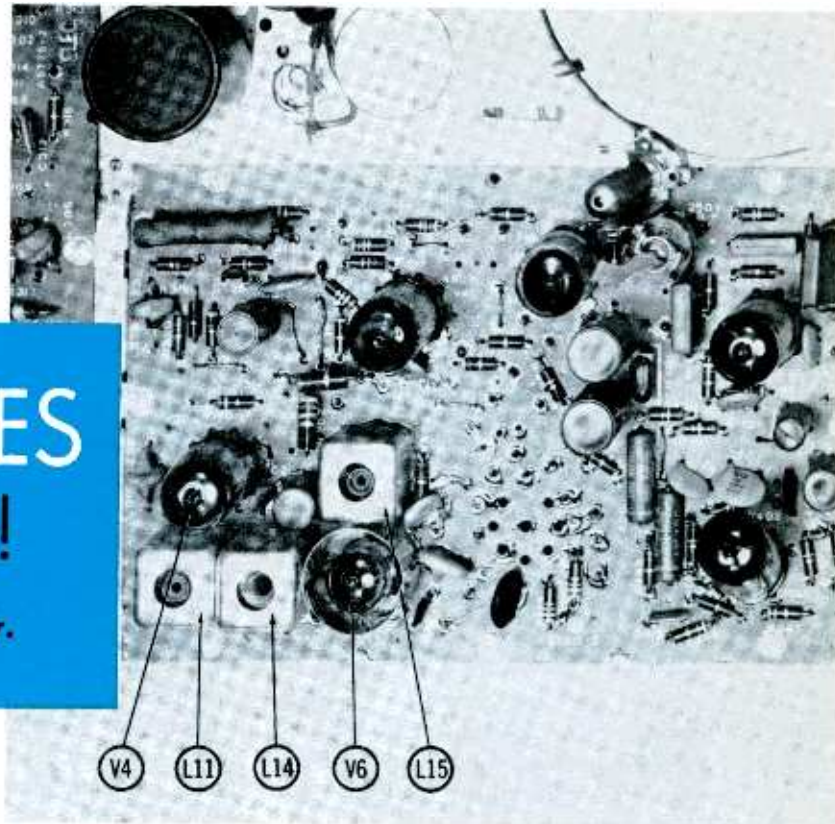


Fig. 3. Frequency response of ear varies with loudness, as these curves show.



# AUDIO TROUBLES can be tricky, too!

by Calvin C. Young, Jr.



**Fig. 1. Audio IF and detector component section used in Admiral receiver.**

An Admiral Model LHR21F321 TV set that came into the shop recently did a good job of reacquainting me with the fact that audio troubles aren't foreign to TV receivers. In all probability, your awakening won't come as a result of a similar brush with the same make of receiver; however, the lesson I learned should help rekindle the old thought processes and enable you to "think out" and solve audio problems as they arise.

### The Initial Approach

The problem started out as a routine complaint of distorted sound, which I figured would be cleared up with a new tube or two. Replacing all of the sound and audio tubes, and adjusting the detector and IF transformers, failed to eliminate the distortion. This was quite surprising, since one of the push-pull output amplifiers and the detector tube had tested defective in a good tube tester.

A quick visual check of the chassis, cabinet and speaker hookups revealed that it would be much simpler to take cabinet and all to the shop. (Because of the nature of the trouble, I deemed it necessary

to take the speakers as well as the chassis. Connection for the four speakers, two on each side of the low-boy cabinet, were wired and soldered, thereby complicating their removal and reinstallation.) Luck was with me, since the man of the house was at home and willing to offer his brawn to help get the set into the service truck.

### Shop Procedure

Further analysis of the problem in the shop indicated that the audio distortion had at least two causes. The sound was mushy and garbled at low volume levels, while a rattling condition was noted at high volume settings. It also seemed that maximum volume wasn't loud enough—at least it wasn't what I considered normal for four speakers and a 10-watt amplifier.

Realignment of the IF and detector stages in accordance with the procedure outlined in the service literature failed to improve sound quality at all. Tapping the chassis near some of the components disclosed unusually high microphonic tendencies. The condition seemed to be worse when the areas around L11, L14, L15, V4 and V6 (all

shown in Fig. 1) were tapped. The tubes were rechecked and the detector and output tubes previously found defective were now replaced. As I expected, this had little effect on the trouble.

The next step was to remove the TV chassis. Then the reverse side of the printed wiring board was carefully checked. Voltage readings were observed at key points while the three IF transformers (L11, L14 and L15 in Fig. 1) were tapped and twisted in several directions. At one point, I was able to get the sound to cut out when exerting a slight force on the shield housing L14. After removing this shield, the dual-winding transformer was carefully removed from the printed board. A subsequent visual inspection revealed traces of excess solder, which I could only assume was shorting one of the secondary coil terminals to the grounded transformer shield.

A little heat from a miniature soldering iron caused the excess solder to be drawn to the terminals. (This same principle can be employed if you desire to remove a component from a printed board. Simply heat the lead of the component to be removed, being very care-

why  
the most  
advanced  
professional  
cartridge...



**Electro-Voice**® NEW MAGNERAMIC \* 31 MD7

has ceramic  
elements!

For more than 35 years, Electro-Voice has been a leader in the development and manufacture of dynamic microphones and loudspeakers. Why then, with this extensive experience in designing and producing electro-magnetic devices, is Electro-Voice introducing the new Magneramic 31 Series stereo cartridge using ceramic elements?

The reason is that Electro-Voice is genuinely convinced that a precision ceramic cartridge is the finest type that can be made today . . . definitely superior to the magnetic type. The superiority of the Magneramic 31 is demonstrated in these three areas.

**GREATER FLEXIBILITY** — The 31 Series cartridge will operate perfectly at any stylus pressure from 2 to 20 grams. The same stylus assembly can be used for operation on both turntable and record changers; performance need not be compromised by using a special, stiff stylus assembly for record changers. Record wear is the only criterion in setting stylus pressure — cartridge operation is not affected. Thus, when converting from a changer to a turntable, or vice versa, replacement of the stylus assembly is not necessary when using the Magneramic 31.

**HIGHER OUTPUT** — Along with the trend toward less efficient speaker systems, more amplifier power has become a necessity. While most stereo amplifiers are now designed with input sensitivities to match the typical 5-millivolt output of magnetic stereo cartridges, nearly all monaural amplifiers were designed for at least 8-millivolt input. These cannot be driven to full output with a magnetic stereo cartridge. The Magneramic 31 develops a full 8-millivolt output and couples directly into any "magnetic" preamp unit. This higher output should especially be considered by those planning conversion to stereo utilizing existent monaural amplifiers.

**FREEDOM FROM HUM** — The increased amplifier gain required to satisfactorily drive low-efficiency speakers coupled with decreased cartridge output has significantly increased system hum problems. Also, conventional methods of hum elimination used in monaural magnetic cartridges become difficult or impossible to apply to stereo magnetics. The Magneramic 31 completely eliminates these problems — it is non-inductive and has adequate output.

The Electro-Voice Magneramic 31 MD7 cartridge directly replaces any monophonic or stereophonic magnetic cartridge now on the market. It feeds into the preamp input-jack specified for magnetic cartridges and does not require adaptors or circuit modifications.

**SPECIFICATIONS — MAGNERAMIC 31 MD7**

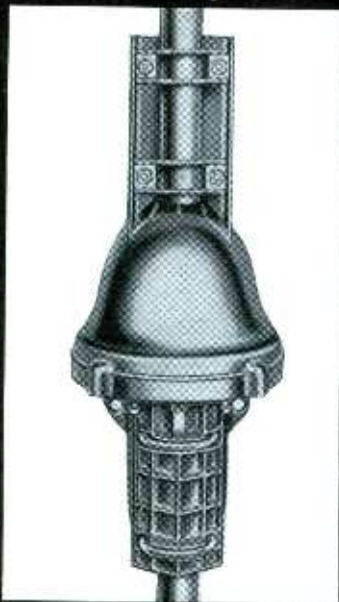
*Response Range:* 20 to 15,000 cps  $\pm$  2 db  
*Compliance, Vertical:*  $3.5 \times 10^{-6}$  cm/dyne  
*Compliance, Lateral:*  $3.5 \times 10^{-6}$  cm/dyne  
*Isolation:* 28 db @ 1000 cycles  
*Tracking Force:* 2 to 4 grams in transcription arms  
 4 to 6 grams in changer arms  
*Styli:* .7 mil diamond  
*Output:* 8 millivolts  
*Recommended Load:* 22,000 to 47,000 ohms  
 (Magnetic phono inputs)  
*Elements:* 2, Lead Zirconium Titanate (Ceramic)  
*Weight:* 8 grams  
*Terminals:* 4, standard .050" connectors  
*Mounting Centers:*  $\frac{1}{2}$ " and  $\frac{1}{8}$ " fits both  
*Audiophile Net:* \$24.00

Want more information? Write to Dept. 129R for the booklet entitled, "FACTS ABOUT THE ELECTRO-VOICE MAGNERAMIC CARTRIDGE"

**Electro-Voice**® INC.

BUCHANAN, MICHIGAN

## Cornell-Dubilier Rotors



turn profits  
your way

Whether you are after original installation business or replacement sales, you'll find the rotor best-suited for any job in the complete CDR line. Consider, the heavy-duty TR-4 recommended for areas where ice-storms, heavy snowfalls and strong winds impair the efficiency of antennas turned by ordinary rotors. Your CD Rotor distributor is ready to show you why the TR-4 and other CD Rotors are the easiest to install...most satisfactory in the long run. Write for catalog TVR to Cornell-Dubilier Electric Corp., S. Plainfield, N. J.

**CDÉ** **CORNELL DUBILIER**

Affiliated with Federal Pacific Electric Company

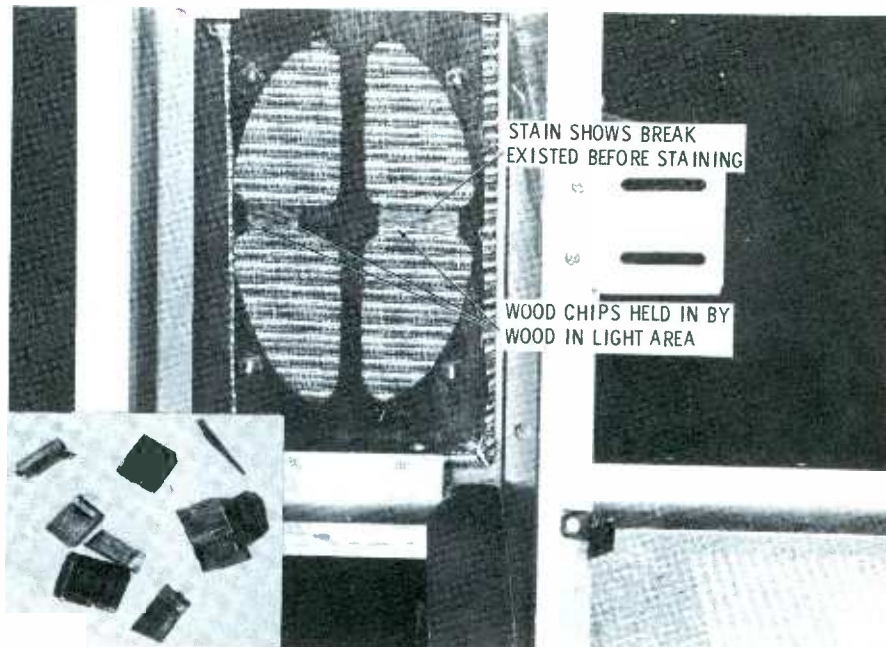


Fig. 2. Loose wood in 6" x 9" speaker cutout rattled at high volume levels.

ful not to heat the foil surface itself, and the solder will be drawn to the heat of the iron. A stiff brush is also useful for removing surface solder as it becomes molten. When most of the solder has been "worn away" in this manner, the remainder should be drawn to the heated lead, leaving it free from contact with the board.)

Getting back to the Admiral, I felt that since one of the IF transformers had revealed traces of excess solder, the others could bear investigation. Each of the shields was removed, and the extra solder was drawn back to the hot iron. Replacement of the shields and a touch-up of the IF alignment cleared up the sound distortion at low volume levels.

Because one of the audio output tubes had proved defective, the audio amplifier (located on a separate chassis) was given a quick check for leaky coupling capacitors, burnt resistors, etc. No defects were noted. This left only one possible source for the high-level rattling still present—the speakers themselves.

The four speakers were carefully removed and given the usual tests for rubbing voice coils and unbonded cone edges. No evidence of either type of defect was noted. The next step was to connect the amplifier output to the shop's speaker system—a 12" coaxial unit enclosed in a bass reflex cabinet. There was no trace of the distortion, so the cause for the trouble was definitely isolated

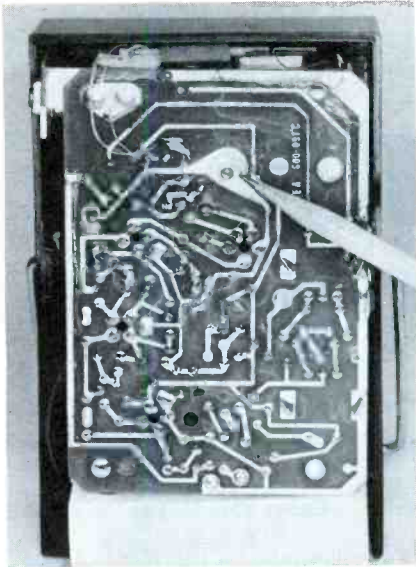
to the speakers—but they still didn't show signs of any defect that could cause the trouble. However, the speakers were connected to the audio amplifier and given a test in free air. This time the volume was slightly lower and fidelity was off a bit, but there wasn't a trace of the rattle.

Suspecting a rattle in the cabinet, I started a careful inch-by-inch check of the cabinet. Almost immediately, I found the cause—some loose wood on the cross member of the 6" x 9" speaker cutout (see Fig. 2). One layer of the plywood was loose and rattling. The bright spots pointed out are the places where the wood still held the loose layer to the board. All the evidence indicated that the defect had been present before the set left the factory. However, after talking to the customer, it was concluded that the condition didn't actually develop into a trouble until the set had been in operation for awhile.

The final solution to the problem included removal of all the loose wood chips (see Fig. 2 insert) and application of a layer of wood glue to the plywood around the speaker cutout. In lieu of a suitable glue, a heavy coat of varnish can be used.

My experience served to emphasize that you should not be too hasty in making a decision to take only a part of a TV receiver into the shop for repairs when the trouble could be caused by a portion left at the home.





### Something to Watch For

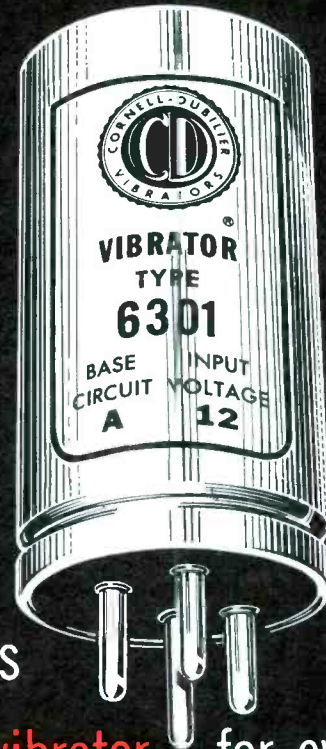
Here is a trouble which *you* can cause quite innocently by merely checking or replacing the batteries in many of today's transistor portables. It has to do with the printed-board retaining bolt and nut, which also serves, in conjunction with a thumb screw, to secure the rear cover to the case. The secret is that it *also* bonds the ground line of the printed board to the remainder of the chassis.

Quite often, loosening the thumb screw will also loosen the ground connection. The result is intermittent operation, dead set, low gain, etc., which may correct itself when the case is jarred or moved. It's good practice, when working on portable radios that incorporate this design, to tighten the nut holding the board as soon as the back is removed. ▲

### Guess Who . . .



... wouldn't be caught dead watching T.V. ten years ago because it was just a crazy fad"



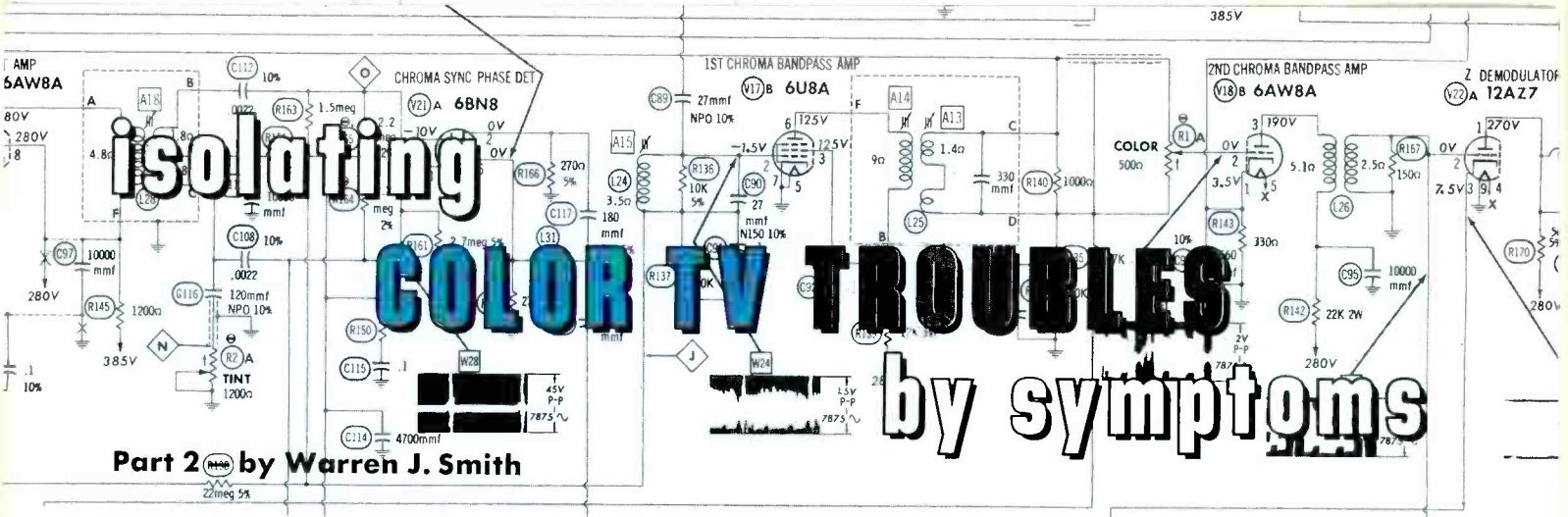
there's  
a **C-D vibrator** for every  
make and model

The C-D brand name on a vibrator is your guarantee of dependable performance, long trouble-free service. Because C-D vibrators are built to last, you can use them with full confidence. That's why it pays to reach for a C-D when a vibrator replacement is called for.

Remember, too, that there's a C-D vibrator type for every make and model car on the road. And the C-D VIBRATOR REPLACEMENT GUIDE makes it quick and easy for you to select the exact type required. Ask your local C-D distributor for a free copy of VIB-3, or write to Cornell-Dubilier Electric Corp., S. Plainfield, N. J.



**CORNELL-DUBILIER ELECTRIC CORPORATION**  
Affiliated with Federal Pacific Electric Company



**Part 2** by Warren J. Smith

Now that color TV has passed its fifth birthday, a vast amount of field experience has been accumulated on color sets. Thus, the serviceman has the opportunity to learn not only theoretically what defects can develop in color circuits, but also what types of breakdowns actually do develop. The October installment touched on some common defects which have been observed in receivers now in use. More of these often-encountered troubles are described in the following paragraphs.

**The Color Killer**

As its name implies, the color killer blocks the chrominance section to prevent noise pulses in the 2- to 4-mc range from producing colored snow (or confetti, as it is sometimes called) in black-and-white pictures. Intermittent operation of the color section can often be traced to the killer circuit, especially when the receiver is operating on color signals of marginal quality. This symptom usually shows up when the hue control is varied; just as the correct setting is approached, all color will abruptly

drop out of the picture. Moving the antenna lead-in around or changing the antenna orientation slightly will produce the same effect. The difficulty is due to a weak burst signal which cannot completely cut off the color killer, but which can still synchronize the subcarrier oscillator. All of the later-model color sets have some sort of killer threshold control (see Fig. 1) which can be adjusted for the prevailing signal level. Some receivers (particularly the earlier models) are not equipped with any control for this purpose, so the color killer in these sets must operate at a fixed level. When such a receiver is used in a weak or marginal signal area, or with a low-gain antenna system, the color killer will not function properly. The result is a black-and-white picture only, or color constantly fluctuating in and out of the picture as the signal level changes. Replacing the color-killer input resistor with a linear potentiometer of equal value will permit optimum adjustment of the killer control voltage. If preferred, a SPST toggle switch can be installed in series with the cathode lead to permit the viewer to com-

pletely disable the color killer at will.

**Color Oscillator**

As mentioned in the first part of this series, the burst signal is applied directly to the subcarrier oscillator in some of the later-model color sets, instead of controlling the oscillator indirectly through a phase detector and reactance tube. One version of this "crystal-ringing" circuit is shown in Fig. 1. When the crystal circuit is excited with burst energy from V23B, it oscillates at its resonant frequency (3.579545 mc) for a short time after the source of excitation has been removed. The resulting CW output is applied to a bias rectifier, which in turn is coupled to the color killer. After rectification, the CW signal is filtered to produce a negative DC voltage which biases the color killer below cutoff.

The plate of the color killer is keyed by positive pulses from the horizontal output transformer, instead of being fed a DC voltage from the B+ supply. When the killer stage is in a conducting state (no output from the bias rectifier), each

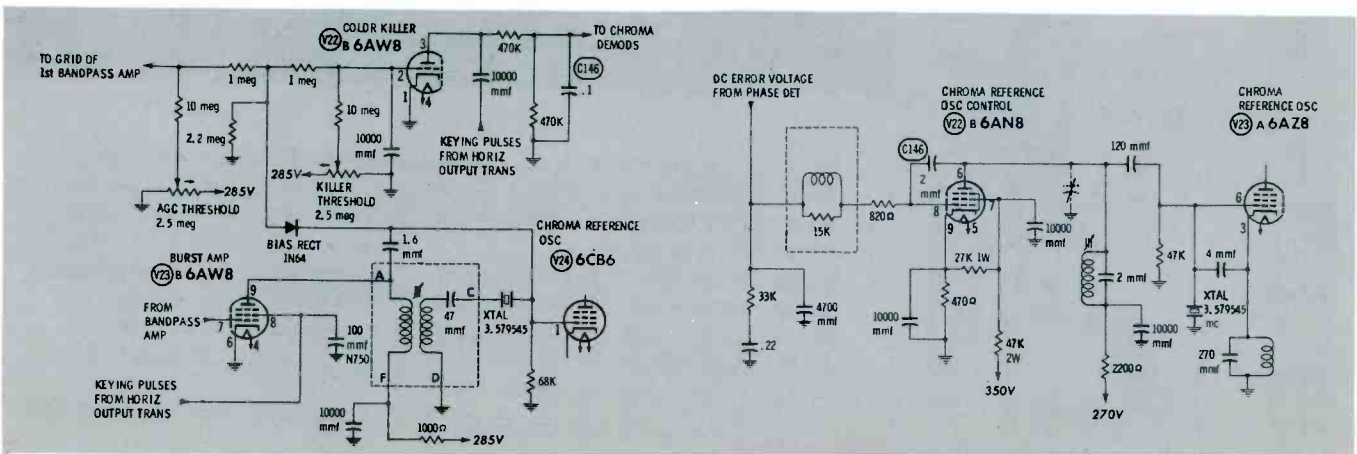
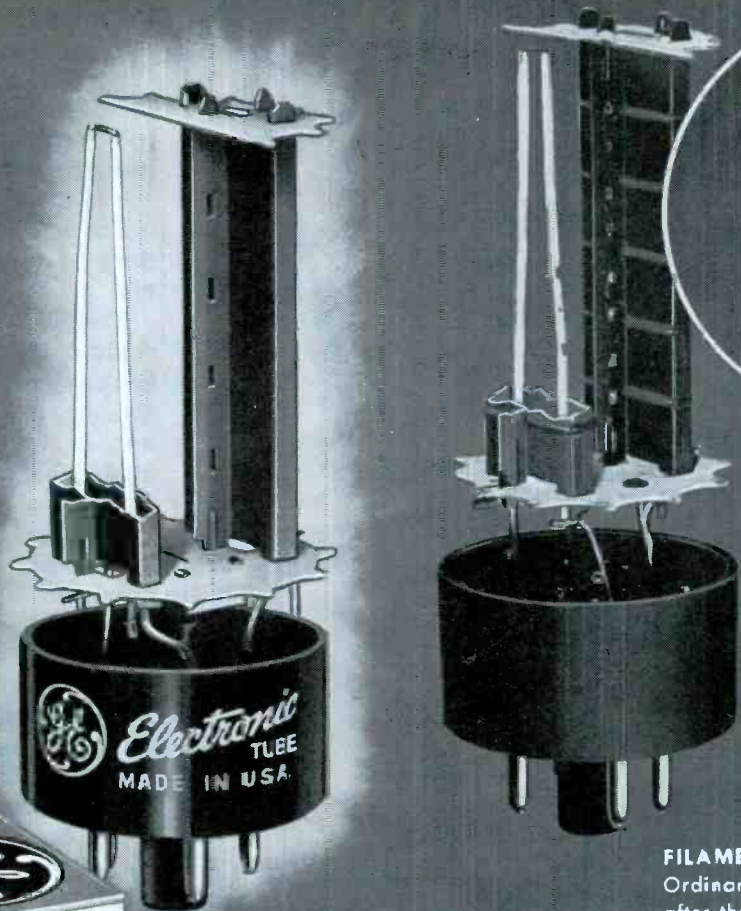


Fig. 1. Color oscillator synchronized by burst signal applied directly to crystal circuit. (RCA Chassis CTC5AA)

Fig. 2. Color oscillator synchronized by a reactance tube driven in turn by a phase detector. (RCA Chassis CTC4)



**CLOSE-UP of pitted area**  
The filament is so badly damaged that it soon will break, or bend to meet the plate, shorting out the tube.



**FILAMENT INTACT** General Electric 5U4-GB filament, after life test inside its unribbed plate at 35% above rated tube voltage, shows no destructive effects from "hot spots".

**FILAMENT BADLY PITTED.** Ordinary 5U4-GB filament, after the same life test inside its ribbed plate, shows minor or heavy damage that has occurred opposite each rib.

## Smooth Plates of G-E 5U4-GB Protect Filaments!

**Service-Designed Tube is free from "hot spots" that damage filaments of less dependable 5U4-GB's with ribbed plates!**

Install the rectifier tube with the smooth, unribbed plates—General Electric's Service-Designed 5U4-GB! No raised metal lips to collect contaminants! These build up into ridges which serve as sources of back emission, causing "hot spots" that melt and eventually destroy the filaments of ordinary tubes (see photographs above, right).

Dependable from the moment you install them, Service-Designed 5U4-GB's mean fewer callbacks and less chance of a rectifier-tube short-circuit, with risk of transformer burnout—a costly possibility in many modern TV sets. See your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.*

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

2-111-206

12% TO 15% LESS ATTENUATION!

## polyfoam

### RG-8/U TYPE CABLE

#### DESCRIPTION

AMPHENOL introduces a new polyfoam dielectric coaxial cable equivalent of RG-8/U but with a significant reduction in attenuation. Part number is 621-111.

#### ELECTRICAL AND MECHANICAL CHARACTERISTICS

Impedance—50 ohms  $\pm$  2 ohms  
Attenuation—4.0 db/100 feet nominal at 400 mc.  
Dielectric Strength—5000 V. RMS  
Corona—3000 V. RMS  
Capacity—26.0 mmf/ft. nominal  
Overall Diameter—.405"  $\pm$ .010"

#### FEATURES

From 12% to 15% less attenuation than standard RG-8/U.  
Lower capacity than solid dielectric 50 ohm cables.  
Used with standard UHF Series connectors.

#### AVAILABILITY

Contact your local  
Authorized AMPHENOL  
Distributor!

**AMPHENOL**

*distributor division*

AMPHENOL-BORG ELECTRONICS CORPORATION  
*broadview, illinois*

keying pulse creates a surge of plate current which charges filter capacitor C146 (Fig. 1) to a high negative potential. This potential is applied to the chroma demodulators (or to the grid of the bandpass amplifier in some set designs), cutting them off during monochrome reception.

Trouble with this circuit is generally confined to bad tubes, defective capacitors, or a defective keyer winding. In one particular case, the trouble was traced to a defective crystal, but as a rule crystals give little or no trouble. Those that are found to be defective are probably the result of overheating or careless handling.

In sets where the color subcarrier oscillator is controlled by a reactance tube, minor faults in this control stage can cause a wide variety of color-sync and color-reproduction difficulties. The most troublesome is increased value, or leakage in the small plate-to-grid coupling capacitor (C146 in Fig. 2). Leakage causes the grid to go positive, and an increase in value results in excessive shunt capacitance across the crystal, thus impairing or killing the subcarrier oscillator. Once in a while, the latter defect results in a "hunting" action of the oscillator. This produces incorrect or continuously changing colors in the picture which cannot be corrected with the color phasing control. In some receivers, C146 is omitted, and the stage operates on the grid-to-plate capacitance alone. Due to variations in internal capacitance among tubes of the same type, it may be necessary to try several before finding one which will work satisfactorily.

#### Wrong Color

Incorrect color values can often be quickly localized by observing a monochrome picture while the contrast control is at its minimum setting. Color in the raster indicates poor color purity or an incorrect balance among the red, green, and blue beam intensities. Nonuniform coloring in the picture is caused by a purity defect, while a uniform tint of one color indicates a lack of CRT beam balance. Fringing at the edges of objects in the picture, or the appearance of color when the contrast control is turned up, may indicate

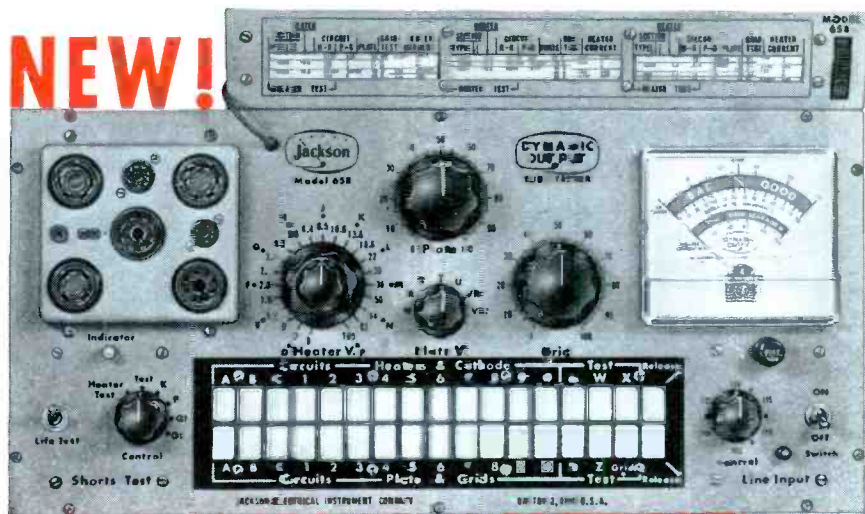
incorrect convergence or focus adjustments, or possibly a defect in the video or chrominance signal circuits.

When a monochrome picture is correctly reproduced in black and white, but a color picture shows incorrect hues, one of three faults may be indicated. First, and most common, the hue control is improperly adjusted for the correct reference phase. Second, there is an incorrect phase relationship between the CW signals applied to the demodulators by the oscillator; in this case, misalignment caused by drift of the quadrature amplifier may be the difficulty. The third possible defect is an imbalance among the relative amplitudes of the color-difference signals in the demodulator or color-adder circuits. Misadjustment of the color gain controls may be the trouble. In I/Q receivers, a lack of I signal results in a picture without cyan and orange values, while a loss of Q signal means a picture without values of magenta and yellow-green. To locate the cause, check the operation of the associated demodulator stage.

