

# ELECTRONIC TECHNICIAN

Including 16 pages of  
**Circuit Digests**



**\* ROVING REPORTER ASKS —**

*"Do you encourage  
over-the-counter parts sales?"*

*See page 22*

**50¢**

**December • 1957**

# SAVE MANY WAYS

You pay nothing extra for cabinet

Cabinets stack neatly with others

28 clearly identified compartments

Spend much less time ordering



## with **IRC**<sup>®</sup> Resist-O-Cabinets

### Four "Savingest" Assortments

IRC Resist-O-Cabinets come complete with a colorful all-metal cabinet and any one of four resistor assortments. All resistors are guaranteed fresh and packed in the cabinet at the factory. Cabinets are yours at no extra charge. They have 4 "non-spill" drawers with 28 clearly identified compartments. Design permits neat stacking.

Assortment	No. 3A 2 Watt	No. 4A ½ Watt	No. 5A 1 Watt	No. 6A Combination
Contents	120 BTB 2 Watt Fixed Composition and BW-2 Insulated Wire Wound Resistors. 33 different values from 4.7 ohms to 1 megohm.	150 BTS Fixed Composition Resistors. 28 different values from 47 ohms to 10.0 megohms.	125 BTA Fixed Composition Resistors. 28 different values from 47 ohms to 4.7 megohms.	Combination of 139 ½, 1, and 2 Watt Resistors and Type DCF Precistors. 68 types — 32 different values from 47 ohms to 5 megohms.
List Price	\$39.60	\$25.50	\$31.25	\$31.65
Your Price	<b>\$24.00</b>	<b>\$15.00</b>	<b>\$18.75</b>	<b>\$18.85</b>

ORDER FROM YOUR IRC DISTRIBUTOR

Radio and TV technicians who use IRC Resist-O-Cabinets call them the "savingest" resistor deal they know of. Here's why. You save time and trouble in ordering—all of the resistors most used in TV repair work are pre-selected for you. You save money—you not only get resistors at regular dealer price, but also a handsome all-metal cabinet at no extra charge. And you save time on the job—you know what you have—and you have what you want when you want it. To trim costs and fatten profits, buy resistors in IRC Resist-O-Cabinet assortments.

Wherever the Circuit Says



# ELECTRONIC TECHNICIAN

Include  
Circuit Digests

TELEVISION • ELECTRONIC • RADIO • INDUSTRIAL AUDIO

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December, 1957

**FRONT COVER** At various locations across the country, Electronic Technician roving reporters query shop owners on their over-the-counter sales practices. Interviews explain why tube and parts sales are encouraged or discouraged. See article starting on page 22.

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## CIRCUIT DIGESTS

**ALIGNMENT**

1. Turn tuner channel as above and note dist.
2. Connect sweep generator to test point and note dist.
3. Apply -3 volts bias to detector and note dist.
4. Adjust mixer plate coil for maximum deflection and note dist.
5. Remove detector and note dist.
6. Connect oscilloscope to test point and note dist.
7. Adjust remaining thru to accomplish this: it is a

**PARTS LIST**

C-100	100K 1/2W 5% carbon
C-101	100K 1/2W 5% carbon
C-102	100K 1/2W 5% carbon
C-103	100K 1/2W 5% carbon
C-104	100K 1/2W 5% carbon
C-105	100K 1/2W 5% carbon
C-106	100K 1/2W 5% carbon
C-107	100K 1/2W 5% carbon
C-108	100K 1/2W 5% carbon
C-109	100K 1/2W 5% carbon
C-110	100K 1/2W 5% carbon

# LET'S TAKE WHISKERS\*

*\*Whiskers are an old disguise  
to cover up the facts!*

## **IMITATOR NO. 1 SAYS**

*in an advertisement in the SATURDAY EVENING POST*

**that its sets do not have to be fine tuned!**

*Big headlines say: "Stop fiddling with fine tuning—now—brings you Electronic Self-Tuner." The ad continues: "You just touch a button and the next channel comes on with a sharp-tuned picture . . . It's automatic—for you pre-tune each channel individually the day you get your set."*

## **LET'S TAKE THE WHISKERS OFF!**

The fact is that Zenith has had pre-tuning—called BULL'S EYE TUNING—since the first Zenith Television Set ever marketed in 1948! Now, it appears to be new because someone else thinks he has discovered it and starts using it.

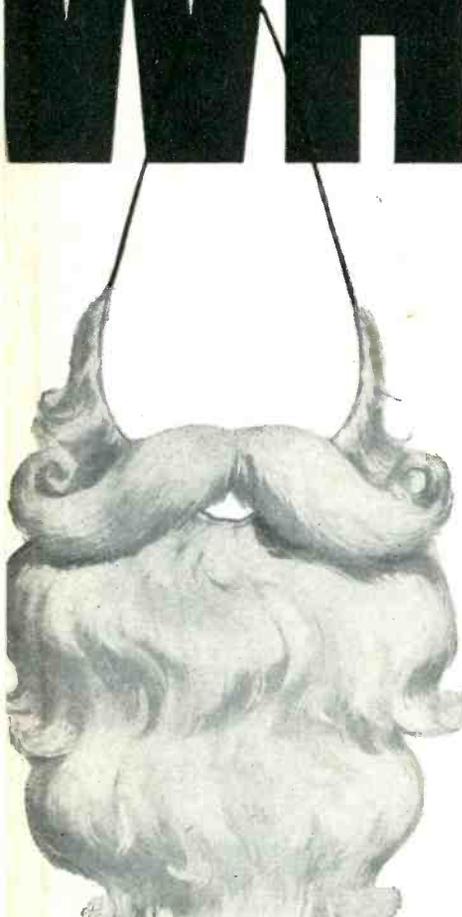
## **IMITATOR NO. 1** further says in the same ad

*"Now remote control is truly practical."*

*And also says that its consoles "include remote control—at no extra cost."*

## **LET'S TAKE THE WHISKERS OFF!**

The fact is that what they are talking about is a "one-half" imitation of Zenith's "Lazy Bones" remote control which Zenith put on the market in 1950, and which changes stations in either direction. The one being advertised currently by our imitator is merely a wired contraption that changes stations in one direction—it is as obsolete as the covered wagon, because now, Zenith's Space Command Remote TV Tuning Control turns the set on and off, changes stations in either direction, and cuts off long, annoying commercials while the picture remains on the screen. And, Space Command Tuning uses no wires, no flashlights, no batteries.



enith

# THE OFF!

At Zenith we are growing weary of inventing and introducing new, novel and different television improvements—only to see them imitated years later by competitors who boast that they brought them to you or by competition disguising their imitations in new terminology and then claiming them in advertising as new—as exclusive—as their inventions.

**IMITATOR NO. 2** says in an advertisement in LIFE magazine

*"One touch changes channels and fine-tunes picture and sound electronically!" It says . . . "EVEN BLINDFOLDED, YOU GET PERFECT TUNING."*

## LET'S TAKE THE WHISKERS OFF!

The whiskers on this one have a nine-year growth dating back to 1948, when Zenith first introduced one-knob automatic station selection. New Zenith sets then, and now, are pre-tuned!

**IMITATOR NO. 2** also claims discovery of remote TV control

*This same ad in LIFE magazine also claims: "FIRST TRUE REMOTE CONTROL!" ". . . lets you change channels and soften sound . . ." "No wire stretching to set!" "No batteries!"*

*What they don't tell is that this gadget has to have wires running to the electric light line, and even then it will not turn the set "on" and "off" and will not completely mute the sound of long, annoying commercials while the picture remains on the screen as does Zenith Space Command Tuning.*

## LET'S TAKE THE WHISKERS OFF!

These whiskers sprouted seven years ago! In 1950 Zenith introduced, as mentioned above, "Lazy Bones" remote control . . . and since that time Zenith researchers and engineers have worked to develop and introduce the one remote TV control that obsoleted all others. This is Zenith Space Command Television, introduced to the public in 1956. With Space Command Tuning you can tune TV from anywhere in the room by "silent sound" . . . without wires, cords, batteries, transistors or flashlights!

ZENITH RADIO CORPORATION • CHICAGO 39, ILLINOIS

THEY SAY "imitation is the best form of flattery," but, do you blame us for getting weary of having competitors boast of, or claim as new, improvements which we invented and introduced, and have been supplying to the public for years?

*The Royalty of*  
**RADIO, TELEVISION, HIGH FIDELITY AND HEARING AIDS**

*Backed by 38 years of leadership in Radionics exclusively*

The Zenith logo features the word "ZENITH" in a bold, italicized, sans-serif font. The letters are white with a black outline, set against a black rectangular background.

# MORE TV SIGNAL GAIN AT LOWER COST FOR ALL VHF INSTALLATIONS...



**Automatic Broadband  
VHF BOOSTERS and AMPLIFIERS**

Whether you need signal amplifiers for a 2000-set master TV system or a booster for a single TV receiver, there's a B-T unit that's designed for the job.

Most TV technicians and installers will say 'amen.' They have learned that they can rely on products bearing the B-T Labs symbol. Rigorous factory quality control of construction, gain and match assures dependable and uniform performance of each product that goes out into the field.

And for positive proof of superior engineering . . .

Exclusive patents:  $\left\{ \begin{array}{l} 2,710,314 \\ 2,710,315 \\ 2,609,466 \end{array} \right\}$  covering automatic broadband circuits and relays have been granted to Blonder-Tongue.

Check to see which one of these units will clear up your specific signal gain problem.

## VHF AMPLIFIER Model MLA

Powerful all-channel VHF cascode amplifier with more than 37 db gain. Has variable gain controls for equalizing high and low bands. Output on each band: 1.25 volts RMS, flat to within 2 db. Self-powered. Matched input. 75-ohm coax fittings at input and output. When used with MAGC maintains constant output level.

\$124.50 list

## COMMERCIAL ANTENSIFIER Model CA-1

A popular broad band VHF amplifier for antenna and line applications. Gain: 26 db on low band and 24 db on high band. Low noise circuit. Matched 75 ohm and 300 ohm input. Gain control. Self-powered. \$84.50 list

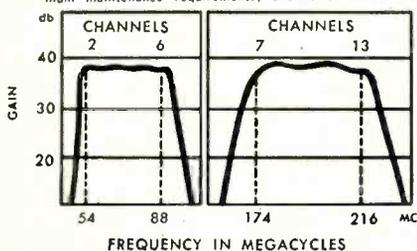
## ANTENNA BOOSTER Model AB with Remote Control

More than 25 db gain. Most popular broadband antenna amplifier in weatherproof housing with mast-mounting bracket. Remote control power supply located near set. Furnishes either 24 or 110 volts to amplifier, as desired. Single line carries power 'up' and signal 'down.' 'On-off' is automatic with TV set. Swing down chassis for easy servicing. \$99.50 list

## HOME BOOSTER Model HA-3

Provides more than 16 db gain. Automatic 'on-off' operated by TV set. No tuning. Features low-noise, push-pull, broadband circuits. Self-powered. \$44.50 list

This Typical Response Curve means superior performance — greater gain with lower noise, flatter response, minimum maintenance requirements, and lower initial cost.



Dept. T-12



**BLONDER-TONGUE LABS., INC.**

9-25 Alling Street, Newark 2, N. J.

Industrial TV Cameras • TV Systems • VHF and UHF Amplifiers and Converters • TV Accessories

## Editor's Memo



One of the most highly regarded qualities among technical and business specialists is the ability to make correct decisions. Sometimes an important decision is made within seconds, sometimes years must pass.

There's a story, probably more instructive than historically accurate, about a highly mechanized factory which stopped running one day. Somewhere along the automated production line the conveyors were jammed. After several hours of trying, plant maintenance decided it couldn't fix it, so an outside troubleshooter was called in.

When the troubleshooter arrived, he looked over the plant for a few minutes, quickly checked a few items, and proceeded to climb up on the rafters. At one particular junction of the overhead conveyors he stopped, took out a heavy monkey wrench and slammed it against a rail switch. Lo and behold the lines started to run again.

The troubleshooter then submitted his bill for \$150. "That's robbery," cried the plant manager. "You were in the plant about 15 minutes. You replaced no parts. Even with travel time, the whole job couldn't have taken you more than one hour. All you did was hit the switch. \$150 is too much money for one hour's work."

"You would lose about \$1000 for every hour the lines aren't running," replied the troubleshooter. "So \$150 is cheap enough, considering that your own maintenance men couldn't fix it. The \$150 is not for my time. You're paying for my knowledge of which switch to hit."

Deciding on which switch to hit is similar to many of the decisions electronic technicians must make each day.

Who makes the decisions is a question of chain of command. By all rights the good decision maker should be near the top of the command.

One of my neighbors says she has everything worked out with her husband regarding decisions. She makes the small decisions, he the big ones. She decides which TV program to watch, where to go for vacation, how much to spend for a house, how many children to have, etc. He makes the big decisions—will there be a war with Russia, will the next president be a Republican, is our foreign aid being properly administered, etc.

*Al Foman*



# To help you...

## 4 NEW CBS TECHNICAL AIDS

Here are four new CBS technical publications on tubes and semiconductors. Each is especially designed to make life easier for electronic technicians and engineers:

### Technician's Handbook...

compact, comprehensive ready-reference data by and for the electronic service technician. Only \$1.50 net.

### Engineer's Handbook...

complete EIA data and two-color curves by and for engineers — and technicians who want all the facts. Only \$7.50 net.

### Transistor Course...

fast, fascinating home-study course — teaches basic fundamentals of transistors through use. Available from CBS Tube distributors.

### Tube Tips...

monthly inside information on tubes and semiconductors — especially for service technicians. From CBS Tube distributors only.

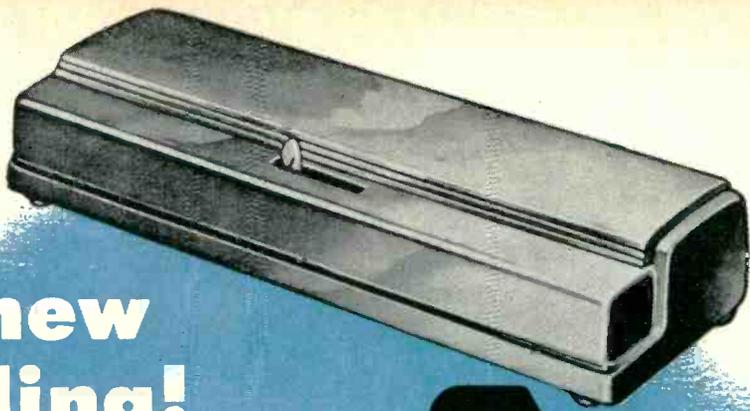
You'll want all four of these CBS technical aids. See them . . . examine them . . . get them at your CBS Tube distributor's . . . today!

### ELECTRON TUBES



**CBS-HYTRON**, Danvers, Mass.  
A Division of  
Columbia Broadcasting System, Inc.

For the best in entertainment tune to CBS



**new  
styling!**

**vi fi**

## INDOOR TV ANTENNA

AMPHENOL's new Vi-Fi is the most practical and functional indoor TV antenna ever designed. Its slender line styling matches the clean, beautiful look of the new TV sets and appliances; its colors (three choices) blend with the set—harmonize with the room.

Equally important, Vi-Fi's Video Fidelity provides outstanding reception. Through "Slide Rule" tuning, which inductively matches the antenna to transmitting frequencies, and Matching Transformer Coupling, which matches impedance between set and antenna, the Vi-Fi provides sharp, beautiful pictures.

**TO HELP YOU MERCHANDISE VI-FI:  
COLORFUL COUNTER TOP DISPLAY**



AMPHENOL ELECTRONICS CORPORATION  
chicago 50, illinois

**AMPHENOL**

## LETTERS

To the Editor

### CRT Conversions

Editor, ELECTRONIC TECHNICIAN:

In your August 1957 issue you discussed the conversion of TV sets from metal to glass picture tubes. Where can I get the parts and more information? Incidentally, I read your wonderful magazine over and over again every month until I receive the next one. Keep up the good work.

BEN F. DAVIS

Los Angeles, Calif.

• For more crt conversion data, write to Colman Tool & Machine Co., P.O. Box 7026, Amarillo, Texas.—Ed.

### Crosley Parts

Editor, ELECTRONIC TECHNICIAN:

Didn't I read in ELECTRONIC TECHNICIAN a few months ago that Crosley had turned over all their replacement parts to another manufacturer when they stopped making radio and TV receivers? Which company was it?

JEROME FOWLER

Tuscaloosa, Ala.

• Crosley sets were taken over by Philco Corp., Tioga & C Sts., Philadelphia 34, Pa.—Ed.

### Frozen Yokes

Editor, ELECTRONIC TECHNICIAN:

I have a problem on my hands and would appreciate your advice. A set came into my shop with a yoke that is frozen to the CRT neck. How can I remove the yoke without damaging the CRT?

NICHOLAS J. MAZZOLLA

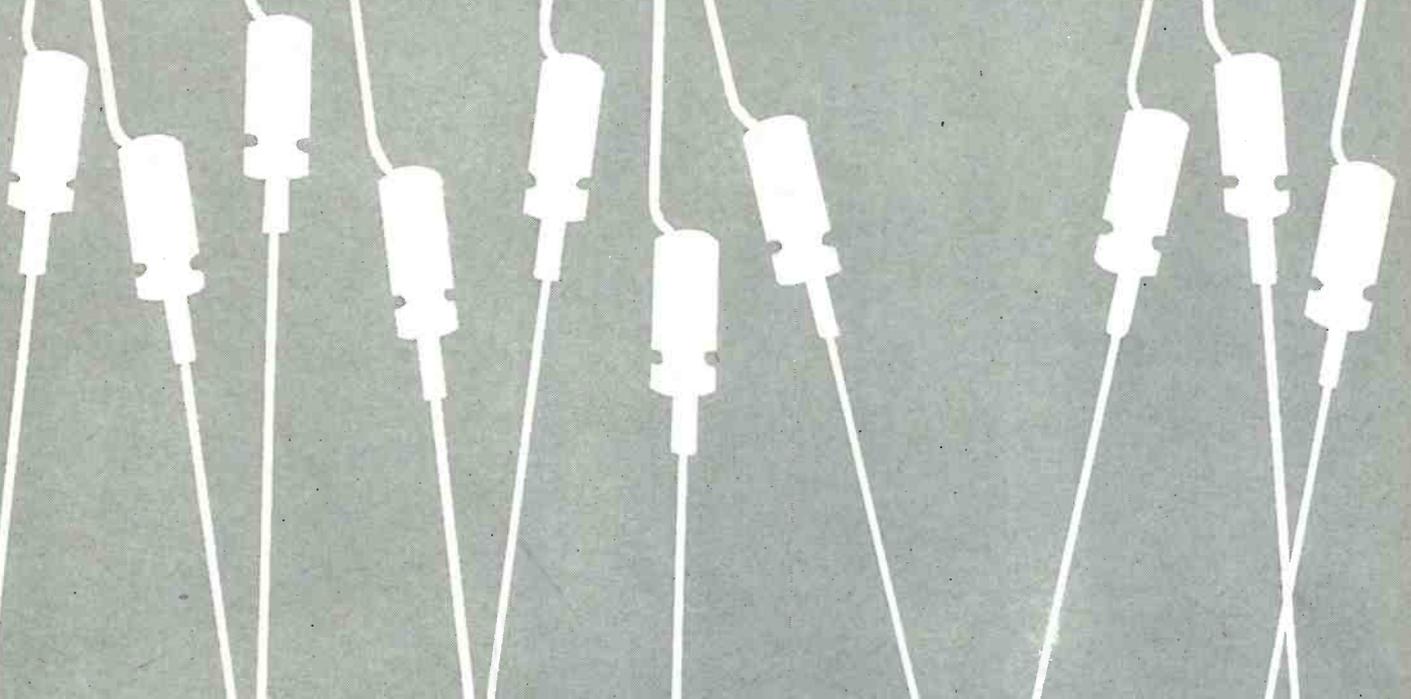
Dunmore, Pa.

• Disconnect yoke leads from set and apply 110 volts ac direct to horizontal windings. This should produce enough heat to cause the yoke to expand. Using only moderate force and utmost caution—repeat, utmost caution—use twisting motion to overcome yoke-to-neck seal. Work toward CRT base after lubricating neck and base. Odds are 50-50 of damaging yoke windings while working yoke over base. Another approach is to remove base, particularly on bad tubes. If base does not come off easily, hacksaw out small sections at a time, being careful not to damage the glass. Once base is loose, unsolder leads in base pins and remove base without twisting. Do not break wires. After base is off, yoke will slide off easily. It's possible to resolder base pins. If you break any yoke windings, replacement is generally recommended. And play safe . . . let the customer know about the risk of breakage.—Ed.

(Continued on page 8)

**NEW  
FROM  
PYRAMID**

**DRY ELECTROLYTIC CAPACITOR FOR EXTREME TEMPERATURE RANGE REQUIREMENTS TYPE TR**



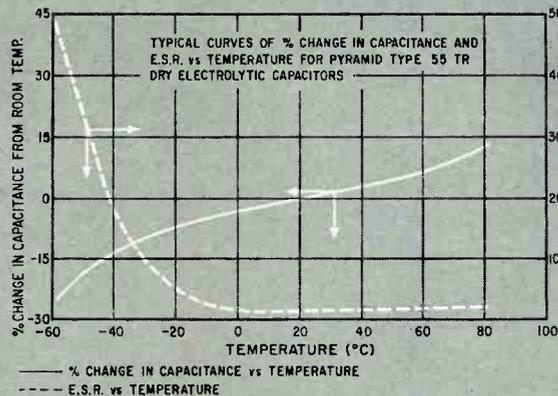
For applications previously reserved for Tantalum capacitors, Pyramid announces a new high reliability, dry electrolytic to be designated as Type TR. These are extended life capacitors using high purity aluminum foil, and can be supplied for any capacity requirements desired. Units are available in both polarized and non-polarized construction.

**4 OPERATING TEMPERATURE RANGES:** Type 20-85 TR  $-20^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . Type 20-100 TR  $-20^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$ .  
Type 40 TR  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . Type 55 TR  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

**CAPACITANCE TOLERANCES:** Pyramid type TR units are made with commercial capacitance tolerances.

**POWER FACTOR:** TR units rated less than 15 working volts have a maximum power factor of 25% at  $25^{\circ}\text{C}$  and 120 cps. Type TR units rated 15 working volts and over have a maximum power factor of 15% at  $25^{\circ}\text{C}$  and 120 cps.