Hum in the chroma circuits results in horizontal bars through the picture, just as in monochrome receivers, but the bars have colors associated with the stage in which the hum is introduced. This makes the fault fairly easy to locate. For instance, a 60-cycle hum voltage introduced in the Q demodulator produces bars with Q colors in the picture; during one-half cycle the hum bars will be yellow-green, and magenta in the next half cycle. Hum occurs in color sets as often as in black-and-white sets, and usually for the same reason — heater-to-cathode leakage.

We have called your attention to a number of typical color-set troubles to simplify the task of diagnosing color faults. The foregoing information is intended to save you time by providing clues on "where to look first."

Helpful as they are, however, these hints cannot solve all color-circuit problems for you. To aid you in following a methodical procedure for locating all color defects — no matter how obscure — the next article in this series will consist of a thorough, systematic step-by-step troubleshooting guide for color receivers. ▲



## NEW!

# DYNAMIC<sup>®</sup> OUTPUT 658 TUBE TESTER BY JACKSON

*Makes More . . . and more accurate tests  
Than Any Service Tube Tester Ever Made!*

At last, here is a tube tester that will test practically every tube the average serviceman will ever encounter. Faster, more versatile, more accurate for more types, the new 658 is the ideal choice for service, laboratory, and engineering applications.

**DYNAMIC OUTPUT PRINCIPLE**—8 voltage positions for plate, screen and voltage regulators. Variable DC voltage, plus variable AC signal voltage is applied to control grid. The meter then reads only the AC component in the plate circuit. A much more valid test than mutual conductance, because it considers the entire output curve of the tube, not just a small portion.

**TESTS NEW 12-VOLT PLATE HYBRID TUBES**—Ample current capacity for even high current space charge grid tubes. The 658 is the only tester made with this capability.

**TRUE RECTIFIER TESTS**—AC voltages are applied to diodes and rectifiers. Meter then reads plate current—the only valid test for rectifiers. Easily handles even high current rectifiers up to 250 ma.

**GRID LEAKAGE TESTS**—Highly sensitive grid leakage test indicated directly on special meter scale. Sensitivity of 15 megohms.

**TESTS "EYE" TUBES UNDER DYNAMIC CONDITIONS**—Eye can be opened and closed to determine accurately its operating limits.

**HEATER-CURRENT TESTS ON SERIES STRING TUBES**—Actual current is read directly on meter scale.

**HEATER CONTINUITY CHECK WITHOUT WARM-UP**—No wasted time if the heater is burned out.

**TESTS ALL VOLTAGE REGULATOR AND REFERENCE TUBES**—Actually indicates striking voltage and control voltage range.

### PLUS THESE AND MANY MORE FEATURES

Famous Jackson Push-Button Sequence Switching  
New Silicon-Rectifier Balanced double-bridge circuit  
Triple Shorts Sensitivity Tests to suit each tube  
231 Heater voltage combinations from 0.6 to 120 volts  
Fused line for overload protection. Panel mounted fuse

Famous Jackson Life-Line Test  
Grouped tube sockets for easy accessibility  
Complete data for testing more than 1,200 types  
Compact portable case—21" l. x 13¾" w. x 7" d.  
Sockets for 4, 5, 6, 10ktal, octal, miniature 7 and 9 pin tubes plus two for sub-miniatures

SEE IT AT YOUR DISTRIBUTORS OR WRITE TODAY FOR LITERATURE

**\$189.95**



THE JACKSON ELECTRICAL  
INSTRUMENT CO.  
16-18 S. Patterson Blvd., Dayton 2, Ohio  
In Canada: The Canadian Marconi Company



An  
exclusive  
service  
by

**Amperex®**  
distributors:

## VALVO RECEIVING TUBES

*for replacement in  
European radios*

Many European radios and hi-fi components now popular in this country utilize the European-made VALVO tubes, which have thus far had no American distribution. As a special service to the trade, VALVO tubes are now being stocked by all franchised Amperex distributors. Replacement of the original tubes with completely identical types will assure optimum results in the repair and servicing of these European sets.



**ask Amperex**  
for the name and address  
of your nearest distributor

**Amperex Electronic Corp.**  
230 Duffy Avenue Hicksville, L. I., N. Y.



**Time Tip — V.** Worry is like a short circuit in your mind. Any unsettled doubt or dread wastes mental energy instead of channeling it into useful work.

Big worries, like a “dead short,” are usually disabling enough to get immediate attention. People thus manage to cope with problems such as illness in the family, or a threatened lawsuit, because they at least know what’s troubling them. Not so easy to pin down are the smaller, more vague worries which may not even be consciously recognized as such. These “fusses and frets” are like leaky capacitors in your mental circuits; they let you go ahead with your normal work, but they cut down your efficiency and cause unnecessary wear and tear on your whole personality.

Everybody has his share of little worries; and, since they keep piling up, it is important to get rid of each one as soon as you possibly can. One of the best ways to do this is to give each problem your undivided attention for a short period—at least long enough to come up with a solution “for the time being.” If you don’t habitually attack worries head-on, they will continually try to claim the attention of your subconscious mind while your conscious thoughts are directed at something else. The usual results are daydreaming, carelessness, lack of progress in your work, and a “worn-out” feeling at the end of the day.

At times when you feel stymied by your work, take a few minutes for a “worry break.” Try to analyze the distractions which are holding you back, make up your mind what to do about them, and then force them out of your head until you can take some action.

Sometimes you’ll have to conclude that the worries are “too big, or too numerous, to be taken care of right away. In that case, put them off—but promise yourself that you’ll think the problem through at some definite time in the near future. May-be an evening session in the shop,

or a Saturday afternoon out fishing, will give you a chance to work out a solution.

A properly-handled “worry break” clears the air and enables you to concentrate on the job at hand. Remember, you can’t afford to let unsolved problems interfere with your work; this only adds one more worry to the heap.



**Winter Changeover.** The following list of “winterizing” services was submitted by ABC-TV of Libertyville, Ill. (with apologies to the auto service industry). We suggest, however, that you don’t let any of your customers see this list, or some of them are liable to insist on having these services performed—and will watch over your shoulder to make sure you do!

- Change transformer oil.
- Grease flybacks.
- Add antifreeze to tuner.
- Rotate tubes.
- Check oil level in capacitors.
- Clean and regap ion trap.
- Adjust timing of linearity coil.
- Remove stray ions from ion trap.
- Tranquelize all self-excited oscillators.
- Set tube heaters to 212°
- Advance spark at second anode.
- Check trigger for electron gun.
- Repeak all IF’s to prevent snow accumulation on flat-topped responses.
- Make sure the cathode follower is in step.
- Clean drain on vertical sync.
- Integrate the discriminator.
- Reseat all standing waves.
- Boresight electron gun.
- Re-blue electron gun.
- (Special for color sets) Re-blue the blue gun; re-green the green gun; re-red the red gun.
- Empty grid leak pan.
- Plug all grid leaks.
- Remove and clean all IF cans.
- Blow out all fuses.
- Remove bias from discriminator.
- Dredge all channels.
- Clean all filters.
- Renew holster for electron gun.
- Sweep all frequencies.
- Install new beaters in the mixer.
- Apply tourniquet to all bleeder resistors.

# SAVE $\frac{1}{2}$ THE TIME

## Make Twice The Profit!

### in TV Trouble-Shooting

**THIS EASY  
SIGNAL INJECTION  
POINT-TO-POINT  
DIRECT VIEWING  
WAY—**



# B&K

## MODEL 1075 TELEVISION ANALYST

Solve Rough Sweep Output Problems



**NEW Model A107  
DYNA-SWEEP  
CIRCUIT ANALYZER**

Saves many hours of service work. Provides vertical and horizontal sync and driving pulses that enable you more easily and quickly to check out every stage in the sync and sweep sections of a television receiver.

Tracks down troubles in the horizontal and vertical output circuit including defective output transformer and yoke; checks for shorted turns, leakage, opens, short circuits, and continuity. Includes unique high-voltage indication. Eliminates trial and error replacements.

**Model A107 Dyna-Sweep.** Companion unit for use only with B&K Model 1075 Television Analyst for driving source.  
Net, \$49.95

**Model 1070 Dyna-Sweep.** Same as Model A107 but has its own horizontal and vertical driving pulse, and is used independently of the Model 1075.  
Net, \$69.95

**New Technique Makes TV Servicing  
Easier, Faster, More Profitable**

Thousands of service technicians already save thousands of hours every day with the amazing B&K TELEVISION ANALYST. Enables you to inject your own TV signal at any point and watch the resulting test pattern on the picture tube itself. Makes it quick and easy to isolate, pin-point, and correct TV trouble in any stage throughout the video, audio, r.f., i.f., sync, and sweep sections of black & white and color television sets—including *intermittents*. Makes external scope or wave-form interpretation unnecessary. Enables any serviceman to cut servicing time in half, service more TV sets in less time, really satisfy more customers, and make more money. Color generator provides both rainbow pattern and color bars.

**MODEL 1075 TELEVISION ANALYST.** Complete with standard test pattern, white dot, white line, and color-bar slide transparencies, and one clear acetate. Net, **\$259<sup>95</sup>**

See your B&K Distributor or Write for Bulletin ST24-R

# B&K

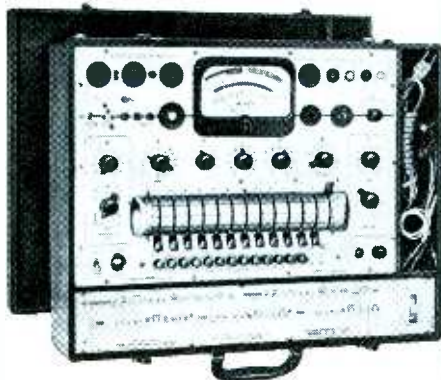
**B & K MANUFACTURING CO.**

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

Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont.  
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

# MORE OF EVERYTHING YOU WANT IN A TUBE and TRANSISTOR CHECKER

1. *Electronamic*® Tube Performance Checker
  2. Comprehensive Transistor Checker
  3. Complete Crystal Diode Tester
  4. CR Tube Beam Current Tester
  5. Functional VR Tube Tester
  6. Direct Reading Gas Tester
- ... plus Free Tube and Transistor Test Data Subscription Service for one full year!



... AT  
**A PRICE THAT  
MAKES SENSE**  
THE  
**PRECISION  
MODEL 10-60**

1. Positive, all-inclusive tube performance testing ... not limited to mutual conductance alone.
2. Widespread  $I_{c_{ao}}$  ranges cover all types of transistors—low, medium and high power n-p-n and p-n-p types.
3. Crystal diode tests: 22 selected DC voltages for forward and reverse current tests.
4. Cathode ray tubes tested for true beam current.
5. Tests voltage regulator tubes for regulation at manufacturer's specified current limits.
6. Special gas test circuit indicates troublesome gas content directly on sensitive  $5\frac{1}{2}$ " meter.

Model 10-60: Complete with 5 window hi-speed geared roller chart unit and technical manual. . . . Net Price \$195.00

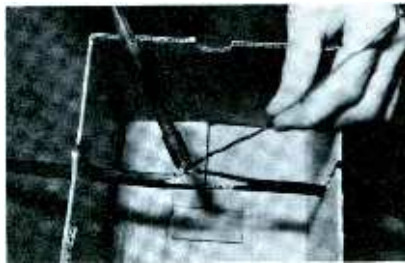
Model 10-40: Physically and electrically similar to the Model 10-60 but without transistor and crystal diode testing facilities. . . . Net Price \$149.50

- ▶ Available and on display at leading electronic part distributors. Write for complete *PRECISION* catalog.
- ▶ *PRECISION* Test Equipment carries a full year warranty!



# TIPS

# for TECHS



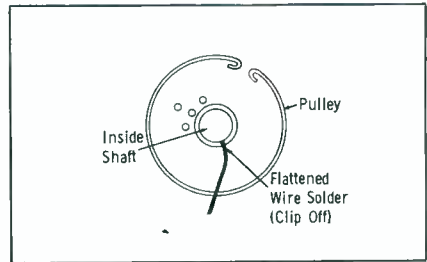
**Box Is Wire-Soldering "Vise"**

Soldering joints in TV I e a d-i-n wire and other electrical wires is a troublesome three-handed operation. A person needs one hand to hold the soldering iron, another to hold the solder, and a third to hold the wire until the freshly-soldered joint has had sufficient time to set. A cardboard box slit down either side as shown makes a handy "vise" for holding wires while they are being soldered. A weight may have to be placed in the bottom of the box to hold it stationary.



**Springs Protect Test Leads**

Test leads are about the most often used item found on the service bench. Naturally this makes them more vulnerable to wear, and the wires will often break inside the insulation at the point where the test lead leaves the prod handle or pin plug. This condition usually results in false meter readings, often sending the unsuspecting serviceman off on a time-consuming and unprofitable wild goose chase. To keep your test leads from breaking internally at these points, remove the pin plug and slip a couple of stiff, snug-fitting springs over the lead; then replace the plug. Slide one spring up to the point where the lead enters the prod handle, and slide the other near the instrument's plug as shown. The springs will provide additional support to keep the wires from receiving too much flexing or being bent at too sharp an angle.



**Tuning Pulley Repair**

Although it doesn't happen very frequently there are times when the dial cord drum pulley on the shaft of a tuning capacitor will work loose and slip around the shaft. Solder usually won't stick to the shaft, so remove the pulley and take a piece of wire solder that has been hammered flat, place it in the shaft hole and force the pulley back on the shaft. The hammered piece of solder will act as a wedge to bind the pulley tightly to the shaft and prevent it from turning.



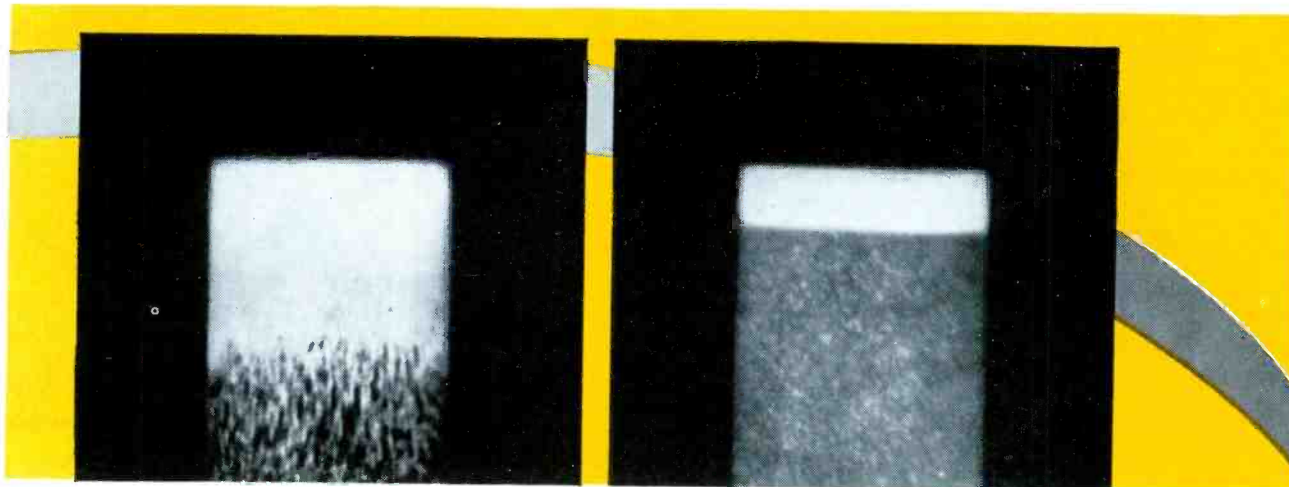
**Fuse Clips as Prod Hangers**

If you need some neat way to hang up your pairs of test prods on a wall panel, here's how. Attach some fuse clips to the panel and just snap the prods into them as shown. Be sure to break off or bend the "ears" on the clips so that the prods will fit in easily and without damage.

**Printed Board Sockets**

The next time you have to replace one of those wafer-type tube sockets used in the printed circuits of auto radios or other gear, here's a tip you'll find particularly helpful. Break the top socket wafer with a screwdriver or knife, tip the chassis over and heat the socket contacts from the underside. The contacts will then effortlessly drop out one by one on the bench.





Inherent physical superiority of Sylvania's exclusive Sarong cathode, right, over a conventional cathode, left, is evident in this photomicrograph comparison. The texture,

thickness, sharp coating edges and overall uniformity of Sarong represent major improvements in the heart of the electron tube never before achieved in mass production.

# Only Sylvania has SARONG—

the revolutionary new  
receiving tube cathode that means  
better service profits



Fewer call-backs due to intermittents and shorts . . . reduced noise and less arcing . . . these are some of the benefits available to you *now* with this "can't be copied" Sylvania development.

The Sarong cathode is a completely new development that transforms conventional sprayed cathode coating into a thin uniform film, precision-wrapped and securely bonded, around each cathode sleeve.

Now in use in nearly 1 million receiving tubes, Sylvania Sarong is a field-proven development setting new standards of efficiency and quality in electron tube performance.

First tubes to incorporate Sarong are tv tuner types 6BZ7, 6BQ7A, 6BC8 and 6BS8. Eventually Sarong

cathodes will be utilized in a full line of Sylvania receiving tubes.

**Here's why it will pay  
your dealers to replace with  
Sylvania Sarong cathode tubes:**

- Reduced noise . . . uniformity in spacing has resulted in improved noise level up to 0.6 db for TV frequencies.
- Less heater-cathode leakage . . . Sarong is flake-resistant and smooth textured. No stray coating particles to stick inside cathode.
- Greater tube ruggedness against shock and vibration because of Sarong's superior coating adhesion.
- Reduced cathode-grid shorts, intermittent short circuits, and less arcing due to controlled uniformity of Sarong

thickness. Sarong cathode coating is held to thickness tolerances five times closer than conventional sprayed cathode coating.

Sylvania Sarong will help you make better profits through reductions in call-backs. See your Sylvania representative today for the full story on Sarong—available *only* from Sylvania.

SYLVANIA ELECTRIC PRODUCTS INC.  
1740 Broadway, New York 19, N. Y.  
In Canada: P. O. Box 1190, Station "O,"  
Montreal 9.

Sarong cathodes are now in use in four Sylvania tv tuner types. Eventually all Sylvania receiving tubes will contain Sarong cathodes.



**SYLVANIA**   
Subsidiary of  
**GENERAL TELEPHONE & ELECTRONICS**

# Hit any target



with  
**Centralab**  
**Universal Shaft**  
**Model B**  
**Radiohm® Controls**



If you're aiming for faster servicing and greater profits, ask for CENTRALAB Model B Controls. These are the only replacement carbon controls with a truly universal shaft that adapts to any application.

For any shaft target—split knurl, shallow flat, deep flat, half round, round, etc.—the Model B hits the bulls-eye. Its universal fluted, knurled-type shaft adapts to all knobs perfectly. AC Line switches snap right on, trigger-quick, to convert the control to a switch type unit.

Shoot right over to your CENTRALAB distributor and stock up on Model B Controls . . . and while you're there, be sure to Tell him you want your free copy of the brand-new CENTRALAB catalog.

# Centralab

B-5957 

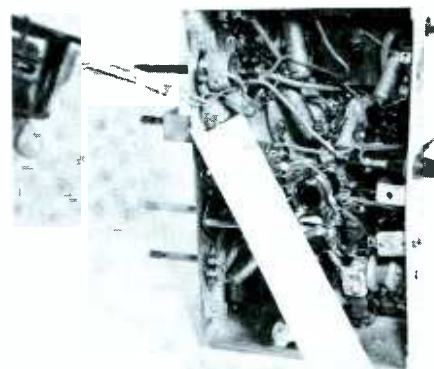
A DIVISION OF GLOBE-UNION INC.  
 942 L EAST KEEFE AVE. • MILWAUKEE 1, WIS.  
 IN CANADA: 669 Bayview Ave. • Toronto 17, Ont.

**CONTROLS • ROTARY SWITCHES • CERAMIC CAPACITORS**  
**PACKAGED ELECTRONIC CIRCUITS • ENGINEERED CERAMICS**



### Shaving Mirror Aids Servicing

A magnifying shaving mirror is a useful gadget to keep around the radio-TV service bench. You can use it to view a TV picture when working behind the set. And, when you have a hard time seeing into a dark corner of a chassis or cabinet, you can use it to reflect light. When you need to concentrate heat on various circuit parts to find an intermittent, but someone else is using your heat lamp, use the mirror to direct the rays of the sun on the suspected parts. When working on a tiny soldering job (coils and such), you can also use the mirror's magnifying quality to advantage. In addition, when you have to do some work on the inside of a cabinet, why work by feel alone when the mirror can let you see what you are doing?



### Soldering 'Trough'

When soldering in a circuit where there's a danger that drops of hot solder will fall down among parts and wires, you'd better make a "trough" to roll the drops out onto the bench. Take a piece of thin cardboard about 1" wide and 12" long and fold it lengthwise down the middle. Lay one end under the joint you are soldering, and rest the other end on the bench as shown.



*Helping you avoid  
complaints and call-backs —  
That's the job of BUSS Fuse Engineers. . .*

Essential to your building a profitable business is creating satisfied customers and avoiding service complaints.

Handling known, 'trouble-free' items helps you do this. In fuses, the brand you can handle with confidence is BUSS. To assure you of this, our engineers are:

(1) Testing in a sensitive electronic device every BUSS and FUSETRON Fuse made. Any fuse not properly calibrated and constructed and right

in all physical dimensions is automatically rejected.

(2) Maintaining a 44 year reputation for fuses that give maximum protection against damage due to electrical faults — and maximum protection against wasteful shutdowns caused by fuses blowing needlessly.

(3) Providing a complete line of BUSS and FUSETRON Fuses of all sizes and types . . . plus a companion line of fuse clips, blocks and holders to

meet all electrical protection problems.

It's easy to see that when you standardize on BUSS fuses — you are protected against faulty fuses causing you trouble, you are handling the brand of fuses your customers know and trust, — and you are simplifying your stock handling and record keeping problems by using one source for all your fuse needs.

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

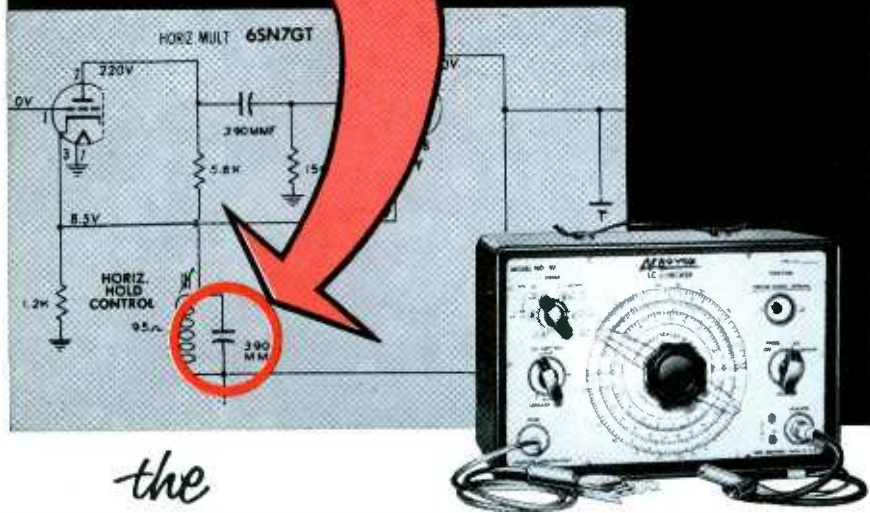
1259

*BUSS fuses are made to protect - not to blow, needlessly.*

*BUSS makes a complete line of fuses for home, farm, commercial, electronic, electrical, automotive and industrial use.*



can your present  
test equipment  
check this capacitor  
in circuit?



*the*  
**All New Aerovox Model 97**  
**LC-CHECKER**

*will do this and much more!*

Yes, the Aerovox LC-Checker will check the above and similar capacitors *regardless of the parallel circuitry and without disconnecting them from the circuit*. You can quickly and accurately locate defective units without performing the time consuming task of unsoldering and resoldering components. If your present test equipment cannot match this performance, then you *need* an Aerovox LC-Checker.

This versatile instrument also tests for capacitor leakage, determines resonant frequency of tuned circuits, checks inductance and performs many other service-important functions all for the low price of **\$69.95**.

**SEE IT...TRY IT...BUY IT TODAY...**

...at your local Aerovox Parts Distributor. Write for free literature and address of your nearest distributor.

**AEROVOX CORPORATION**

DISTRIBUTOR DIVISION

NEW BEDFORD, MASSACHUSETTS



**Detachable Cord for Your Gun**

Do you waste a minute or more untangling the cord of your soldering gun every time you take it from the tool kit? Chances are that you do. If you've ever wished your gun had a detachable line cord, why not give it one? Just take your soldering gun apart, unsolder its power cord, widen the opening in the bottom of the pistol grip handle with a file, and install a male AC connector to fit your cheater cord. Use self-tapping screws as shown to mount the connector. This arrangement will also save space in your tool kit, since you will use the same "cheater" cord for TV sets.



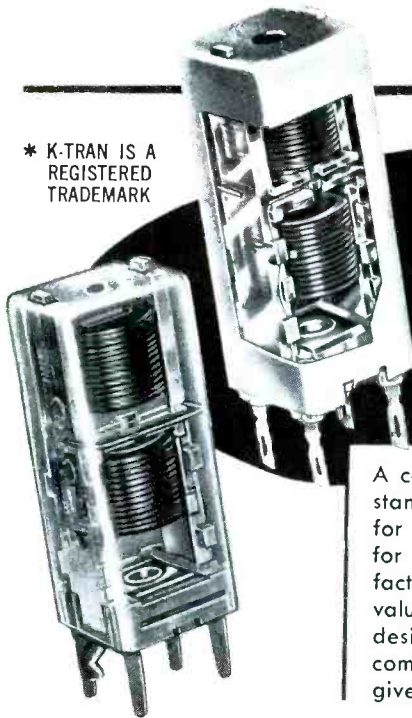
**Gadget Bag is Meter "Caddy"**

Those VTVM's, VOM's, and other small portable test instruments that are carried to the job on house calls are delicate instruments and should receive the best of care. The bang-about wear and tear conditions present in the average technician's tool box are something most meters can't withstand too long. For those who want long meter life, a photographer's gadget bag is an ideal instrument caddy. Most gadget bags are lined with shock-absorbing material and have compartments roomy enough to accept the average VTVM or VOM. They are mighty easy to carry, too. You can buy one from most any photographic store for a small price compared to the cost of a new VTVM or VOM.

# Miller



\* K-TRAN IS A REGISTERED TRADEMARK



## THE FAMOUS K-TRAN\* I.F. TRANSFORMERS

A complete line of the finest I.F. transformers available anywhere at any price. Both standard and miniature sizes in all of the commonly used I.F. frequencies are stocked for immediate delivery. Conventional as well as printed circuit types are available for both vacuum tube and transistorized applications. Original equipment manufacturers will find the K-Tran the ideal choice for new equipment designs thus saving valuable engineering manhours and being assured of a top quality transformer designed by engineers with over 30 years of manufacturing experience in electronic components. The K-Tran also makes an excellent replacement transformer and will give results equal to or better than the original.

### AVAILABLE IN THE FOLLOWING FREQUENCIES

CAT. NO. Printed Circuit Types	CAT. NO. Regular Standard Types	Dimensions: 3/4" square x 2" high	FREQ.	USE
13-PH1	12-H1		262 KC	Input transformer
13-PH2	12-H2		262 KC	Output transformer
13-PH6	12-H6		262 KC	Output transformer with diode filter
13-PC1	12-C1		455 KC	Input transformer
13-PC2	12-C2		455 KC	Output transformer
13-PC6	12-C6		455 KC	Output transformer with diode filter
13-PC7	12-C7		455 KC	Input transformer for battery radios
13-PC8	12-C8		455 KC	Output transformer for battery radios
13-PC9	12-C9		455 KC	Input transformers for AC-DC radios
13-PC10	12-C10		455 KC	Output transformer for AC-DC radios
	12-C11		455 KC	IF transformer (G.E.-RTL 143 and 163)
	12-C12		455 KC	Tapped Pri. I.F. transformer
	12-C45		455 KC	Discriminator
	13-W1		1500 KC	Input and interstage transformer
	13-W2		1500 KC	Output transformer
6203-PC	6203		4.5 MC	Input or interstage transformer
6204-PC	6204		4.5 MC	Discriminator transformer
6205-PC	6205		4.5 MC	Ratio detector transformer
6206-PC			4.5 MC	Ratio Det. (GE-RTD-Q26)
6207-PC			4.5 MC	Ratio Det. (GE-RTD-Q25)
6208-PC			4.5 MC	Ratio Det. (GE-RTD-Q20)
1463-PC	1463		10.7 MC	Input or interstage transformer
1464-PC	1464		10.7 MC	Discriminator transformer
	1464-WB		10.7 MC	Discriminator 900 KC Peak to Peak
1465-PC	1465		10.7 MC	Ratio detector transformer
	1465-WB		10.7 MC	Ratio detector 800 KC Peak to Peak
	6260		21.25 MC	I.F. Transformer
	6261		21.25 MC	Discriminator transformer
	6262		21.25 MC	Ratio detector transformer
6230-PC	6230		44 MC	TV Converter I.F. Transformer
6231-PC	6231		44 MC	TV First I.F. Transformer
6232-PC	6232		42.5 MC	TV second I.F. Transformer
6233-PC	6233		42.5 MC	TV third I.F. Transformer
6234-PC	6234		44 MC	TV fourth I.F. Transformer



Miniature I.F. Transformers for printed circuit transistorized applications. These miniature I.F. Transformers have tuned primary and untuned secondary windings. Proper impedance match between primary and secondary insures optimum performance.

Dimensions: 1/2" square x 3/4" high

CAT. NO.	FREQ.	SPECIFICATIONS
2031	455 KC	10K Ohm pri. to 600 Ohm Sec., Input
2032	455 KC	10K Ohm pri. to 1000 Ohm Sec., Output
2041	455 KC	25K Ohm pri. to 600 Ohm Sec., Input
2042	455 KC	25K Ohm pri. to 1000 Ohm Sec., Output
2051	455 KC	100K Ohm pri. to 1000 Ohm Sec., Input

Sub-Miniature I.F. Transformers for printed circuit transistorized applications. To our knowledge the smallest I.F. Transformers in existence. Ferrite cup core construction permits the use of extremely small shields without adversely affecting transformer operation. A high impedance, tapped primary winding coupled to a low impedance secondary provides optimum energy transfer between stages.

Dimensions: 3/8" square x 3/8" high

CAT. NO.	FREQ.	SPECIFICATIONS
9-C1	455 KC	25K Ohm pri. to 600 Ohm Sec., Input
9-C2	455 KC	25K Ohm pri. to 1000 Ohm Sec., Output

Also a sub-miniature I.F. Transformer for conventional circuitry using vacuum tubes. A 455 KC intermediate frequency transformer which has all the desirable features of the standard size I.F. and is smaller than a MINIATURE tube. Through the use of a ferrite cup core these sub-miniature I.F. Transformers offer the gain and bandwidth characteristics previously obtained only in larger I.F. assemblies. For AC-DC or battery radios.

Dimensions: 1/2" square by 1 1/2" high

CAT. NO.	FREQ.	USE
10-C1	455 KC	Input transformer
10-C2	455 KC	Output transformer

Literature on any of the above I.F. Transformers or our latest general catalog 60 — TV guide 160 — Auto guide 260 — are available on request. Over 2,000 Radio & TV parts distributors to serve you the world over.

**BUY WITH CONFIDENCE — BUY MILLER.**

**Available Through Your Local Distributor**  
Miller Quality Products are recognized by the entire electronics industry as representing the finest in workmanship, performance, and dependability.

\*Manufactured under K-Tran patents of and by Automatic Manufacturing Corp., Division of General Instrument Corporation.

## J. W. MILLER COMPANY

EXPORT REPRESENTATIVE

Roburn Agencies, Inc.  
431-435 Greenwich Street  
New York 13, New York  
WOrth 6-2130

FACTORY

5917 SOUTH MAIN ST., LOS ANGELES 3, CALIF.

Phone ADams 3-4294

FAX No. XCM

CANADIAN REPRESENTATIVE

Warehouse Stock  
Atlas Radio Corporation, Ltd.  
50 Wingold Ave.  
Toronto 19, Ontario, Canada

See Us At Booth #2112 at the WESCON SHOW.

# TEMPERATURE-COMPENSATING CAPACITORS

*Where and why they are used, plus some hints on making replacements in tuners and critical oscillator circuits. — by George D. Philpott*

With understandable reluctance, some TV technicians shy away from making relatively minor tuner repairs (such as replacement of small capacitors) simply because they feel they are not well enough versed on temperature-compensating capacitors, circuit tolerance requirements, installation procedures, and the exacting alignment job which sometimes must follow a tuner repair. However, by keeping a few significant facts in mind about these apparently difficult problems, a serviceman may solve them profitably—in addition to providing greater satisfaction to his customers.

Approaching the task, it hardly seems necessary to explain in any great detail why RF and oscillator circuits in the average FM or TV tuner present a touchy problem. We know this from experience — and some of it sad, indeed. Change one relatively insignificant-looking capacitor in the “fingers-off” section of a TV tuner, installing a unit which does not meet every circuit

requirement, and “ouch!”—you’ve got trouble. On the other hand, use the correct type of capacitor, paying careful attention to circuit dress, and high-frequency circuits like tuners are not much more difficult to repair than any other section of a television receiver.

The first thing to remember concerning capacity requirements in a resonant RF circuit is that *oscillator-frequency drift will occur unless the capacitors employed in the circuit are designed to compensate for temperature variations*. Receiver manufacturers have known this for years and design their equipment accordingly. So, the service technician must watch out for these special capacitors in RF circuits, lest his tuner jobs get sadly fouled up.

To avoid time-consuming errors along this line, you should have a reasonable working knowledge of at least two different types of temperature-compensating capacitors in common usage—namely, the negative-positive-zero (NPO) and the

negative-coefficient N-type.

The NPO capacitor is commonly employed in tuners for DC isolation and coupling purposes. In Fig. 1, for example, C12 (20 mmf, 500 WVDC) is being used for coupling the oscillator grid to the tuned tank. If this unit were permitted to change capacitance in either direction, the oscillator frequency would be altered. Also in Fig. 1, we find NPO unit C16 “holding the line” capacity-wise in the tuned plate circuit of the mixer. If a capacitance change occurred at this point in the circuit, the tuned frequency of the stage would vary.

At this point, it is worth mentioning that NPO-type capacitors are not restricted to the RF sections of television receivers, but also have their place in the video, sound, and even sweep sections of many models. Fig. 2 depicts an NPO unit (C30) being used as a coupling capacitor in the sound take-off circuit at the plate of the video detector. (A change in capacitance here would cause misalignment in the 4.5-mc tuned circuit of the first sound IF stage.) Some FM and TV receivers also use an NPO capacitor in the tuned secondary circuit of the discriminator or ratio detector. Furthermore, many receivers have NPO units in critical portions of the vertical and horizontal oscillator sections.

Studying all these various uses, we can conclude that these special capacitors are a “must” in circuits where frequency stability is important. They are not needed, however, in most plate, screen, and cathode bypass applications, nor in noncritical coupling circuits.

NPO’s may be purchased in numerous values within the approximate range of 0.5 to 300 mmf. All are designed to avoid appreciable change in capacitance over the

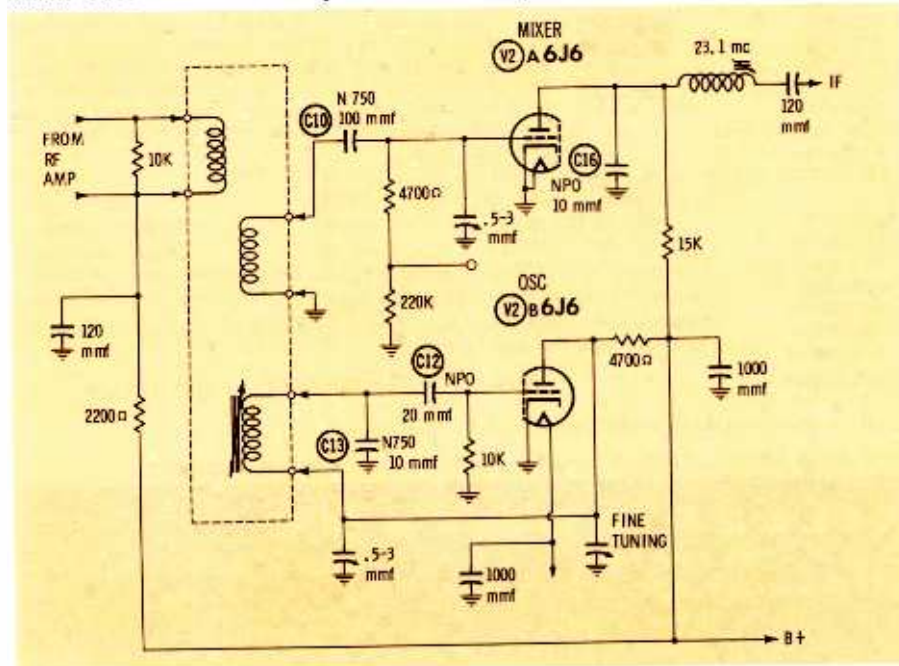
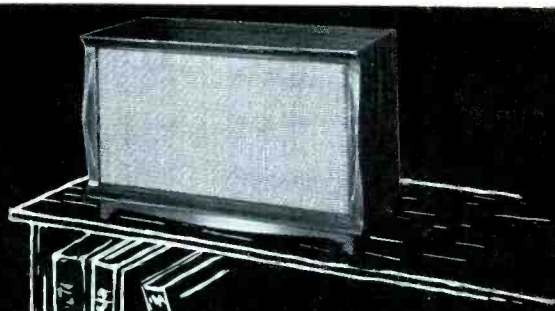
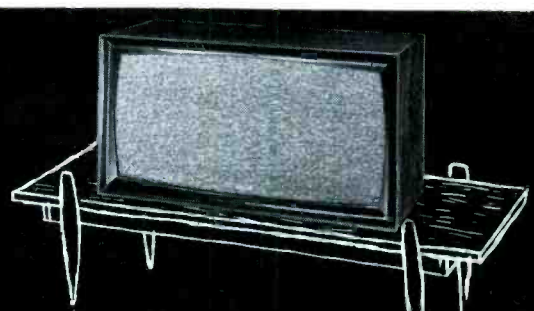


Fig. 1. Temperature-compensating capacitors help stabilize RF oscillator.



### TR-10 TRI-ETTE 3-Way Speaker System.

Compare the Jensen TRI-ETTE with any bookshelf speaker and let your own ears tell you the reason for its rocketing popularity . . . *it sounds better!* It's what you'd expect from advanced Jensen engineering that begins where others leave off. Efficient too . . . needs only a 10-watt amplifier. Handsome in graceful contemporary design with fine woods in choice of Walnut, Mahogany or Tawny Ash. Get a TRI-ETTE speaker system for superb mono hi-fi . . . add another for the finest stereo reproduction in small space at only \$119.50 each. Table Base (extra) . . . \$5.45. Matching Floor Stand 14" high (extra) . . . \$12.95



### DF-1 DUETTE 2-Way Speaker System.

A new high in loudspeaker value . . . a high quality, economically priced 2-way "bookshelf" system made possible by an entirely new and different high compliance 8" FLEXAIR\* woofer by Jensen . . . capable of movement more than twice as far as previously available units . . . with low distortion bass down to 36 cycles in tube-vented BASS-SUPERFLEX\* enclosure. Fine furniture crafted of 3/4" selected veneer in choice of Walnut, Mahogany or Tawny Ash finished on four sides for horizontal or vertical placement. Only \$79.50. Table Base (extra) . . . \$5.45. Floor Stand for vertical placement (extra) . . . \$7.50

You should know there is something better!

# Jensen "BOOKSHELF" LOUDSPEAKERS AND KITS

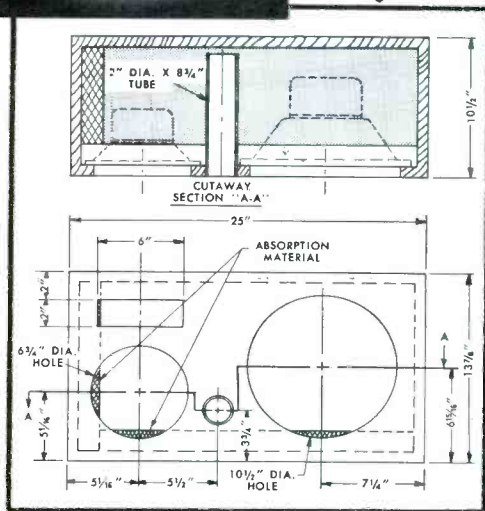
SPEAKER SYSTEMS IN FINE FURNITURE OR KITS FOR STEREO AND MONO HI-FI



## KT-33

### 3-WAY SPEAKER SYSTEM KIT

BASIC ENCLOSURE DATA



### USE THESE KITS IN YOUR OWN CABINETY OR BUILT-IN SYSTEM

For outstanding TRI-ETTE performance in your own enclosure or custom built-in system, the KT-33 Kit is the answer. Includes P12-NF 12-inch FLEXAIR woofer, P8-UM 8-inch midchannel, RP-103A compression driver tweeter, H-F control, crossover network, wiring

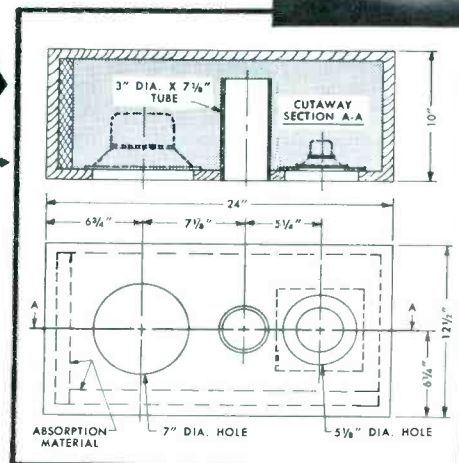
and full instructions for enclosure construction and installation. (Enclosure vent-tube 46MP06 must be ordered separately. Price 50c postpaid, direct from factory.) **KT-33 Speaker Kit.** Net only \$80.00. **KT-233 TWINKIT\*** Two matched systems for stereo. Net Only \$160.00.

## KDF-1 2-WAY SPEAKER SYSTEM KIT

For fine sound at minimum cost, Jensen's KDF-1 DUETTE Speaker Kit gives you complete 2-way system performance. When you make your own cabinet or built-in speaker system and install the KDF-1 Kit you'll save and get the same fine performance of the DF-1 DUETTE furniture model. Includes P8-QF 8-inch FLEXAIR woofer, enclosure vent-tube, P35-VAH tweeter, coupling element, terminal panel, H-F control, wiring material and complete instructions for building enclosure. Net only \$29.75.



BASIC ENCLOSURE DATA



ALL JOINTS MUST BE AIR TIGHT  
USE 3/4" PLYWOOD THROUGHOUT

**Jensen MANUFACTURING COMPANY**

Division of The Muter Company

6601 S. Laramie Avenue • Chicago 38, Illinois

In Canada: Renfrew Electric Co., Ltd., Toronto

In Mexico: Radios Y Television, S.A., Mexico, D.F.

\*T.M.

**PROFESSIONAL**  
technicians  
use  
*Dave Rice's*  
**OFFICIAL**  
**ORDER BOOKS**  
for every  
**TV-RADIO**  
service  
call

This is the businesslike approach to service record keeping. TriPLICATE forms serve as order form, invoice and office record, with spaces for complete information on every job. Separate listings for receiving tubes, pix tube, parts, serial numbers, labor and tax charges, signatures, etc. 75c a book, \$6.50 for dust-proof box of 10. In stock at your distributor. Write for your free folder describing Dave Rice's OFFICIAL ORDER BOOKS, including an actual size sample copy of the handy order form.

\*\*\*\*  
For customer's prices on every replacement part, plus flat rate and hourly service charge data, regional and national, Dave Rice's OFFICIAL PRICING DIGEST, listing over 63,000 items. \$2.50.

**ELECTRONIC PUBLISHING CO., INC.**  
180 N. WACKER DRIVE  
CHICAGO 6, ILLINOIS



**VIS-U-ALL**  
BUSINESS BUILDING TEST EQUIPMENT FOR SERVICE DEALERS

here's  
**MONEY MAKING CONVENIENCE**



tubes, tools and built-in tube tester... all in one handy case!

THE V 100 **DYNAMIC CADDY-TESTER**

Built-in tester checks over 800 TV-radio tubes dynamically; also tests picture tubes and selenium rectifiers. On house calls, you test all tubes in a set... sell more, make more! Only 4 sockets and exclusive Master Switch test all receiving tubes, past, present and future. Never obsolete. Well built, professional caddy holds 150 tubes.

ONLY \$109.00

Write for Details

**VIS-U-ALL PRODUCTS CO.**  
643 EASTERN, S. E.  
GRAND RAPIDS 6, MICHIGAN

temperature range from  $-20^{\circ}$  to  $+85^{\circ}\text{C}$ . In other words, the NPO will hold capacitance (within the rated tolerance) to  $185^{\circ}\text{F}$ —hot to the touch! In this day of compact circuitry, we can easily understand the necessity and usefulness of this type of capacitor.

The N750 type of capacitor is different from the NPO and general-application types, inasmuch as it undergoes a reduction in capacitance value as temperature increases. Precisely speaking, it decreases in capacitance at the rate of 750 parts per million for every degree C of temperature rise. So here we have a capacitor capable of resisting frequency drift due to an increase in capacitance of the rest of the circuit. N-values besides the popular N750 are available in a wide combination of temperature coefficients, capacitances, and tolerances. The N750, and counterpart units with negative temperature coefficients of anywhere from 33 to 1500 ppm/ $^{\circ}\text{C}$ , are available in capacitance values from about 3.3 to 750 mmf. They are extensively used in tuners to form part of the capacitance across the various tuning coils. Note, for example, C10 and C13 in Fig. 1. When a temperature rise attempts to cause an increase in the general shunt capacitance of the tuned circuit, the N750 unit compensates for this effect and holds the over-all circuit capacitance reliably constant. By proper selection of the right values of N750-type units, it is possible to compensate for nearly any temperature-induced frequency deviation.

Fig. 3 shows N750-type units being used in conjunction with an NPO-type capacitor in an oscillator circuit of an FM radio set. Even though this receiver has automatic frequency control, it is sometimes desirable to operate the set with the AFC feature disabled (for example, when listening to a weak station near a strong one on the dial). Thus, the set manufacturer considered it advisable to minimize oscillator frequency drift by using temperature-compensating units.

Sometimes a capacitor with a certain desired combination of capacitance value and temperature coefficient is not immediately available. In such cases, an NPO unit can be

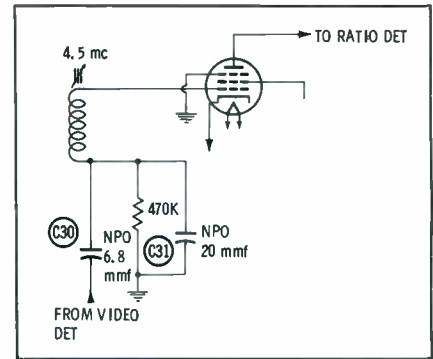


Fig. 2. NPO units in sound take-off circuit prevent drift in the sound IF. paralleled with an N750 to give a great variety of intermediate capacitances and temperature coefficients. The correct values to use can be determined by a simple formula:

Multiply the desired capacity in mmf by the desired temperature coefficient, and divide the answer by 750. The resultant figure will be the value in mmf of the N750 unit needed. To find the value of the proper NPO capacitor, subtract the computed value of the N750 unit from the desired value; the result will be the required capacitance of the NPO unit.

Example:

A 100-mmf capacitor is needed for repairing a tuner, and its desired temperature coefficient is to be N330 — corresponding to a negative change of 330 parts per million per degree Centigrade.

Multiply:  $330 \times 100 = 33,000$ ;

44 mmf,

divide:  $750/33000$

the N750 value;

subtract: 100

44

56 mmf,

the NPO value.

For all practical purposes, units of the nearest standard values may

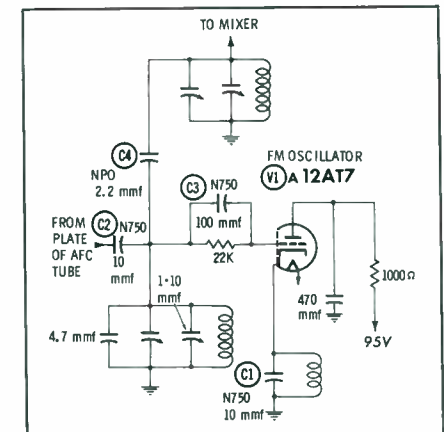


Fig. 3. FM tuner uses N750 and NPO capacitors as added "drift insurance."



be used. However, in the rare cases where it is necessary to have the exact capacitance and temperature coefficient, units of the *same type* may first be paralleled to achieve the desired values. These may then be combined according to the formula.

Important note: Before using any combination of capacitors to replace a single unit, consider these two points—the space available for the replacement combination, and the possible increase in stray capacitance due to the additional connecting leads, etc.

To aid the service technician in identifying temperature-compensating capacitors as to type, it would be a good idea to review a few facts about color coding. Tubular ceramic units with a 5-dot code have the "temperature-coefficient" dot at the left end. (This dot can be recognized by its position, extremely close to the end of the component.) On ceramic disc capacitors, the "temperature" dot is located beneath the value and tolerance dots—on the side of the disc toward the leads. The NPO-type capacitor is coded black, the N220 yellow, the N330 green, and the N750 violet.

As a further hint to technicians making tuner repairs, it is well to remember that "weak" tuners may sometimes need only replacement of a coupling capacitor—say the unit between the local oscillator and mixer. Snowy pictures and poor sensitivity quickly result from a defective capacitor in any coupling network. Defective bypass capacitors usually result in badly distorted output, recognized as overloading, interference patterns in the picture, etc.

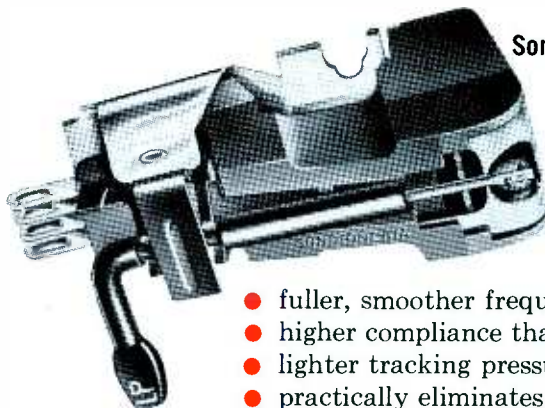
By adhering to the wise rule of not making any component changes in the critical circuitry of today's tuners unless the correct replacement is recognized and used, the average technician will encounter little real difficulty in handling some seemingly "impossible" jobs like an expert.

If any mystery remains concerning these small temperature-compensating capacitors, perhaps it concerns the brain-tickling question, "What about capacitors with *positive* temperature coefficients?" The answer is simple—these are the "firecrackers" that made temperature compensation necessary in the first place! ▲

Now...from Sonotone—

# 4 Big Improvements

in the quality stereo cartridge



Sonotone 8TA cartridge replaces 8T as industry standard

The new Sonotone 8TA cartridge gives greater than ever stereo performance... has 4 big extras:

- fuller, smoother frequency response
- higher compliance than ever before
- lighter tracking pressure
- practically eliminates dust pile-up

ONLY \$1450\*

## Sonotone 10T unitized stereo at lowest price ever

New 10T cartridge sells at record low price of \$6.45.\* And it covers the complete high fidelity range. 10T's unitized construction makes it easiest to install, easiest to replace. Low price means more sales—more profits.



### SPECIFICATIONS

	8TA	10T
Frequency Response .....	Smooth 20 to 20,000 cycles. Flat to 15,000 with gradual rolloff beyond.	Flat from 20 to 15,000 cycles ± 2.5 db.
Channel Isolation .....	25 decibels	18 decibels
Compliance .....	$3.0 \times 10^{-6}$ cm/dyne	$1.5 \times 10^{-6}$ cm/dyne
Tracking Pressure .....	3-5 grams in professional arms 4-6 grams in changers	5-7 grams
Output Voltage .....	0.3 volt	0.5 volt
Cartridge Weight .....	7.5 grams	2.8 grams
Recommended Load .....	1-5 megohms	1-5 megohms
Stylus .....	Dual jewel tips, sapphire or diamond.	Dual jewel tips, sapphire or diamond.

\*including mounting brackets

Sonotone makes only 6 basic ceramic cartridge models... yet has sold over 9 million units... used in over 662 different phonograph models. For finest performance, replace worn needles with genuine Sonotone needles.

**Sonotone** PRO-C Electronic Applications Division, Dept. CP-129  
ELMSFORD, NEW YORK



Leading makers of fine ceramic cartridges, speakers, tape heads, microphones, electronic tubes.  
In Canada, contact Atlas Radio Corp., Ltd., Toronto



# NOTES on test equipment

by Les Deane

## A Square Deal



Fig. 1. The Model 1715 may be used with scope to test amplifier response.

With the growing need for precision instruments to perform specialized tasks, I thought it fitting to report on one such unit this month. My selection was the Model 1715 square wave generator featured in Fig. 1, which is manufactured by RD Instruments (a division of Hickok Electrical Instrument Co., Cleveland).

Although the Model 1715 has many general applications, it is primarily designed for use in conjunction with an oscilloscope to check frequency response and phase-shift characteristics of audio and video amplifiers.

### Specifications are:

1. Power Requirements—115 or 230 volts  $\pm 10\%$ , 50/60 cps; power consumption 195 to 210 watts; self-regulated supply overcomes variations in line voltage; 2.5-amp line fuse provided.
2. Generated Frequency — 6 ranges from 1 cps to 1 mc; symmetry control provided for balanced square wave signal; frequency dial calibrated linearly from 1 to 10.
3. Output Connectors—75-ohm coax-type BNC and 600-ohm banana

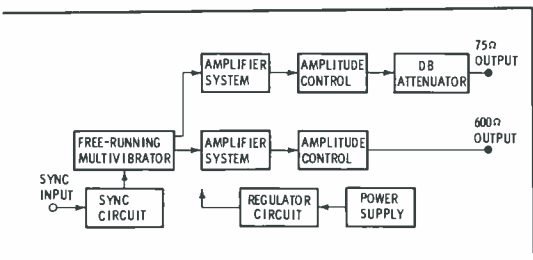


Fig. 2. Block diagram of Model 1715 Generator. Note its dual output feature.

jack; low impedance output 7 volts p-p with .02 u-sec. rise time; high impedance output 55 volts p-p with .1 u-sec. rise time; amplitude control provided for each output plus a 0 to 60 db step attenuator for 75-ohm output.

4. Synchronized Operation—requires positive-going sync signal or sine wave; recommended peak signal 5 volts, minimum 3 volts; type BNC coax-input connector provided.
5. Size and Weight—10" x 14½" x 15¾"; 30 lbs. net.

The 1715 is housed in an aluminum case equipped with a carrying handle; all controls and terminals are located on the front panel. On the left side of the panel, you'll find all of the controls and jacks associated with the 75-ohm output, while those associated with the 600-ohm output, plus a frequency range selector, are located on the right. The large dial is a fine frequency adjustment which is calibrated in divisions of .2 from 1 to 10. The control located directly below the dial, labeled SYMMETRY, is used in equalizing the positive and negative segments of the generated wave to produce a symmetrical output signal.

The chassis is of vertical construction, and with the wrap-around sides of the case removed, is easily maintained. Heat rise in the instrument is reduced by both natural and forced air ventilation. When I first turned the unit on, I thought the humming sound might be the generator grinding out the square waves, but I found that it was actually the motor on a small exhaust fan mounted in the rear of the case.

The instrument employs a total of 15 tubes (including power rectifier and regulators) in circuits sectionalized as shown by the diagram in Fig. 2. The heart of the generator is a free-running, plate-coupled multivibrator, which produces the square-wave signals. By switching in various capacitors, and by adjustment of the frequency vernier, this circuit oscillates over the range of 1 cps to 1 mc.

The multivibrator can also be controlled by an external sync signal. The sync circuit amplifies, shapes, and rectifies positive-going pulses. The resulting trigger voltage is then applied to one of the plate circuits of the multivibrator

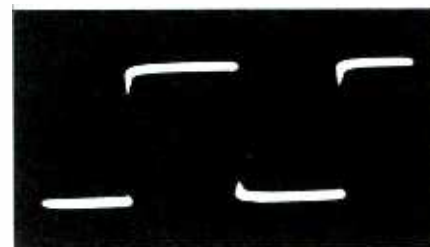
for synchronized operation.

Two separate channels are employed for the amplification of the generated square wave. Both channels incorporate clipper amplifiers, power amplifier, and individual amplitude controls. The 75-ohm channel also features an output step attenuator which is calibrated in decibels. Incidentally, the two outputs may be used either one at a time or simultaneously.

The low-voltage supply makes use of a power transformer and 5U4GB rectifier, while the regulator circuit employs three separate tubes to insure a constant plate supply free of ripple and noise.

Since square waves possess such steep leading and trailing edges, they are ideal for testing wide-band amplifiers. A square-wave signal is actually a combination of sine waves at the fundamental and odd harmonic frequencies. For most practical test applications, a square wave can be considered to contain frequencies from 1/10 to 10 times the fundamental rate. Thus, if we use a 60-cycle square wave as a test signal, we can consider that it represents a frequency range of around 6 to 600 cycles. It should be pointed out, however, that the frequency range represented by signals from the Hickok generator is somewhat greater than this, as evidenced by the rapid rise time specifications of .02 and .1 micro-second.

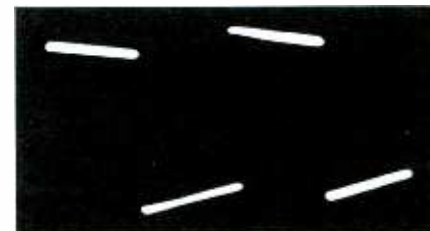
For an actual application of the generator, let's suppose you encounter a TV picture that exhibited smear or loss of detail. Such symptoms are an indication of inadequate frequency response in the video amplifier stage. A video amplifier



(A) Good squarewave (100 kc.)

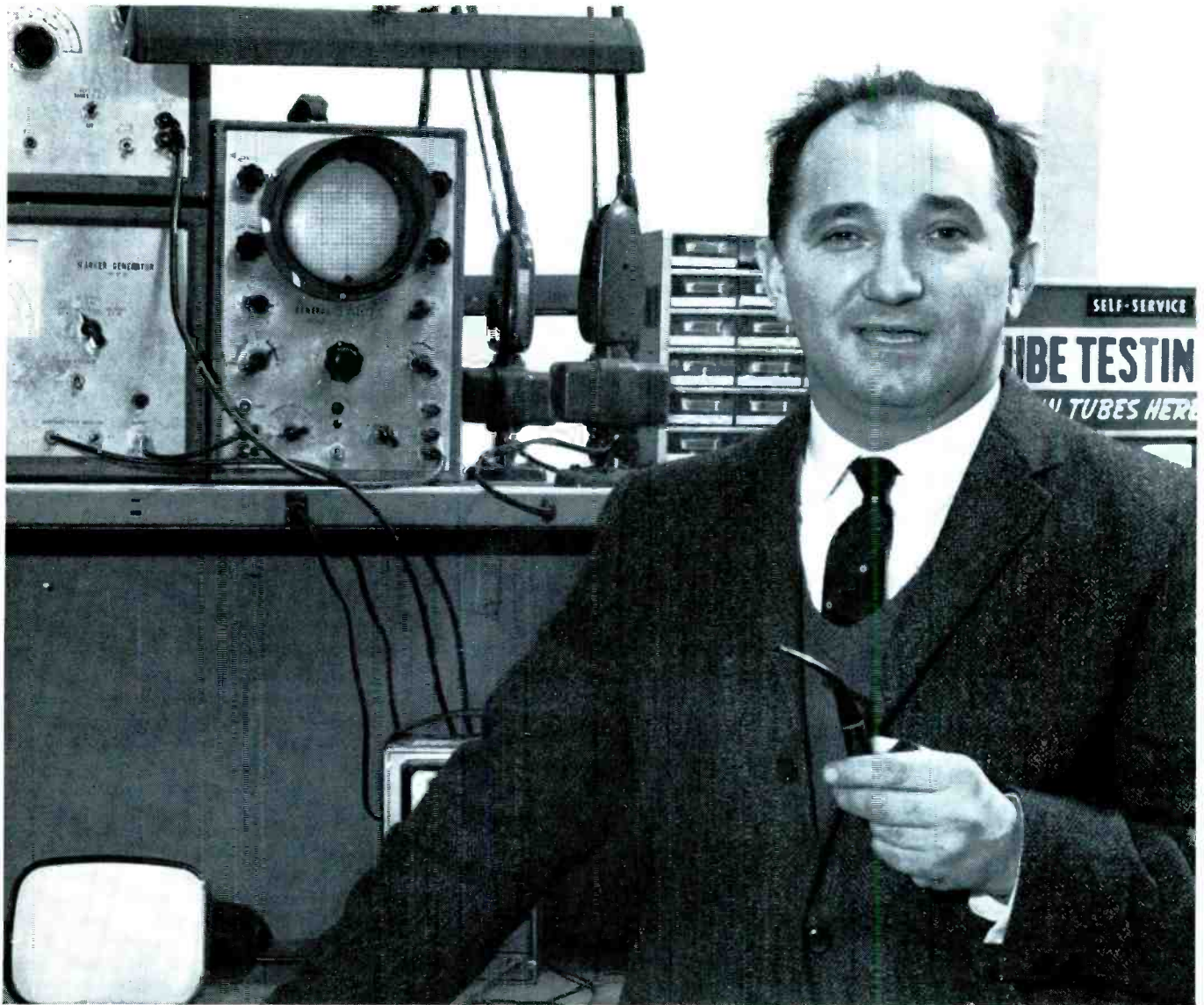


(B) Rounded leading edges (500 kc.)



(C) Sloping top (60 cps).

Fig. 3. Output waveforms of a typical video amplifier under square-wave test.



# “YOU’LL RARELY SEE a General Electric ‘Designer’ in the shop,”

**says Richard Vician, West Branch Manager of Television Engineers Inc. and Certified Television Service Inc., Chicago, Ill.**

“Our men seldom have to pull the chassis of a General Electric ‘Designer’. They can do 9 out of 10 repairs in the home, because most key check points are easy to get at when you take the back off.”

Mr. Vician and Glenn W. Geist, President of the firm—Television Engineers Inc. and Certified Television Service Inc.—agree this makes money.

As Dick Vician puts it: “The easy availability lets us get more service calls done in a working day . . . more calls per man and more profitable operation. It means happy customers, too, because their bills are easier to take and sets stay in service.”

You can leave the “Designer” chassis in the set and still get at *both sides* of the printed boards. All tubes are easily replaceable. Fuses are accessible and you can get at key check points.

**Precision Etched Circuitry** is the name General Electric gives to its reliable, uniform circuitry. Each board has a *painted* schematic so that you can find your way through it easily. Service one and you’ll be thoroughly familiar with it.

“Designer” TV—the easiest-to-service sets in television! General Electric Company, Television Receiver Department, Syracuse, N. Y.



**GENERAL  ELECTRIC**

# STOP that interference!



ELIMINATE OR REDUCE  
TV AND FM INTERFERENCE

## Tunable MOSLEY Wave Traps

Now! High Q series-resonant wave traps help knock out TVI and BCI. High Q series-resonant type wave traps may be used on any receiver input, 50 to 600 ohms, balanced or unbalanced. Easy to install. Solderless. Choose type whose range includes frequency of interfering station.



List Price \$4.82

TYPE	RANGE (mcs.)
WT-7	6.8-8.5
WT-14	13.8-16
WT-21	16-28
WT-41	27-55
WT-78	47-110
WT-165	100-230

**Mosley**  
Electronics, Inc.  
St. Louis, Missouri

should have fairly flat response from about 30 cycles to over 3 mc for good, clear picture reproduction.

Before I performed a square wave test on the video amplifier stage of a set in our lab, I first checked the response of the scope I intended to use. If the scope itself introduces any distortion to the wave, you must take this into consideration when testing the amplifier.