**D.C. LEAKAGE:** Leakage current limits for Pyramid type TR capacitors measured after the working voltage has been applied for 5 minutes may be determined from the following formulas: At  $25^{\circ}\text{C}$ ;  $I=0.04CV$ , At  $85^{\circ}\text{C}$ ;  $I=0.35CV$ , At  $100^{\circ}\text{C}$ ;  $I=0.63CV$ . Where:  $I$ =leakage current in microamperes,  $C$ =capacitance in microfarads,  $V$ =rated working voltage.



**WORKING VOLTAGE:** Pyramid type 20-85 TR can be supplied up to 450 working volts. Pyramid types 20-100 TR, 40 TR and 55 TR can be supplied up to 150 working volts.

**SURGE VOLTAGE:** The surge voltage rating of Pyramid type TR capacitors at  $85^{\circ}\text{C}$  and  $100^{\circ}\text{C}$  is 115% of the rated working voltage.

**LIFE TEST:** After 1000 hours at  $85^{\circ}\text{C}$  or  $100^{\circ}\text{C}$ , and working voltage applied, Pyramid type TR capacitors meet the following specifications at  $25^{\circ}\text{C}$  and 120 cps. The capacitance is within  $\pm 40\%$  of the capacitance measured before life test. The power factor is less than 150% of the power factor measured before the life test. The leakage current is within the limits specified above.

For circuit application information and a copy of TR Engineering Bulletin write to Industrial Division:

**PYRAMID**  
ELECTRIC COMPANY  
1445 HUDSON BOULEVARD  
NORTH BERGEN, NEW JERSEY

(Continued from page 6)

### Alarm Transistors

Editor, ELECTRONIC TECHNICIAN:

I just read the timely and informative article "Industrial Electronic Burglar Alarms" in your October issue. It may be of interest to your readers to know that the phototransistor used in this alarm is the General Transistor type 2N318/GT66, and that Walter Kidde's burglar alarm represents only one of many industrial control applications for this transistor. Other possible uses include automatic door openers, smoke density control and automobile headlight dimmers.

I would also like to add that I read ELECTRONIC TECHNICIAN every month, and consider it a "must" for information on the latest developments in the maintenance field.

EDWIN P. BERLIN

Advertising & Promotion Manager

General Transistor Corp.  
Jamaica, N.Y.

## News of the Industry

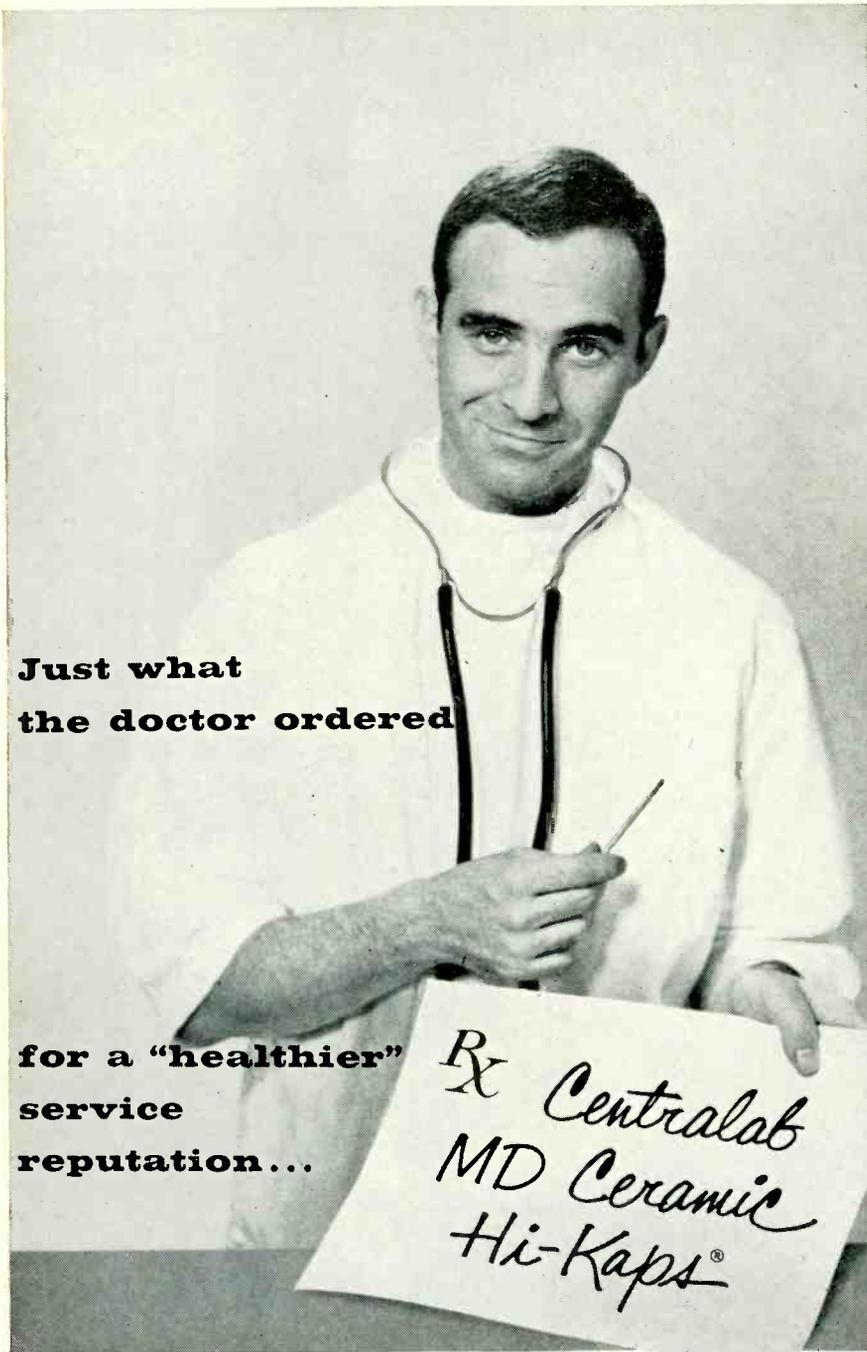
ASTRON CORP. announces the appointment of HENRY MUTZ as administrator of the firm's newly integrated RF Filter design and Filter sales division.

ALLEN B. DU MONT LABORATORIES, INC. announces the appointment of R. E. RUTHERFORD SR. as staff assistant to S. J. KOCH, Vice President, Tube Operations, and K. E. HOAGLAND as director of engineering, Tube Operations. Both posts are newly created to coordinate the firm's efforts in realigning the Television and Industrial Tube Divisions. Also, currently announced is the appointment of F. H. GUTERMAN as general manager of the Technical Products Division.

JFD MANUFACTURING CO., INC. states that "The suit pending before the United States District Court for the District of New Jersey between JFD MANUFACTURING CO., INC., and ARTHUR BAUM and REGO INSULATED WIRE CO., involving JFD's MAGIC GENIE antenna has been discontinued by the parties and REGO has discontinued the manufacture and sale of the FUTURAMA indoor television antenna."

WEBCOR, INC.'s Government Division plans to make available its environmental and general test facilities to industry generally. In the past, these facilities have been used by the firm exclusively.

(Continued on page 10)



Just what  
the doctor ordered

for a "healthier"  
service  
reputation...

Check these "undoctored" facts yourself to learn why CRL MD (molded disc) ceramic capacitors outlast and outperform conventional "mud" discs—yet cost the same. You'll find that CRL molded discs give you:

1. Three times the voltage breakdown — 3000 V.D.C. breakdown to ground.
2. Eight times the lead strength—greater than the breaking strength of the No. 22 tinned-copper wire itself.
3. Ten times the humidity resistance — .005% or less moisture absorption by the molded casing.
4. Many times the resistance of ordinary discs to physical shock and vibration.

The results: more satisfied customers . . . more business for you . . . and a self-assurance that you gave the best.

Pick them up at your CRL distributor who handles these and thousands of other quality components described in Centralab Catalog 30, which is available on request.

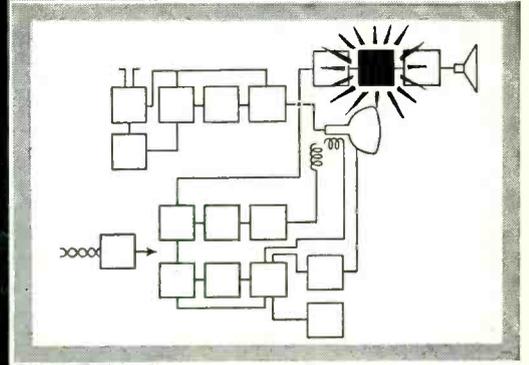
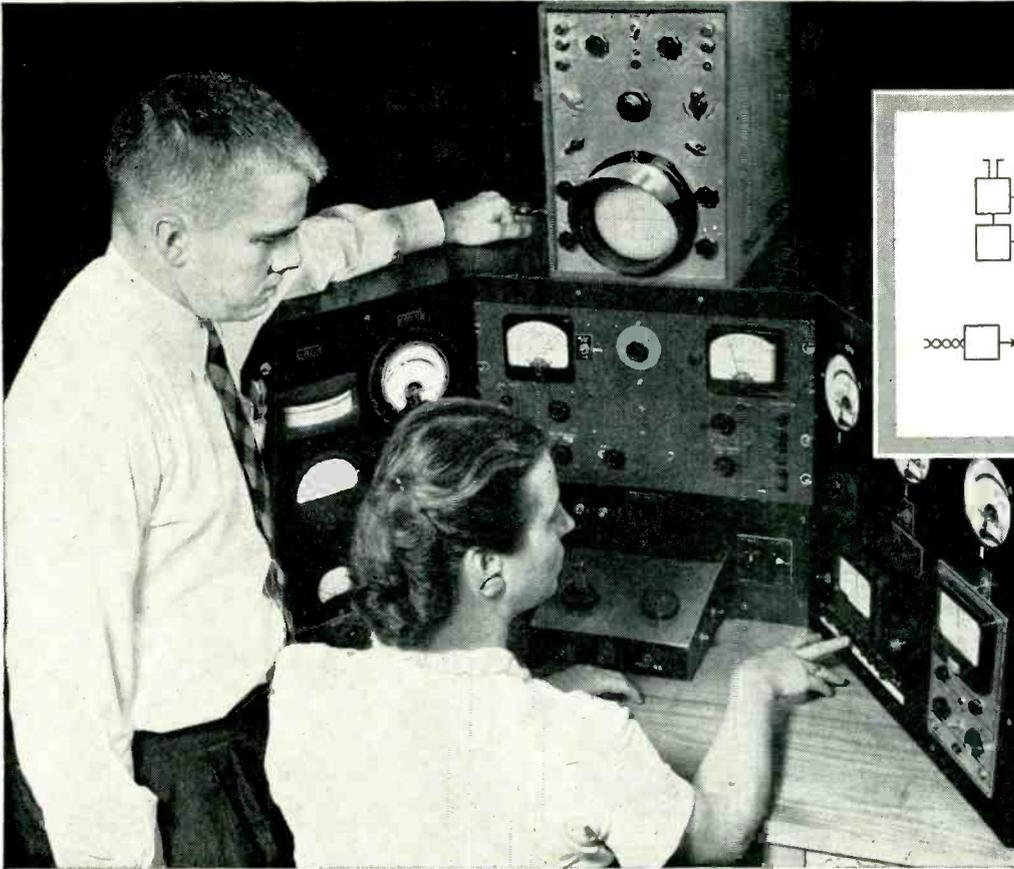


D-1758

# Centralab

© Centralab Trademark

A DIVISION OF GLOBE-UNION INC.  
902L EAST KEEFE AVENUE • MILWAUKEE 1, WISCONSIN  
IN CANADA: 804 MT. PLEASANT ROAD • TORONTO, ONTARIO



◀ G-E PROCESS ENGINEER J. N. Holeman studies the dial reading of a 6BN6 being checked for AM rejection. When taken at intervals from their life-test racks, these G-E audio tubes must continue to show an AM rejection figure that, under standard operating conditions, is at least -25 decibels.

## Guard customers' sets from hum and sync buzz! Install G-E high-quality TV audio tubes!

Once you have adjusted the buzz control on a customer's TV set for noise-free audio, it is annoying . . . and costly in working time . . . to be summoned back later because the buzz has recurred.

Change in the AM-rejection characteristics of an audio tube may produce this result. In order to keep down service callbacks needed to remove buzz and hum, General Electric tests 6BN6's, 3AL5's, 5T8's, and other audio detector types under conditions which closely parallel actual operation—and over periods of time that give ample opportunity for any change in characteristics to develop.

This testing for stability of characteristics throughout tube life, supplements G-E manufacture that employs fully every modern method for building superior performance into the finished product.

A pace-setter in designing and applying audio types, General Electric brings you tubes for replacement that add real listening pleasure to customers' visual enjoyment. Install audio-tube quality you can back up . . . and which will back up *your* service reputation! Phone your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

*Progress Is Our Most Important Product*

**GENERAL**  **ELECTRIC**

161-1A12



# RIDER Service "Aids"

## For the Technician Who Wants to Get Ahead

### TV - RADIO - AUDIO - ELECTRONICS

fabulous "picture-book" course

#### BASIC TELEVISION

by Dr. Alexander Schure

This new 5 volume addition to the famous "picture book" courses is the most understandable presentation of black and white television receiver theory at the basic level ever published.

It starts with the transmitter and discusses in detail the following subjects: Volume 1, the transmitter; the handling and the operation of the camera; formation of the picture signal and the general content of the transmitter. Volume 2 covers the organization of the entire TV receiver treating each section individually from antenna to picture tube. Volumes 3, 4 and 5 treat with TV receiver circuit explanations. Each volume covers a specific number of sections in the receiver.

Valuable to both the professional technician and the beginner because it is so comprehensive, so accurate and so easy to read and understand. However, it is specifically directed towards those technicians who are in the early stages of their career—and to beginners. Ideal for apprentice training in every service organization which is conducting an on-the-job training program. Perfect to keep handy in the shop for reference.

#198—soft cover, 5 vols. 590 pages (approx.) \$10.00 per set. 198-H all 5 volumes in a single cloth covered binding, \$11.50.

#### 3rd SUPPLEMENT to the RECEIVING TUBE SUBSTITUTION GUIDEBOOK by H. A. Middleton

A must for every technician! Contains more than 830 latest receiving tube substitutions • more than 200 picture tube substitutions • more than 230 American to European tube substitutions • more than 200 European to American tube substitutions • a cumulative index listing the tube types treated in the basic book and all 3 supplements. It pays for itself almost immediately!

Soft cover, 72 pp., 8½ x 11", illus. #139-3 ..... Only \$1.35

#### RECEIVING TUBE SUBSTITUTION GUIDEBOOK by H. A. Middleton

#135, soft cover, 224 pp., 8½ x 11", illus., \$3.00

#### FIRST SUPPLEMENT

#139, soft cover, 48 pp., 8½ x 11", illus., \$ .99

#### SECOND SUPPLEMENT

#139-2, soft cover, 48 pp., 8½ x 11", illus., \$ .99

#### REPAIRING TELEVISION RECEIVERS by Cyrus Glickstein

The most modern completely practical book, written by an expert with long experience in television receiver repair. Devoted to troubleshooting and repair techniques which are modern, yet down-to-earth. Covers the use of simple as well as elaborate test equipment of all kinds. Profusely illustrated.

Soft Cover, 212 pp., 5½ x 8½", illus. #191 ..... Only \$4.40

#### ADVANCED TV SERVICING TECHNIQUES

by Zbar and Schildkraut

A complete advanced TV servicing course, developed by the Radio-Electronics-Television Manufacturers Association. Shows how to use every conceivable type of test equipment, how to service every part of a TV receiver. Explains latest techniques. Soft cover, 8½x11".

MAIN TEXT, 192 pp., illus. #161 ..... \$3.60

LABORATORY WORKBOOK, 32 pp. #161-2 ..... \$ .95

#### TV PICTURE TUBE-CHASSIS GUIDE

by Rider Lab Staff

No busy service technician can afford to be without this easy-to-use TV tube type chassis guide. It covers all picture tube types used in TV receiver production from 1946 to February 1957—over 7,000 listings. This reference guide is organized by chassis number, and in some cases, by models so that the technician can immediately locate the correct picture tube type simply by knowing the chassis number.

#204 ..... Only \$1.35

#### REPAIRING HI-FI SYSTEMS

by David Fidelman

This book deals with finding the troubles and repairing faults in hi-fi equipment with no test instruments—simple equipment—and elaborate equipment. Encompassing the repair of high fidelity equipment such as tape recorders, record players and changers, AM and FM tuners, preamplifiers, amplifiers and loudspeakers, the approach is in a gradual, easy-to-understand, down-to-earth manner. Typical troubles are analyzed and repaired through a system of logical steps.

Soft cover, approx. 170 pp., 5½x8½", illus. #205 ..... only \$3.90

Coming in February . . .

#### BASICS OF DIGITAL COMPUTERS by John S. Murphy

For a career in the fastest-growing segment of the electronics industry read this 3-volume "Picture-Book" course.

IF YOU WANT THE BEST IN TV SERVICE INFORMATION

PHILCO GE EMERSON SYLVANIA ZENITH WESTINGHOUSE  
ADMIRAL RCA MOTOROLA HOFFMAN CROSLY PACKARD-BELL

Covers Production 1950-1956

### RIDER'S NEW S D O SERVICE

(Single diagram only)

ONLY 50¢ PER CHASSIS AT YOUR LOCAL JOBBER

### MUST READING FOR EVERY TECHNICIAN

#### HOW TO INSTALL & SERVICE INTERCOMMUNICATION SYSTEMS by Jack Darr

#189, soft cover, 152 pp., \$3.00

#### SERVICING TV AFC SYSTEMS

by John Russell, Jr.

#192, soft cover, 128 pp., \$2.70

#### SERVICING TV VERTICAL & HORIZONTAL OUTPUT SYSTEMS by Harry Thomas

#150, soft cover, 176 pp., \$2.40

#### TV TUBE LOCATION & TROUBLE GUIDE (RCA)

by Rider Lab Staff

#194, soft cover, 56 pp., \$1.25

#### HANDBOOK OF 630-TYPE TV RECEIVERS

by Miller & Bierman

#174, soft cover, 200 pp., \$3.50

#### HOW TO USE METERS

by John F. Rider

#144, soft cover, 144 pp., \$2.40

#### HOW TO USE TEST PROBES

by A. Ghiradi & R. Middleton

#165, soft cover, 176 pp., \$2.90

#### HOW TO SERVICE TAPE RECORDERS

by C. A. Tuthill

#167, soft cover, 160 pp., \$2.90

## NOW AVAILABLE!!!



## RIDER'S TV 21

The only source of unabridged, factory prepared and factory accurate TV receiver servicing information.

#### LIMITED PRINTING

Reserve your copy at your jobber. If your jobber does not handle Rider manuals, write direct.

Rider books, manuals, S D O are available at your Parts Jobber. Look for the Rider Bookseller. If these books are not available, order direct.

I-12

(News. Continued from page 8)

**CBS-HYTRON**, a division of Columbia Broadcasting System, will have a new home for CBS Laboratories by summer, 1958, located on an 11-acre hilltop site in the Stamford, Conn. area.

**INTERNATIONAL RESISTANCE CO.** announces the following appointments: M. I. ZWERIN as special representative for market development of new products; J. B. HENRY as sales manager of New Products Division. Also, appointed as sales manager of the firm's subsidiary, Circuit Instruments, Inc., St. Petersburg, Fla., is F. T. TRO-ILLO.

**RADIO RECEPTOR CO., INC.** has completed consolidating semiconductor production under one roof at its main plant located at 240 Wythe Ave., Brooklyn, N. Y., which is one of three buildings the firm has in the area. SEYMOUR WINUK has been promoted to assistant sales manager for selenium rectifiers, semiconductor division.

**MERIT COIL AND TRANSFORMER CORP.** is building a 12,000 sq. ft. addition to its Hollywood (Fla.) plant, to provide warehousing facilities for the firm's southeastern distributors and to take care of its rapidly expanding Latin American market.

**INTERNATIONAL TELEPHONE & TELEGRAPH CORP.** reports that the Components Division, Clifton, N. J., has launched a two-part sales promotion for selenium rectifiers. Includes a vacation contest with all-expense-paid 7-day trips to Miami, Puerto Rico, Acapulco, and Las Vegas as prizes, and a year-round "profit sharing plan" featuring merchandise prizes available through coupons earned by purchase of IT&T products sold under the name, Federal Selenium Rectifiers.

**THORDARSON - MEISSNER** announces the confirmation, by Local Lodge 2042 Int'l Assn. of Machinists (AFL-CIO), of a full five-year extension of their present contract without any wage increase.

**FILTERS, INC.** reports that G. E. POTTER has been appointed to the firm's sales department as director of field applications.

**CENTRALAB**, a division of Globe-Union, Inc., reports that JOHN PRUTTON has joined their capacitor sales section.

**CHANNEL MASTER CORP.** has launched an advertising campaign, in national magazines and Sunday supplements, featuring the firm's TV fringe area T-W antenna. A free "Antenna Check-up Kit" offer is made in the new ads.

**ULTRAVISION MANUFACTURING CORP.**, Hawthorne, N. J., has recently opened a warehouse in Columbus, Ohio, at 245 Mt. Vernon Ave., as part of an over-all expansion program. Facilities at the Hawthorne plant were recently expanded.

**JOHN F. RIDER PUBLISHER, INC.** 116 West 14th Street, New York 11, N. Y.

**GENERAL ELECTRIC CO.** has named **E. N. GAULDING JR.** as district sales manager for their Communication Products Department in the Des Moines, Iowa area.

**INTERNATIONAL RADIANT CORP.**, under the management of the Rubel Corp., reports completion of a new, modern plant at their new address: 111 New York Ave., Westbury, L. I., N. Y. **K. D. KLEIN** has been appointed sales manager.

**TEXAS INSTRUMENTS, INC.** reports that they have reduced prices, for the second time this year, on their silicon semiconductors. Prices are lowered as much as 22 percent on silicon transistors and 35 percent on silicon glass diodes. Also, the firm has opened a new plant in Bedford, England, to manufacture transistors and other semiconductor devices. It is their first manufacturing facility to be established outside of the United States.

**TRIO MANUFACTURING COMPANY** has announced the appointment of **A. L. PEZMAN** as sales manager. Mr. Pezman was the firm's legal-counsel prior to assuming his new position.

## Reps & Distributors

**AMPEREX ELECTRONIC CORP.** reports the appointment of **MEL PEARSON & CO.**, Denver, Colo., for Colorado, Arizona, New Mexico and Utah.