Since peaking components are usually added to both the input and output circuits of a video amplifier in commercial receivers, I found that it's best to connect the generator output across the video detector load rather than the grid of the amplifier tube. The AC input to the scope is attached across the plate load of the tube.

In Fig. 3, I have shown the output waveforms obtained from a typical video amplifier test. Note that A shows re-

sponse with a square-wave frequency of 100 kc, which indicates that video circuit response is flat from at least 10 kc to 1 mc. Running the generator frequency up to 500 kc, I obtained the waveform in Fig. 3B, which exhibits excessive rounding off of the leading edge. This is indicative of very poor response at the higher frequencies, in this case above 5 mc. With the generator frequency at 60 cps, the flat top of the square waves became tilted as shown in Fig. 3C, which tells us that response is down at 6 cps and below.

I noted that the output of the Model 1715 remained absolutely constant in amplitude over its entire frequency range, which is an important factor in making precise frequency-response and phase-shift tests. And for hi-fi servicing, you couldn't ask for more exacting specs in a square-wave generator.

## Let's Check Tubes

The portable instrument pictured in Fig. 4 is the most recent addition to the line of tube testers manufactured by Vis-U-All Products Co., Grand Rapids, Mich. Identified as the Model V1003, it is designed for speedy tube testing, with a simplicity of use suitable for self-service counter operation.

This new tester incorporates features of an earlier model, the V1002, plus two separate functions for testing transistors and portable radio batteries. Physical improvements include a wrap-around plexiglass meter, increased visibility of the setup markings on the panel, and a newly-styled leatherette-covered case with a lid locking provision. The Model V1003 is sold complete with "cheater" type power cord, test leads, and adapter cable for checking picture tubes.

Specifications are:

1. Power Requirements — 105/125 volts, 60 cps; power consumption in standby less than 5 watts; one self-contained 1.5V battery; overload indicator and meter fuse provided.
2. Tube tests—emission automatically indicated on BAD?-GOOD scale of panel meter; grid-to-cathode and heater-to-cathode leakage and shorts, as well as gas content, indicated by neon bulb on panel; six test sockets provided.
3. CRT Test — 53° to 90° picture tubes checked by using special adapter cable, general operating condition of tube indicated on panel meter.
4. Transistor Tests—relative leakage and gain measurements for all medium and low power PNP and NPN types, special GOOD-FAIR-POOR leakage scale and two test sockets provided.
5. Battery Test — checks 1.5 to 90 volt units under load conditions; battery evaluated by reading on linearity scale of meter; two test leads provided.

6. Size and Weight — portable case 17" x 6" x 12"; 16 lbs.

Examining this tester in the lab, my preliminary analysis was confined to the panel. The instrument makes use of only 6 test sockets, including a separate octal type for 0Z4's, and a 7-pin miniature type for portable radio tubes such as the 1R5, 1U4, 3S4, etc. The lower-left corner of the panel contains a conventional interlock receptacle for the power cord. You might consider this as an on-off switch, for power is applied to the unit automatically when this connection is made. Directly above the interlock is an 11-position filament selector which provides a choice of heater voltages from 1.5 to 117 volts. In the lower right corner, you'll find a SHORT TEST lever and METER REVERSE button. The shorts lever has two positions — one for filament-to-cathode and the other for grid-to-cathode shorts and leakage indications. With the neon bulb as an indicator, I found the sensitivity of the leakage test to be about 3.5 megohms. When

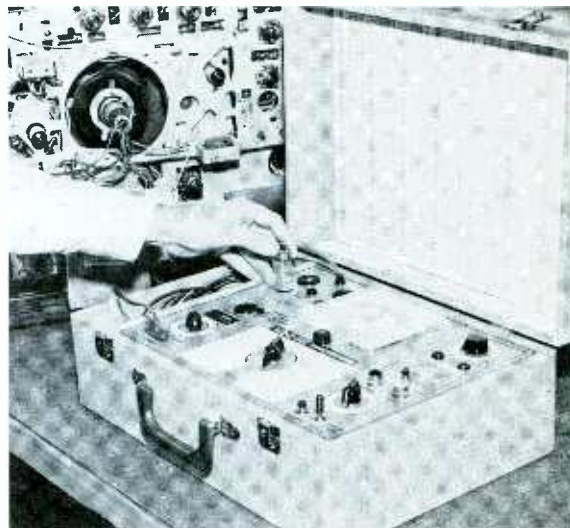
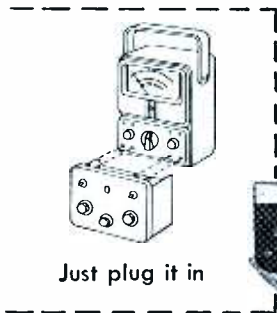


Fig. 4. The Model V1003 has a built-in compartment for leads and adapter.

# New Simpson "Add-A-Testers"



Another Great "First"  
from Simpson

## Converts your 260\* into seven different testers!

Think of it! A small investment turns your 260 VOM into a whole array of testers—equipment with a quality that is found only in individual pieces of test equipment at much higher prices. The secret lies in combining an adapter with the *top-notch meter and circuitry* of your 260.

Each combination of Add-A-Tester unit and 260 is self-contained, self-powered. Each adapter goes on and off in a jiffy. No gadgets, no complicated connections. Furthermore, Add-A-Tester units require only 1/2 to 1/3 the storage space of individual testers. By reducing bench clutter, this compactness makes jobs go faster, raises shop efficiency. Make your 260 do double duty. Stop in at your Electronics Parts Distributor or write the factory for further information.

\*Trademark

# Simpson

**ELECTRIC COMPANY**

5209 West Kinzie Street • Chicago 44, Illinois  
Phone: EStebrook 9-1121  
In Canada: Bach-Simpson Ltd., London, Ontario

**WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT**

### TRANSISTOR TESTER, Model 650.....\$26.95

Beta Ranges: 0-10, 0-50, 0-250, (F.S.)  
Beta Accuracy:  $\pm 3\%$ , with 260  $\pm 5\%$  nominal  
Ico Range: 0-100  $\mu$ a  
Ico Accuracy:  $\pm 1\%$ , with 260  $\pm 3\%$  (F.S.)

### DC VTVM, Model 651.....\$32.95

Voltage Ranges: 0-.5/1.0/2.5/5.0/10/25/50/100/250/500

Accuracy:  $\pm 1\%$ , with 260  $\pm 3\%$  (F.S.)  
Input Impedance: greater than 10 megs all ranges

### TEMPERATURE TESTER, Model 652....\$38.95

Temperature Ranges:  $-50^{\circ}\text{F}$  to  $+100^{\circ}\text{F}$ ,  $+100^{\circ}\text{F}$  to  $+250^{\circ}\text{F}$

Accuracy: with 260  $\pm 2^{\circ}$  (nominal)  
Three lead positions provided  
Sensing Element: thermistor

### AC AMMETER, Model 653.....\$18.95

Ranges: 0-0.25/1/2.5/12.5/25 amps  
Accuracy:  $\pm 1\%$ , with 260  $\pm 3\%$  nominal  
Frequency Range: 50 cycles to 3000 cycles

### AUDIO WATTMETER, Model 654.....\$18.95

Load Ranges: 4,8,16,600 ohms  
Wattage: Continuous 25 watts (8,600 ohms)  
50 watts (4,16 ohms)  
Intermittent 50 watts (8,600 ohms)  
100 watts (4,16 ohms)

Accuracy:  $\pm 5\%$ , with 260  $\pm 10\%$  nominal  
Direct reading scale from 17 microwatts to 100 watts

### MICROVOLT ATTENUATOR, Model 655...\$18.95

Ranges: 2.5 microvolts to 250,000 microvolts  
continuously variable in decade steps  
Frequency: DC to 20 KC  
Accuracy:  $\pm 1\text{db}$

### BATTERY TESTER, Model 656.....\$19.95

Checks all radio and hearing aid batteries up to 90 volts at the manufacturer's recommended load, or any external load.

Note: All Simpson 260 Adapters provide for normal 260 usage without disconnecting the adapter.



Model D-612T \$49.95 net

Lift it...



**you can feel  
the extra quality  
in an EPL  
DC POWER SUPPLY!**

**Powers transistor circuits,  
12/6 volt hybrid/tube  
auto, marine radios**

EPL power supplies are heavier because they're built with top quality, heavy duty components to provide unequalled durability and performance. Ample regulation for operating solenoid tuning controls in auto radios. Patented conduction cooling gives greater safety margin, longer rectifier life and higher current carrying capacity.

- out-performs all others in its price class
- lowest ripple
- costs less per output
- reserve power to handle any service job
- backed by Certified Proof-of-Performance chart
- longer life

2 ranges: 0-8 and 0-16 volts continuously variable.

Less than 0.5% ripple up to 5 amperes. 2% ripple at 10 amperes.

10 amps. at 12 v. continuous duty. 20 amperes intermittent.

FREE BULLETIN D612T

See the Difference at Your Jobber



**ELECTRO  
PRODUCTS  
LABORATORIES**

4501-R Ravenswood, Chicago 40  
Canada: Atlas Radio Ltd., Toronto

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

9674

I checked several gassy tubes in the Model V1003, I noted that the short bulb either flickered or glowed continuously, thus indicating the tube should be rejected.

The reverse button is used to obtain proper meter deflection during the emission check for certain tubes. Also in this section of the panel, is a load adjustment which has linear calibrations from 0 to 100. It must be set to the exact value prescribed in the tube setup information.

In the center of the panel there is a 4" meter at the top, with a 1/500-amp fuse directly below it, and a large area at the bottom devoted to a 12-position switch surrounded by tube data. Each position of this switch is numbered, and the different positions permit the operator to make various tube-element connections for 5 of the 6 panel sockets. Although there are over 400 different tube settings listed on the chart inside the lid of the tester, almost 100 of the more common types are printed on the panel in groups around the selector switch. A load setting is given after each listing; therefore, if you know the proper filament voltage, you need not refer to the large lid chart.

In a few cases, I noticed that a "hot" tube (i.e., one with an emission higher than average) caused the meter pointer to go off scale. By quickly changing the load setting, however, I was able to bring the needle back to a reasonable reading and complete the test. When testing tubes in any checker, it's always a good idea to have the tubes warmed up. A hint in the V1003 manual suggests that you pre-heat them by pulling the low-voltage rectifier in those sets employing parallel filament circuits. This leaves the other tubes lit, yet eliminates shock hazard and excessive conduction in one tube due to removal of another.

One extra feature of the Vis-U-All unit is its ability to test portable radio batteries. The section of the panel devoted to the battery test is shown in Fig. 5. Two test leads are supplied—one red and one black. The selector switch above the test jacks is marked off in 11 different battery potentials, each representing a given load for the particular unit to be tested. Observing the correct polarity, the test leads are placed across the battery terminals, and

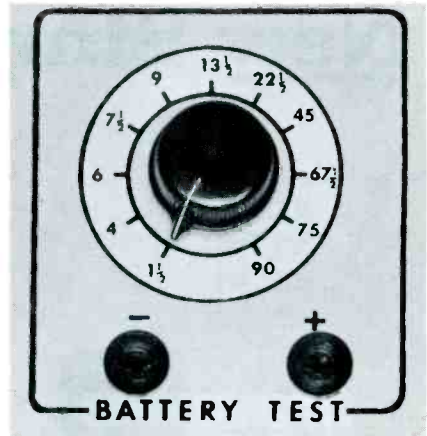


Fig. 5. Provisions for checking portable radio batteries on Vis-U-All tester.

the condition of the battery is indicated on the linear 0 to 1 scale of the meter. If the reading is not .8 or better, the battery should be replaced.

The other extra of the Model V1003 is its transistor test (see Fig. 6). On the right side of the panel, you'll find two transistor sockets and a test button. Since the test circuit makes use of a built-in penlight cell, the battery voltage should be checked before a transistor is tested. This is accomplished by inserting a 1000-ohm resistor between collector and emitter on either test socket. If the battery is satisfactory, the meter should read .8 or better.

To test a transistor, you must first determine whether it is a PNP or NPN type. After plugging it into the appropriate socket, leakage is automatically indicated on the bottom meter scale which is calibrated in three sections—GOOD-FAIR-POOR. In the gain test, you merely depress the gain button and note

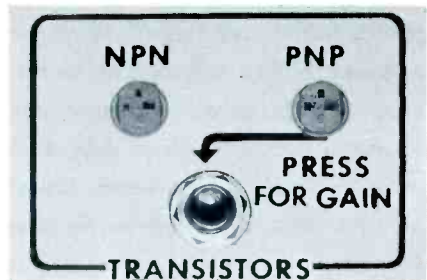


Fig. 6. Transistor test section of V1003. Leakage and gain are read on meter.

**the D-400 Hi Leak Analyzer**

MADE BY THE DESIGNERS OF THE Pioneer 250

SEE YOUR DISTRIBUTOR

\$12.95 NET

**DOSS**

**ELECTRONIC RESEARCH, Inc.—820 Baltimore • Kansas City, Mo.**



**capacitor tester SAVES YOU TIME**

■ An extremely sensitive instrument designed to quick-check bypass condensers for leakage or open conditions.

The D-400 utilizes the relaxation oscillator principle and supplies 100 volts DC for the purpose of testing. A built-in neon indicator makes testing fast and simple.

Tests for leakage up to 500 megohms in any capacitor within the range of 0 to 1.0 MFD. Also ideal for testing filament continuity, etc.

the increase in meter deflection. If the increase is at least one division on the gain scale, as compared to the leakage reading, the transistor is okay. A shorted transistor will cause a full-scale reading in the leakage test, while an open one will produce no deflection in either test.

To sum up my investigation of the Model V1003, I found it to be one of the fastest tube checkers I have ever used and, for this type of tester, it is reasonably accurate. Since it is simple to operate, it is an ideal self-service instrument for the front counter of any service shop.

## New Waveform Watcher

Waterman Products Co., Inc. of Philadelphia, has recently developed a 5" oscilloscope especially for the TV and hi-fi service industry. Identified as the Model S-16-A. *Craftscope*, it features portability and a usable frequency response from DC to 7 mc. The instrument comes complete with combination probe and instruction manual.

Specifications are:

1. Power Requirements — 105/125 volts, 50/400 cps; power consumption 65 watts; 2-amp line fuse provided.
2. Vertical Input System—wide-band response within 2 db from DC to 3.58 mc, +½—3 db to 5.7 mc, sensitivity 100 mv/cm; high-sensitivity response +½—3 db from 3 cps to 800 kc, sensitivity 7 mv/cm; 400 volts maximum input; input impedance 1 megohm shunted by 40 mmf; pulse rise time .07 microsecond; both DC and AC input connectors provided.
3. Horizontal Input System — frequency response +½—3 db from 3 cps to 300 kc; sensitivity 28 mv/cm; input impedance 1 megohm shunted by 120 mmf.
4. Sweep System—internal frequency range of from 5 cps to 50 kc in four ranges, preselected sweep rates of (V) 30 and (H) 7,875 cps; external sweep and sync input on front panel; ± internal and line sync with amplitude and phase

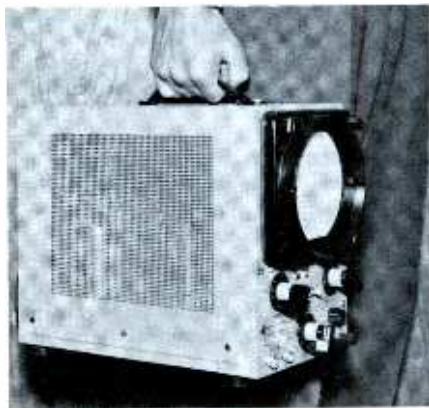


Fig. 7. Waterman's Model S-16-A wide-band 5" scope is compact and portable.

# Sylvania Audio-Power Transistors



Here are two problems you won't have to face when you replace with Sylvania

### Problem No. 1:

*Which type replaces which?*

Sylvania has the most complete line available. And your Sylvania distributor has them in stock. The full line listed here equips you to replace the output transistors of every major auto-radio make. To make your job easier, Sylvania has prepared an interchangeability chart—available from your Sylvania Distributor.

#### Sylvania's Auto-radio Transistor line

2N155	2N242	2N296	2N350	2N677
2N176	2N250	2N301	2N351	2N677A
2N235	2N255	2N301A	2N399	2N677B
2N235A	2N256	2N307	2N401	2N677C
2N235B	2N257	2N307A	2N419	2N678
2N236B	2N285A	2N326	2N420	2N678A

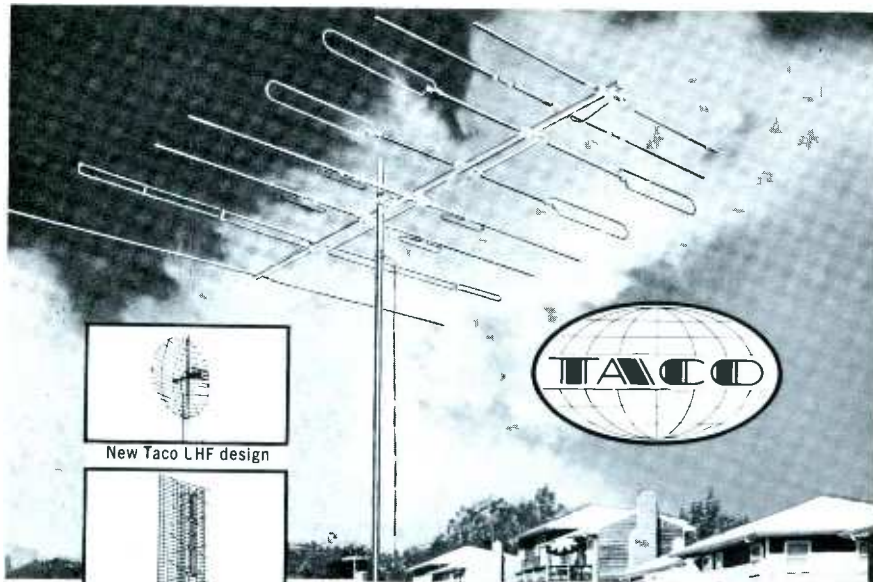
### Problem No. 2:

*The broken mica washer*

More often than not the mica washer flakes when you remove the output transistor from the auto radio chassis. To save you time and money, Sylvania now packs a tight-fitting mica washer with every transistor. Next time you need an audio power transistor—get it from your Sylvania distributor and ask for Sylvania by name.

 **SYLVANIA**   
Subsidiary of  
**GENERAL TELEPHONE & ELECTRONICS**

SYLVANIA ELECTRIC PRODUCTS INC.  
Semiconductor Division  
100 Sylvan Road, Woburn, Mass.



## Use the best- TO BE THE BEST-

Back up your skills and reputation with the best—always use a Taco antenna to assure top-notch performance and lasting satisfaction. You'll find Taco antennas go up easier and work better—and you make more money!

*Write for complete details*

THE  
**TV-riffic**  
ANTENNAS

TECHNICAL APPLIANCE CORPORATION, Sherburne, New York.



### SK-310 NEV-A-BREAK SOC-KIT

THE ONLY CRT REPLACEMENT SOCKET THAT PROTECTS AGAINST ANNOYING WIRE BREAKAGE!

#### Kit contains:

- Heavy duty socket
- Reinforced back plate
- Durable contacts
- Clamp and hardware
- Complete in handy plastic utility box, only

**\$1.75** DEALER NET



"Forget that lousy ruby, Ed. Let's pry this Jensen cartridge loose."

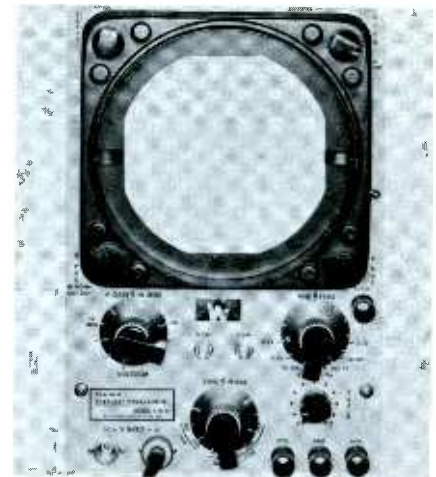


Fig. 8. Close-up view of the Craftscope showing the details of its front panel.

*adjustments provided.*

5. *Internal Calibration*—neon relaxation oscillator provides reference signal; with calibration control preset, peak-to-peak values are indicated by vertical scan in cm times dial indication; 1 screen division = 1 cm.
6. *Z-Axis Modulation* — blanking input provided on front panel for control of beam blanking or intensification; positive signals required for blanking.
7. *Other Features* — phase reversal switch and vertical balance control on front panel; edge-lit graph screen with dimmer control; front mask designed for camera adapter; combination 1-to-1 and 10-to-1 probe supplied.
8. *Size and Weight* — 12½" x 7" x 10½"; 18½ lbs.

The Model S-16-A is one of the most compact 5" scopes I have ever used. It features a short, flat faced CRT housed in an all-metal case only slightly over one-half cubic foot in total size. The mask assembly consists of a graticule with calibrated grid lines that can be illuminated to different intensities through use of a special dimmer adjustment. This assembly also accommodates conventional clamp-on camera equipment for taking pictures of waveforms displayed on the screen.

To familiarize you with the operation of the Craftscope, I have shown a close-up of its front panel in Fig. 8. One feature not too apparent when you first examine the instrument is the location of the phase-reversal switch. It is actuated by the same knob that controls vertical positioning of the CRT beam, which is found in the lower-left corner of the mask assembly. The switch serves to invert the pattern on the screen by reversing connections to the vertical deflection plates; thus, a response curve can be displayed to agree with the polarity shown in any manufacturer's alignment instructions.

The only other adjustment not plainly marked on the front is the dimmer adjustment for the illuminated graticule. This is a small lever protruding from the





Fig. 9. Probe for the Craftscope has reversible tip for 1:1 and 10:1 inputs.

right side of the mask, as can be seen in Fig. 8. With the lever down, no light is reflected from the etched calibration lines; however, as the lever is moved upward, illumination increases.

When working with this scope to view various TV waveforms, I found the calibration feature very interesting. The method used to determine peak-to-peak amplitudes is somewhat different from that employed in most general-purpose instruments. In the first place, the graticule or calibration screen is marked off in centimeters, with both intersecting center lines subdivided into smaller divisions of .2 of a centimeter each. You'll find it isn't necessary to convert from centimeters to inches or from millivolts to centimeters in order to determine an ordinary peak-to-peak value in volts. To calibrate the vertical input circuit for amplitude measurements, you merely flip the VOLTS/CM selector to the CAL position and adjust the small v. CAL control until the calibration signal occupies four vertical squares (4 cm) on the screen. When measuring the unknown peak-to-peak value of a wave, you then set the VOLTS/CM selector to one of its .1 to 5 attenuation positions so that the vertical scan covers from 2 to 6 squares on the screen. The peak-to-peak voltage is equal to the number of vertical squares times the dial setting (.1, .2, .5, 1, 2, or 5). Since the height of the calibrated graticule is 10 cm, a 50-volt input signal gives full-scale deflection with the attenuator set at maximum (5). For viewing signals of higher peak-to-peak amplitudes, additional attenuation must be introduced either by changing the setting of the v. CAL adjustment for less deflection sensitivity, or by using the 10-to-1 attenuation factor of the probe supplied with the instrument.

This probe is pictured in Fig. 9. Note that it has a removable tip which provides for either direct or attenuated signal transfer to the vertical input. With the longer tip out, however, a 9-megohm resistor is placed in series with the input, and the attenuation is 10 to 1. When using the probe in this position, remember that all peak-to-peak readings must be multiplied by 10.

# RCA TEST EQUIPMENT

## "the professional's touch"



### WR-69A TELEVISION/FM SWEEP GENERATOR

USE: for visual alignment and trouble shooting of TV rf/lf/vf circuits and other electronic equipment. IF/Video frequency ranges 50 Kc to 50 Mc, TV channels 2 to 13, plus FM range—88-108 Mc. Sweep width 0-12 Mc or more. Output level—0.1 volt or more. Attenuation ratio 60 db or more below maximum output. \$295.00\* (including all cables, instruction book).



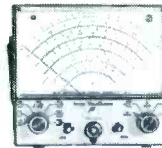
### WO-91A 5-INCH COLOR-TV OSCILLOSCOPE

USE: high-performance, wideband oscilloscope ideally suited for color-TV black-and-white TV, and other electronic applications. Dual bandwidth (4.5 Mc, 0.053 volts rms/in.) (1.5 Mc, 0.018 volts rms/in.). Internal calibrating voltage and calibrated graph screen. Includes special direct/low cap shielded probe and cable. \$239.50\* (includes ground cable, insulator clip, instruction book).



### WR-99A CRYSTAL-CALIBRATED MARKER GENERATOR

USE: to supply a fundamental frequency rf carrier of crystal accuracy for aligning and trouble-shooting color, black-and-white TV, FM receivers and other electronic equipment operating in 19 Mc to 360 Mc range. \$242.50\* (complete with output cable, two phone tips, instruction book).



### WV-98A SENIOR VOLTOHMYST®

USE: for making accurate ac and dc voltage measurements as well as measuring resistances from 0 to 1,000 megohms. Measures peak-to-peak values of complex waveforms. Ruggedized, die-cast aluminum case. Large, easy-to-read 6 1/2-inch meter! A fine VTM for electronic technicians and engineers! Includes special dc/ac-ohms shielded probe and cable. \$79.50\* (complete with ground lead, alligator clip, instruction booklet).



### WR-70A RF/IF/VF MARKER ADDER

USE: To be used with WR-69A, WR-99A or similar electronic equipment. Eliminates possibility of waveform distortion during visual alignment techniques by adding markers after the rf signal is demodulated. \$74.50\* (complete with cables, instruction book).



### WT-110A AUTOMATIC ELECTRON-TUBE TESTER

USE: especially for TV and general electron-tube service testing through automatic punched-card selection of correct test conditions on wide variety of tubes. Checks vacuum-tube rectifiers under high-current conditions. \$199.50\* (complete with 263 punched cards, 24 blank cards, card punch, instruction book).



### WR-46A VIDEO DOT/CROSSHATCH GENERATOR

USE: a "must" for making color-TV static and dynamic convergence adjustments in the home or shop. Derives sync from station-tuned TV set and reinserts highly stable video dot, bar, or crosshatch patterns to picture tube grids or video amplifier grids. \$179.50\* (complete with cables, instruction book).



### WR-49B RF SIGNAL GENERATOR

USE: for alignment and signal tracing of AM/FM receivers, low-frequency signal tracing and alignment of TV vt/lf amplifiers. Six ranges—85 Kc to 30 Mc. Internal 400 cps modulation. Low rf signal leakage! DC blocking capacitors at rf and af output terminals prevent damage to instrument or external circuits. \$79.50\* (complete with shielded cable for rf and af output, instruction book).



### WR-61B COLOR-BAR GENERATOR

USE: for checking overall operation of color-TV receivers and a "must" for adjusting and troubleshooting color phasing and matrixing circuits. Generates signals for producing 10 bars of different colors simultaneously. \$295.50\* (complete with cables, TV-input adapter, instruction book).

PLUS a complete line of test equipment accessories—video multimarkers, TV isotaps and bias supplies, various probes and cables including high-voltage types. Add "the professional's touch" to your service—see RCA's full line at your Authorized RCA Test Equipment Distributor!

\*User Price (Optional)



**RADIO CORPORATION OF AMERICA**  
Electron Tube Division  
Harrison, N. J.

# NEW IMPORTANT SAMS BOOKS

## "Printed Circuit Diagnosis Made Easy"



Helps you become an expert in servicing printed circuit boards. Practical, simplified approach saves time troubleshooting all types of printed circuits. Explains correct way to interpret and use various styles of data shown in service literature. Describes best procedures to follow when only a schematic diagram is available.

Sample problems illustrate each phase of printed circuit troubleshooting. A "must" book for your service library. Illustrated; 64 pages; 5½ x 8½". Only..... \$1.00

## "Radio Receiver Servicing"

ALL-NEW EDITION



Latest enlarged edition of John T. Frye's famous best-seller. Includes new chapter on how to service transistor radios and printed circuits. The most understandable and valuable guide to radio servicing; based on the author's 25 years of practical experience. Includes a separate chapter on each type

of trouble, such as the dead set; tubes light but no sound; noisy sets; weak sets; sets unable to separate stations, etc. 208 pages; 5½ x 8½". Only..... \$2.95

## "Howard W. Sams Handbook of Electronic Tables and Formulas"

FOR ELECTRONIC TECHNICIANS



Specially prepared for electronic technicians, junior engineers and students. A valuable compilation of tables, charts, formulas and laws useful to all who work in electronics. Five comprehensive sections include: Formulas and Laws of Electronics; Constants, Standards, Symbols, Codes; Service and Installation Data; Mathematical Tables and Formulas; Miscellaneous.

Features full-color frequency spectrum chart based on latest 1959 FCC allocations. 134 pages; 5½ x 8½"; hard-cover. Only \$2.95

## "Television Tube Location Guide" Vol. 9



Latest volume in this invaluable series. Gives tube location data for TV sets produced in 1958-1959. Shows position and function of tubes in over 250 receiver models—just find the trouble and replace defective tubes without removing chassis! Shows major component placement; signal path; pin orientation on socket;

series string filaments; fuse location. Includes tube failure check charts. 96 pages; 5½ x 8½"; comb binding. Only..... \$1.25

## HOWARD W. SAMS & CO., INC.

Order from your Sams Distributor today, or mail to Howard W. Sams & Co., Inc., Dept. M-39 2201 E. 46th St., Indianapolis 6, Ind.

Send me the following books:

- "Printed Circuit Diagnosis Made Easy" (PC-1)
- "Radio Receiver Servicing" (RS-2)
- "Handbook of Electronic Tables" (HTF-1)
- "Television Tube Location Guide" Vol. 9 (TGL-9)

\$..... enclosed.  Send Free Book List

Name.....

Address.....

City..... Zone..... State.....

(outside U.S.A. priced slightly higher)



# THE TROUBLESHOOTER

ANSWERS YOUR SERVICE PROBLEMS

## The Roots of Boost

The schematics for many receivers carry a warning not to measure the boost voltage at the cathode of the damper tube. In such cases, how and where should boost be measured for best results?

IGNATIUS TIZZANO

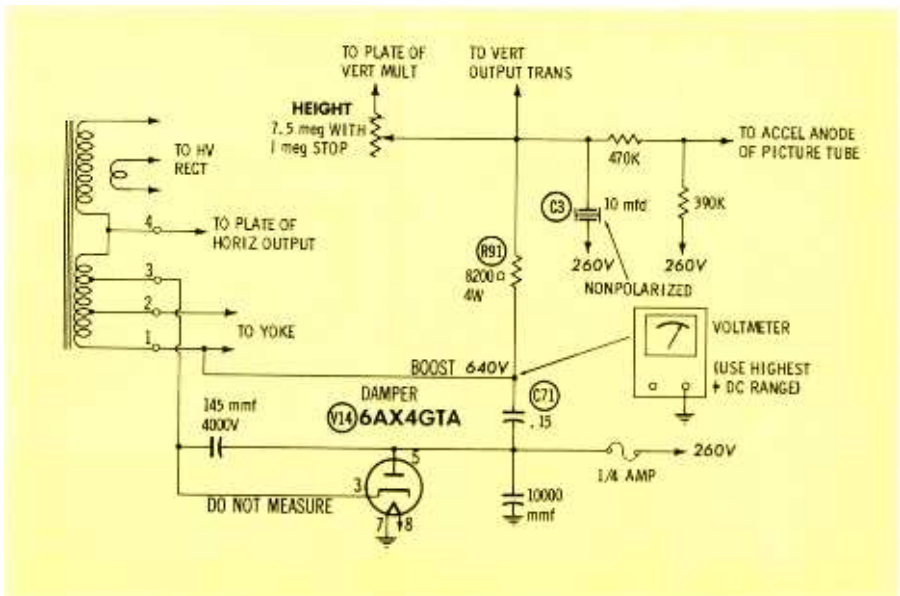
South Ozone Park, N. Y.