**ALLIED RADIO, INC.**, has been appointed Distributor of **MOTOROLA** semiconductor devices in the greater metropolitan Chicago area. In addition to the regular Motorola line of semiconductors, several types of transistors will be marketed.

**ALLEN B. DU MONT LABORATORIES INC.** increases coverage for its industrial TV product line to 84 metropolitan areas by the appointment of the following three distributors: **ALL-TRONIC SUPPLY, INC.**, Amarillo, Texas; **FLAGLER RADIO CO.**, Miami, Fla.; and **TORRENCE SOUND EQUIPMENT CORP.**, Toledo, Ohio.

**BELL & HOWELL** has appointed **THE HALL DISTRIBUTING CO.**, Los Angeles, Calif., for their line of tape recorders.

**KTV TOWER & COMMUNICATION EQUIPMENT CO.** has appointed **E. M. COTTER**, Dallas, Texas, as their representative in that area.

**RADIO RECEPTOR CO.** announces the appointment of **RODGERS ASSOCIATES**, Hampden, Mass. as distributor sales representative for semiconductor products.

(Continued on page 16)

look what **\$24<sup>50</sup>** buys  
in test equipment!



**HEATHKITS  
GIVE YOU  
TWICE AS MUCH  
equipment for  
every dollar  
invested**

The famous model V-7A Vacuum-Tube-Voltmeter is a perfect example of the high-quality Instruments available from Heath at  $\frac{1}{2}$  the price you would expect to pay! Complete, only **\$24<sup>50</sup>**



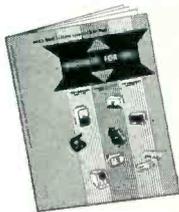
Get the most out of your test equipment budget by utilizing **HEATHKIT** instruments in your laboratory or on your production line. Get high quality equipment, without paying the usual premium price, by dealing directly with the manufacturer, and by letting engineers or technicians assemble Heathkits between rush periods. Comprehensive instructions insure minimum construction time. You'll get more equipment for the same investment, and be able to fill your needs by choosing from the more than 100 different electronic kits by Heath. These are the most popular "do-it-yourself" kits in the world, so why not investigate their possibilities in your particular area of activity! Write for the free Heathkit catalog now!



Contains detailed descriptions of Heathkit models available, including VTVM's, scopes, generators, testers, bridges, power supplies, etc.

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Mail coupon below for your copy—Now!



Also describes Heathkit ham gear and hi-fi equipment in kit form. 100 interesting and profitable "do-it-yourself" projects!

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A SUBSIDIARY OF DAYSTROM, INC.,  
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City & Zone \_\_\_\_\_

State \_\_\_\_\_



# Audio NEWS LETTER

H. H. SCOTT has introduced the Model 300 FM/AM tuner, designed for simplicity of operation. The company reports that the use of wide-band design allows better tuning of weak stations than with AFC.

ELECTRONIC TECHNICIAN MAGAZINE has been accepted as an associate member of the Institute of High Fidelity Manufacturers. This is the only trade magazine in the electronic maintenance field to hold such membership. Several consumer magazines are also associate members.

BOGEN sales VP Larry Le-Kashman will return to a top spot at ELECTRO-VOICE.

ALTEC LANSING has introduced the "Quartet" 344A 20-watt amplifier-preamp using printed circuits. It features 6 inputs, performance specified at 20 to 22,000 cps. Size is 5-15/16" H x 14-5/8" W x 8-13/16" D. Price is \$106, plus \$18 for cabinet.

INSTITUTE'S HIGH FIDELITY SHOW IN RETROSPECT. Final attendance figures for New York Show held during Oct. 8-12, add up to 40,338. Over-all exhibitor reaction is very good. The Institute is in the process of tabulating visitor appraisals based on questionnaire printed in the Show program. Results could be helpful marketing guide. Not so favorably impressed was the NEW YORK TIMES' critic Harold Schonberg who wrote on Oct. 13 that noise ranked over the music. . . . "this year especially the demonstrators went all out with a species of musical distortion that was as unsettling to a sensitive ear as it was untrue to the fine electronic equipment." Most critics and visitors seem to agree that stereo was the star of the show.

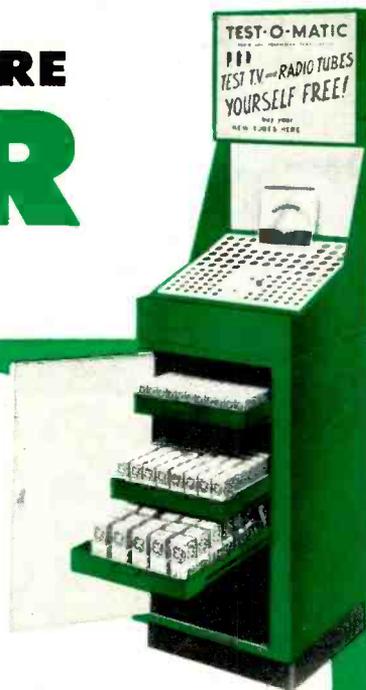
FEN-TONE CORP. announces a new miniature bi-directional ribbon velocity mike called the "Trix Sixty Special." It is reportedly suitable for both studio and PA, with response 50 to 12,000 cps within 2 db. Output at 50 ohms referred to hi-Z is -58 db. Net price is \$96.50.

REEVES SOUNDCRAFT has had a new plant designed by Trundle Consultants for construction in Danbury, Conn. Completion date for the 50,000 sq. ft. plant is expected to be mid-1958. Though extensively automated, the \$1 million facility will employ 150 in the production of magnetic tape for hi-fi and commercial applications. The company's Stamford, Conn., plant is currently running three shifts with a 6-month backlog.

(Continued on page 14)

## TUBE SALES ARE YOUR BUSINESS!

And SELF-SERVICE TUBE SALES are big business you're missing. Shell Test-O-Matic tube tester is the precision unit that can get this business for you. Available *only* through your distributor, the Test-O-Matic is America's most reliable and versatile self-service tube tester. Tests over 800 tube types in its 117 tube sockets. Customers can rely on its accuracy when they replace tubes. Easy to use, service-free, the Test-O-Matic sells hundreds of tubes for you every month at full list price. Identified with your organization, it creates service business for you.



### SHELL "TEST-O-MATIC" TESTS MORE TYPES THAN ANY OTHER SELF-SERVICE UNIT

Over 800  
Tube Types

There's no substitute  
for 117 tube sockets

Precision  
Engineered

Compact, Rugged  
and service-free

#### Don't turn your back on money! Write Now!

For complete details on setting up a profitable "Test-O-Matic" route get this new booklet. Tells how to open high traffic outlets, finance your investment, handle restocking, billing, inventory . . . everything to help you get your share of this new do-it-yourself business. Shell also gives you sales support with advertising aids, window banners, etc. Write today to —



### SHELL ELECTRONIC MANUFACTURING CORPORATION

1688 Utica Avenue, Brooklyn, New York

# PROOF UNIVERSITY SPEAKERS STAY SOLD!

To insure valid statistics, this tabulation covers the largest selling brands, based on a four-year survey (April 1953 to March 1957) of classified and "Swap or Sell" ads for used high fidelity loudspeakers. All ads authenticated as placed by private individuals in Audio, High Fidelity and Music At Home

## PERCENTAGE OF TOTAL INSERTIONS IN "SWAP OR SELL" COLUMNS

SPEAKER "A"	SPEAKER "B"	SPEAKER "C"	UNIVERSITY
46 1/2 %	23 1/4 %	16 1/4 %	13%

## Fewest number of ads offer University equipment ... outstanding testimonial of user satisfaction.

We have always believed that the tremendous volume of University speakers sold in the past to hi-fi enthusiasts attested to the genuine listening satisfaction designed into all our products.

We think that all legitimate hi-fi loudspeakers sound pleasing, but the acid test of listening satisfaction is a speaker's "staying power". Does it grow with your hi-fi tastes, continue to please year after year . . . or is it obsolete before its time . . . ready for swap, sale or discard?

Yes, in the "Swap or Sell" columns of the leading audiophile magazines, you soon know which of the prominent brands of loudspeakers readers out-grow . . . and, *by the absence of such ads*, which of these leading loudspeakers remain in the home!

The record speaks for itself. This accurate survey, taken over a span of four years, shows that speaker "B" has almost 50% more "for sale" listings than University . . . while speaker "A" is offered more than three times as often! Here is indisputable unsolicited testimony from average hi-fi users themselves that University *stays sold*, continues to serve year after year as a source of rich musical pleasure.

University offers the largest selection of speakers and components to meet every size and budget requirement



WOOFERS



TWEETERS



DIFFAXIALS



NETWORKS

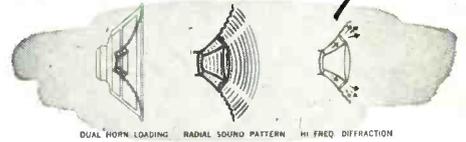


ENCLOSURES

LISTEN

University sounds better

... and here's why



DUAL HORN LOADING RADIAL SOUND PATTERN HI FREQ. DIFFRACTION

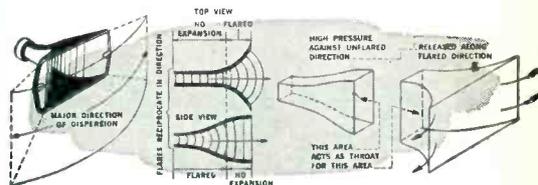
### PATENTED DIFFUSICONE PRINCIPLE.

Available only on University Diffaxials. Mid and high frequencies are extended with remarkable efficiency through coaxial dual horn loading at the apex of the loudspeaker cone. A radial projector combined with aperture diffraction provides uniform, wide-angle dispersion, assuring *full fidelity* no matter where off speaker axis you may be listening.



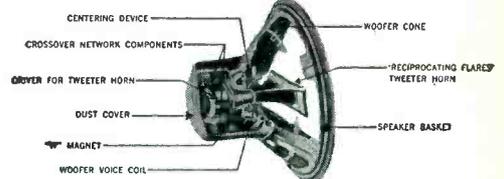
### EXCLUSIVE BI-SECTIONAL CONSTRUCTION

Typical of University's advanced design and fabrication techniques is the unique bi-sectional construction of completely independent basket and magnet assemblies. This results in a precision product—vibration and shock-proof in operation, built for trouble-free long life.



### PATENTED "RECIPROCATING FLARE" DESIGN

On all University tweeters the compression driver is coupled to a "reciprocating flare" horn designed to provide *maximum* uniformity of wide-angle dispersion in the horizontal plane with optimum vertical coverage. This is the greatest single advance in wide-angle horn development in over a decade.



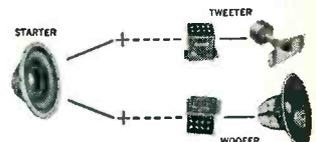
### TRUE THRU-AXIS DESIGN

In *true thru-the-axis* design, the tweeter driver unit is fitted to the "reciprocating flare" horn *thru the center* of the woofer magnet assembly. Only with *this thru-the-axis* design is it possible to project high frequencies thru a horn of scientific formula-correct length and configuration . . . and thus achieve highest efficiency, lowest distortion and uniform wide-angle treble reproduction.

### MAXIMUM COMPONENT FLEXIBILITY

To meet the ever varying technical needs of expanding aspirations and improvements, University components are designed to provide a maximum of application and operational flexibility, e.g.: woofers with dual impedance voice coils, networks and filters to match all popular impedances and crossover frequencies, speakers having adjustable response devices, etc. *Therefore . . .*

Only University can offer...

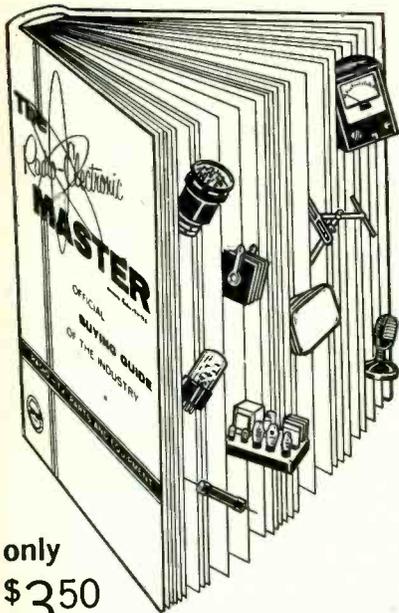


### GENUINE PROGRESSIVE SPEAKER EXPANSION

The "Master Blueprint" that prevents your speaker from becoming obsolete, because you can *improve* without discarding existing speakers or systems! You choose from literally dozens of different starter speaker set-ups to suit your present taste and purse. Then, when and as you wish, you integrate these components into *tomorrow's* magnificent deluxe system . . . safeguarded by unmatched engineering flexibility and variety that makes "step-by-step" improvement a wonderful reality.

These are just a few of the reasons why University assures you superior sound that lives and lasts through the years. As other satisfied purchasers know . . . you might spend more—but you can't equal University.





only  
\$3.50  
at your distributor

...it's  
here!

# 1958 RADIO-ELECTRONIC MASTER (22nd edition)

biggest, most authoritative buying guide ever published

## TV - RADIO - AUDIO - ELECTRONICS

Completely catalogs over 150,000 standard electronic parts and equipment necessary to radio-TV-audio and industrial servicing. It places the entire electronic industry at your fingertips!

1584 pages  
The world's largest and  
most referred to electronic  
buying guide contains...

direct-from-the-factory pro-  
duct information covering  
150,000 items produced by  
350 manufacturers

- ★ complete descriptions
- ★ specifications
- ★ prices
- ★ 11,500 illustrations

### When you BUY and SELL You can immediately find out

What product best fills your needs?

How does it compare with other makes?

What does it look like?

What does it cost?

...because the MASTER is systematically arranged in 18 product sections with all similar products grouped together.

### You operate more efficiently, more profitably with The MASTER

The MASTER describes, illustrates, lists specs of all items necessary to radio-TV servicing. What's more - it offers thousands of additional products that can lead to extra income in Hi-Fi, sound and industrial servicing. You can buy, sell and bill direct from The MASTER. It shows list prices! It's invaluable at the bench, over-the-counter or in the field.

Remember, no matter what product or component you require...**YOU FIND IT FASTER IN THE MASTER!**

Act now - the supply is limited

Get your 1958 MASTER today at local parts distributor or write for list.

**THE RADIO-ELECTRONIC MASTER** 60 Madison Avenue, Hempstead, N. Y.

## Audio News Letter

(Continued from page 12)

ELECTRO-VOICE has initiated a Fair Trade Dealer Franchise Program for the first time in its history. It went into effect in California. Goal of the program is to stabilize retail prices of the firm's hi-fi products in areas where promiscuous discounting has been rumored. Though discounting is reportedly a common practice in most major markets, a company spokesman was quick to point out that California distributors have elected to hold a constant price line for electronic merchandise.

PILOT announces the addition of hi-fi FM/AM radio-phono Model PT-1055 ensemble. It embodies the FA-550 tuner, 410A amplifier, matched 4-way, 5-speaker system, GARRARD RC-88 changer, and variable reluctance cartridge. Cabinet with folding doors measures 32" H x 39" W x 16-1/2" D. Price is \$625 in mahogany.

REK-0-KUT has opened a \$250,000 plant in Corona, N.Y. The 25,000 sq. ft. plant is capable of doubling production.

1958 RADIO-ELECTRONIC MASTER, 22nd edition is available. Out of total of 1584 pages containing over 150,000 items of 350 manufacturers, there are over 200 pages covering audio products made by more than 70 producers. It's reported to be the largest catalog ever published in the electronic industry.

GENERAL ELECTRIC has a new high frequency counter demonstrator for dealers. It includes the Al-404 tweeter and the Al-421 crossover network, which is connected to the store's single-cone speaker system. A flip of the built-in switch demonstrates the improved high frequency response.

## Association News

### NATESA Executive Council

New NATESA Executive Council for 1957-58 is made up of Frank J. Moch, Exec. Dir.; Winston Haines, Western V. P.; Cordell Britt, East Central V. P.; Bertram Lewis, Eastern V. P.; Pascal Pratt, Eastern Sec.; O. W. Andrews, Western Sec.; Joe Driscoll, West Central Sec.; Marvin Miller, East Central Sec.; Mac Metoyer, Sec. Gen.; Russell Harmon, Pres.; Nelson Burns, Treas.; Albert C. W. Saunders, Educ. Dir.; and Vincent Lutz, West Central V. P.

### ESDA Creed

The Electronic Service Dealers Association of Western Pennsylvania declares that: The association as a group guarantees the work of each of its members. Each member has passed a rigid investigation as to . . . his integrity . . . his know-how . . . his equipment. Each member must maintain these high standards to keep his membership. Equipment plus know-how . . . Equals . . . Best possible performance. Integrity . . . Equals legitimate parts and fair prices.

Joseph Simandel was unanimously selected as the new Recording Secretary to take the place of Norwell Jackson.

### RTA Committee Chairmen

Richard J. Kelso, President of the Radio Television Association of Santa Clara Valley in California appointed the following committee chairmen: O. N. Timmons, Membership; Russell J. Hamm, Program and Attendance; Jack Morrisroe, Fair Trade and Grievances Committee; C. S. Dawson and Jim Davis, Advertising and Publicity; and Harold L. Kelly Jr., and W. I. Smith, Committee-At-Large.

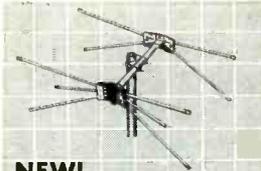
### ETA Elects

ETA, Jamestown, N. Y., has elected Malcolm Nelson, Pres.; George Carlson, V. P.; and Dick Starr, Sec.

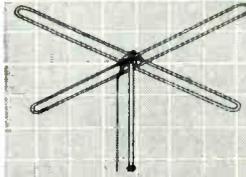
Associations are encouraged to send in copies of their publications, news, and other press releases.—Ed.



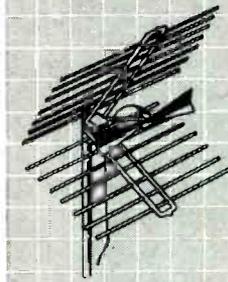
"All I said was 'I'll bet your set at home works like a million.'"



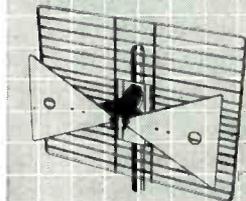
**NEW!**  
MASTER CONICAL  
#4051, \$9.75 LIST



**NEW!**  
FM TURNSTILE KIT  
#4656, \$14.95 LIST



**NEW!**  
SPEED RIG  
CORNER REFLECTOR  
#4471, \$8.95 LIST



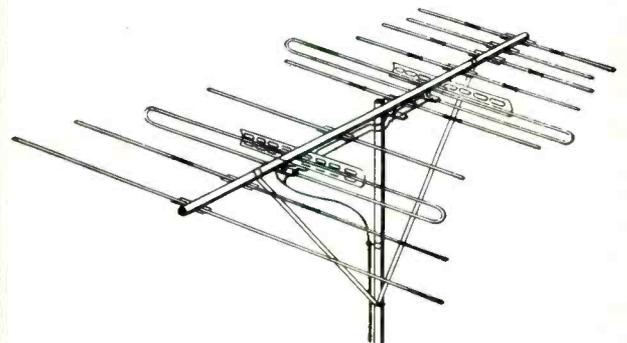
**NEW!**  
DELUXE UHF BOW-TIE  
#4467, \$3.95 LIST

and the completely new



For example, NEW IMPROVED  
**SUPER WIZARD FRINGE ANTENNA**

The finest fringe antenna you can buy—over 14 db gain, extremely sharp directivity, smooth response, and completely pre-assembled for instantaneous installation. Give your customers the very best—give them the Super Wizard. #4240, \$37.90 List



All these, plus 11 new conicals and 8 new UHF, have been added to the WALSCO line, making it among the most complete and comprehensive in the industry. Carefully engineered and as up-to-date as tomorrow, WALSCO TV antennas are your finest choice always.

**Free!**

A copy of the brand-new WALSCO TV ANTENNA CATALOG . . . at your distributor or write directly to us for it.

**WALSCO ELECTRONICS MFG. CO.**

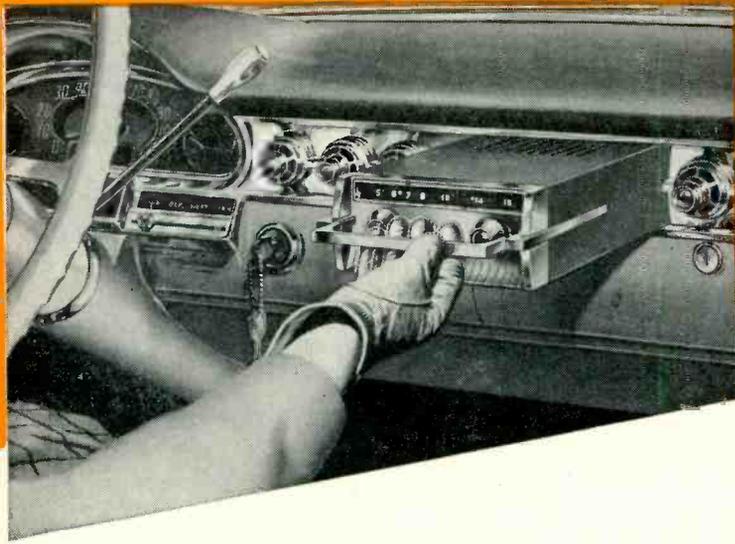
A Division of Textron, Inc.  
106 WEST GREEN STREET  
ROCKFORD, ILLINOIS

Please rush me a copy of the brand-new, free WALSCO TV ANTENNA CATALOG.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

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



*A new market for you!*  
**Mallory**  
**Mercury Batteries for**  
**New Portable**  
**Car Radios**

Many 1958 cars will have a new kind of radio that fits into the dash, yet slips out and plays anywhere on its own batteries. Only Mallory-developed Mercury Batteries meet the tough battery specifications of the new sets:

**High temperature:** Withstand the 190° F temperatures often developed under the auto dash.

**Leak-free:** Won't leak from heat, old age or short circuits . . . never damage a customer's valuable radio.

**Constant Voltage:** Provide uniform operating efficiency without audio distortion.

**Long Life:** Last longer on your shelf or in the customer's radio . . . reduce the nuisance of frequent battery changes.

That's why Mercury Batteries, pioneered by Mallory, are your best bet for service profits and customer satisfaction. Only Mallory manufactures a complete line of both zinc-carbon and mercury batteries for all applications.

**Mallory Battery Company**  
*A Division of*



- Capacitors • Vibrators • Resistors • Controls • Switches • Filters
- Rectifiers • Power Supplies • Mercury and Zinc-Carbon Batteries



(Reps. & Dists. Continued from p. 11)

**ERIE RESISTOR ELECTRONICS DIVISION** announces two new appointments. M. E. DARRIN, formerly the firm's sales representative in the New York area, has been made sales manager of the greater Philadelphia-Camden territory. T. O. BROWN, formerly manager of sales service, succeeds M. E. DARRIN in the New York territory.

**GLASER-STEERS CORP.** reports the appointment of the following sales representatives for the firm's Seventy-Seven high fidelity record changer: **THE HARRY MILLER CO.**, Red Bank, N. J.; **ARTHUR H. PETERSON**, Chicago, Ill.; **GENE ROSEN & ASSOCIATES**, Rockville, Md.; **SCHROEDER SALES CO.**, Cleveland, Ohio.; **STANLEY K. WALLACE ASSOCIATES**, Lutz, Fla.; **KOESSLER SALES CO.**, Los Angeles, Calif.; **CHARLES LUCAS SALES CO.**, Dallas, Texas; **BURT C. PORTER CO.**, Seattle, Wash.; **ZIMMER SALES CO.**, Merriam, Kansas; **THE GATES CO.**, Salt Lake City, Utah.

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## Catalogs & Bulletins

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**TUBING:** A 4-page brochure (Z-1) describes Alphlex Zipper Tubing. Includes illustrations, specifications, and dimensional diagrams. Alpha Wire Corp., 200 Varick St., New York 14, N. Y. (ELECTRONIC TECHNICIAN No. B12-1)

**FUSES:** A 24-page television fuse chart. Shows proper fuse to use, how fuse is mounted, and what fuse protects. Alphabetically by name of television set manufacturer. Has fuse identification chart. Bussmann Mfg. Div., McGraw-Edison Co., University at Jefferson, St. Louis 7, Mo. (ELECTRONIC TECHNICIAN No. B12-3)

**ANTENNAS:** Catalog price lists, multi-colored bulletin and other literature presents information on the use of antennas in the "twilight area"; the section that lies between the primary and fringe areas. Other models are also shown. Winegard Co., 3000 Scotten Blvd., Burlington, Iowa. (ELECTRONIC TECHNICIAN No. B12-15)

**HIGH FIDELITY SYSTEMS:** Liberally illustrated 48-page booklet answers questions about the nature of hi-fi. Gives fundamental principles for sensible system planning. 25¢ per copy. Heath Co., 305 Territorial Rd., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN No. B12-8)

**TEST EQUIPMENT:** 8-page composite test equipment catalog, form SM-31. Lists and illustrates 24 pieces of new test gear. Includes two new color generators and a new automatic tube tester. Hickok Electrical Instrument Co., 10523 Dupont Ave., Cleveland 8, Ohio. (ELECTRONIC TECHNICIAN No. B12-9)

**ELECTRONIC & ELECTRIC PROBE:** Compact chart, measuring 10½" x 12¼". Shows how to check for trouble in TV, radio and electric circuits. Kingston Electronic Corp., Medfield, Mass. (ELECTRONIC TECHNICIAN No. B12-10)

**FLYBACKS & YOKES:** TV replacement guide supplement #9-57. Covers replacements for the top American manufacturers of TV receivers in the 10 most popular categories of components. Thordarson-Meissner, 7th & Bellmont, Mt. Carmel, Ill. (ELECTRONIC TECHNICIAN No. B12-14)

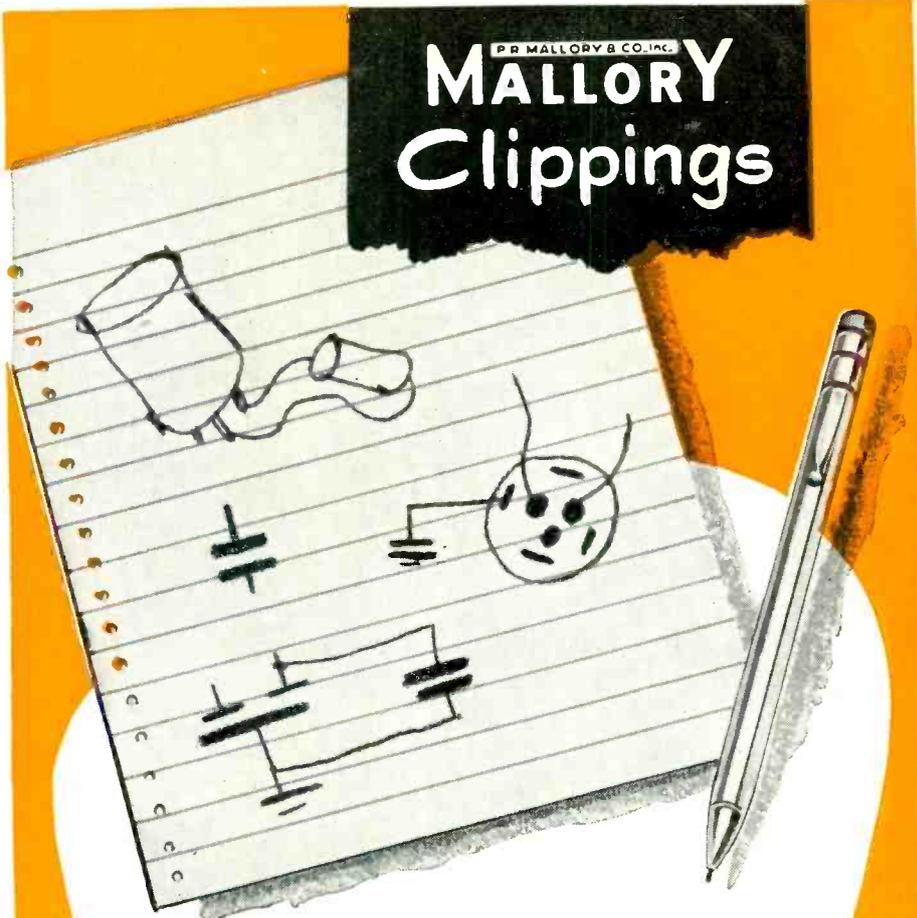
**HIGH FIDELITY COMPONENTS:** Catalog of hi-fi components. Gives technical information and illustrates firm's amplifiers, tuners, and turntable. Ask for catalog P. H. H. Scott, 111 Powdermill Rd., Maynard, Mass. (ELECTRONIC TECHNICIAN No. B12-13)

**ANTENNAS:** Engineering bulletin, "Quality Story", describes the quality and design features built into TACO Golden Topliner antennas. Literature announcing a special offer is also included. Technical Appliance Corp., Sherburne, N. Y. (ELECTRONIC TECHNICIAN No. B12-16)

**ADAPTOR:** Bulletin describes the Model D1, Adapt-It adaptor which converts the new 110° CRT bases to standard duo-decal types to facilitate the use of existing test equipment, rejuvenators, patch cords, etc. Also available is a bulletin describing exact replacement resistors for transistor auto radios. Workman TV Inc., 309 Queen Anne Rd., Teaneck, N. J. (ELECTRONIC TECHNICIAN No. B12-17)

**ELECTRONIC CIRCUITS:** 12-page guide containing schematics and specifications on all 96 types of packaged electronic circuits. Lists manufacturer's part number on all packaged circuits used by 130 radio and television manufacturers since 1949 and corresponding Centralab replacement. Ask for P.E.C. Guide No. 4. Centralab, a Division of Globe-Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wisc. (ELECTRONIC TECHNICIAN No. B12-5)

**LOUDSPEAKERS:** New 12-page catalog No. 165B describes new line of loudspeakers including the new Bass-Ultraflex systems. Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, N. Y. (ELECTRONIC TECHNICIAN B12-18)



P. R. MALLORY & CO. INC.  
**MALLORY**  
**Clippings**

*(A series of service hints  
gleaned from the notebooks  
of Mallory design and  
application engineers)*

Some replacement capacitors may be physically larger, or slightly more costly, than the original capacitors used in a piece of equipment. Still it may be preferable to use these replacement capacitors which are not "exact", rather than obsolete the equipment because "exact replacements" are not available.

For example, one or more sections of a multiple unit can be left unconnected, if not needed, without affecting or impairing the capacity or useful life of the remainder of the units.

A separate tubular capacitor can be paralleled with any section of a multiple capacitor to create a capacity section not available in stock multiple units. The lowest voltage rating of the paralleled sections must not be exceeded!

Regardless of the circuit—you can count on Mallory capacitors to do any service job—right. See your Mallory Distributor, today, and lay in a working replacement stock.

P. R. MALLORY & CO. Inc.  
**MALLORY**  
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

Capacitors • Controls • Vibrators • Resistors • Switches • Rectifiers  
Power Supplies • Filters • Mercury and Zinc-Carbon Batteries

*another first*

*for*

**RAYTHEON  
BONDED  
ELECTRONIC  
TECHNICIANS**



*Now eligible for*

**GROUP LIFE INSURANCE**

*from* **RAYTHEON**

**SPONSORING BONDED PROGRAM DISTRIBUTORS**

*at no added cost.....*

Registered Bonded Dealers who by preference use Raytheon Receiving Tubes are now eligible for valuable life insurance coverage through their sponsoring distributors. It is obtainable without the necessity of a physical examination.

This Group Life Insurance Plan for Raytheon Bonded Electronic Technicians is underwritten by one of America's leading insurance companies for the exclusive use of sponsoring distributors of the Bonded Dealer Program.

Any Sponsoring Bonded Distributor who meets the necessary requirements for setting up a Group Life

Insurance Plan for Bonded Dealers may help them obtain this important protection.

Check with your Raytheon Sponsoring Distributor and see if he has available to you this automatic way to gain personal security for you and your family. If you're not already a Raytheon Bonded Dealer, here's another wonderful reason why you should call your distributor and see if you can qualify. Being a Raytheon Bonded Dealer makes you stand out from the crowd. And using finest quality Raytheon Receiving Tubes for replacement work makes you the fair-haired boy with your customers, too.



**RAYTHEON MANUFACTURING COMPANY**

*Receiving and Cathode Ray Tube Operations*

NEWTON 58, MASS. 55 Chapel Street      CHICAGO, ILL. 9501 Grand Ave. (Franklin Park)      ATLANTA 6, GA. 1150 Zonolite Rd. N.E.      LOS ANGELES 7, CALIF. 2419 So. Grand Ave.

Raytheon makes all these

Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes.



# ELECTRONIC TECHNICIAN

Including  
**Circuit Digests**

## Highlights of 1957

1957 was another big year—a record year—for electronic maintenance technicians. The nation's 62,000 major service outlets collected \$2.4 billion for labor and parts. Slightly over 90% was for TV-radio repair; the remainder, growing in importance every year, was accounted for by hi-fi and commercial sound work, communications and industrial electronic servicing.

Here are some 1957 milestones:

The widespread use of 110° picture tubes with short front-to-back distance gave birth to the slim look in TV receivers.

Transistors became increasingly important in electronic products, production of these semiconductors climbing to some 25 million units, three times those made in 1956.

The first commercial cable theatre, first run movies wired to TV homes, went into operation in Bartlesville, Okla.

Stereophonic sound came into increasing prominence among hi-fi enthusiasts.

Color TV continued to gain acceptance, but at a slow pace. Half of the nation's TV stations were equipped to broadcast network color programs.

Video tape recording became a commercial reality, and began to supplant filmed kinescopes.

The use of TV in schools was furthered by a pioneer hookup for the Hagerstown, Md., educational system.

The tragic—and rare—accidental electrocution of a young boy by a portable TV set stirred comment on the need for designing more safety features into receivers.

The Federal Communications Commission established procedures for setting up experimental subscription TV operations by broadcast stations.

Self-service tube testers became a recognized factor in the sales of replacement tubes, accounting for an estimated 7% to 10% of sales.

All in all, 1957 seemed to be another typical year of design progress and increasing business volume for the electronic maintenance industry.

### Season's Greetings

Christmas will be here soon, so on behalf of all the folks on the ELECTRONIC TECHNICIAN staff we send you our most sincere wishes for an enjoyable holiday.

We also want to say thanks to each subscriber and advertiser for your continued interest throughout the year. Your support has enabled us to attain the largest audited circulation in the field, including the largest number of gainfully employed technicians and owners of service businesses. We're grateful to you.

This is also the time for us to make a few New Year's resolutions. First, in 1958 we'll continue to

bring you Circuit Digests exclusively every month—16 pages of the latest circuits. Second, we expect to bring you the largest number of editorial pages and helpful articles of any magazine in the field, as we've done this year. Third, we promise to bring you more important scoops, including at least one which will have significant national repercussions.

Yes, a big 1958 is planned for ELECTRONIC TECHNICIAN. And we hope you will have a big year, full of the success and fulfillment that is due to the hard-working specialists who keep America's electronic wheels turning.

Merry Christmas!

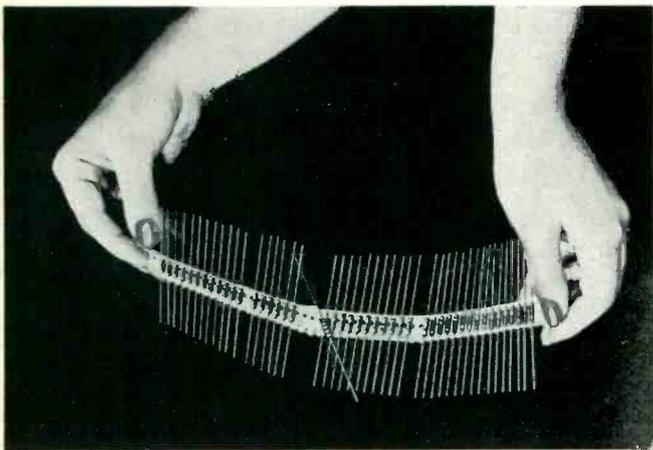
# Tuning In the

**CABLE THEATRES**, or telemovies, which consist of TV homes wired to receive first-run motion pictures, look promising, even though they have a way to go to assert proven acceptance. Milton J. Shapp, President of Jerrold Electronics, reports that his company is working with several movie exhibitors who plan to add cable theatres. Eyes are focused on the Bartlesville, Okla., installation made by Jerrold. This system, which started on Sept. 3, 1957, has over 500 subscribers who pay \$9.50 monthly for a package of 13 first-run movies and an equal number of re-runs. This represents a 12% saturation of TV homes in the area. Initial projections anticipated 200 subscribers at this time.

**TV SET MANUFACTURERS** are locking horns over the competitive design features of their receivers. In an aggressive promotional campaign, Zenith states: "Out of consideration for servicemen we use no printed circuitry in our television chassis . . . even though . . . the daddy of printed circuitry . . . is head of our Research Department. . . . Horizontal chassis is more accessible and easier to service."

**NEW TRANSISTOR** developed by Philco is called MADT, Micro Alloy Diffused-base Transistor. This field-accelerated type is capable of operating through the entire VHF and part of the UHF spectrum, as high as 1000 mc. Gain is 16 db at 100 mc.

## "Grip Strip" Whips Slips



New packaging technique for 1/2-watt fixed composition resistors holds resistors in place, preventing spilling. Designed by International Resistance Co. for automatic component assembly, resistors are released when strip is bent back, but hold firm when strip is twisted.



**ELECTRONIC STORAGE** display panels that can be used for prolonged viewing of projected light images to which they are exposed for only 1/100 second have been described by RCA. It results from the discovery of a previously unknown phenomenon in cadmium selenide, a photoconductor material which is an insulator in darkness but becomes a conductor of electricity upon exposure to light. Under the influence of applied voltage and exposure to light, the conductivity of the cadmium selenide will increase sharply and will remain high for minutes after the light source has been cut off. The panel itself is a "sandwich" formed by a thin layer of cadmium selenide photoconductor on one side, and a layer of electro-luminescent material on the other, separated by a thin layer of opaque materials.

**NATION'S SMALLEST TV STATION** is claimed for Port Jervis, N.Y. The channel 6 station contains \$5000 worth of equipment made by Dage Television, including one camera. It's located in a converted two-car garage. Signals are fed into the town's community antenna system to the 2500 families subscribing to this service. Local sponsors deliver their own commercials, the local automobile dealer driving right up to the station as the camera is trained on him.

**FIRST PERSON** to appear in the earliest remote telecast was the late Alfred E. Smith when he accepted the Democratic nomination for president in August 1928. GE reports that the historic event was viewed by people grouped around four TV sets then operating in Schenectady.

# Picture .....



**TV SERVICE CONTRACT** charges must be reported as current income for the year it is received, according to a Washington Tax Court ruling. This decision prevents income-splitting over the two different calendar years covered by a one-year contract.

*AUTOMATIC fine tuning on TV receivers is being vigorously pushed by manufacturers. As a matter of fact, it has added a new abbreviation to electronic jargon—AFT. Standard Coil Products, makers of AFT tuners, reports it took 16 months of intensive research to develop units that will lock in on the picture when channels are switched. (For technical data, see Circuit Digest 373, Standard Coil "Fireball" tuner, in the Oct. 1957 issue of Electronic Technician and Electronic Automatic Fine Tuning, Sept. 1957.)*

**INDUSTRIAL ELECTRONIC QUOTE:** "Manufacturers of electronic parts should be thinking about making it attractive to parts distributors to become active in going after the electronic parts business at the industrial level. The simple way to do that is for manufacturers to change the current practice of selling industrial accounts direct and at a lesser price than that charged their authorized distributors. It will take a little guts to change present policies."—Gail Carter, Director of Sales, Merit Coil & Transformer.

## CALENDAR OF COMING EVENTS

- Dec. 8-11: Eastern Joint Computer Conference, Park Sheraton Hotel, Washington, D. C.
- Jan. 10-12: Southwest Seminar of National Electronics Distributors Association and Electronic Industry Show Corp., Galvez Hotel, Galveston, Texas.
- Jan. 13-15: NARDA Annual Convention, Conrad Hilton Hotel and the Merchandise Mart, Chicago, Ill.
- Jan. 17-19: Long Island Guild Electronics Fair, Hempstead Armory, Hempstead, New York.
- Jan. 27-30: Plant Maintenance & Engineering Show, Int'l Amphitheatre, and the Palmer House, Chicago, Ill.
- Feb. 2-7: Special Industrial Radio Association Meeting, Detroit, Mich.
- Feb. 8-11: Television Service Ass'n Midwest Electronic Forum, Detroit, Mich.
- Mar. 24-27: IRE National Convention, New York, N. Y.
- Mar. 27-29: Ninth Biennial Electrical Industry Show, sponsored by Electrical Maintenance Engineers Association of Southern California, Shrine Exposition Hall, Los Angeles.
- Apr. 10-12: Southwest Regional Conference & Electronic Show, Municipal Auditorium, San Antonio, Texas.
- Apr. 28- May 1: National Association of Radio & TV Broadcasters Annual Convention, Hotels Baltimore & Statler, Los Angeles, Calif.
- Apr. 30- May 2: 7th Region IRE Tech. Conf. & Trade Show, Sacramento, Calif.

*MYSTERY METALS few of us have ever seen may make possible numerous electronic advances. For example, the expensive and scarce metal rhenium is reported as being capable of extending the life of a TV tube five to ten times. When used in the filament, it does not tend to coat the tube or initiate other effects the way tungsten does.*

## RANDOM NOISE

**TRANSOCEAN TELECASTS**

WERE FIRST MADE IN 1931 WHEN EXPERIMENTAL 24-LINE, 15-FRAME/SECOND PICTURES OF GEOMETRIC FORMS WERE SENT FROM SCHENECTADY TO GERMANY & AUSTRALIA

**RADAR PATENT APPLICATION** FOR BASIC PPI (PLAN POSITION INDICATOR) SYSTEM, WHICH SHOWS ALL OBJECTS AS IF ON A MAP WAS FILED 20 YEARS AGO—IT HAS JUST CLEARED THE LEGAL HURDLES, REPORTS IT & T

*TOM HIGGINS JR.*

25 MILLION TRANSISTORS

HAVE BEEN MADE IN 1957—THREE TIMES AS MUCH AS IN 1956— VALUE OF ALL SEMI-CONDUCTOR SALES, INCLUDING DIODES, IS OVER \$125 MILLION

# Roving Reporter Interview: Do You Encourage

*ELECTRONIC TECHNICIAN* correspondents across the country

## WICHITA, KANSAS



• Guy Groom Jr. is the owner-manager of Broadway Electronics, Wichita, Kansas. His shop employs three service technicians. What does he think about selling television parts and tubes over the counter?

"We split the difference," Groom said. "We sell tubes over the counter, but we don't sell parts."

What is the reasoning behind it?

The margin on tubes is high enough to make a reasonable profit, according to Groom's way of thinking. Then, too, anybody can buy tubes from many of the cut-rate drug stores, super-markets, etc.

"Why should we alienate a possible future customer," he asked, "by refusing to sell the tubes here when they can buy them elsewhere?" If we sell the tubes, we not only make a reasonable profit, but we build good relations for future business."

It has been his experience that an over-the-counter customer will probably buy more than he actually needs. On the other hand, if a technician checks out the set, the only tubes replaced are the ones that are

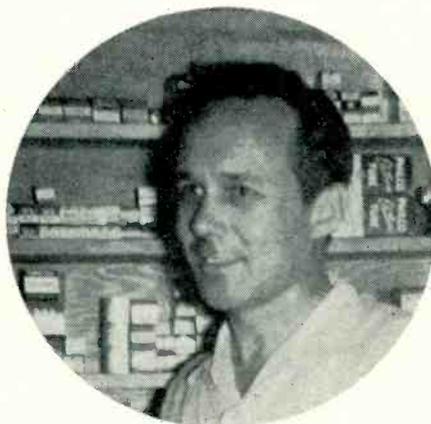
absolutely necessary.

Sales over the counter account for about 5% of the business. In a way, it is a first step in getting acquainted with customers who will later help provide the other 95%.

Where parts are concerned, the only sales Broadway Electronics will make are to students of television repair work. Installation of anything other than tubes is too serious a matter for the family handyman to undertake—it is work demanding a specialist.

Groom has been in television repair since 1949. He has had his own shop—a modern, attractive building, on a main thoroughfare—for the past four years. •

## BROOKHAVEN, GA.



• E. H. Norman, owner of Norman's TV Sales and Service Company, 4049 Peachtree Rd., Brookhaven, Ga., is a firm believer in the wisdom of a

service firm encouraging over-the-counter tube and parts sales to consumers.

Norman, who has followed this policy for the two years he has been at his present location, finds such a policy builds good will and customer loyalty, saves the firm money, and increases business.