Begin at one of the load circuits which obtains voltage from the boost supply, and trace back until you find a connection going to the horizontal output transformer. At this point, you will usually find a capacitor corresponding to C71 in the attached diagram. (This is often a tubular unit of medium value, but it may be an electrolytic capacitor in some of the more recent models.) Boost voltage is developed across this component. In addition, C71 filters out high-amplitude flyback pulses; thus, the output-transformer terminal connected to C71 is established as the "bottom end" of the transformer. This means that DC voltage may safely be measured here. On the other hand, the damper cathode in many sets is connected to an intermediate tap on the horizontal output transformer—so it receives flyback pulses of sufficient amplitude to damage the input circuit of a voltmeter.

In practically all sets, the most convenient place to begin tracing the boost circuit is at the arm of the height control. Another handy spot is at the accelerating anode of the picture tube. Tracing back toward the horizontal sweep section, you will usually find that the boost line includes an RC filter network (R91 and C3 in the circuit shown). The arrangement of this filter follows a consistent pattern among various set designs, although a wide variation of resistor and capacitor values will be noted. Some receivers include two or more series resistors in the boost line, so check to make sure there are no resistors wired between your test point and the output transformer; otherwise, you will not be measuring the full value of boost voltage. In the occasional set which has the horizontal windings of the yoke in series with the boost line, measure boost on the load-circuit side of the yoke—not the flyback side.

## Tongue-Tied

Please help us repair three identical TV sets (Hotpoint Model 17S301) which all have the same trouble symptom. The sound goes dead at irregular intervals, but it comes back as soon as the volume control is advanced. We have replaced



all audio tubes and coupling capacitors, as well as the volume control in each set; in addition, we've tried our shop speaker in place of the regular speaker. None of these efforts have produced any results.

A. G. HESHMATI

Carmel, Calif.

We've heard several reports of defective ratio-detector transformers in the General Electric and Hotpoint "U" chassis, which is of about the same vintage as the "MM" chassis employed in Model 17S301. Although not identical, the ratio-detector cans used in these two chassis appear to be very similar; so your trouble may be due to a defect in this component.

If the transformer isn't at fault, the next most probable trouble is a slight break (or a bad solder joint) in the printed wiring. Since it causes only an intermittent trouble, the defect is probably very small and hard to locate. So, instead of hunting all over the audio section for a bad spot, first try to localize it by means of a signal-tracing or signal-injection test.

### Dimmit!

What would cause a Hallicrafters Chassis A1400D to have too much brightness, even with the control turned all the way down?

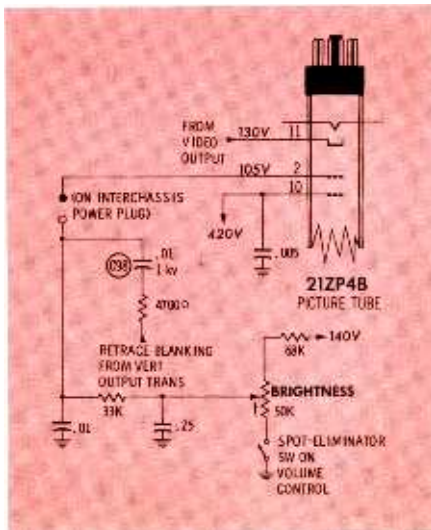
ROBERT L. WHEATON

Painted Post, N.Y.

Several troubles in the unusual CRT circuitry of this model could result in excessive and uncontrollable brightness. For one thing, the spot-eliminator switch (ganged with the receiver on-off switch and volume control) might have defective contacts. If it remained electrically open while the set was operating, there would be +140 volts on the picture-tube grid regardless of the brightness-control setting. Of course, this would result in a positive bias on the CRT.

Another very possible defect is leakage in the .01-mfd, 1000-volt capacitor C98, which couples a retrace-blanking signal from the vertical sweep section to the picture-tube grid.

Insufficient cathode voltage on the



# Service Technicians! YOU EARN MORE... YOU RATE with the public when you own the PHOTOFACT® service data library!



"With Sams PHOTOFACT I am able to give my customers faster service. I like the Circui-Trace feature—it makes servicing printed circuits much easier and not so time-consuming."

—Henry Kiers  
Hull, Iowa

YES, if you are one of the thousands of owners of a complete PHOTOFACT Service Data Library, you are enjoying maximum earnings. It's inevitable, because no matter how expert you are, you can always *save more time on any job, get more jobs done daily—EARN MORE, DAY IN AND DAY OUT...*

Moreover—as the owner of a complete PHOTOFACT Library, you know your customers' sets *best*. You can actually show each customer you have the PHOTOFACT Folder covering his very own set. Result: You command public respect and acceptance which paves the way to more business and earnings for you...

### HOW TO STAY AHEAD...

Today, the truly successful Service Technicians are those who own the complete PHOTOFACT Library, who can meet and solve any repair problem—faster and more profitably. And these men *keep ahead* because they're on a Standing Order Subscription with their Distributors to receive all new PHOTOFACTS as they are released monthly.

For PHOTOFACT Library Easy-Buy Plan details and Standing Order Subscription, see your Sams Distributor today, or write to Howard W. Sams...

**"PEET" PROGRAM** **BIG NEW PLUS!**

get the details

If you now own a **PHOTOFACT** Library, you can apply for membership in the powerful new "PEET" program, designed to build prestige and business for the Service Technician who qualifies. Ask your Sams Distributor about "PEET" or mail coupon today!

**HOWARD W. SAMS & CO., INC.**  
2201 E. 46th St., Indianapolis 6, Ind.

Send me full details on the new "PEET" Program. Include full information on the Easy-Buy Plan and Free File Cabinet deal

I'm a Service Technician:  full-time;  part-time

My Distributor is: \_\_\_\_\_

Shop Name \_\_\_\_\_

Attn: \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

CRT would have as serious an effect as excessive grid voltage. If you measure less than the normal 130 volts on the cathode, see if you have heater-to-cathode leakage in the picture tube or a partial short in the video-output plate circuit.

### Hot Stuff

Every book says to use an isolation transformer when servicing "hot-chassis" receivers, but I still know many servicemen who don't use one. How do they get by?

ROBERT H. ARTHUR

York, Ala.

If you closely observe a technician working on a "hot" set without an

isolation transformer, you may notice that he starts out by checking to see if the receiver chassis is connected to the earth-ground side of the AC line. (He can best do this by momentarily bridging a neon lamp or AC voltmeter from chassis to earth ground; if he gets an indication of voltage, this is a warning to reverse the line plug in its socket.) Modern polarized plugs and sockets are designed so that the receiver positively must be connected to the line with chassis going to ground.

Trouble with "hot-chassis" sets arises from the opposite situation, where the set chassis is connected to the ungrounded side of the line. Of course, this places 117 volts AC not only on the receiver chassis, but also on the ground

bus or chassis of any test equipment being used. Most test instruments have their own built-in isolation from the line, so a direct short across the AC power circuit is unlikely (as long as no line-to-chassis short occurs in the test equipment). On the other hand, a serious short circuit may result from connecting an externally-grounded antenna system to a "hot" receiver when the line plug is incorrectly inserted. A house fuse will probably be blown, if the antenna coil in the tuner is not burned out first.

As for servicemen who just plug a "hot" receiver into a wall socket and proceed with the repairs, you'll probably notice that they avoid shocks simply by not touching any metal parts of the equipment on the bench. Depending on how their little game of "line-plug roulette" turned out, they may or may not have a considerable amount of AC voltage on the chassis to produce hum and other deceptive effects in their test measurements. And they are evidently willing to take the risk of accidentally causing a short across the line.

An isolation transformer provides a valuable extra measure of safety. By using this unit between receiver and wall socket, you are (1) relieved of worrying about the proper way to plug in the set's line cord; (2) given maximum protection against a "dead short" across the AC terminals; (3) insured against unpleasant (and possibly fatal) shocks when contacting metal portions of equipment; and (4) freed from the annoyance of high-amplitude AC hum on supposedly grounded connections.

# 1960 RADIO-ELECTRONIC MASTER

now available at your distributor

NEW...STREAMLINED...28 EASY-TO-USE PRODUCT SECTIONS COVER ALL LATEST PRODUCTS

Printed Circuit Components • Stereo equipment • Color TV service instruments • miniature and sub-miniature components • Automatic test equipment • Remote control radio equipment • Silicon rectifiers • New transistor types .... Plus every new product for servicing, experimenting, design, industrial and military applications.

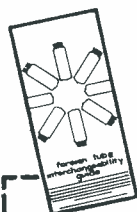
FASTER...EASIER...MORE PROFITABLE SERVICE OPERATION

Covers all items necessary for radio-TV-audio servicing. Offers thousands of products for extra income in hi-fi, sound and industrial servicing. Buy, sell and bill direct from The MASTER...it shows list prices!

No matter what product or component you require... YOU'LL FIND IT FASTER IN THE

## 1960 MASTER

RADIO ELECTRONIC MASTER, 55 Sewell St., Hempstead, N.Y.



FREE...FROM YOUR DISTRIBUTOR

24-page Foreign Tube Interchangeability Guide or write direct enclosing 25¢ for handling

### Pale Pix

The picture on a Motorola Model 17T22 is barely visible. The 12BY7 video amplifier is in good condition, and voltages on this tube are normal. I have tried a new picture tube without good results.

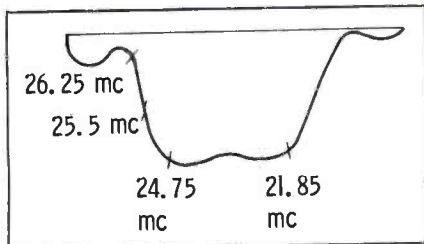
R. H. GIBSON

Punxsutawney, Pa.

Is screen brightness normal, and are the lines in the raster clearly focused? If so, check the peak-to-peak signal voltage on the grid of the 12BY7 with an oscilloscope or peak-reading VTVM. A feeble signal at this point—very much less than a volt—indicates trouble in the detector, IF, RF or AGC circuits. Check the setting of the local-distant switch, and make sure you do not have too much AGC voltage for existing conditions. Also check tubes and voltages in the RF and IF sections.

If the input signal to the video amplifier seems normal, you may have trouble in this circuit or in the cathode circuit of the picture tube. Make further component tests in this area.

Poor brightness and fuzzy focus indicate trouble in the circuits associated with the CRT. Check the voltages on the various base pins for clues to possible defects; don't forget the filament voltage. Also see if the high-voltage rectifier circuit is working normally.



### Alignment Ups and Downs

The over-all video IF response pattern for RCA Chassis KCS47B, given in PHOTOFACT Set 134, Folder 9, calls for a 21.85-mc marker up at the top of the curve. I have been unable to place it there; 21.85 mc always ends up at the foot of the curve.

CHARLES W. McDONALD

Port Huron, Mich.

One of the traps which govern the "low end" of the curve is probably set at the wrong frequency. Double-check the following adjustments for minimum detector output at the indicated frequencies: 21-mc absorption trap A2 in the cathode circuit of the fourth IF; 21-mc sound take-off transformer secondary A1 in the third-IF grid circuit; and 19.5-mc absorption trap A5 in the first-IF grid circuit. In addition, make sure that the 21.75-mc adjustment A8 (also in the sound take-off transformer) is correctly peaked.

If these adjustments don't take care of your problem, look for circuit defects which might be causing weak output on the low-frequency side of the response curve. Low transconductance in one of the IF tubes might be to blame. Or, if the third video IF or first sound IF tube is drawing grid current for some reason, it will tend to load down the sound take-off circuit and prevent you from adjusting A8 for a satisfactory peak. A faulty AGC network is another possible cause of response-curve distortion.

### Gremlins Again!

A nearly new Admiral portable (Chassis 15C1) stubbornly defied the efforts of four technicians to restore a lost raster and clear up garbled sound. At long last, it was discovered that the vertical and horizontal oscillator tubes (the bottom two in the series filament string) were not getting heater voltage because of a shorted RF bypass capacitor connected to the filament line where it entered the tuner. The horizontal oscillator tube is close enough to the fusible resistor to be warmed by it, so it felt "live" to probing fingers.

PATRICK J. MARTIN

Los Gatos, Calif.

Here's further proof (as if we needed it!) that the unlikeliest troubles are apt to occur. Bet you're now relying on an AC voltmeter instead of "feeling your way" around the filament circuit.

### Dropout

I have been having trouble with the Neutrode tuners in several Zenith sets

of the 17Z21 and similar chassis series. In each case, the picture fades out after the set has been on for awhile (anywhere from 10 minutes to three hours). Sometimes it can be brought back by switching off channel and then back again. I've been able to determine that the trouble is due to intermittent operation of the oscillator.

On the easy-to-fix ones, the filament of the 6CG8 goes out because of a bad connection between pin 4 of the tube socket and ground. Flowing solder over the connection doesn't repair it permanently, so I have been soldering a short wire jumper between the socket lug and the printed-wiring board.

In other sets, the heater of the 6CG8 remains lit, but the voltage at the oscil-

lator grid (pin 1) drops to zero when the trouble appears. Even when a picture is present, the voltage at this point is only about half of the normal value. What do you think might be causing this symptom?

WEBSTER H. FOULON

(no address given)

Occasional reports have been received of defective ceramic capacitors in the oscillator grid circuit of early-production Neutrode tuners. These units can be replaced with conventional ceramic disc capacitors of correct value and temperature coefficient. Pay special attention to the 6.8-mmf, N330 unit wired between the oscillator grid and coil terminal 7, as well as the 3-mmf, NPO capacitor between terminal 7 and ground.

# HICKOK

## transistor-radio tester

### 810

**Hickok-engineered**

... for fast and complete troubleshooting of transistor radios.

- A combination AM signal generator and tuned receiver for signal tracing.
- Transistor test circuit . . . measures leakage and gain.

Fast . . . Accurate . . . Complete **\$119**

**ENGINEER'S TRANSISTOR ANALYZER**

Accurate and easy to use. Permits evaluations of a transistor to determine its ability to function under specific circuit conditions.

Model 850 . . . . . **\$138**

Ask your distributor for a "Hickok-demonstration" . . .

**THE HICKOK ELECTRICAL INSTRUMENT CO.**

10514 Dupont Ave.  
Cleveland 8, Ohio

GREATEST NAME IN TESTERS

## FM-Detector Circuits

(Continued from page 22)

Coupling capacitor C3 is relatively large in value—at least large enough to have very low reactance at 4.5 mc. Consequently, the signal voltage coupled through C3 undergoes little or no phase shift. Since it is in phase with the original signal voltage E1 in the primary of L1, this capacitively-coupled voltage is called a *reference* signal.

E1 also induces a voltage in the secondary winding of the transformer. This inductively-generated

voltage is in phase with E1 (or 180° out of phase with it, depending on the way the secondary winding is connected to the external circuit). This induced voltage sets up a *circulating current* (Ic) in the tuned tank, which then develops a voltage across C2. Since it is developed across a capacitor, this voltage is 90° out of phase with Ic. In a discriminator transformer, the secondary winding is center-tapped, and two output signals of opposite polarity are taken from its two halves. Since the voltage across the

secondary of L1 is the same as the voltage across C2, E2 and E3 respectively lead and lag Ic by 90° as shown in Fig. 2A.

If the incoming signal is unmodulated, or if the modulation momentarily has zero value, the signal frequency will be exactly 4.5 mc. This is not only the center frequency of the sound IF section, but also the resonant frequency of L1. In this case, the inductance and capacitance of the tuned secondary circuit will effectively cancel each other, and this circuit will appear to behave as a pure resistance. As a result, Ic will be in phase with the voltage induced in the secondary winding; therefore, this current will also be in phase with primary voltage E1. Since voltages E2 and E3 respectively lead and lag Ic by 90°, they will have a similar phase relationship with E1 (see Fig. 2A).

Remember, a "sample" of E1 has been injected into the secondary circuit through C3. In the upper half of the secondary winding, this reference voltage and E2 will add to produce an output signal. Since there is a phase difference between the voltages, we must use vectors to show how they add. The resultant voltage is indicated by the diag-

### Why Pay More . . . the D-600

## Electrolytic Substitute

**tests ALL radio and TV electrolytics!**

■ Technicians all over the country are reporting that this is one of the handiest tools on the bench. A dual, split switch and built-in neon indicator allows you to shunt test in seconds without the danger of heating. A fast, in-circuit method of testing. Two ranges . . . Low and High (10-40 MFD 450V), (50 MFD up 450V)

\$895

NET

MADE BY THE DESIGNERS OF THE *Pioneer 250*



SEE YOUR DISTRIBUTOR

**DOSS** ELECTRONIC RESEARCH, Inc.—820 Baltimore • Kansas City, Mo.

## 24 HR TV TUNER ALIGNMENT SERVICE

VHF or UHF — All Makes



<p>90 DAY WARRANTY ISSUED ON ALL TUNERS</p>	<p>DEALER NET PRICE</p>	<p>VHF Tuners . . . . . \$950</p> <p>UHF Tuners . . . . .</p> <p>UHF Converters . . . . .</p> <p>UHF-VHF Combinations . . . . . \$17.95</p>	<p>F.O.B. EVANSTON, ILL. WE SHIP C.O.D.</p>
---	-------------------------	---	---

THE ABOVE SERVICE & PRICES ARE FOR UNMUTILATED UNITS. Missing, broken & damaged parts, defective tubes charged extra at LOW net prices.

IMPORTANT: SHIP COMPLETE. —INCLUDE ALL BROKEN PARTS. STATE MODEL & COMPLAINT. PACKAGE WELL TO AVOID TRANSIT DAMAGE.

**JW Electronics      2404 Bradley, Evanston, Illinois**

### HI-FI IN A BOTTLE!

lowers cone resonance . . . extends frequency response and adds "hi-fi" quality to any speaker

Flexicone permanently softens outer edges of any speaker cone. John Dodgson, *Audio Consultant of N.R.I. News*, reports: "After a Flexicone treatment a 12" speaker which had been resonating at 90 cps dropped to 41 cps. Listening tests clearly show the improvement . . . medium and high frequencies are cleaner and less harsh." Thoroughly tested—takes 15 minutes to apply—provides lasting improvement in your speaker! Each kit treats one 15", two 12", four 8", or six 6" speakers.

- Softens outer edge of speaker cone
- Lowers speaker cone resonance 10 to 40 cps
- Easy 1-2-3 application
- One treatment lasts a speaker lifetime.

SPECIAL INTRODUCTORY OFFER



To acquaint you with FLEXICONE we'll give you absolutely FREE one \$3.25 Tiny Tom 5" x 7" high impact Styrene Speaker Housing with each Flexicone Kit at \$3.00. Available in 6 soft colors: Brown, Grey, Pink, Green, Blue or Yellow.

\$6.25 VALUE for Only \$3.00, postpaid.

**PORTER & DIETSCH**  
2459 University Avenue St. Paul 14, Minn.

## FLEXICONE

SPEAKER RESONANCE IMPROVEMENT KIT



ORDER NOW ONLY

\$3.00

Complete Kit

RUSH ORDER COUPON

PORTER & DIETSCH, Dept. PF  
2459 University Avenue, St. Paul 14, Minn.

Gentlemen: Enclosed is my check for \$3.00. Please send me postpaid the \$6.25 value, one \$3.00 FLEXICONE KIT plus one \$3.25 Tiny Tom Speaker Housing (All for \$3.00). State choice of "Tiny Tom" color. . . . .

Name . . . . .

Address . . . . .

City . . . . .

State . . . . .

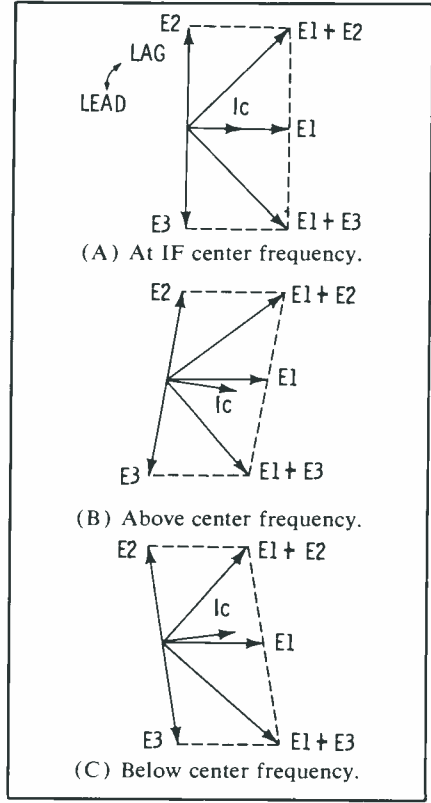


Fig. 2. Phase relationships between voltages in discriminator transformer.

onal arrow in Fig. 2A labeled "E1 + E2." In a similar manner, two voltages add in the lower half of the secondary winding to produce the voltage labeled "E1 + E3."

The length of these vector arrows is proportional to voltage amplitude, so you can see that E1 + E2 will be equal to E1 + E3 when the input signal frequency is exactly 4.5 mc. These equal voltages, applied to the plates of the two diodes, will cause them to conduct equally.

Before going on to consider what happens to the transformer output voltages at frequencies other than resonance, let's examine the results of diode conduction. Electron flow through the upper diode circuit proceeds down through the upper half of the transformer secondary to the center tap, up through R1, and from cathode (pin 3) to plate (pin 2) of the tube. Conduction in the lower circuit is up through the lower half of the secondary winding, down through R2 to ground, and from the cathode (pin 7) of the lower tube section to the plate (pin 1).

The audio output, obtained across the two resistors in series, is equal to the *difference* between the positive voltage developed across R1 and the negative voltage across R2. Note that the two resistors are equal in value; this means that equal diode currents will produce equal voltages of opposite polarity across the load. Thus, at resonance, the two voltages will cancel and the resultant output will be zero.

Now suppose that the frequency of the sound IF signal rises because of a "positive swing" of modulation. Since the signal is above the resonant frequency of L1's secondary, it sees this circuit as being more inductive than capacitive. As a result,  $I_c$  will lag the primary voltage E1 by some angle less than  $90^\circ$ , as indicated in Fig. 2B. The degree of lag is proportional to the amount of "swing" away from the resonant frequency. Voltages E2 and E3 still maintain their  $90^\circ$  phase difference from  $I_c$ ; so, as Fig 2B demonstrates, the phase difference between E2 and E1 will decrease while that between E1 and E3 will increase. The vectors show the results: The sum voltage E1 + E2 applied to the upper diode will become greater than the voltage E1 + E3 applied to

the lower diode. The former tube section will then conduct more heavily than the latter; there will be more positive voltage across R1 than negative voltage across R2; and the net voltage will be positive.

A decrease in the IF signal frequency (below 4.5 mc) has just the opposite effect. The secondary circuit of L1 becomes more capacitive than inductive, so  $I_c$  leads E1 in phase. Output voltage E1 + E3 then becomes greater than E1 + E2, as diagrammed in Fig. 2C; the lower diode "outconducts" the up-

per one; and the output voltage changes in a negative direction.

Amplitude of the output voltage is directly proportional to the amount of frequency swing of the input signal away from resonance (within the  $\pm 25$ -kc range of the detector circuit). This effect is illustrated in Fig. 3. Since the incoming signal frequency varies at an audio rate (less than 15,000 fluctuations per second), the output voltage is basically an audio signal. It is filtered to remove IF signal components, and then ap-

The MONEY-MAKING Technicians are using

The **Pioneer 250** . . . . by **DOSS**  
HORIZONTAL SWEEP QUANTALYST

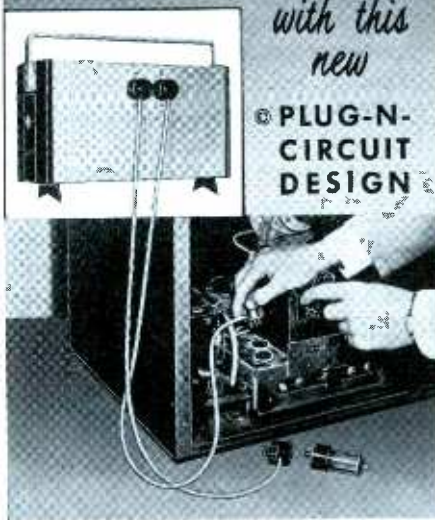
This is the  
**ONLY INSTRUMENT**  
to do the complete job of component  
failure isolation in the entire  
HORIZONTAL SWEEP CIRCUIT



\$12900 NET

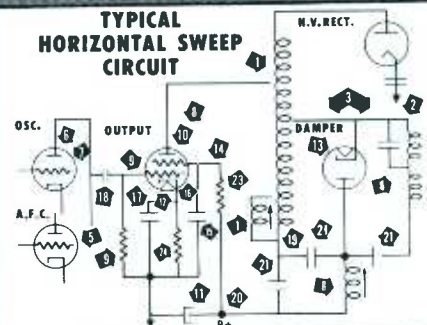
Tests made in minutes  
with this  
new

PLUG-N-CIRCUIT  
DESIGN



©  
**PLUG-N-CIRCUIT DESIGN**  
★ UNNECESSARY CHASSIS PULLING  
★ SAVES "SEARCH & PROBE TIME"  
★ ELIMINATES ALL GUESSWORK

TYPICAL  
HORIZONTAL SWEEP  
CIRCUIT



DYNAMIC IN-CIRCUIT TESTS . . .  
(RECEIVER ON)

- |  |  |
|--|--|
| 1. Flyback Transformer (Shorted Turns) | 10. Amplifier Gas Condition (Screen Re-emission) |
| 2. Yoke (Shorted Turns)                | 11. Amplifier B+ Ripple                          |
| 3. Flyback-Yoke Match                  | 12. Amplifier Heater Voltage                     |
| 4. Yoke Inductance (mh)                | 13. Damper Heater Voltage                        |
| 5. A.F.C. Sync. Range                  | 14. Amplifier Screen Voltage                     |
| 6. Oscillator Frequency (cps)          | 15. Amplifier Screen Condenser                   |
| 7. Oscillator A.C. Output              | 16. Amplifier Cathode Voltage                    |
| 8. Amplifier Cathode Current           | 17. Amplifier Cathode Condenser                  |
| 9. Amplifier Grid Condition            | 18. Oscillator Coupling Condenser                |
|  | 19. Boost Voltage                                |
|  | 20. B+ Voltage                                   |

STATIC CIRCUIT TESTS (RECEIVER OFF)

- |                                |                        |
|--------------------------------|------------------------|
| 21. Boost to B+ Resistance     | 23. Screen Resistance  |
| 22. Boost to Common Resistance | 24. Cathode Resistance |

Tests the component you suspect, or the many you don't

New Features You Get *Only* from **DOSS**

For complete information including  
FREE Quantalyst Trouble-Shooting  
Chart — Please request Folder MP3

**ELECTRONIC RESEARCH, INC.**  
820 Baltimore • Kansas City 5, Mo.

**LATEST VOLUMES IN  
POPULAR SAMS  
SERIES BOOKS**

**"Servicing Transistor Radios" Vol. 4**



Complete analysis of popular transistor radios produced in 1958-59. Includes special section on "Techniques in Servicing Transistor Circuits." All data based on actual lab analysis. You get famous Sams Standard Notation schematics with Circuit-Trace; full photo views of each chassis; alignment data; parts replacement information — all you need for time-saving, profitable transistor radio servicing. Cumulative index covers all volumes in series. 160 pages; 8½ x 11". Only.....**\$2.95**

**"Record Changer Manual" Vol. 12**



Complete analysis of 62 record changers produced in 1958-59 including: Dual, Fairchild, Garrard, Lesa, Miracord, Perpetuum - Ebner, Silverstone, V - M, Webcor, Westinghouse, Wumo. Provides general description, operating instructions, exploded views, change cycle data, adjustments, trouble chart, parts list, etc. Includes index for all volumes in series. 160 pages; 8½ x 11". Only.....**\$2.95**

**"Tape Recorder Manual" Vol. 4**



Full analysis of 21 tape recorders produced in 1958-59. Covers Bell & Howell, Bell Sound, Grundig Majestic, Knight, RCA, Revere, Sylvania, Telectro, Tower. Includes general description, operation data, trouble shooting and maintenance facts, diagrams, parts lists, etc. With special editorial section on magnetic tape recording. Has cumulative index. 160 pages; 8½ x 11". Only.....**\$2.95**

**"Auto Radio Manual" Vol. 9**



Covers scores of popular auto radios produced in 1958-59. Most complete data available: Schematics, chassis photos, voltages, resistance readings, parts lists and replacement data — everything you need to know for quicker, easier auto radio servicing. 160 pages; 8½ x 11". Only.....**\$2.95**

**HOWARD W. SAMS & CO., INC.**

Order from your Sams Distributor today, or mail to Howard W. Sams & Co., Inc., Dept. MM-39, 2201 E. 46th St., Indianapolis 6, Ind.

Send me the following books:

- "Servicing Transistor Radios" Vol. 4 (TSM-4)
- "Record Changer Manual" Vol. 12 (RC-12)
- "Tape Recorder Manual" Vol. 4 (TR-4)
- "Auto Radio Manual" Vol. 9 (AR-9)

\$\_\_\_\_\_enclosed.  Send Free Book List

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

(outside U.S.A. priced slightly higher)

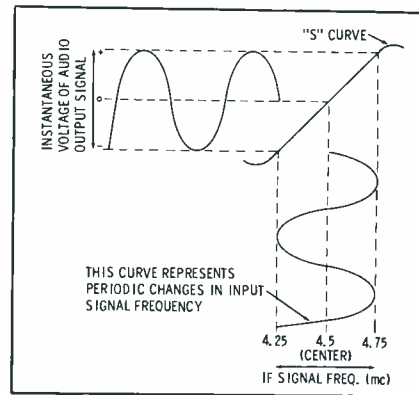
plied to the audio amplifier of the receiver — usually by way of the volume control.

The "S"-shaped response curve in Fig. 3—with zero output corresponding to center-frequency input, and with good linearity over the entire operating range—is typical of a properly-aligned FM detector circuit.

**Ratio Detector**

A typical modern ratio detector (Fig. 4) differs from a discriminiator in a number of circuit details. One of the most noticeable differences is that the cathode (instead of the plate) of the upper diode is connected to the transformer. Effectively, then, both diodes are connected in series across the electrolytic capacitor C1. They both conduct on the same alternation of the input signal, thus charging to virtually the peak value of the signal voltage. Due to the large capacitance of C1, the combination of C1 and R2 has a very long time constant—equal to many cycles of the sound IF signal. Consequently, the charge on C1 remains at very nearly the established peak value, and the total voltage across both diodes remains nearly constant as long as the average strength of the input signal does not change. This is quite an important point, because it explains the ratio detector's ability to "ignore" amplitude modulation in the sound IF signal.

Even though the total voltage developed across the detector seldom varies, the voltage at the center tap of the transformer secondary *does* fluctuate according to the modulation in the sound IF signal. (This effect takes place because varia-



**Fig. 3. Frequency shifts in input signal causes changes in audio amplitude.**

tions in input-signal frequency produce unequal conduction of the two diodes—just as in the discriminator.) Therefore, an audio output signal can be obtained at the midpoint of the detector circuit.

The above paragraph explains ratio-detector operation in a nutshell, but there are several interesting circuit features which merit further explanation. First of all, most commercial-type ratio detectors differ from discriminators in the method used to couple a reference-phase signal from the primary to the secondary of the transformer. Instead of having a coupling capacitor such as C3 in Fig. 1, a typical ratio-detector transformer incorporates a small *tertiary* winding in series with the lead from the center tap of the secondary. Since this extra winding is untuned and very closely coupled to the primary, the voltage developed across it is in phase with the primary voltage.

Another "different" feature of the detector in Fig. 4 is its load circuit, which you may not immediately recognize because there are no matched load resistors correspond-



**RESIST-O-BIN**

FREE! with any of 4 Handy-Pak Carbon Resistor Assortments • 34 Values

**\$24<sup>48</sup>** to **\$48<sup>96</sup>** Dealer Net

All-metal • 36 Compartments



Order from your IRC Distributor

INTERNATIONAL RESISTANCE COMPANY  
DISTRIBUTOR SALES DIVISION  
414 N. 13th STREET • PHILADELPHIA 8, PA.