Norman learned early that it makes a customer mad to pay a \$5 service charge to bring a service technician into the home to find nothing wrong with the set except the need of a \$2 tube.

"Customers invariably will resent that service charge and feel they are being overcharged, whereas in reality the service firm is losing money on this call, when you consider the wear and tear on the truck, gasoline, serviceman's wage, insurance, and other factors," Norman explains.

To get around this distrust on the part of the customer and to cut down on unprofitable service calls, Norman inaugurated the policy of over-the-counter tube and parts sales. It has definitely paid off, Norman reports.

"When a person calls in over the phone and says there is something wrong with his television receiver, I ask him a few leading questions and usually can tell whether or not he is having tube trouble. If I think he is, I ask him to bring in his tubes or his set for a free tube check. We check the tubes in the presence of the customer. If any of the tubes are at fault, I sell him the ones he needs and he puts them in himself. We've saved the customer money, we've made a small profit for ourselves, and we've built customer good will.

Norman's also uses window stickers advising passersby that they can

# Over-The-Counter Sales?

*report on the sales practice of different service businesses.*

check their TV tubes free.

Norman finds he averages ten per cent of his tube sales over-the-counter, and 99 per cent of the time he has the tube needed in stock. He also stocks the most common universal parts.

Norman admits his over-the-counter policy does cut into his service volume to some extent, but he believes it more than pays off in the long run in the good will he is building up.

One headache in over-the-counter sales, Norman points out, "is the person who will take up your time explaining exactly what tubes are needed, and then walks out to buy those tubes from a wholesaler." •

## SAN FRANCISCO, CALIF.



• Do-it-yourself repairing of television sets may cost more than it saves, in the opinion of Ben Wilmer, manager and co-owner of Radio Tele-

vision Laboratories, 1911 Hayes St., San Francisco, a firm that employs three technicians in addition to the owners.

Wilmer is willing to sell tubes and other TV parts over the counter, but he discourages people from bringing in tubes for testing and buying "only the tubes they need," for two reasons:

First, many tubes may be performing satisfactorily in the set, but "won't be quite up to snuff on our testing machine." As a result, Wilmer says, customers may wind up spending \$6 or \$7 for tubes when a \$3.50 house call would have repaired the set.

Second, if tubes are removed from the IF strip and are not replaced exactly as they were, he believes the set could be thrown out of alignment.

People occasionally bring tubes from a set in need of repair into the shop for testing, and Wilmer is willing to check them, although press of business often forces him to ask them to leave the tubes so that the work can be done at a more convenient time. Ordinarily, Wilmer is able to replace defective tubes from stock.

But when asked, Wilmer unhesitatingly urges customers to allow the set to be serviced rather than to bring in tubes for testing. He manages to keep the customer's good will by pointing out the savings in cash and satisfaction likely through proper servicing in preference to "do-it-yourself" methods.

Wilmer considers it unlikely that consumer-selling parts jobbers are aided particularly by his policy. "If the customer is convinced, we get the repair business. Otherwise, he brings in the tubes to us for testing and usually buys replacements from us." •

## WEST HARTFORD, CONN.



• Mr. J. L. Ottenberg, owner of a television service business bearing his name, is located at 335 Park Road, West Hartford, Conn. He is quick without being abrupt, and makes every effort to extend goodwill. Many of his customers come from moneyed suburbs.

He gladly offers to sell tubes and parts to over-the-counter customers, believing such sales are an integral part of his overall public relations program.

"Why not?" asks Ottenberg. "It seems an excellent way to build customer goodwill."

Although he doubts that any substantial profit can be traced to over-the-counter sales, he believes that this accommodation attracts the customers to the store for subsequent sales and service. Ottenberg reports that these sales, all of which are filled from stock, do not affect servicing volume. On the contrary, he is convinced that dealer over-the-counter sales contribute much toward keeping customers away from parts jobbers who sell to the public.

# R

# For Sick Scopes

## Symptoms, Causes & Cures For Hum, Low Emission, Grid Emission, Gassy Tubes & Poor Frequency Response.

ROBERT G. MIDDLETON

• Scopes are heir to many ills similar to those found in other electronic equipment. Their troubles resemble the type found in TV sets and the same type of treatment should affect a cure. From experience the technician learns to recognize the symptoms and without much ado is able to place his finger on the group of components responsible.

Since the scope is not wired for sound, the listening test for hum due to a defect in the B+ filtering system is not available. At this point, some one might ask, why not use an audio type signal-tracer for this purpose? The answer is that the audio

Fig. 1—Distortion in a square-wave pattern caused by 60-cycle hum. High and low horizontal sweep rates are displayed in the upper and lower photos respectively.

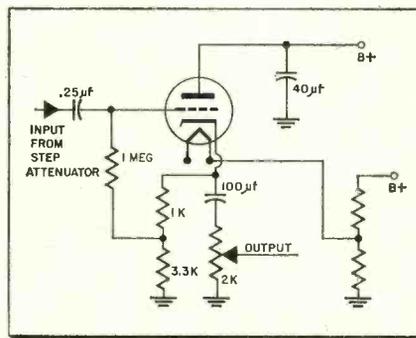
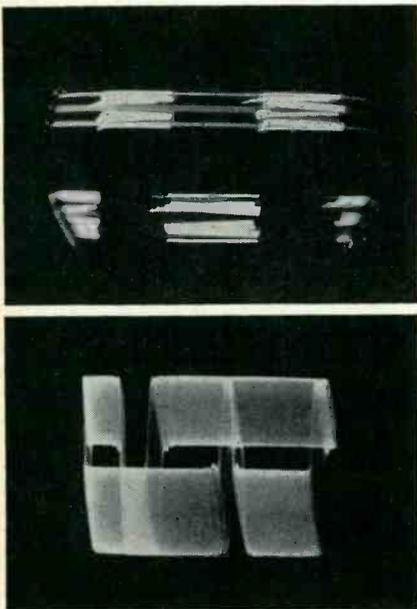
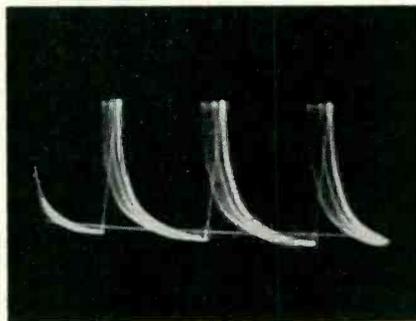


Fig. 2—Scope input stage. Positive d-c bias on heaters minimizes heater emission. High-impedance input requires a gas-free tube.

signal tracing technique is valid. For that matter any method the technician is familiar with and is accustomed to using can be employed. Even though the scope is not supposed to behave like a delinquent and has no facilities for sound, it can on occasion start to hum, whistle, smoke, burn, smell, and bite. About the last bit of unpleasantness, it is well to remember that the grid and cathode of the CRT usually operate 100 to 2,000 volts above ground. Always be certain that the scope is

Fig. 3—Left and right blurring due to hum in the horizontal amplifier.



turned off, and the high-voltage filter capacitors discharged before touching the CRT terminals.

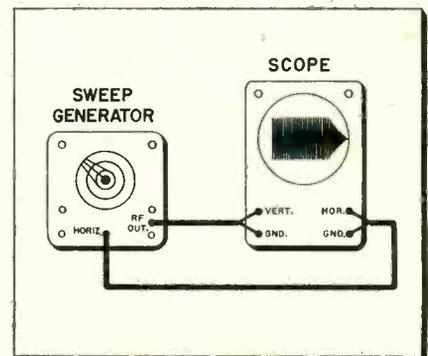
Inasmuch as the CRT in the scope and in the TV set operate on pretty much the same principles, servicing should present no new problems. Since the display of intelligence is different, the symptoms displayed on the different screens for the same type of trouble will vary, and the correct prescription will depend pretty much on the technician's prognosis. Having mentioned hum, first, it will be dealt with accordingly.

### Hum In The Trace

Fig. 1 shows the appearance of a square-wave pattern with a considerable amount of 60-cycle hum voltage. The upper photo shows the type of distortion which is produced at a relatively low sweep rate, while the lower photo shows the same distortion observed at a high horizontal sweep rate.

Heater-cathode leakage in the early stages of the vertical amplifier is a common cause of such trouble. The cathode of the input stage often

Fig. 4—Test setup for checking the frequency response of the vertical amplifier. Trace on the scope shows flat response.





operates far above a-c ground, and the resistance of the step attenuator in the grid circuit is quite high. These conditions are conducive to the development of hum due to heater-to-cathode leakage. To make matters worse, hum in the input stage is amplified by all succeeding stages. To minimize this tendency

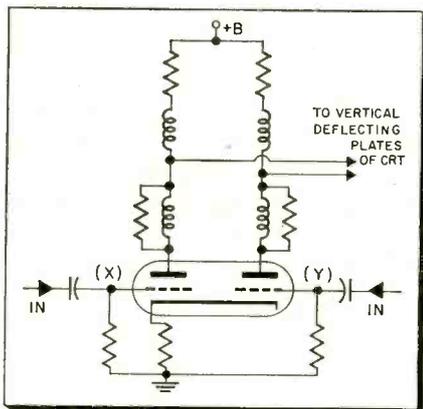


Fig. 5—Push-pull vertical output stage.

for heater emission, it is not unusual to find the heater of the input stage with several volts of positive d-c bias, as shown in Fig. 2. Hum may be present in the horizontal amplifier as well as in the vertical amplifier. Hum in the horizontal amplifier causes a left-and-right blurring of the pattern, as shown in Fig. 3.

#### Low Emission

When emission drops off in a tube, the maximum undistorted output decreases, and overload symptoms (clipping and limiting) make an appearance in the patterns. Low emission is usually most troublesome in the output stages, because maximum

output is required at this point. It will sometimes be of advantage to select tubes for use in the output stages of the vertical amplifier. Tube tolerances vary, and an improvement may be noted with some tubes. Manufacturers usually avoid the use of circuits requiring a special selection of tubes, especially when the product is mass produced. Nevertheless, tubes are sometimes driven to maximum capability in the output stage of the vertical amplifier, because of the conflicting requirements imposed by selling price, frequency response, and voltage output for full-screen deflection.

#### Gas & Hot Grids

Tubes used in the vertical-amplifier stages usually operate with relatively high values of grid-leak resistance. This high value is used to obtain the required high-input impedance in the input stages, and is used in subsequent stages to obtain improved low-frequency response with reasonable values of coupling capacitors.

Thus, a 1.5-meg grid leak can be used in combination with a 0.25- $\mu$ f coupling capacitor, while a 0.5-meg

Fig. 6—Lack of symmetry shows unbalance in output stage at both high and low frequencies.

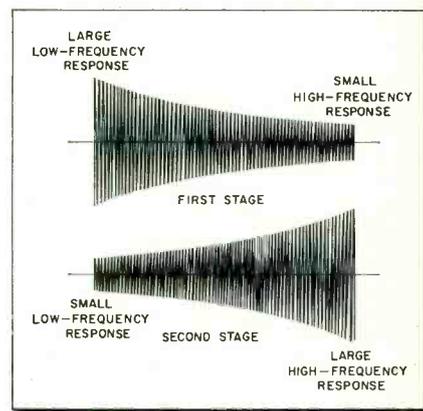
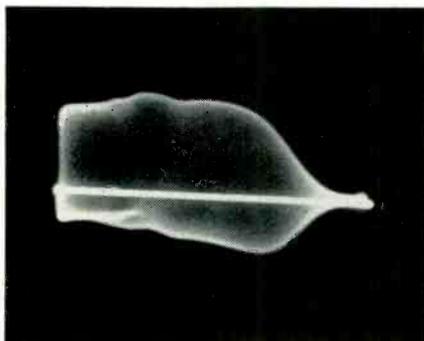


Fig. 7—Compromised response of one stage to make up for the poor response of another can be done at the expense of added distortion.

grid-leak resistor would require a 0.75  $\mu$ f capacitor. From the standpoint of economics, it is easy to see why large values of grid-leak resistance and smaller values of coupling capacitance are used in some commercial scopes. It might be considered that 5 or 10-megohm grid leaks could be used, with a substantial saving in capacitor costs.

However, the use of excessively high values of grid-leak resistance aggravates the undesirable effects of gassy tubes and grid emission. They cause grid bias to drop, and even swing positive. Loss of bias can be readily checked with a VTVM. For correct readings, it is best to measure between grid and cathode, rather than from grid-to-ground. An excellent way to detect grid current, is to measure the voltage drop across the grid resistor. When high values of grid resistance are used, once again, it may be of advantage to make a special selection of tubes.

(Continued on page 26)

## Sick Scopes

(Continued from page 25)

Satisfactory operation of a multi-vibrator depends upon a sharp cut-off characteristic. A tube having a remote cut-off characteristic due to gas current or grid emission will sometimes refuse to oscillate. Like the receiving tubes used in the scope circuitry, the CRT is also subject to gradual deterioration and eventual failure, due to gas or grid emission. If the brightness of the pattern increases up to a certain point, then suddenly starts to extinguish as the brightness control is advanced still further, the cause may be due to a gassy CRT.

The same symptom is sometimes encountered when the high-voltage rectifier tube has low emission, or if the high-voltage filter resistor increases in value. The loss of grid bias causes excessive beam current. As the current increases the high voltage decreases. As the high voltage decreases the trace will bloom and brightness will decrease. The heavy current also distorts the electron-lens system in the CRT, and causes loss of focus. If this condition of high beam current persists long enough, the electron gun might overheat beyond the critical temperature point, and become permanently distorted. Excessive heating of metal parts also cause more gas to be released. Gas can enter the tube in two ways, leakage from the outside atmosphere, and release from overheated-expanded pores in the metal-gun structure. Substantial departure from grid bias values noted in the service manual for the instrument raise the suspicion of gas in the CRT.

### Frequency Response

When the over-all frequency response of the vertical amplifier is tested as shown in Fig. 4, and a flat response is not obtained, the problem is to determine which stage is causing the distortion. This can be done by making a stage-by-stage check of the frequency response. The signal-substitution method is usually more straight-forward and easier to handle than the signal tracing procedure. Consider a typical output stage of a service scope, as shown in Fig. 5. This is a push-pull circuit in which both grids are driven by signals from the preceding stage, and provide a balanced output.

It can be readily perceived that the CRT is a good indicator of frequency response. The output from a video-frequency sweep generator is applied first to one grid at point X in Fig. 5. The response is noted on the scope's screen. The amount of vertical deflection will be small, but readable. The generator is next connected to the other grid at point Y, and the response is again noted. If the output stage is operating properly, a flat and equal response will be

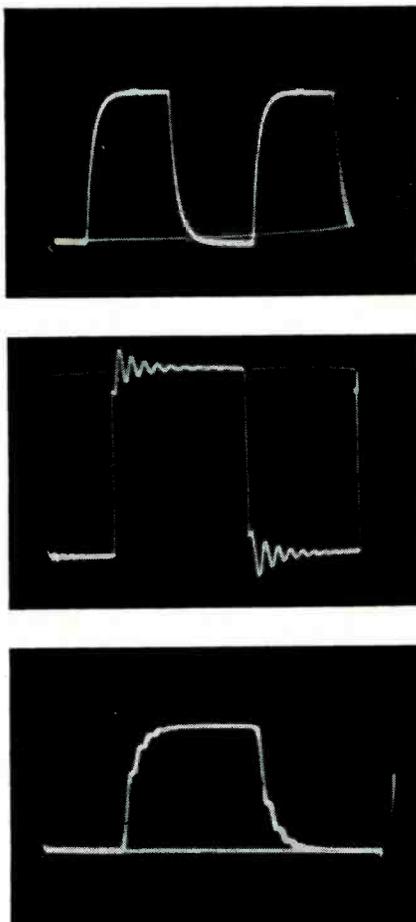


Fig. 8—Top—Loss of highs causes rounding of square waves. Center—Excessive high frequency response causes ringing and overshoot. Bottom—Distortion due to combined response.

obtained over the rated frequency range of the amplifier. In case unequal deflections are obtained in the two tests, check the values of the plate-load resistors. Unequal output may be due to one resistor being substantially higher than the other.

Resistors may vary widely in absolute value, and still be within tolerance. If one resistor is on the high side, and the other on the low side, it is easy to see that the stage will be thrown out of balance.

Unbalance in the plate-load resistors causes unequal amounts of

deflection at low frequencies. Unbalance in the peaking coils causes unequal amounts of deflection at high frequencies. Fig. 6 shows a typical sweep response for a bad condition of unbalance in a push-pull stage. Unbalance is present at both low and high frequencies.

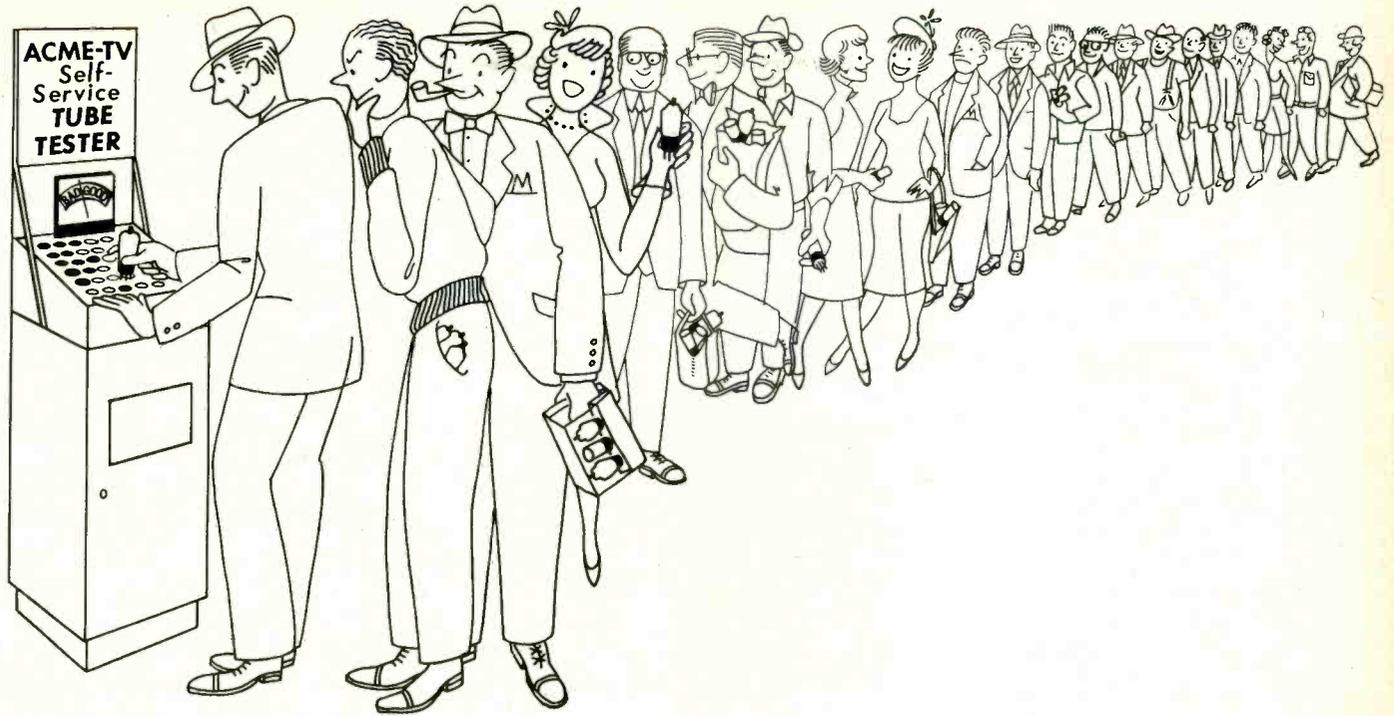
After checking the output stage, the generator is applied to the grid of next-to-the-last stage and the screen of the CRT is again observed. For push-pull circuits each half is tested separately as before. The procedure is carried on until the input terminals of the scope is reached.

Sometimes it becomes difficult to flatten out the response of a stage. The temptation to compromise the frequency response of one stage to compensate for another, as shown in Fig. 7, should be avoided. Although it is possible to obtain a flat over-all response in this manner, the transient response of the scope will then be depreciated, and some distortion will be introduced.

The nature of this distortion is illustrated in Fig. 8. A stage having poor high-frequency response causes diagonal corner rounding when a square-wave signal is applied. On the other hand, a stage with excessive high-frequency response causes overshoot and ringing. When a stage with poor high frequency response is followed by a stage with excessive high frequency response, the reproduced square wave shows a combination of both distortion factors. The ringing of one stage is superimposed upon the rounded corners from the other. The scope is best suited for service work when the response of each stage is made as flat as possible.



"There was a mouse in it."



## Progress Report:

# Self-Service Tube Testers

*Business Is Booming. Here's a Plan for Technicians.*

ALBERT J. FORMAN, EDITOR  
ELECTRONIC TECHNICIAN

● Two years ago the self-service tube tester was in its infancy. The results of a market study, published in the November 1955 issue of *Technician* magazine, showed there were about 1000 such testers in use serving do-it-yourself tube customers. At that time it appeared that self-service testers were on the rise, that they would substantially increase in number over the coming years.

Experience has seen these testers grow beyond the fondest hopes of many of their most ardent enthusiasts!

Estimates vary, but there are many indications that between 20,000 and 25,000 self-service testers are in use today. One manufacturer puts the figure at 30,000. And the number is growing every day. By 1959 it is reasonable to expect that over 50,000 of these units will be in operation.

The importance of self-service testers can be gaged by the business volume they account for. A tester in a good location can easily gross \$50 per week and more. Taking into account those testers in poor locations, when we consider a conservative average of only \$20 to \$25 per week per tester, the current annual gross comes to a whopping \$20,000,000 to \$30,000,000. In 1955, self-service testers accounted for 0.4% of the replacement tube market; at the end of 1957 they dominated 7% to 10% of the market. In 1958 the percentage will be still higher.

**Want more technical and business information on setting up a self-service tester route? Write to:**

**Editor  
ELECTRONIC TECHNICIAN  
480 Lexington Avenue  
New York 17, N.Y.**

This is not to say that self-service testers will take over the entire replacement tube market. A saturation point will be reached. Most TV set owners are not inclined to dig into receiver innards. Nevertheless, electronic technicians are faced with an important economic problem. Since only one in five self-service testers are operated by technicians, the servicing industry stands to lose considerable revenue to drug stores and vending machine operators.

### Technician Attitudes

Two years ago the majority of technicians looked upon self-service testers with disfavor. They maintained that it would misleadingly encourage more do-it-yourself repairs, with the attendant shock hazard; that it was a novelty and would wear off; that it would detract from confidence in the service technician; and finally, that drug stores, supermarkets and vending machine operators would benefit.