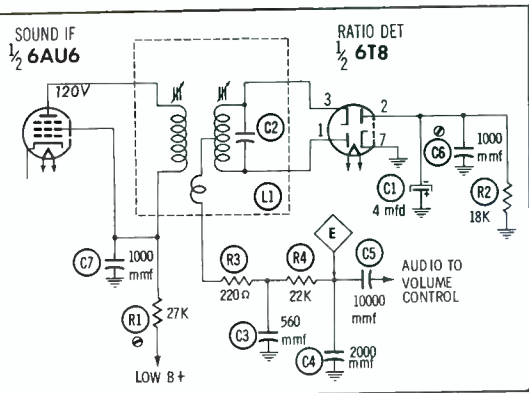


Fig. 4. Output of ratio detector circuit is developed across capacitor C3.

ing to those in a discriminator. Instead, both diode-output voltages are developed across a single capacitor (C3) between the center tap of L1 and ground. This component forms part of two distinct IF signal paths in addition to the previously-mentioned circuit (C1 and the two diodes in series). Plate current of the lower diode (high-frequency AC) travels upward through the bottom half of the transformer secondary to the center tap, through isolating resistor R3, down through C3 to ground, and back to the diode cathode. Conduction in the upper half of the circuit is upward from ground through C3, R3, the upper half of the secondary winding, and the upper diode; the return path to ground is through C1. In some circuits, small-value capacitor C6 is placed in parallel with C1 to compensate for the inductive reactance offered to high-frequency signals by C1.

When the incoming signal is on center frequency, the diodes conduct equally; so the signal voltages developed across C3 are equal in amplitude but opposite in polarity. This state of affairs results in no audio output. At frequencies other than resonance, the opposing signal voltages across C3 become unbalanced due to unequal conduction of the diodes; as a result, the output voltage changes in either a positive or a negative direction.

R4 and C4 form a standard FM deemphasis circuit. This combination also filters IF signal energy out of the output signal, leaving pure audio.

### Troubleshooting

When servicing a discriminator or ratio detector, *always substitute*

## NEW FROM SECO DYNAMIC TRANSISTOR CHECKER



MODEL 100

### DYNAMICALLY CHECKS WIDE RANGE OF TRANSISTOR TYPES EITHER "IN OR OUT" OF CIRCUIT!

This new low-cost checker uses an entirely new approach but a proven DYNAMIC principle for checking transistors. safely tests PNP and NPN transistors either "in or out" of the circuit. Covers wide range of types: small signal including "drift" types, medium power; and power types. Provides positive check for "opens," shorts, and gain—condition indicated by means of a visual indicator plus jacks for meter or scope. Also provides GO-NO-GO test at practical currents—and permits matching of similar transistor types. No set-up required—no further leakage tests necessary. Model 100 is compact, lightweight, complete, and ready-to-use . . . helps you cash-in on the big profits in the fast growing transistorized equipment servicing field!

MODEL 100—Wired and factory tested . . . . \$19.95 NET

## NEW FROM SECO LOW COST, COMPLETE TUBE TESTER



MODEL 78

### GRID CIRCUIT and TUBE MERIT TESTER

Complete test coverage of all modern TV tube types as well as all heater type radio tubes including hybrid types, using only 5 sockets. Incorporates patented Seco GRID CIRCUIT TEST plus a reliable CATHODE EMISSION test using new low impedance low test voltage circuit—also checks filament continuity and provides open element test. One easy-to-read meter indicates results for both Grid Circuit and Tube Merit Tests. Two-stage dc amplifier isolates meter from tube under test to protect meter—and makes it possible to achieve a wide range of load currents and test conditions. Complete with portable carrying case, pin straighteners, and flip-chart for quick set-up data.

MODEL 78—Wired and factory tested . . . . \$69.50 NET



### outstanding reliability, accuracy

Provides 3 important tests: amplifier types tested for gain by Dynamic Mutual Conductance method—power types tested for cathode current by Cathode Emission method—all types tested for shorts and grid error by Grid Circuit Test developed and patented by Seco. Dynamic Mutual Conductance Test pre-wired to eliminate elaborate set-up. Cathode Emission Test done by free point pin-selector method—will not be obsolete. Completely self-contained in portable carrying case.

MODEL 107—Wired and factory tested \$139.50 NET



MODEL HC-6  
IN-CIRCUIT  
CURRENT  
CHECKER

### positive, on-the-spot check of horizontal output current!

This new, low-cost current checker provides simple means for making a positive on-the-spot check of TV horizontal circuits. Can be placed into the circuit in seconds—no unsoldering of circuit wiring—immediately indicates whether horizontal tube cathode current is within manufacturer's recommended limits. Valuable as a fast, accurate indicating device when adjusting horizontal drive and linearity. Eliminates one of the most common causes of callbacks. Compact, inexpensive, easy to use.

MODEL HC-6—Wired and factory tested \$12.95 NET



MODEL GCT-8  
GRID CIRCUIT  
TESTER

### fast check of critical "control grid" conditions

Model GCT-8 checks "control grid" condition of vacuum tubes faster, more accurately than any other tester! As many as eleven simultaneous checks—automatically! Quickly spots grid errors and leakage—stops guessing, substitution checking, and costly rechecks. Electron-Eye tube indicates faults at a glance. Truly portable. The perfect companion to any tester that employs only conventional gas and shorts test. Carry it on all calls.

MODEL GCT-8 Complete Kit . . . \$19.95 NET

MODEL GCT-8 Wired and tested . \$29.95 NET

SEND FOR COMPLETE SECO STORY ON . . .

<input type="checkbox"/> Three Tube Testers <input type="checkbox"/> VTVM <input type="checkbox"/> Dynamic Transistor Checker	<input type="checkbox"/> In-Circuit Current Checker <input type="checkbox"/> 100% Accurate Flyback Checker <input type="checkbox"/> Battery Eliminator
---	--

Sold Only Thru Electronics Parts Distributors

OUTSTANDING RELIABILITY—TOP DOLLAR VALUE!

**SECO MANUFACTURING CO.**  
5015 Penn Ave. So., Minneapolis, Minn.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

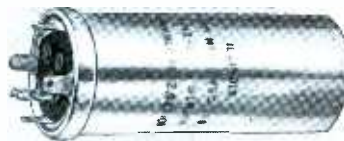
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

# DOUBLE PROFITS

with these two ILLINOIS "HOT" LINES

You really make extra profits with ILLINOIS UMP Twist Prong Capacitors which are especially designed for TV replacement. Each capacitor is fully guaranteed for one year . . . and is needed and in demand for replacement use NOW!

Time Tested Quality



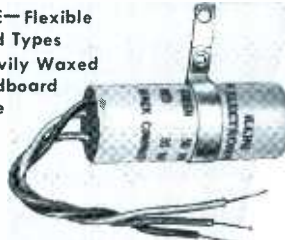
UMP

ELECTROMITE

Here are popular, fast moving capacitors which mean repeat business for you. They withstand extreme moisture and temperature conditions. Made of highest quality and unconditionally guaranteed for one year, these attractively-priced capacitors are packaged in eye-appealing boxes.



INTE—Flexible Lead Types Heavily Waxed Cardboard Case



IHCE—Tubular Types Aluminum Case



ILLINOIS "UMP" and "ELECTROMITE" Capacitors are available from leading electronic parts distributors.

**ILLINOIS**

CONDENSER COMPANY  
1616 NORTH THROOP STREET  
CHICAGO 22, ILL. EV 4-1300

Write for our complete catalog.

Export Department: 15 Moore Street, New York 4, New York

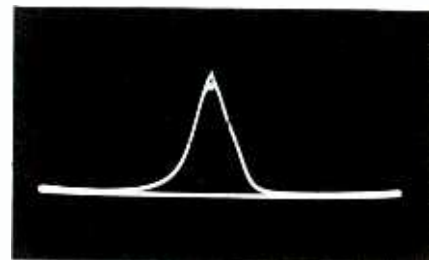


Fig. 5. Response curve of sound IF, or check tubes first. In case there is a complete loss of audio, check the plate and screen voltages of the last sound IF amplifier or limiter tube to make sure that no breakdowns have occurred in the detector input circuit. Low voltages might indicate an open condition or excessive resistance in the plate decoupling resistor (R3 in Fig. 1), possibly because of a leaky or shorted decoupling capacitor. Then, again, there might be a primary-to-secondary short in the detector transformer. If the input side of the detector seems OK and the sound section is still dead, check for an open component in series with the detector output lead — or perhaps a shorted capacitor from this lead to ground.

In the ratio detector (Fig. 4), an open condition in C6 might not be noticed; but, if C1 should open, there would be a nontunable buzz in the sound, because the self-limiting feature of the detector would be disabled. If C1 became very leaky, the voltage across the entire detector would be greatly reduced, and the audio volume would follow suit.

Now, the biggest problem in either of these circuits is *not* a matter of minor components shorting or opening; after all, there is very little DC or pulse voltage in the sound detector proper. The real troubles are most often due to difficulties in the transformers themselves. Due to gradual changes in component values or in operational characteristics of tubes, the primary and secondary of the detector input transformer may become detuned—as may the preceding IF transformers. The first or second time this happens, you may be able to retune them by ear. But when the third or fourth time rolls around (and this is particularly true of old sets with 21.25-mc split-sound systems), the old sweep and marker generator must be hauled out and a calibrated signal at the

ALL NEW **BERNS**

PERFECT *Audio*

## "PIN-PLUG" CRIMPER

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



USE END OF BLADE AS SCREWDRIVER

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

USE END OF TOOL TO PUSH ON GROUND CONNECTOR



only **\$1.25**

A new tool that makes audio pin-plug connections without soldering. Center conductor is simply placed in the pin; a squeeze of the crimper finishes the job, providing a solid electrical connection. Pin keeps its original form. Braided-shield ground connections are easy, too. Other end of tool is used to push on copper C-ring clamp. No chance of melting heat-sensitive insulation. Pin-plugs and C-rings—only 95c per bag of 20, or C-rings only—2 for 5c.

3 models to choose from: PT-1 for 3/32" pin diameter; AU-2 for 1/8" pin diameter; LC-3 for 5/32" pin diameter.

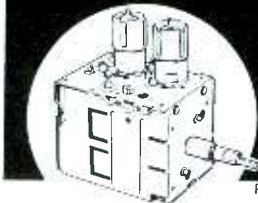
Available at your parts distributor.

Another fine product from

**BERNS**

Mfg. Co.  
9853 Chalmers,  
Detroit 13, Mich

**TARZIAN Offers 48-Hour, Direct Factory Service on Tuner Repairs**



only

**\$8.50**

Price Effective Jan. 1, 1960

That's right. Net, \$8.50 per unit and \$15 for UV combinations, including ALL replacement parts. 90-day warranty against defective workmanship and parts failure. Tuners repaired on approved, open accounts. Replacements offered at these prices\* on tuners not repairable:

VHF 12 position tuner . . . . . \$22.00  
VHF 13 or 16 position . . . . . 23.00  
VHF/UHF combination . . . . . 25.00  
UHF only . . . . . 15.50

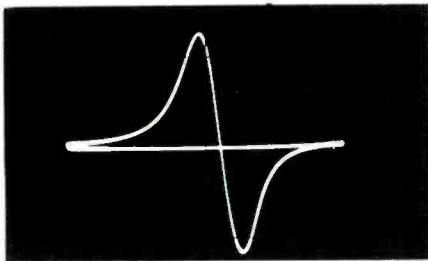
\*Subject to change



Tarzian-made tuners are easily identified by this stamping on the unit. When inquiring about service or replacements for other than Tarzian-made tuners, always give tube complement . . . shaft length . . . filament voltage . . . series or shunt heater . . . IF frequency, chassis identification and allow a little more time for service. Use this address for fast, 48-hour service:

**SARKES TARZIAN, Inc.**

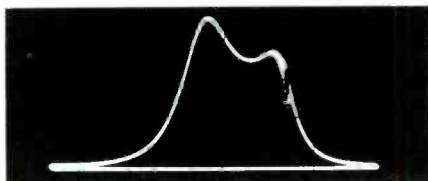
Att.: Service Mgr., Tuner Division  
East Hillside Drive  
Bloomington, Indiana



**Fig. 6. Response of sound detector.** IF center frequency applied to the sound IF or detector input. Fortunately, the alignment procedures and response curves are very similar for both discriminators and ratio detectors. Look at Fig. 5, and you will see a normal response curve of a sound IF amplifier, with the center frequency indicated by a marker pip at the very top of the curve. Fig. 6 shows a typical "S"-curve response pattern obtained at the output of either type of detector. To obtain this curve, connect your oscilloscope to point E in either circuit—Fig. 1 or Fig. 4. Note that the middle portion of this pattern corresponds to the "S" curve in Fig. 3.

As you tune each transformer to resonance, watch the changes in shape and amplitude of the appropriate scope pattern. *This is how you spot a defective tank capacitor.* These are usually little mica capacitors that are "buried" in the transformer cans. They can either leak or become open, but mostly they leak. When this trouble occurs, the transformer is detuned from its correct operating frequency and the sound volume is greatly reduced. Nothing you can do will increase the volume to its original level.

If an IF transformer develops this fault, the response curve of the affected stage will probably appear something like Fig. 7. A similar trouble in the detector transformer will produce enough distortion in the response curve for you to recognize the fault. Replace the defective unit and realign the sound section. By all means, use an oscilloscope and a sweep generator plus



**Fig. 7. Faulty sound IF response due to leaky capacitor across transformer.**

a calibrated marker generator. The other alignment method, using a fixed-frequency signal generator and a VTVM, is only a fair approximation at best. The waveform on the scope screen is much more accurate because it lets you see the whole response curve at once—not just one point at a time. When you have finished performing an accurate alignment of the sound IF's and detector, and have made sure there are no defects in the video circuits preceding the sound-takeoff point, you should be able to rotate the set's fine tuning control through-

out its range on all stations without noticeable buzz. And the sound from the speaker should be good and strong!

If the audio output still doesn't sound right, there may be trouble between the volume control and the speaker. As the *Shop Talk* column in the November issue pointed out, the best means of troubleshooting the audio amplifier section is a signal-tracing method, using an ordinary audio signal generator. A voltmeter will also come in handy when you begin to get close to the source of the trouble. ▲

## Transistor Radio Servicing CAN be Highly Profitable



The ONLY Complete Transistor Radio Service Lab  
Everything you need for less than \$50



Check Transistors, Diodes, Rectifiers . . .

### SENCORE TRC4 TRANSISTOR CHECKER

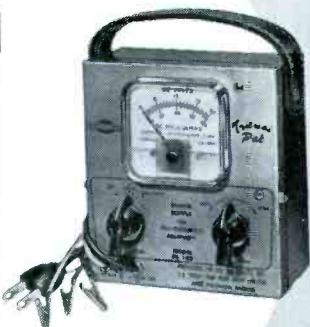
Accurately checks all transistors in hearing aids, radios and power transistors in auto radios. Tests for opens, shorts, leakage, current gain. Measures forward-reverse current ratio on all crystal diodes. Measures forward and reverse currents on selenium rectifiers. With set-up chart for accurate checking of each transistor. Size, 5x4½x2½". With batteries. DEALER NET..... 17<sup>95</sup>



Replace Batteries During Repair . . .

### SENCORE PS103 BATTERY ELIMINATOR

All-new "Transi-Pak," twin to TRC4 Checker above. Provides variable DC voltage to 24 volts; 1.5-volt biasing tap (a "must" for servicing Philco and Sylvania radios). Metered current output, to 100 ma. Handles 200-ma peaks. Two 200-mfd electrolytics provide proper filtering and low output impedance. No hum or feedback problems. Ideal for alignment using station signal; adjust IF slugs for max. current, also ideal for charging nickel-cadmium batteries. Size, 5x4½x2½". DEALER NET..... 17<sup>95</sup>



Find Defective Stage in a Minute . . .

### SENCORE HG104 HARMONIC GENERATOR

New signal generator designed primarily for fast signal-tracing of transistor radio circuits. No need to unsolder all transistors. Provides RF, IF and audio signals *simultaneously*, drastically cutting service time. Traces from speaker to antenna. Clear 1000 cycle note signal is heard in speaker from all good stages. Signal weakens or stops at defective stage. Equally as effective for testing TV, hi-fi and other audio circuits also. Size, 3½x4½x1¾". With batteries. DEALER NET..... 9<sup>95</sup>



Turn page for other

**SENCORE**  
Time Savers

See your Parts  
Distributor  
NOW!

**SENCORE**  
ADDISON 2, ILLINOIS

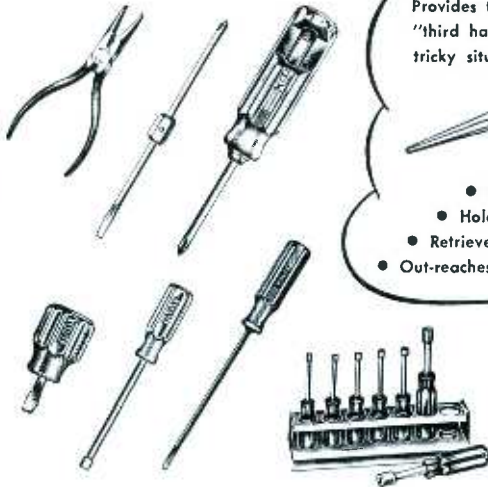
Choose . . .

**XCELITE**

Hand Tools . . . the Professionals do!

You need the BEST TOOLS to do the BEST JOB . . .

Your Radio, TV and Electronic  
Parts Distributor has them!



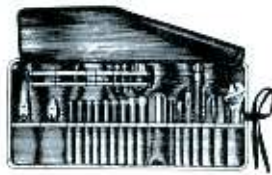
Check the "SEIZER"

Provides the necessary  
"third hand" in so many  
tricky situations!



No. 42H

- Clamps on as a Heat Sink.
- Holds wires etc. while soldering.
- Holds dial cords when stringing them.
- Retrieves small items from awkward places.
- Out-reaches and out-holds needle nose pliers.



Select from the Complete Line of Quality Tools and Handy Kits . . .

**XCELITE, INCORPORATED**  
ORCHARD PARK, NEW YORK  
Canada: Charles W. Pointon, Ltd., Toronto

**XCELITE**  
Quality Hand Tools  
PREFERRED BY THE EXPERTS

**DON'T GUESS . . .**

KNOW THE TEMPERATURE OF YOUR SOLDERING GUN BEFORE TOUCHING PRINTED CIRCUITS AND LAMINATED WIRING BOARDS!



**ESICO GUNCHOKE®**

REDUCES TEMPERATURE OF YOUR SOLDERING GUN TO TWO CONSTANT HEATS - 500° OR 600°

- Assures correct temperature for soldering printed circuits and laminated wiring boards.
- No need to wait for a slow-heating iron — and still have doubtful temperature.
- Just plug into GUNCHOKE and GUNCHOKE into outlet.
- Small, compact, to fit in your tool kit.

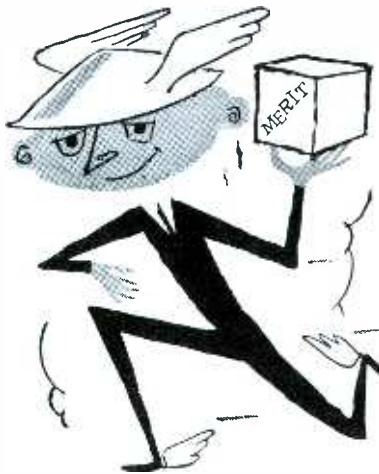
FOR ALL WIDELY USED GUNS  
Get GUNCHOKE from your distributor

ESICO

**LUGER GUN**

Perfect balance permits delicate touch for most intricate work. Transformer built in handle eliminates tip heaviness. Long, thin tips simplify soldering connections inaccessible with other guns. LUGER is 150-watt capacity.

**ELECTRIC SOLDERING IRON CO., INC.**  
559 W. Elm Street DEEP RIVER, CONN.



**QUICK-SILVER FOR YOU . . .  
MERCURY FOR US**

Merit shipments to all parts of the United States are jet-fast, and sure as sunrise. Mercury, the mythical god, would be pleased.

MERIT CONSISTENT QUALITY PLUS FAST DELIVERY MEANS QUICK-SILVER FOR YOU . . . EXTRA-DOLLARS AND BIGGER PROFITS.



COMPARE IT WITH  
**MERIT**  
MERIT COIL AND TRANSFORMER CORP  
MERIT PLAZA . HOLLYWOOD, FLORIDA

**Large Current Tubes**

(continued from page 27)

terminal A of the AC supply is negative and B is positive, the path of electron flow is from A through the transformer to the cathode of V1. Current does not pass through D, but flows from the mercury pool of V1 to the ignitor of this tube. From the ignitor, it goes through C, S2, the fuse, S1, and F, back to power-supply terminal B. This momentary current through the ignitor circuit starts an arc in V1, thus allowing heavy current to begin flowing through the welding transformer, from plate to cathode of V1, and back to B. During the next half-cycle of AC input, when B is negative with respect to A, the circuit action reverses and V2 is driven into conduction.

From this description, it can be seen that the circuit acts as a full-wave rectifier, with one tube conducting during each alternation of the AC supply voltage. By controlling the portion of each alternation over which the tube is actually in a conducting state, the operator can achieve control over the amount of output current delivered to the material being welded.

Initiating switch S2 furnishes the necessary current control by regulating the time at which conduction starts on each alternation. The circuit also contains a water-flow switch (S1) which automatically shuts off the equipment if water circulation ceases.

Fig. 9 shows the effect of S2, which is usually a thyatron instead of a mechanical switch. The applied AC voltage is indicated in Fig. 9A; in part B of the figure, the voltage across the ignitrons is plotted as it would appear on an oscilloscope (assuming that the load is not reactive). At point 1, the switch is closed and the ignitrons fire. Note that the tube voltage falls to a very low value when the switch is closed. This is due to the low IR drop across the ignitron during conduction. Because of the ignitor voltage drop at

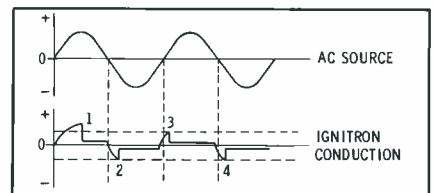


Fig. 9. Waveshape of the voltage across ignitrons in the circuit of Fig. 8.

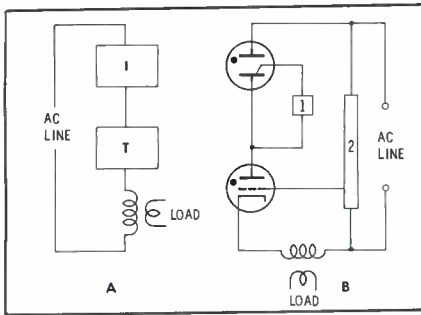


Fig. 10. Ignitron controlled by a thyatron in series with the ignitor circuit.

the start of each conduction period, there are sharp pulses at 2, 3, and 4.

Another commercial circuit is shown in Fig. 10. Note that the load, the thyatrons, and the ignitrons are in series. The thyatron firing cycle is adjusted by controlling the thyatron grid with a small signal. This, in turn, controls the ignitron firing time—which determines the average current per cycle through the load. In Fig. 10B, block 1 represents the ignitor circuit, and block 2 represents the control circuit for the thyatron (a phase-shifting network).

There are three main applications for which ignitrons are particularly suited: resistance welding, power rectification, and power conversion or transmission.

In welding applications, ignitron tubes are used to control the primary current supplied to resistance welding transformers from supply circuits of 220, 440, 550, 1100, and 2300 volts (rms). These circuits provide the most exact means of weld control ever developed. The tubes operate as switches and, through suitable electronic control, may be arranged to provide one, two, or a dozen cycles of current at given weld settings which may be repeated indefinitely without change in the number of cycles. As a result, very great uniformity in the welds is obtained, and losses from poor welds are reduced.

Ignitrons for power rectification are available in sizes which permit DC power outputs of 40 to 1000

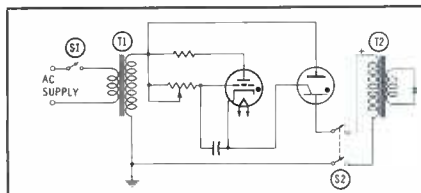


Fig. 11. Thyatron-ignitron circuit used in reactor-storage welding control unit.

kilowatts (depending on the operating voltage) to be obtained from single units. Usual DC voltages are 125, 250, 600, and 900 volts. Such rectifiers are used to provide power for machine shops, elevators, mines, electrolytic reduction plants, arc welding, and similar types of service. Suitable voltage-regulating equipment may be provided to give practically constant output voltage from zero to full load.

The third class of application is high-voltage DC power transmission, or conversion of power at one frequency to power at another. In

such applications the tubes are primarily for power conversion and are grouped to form units of 2000- to 20,000-kilowatt capacity. Higher capacity may be obtained with additional units. These electronic power converters provide a nonsynchronous tie between two power systems and are able to transmit a constant amount of power regardless of the usual frequency and voltage variations in either the supply or receiving system.

### Stored-Energy Welding

An example of the combined use

*Servicemen!* **SAVE TIME...SUBSTITUTE THE SENCORE WAY**  
**The Fastest, Surest Method Known!**

**Substitute for Capacitors, Resistors**  
**SENCORE H-36—THE "HANDY 36"**  
 36 most-often-needed resistors and capacitors, for fast, easy, direct substitution in all circuits. ● Eliminates searching for replacement components for test purposes. ● Avoids unnecessary unsoldering and soldering—no more solder mess. ● Pays for itself the first month in time saved. ● Flick of a switch instantly selects any one of...  
 24 RESISTORS from 10 ohms to 5.6 megohms  
 10 CAPACITORS from 100 mmfd to .5 mfd  
 2 ELECTROLYTICS, 10 mfd and 40 mfd  
 DEALER NET..... **1275**

**Substitute for Electrolytic Capacitors**  
**SENCORE ES102 ELECTRO-SUB**  
*Usable from 2 to 450 volts, D.C.*  
 Contains 10 electrolytics from 4 to 350 mfd. Select the correct value with the flick of a switch. Features automatic discharge, surge protector circuit. Prevents accidental "healing" of capacitor being bridged. Completely safe—no arc or spark when connecting or disconnecting. DEALER NET..... **1595**

**Substitute for Fuse Resistors During Repair**  
**SENCORE FS3 "FUSE-SAFE" CIRCUIT TESTER**  
 Instantly tells you whether or not it is safe to replace fuse resistors, fuses, or circuit breakers. Separate red and green scale for each commercially available fuse resistor used in radio and TV. Eliminates guesswork and wasted time. Also handy for wattage checks up to 1100 watts. DEALER NET..... **895**

**Substitute for Bias Batteries During Repair**  
**SENCORE BE3 "ALIGN-O-PAK"**  
 Completely isolated DC supply, with less than 0.1% ripple. Eliminates messy batteries in TV service work. Handy for alignment, AGC trouble-shooting, or checking gated sync circuits. Just dial the voltage you need, 0-18 volts, positive or negative. Covers all voltages recommended by TV set manufacturers. Size, 3½x4½x1¾". For 110-120 volts, 60 cycle AC, DEALER NET..... **785**

**UNIVERSAL TV JUMPER CORD**  
 Fits any set from back to chassis. Box has male and female plugs for additional power source, soldering, etc. DEALER NET **195**

Turn page for other  
**SENCORE**  
 Time Savers

See your Parts Distributor Now!

**SENCORE**  
 ADDISON 2, ILLINOIS



## COMING IN JANUARY

### Replacing Modular Component Sections

Some of the newest TV sets utilize modules in certain applications. This picture story explains how to isolate defective sections and repair them with standard replacement units.

### Rx for Interlace

Sync circuits cause some of the toughest "dog" troubles ever encountered, but with this author's "prescription," you'll be much better equipped to handle any "epidemic."

### How to Master the PC Board

If you have trouble finding your way around printed boards and replacing printed-circuit components, you'll find several helpful suggestions in this January story.

### Now — Three Channels for Stereo

To keep you upon the rapid developments in the stereo field, here's a story on the latest techniques in stereo design—complete with schematics and descriptions of circuit operation and function.

**Other interesting, helpful and informative articles you won't want to miss include:**

**Single Sideband Adapters  
Previews of New Sets  
Video Speed Servicing  
Notes on Test Equipment  
Industrial Control Circuits**

... plus all the other regular PF REPORTER departments, designed to make it the ONE magazine especially prepared for the palates of electronic servicemen.

**to enter a new or renewal subscription, simply fill in and mail the coupon below**

### Please enter my subscription for:

1 Year \$4.00     2 Years \$7.00     3 Years \$9.00

Above rates apply only in U.S.A., its possessions, and Canada. All other countries: 1 year \$5.00, 2 years \$9.00, 3 years \$12.00

Bill Me     Remittance Enclosed     Extend Present Subscription

Give to your parts distributor or mail to PF REPORTER,  
2201 E. 46th St., Indianapolis 6, Ind.  
Please Check Your Business Classification

Name \_\_\_\_\_  
Firm \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

Independent Radio, TV Serviceman  
 Retailer with Service Department  
 Industrial Electronics Service  
 Other (Specify occupation and title)

Service Mgr.  
 Employee  
 Owner, Mgr.

1259

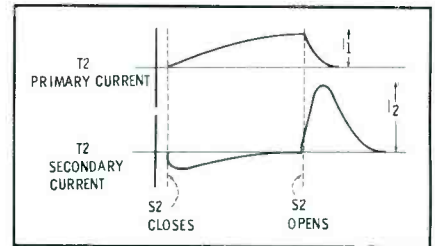


Fig. 12. Current waveforms for Fig. 11.

of thyratrons and ignitrons is in the Sciaky or reactor-storage welding control process shown in Fig. 11. Only one phase of a three-phase AC supply is illustrated. The AC is stepped up through T1, and the secondary voltage is shifted in phase and applied to the thyatron grid to control this tube's conduction. When the thyatron is activated, it fires the ignitor circuit and starts the ignitron, whose plate is connected to the high side of T1. The ignitron controls the current in transformer T2.

In operation, the work to be welded is clamped in place at X (secondary of T2), and S1 is closed. S2 is then closed, but this does not immediately activate the welding current. As Fig. 12 demonstrates, the primary current of T2 slowly increases at an exponential rate because of the large inductance of the primary. There is a secondary current flow (in the opposite direction) which decreases as the primary current stops charging.

When S2 is opened, primary current decreases rapidly. Since this produces a large magnetic field, there is a large surge of secondary current which does the welding. The peak current of the output (I2) is four or five times the peak rectified current (I1).

A modification of this storage principle, using a capacitor, is shown in Fig. 13. Here the rectifier charges C (a bank of capacitors) while S is open. When switch S is closed, the energy stored in C discharges through the transformer to the load to make the weld. Actually, of course, the total output energy is equal to the total input energy (except for losses). But the output is delivered for a short period, whereas the capacitor bank is charged over a long period. Thus, a much smaller rectifier can be used than if all the energy were supplied directly to the load through a conventional output transformer.

The Weldmatic Model 1015

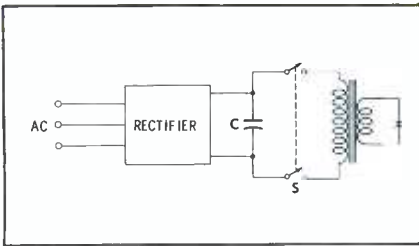


Fig. 13. Capacitor-storage weld circuit.

shown in Fig. 14 is a bench-mounted self-contained precision resistance welder used to join small metal assemblies in electronics, instrument and ordnance work. With this type of unit, it is practical to obtain such welding advantages as better mechanical performance of joints, higher tensile strength, better fatigue resistance, lower electrical resistance, less electrical noise, and freedom from flux or other contaminants.

The stored-energy principle used in the Model 1015 permits easy welding of high-carbon steel, copper, silver, tungsten, molybdenum and other "difficult" materials. Millisecond weld time prevents discoloration, excessive deformation or metallurgical change. Dissimilar metals and parts of widely varying thicknesses are joined with ease.