*(Continued on page 43)*

# You And The FCC

*How You Can Service The Communications Industry.*

*How To Get Guides, Forms, & Other Reference Materials.*

GRANT WOODSIDE  
CHIEF ENGINEER  
FCC LICENSING PROCEDURES  
MOTOROLA, INC.

## SAFETY AND SPECIAL RADIO SERVICES (abbreviated)

SERVICE	ELIGIBILITY	FCC RULES
AVIATION	All commercial and private aircraft and ground stations	Part 9
AMATEUR	Non-commercial hobbyists and experimenters	Part 12
CITIZENS	All citizens not otherwise eligible for other licenses	Part 19
EXPERIMENTAL	Commercial research and development	Part 5
INDUSTRIAL	Business enterprises	Part 11
Power	Electric, gas, steam and water public utilities	
Petroleum	Petroleum product prospectors, producers, refiners and pipeline operators	
Forest Prod.	Timber and logging companies	
Relay Press	News services and newspapers	
Motion Picture	Motion picture studios	
Low Power	Any business enterprise	
Special	Any manufacturing, construction or production activity in a rural area (including forming) or in an urban area within limitations	
LAND	Common and contract carriers of passengers and freight	Part 16
TRANSPORTATION	Railroad operating companies	
Railroad	Taxicab operators	
Taxicabs	Common or contract carrier transportation	
Motor Carrier	Public garages and auto clubs	
Auto Emerg.	All commercial and private land stations for maritime communications	Part 7
MARINE	All marine-utility (portable) stations on land or shipboard	Part 7
	All commercial and private radio equipped vessels	Part 8
PUBLIC SAFETY	Agencies protecting life and property	Part 10
Police	Municipal, county and state police	
Fire	Municipal and volunteer fire dept's.	
Forestry-Conservation	Governmental and private forest protection	
Highway Maint.	Governmental operation, supervision and maintenance of public roads	
Special	Disaster relief organizations	
Emergency	Physicians and veterinarians in rural areas	
	Ambulances and rescue squads	
	Communications common carrier standby	
	Isolated area communications	
	Communications common carrier emergency	

• As members of the vast radio service industry, communication service companies should be personally concerned with that Federal agency responsible for efficient regulation of the entire radio spectrum. The Federal Communications Commission is the government agency charged with regulating communication by means of radio and licensing non-government radio stations and their operators. The Commission is not under any government department but is an independent Federal establishment reporting directly to Congress.

The FCC functions in the interest of all those having a need to use radio communication by insuring that the limited amount of spectrum space or usable channels are not used indiscriminately, and increasing the general public benefit of instant communications, thus preventing a chaotic situation. Although the radio spectrum is one of our many natural resources, it is limited in size, and if the maximum possible benefit is to be realized in its use, then all concerned,—the station licensee, the operator, and the maintenance technician—must join forces.

Communication service companies obtain their two-way radio maintenance customers from the broad category of public safety, industrial and land transportation users. This ever-increasing market for mobile two-way radio is regulated within the FCC by the Safety and Special Radio Services Bureau. These Services include some of radio's oldest and newest applications. The safeguarding of life and property at sea was the first practical application of radio communications, and today, the new uses include such things as radar speedmeters to monitor highway travel. The scope of this group covers maritime, land mobile and aeronautical radio users. Of particular interest to the communication service companies are land mobile users. In this group are found the

RENEWAL

The United States of America

NUMBER  
F1-W-1114

## FEDERAL COMMUNICATIONS COMMISSION

## RADIO TELEPHONE OPERATOR LICENSE

## FIRST CLASS

(General Radiotelephone Certificate)

*This certifies that*

\*\*\* GRANT EDWARD WOODSIDE, Jr. \*\*\*

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THIS LICENSE IS GRANTED UNDER THE AUTHORITY OF THE COMMUNICATIONS ACT OF 1934, AS AMENDED, AND THE TERMS AND CONDITIONS THEREOF AND OF ALL LEGISLATIVE ACTS, EXECUTIVE ORDERS, AND TREATIES TO WHICH THE UNITED STATES IS SIGNATORY, AND ALL ORDERS, RULES AND REGULATIONS OF THE FEDERAL COMMUNICATIONS COMMISSION, WHICH ARE BINDING UPON RADIO OPERATORS, ARE MADE A PART HEREOF AS THOUGH SPECIFICALLY SET OUT IN FULL HEREIN.

NEITHER THIS LICENSE NOR THE RIGHTS CERTIFIED TO HEREIN SHALL BE ASSIGNED OR OTHERWISE TRANSFERRED TO ANY OTHER PERSON.

PLACE AND DATE OF ISSUANCE: Washington, D.C. January 30, 1957

DATE AND TIME OF EXPIRATION: January 30, 1957 AT THREE O'CLOCK A. M., EASTERN STANDARD TIME.

SPECIAL ENDORSEMENT:

Verification Card Form 758-F Issued.



Federal Communications Commission

*Grant E. Woodside Jr.*  
(Licensee)

*Warren C. Stibler*  
(Issuing Officer)

*J. Plouffe*  
(Secretary)

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First Class Radio Telephone Operator License issued by the FCC must be properly displayed and renewed every five years.

police, fire and highway maintenance departments, gas and electric utilities, petroleum and forestry industries, railroads, buses, highway trucks and streetcar systems, ambulances, doctors, taxicabs, and a multitude of generalized industrial users such as farmers, manufacturers, contractors and fuel oil and bottled gas distributors. This is to name but a few of the users of land mobile two-way radio. Annually, the number of licensees is growing without precedent, and the future will see ever-increasing demands on the limited amount of radio channels.

Although it is the FCC's responsibility to promulgate the Rules and Regulations to insure the orderly and efficient utilization of the radio spectrum, the job is so tremendous that it cannot be accomplished without a continuing cooperative effort by all concerned outside of the Commission.

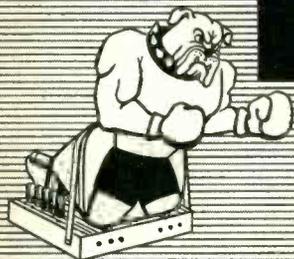
The two-way radio service company has an important role to play in the efforts of those outside of the

FCC that help insure the orderly occupancy and use of two-way radio channels. The Regulations state that all transmitter adjustments and tests of radio stations which could affect proper operation be made by or under the immediate supervision and responsibility of a person holding a First or Second Class Commercial Radio Operator License. In addition to providing proper and adequate maintenance for two-way radio equipment, the service company is responsible for the required station log entries of measurements: plate-power input, tolerance of the carrier, and degree of modulation of each transmitter. The record entries must show the specific name of the person making the measurements, and when an outside measurement agency is employed by the licensee, the name and address must be included.

The Field Engineering and Monitoring Bureau is the Commission's police force, however, this token staff is of such size that without a high

degree of self-enforcement by the licensees, a situation would soon exist wherein no general public benefit could be realized from the radio spectrum allocated to the land mobile users. The Commission's Field Staff continually monitors radio transmissions for adherence to the rules governing frequency stability, power input and modulation, and investigates interference complaints. The successful communication company's personnel maintain a cordial and close working relationship with the local regional offices of the Commission, such that most complaints and unintentional violations of the rules require no formal FCC intervention. Many interference complaints result, even though all equipment involved are operating well within the required limits of the rules. It is in these instances that the communication service company provides an important service to the users of radio frequencies, by engineering solutions to the interference

(Continued on page 52)



# "Tough Dog"



## Corner

### Difficult Service Jobs Described by Readers

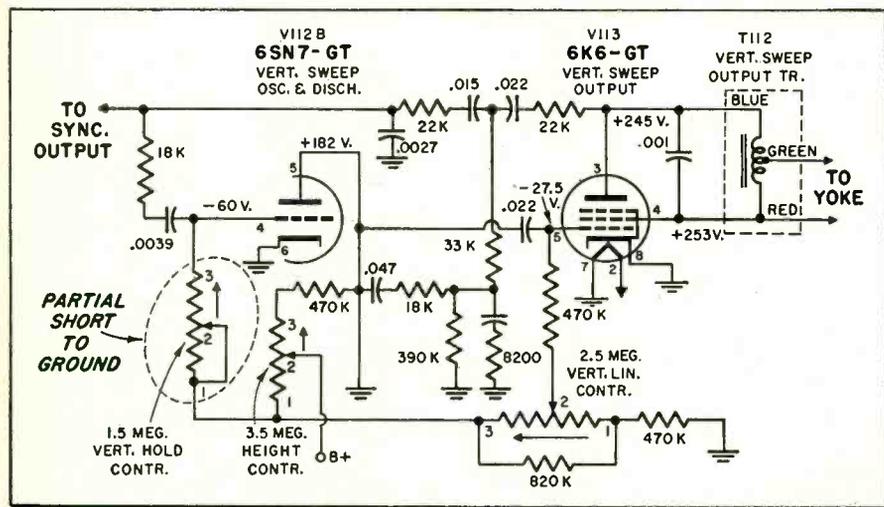
#### No Vertical Hold

The vertical hold control on this RCA chassis KCS 83, had very little effect, and the vertical frequency was much too fast. Considerable foldover was evident, the picture was either squeezed at the bottom or folded half way down from the top as the hold, height and linearity adjustments were tried. The picture could be locked at double frequency with extreme foldover. Complexity of this circuit which contains a divider network, shaping network, and use of oscillator-developed voltage to bias the output tube to establish linearity control was of little or no help in diagnosing the possible cause of trouble. This looked like a cut and try operation, and such it turned out to be, so I decided to go at it systematically. I changed both tubes without appreciable improvement. Checked tube socket voltages and only one was off. This was the negative grid voltage at the

6K6 which measured  $-15$  instead of  $-27.5$  volts. Thinking this reduction might be caused by a leaky coupling capacitor which could put a small positive voltage on the grid and thus reduce the bias. The capacitor lead was lifted off the grid and it checked perfectly. Since this stopped oscillation there was no way to check bias so I tried a new capacitor, just to be on the safe side, but it didn't help. I replaced the original lead and checked voltage across the  $470\text{K}$  grid resistor for possible leak at the socket. No appreciable d-c voltage was obtained. I made a mental note of the lowered bias and proceeded by checking each capacitor for capacity and leakage. All OK. While each capacitor was disconnected I checked each resistor connected to it for correct value. All were within tolerance. I had previously discarded the idea of a bad output transformer since the waveforms taken on an oscilloscope were very similar to those shown in the service manual. Once again,

to be on the safe side, I hung a new transformer (fortunately in stock) on the circuit and found no improvement. I resoldered the original transformer and backed-off a bit to study the circuit further. Two things stood out as clues: First, the 6K6 grid voltage was low, and second, I had noticed that with certain settings of the height and linearity controls, the hold control would cause the picture to move downward more slowly as it moved toward one end. Rotating in the opposite direction and just before reaching the other end it would tend to speed up again in the downward direction. Somehow these were tied in together, but how? If the 1.5 meg hold control had increased in value it would leave less voltage across the linearity control but I had checked the resistance of this before and it was normal. Also if the linearity control or its shunt had decreased in value the same effect would be present, but these parts had been checked individually and I found them to be OK. Then it hit home—that word "individually"! The total resistance between the 6SN7 grid and ground should be approximately 2.5 megohms. I turned off the receiver, and checked the resistance from the grid of the 6SN7 to ground. Moving the linearity control back and forth produced no change. When I did the same with the hold control the resistance changed from about 500K to 1.2 megohms. Here was the trouble. I lifted the control completely off the chassis after unfastening the nut holding it and then turned on the receiver. The set worked perfectly. The trouble was due to internal leakage between part of the resistance strip and the shell on the control. A new control completed the repair and another bad headache was out of the way.—  
M. G. Goldberg, St. Paul, Minn.

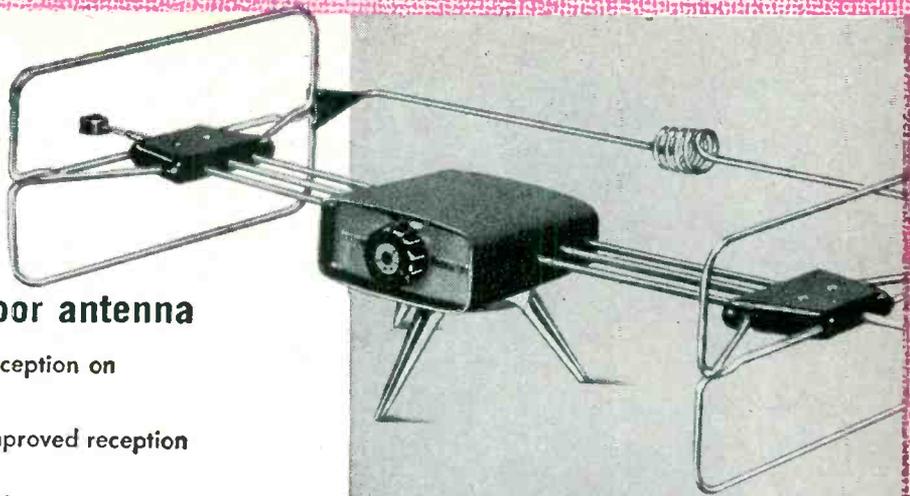
Partially shorted control on this RCA chassis KCS83, caused loss of vertical hold.



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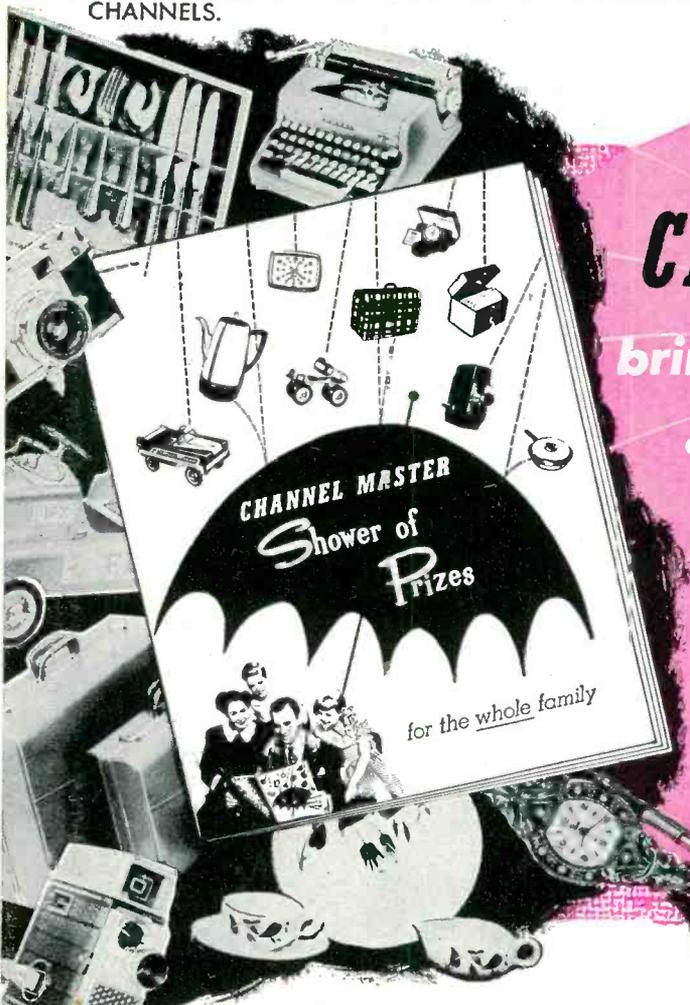
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# Two Or More Receivers In Every Home With

# TV Multi-Set

## Resistive, Transformer & Combination Devices Help Solve

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SYSTEMS DESIGNER  
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&  
ROBERT CORNELL  
TECHNICAL EDITOR  
ELECTRONIC TECHNICIAN

• The simple construction, small size, few parts and low price of TV set couplers cause many technicians to underrate the importance and underestimate the amount of thought and engineering that have gone into these devices. There are instances where two or more sets operating on the same line may seem to operate in the same manner with or without a coupler. There are instances where reception on some channels may improve when a second set is attached directly to the same transmission

line. There are even instances where good reception was lost when a coupling device and another set were added. All this plus other popular misconceptions have caused the coupler to suffer from various sorts of abuse and complaints.

Primarily, the problem is to establish good reception on all channels on the various TV sets that may be attached to the same line. However, new problems suddenly appear when the second set is added. Good results can be had by gaining an insight into the causes and cures of the troubles that usually develop in a multiple set installation.

### Coupling Methods

As in any electronic circuit, resistance coupling, capacitive coupling, inductive coupling, trans-

former coupling and combinations thereof may be used. Each type has its advantages and drawbacks. A logical approach requires that the impedance of the antenna, transmission line, coupler and TV sets be selected so as to accomplish impedance match. This allows maximum transfer of energy and minimum distortion. Unmatched or improperly terminated lines cause reflections and standing waves, which in turn are responsible for irregularities in signal strength and ghosting effects.

The purpose here is to discuss 300-ohm installations, and is not to be construed that this system is better or worse than the 72-ohm shielded systems. Each has its right to fame. In most instances the principles are the same, but the practical approach is different, and enough new considerations justify a separate treatment.

Fig. 1—Impedance variations which take place when more sets are added to the line.

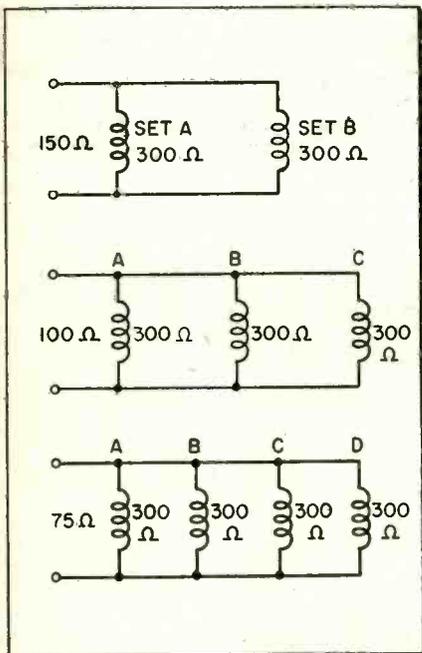


Fig. 2—Resistive coupling provides impedance match, but introduces additional losses.

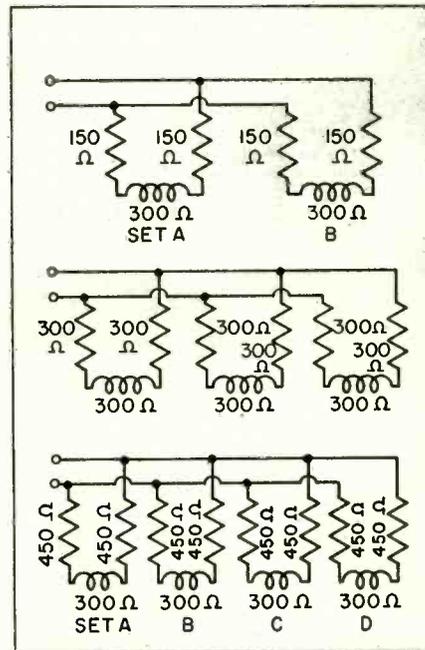
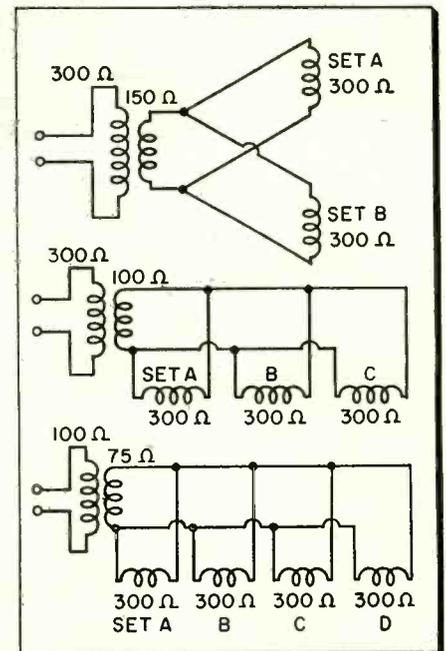


Fig. 3—Transformer coupling accomplishes impedance match and approaches the theoretical minimum loss at each set.



# Antenna Couplers

## Problems Of Distribution, Impedance Matching & Isolation.

If two or more 300-ohm sets are connected in parallel, the total impedance confronting the antenna will be anything less than 300 ohms. Fig. 1 shows this basic impedance matching problem. At this point, it may be interesting to note that the sets are represented as inductances rather than resistances. This should immediately sound the alert—with different frequencies and with different tuning conditions in the TV set, 300 ohms is not often realized. Lest this problem be complicated beyond the point of comprehension, it is best to assume that equipment marked 300 ohms is just that, and an effort to pick up this loose end will be made later in this discussion.

The premise being that the antenna and transmission line is 300 ohms, several matching or coupling devices may be used. Fig. 2 shows resistive coupling. It can be readily seen from the progression of from two to four sets, each resistor increases by 150 ohms as another set is added to the line. Two other facts now become obvious, in order to

Fig. 4—Impedances vary when sets are tuned to different channels at the same time.

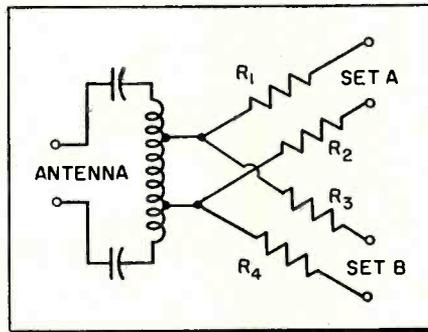
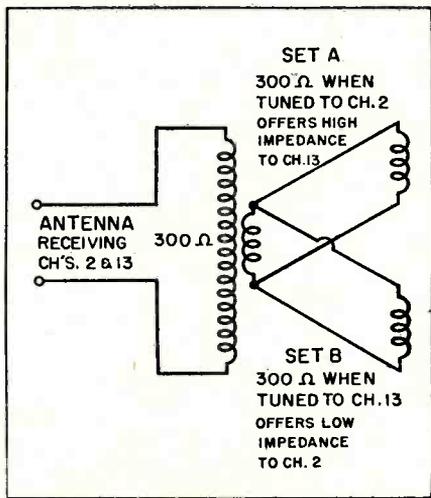
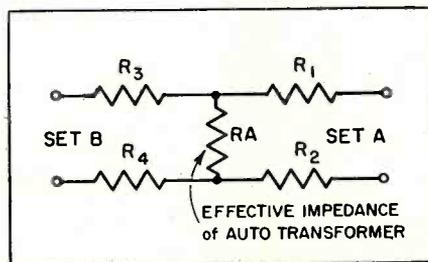


Fig. 5—Combination transformer and resistive type of coupling using an autotransformer.

maintain impedance match, all the sets must be connected; secondly the available signal divides itself equally into each set. Assuming no other losses, which is indeed hypothetical, in a two set arrangement, the most signal available is  $\frac{1}{2}$  of the original. This is an inherent characteristic and only an amplifier can raise the signal level fed into the set. In most metropolitan areas this is no problem as there is more than enough signal

Fig. 6—Equivalent circuit of combination coupler shows losses between sets to be twice as much as between either set and antenna; thus providing better isolation than is possible in a straight transformer device, and it is possible to design for smaller losses than in a resistance type coupler.

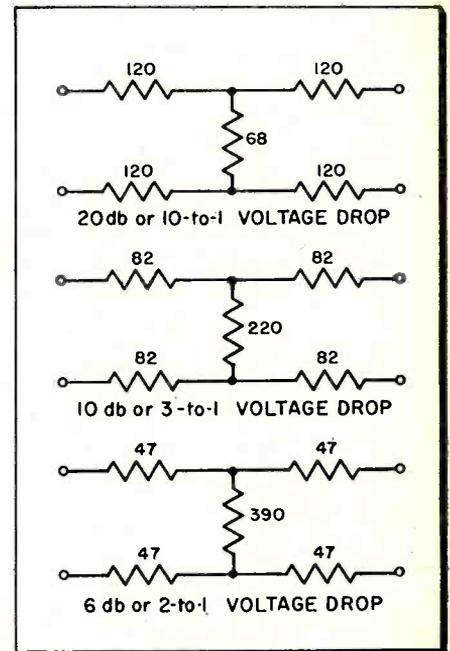


to do the job. Should it become necessary to temporarily disconnect a set from a balanced line, impedance match can be maintained by substituting a 300-ohm resistor for the set.

The presence of all these resistors suggests additional losses. Considering the 2-set arrangement set A shows an impedance of 600 ohms, as does Set B. These two are paralleled to give an equivalent of 300 ohms, which matches the line. However, the resistors absorb one half the energy in each leg in the system, and the sets see a signal which is theoretically down by 6 db. Under the circumstances it would seem to be advisable to find a more efficient system. Fig. 3 shows, in effect, a matching transformer which is capable of providing the proper impedances. The signal is equally divided among the sets. The 2-set arrangement is

(Continued on page 48)

Fig. 7—Non-inductive resistor, 300-ohm attenuator pads for controlled losses.



# Choosing A Phono

## Electrical And Mechanical Consideration. Should It Be A Crystal,

NORMAN H. CROWHURST

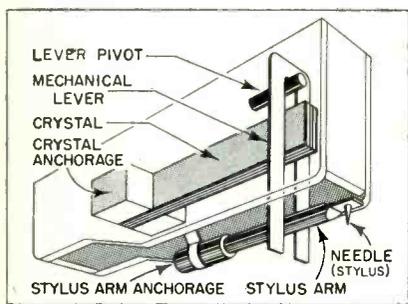


Fig. 1—Crystal and ceramic type operates on piezoelectric principles. Impedance and output are high. They are non-inductive.

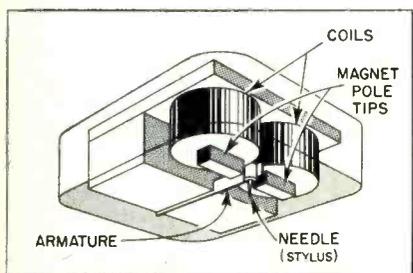
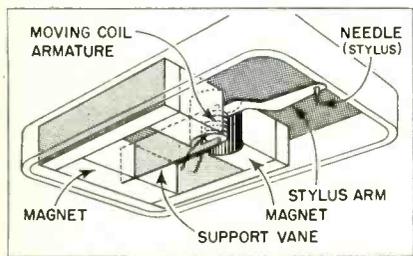


Fig. 2—Variable reluctance pickup is a magnetic type having an iron core armature. Has low impedance and low output characteristics.

Fig. 3—Dynamic cartridge has a coil for an armature which is placed in a magnetic field. Characteristics are similar to reluctance type.



• When a customer asks, "What is the best pickup cartridge?" it is well to ascertain just what he has in mind. In addition to the price factor, electrical and mechanical characteristics must be considered. It is true that a better cartridge can improve the performance of a given record player, however if the design of the original equipment including the turntable, arm and amplifier cannot take advantage of the new improved characteristics built into the modern cartridge, there is little gained unless certain modifications are also performed.

There are four basic types of pickups: the crystal or ceramic, magnetic (variable reluctance), moving coil and FM. The ceramic type is shown in Fig. 1. The variable reluctance and moving coil pickups are shown in Figs. 2 and 3 respectively.

The FM pickup uses a capacitor element in the cartridge that modulates a radio frequency generated by a separate unit. Earlier models of this pickup suffered from the disadvantage that the r-f oscillator was apt to drift out of range of the linear operation of the discriminator unit. This meant that adjustment was necessary from time to time to ensure good reproduction. Modern samples of this pickup have been cleared of this defect. Their liability to drift has been considerably reduced. However, the complete setup is more costly because of the added r-f oscillator and discriminator circuit. Also, additional components mean more things to breakdown and require more servicing.

Examination of the practical construction of pickups shows that a moving coil is not inherently free from distortion any more than the other types, nor is the FM type in the clear. It is just that the distortion-causing elements are different.

In the moving coil cartridge, if

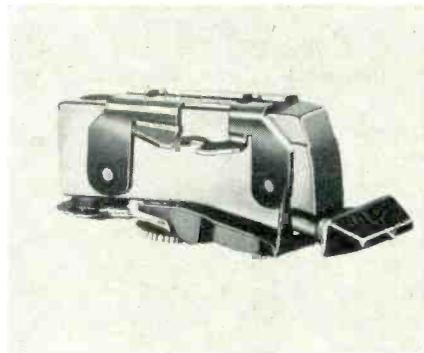


Fig. 4—The Shure W9 is a dual needle, dual-voltage crystal type with a frequency response up to 10,000 cps and up to 5-volts output.

the magnetic field in which the coil moves is perfectly uniform, and if the coil rotates about its axis as driven by the stylus, without any other kind of movement, then it is basically free from distortion. In actual practice, both of these "ifs" are unlikely: the magnetic field is never perfectly uniform; and the method of suspending the coil frequently causes movement that is not

Fig. 5—Astatic's plug-in ceramic cartridge-needle combination Model 81TB has a frequency response from 30 to 15,000 cycles at a 1-volt output with a compliance of better than 1.



# Pickup Cartridge

## Ceramic, Variable Reluctance, Moving Coil Or FM Type?

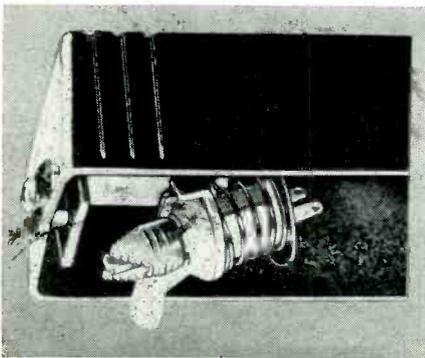


Fig. 6—Electro-Voice's Power-Point is a dual-needle high-compliance ceramic type having a response from 20 to 10,000 cycles and usable output to 15,000 cycles, 1-volt output, and a tracking force of 5 to 8 grams.

purely rotational. However, the design is usually arranged so the distortion produced by these nonlinear elements is minimized.

The same is true of the other kinds of pickup. The magnetic type is inherently nonlinear according to theory because of frequency dependence and variations in the magnetic field which produces the electrical output. But this nonlinearity

Fig. 7—Ronette's TX-88 is a wide range hi-fi ceramic type having an output of 0.4 volts. Can be used with or without a preamp.



too can be minimized and virtually eliminated by suitable design, choice of dimensions, and controlled stylus movement.

The ceramic type has similar limitations, but it has the advantage of a much larger output. The impedances are very different too. The ceramic has a high impedance output and should be connected to a high impedance input for proper operation. This means that as well as saving on the cost of the pickup itself it is possible, if the amplifier is bought with this pickup in mind, to save on the system also. When using the crystal or ceramic pickup the amplifier does not need the additional amplification and equalization necessary for the other types.

### Mechanical Considerations

An inherent disadvantage in the early crystal types has been the much lower compliance, or greater stiffness, in the stylus movement. Development of the moving coil and magnetic types has resulted in high

Fig. 8—Sonotone's Model 2T is a dual-needle ceramic type having a frequency response from 30 to 15,000 cycles  $\pm 3$  db at a tracking force of 8 to 10 grams, compliance of 1, and a 1-volt output. The "5" series shown has a wider, more even response and greater compliance.

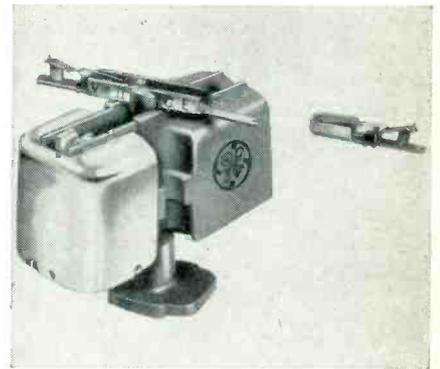


Fig. 9—GE's new variable reluctance type features a frequency response from 20 to 20,000 cycles at 4-grams tracking pressure.

stylus arm (not tone arm) compliance so that a very small tracking force (1 to 5 grams) is needed to keep the stylus in the groove. The earlier crystal pickups needed a force several times this amount. However, development has improved ceramic types too. Improve-

(Continued on page 39)

Fig. 10—Fairchild's moving coil is similar to the D'Arsonval movements found in test instruments. It has a uniform response to 20,000 cycles at a tracking force of from 4 to 8 grams.



# SHOP HINTS



## Tips for Home and Bench Service

### Optimum Deflection

For optimum performance of the horizontal-deflection circuit in the KCS68 and KCS81 RCA Chassis it is important that the horizontal drive, horizontal linearity and width controls be adjusted correctly. Incorrect adjustment may cause overheating of the H-V transformer with arcing and possible damage to the transformer and other components.

The best method for adjusting these controls is as follows:

1. Place the width link in the minimum width position. (Short the upper and middle connections).
2. Set the width control to the maximum counter-clockwise position.
3. Adjust the horizontal drive trimmer counter-clockwise two turns from tight or just before overdrive line appears.
4. Insert a 0-500 ma. meter in series with the cathode resistor of the horizontal output tube and ground. Adjust the horizontal linearity control for minimum current on the meter (115 to 125 ma.).

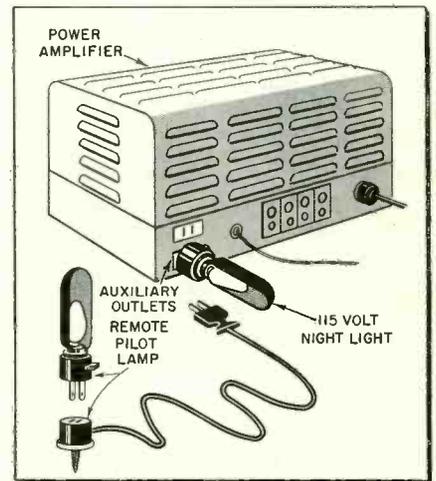
5. Adjust the width control to obtain sufficient width to fill the screen.

It is possible that sufficient width cannot be obtained due to low a-c line voltage. In this event more width may be obtained by moving the width link to the lower position. In this position the width coil is out of the circuit and increased width is obtained.

In some cases overheating of the H.V. transformer may occur although proper adjustments have been made and the tubes and components are not defective. This condition, then, is probably due to tube and circuit tolerances. In this event a capacitor may be connected as shown in the partial schematic diagram. Any value may be used from 18 to 33  $\mu\text{f.}$ , 6000 volts.—*RCA Television Service Tips, Camden, N.J.*

### Pilot Light

To prevent the possibility of forgetting to turn off the amplifier of a sound system, a pilot light can be



Night lamp serves as amplifier pilot light.

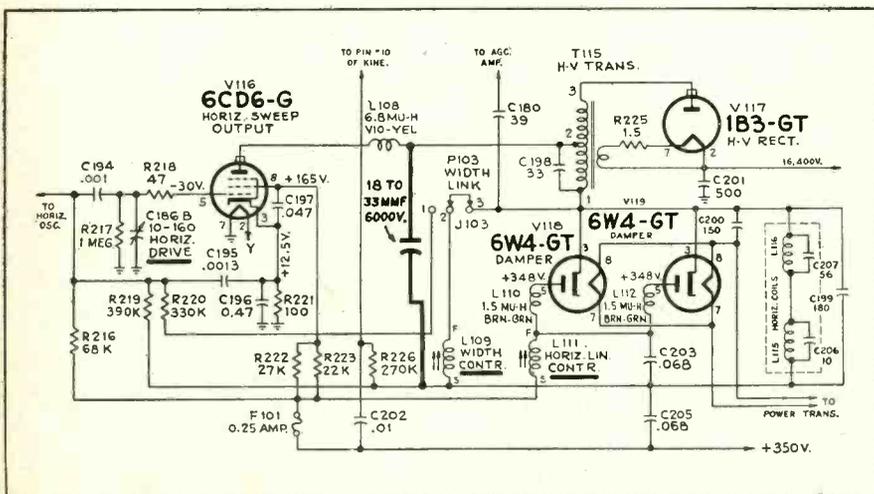
quickly improvised from a plug-in type night light. It is quite discouraging to come back to your record player a couple of days after you last used it, and find that the system has been perking all the time. If the auxiliary outlets on the chassis are suitable, simply plug the lamp into one of these outlets. A suitable outlet is one whose power is turned on and off by the amplifier's on-off switch. Some amplifiers have two a-c outlets and only one of them is controlled by the switch. If the desired outlet is occupied, use a double socket.

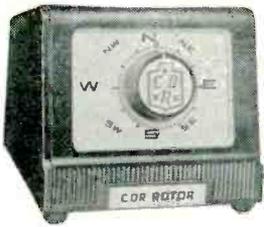
If the chassis is concealed, a remote pilot lamp can be hooked up using an extension cord.—*Hugh Lineback, Stillwater, Oklahoma.*

### \$\$\$ FOR YOUR IDEAS!

Shop Hints wanted. ELECTRONIC TECHNICIAN will pay from \$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do as long as it can be followed. Photos are desirable. The amount paid will depend upon how original and practical the idea is. Unacceptable items will be returned. Send your entries to "Shop Hints" Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.

Partial schematic of the RCA Chassis KCS81 showing the horizontal output circuit.





AR-22



TR-2



TR-4



# 5-star feature...



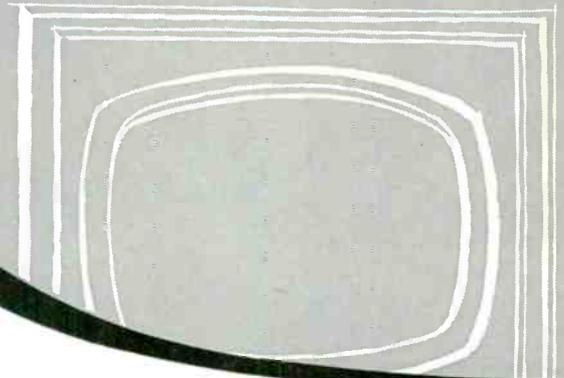
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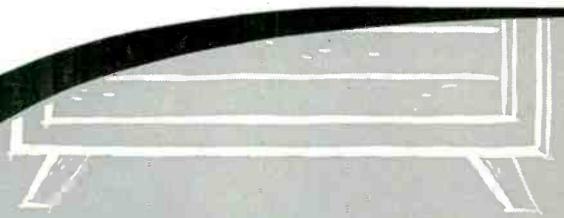
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# New Tube Testers

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## ← Affiliated U-CHECK-'EM

The "U-Check-'Em" utilizes only 40 long-life, phosphor-bronze sockets for self-service testing of all common radio-TV tubes. It is further reported that the new models employ a system of dynamic emission, with a universal filament control. All models are fitted with charts listing 250 of the most popular tube types. Data on 300 additional tubes is also available. Affiliated Television Labs., Inc., 112-07 Francis Lewis Blvd., Queens Village 29, N. Y. (ELECTRONIC TECHNICIAN 12-5)

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## ← Vis-U-ALL TESTER

Designed to stimulate traffic for the service dealer, a new counter merchandiser, the Vis-U-All Model V101, is being distributed through radio parts distributors. Checks auto radio tubes and vibrators. It provides an excellent quality check for OZ4 tubes and handles all of the latest hybrid types. A handy substitution guide is provided on the instruction chart showing interchangeable types. Vis-U-All Products Co., 303 Fuller Ave., N. E., Grand Rapids 3, Mich. (ELECTRONIC TECHNICIAN 12-6)

As described in ELECTRONIC TECHNICIAN send me more data on the B&K Accessory Socket Panel Model 510. (12-7)

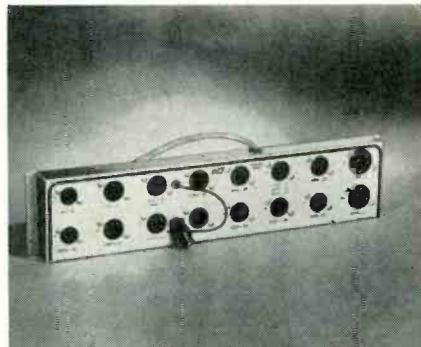
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## ← B&K ACCESSORY PANEL

A new Model 510 Accessory Socket Panel extends the use of the Model 500 Dyna-Quik Dynamic Conductance tube tester. Simple addition provides 50% more sockets which enables a quick-check of many more TV, and radio tube types, both old and new, including portables. It fits inside the cover of the Model 500. Completely wired, ready to install and connect. Size 1/4" x 3". Net, \$29.95. B&K Manufacturing Co., 3731 N. Southport Ave., Chicago 13, Ill. (ELECTRONIC TECHNICIAN 12-7)

As described in ELECTRONIC TECHNICIAN send me more data on the Century Fast-Check Tube Tester Model FC-1. (12-8)

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## ← Century TUBE TESTER

Only 2 settings required to test over 600 tube types quickly. The Fast-Check Tube Tester Model FC-1 eliminates time consuming multiple switching and checking of roll charts. It has 41 tube sockets to accommodate all present and future tube types, including: the newest series-string stype for TV; OZ4's and hybrid auto radio type; and voltage regulators. It is line isolated to eliminate shock hazards. Century Electronics Co. Inc., 111 Roosevelt Ave., Mineola, N. Y. (ELECTRONIC TECHNICIAN 12-8)

## Pickup Cartridge

(Continued from page 35)

ments in the mechanical coupling between the stylus and the ceramic unit as well as in the unit itself, has resulted in types of considerably increased compliance and reduced tracking force as low as 1 gram.

At one time a low tracking force meant that the unit was very delicate and therefore should be handled with very loving care. This of course was regarded as a disadvantage, and the manufacturers have largely overcome this difficulty. There are many pickups that require only a light tracking force, yet are rugged enough to be handled relatively roughly without injury.

When recommending a cartridge that has a low tracking force characteristic, it is important to consider the turntable, tone arm and other mechanical conditions. The trip mechanism on some changers may flip the arm back instead of triggering the change cycle. Some changers let the arm down with a bang, and the pickup will do a jitter-bug dance before it will settle down.

### Electrical Characteristics

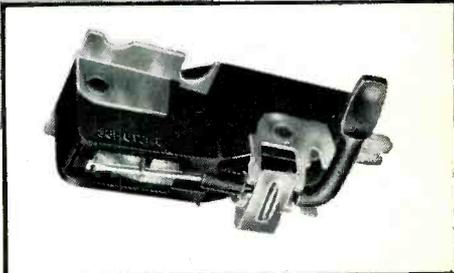
Other practical considerations are, having the right impedance, level matching, and equalization characteristics. The moving coil and magnetic types have an output that is proportional to the velocity of stylus movement. For these types of pickups, high-gain preamplifiers are provided with a suitable input impedance. It may be necessary to adjust the input impedance of some preamplifiers to the value recommended for a particular type of cartridge. On the other hand, the output of the ceramic cartridge and the FM pickup has a constant amplitude, being dependent upon stylus deviation and not its rate of movement. Manufacturers' specifications for equalizer networks should be observed. In some situations when using a ceramic or crystal cartridge it may be possible to do away with the equalization network.

That we have discussed cartridge limitations in detail should not obscure the most important point; namely, high fidelity sound reproduction may be obtained from a wide variety of good quality cartridges regardless of which one of the four types is used. Fortunately, most of

(Continued on page 41)



**Sonotone "3 Series"**  
**Ceramic Cartridges**



**New super-fidelity cartridge opens the door to profitable hi-fi business!**

Here's the cartridge that set utterly new standards for performance. Response—flat from 20-15,000 cycles, *without* equalization ... Compliance — 2.0 minimum ... Output—a whopping 0.5 volts!

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"in view of its excellent listen-

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\*The Audio League Report, April 1956—the hi-fi authority.