Operation requires a minimum of operator skill. Because the weld is made within milliseconds, production speed is governed entirely by operator response. Using the capacitor-discharge principle, the unit welds with a single, short pulse of heavy current. Energy is accurately regulated by an electronic power supply having a single, stepless control. Applied electrode pressure, set by a knob on the head, is directly

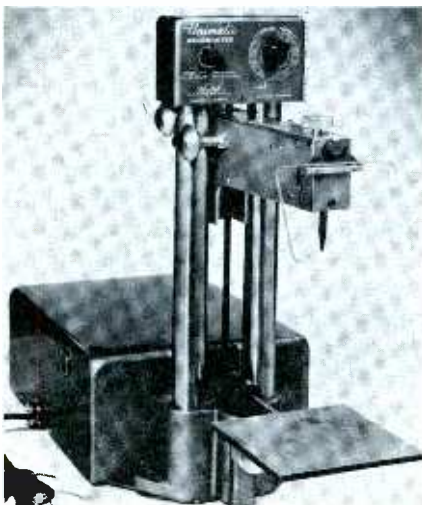


Fig. 14. Weldmatic Model 1015 operates from 117-volt, 60-cps AC supply.

indicated on a force scale, and is adjustable over a wide range. Welds are uniform because output remains constant despite line-voltage fluctuations.

### Maintenance

Very little maintenance, in the usual sense of the word, is required for either ignitron or thyatron tubes; however, the tubes should be kept clean, and accumulations of waste should not be allowed to collect around the anode insulation bushing. If water jackets of an ignitron become clogged with silt, they

can be cleaned out. Operational failures of ignitron tubes, due to the tubes themselves, are usually the result of air leakage, gas, or ignitor failure. Gas and air leakage most frequently result in arc-back, usually accompanied by severe flashing or red-hot sparks in the anode seal. In general, such failures can be spotted by a visual inspection of the equipment while it is operating.

Spare ignitron tubes may be checked for vacuum by means of a spark coil of the make-and-break type. Ignitor failure (where the tip has been burned off) results in mis-

*Check* **TUBES, VIBRATORS**  
**THE SENCORE WAY**

**FAST  
ACCURATE  
TROUBLE  
SHOOTING**

### America's Most Popular Tube Tester

more than 25,000 now in use

#### SENCORE LC3 LEAKAGE CHECKER

Whips those "tough dog" tube troubles . . .

Ask any serviceman who owns one . . . or try one for just one day of servicing in your shop. You'll see for yourself how much time the LC3 can save you. Checks for leakage between all elements, whether caused by gas, grid emission or foreign particles. Also checks leakage on all capacitors with voltage applied—including electrolytics. Provides instant filament checks in "Fil-Check" position—no need for a second filament checker. One spare pre-heating socket and new roll chart prevent obsolescence. New charts provided—no charge. Leakage sensitivity; 100 megohms, control grid to all other elements; 50,000 ohms, heater to cathode. Size, 7x6x3½". Wt., 3 lbs. For 110-120 volts, 60 cycle AC. DEALER NET **28<sup>95</sup>**



**NOW . . . checks 172 tube types—more than any other checker of this type.**

**NEW . . . replaceable Roll Chart prevents obsolescence.**

**Check Filaments of All Receiving Tubes and Picture Tubes**



#### FC4 FILAMENT CHECKER

For fast, easy checking of all tube filaments, without pulling chassis. Neon light goes out if tube filament is good. Also acts as continuity and voltage tester. Neon lamp glows when 115 v. AC is applied by heater cord, providing a check on power to TV set. Size, 3½x4x1". With leads. DEALER NET. . . . . **2<sup>95</sup>**

**Check 3- and 4-Prong Vibrators . . . Faster, Easier**



#### VB2 "VIBRA-DAPTOR"

Plugs into any tube checker; ideal for use with LC3 above. To check 6-v. vibrators, set for 6AX4 or 6SN7; for 12-v. vibrators, set for 12AX4 or 12SN7. Two No. 51 lamps indicate whether vibrator needs replacing. Instructions on front panel. Steel case. Size, 1½x1½x3". DEALER NET. . . . . **2<sup>75</sup>**

See your Parts Distributor NOW!

Turn page for other



**SENCORE**  
ADDISON 2, ILLINOIS

**SUBSTITUTE PARTS WITH-OUT SOLDERING**  
Quickly with E-Z-Hook "SUB" Connectors Easily Has 1001 Uses!

**NEW** E-Z-Hook "SUB" Connectors

Connect a speaker, or

Substitute a

- transformer
- capacitor
- resistor, or choke

**In Seconds!!**

- ★ Makes connections instantly!
- ★ Won't pull off!
- ★ Insures positive contact!

Saves time, money and parts in servicing, experimenting, instructing and production.

**E-Z-HOOK SUB**  
No. 71-1...SUB...Only 69¢ ea.  
Six Colors! - for Easy Lead Identification

Canadian Rep.: Len Finkler & Co., Toronto, Ontario

**E-Z-HOOK TEST PRODUCTS**  
SAFE • FAST • SURE

ORDER THROUGH YOUR PARTS DISTRIBUTOR  
E-Z-HOOK TEST PRODUCTS  
Dept. F, 1536 Woodburn Ave.  
Covington, Ky.

**BERNS PERFECT PIN-CRIMPER**  
Picture-Tube Repair Tool

Eliminates that hard soldering job.

only \$1.25

PT-1

Fix loose pin connections in seconds. Pays for itself in time saved on one job alone. 3" long.

Patent 2,878,698

Intermittent operation of picture tubes due to defective solder connections at socket pins is easily corrected through the use of the Berns Perfect Pin Crimper. Actually a 3-in-1 tool that can also be used as a channel-selector wrench and screwdriver, it serves to notch pins and element leads to provide solid electrical connections. Pin keeps its original form.

3 models to choose from:  
PT-1 for 3/32" pin diameter.  
AU-2 for 1/8" pin diameter.  
LC-3 for 5/32" pin diameter.

Available at your parts distributor.  
Another fine product from:

**BERNS Mfg. Co.**  
9853 Chalmers,  
Detroit 13, Mich

firing. This fault can be detected by connecting an ohmmeter between the ignitor lead and cathode terminal and slightly tipping the tube to lower the mercury level on the ignitor. The normal tube may be tipped approximately 20° from vertical before the ignitor-mercury contact breaks.

Ignitor wetting sometimes occurs in tubes which have carried excessive current. In this case, cathode spots form on the side walls of the tube, and metal vaporized from these spots finds its way into the mercury pool. This metal is in turn re-evaporated by the arc around the ignitor, and this element tends to become coated with a layer of vaporized metal. The ignitor usually has no protective oxide coating, and amalgamation with the mercury (wetting) takes place. A simple check for this type of failure is again to connect an ohmmeter between the ignitor and cathode terminals. As the tube is tipped slightly to withdraw the ignitor from the mercury, there should be a gradual increase in resistance. If the ignitor is wet, the resistance will remain constant and then suddenly jump to a new and higher value.

Operation with excessive water temperatures usually results in arc-back in the case of the rectifier tubes, and extra conduction cycles in the case of the welder tube.

The ignitron tube forms the closing switch in the circuit where it is used, whether this be a welder or rectifier. Most faults, therefore, are noticed only when this switch is closed, and trouble in other parts of the equipment may frequently be considered as tube trouble. The simplest check is to replace the seemingly faulty tube with a spare tube. Failure may also be caused by the thyatron firing tube.

A cathode-ray oscilloscope is a valuable test instrument for further troubleshooting because it permits a visual observation of the voltage waveshapes across the tube and other components in the circuit. A knowledge of the waveshapes to be expected under both normal and abnormal conditions can often lead to a direct solution to the trouble. In addition to a cathode-ray oscilloscope, the serviceman will find a VOM useful in checking circuit values. ▲

# SOUND

FOR EVERY PA PURPOSE



**10•20  
30•60  
WATTS**

BY PRECISION ELECTRONICS

**MODEL 30 PA  
30 WATT AMPLIFIER**

De Luxe, dependable amplifier with constant duty transformer and quality components. Input mixing for 2 microphones and phono channel. Bass and Treble controls. Frequency response  $\pm$  2DB. 30-15,000 CPS. Hum and noise 70DB. below rated output. Output 4, 8, 16 and 250 ohms. Two tone brown enamel wrinkle finish cabinet. Also available with phono turntable. Net \$59.95

AT LEADING SOUND DISTRIBUTORS OR WRITE

Precision Electronics, Inc.  
9101-M King Ave., Franklin Park, Ill.  
Please Rush Public Address Equipment Catalog.

Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



## Satisfaction from Hi-Fi

(Continued from page 31)

trol used with many radio receivers. It is usually a two-position switch marked "bass" and "treble." Circuitwise, the control merely switches a capacitor in or out of the circuit. When the capacitor is connected, the high-frequency signals are reduced in amplitude—so this is the "bass" position. In other words, we effectively boost the bass response by reducing the treble. Of course, the same effect would appear to be obtained by boosting the bass; equipment users should be aware of this in seeking proper adjustments of the tone controls.

Tone controls can be used in a number of ways:

1. By turning down the treble, record noise can be reduced. Some of the higher signal frequencies may be lost, but normally this is not nearly as objectionable as the noise.

2. Reducing both the bass and treble settings will decrease noise. Decreasing the amplitude at both ends of the frequency range (but not at medium frequencies) sacrifices response somewhat, but only at frequencies to which the ear is least sensitive. The great reduction of noise may be well worth the sacrifice.

3. Reducing the bass response also reduces the amplitude of any hum which may be present. Hum is usually at 60 or 120 cps, so the bass control has considerable effect on its elimination.

4. Even when noise and hum are not a problem, tone controls are useful in varying the response to suit individual listeners' tastes.

5. When the exact equalizer setting is not available, the tone controls can alter the response curve to produce the desired equalization. If an equalizer is not used, the tone controls may be adjusted to give some degree of equalization.

Different listeners vary widely in their choice of tone-control settings. A few hi-fi owners have the strange idea that hi-fi means maximum bass and maximum treble. A person with poor high-frequency perception may find it necessary to turn up the treble to a level which may seem too high for others. Then there are those who buy the best equipment available, only to turn the bass all

the way up, and the treble all the way down! "Right" or "wrong," each individual has the privilege of adjusting the tone controls to his own level; however, customers should be encouraged to experiment with the controls and learn how to use them to best advantage.

### Loudness Controls

A number of cartoons have appeared in which the hi-fi owner was depicted playing his set with tremendous volume. Most of these are exaggerations, but there is a valid reason for playing a hi-fi set

good and loud. The frequency response generally sounds better at high volume levels than at low levels, because our ears respond differently to the various audio frequencies at different sound intensities.

Some years ago, a set of curves (Fig. 3) was drawn up representing the response of the "average ear" at various volume levels. These are popularly known as Fletcher-Munson curves, after the men who compiled the information. Frequency is plotted along the horizontal axis, and intensity levels



The missing link in TV service ...

## SENCORE SS105 SWEEP CIRCUIT TROUBLE SHOOTER

IT'S A ...

**UNIVERSAL HORIZONTAL OSCILLATOR.** For direct substitution. No wires to disconnect in most cases. Traces trouble right down to the defective component. Variable output from 0-200 volts, peak-to-peak.

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

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

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

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

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

Size, 7x6x3½". Wt. 4 lbs.  
For 110-120 volts, 60 cycle AC.

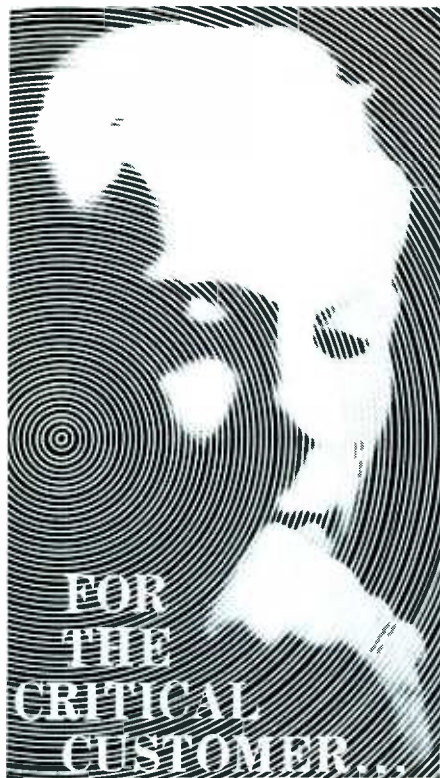
DEALER NET 39<sup>50</sup>



HORIZ. OSC.	VERT. OSC.
HORIZ. O.P. STAGE	VERT. O.P. STAGE
HORIZ. FLYBACK TRANSFORMER	VERT. O.P. TRANSFORMER
HORIZ. DEFLEC. YOKE	VERT. DEFLEC. YOKE

See Your Parts Distributor NOW!

**SENCORE**  
ADDISON 2, ILLINOIS



the world's most  
trouble-free cartridges..

**SHURE**

*Stereo Dynamic*

**HI FI PHONO CARTRIDGES**  
Shure High Fidelity Stereo Dynamic phono cartridges are designed to satisfy the most critical requirements. Made under custom laboratory conditions, each unit is checked electrically, mechanically and acoustically to insure trouble-free performance.

**PROFESSIONAL  
MODEL M3D  
AT \$45.00\***



\*audiophile net,  
with 0.7 mil diamond

Incomparable quality—the overwhelming choice of independent critics and experts. Floats at only 3 grams in transcription tone arms. Distortion-free response from 20 to 15,000 cps. Superbly designed and built to perfectionist tolerances.

**CUSTOM  
MODEL M7D  
AT \$24.00\***



\*audiophile net,  
with 0.7 mil diamond

Outclasses every cartridge except the Shure M3D—by actual listening tests! Tracks perfectly at minimum pressure available in record changer arms. Smooth from 40 to 15,000 cps.

Use Only Shure Replacement Styli that carry the certification "Precision Manufactured by Shure." Inferior imitations can seriously degrade the performance of the cartridge.

Literature available:  
**SHURE BROTHERS, INC.**  
222 Hartrey Avenue, Evanston, Illinois

along the vertical axis. Intensity is plotted in decibels, with zero db representing the sound level at the threshold of hearing for a signal frequency of 1000 cps. Each line is an "equal loudness contour," and by reference to the bottom curve we can see that about +64 db of a 30-cycle signal is required to give the same sensation of loudness as a 1000 cps signal at the zero-db level. It is evident from the curves that the human ear is most responsive to sounds having frequencies of 3000 to 4000 cps.

As volume level increases, the Fletcher-Munson curves tend to become more nearly flat, meaning that the requirements for a certain loudness level are more nearly the same for all frequencies. Summarized, all of this means that the frequency response (as we hear it) is improved as the output sound level is increased. And all of this occurs with no change in the response of the audio-reproducing equipment.

This peculiar imperfection in our hearing mechanism shows up mostly at low volume levels. We can compensate for it to some extent by turning up both the bass and the treble, but this has its disadvantages. Besides being bothersome, it is difficult to advance the controls by just the proper amounts. However, if the volume control is replaced with a loudness control, automatic compensation can be made for the above-described effect at all volume levels. There are a number of different types of loudness controls, but the one shown in Fig. 4 is fairly typical.

This control circuit employs three ganged potentiometers, two fixed resistors, and two capacitors. R1,

the volume control proper, determines the signal amplitude. Isolating resistor R2 prevents interaction between the controls. At maximum volume level, all three potentiometer arms are at the top ends of the respective controls. C1 and R3 are then effectively cut out of the circuit and do not affect response. The series circuit consisting of R4, R5, and C2 has maximum impedance so that the reactance of C2 has minimum effect on response. With the controls at the other extreme (minimum loudness), R3 and C1 are in series with the signal path. The reactance of C1 varies inversely with frequency so that less voltage drop occurs across it at high frequencies; therefore, the response to "highs" is improved.

With R4 set for minimum resistance, C2 has its maximum effect. It is in shunt with the signal and thus gives increased low-frequency response. At intermediate settings of the controls, the capacitors have varying effects—depending on the exact level chosen. It would be difficult to design a network which would exactly compensate for the loudness response, especially since each individual varies somewhat from everyone else with regard to hearing ability.

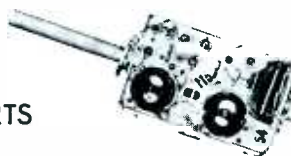
#### Stereo Balance Controls

Dual-channel amplifiers in stereo systems often include ganged volume, loudness, tone and other controls to permit simultaneous adjustment of both amplifier sections. In addition, many of these amplifiers incorporate *balance* controls for equalizing the levels in both stereo channels. It can be pointed out to the user that this balance

PHONE  
ED 9-9653

90 DAY  
WARRANTY

7.50  
PLUS PARTS



### Precision Tuner Service

ALL TYPES T.V. TUNERS REPAIRED AND ALIGNED TO FACTORY SPECIFICATIONS ON CRYSTAL-CONTROLLED SWEEP GENERATORS

UHF - VHF \$13.50

P. O. Box 272, 601 N. College  
BLOOMINGTON, INDIANA

State make and model. Send  
all parts, tubes and shields

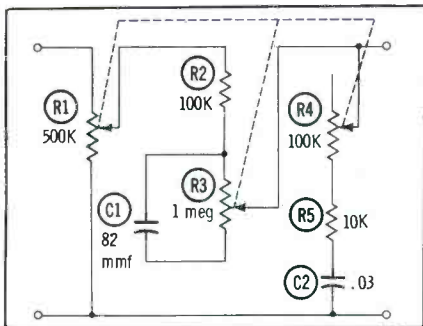


Fig. 4. Typical loudness-control hookup.

control does not necessarily have to be adjusted for perfectly equal volume from the two sets of speakers. Actually, the system can be purposely *unbalanced* so that listeners can sit "off to one side" — not directly across the room from the stereo system—and still obtain an acceptable stereophonic effect. (To achieve this, volume is reduced in the "near" speakers and increased in the "far" ones.) With a little experimentation, the stereo listener can determine the most pleasing balance setting for his purpose.

#### Record Care

A large portion of hi-fi program material originates on records, and the owner of hi-fi equipment often has a sizable investment in records alone. Proper care of these records will protect this investment and add years to the playing life of each disc, so hints along that line are in order. Here is a listing of the most important items in record care.

1. Store each record in its own cardboard jacket, preferably also using an inner covering of plastic or paper.

2. Never stack records unless they are in their jackets. Store them so that the records are vertical, not horizontal.

3. Prevent dust pickup by keeping records properly stored except when playing them.

4. Spraying the record with anti-static fluid or wiping them with a properly treated cloth gets rid of the static charge which attracts and holds dust. Once treated, the records can be cleaned with any soft, clean rag.

5. Touch the records only in the label area and at the edge. An oily residue from the fingers causes the disc to hold dust and dirt.

6. Be careful not to drop the

**NOW** THE MONEY MAKING ADVANTAGES OF MULTIPLE SOCKET TUBE TESTING ARE PLACED WITHIN EVERYONE'S REACH

### Model 101 TUBE TESTER

FEATURE FOR FEATURE THE 101 REPRESENTS THE GREATEST VALUE IN TUBE TESTERS

- Checks emission of over 700 tube types (including OZ4s, series-string TV tubes, gas regulators, auto 12 plate volt, hi-fi and foreign tubes) employing the time proven dynamic cathode emission test principle.
- Checks for gas content.
- Checks for inter-element shorts and leakage.
- Checks all sections of multi-purpose tubes . . . will pick up tubes with one "Bad" section.
- 3 settings enable a test of any tube in less than 10 seconds.
- Positively cannot become obsolete as new tube types are introduced.
- 3½" D'Arsonval type meter—most accurate type available . . . sensitive yet rugged.
- 17 long lasting phosphor bronze tube sockets.
- Line isolated—no shock hazard.
- Variable load control enables you to get accurate readings on all tubes.
- 5 filament positions.
- Detachable line cord.
- Handy tube chart contained in special back compartment.
- New tube listings furnished periodically.
- Housed in sturdy gray hammer-tone steel case.
- Size: Width 9", Height 8½", Depth 2¾".
- Bears standard EIA warranty on parts and workmanship.



Model 101 **\$3995**  
Dealer Net . . . . .

**Model AD-1 CRT ADAPTER**  
available for use with the Model 101 — makes the 101 a highly accurate picture tube tester. A single adapter head enables you to test all black and white picture tubes (including the new short neck 110 degree RCA type) for emission, shorts and gas content.

**Model AD-1 CRT ADAPTER \$395**  
Dealer Net . . . . .

THESE SELF-SERVICE TUBE TESTERS ARE RATED #1 BY SERVICEMEN EVERYWHERE FOR PERFORMANCE, DURABILITY AND VALUE

### Model 201-F SELF SERVICE TUBE TESTER

COMPARE THESE FEATURES WITH ANY SELF-SERVICE TUBE TESTER MADE BY ANY MANUFACTURER AT ANY PRICE

- Checks quality (emission, shorts and gas) of over 800 tube types, covering over 99% of all TV and radio tubes in use today, including the newest series-string TV tubes, OZ4s, one volt tubes, magic eye tubes, hi-fi and foreign tubes.
- Cannot become obsolete as circuitry has been engineered to accommodate new tube types as they are introduced.
- Completely self-service . . . just two settings are required to test a tube in less than ten seconds.
- Checks each section of multi-purpose tubes.
- Tests all 6 and 12 volt standard auto radio vibrators.
- 46 long lasting phosphor-bronze beryllium sockets.
- Handy push button fuse can be reset manually — never needs replacement.
- Attractive red and hammer-tone gray durable metal cabinet.
- Tube compartment with own lock holds over 400 tubes.
- Tube storage drawers with tube carton dividers and drawer sheets provide for automatic inventory control.
- Takes only 19"x19" of floor space. Stands 6'1" high.
- Large seven inch easy-to-read meter is extremely sensitive yet rugged — is fully protected against accidental burn-out.
- Etched aluminum panel always retains its handsome appearance.
- The most complete tube chart in the field lists over 800 tube types.
- New tube listings are furnished periodically.
- Handy tube substitution guide included with each tester to prevent lost sales due to out of stock tube types.
- Colorful window streamers supplied with each tester to attract customers.
- An illuminated colorful plastic display tops the cabinet — designed to attract attention.
- Shipped in one carton completely assembled.
- Bears standard EIA warranty on parts and workmanship.



Model 201-F  
(floor model) **\$15850**  
Dealer Net . . . . .

ALSO AVAILABLE  
Model 201-C  
(counter model) **\$10950**  
Dealer Net . . . . .

See your local parts jobber NOW or write TODAY for literature



**ELECTRONICS CORP.**

manufacturers of quality electronic products

Dept. 1206 77 Searing Ave., Mineola, N. Y.

# NEW



Type "PCT" ... constructed in strong red cardboard tubes, wax impregnated, one end closed, printed circuit board terminals.

Type "PCTL" ... has insulated lead out top providing for low voltage section.

For 65°C operation ... recommended for table and clock radios ... individually packaged ... guaranteed for one year.

- ALL PLANET capacitors are**
- engineered for quality
  - guaranteed for one year
- Call your DISTRIBUTOR**

**PLANET SALES CORPORATION**  
 225 Belleville Avenue  
 Bloomfield, N. J.

disc or, allow it to be scraped or scratched in any way.

7. Store records in a closed cabinet in a dry location where heat is not excessive. This keeps them cleaner and minimizes warping.

### Stylus Wear

Regardless of some claims to the contrary, there is no such thing as a permanent stylus. After too much wear, the stylus begins to flatten and actually chisels out the record grooves, eventually ruining the disc. But even before this occurs, a worn stylus increases noise and gives poor frequency response. There are three popular types of stylus material; metal (usually osmium), sapphire, and diamond. As a general rule, a metal stylus should not be used for more than 20 hours of playing time, nor should a sapphire be used more than 100 hours. These are the maximum figures under ideal playing conditions; styli may not last that long if tone arms are not adjusted for correct stylus pressure and tracking force. (This should be checked by the serviceman who installs the equipment.)

A good diamond stylus has the longest life of all, and can usually be used for up to about 1000 hours. However, even diamonds wear out eventually and should be replaced.

Some hi-fi owners may need a gentle reminder that the price of a new stylus is very low when compared with the replacement cost of an entire record collection.

### MORE ABOUT MICROPHONES

For lack of space, the October column, "How to Choose and Use Microphones," glossed over a few points on which some elaboration is called for. This short addendum, therefore, is for those who would like a few more specific details.

In comparing the difference in response of ceramic and crystal mikes, the difference in the generator elements themselves has little if any effect on response range. Other design parameters, such as the diaphragm and drive mechanism, do affect frequency response. Temperature and humidity, which limit the use of crystals, has little effect on ceramic elements.

Speaking of diaphragms used in dynamic units, it should be pointed out that while in years past most of

# NEW SOUNDCRAFT VINYL



FOR EVERY  
ELECTRICAL  
TAPING JOB!

Here's the electrical tape that's got everything!

**COMPLETE PROTECTION  
AGAINST INSULATION FAILURE**

- Tremendous durability • Perfect conformability • High dielectric strength (10,000 volts) • Excellent adhesion and staying power • Non-combustible • Extreme resistance to aging • High resistance to temperature and humidity extremes and remarkable adaptability to a wide variety of uses!

**REEVES SOUNDCRAFT CORP.** Great Pasture Road  
Danbury, Conn.

manufacturers of the world's finest magnetic recording tapes



*"He got the idea from  
a science fiction movie."*

for power tools to your liking



**1/2 H.P. SOUPED-UP SABRE SAW  
MODEL 909 ONLY**

Only portable electric saw that can cut 4x4's at 45°, 6" board or log, yet cut any pattern, too! Cuts up to 1/2" steel, 2" pipe. Complete with rip guide, circle cutter, 45° tilting base plate and 7 blades.

Say WEN for Drills, Solder Guns, Sanders  
5810 NORTHWEST HIGHWAY, CHICAGO 31

# BEST BUYS IN TEST INSTRUMENTS



- Praised by the experts
- Lifetime service guarantee
- Ruggedized mechanical design for utmost accuracy & stability
- Only the latest, finest quality parts used



Color & Monochrome • DC to 5 MC Lab & TV 5" Oscilloscope #460

Wired \$129.50 Kit \$79.95

Features DC amplifiers; flat from DC to 4.5 mc, usable to 10 mc.



TV-FM Sweep Generator & Marker #368

Wired \$119.95 Kit \$69.95

Entirely electronic sweep circuit with accurately biased inductor for excellent linearity. Extremely flat RF output.

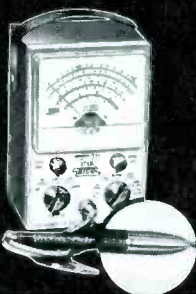
Dynamic Conductance Tube & Transistor Tester #666

Wired \$109.95 Kit \$69.95

Tests all receiving tubes (picture tubes with adapter), n-p-n and p-n-p transistors.



Add 5% in the West



Peak-to-Peak VTVM #232 & Uni-Probe (pat. pend.)  
Wired \$49.95 Kit \$29.95

Uni-Probe — exclusive with EICO — only 1 probe performs all functions: half-turn of probe tip selects DC or AC-Ohms.

In stock at over 1500 distributors in the U.S. and Canada

**IMPORTANT NOTE:** All EICO kits built according to our instructions, and all EICO factory-assembled equipment, conform to the high standards and specifications published in EICO literature and advertisements. All EICO factory-assembled equipment is completely and meticulously hand-wired throughout — no printed circuitry, each factory-assembled unit is 100% final-tested throughout for each feature and function — no "spot" or "partial" checking. In EICO's final-test techniques, nothing is left to chance.

EICO, 33-00 Northern Blvd., L.I.C. 1, N. Y.

them were metallic, most modern dynamic microphones, particularly those of higher quality, use non-metallic diaphragms. This, and other improvements, have permitted dynamic microphones to be designed for practically any application.

Because the internal impedance of a dynamic microphone is inherently very low (voice-coil impedances average between 3 and 12 ohms), an internal matching transformer is, of necessity, included in the over-all unit design. Thus, the output impedance depends entirely on the transformer specifications, and may be low, high, or variable. Directional characteristics of dynamic units vary with case design and frequency. Very small microphones, such as modern lavalier types, are essentially nondirectional regardless of position at low and midrange frequencies. Pressure-activated units utilizing fairly large case diameters become somewhat directional at higher frequencies. However, with the use of phase-shifting devices, which in part involves case design, a cardioid response pattern can be obtained.

Crystal mikes are high-impedance units, and on occasion their response characteristics are used to complement those of the amplifier. The fact that replacement of a crystal mike with a dynamic unit results in a loss of "highs" or "lows" is not likely to be caused by a fault of the microphone. Substituting a dynamic mike for a crystal type on modern equipment almost invariably results in improved response — providing a high-impedance model is selected, or a low-impedance type is used with an external high-impedance matching transformer.

Well-designed ribbon microphones have very good response characteristics, a factor which has made them popular in broadcasting and recording activities; however, they are quite fragile and not suitable for out-of-door use. Rapid movement, such as when quickly moved from one position to another on a TV boom, activate the ribbon and thus produce unwanted noise output.

These factors, as well as others, may well contribute to the reasons why dynamic mikes—which have been improved to the point where they are designed for even the most discriminating uses—have achieved a high degree of popularity. ▲

# BEST BUYS IN CUSTOM

STEREO

HI-FI...



- Praised by the experts
- Lifetime service guarantee
- Modern "low silhouette" horizontal chassis
- Easy console installation



FM Tuner HFT190 Wired \$65.95\* Kit \$39.95\*  
Cover \$3.95. \*Less cover, FET included.  
"One of the best buys." — AUDIOCRAFT

AM Tuner HFT94 Wired \$65.95 Kit \$39.95  
Includes cover & FET.  
"One of the best... ideal for those wishing to add AM to their systems." — HI-FI SYSTEMS

FM/AM Tuner HFT 92 Wired \$94.95  
Kit \$59.95 Includes cover & FET



Stereo Dual Amplifier — Preamplifier HF81  
Wired \$109.95 Kit \$69.95  
"Outstanding quality... extremely versatile."  
— ELECTRONICS WORLD LAB TESTED.



Stereo Dual Preamplifier HF85  
Wired \$64.95 Kit \$39.95  
"Outstanding buy." — THE AMERICAN RECORD GUIDE

Stereo Dual Power Amps  
28-Watt Model HF86 70-Watt Model HF87  
Wired \$74.95 Kit \$43.95 Wired \$114.95 Kit \$74.95



3-Way High Fidelity Speaker System Semi-Kits HFS-3 & HFS-5

- Complete with factory-constructed enclosure
- Easy to assemble — no gluing or woodworking
- HFS-3 unfinished birch, \$72.50; walnut, mahogany or teak, \$87.50
- HFS-5 unfinished birch, \$47.50; walnut, mahogany or teak, \$59.50.
- Other speaker system semi-kits from \$39.95.

In stock at over 1500 distributors in the U.S. and Canada

EICO, 33-00 Northern Blvd., L.I.C. 1, N. Y. PF-12

Show me how to save 50% on top quality:  Hi-Fi  
 Test Instruments  Ham Gear. Send free catalog and name of neighborhood EICO supplier.  
 Send free STEREO Hi-Fi Guide.

Name.....  
Address.....  
City..... Zone..... State.....  
Add 5% in the West

# PRODUCT REPORT

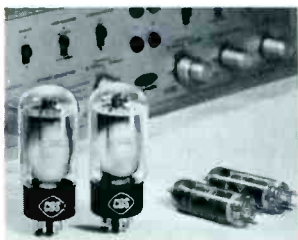
For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

## Stereo Amplifier (46K)



The Webster Electric Model GL20-20 includes preamp and power amplifier circuits for both channels of a stereo system. Audio output is 20 watts per channel. The amplifier will accept input signals from radio tuners, tape decks, and all types of phonograph pickups. A master volume control is supplemented by separate-channel volume, bass and treble controls.

## Matched Pairs of Tubes (47K)



A half-dozen different types of audio output tubes are now being supplied by CBS in matched pairs to help minimize harmonic distortion in push-pull audio amplifiers. Types 7189 and 6L6GC have just been added to the list of paired tubes available, joining the previously-announced 6BQ5, 6V6GT, 5881, and 6550.

## Transistor Test Equipment (48K)

A set of three Sencore instruments for servicing transistorized circuits is now available in a single package called the *Transistor Radio Service Lab*. Units included are the TRC4 transistor tester, the PS-103 *Transipak* power supply (which also measures receiver current drain), and the HG104 harmonic generator for signal tracing. Price of the complete set is \$45.85.



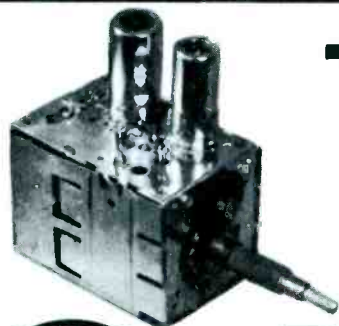
## Styli Counter Display (49K)

A self-service counter display unit, the Duotone 666 *Stereo Stage*, holds an assortment of 18 sapphire styli for use in several popular brands of stereo record players. Six of the styli are designed to fit Ronette cartridges; there are also six each for Sonotone and RCA replacement applications. Retail price of the assortment is \$51.00.



## Tape Maintenance Kit (50K)

Three chemicals for tape recorder maintenance, all in plastic "squeeze" bottles, are furnished with suitable applicators in the Electrical and Chemical Specialty Co. *Master Kit*. The fluids supplied are a cleaner for drive surfaces in the tape transport mechanism; a lubricant for tape heads and guides; and a tape conditioner with antistatic, plasticizing, lubricating, and cleaning properties. The conditioner is dispensed by a special *Tower Applicator* which mounts on top of the recorder and applies a measured amount of fluid continuously to the tape. The complete kit is priced at \$3.98; extra bottles of fluid are 98c each.



# TV TUNERS OVERHAULED

VHF  
OR  
UHF

# ALL

MAKES  
AND  
MODELS

90  
DAYS  
WARRANTY

ALIGNED TO ORIGINAL STANDARDS  
USING THE FINEST EQUIPMENT

VHF OR UHF TUNER OVERHAULED

\$9.95 NET

UHF/VHF COMBINATION OVERHAULED

\$19.90 NET

Prices include labor and minor parts only, defective tubes and damaged major parts are extra at net prices.

Forward defective tuner complete with tubes, shield cover and any damaged parts. Quote make and model and describe complaint. We will ship C.O.D.—F.O.B. Chicago or Toronto.

*Castle TV Tuner Service* 5710 N. Western Ave. Chicago 45, Illinois

Suppliers of rebuilt TV Tuners to leading manufacturers, technicians & service dealers, coast to coast. Original and Only Complete TV Tuner Service covering the North American Continent.

In Canada: — 136 MAIN ST., TORONTO 13, ONT.

### Silicon Rectifier Display (51K)



A Baker's Dozen No. 500 display card, holding 13 Pyramid Type S1-500 silicon rectifiers for TV and radio power supply applications, is being offered at the regular price of a dozen single units. The rectifiers, which are of a "top-nat" design with axial pigtail leads, come complete with conversion fittings for "snap-in" installations.

### FM Radio (52K)



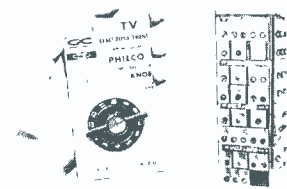
The Blonder-Tongue Model R120 FM radio, featuring temperature-compensating circuitry said to provide drift-free tuning, uses six tubes and a rear-mounted speaker to create the effect of wide sound dispersion. Available in plastic cabinets of grey and white, sandalwood and white, or solid white. Suggested list price is \$39.95.

### Crystal Stereo Cartridges (53K)



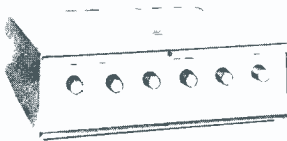
Astatic 80 Series crystal stereo cartridges are made in two different designs (both of the turnover type) to meet different mounting requirements. Specifications are as follows: Output from stereo LP record at 1000 cps, 0.8 volts; frequency range, 30 to 15,000 cps; compliance,  $1.3 \times 10^{-6}$  dyne; and stylus force, 6-8 gm.

### Control Knobs (54K)



Replacement knobs for all "customer controls" on eight widely-sold makes of TV sets (RCA, Zenith, Motorola, Philco, Admiral, General Electric, Westinghouse, and Emerson) are being marketed by G-C Electronics. The line comprises a total of 97 knobs, all packaged on cards and hung on a display rack for quick identification.

### Stereo Amplifier Kit (55K)



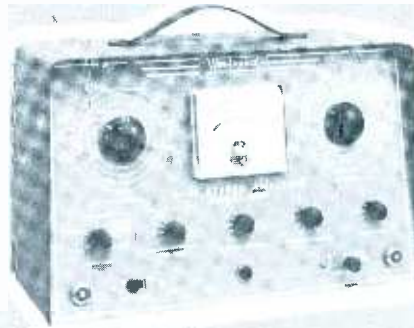
A stereo version of the Grommes Little Jewel hi-fi amplifier kit has dual-channel preamplifiers and 10-watt power amplifiers which can be paralleled to provide 20-watt monophonic output. Model 20-LJK has 4 pairs of inputs: crystal phono, RIAA magnetic phono, NARTB tape, and auxiliary.

### Phonograph Accessories (56K)



A stock of the nine "most-often-wanted" items in the Audiotex phono-accessory line is offered to dealers, complete with a 24" x 13" easel-type counter-display rack. Items included are a record brush, static-eliminating device, stylus brush, antistatic liquid cleaner, silicone-treated record-cleaning cloth, two types of 45-rpm disc inserts, a tone-arm lifting device, and a stylus microscope.

## the modern approach to HI-FI STEREO servicing



Here is a Complete Audio Laboratory of six instruments in one package! Our engineers have designed the "800" to save your time and to simplify the operational procedure of your shop. We know your time is your most valuable inventory. Look at the individual services the "800" performs at a fraction of the cost for all six instruments! . . . \$169.95.

- it's an AUDIO VTVM
  - it's an AUDIO OUTPUT WATT METER
  - it's an AUDIO-SIGNAL GENERATOR
  - it's an INTERMODULATION DISTORTION METER
  - it's a HARMONIC DISTORTION METER
  - it's a DB and NOISE METER
- and it's EASY to use

offers a complete line of test equipment

Dynamic sweep Circuit Analyzer . . . for color and black and white TV. Trouble shoot horizontal and vertical sweep circuits by signal substitution. This same instrument also is a complete compatible flyback and yoke tester! . . . \$69.95.



Dynamic AGC Circuit Analyzer . . . AGC trouble shooting made painless! The "825" solves complex AGC problems fast because it combines AGC test signal, AGC circuit monitor, AGC pulse indicator, Bias clamp and supply, Continuity tester and VTVM . . . \$79.95.



Intermittent Condition Analyzer . . . the fast way to locate intermittents and "borderline" components. Gives modulated test signal for TV or RADIO. "Electro-Wand" pickup loop checks tubes for noise and intermittents. "Electro-Probe" locates faulty components and loose connections without direct circuit connection . . . \$89.95.



Induced Waveform Analyzer . . . adapts any "scope" to check waveforms from the top of the chassis. "Phantom-Probe" makes every tube a test-point without direct connection. Localizes trouble in minutes. Works on TV Channels 2 thru 13, 3.58-4.5 mc IF, 21 mc IF, 40 mc IF, Audio, Video, and Radio frequencies . . . \$169.95.



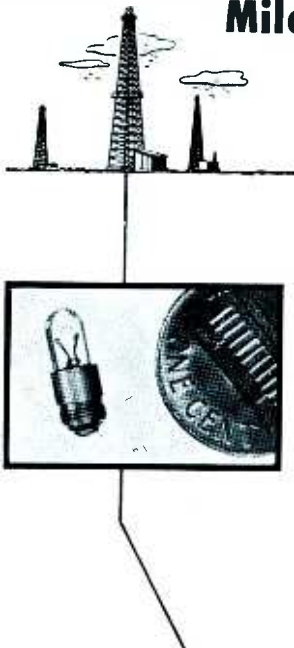
## WINSTON ELECTRONICS

DIVISION OF



4000 N. W. 28th STREET • MIAMI, FLORIDA

## This Lamp Designed to Operate Miles Underground!



In drilling an oil well, the drill pipe often goes astray when the rotary drill is deflected by a tilted strata of hard rock. The drill crew cannot know what is happening 5 to 20 thousand feet below ground.

To check the accuracy of the drilling an instrument containing a camera, a scale indicating any deviation from the vertical and a compass to indicate the direction of the deviation, is lowered into the drill pipe. This instrument is subjected to severe shock and temperatures to 325°F.

The lamps illuminating the scale during photography were frequent casualties, much too frequently for efficiency and economy. Chicago Miniature was consulted, and produced a lamp that, without decreasing light output, increased lamp life by 1500%.

This superior quality is found in all Chicago Miniature Lamps—standard as well as special.

Always specify Chicago Miniature when ordering from your jobber!

Write for Catalog and Complete Information.



**CHICAGO MINIATURE LAMP WORKS**

1518 No. Ogden Ave., Chicago 10, Ill.  
Miniature Lamps for every requirement

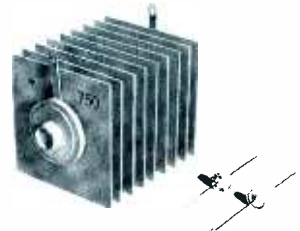
## New Type Indoor Antenna (57K)

In many areas, usable TV and FM broadcast signals are induced on AC powerline and house wiring. The Jerrold *TV-Receptor* antenna taps off these signals by inductive coupling and feeds them to the receiver antenna terminals. No direct-wire connection is made from line to antenna; the device is just slipped over the line cord and forth to locate the point of maximum signal pickup. List price is \$5.95.



## Silicon Rectifiers (58K)

Audio Devices No. 40E5 silicon diodes have a PIV rating of 400 volts and maximum DC output current of 750 ma (with resistive load) or 500 ma (with capacitive load). Other types are also available with PIV ratings from 100 to 500 volts. These rectifiers appear somewhat similar to military-type "top-hat" units except for being encapsulated within an outer ceramic shell.



## Stereo Signal Mixer (59K)

Sound from external sources (such as microphones) can be intermixed with stereo programs in the Switchcraft No. 306TR Stereo-Monaural Mixer. To prevent signal attenuation, the unit contains battery-powered, transistorized amplifiers. Each channel has two input circuits (with independent volume controls) and one phono-jack output. List price is \$37.50.



## Stereo Record Changer (60K)

A nonmagnetic, 6½ lb. turntable, a dynamically-balanced four-pole motor, and an automatic-intermix type of changer mechanism are featured in the Collaro *Constellation* Model TC-99 record changer. Tracking pressure of the tone arm varies less than one gram as the machine plays through a stack of records. Price of the unit is \$59.50 (slightly higher out West).

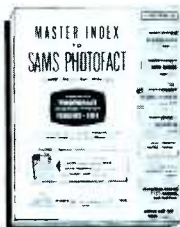


## Moving-Magnet Cartridge (61K)

The stylus of Audio Empire's new *Empire 88 Stereo/Balance* cartridge moves a magnet within a stationary coil assembly that incorporates a hum-balancing feature. The moving element is said to have extremely small dynamic mass so as to maintain smooth performance at high frequencies up to 20,000 cps. Outputs (5 mv per channel) are matched within ± 1 db. Price is \$24.50 with diamond stylus, or \$18.50 with sapphire.



## SAMS PHOTOFAC INDEX



sent direct to your shop

**FREE**

SEND FOR IT!

Yes, now you can have the valuable SAMS MASTER INDEX TO PHOTOFAC FOLDERS and Index Supplements sent direct to your shop at no cost to you! Just mail coupon below and you'll be sure to receive regularly your handy guide to the world's finest service data covering over 33,000 TV, Radio, Amplifier, Tuner Tape Recorder and Changer models. Send for it—it's FREE!

MAIL COUPON

**Howard W. Sams & Co., Inc.**  
2201 East 46th St., Indianapolis 6, Ind.

Put me on your mailing list to receive the Sams Photofact Master Index and Supplements

I'm a Service Technician: \_\_\_\_\_ full time; \_\_\_\_\_ part time

My Distributor is:

Shop Name: \_\_\_\_\_

Attn: \_\_\_\_\_

Address: \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



### Ganged "L" Pads (62K)



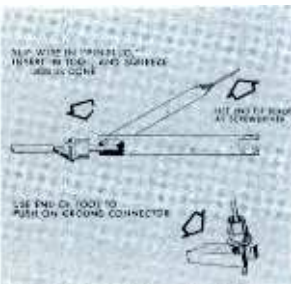
Consisting of twin "L" pads operated by a common shaft, the Mallory "LL" can serve as a constant-impedance, tandem-style volume control in speaker circuits of stereo amplifiers. The "LA," single "L" pad for monophonic circuits, is also obtainable. Both these controls have bushings 1" long to permit installation in thick walls of speaker cabinets. The "LL" is furnished in 8-, 16-, and 50-ohm versions; the "LA" in 8 and 16 ohms only.

### Finish-It-Yourself Cabinets (63K)



Optional versions of the Jensen *Tri-ette* and *Duette* bookshelf-size speaker systems have unfinished cabinet surfaces which the buyer can stain, varnish or paint as he chooses. Provisions are made for custom installation of grille fabric. The *Tri-ette* (\$89.50) is a 3-way system with 12" woofer, 8" midrange unit, and compression-driver tweeter; the *Duette* (\$59.95) has an 8" low-frequency speaker (new type P8-QF) and a direct-radiator tweeter.

### Easier Phono Plug Wiring (64K)



The Berns Audio Pin Crimper (Model AU-2) can be used to attach a shielded cable to a phono plug without making soldered connections. Besides crimping the center conductor tightly within the pin plug, the tool also assists the user in pressing a "C" ring over the shell of the plug to clamp the braided shield firmly in place. The AU-2 is also useful for repairing defective tube-pin connections.

### Rack for Tube Stock (65K)

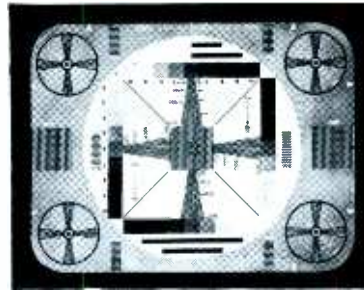


To help TV shops maintain an orderly tube stock, General Electric (through its tube distributors) is making available a wrought-iron display rack called a PROFIT unit. Approximately 5' high and 3½' wide, the rack holds up to 665 tubes in "eggcrate" cases which allow easy removal of any tube. Type numbers are printed on the bottom of empty spaces as a reminder to restock the indicated types.

### AM-FM Tuner Kit (66K)



A choice of AM and FM monophonic reception, provisions for attaching an FM multiplex stereo adapter, a prewired FM "front end," and fully pre-aligned RF-IF circuits are featured in the EICO Model HFT-92 tuner. The dial pointer is a DM70 "exclamation-point" tuning eye. Price is \$59.95 in kit form, or \$94.95 preassembled.



# TV TIPS FROM TRIAD

NO. 5 IN A SERIES

"Haven't you fixed that kluge yet?" the senior PTM said to Joe.

"No, Bill, it shrinks a little horizontally after it's on for an hour, and I can see 'Callback' written all over it."

"What are you going to do next?" queried Bill, as he poured himself a cup of coffee.

"I've already done it," said Joe with a grin. "I knew you'd show up if I waited."

"All right, what do you know about the chassis for sure?" said Bill.

"Well," Joe recited, "New Charley Dog Six, flyback, and damper tube, high voltage ok, boost a little low after an hour, screen ok—"

"How do you know the screen is ok?"

"The service folder says so. It says the screen voltage should be 165 and this one measures about 178, which is within ten percent."

"Let's use the Check Chart\* on it," said Bill.

"Here we go. Set off. Screen resistance?"

"8.2K," replied Joe.

"Set on? Voltage across screen resistor?"

"192."

"Chart shows current is 23 ma. Measure screen to ground."

"Still 178," Joe said.

"Wattage dissipated in screen 4.3 Max safe level 3 watts. *Expected tube life probably less than one hundred hours!*"

"What's next?"

"Let's try it with a 10 watt 18 K. Voltage across resistor?"

"210."

"Current 12 ma. Voltage to chassis?"

"160," Joe said, surprise in his voice.

"Screen wattage 1.9, width better, and boost normal," said Bill, as he finished his cup of coffee. "Now, you could have done that yourself, couldn't you?"

\*Triad Callback Stopper, that is.

\* \* \*

**MORAL: The Triad Callback Stopper Check Chart** may be just as useful to you as it was to Bill and Joe. Get yours from your distributor, or write to us and we'll send you one. Triad Transformer Corporation, 4055 Redwood Avenue, Venice, California.

DECEMBER, 1959

Aerovox Corp. .... 46  
 American Television & Radio Co. (ATR) ..... 14  
 Amperex Electronic Corp. .... 40  
 Ampheno-Borg Electronic Corp. .... 38  
 Anchor Electronic Products—Div. of Antronic Corp. .... 58  
 Astatic Corp. .... 9  
 B & K Mfg. Co. .... 41  
 Berns Mfg. Co. .... 68, 74  
 Bussmann Mfg. Co. .... 45  
 CBS Electronics ..... 15, 16-17  
 Castle TV Tuner Service ..... 80  
 Centralab, A Div. of Globe-Union, Inc. .... 44  
 Chicago Miniature Lamp Works ..... 82  
 Cornell-Dubilier Electric Corp. .... 13, 34, 35  
 Doss Electronic Research, Inc. .... 56, 64, 65  
 EICO ..... 79  
 E-Z-Hook Test Products ..... 74  
 Electric Soldering Iron Co. .... 70  
 Electro Products Laboratories, Inc. .... 56  
 Electro-Voice, Inc. .... 33  
 Electronic Publishing Co. .... 50  
 General Cement Mfg. Co. .... 2nd cover  
 General Electric Co.  
   Receiving Tube Dept. .... 37  
   Television Receiver Div. .... 53  
 Hickok Electrical Instrument Co. .... 63  
 Illinois Condenser Co. .... 68  
 International Resistance Co. (IRC) ..... 23, 66  
 JFD Electronics Corp. .... 12  
 JW Electronics ..... 64  
 Jackson Electrical Instrument Co. .... 39, 84  
 Jensen Industries, Inc. .... 58  
 Jensen Mfg. Co. .... 49  
 Littelfuse, Inc. .... 4th cover  
 Mallory & Co., P. R. .... 18-19  
 Mercury Electronics ..... 77  
 Merit Coil & Transformer Corp. .... 70  
 Miller Co., J. W. .... 47  
 Mosley Electronics, Inc. .... 54  
 Planet Mfg. Corp. .... 78  
 Porter & Dietsch ..... 64  
 Precision Apparatus Co. .... 42  
 Precision Electronics, Inc. .... 74  
 Precision Tuner Service ..... 76  
 RCA Electron Tube Div. .... 59, 3rd cover  
 Reeves Soundcraft Corp. .... 78  
 Sams & Co., Inc., Howard W. .... 60, 61, 66, 82  
 Sarkes Tarzian, Inc.—Tuner Div. .... 68  
 Seco Mfg. Co. .... 67  
 SENCORE ..... 69, 71, 73, 75  
 Shure Brothers, Inc. .... 76  
 Simpson Electric Co. .... 55  
 Sonotone Corp. .... 51  
 Sprague Products Co. .... 10  
 Sylvania Electric Products, Inc.  
   Semiconductor Div. .... 57  
   Tube Div. .... 43  
 Technical Appliance Corp. (TACO) ..... 58  
 Triad Transformer Corp. .... 83  
 Tung-Sol Electric, Inc. .... 21  
 United Catalog Publishers ..... 62  
 Vis-U-All Products Co. .... 50  
 Webster Electric Co. .... 20  
 Wen Products, Inc. .... 78  
 Winegard Co. .... 24-25  
 Winston Electronics—  
   Div. of Jetricon Industries, Inc. .... 81  
 Xcelite, Inc. .... 70

- 1K. AMPHENOL—New edition of company's dealer catalog of service products, including twin lead, antennas, accessories and radio-TV parts. See ad page 38.  
 2K. JFD—New 24-page catalog of UHF, VHF, FM and indoor TV antennas and accessories, plus hi-fi speakers and TV accessories. See ad page 12.  
 3K. MOSLEY—Form CB-2A, describing citizen's-band antennas in both deluxe and standard lines. Form TV-1, describing TV outlets and accessories. See ad page 58.  
 4K. TACO—Promotional material for TV & FM antenna installers, including sample copy of "A Guide to Proper Selection of TV Antennas," available for distribution to customers. See ad page 58.  
 5K. WINEGARD—Brochures on new Trans-coupler and "K" series yagis. Also dealer broadside on super Color 'Cepter. See ad pages 24-25.

**AUDIO & HI-FI**

- 6K. ASTATIC—Catalog 33-3 containing complete listing and descriptions of cartridges, microphones, pickups, and needles. See ad page 9.  
 7K. CBS—Harmony phonograph "Dealer Helps Booklet," RPF-290. See ads pages 15, 16-17.  
 8K. JENSEN MFG.—20-page, 2-color catalog describing complete line of loudspeakers for stereo and monophonic high fidelity applications. See ad page 49.  
 9K. PRECISION ELECTRONICS—Flyer describing the Grommes "Premiere Line" of high-fidelity sound equipment for quality industrial and commercial installations. Includes data on 20, 30, and 50-watt amplifiers, as well as deluxe preamps and booster amplifiers. See ad page 74.

**CAPACITORS**

- 10K. AEROVOX—32-page 1960 edition of servicemen's Catalog, listing electrolytic, paper, mica, and ceramic capacitors, as well as filters, test equipment and accessories. See ad page 46.  
 11K. SPRAGUE—Large, 2-color Ceramichart, with circuit diagrams showing typical ceramic capacitor applications in radio and TV, plus color-code specifications for ceramic and molded mica capacitors. See ad page 10.

**CARTRIDGES & NEEDLES**

- 12K. ELECTRO-VOICE—Data on 1960 Power Point cartridges and needles. Also, a cartridge to needle guide, a cross-reference guide, and a stereo phono needle guide. See ad page 33.  
 13K. SHURE—Phono cartridge replacement guide. See ad page 76.  
 14K. ZENITH—Retail price schedule on single- and dual-needle replacement cartridges, four types of 45-rpm spindles, and center-hole adapters for 45-rpm records.

**CHEMICALS**

- 15K. PORTER & DIETSCH—Folder describing the use of Flexicone to improve speaker response. See ad page 64.

**COMPONENTS (MISC.)**

- 16K. ADMIRAL—74-page 1960 sectionalized parts and accessories catalog on tubes, transistors and diodes, batteries, speakers, TV and radio components, TV tuners, record changers and components, indoor and outdoor TV antennas, and TV receiver stands and bases. Also, large cross-reference wall chart for phono needles.  
 17K. CENTRALAB—24-page general catalog lists complete line of controls, ceramic capacitors, switches and "PEC" packaged electronic circuits. See ad page 44.  
 18K. CHICAGO MINIATURE—New pocket-sized cross-reference catalog listing all lamps and manufacturers, in addition to helpful technical data. See ad page 82.  
 19K. IRC—Catalog DC9 describes 35 Handy-Pak resistor assortments for dealers. See ads pages 23, 66.  
 20K. MILLER—Spec sheet on IF transformers for FM-transistor circuits. See ad page 47.

**FUSES**

- 21K. BUSSMANN—Completely new television fuse chart describing proper fuses to use, how they are mounted, and which circuits they protect. See ad page 45.

**SEMICONDUCTORS**

- 22K. TUNG-SOL—"The Lattice," a semiconductor technical brochure written for design engineers. See ad page 21.

**SERVICE AIDS**

- 23K. ANTRONIC CORP.—Literature on Anchor NEV-A-BREAK SOC-KIT, the replacement socket for CRT testers. See ad page 58.

- 24K. E-Z-HOOK—Convenient reference sheet titled, "How to Build the Five Most Useful Scope Probes," with schematics, mechanical component layouts, etc. See ad page 74.  
 25K. JW ELECTRONICS—Dealer leaflet outlining complete tuner repair and alignment service for all makes and models of UHF and VHF tuners. See ad page 64.  
 26K. MUELLER—New catalog illustrates and describes complete line of electric clips, from miniature alligator types to heavy-duty test clamps.

**SPECIAL EQUIPMENT**

- 27K. AKRO-MILS—16-page, 2-color illustrated booklet describing complete line of storage cabinets for component parts, hardware, etc.  
 28K. ATR—Descriptive catalog sheet on 5-tube superhet hand-wired table-model home radios available with or without synchronous electric clocks. See ad page 14.

**TECHNICAL PUBLICATIONS**

- 29K. HOWARD W. SAMS—Literature describing all Howard W. Sams publications covering servicing of radio, TV, hi-fi, etc. Includes data on "Tube Location Guide," "Printed Circuit Diagnosis Made Easy," "Servicing Transistor Radios, Volume 4," "101 Ways to Use Your Audio Test Equipment," and the revised edition of "Radio Receiver Servicing." See ads pages 60, 61, 66, 82.  
 30K. UNITED CATALOG PUBLISHERS—24-page "Foreign Tube Interchangeability Guide." See ad page 62.

**TEST EQUIPMENT**

- 31K. B & K—Bulletin ST24-R gives helpful information on how to save time and work and make money with point-to-point signal-injection, direct-viewing Model 1075 Television Analyst, Models 550 and 650 dynamic mutual-conductance tube testers, Model 675 automatic tube tester, and Model 440 CRT cathode-rejuvenator tester. See ad page 41.  
 32K. DOSS—Information on the latest in test equipment, including the Pioneer 250 Horizontal Systems Quantalyst. See ads pages 56, 64, 65.  
 33K. EICO—20-page 1959 2-color catalog describes 65 models of professional test instruments, hi-fi, and "ham" gear in both kit and factory-wired form. Shows how to save 50%. Also, 4-page 2-color stereo hi-fi guide. See ad page 79.  
 34K. JACKSON—Flyer describing complete line of "Service-Engineered" electronic test equipment. See ads pages 39, 84.  
 35K. PRECISION APPARATUS—Catalog describing electronic test equipment for service or engineering shop, lab and field requirements. Also explains principles of Electronic tube testing. See ad page 42.  
 36K. RCA—Data sheet on complete line of electronic instruments for home instrument and industrial servicing. See ads page 59, 3rd cover.  
 37K. SECO—12-page booklet on using Model 100 dynamic transistor tester to troubleshoot transistorized equipment. Also, 12-page folder describing complete line of Seco test equipment and service aids. See ad page 67.  
 38K. SENCORE—4-page brochure on complete line of time-saver instruments. See ads pages 69, 71, 73, 75.  
 39K. SIMPSON—Radio, television and industrial test-equipment library featuring VOM's, DC VTVM's, tube testers, etc. See ad page 53.  
 40K. VIS-U-ALL—Catalog #59A contains complete description of business-building test equipment. See ad page 50.  
 41K. WINSTON—Flyers describing complete line of instruments, including an AGC circuit analyzer, intermittent condition analyzer, induced waveform analyzer, rainbow generator, dot generator, sweep circuit analyzer, and audio system analyzer. See ad page 81.

**TOOLS**

- 42K. BERNS—Data on the 3-in-1 picture tube repair tool and the new "Audio Pin-Plug" crimper that lets you make pin-plug and ground connections for shielded cables. See ads pages 68, 74.  
 43K. ESICO—Information on the GUN-CHOKE, a simple and inexpensive device that reduces tip temperature for soldering on printed-circuit or laminated boards. See ad page 70.

**TUBES**

- 44K. AMPEREX—Literature on premium quality frame-grid tubes. See ad page 40.  
 45K. RAYTHEON—Handy 8½" x 11" industrial tube interchangeability guide lists direct substitutions for 262 types.



TUBE TYPE	MODEL 648		MODEL 658		MODEL 658		HEATER CURRENT		
	MODEL 648	MODEL 658	MODEL 658	MODEL 658	MODEL 658	MODEL 658	MODEL 658	MODEL 658	
5GH8	5.0	A128	48V	48V	5.0	129	ab358	60S	10WV.
6EA7	5.0	A127	48V	48V	5.0	127	846	42S	10WV.
6EV6	6.3	238	AC36	15Y2	6.4L	235	ac356	60Q	10WV.
6GH8	6.3	123	456	26WZ	6.4L	123	456	60B	50V.
	6.3	A128	AB358	48V	6.4K	129	ab358	60S	10WV.
	6.3	A127	48V	45V	6.4K	127	846	42S	10WV.
	6.3	A127	48V	45V	6.4K	127	846	42S	10WV.

Latest Chart Form 648-25, 49-5, 688-2

The  
good  
news  
is getting  
around



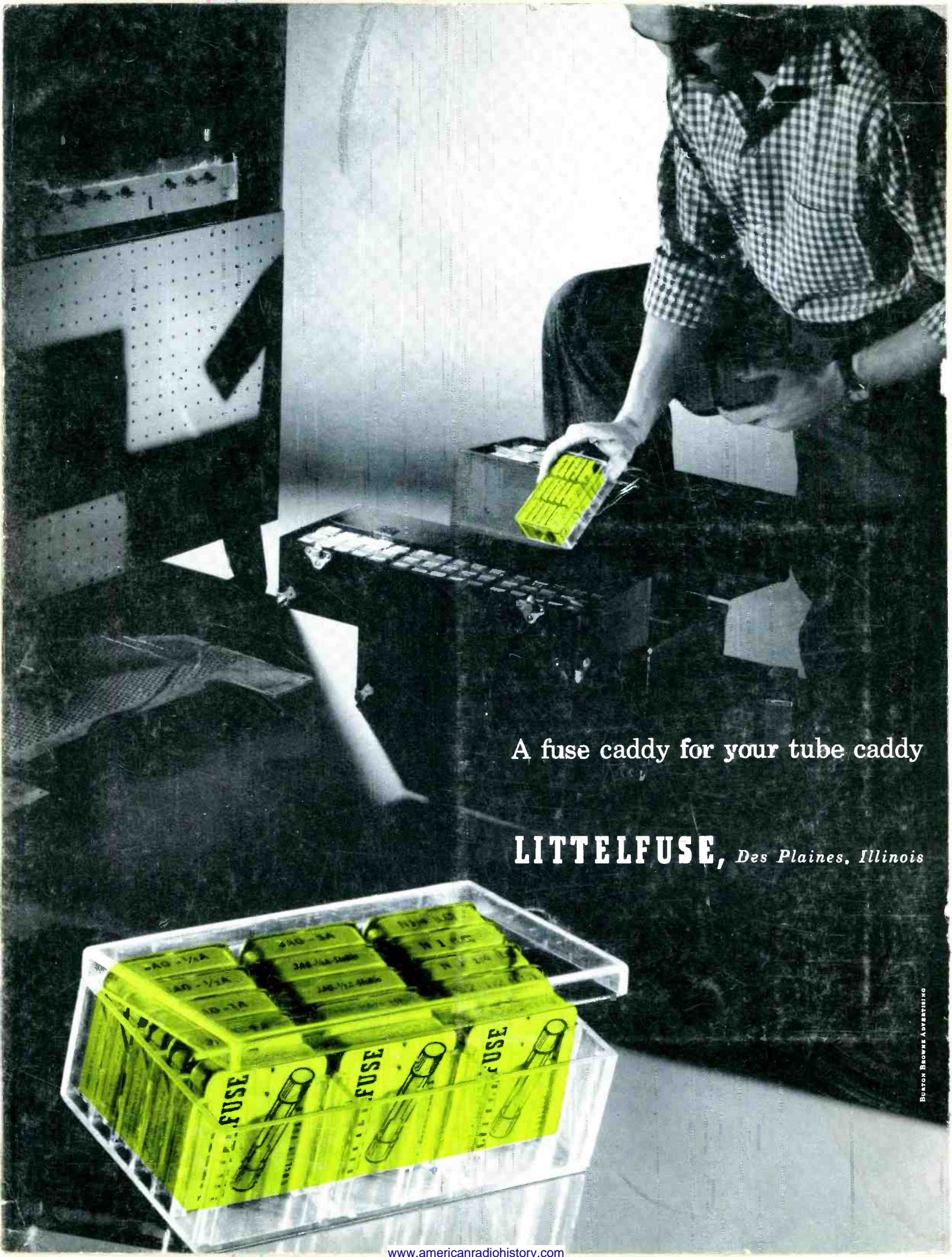
Have you checked the big dealer profits  
on RCA Monogram Picture Tubes?

Head for your RCA Distributor...and get the facts firsthand!



**RADIO CORPORATION OF AMERICA**  
Electron Tube Division

Harrison, N. J.



A fuse caddy for your tube caddy

**LITTELFUSE**, *Des Plaines, Illinois*

BUXTON BROWN ADVANTAGE INC