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3P-3D (3 mil. diamond) .....	23.00
3P-1S (1 mil. sapphire) .....	12.50
3P-3S (3 mil. sapphire) .....	12.50

Electronic Applications Division

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# New Audio Products



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As described in ELECTRONIC TECHNICIAN send me more data on the Jensen line of loudspeakers. (12-9)

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## Jensen SPEAKERS

Nine new unitary loudspeakers have been added to the line of Coaxial and Triaxial high fidelity loudspeakers. New speakers include: a 3-way 15-inch Triax; four new type CX Coaxial 3-element speakers in both 12-inch and 15-inch sizes, the CX120 shown, is a 12" unit; two new Duax 2-element loudspeakers in 12" and 15" sizes; and two new Unax deluxe extended range speakers in 8" and 12" sizes. Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill. (ELECTRONIC TECHNICIAN 12-9)

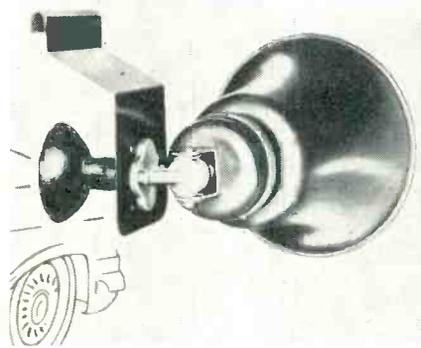
As described in ELECTRONIC TECHNICIAN send me more data on the Atlas Car Window Speaker Support Model WM-1. (12-10)

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## Atlas SUPPORT

Quickly enables any car or truck to become a mobile sound vehicle. The Model WM-1 safely attaches to any automobile window by means of its rubberized cork-lined channel, which slips over the window glass top and locks tightly against the window glass slot when the window is raised shut. Constructed of sheet steel and finished in grey enamel. It comes complete with all hardware for attaching the speaker. Atlas Sound Corp., 1451-39th St., Brooklyn 18, N. Y. (ELECTRONIC TECHNICIAN 12-10)

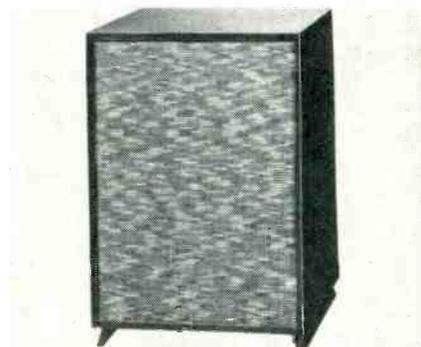
As described in ELECTRONIC TECHNICIAN send me more data on the Sonotone "110" Economy Speaker System. (12-11)

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## Sonotone SYSTEM

A true coaxial speaker system, the "110" is engineered to provide the widest possible range of sound at modest cost. At the heart of this system is the new 12-inch coaxial loudspeaker, CA-12, which uses an inductor-capacitor dividing network. Response is 40 to 14,000 cycles. Direct radiation arrangement allows full utilization of the elliptical cone tweeter and produces a wide dispersion. It is recommended for a budget two-system stereo installation. Sonotone Corporation Elmsford, N. Y. (ELECTRONIC TECHNICIAN 12-11)

As described in ELECTRONIC TECHNICIAN send me more data on the GE Tweeter Demonstrator. (12-12)

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## GE TWEETER

Customers can hear how a G-E A1-404 tweeter improves hi-fi treble response in a single-cone speaker system with this colorful, compact counter demonstrator. Pre-assembled unit, including tweeter and G-E A1-421 cross-over network, is connected to store's single-cone speaker system. Flip of switch (center of unit) cuts in tweeter with its 1500-15,000 cycle response. General Electric Specialty Electronic Components Dept., W. Genesee St., Auburn, N. Y. (ELECTRONIC TECHNICIAN 12-12)

## Pickup Cartridge

(Continued from page 39)

the better amplifiers now on the market have provisions for both high and low impedance pickups.

An amplifier with no equalization network, one requiring high level input or high impedance, would indicate the choice of a good ceramic unit. Where the amplifier has a pre-amplifier and equalization network, ceramic, magnetic or moving coil types may be used. Where low impedance is required, one of the latter two should be selected.

In any case, you should be sure the tone arm is physically capable of mounting the cartridge selected. Where the arm and associated mechanisms are capable of making the most out of any cartridge's capabilities, preference should be given to the one with highest compliance, least distortion, greatest frequency range and lowest needle pressure (tracking force).

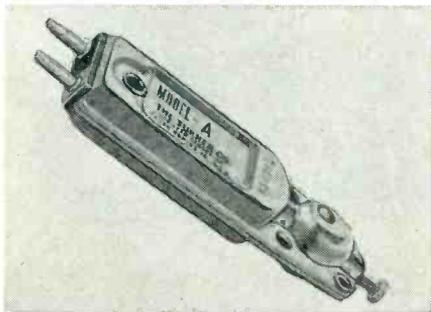


Fig. 11—Turner's crystal type cartridge. External capacitor cuts output to 2 volts or less, when needed.

It should be noted that there are millions of inexpensive phonographs in use which are not capable of top performance. These low fidelity jobs commonly use inexpensive crystal cartridges, and equivalent replacements should be made when needed. A poor speaker and amplifier, such as those often found in children's phonos, could not reproduce a broad range of frequencies, even if the pickup was capable of doing so.

There are, however, many moderately priced phonos in which the cartridge limits performance. In such cases, improvements can be made by replacing the old cartridge with a better one. For details on upgrading phono performance, as well as an extensive discussion of cartridge characteristics, see the article, "Let's Look at Phono Pickup Cartridges," in the September 1957 issue of *ELECTRONIC TECHNICIAN*. •

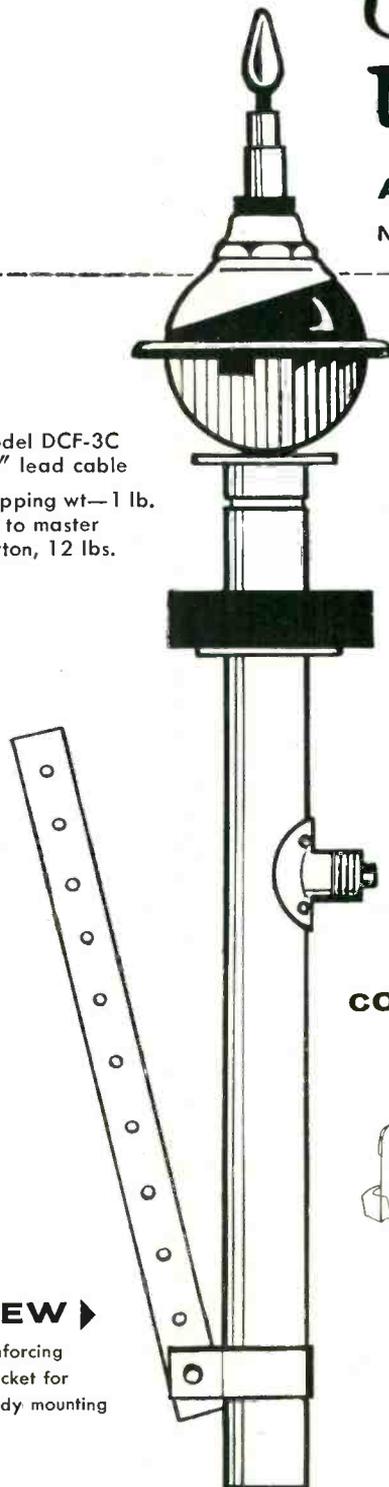
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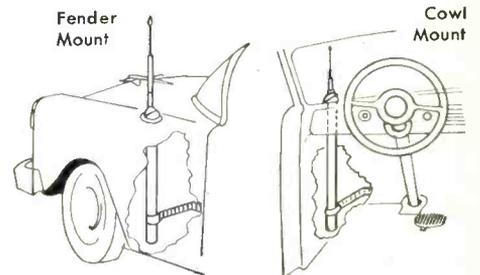


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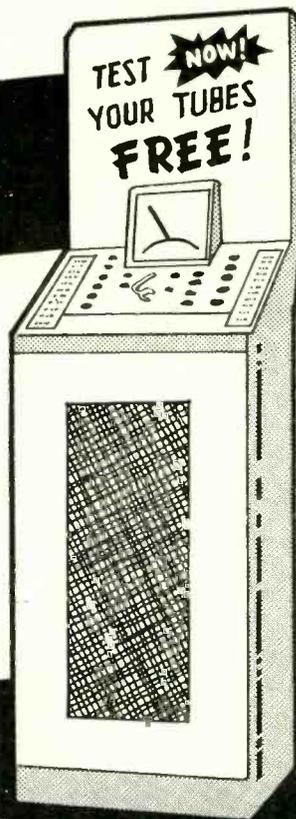
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## Equipment Leasing Corporation

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## Tube Testers

(Continued from page 27)

At that time, a minority of technicians believed quite the opposite. Today, more and more service operators are inclined to favor their handling of tube sales through self-service testers themselves instead of forfeiting the business to drug store chain operators and vending machine companies. Here are the reasons they cite: Do-it-yourself is an established way of life for many people; if we drive them away, they'll flock to the supermarkets. The skyrocketing growth of these testers prove they're no novelty. Public confidence in technicians is promoted by allowing customers to make their own tube tests.

Perhaps the most important inducement for independent electronic maintenance outlets to enter the self-service market is the attraction of extra income—plus economic survival by keeping tube replacement business out of the hands of vending machine operators. "If you can't lick 'em, join 'em" is the refrain of more than one service technician.

Manufacturers of self-service testers appear to have one of two different marketing philosophies. One school of thought favors selling to chain operators. The other focuses on selling testers to service technicians through electronic parts jobbers. (Readers interested in the names and addresses of recommended tester manufacturers will be furnished such information on request.)

### How to Start Your Own Business

If you have even a modest amount of capital available, you can buy a few machines and start building a self-tester route. Before going into the details, one point must be emphasized: A self-service tester is no substitute for a good shop tube tester. Since self-service testers are designed for non-technical people to operate, they must have highly simplified test setup procedures. Operational simplicity generally calls for some compromise of testing completeness. In other words, self-service machines will do a fairly accurate job of pointing out which tubes are bad, but most tube experts recommend that technicians use professional models in their own servicing work.

Self-service testers are not cheap machines. They often have a large number of sockets to minimize cus-

tomers setup, commonly are mounted atop a tube storage cabinet, are generally built to take rugged use, and often have customer-attracting display signs.

Depending on tester designs, these machines generally sell in the \$200-\$300 price range. By the time you stock a tester installation with a tube supply, your per location investment is \$350 to \$400. So the first step is to establish your financing. Let's say, for example, your available cash in the form of savings, family assistance or bank loan is

\$1500. That's about enough to set up four complete locations.

The second step is to select potential store locations very carefully, both from the viewpoint of high customer traffic and cooperative store manager. Typical prospects are food stores, candy stores, drug stores, department stores, dime stores, etc., preferably in your own neighborhood to facilitate tube stock replenishment.

Then approach the store owner or manager and sell him on the idea of  
(Continued on page 45)



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



## ← Aerovox L-C CHECKER

The new Model 97 L-C Checker is completely redesigned and engineered according to the latest design theories. Some new features are: extended frequency range, from 150 kc to 44 mc; recessed front panel with an extra-large, easy-to-read dial; and a magnifying indicator. A partial list of applications include checking capacitors; alignment; resonant absorption troubles; natural period of antenna and transmission lines; etc. \$69.95. Aerovox Corp., New Bedford, Mass. (ELECTRONIC TECHNICIAN 12-1)

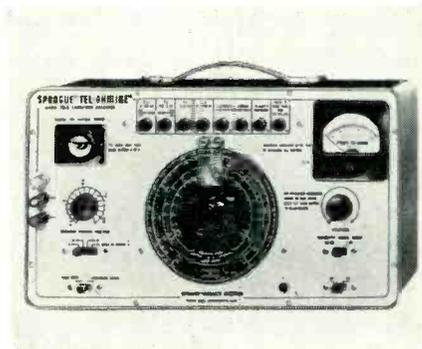
As described in ELECTRONIC TECHNICIAN send me more data on the Sprague Tel-Ohmike 4-in-1 Capacitor Analyzer Model TO-5 (12-2)

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Company \_\_\_\_\_

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



## ← Sprague TEL-OHMIKE

The Capacitor Analyzer Model TO-5 is designed for TV service work. This instrument measures capacity, power factor, leakage current, and insulation resistance of capacitors; plus, the turns ratio of iron-core transformers. Its many features include: pushbutton range selection; extended capacitance ranges from 1  $\mu$ f to 20,000  $\mu$ f; insulation resistance up to 20,000 megohms; direct leakage current readings at rated d-c working voltage; and a three-range power factor indicator. Sprague Products Co., North Adams, Mass. (ELECTRONIC TECHNICIAN 12-2)

As described in ELECTRONIC TECHNICIAN send me more data on the Seco Grid Circuit Tester Model GCT-8 (12-3)

Name \_\_\_\_\_

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Company \_\_\_\_\_

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



## ← Seco TUBE TESTER

New grid circuit tube tester, Model GCT-8, is designed to check grid condition. The presence of any one or a combination of the following faults will register as "bad" on the eye indicator: grid emission, grid-to-cathode shorts, cathode-to-heater shorts, grid-to-heater shorts, grid-to-plate shorts, plate-to-heater shorts, grid-to-screen shorts, screen-to-heater shorts, heater-to-suppressor shorts, and grid-to-suppressor shorts. The Seco Manufacturing Co., 5015 Penn Ave. South, Minneapolis, Minn. (ELECTRONIC TECHNICIAN 12-3)

As described in ELECTRONIC TECHNICIAN send me more data on the Sencore Transistor Checker, Models TRC4 and TDC22 (12-4)

Name \_\_\_\_\_

Address \_\_\_\_\_

Company \_\_\_\_\_

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



## ← Sencore TRANSISTOR CHECKER

A new and improved transistor checker also tests crystal diodes and selenium rectifiers. The TRC4 shown is the same size as the TDC22 and has the same features of non obsolescence by using test leads and sockets for easy hook up. The TRC4 is not designed to supersede the TDC22, but rather to present a step-up in design at a cost of \$17.95 compared to \$15.95. The new checker also tests forward-to-reverse currents on rectifiers. Service Instruments Corp., 171 Official Road, Addison, Ill. (ELECTRONIC TECHNICIAN 12-4)

(Tube Testers, Continued from page 43)

your installing a self-service tester in his store. Point out it will attract more customers, and without any investment on his part provide a steady additional source of income. Though individual arrangements vary, 25% of list to the store owner is typical. That's often \$50 or more net profit to him every month. The agreement is put in writing, tester and tubes remaining your property. In effect, the store owner has the tubes on consignment. You bill him for tubes sold, less his 25%.

It is reported that in areas where different self-service routes are very competitive, stores selling a great many tubes receive as much as 40% of list from the route operator.

With the example of \$1500 starting investment, you make four installations. A service shop could easily handle 20 or more installations, since tubes generally need to be replenished only once each week. Let's see how the finances work out.

#### Dollars and Cents

Depending on how good the store location is, gross sales should range from \$100 to \$300 monthly. Tubes are sold at list price. Suppose the four locations gross \$800. \$200 goes to the store owners. The original cost of the tubes may have been \$360 if your discount was 50% and 10% for a 55% total (greater discounts, 60% and 2% cash, are sometimes available for large purchases). So your gross profit is \$240 per month, or \$2880 per year—not bad for a \$1500 investment. Even when you deduct \$100 for tester depreciation and \$80 for automobile expenses, \$2700 is still a good income for the work involved. Poor location of the four testers could drop your net to \$1000 annually; very good location raise it to \$4000.

Buying self-service testers is not the only way of getting into the business. A company may have a financing arrangement which allows technicians to obtain the machines by rental at a cost as low as \$5 per month. The idea here is to allow the technician's investment to place many more machines in operation than outright purchase would permit. The technician would not own any of the machines, but the same money that would purchase a few testers could, by rental, place 10 to 20 of them in revenue producing locations. Rental fees are also immediately tax deductible; purchase costs must be amortized over a few years.

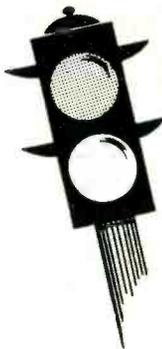
There is still another profit ele-

ment in the self-service picture. Technicians generally display their own names and addresses on their machines. This is an excellent form of advertising since the tube purchaser is encouraged to call that shop if repairs beyond tube replacement are needed.

One byproduct of self-service sales at list prices is the effect of supporting a price umbrella over regular technician-to-customer sales.

By going into self-service tester operations, technicians keep tube replacement business within the servicing industry, making good profits

in the bargain. And from the viewpoint of the public's welfare, even though a great many technicians justifiably do not believe it desirable for most set owners to attempt to make their own repairs, do-it-yourself is being recognized as an established fact of life for a segment of the population. When this segment buys tubes at a self-service machine, it is much better off to have the recourse of going back to a trained technician than to have bought the tube at a chain vending operator's machine whose service starts and ends right at the machine. ●



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- ✓ big 7½" clear plastic meter
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# New Product Review

## Amperex EF86/6267

The EF86/6267 is a nine-pin miniature pentode, designed for preamplifier and input stages having stringent requirements with regard to minimum hum, noise, and microphonics. It is a direct plug-in replacement for the older Z729. The low-frequency noise generated by the tube is equivalent to a voltage of 2  $\mu$ v on the control grid in the bandwidth from 25 to 10,000 cps. The electrode structure is exceptionally rigid to keep microphonics to an absolute minimum. There are no appreciable internal resonances below 1,000 cps and vibrations at higher frequencies are effectively damped out by the chassis and the tube holder. Hum is kept to a minimum by winding the heater as a double helical wire with mutually canceling magnetic fields. Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I. N. Y. (ELECTRONIC TECHNICIAN 12-17)

## C-D CAPACITOR RACK

New self-service capacitor display rack is designed for easy self-service and maximum display value. It is specifically created to provide fast turnover on the new "preferred-type" list of twist-prong electrolytics. Each single-section rack holds 360 cartons, or 720 cartons for the dual-section unit. The rack features a lighted canopy, slanted shelves for easy selection of types, convenient front re-loading, and no "blind stock." Cornell-Dubilier Electric Corp., 1006 Hamilton Blvd., South Plainfield, N. J. (ELECTRONIC TECHNICIAN 12-18)

## Astron CAPACITORS

The Mylar metallized capacitor, Type RQL is a miniature unit in a hermetically sealed case. It is reliable at temperatures up to 125° without derating, and is available in a wide range of case styles and constructional variations. Astron Corporation, 255 Grant Ave., E. Newark, N. J. (ELECTRONIC TECHNICIAN 12-19)

## Anchor KURE-ALL

Designed for use with either parallel or series wired circuits, the UK200 "Kure-All" can be used for open cathode, heater-cathode short, Control-grid short, slow heating or low emission, and any combination of the above faults. List price is \$5.50. Anchor Products Co., 2712 W. Montrose, Chicago 18, Ill. (ELECTRONIC TECHNICIAN 12-20)

## Tung-Sol NEON LAMPS

Newly listed types include the popular NE-2 and NE-51. Also available are the NE-2A, NE-2B, NE-2AR6, NE-2AR10, NE-AR20, NE-2BR6, NE-2BR10, and NE-2R6. Technical and sales information is available. Tung-Sol Electric Inc., 95 Eighth Ave., Newark 4, N. J. (ELECTRONIC TECHNICIAN 12-21)

## RCA TUBES

The 3BU8 and 6BU8 are sharp-cutoff twin pentodes of the 9-pin miniature type intended for use in sync circuits and age amplifier circuits of TV receivers. Heaters are CWU type.

One pentode unit performs the function of combined sync separator and sync clipper; the other the function of age amplifier tube.

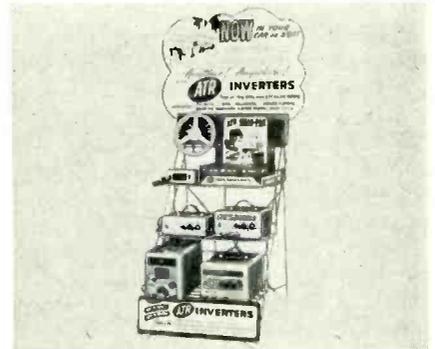
These tubes have a common cathode, grid No. 1, and grid No. 2. In addition, Grid No. 1 and Grid No. 3 of each type have a separate base-pin terminal and may be used independently as a control electrode. RCA Tube Division, Harrison, N. J. (ELECTRONIC TECHNICIAN 12-22)

## Sarkes Tarzian KIT-PAKS

Two popular silicon rectifier models are now being displayed and sold in all-new packaging. Twenty M-500 Replacement Kits for radio are neatly packed in a 3-color display carton. The individual clear plastic kits have been redesigned for better product visibility and compactness. Sarkes Tarzian, Inc., Rectifier Division, Bloomington, Ind. (ELECTRONIC TECHNICIAN 12-23)

## ATR DISPLAY STAND

A light, portable display stand, made of heavy gauge steel wire. Occupies 4 square feet of floor space, and is 5½ ft. high. Displays 5 or 6 inverters and



a carton holding 6 Shav-Paks. At the top of the stand is a description of the inverter. American Television & Radio Co., 300 East 4th St., St. Paul 1, Minn. (ELECTRONIC TECHNICIAN 12-41)

## Electronic Chemical CAN DISPLAYS

Two two-color can display counter pieces. One for the No-Noise Volume Control and Contact Restorer, priced at



\$2.25 (see illustration). The other for the No-Noise Tuner-Tonic, \$3.25. Each holds a single can. Electronic Chemical Corp., Jersey City 4, N. J. (ELECTRONIC TECHNICIAN 12-42)

## Raytheon TUBES

The 4AU6 is a heater-cathode type sharp-cutoff pentode of miniature construction designed for use as a high-frequency amplifier in radio and TV receivers. The 4AU6 is identical to the 6AU6 except that it has a 450 ma CWU heater.

The 17CFP4 is a direct view, rectangular face, electro-static focus and magnetic deflection picture tube. It employs a spherical filter-glass face plate and an aluminized screen. No ion-trap magnet is required. Raytheon Manufacturing Co., 55 Chapel St., Newton 58, Mass. (ELECTRONIC TECHNICIAN 12-26)

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## New Books

**STEREOPHONIC SOUND.** By Norman H. Crowhurst. Published by John F. Rider Publisher, Inc., 116 W. 14 St., New York 11, N.Y. 128 pages. Paper cover. \$2.25.

1957 could be called stereo year, the year three-dimensional sound gained substantial recognition from audiophiles and manufacturers alike. We can expect to see a great deal of stereo equipment on the market in the coming months and years. So we can certainly consider this compact volume most timely. The text is well-written, authoritative and highly informative, as might be expected from the author's extensive experience in hi-fi and writing. The first sections deal with bin-aural listening, reverberation, transients, theory, etc., without any complex presentations. Then the text gets into the details of various systems—2-channel, 3-channel, even the very interesting experimental single channel stereo system. Program media, recording procedure and speakers are also amply discussed. As a background for servicing stereo sound, and as a guide for enjoying it in your own home, this book is highly recommended.

**ELEMENTS OF MAGNETIC TAPE RECORDING.** By M. N. Haynes. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N.Y. 392 pages. Hard cover. \$7.95.

Here is a much needed book on all of the most important aspects of tape recording, authored by a man who has been in the field since 1936 and is now vice-president of Amplifier Corp. of America. It is divided into four sections. The introductory section covers the fundamentals. The second section discusses the recording process, tape phenomena and editing. The third relates to tape handling mechanisms, battery operation, performance specifications and basic repair. The last section explains circuitry. An attractive aspect of this nicely written book is the inclusion of many photos and technical details describing commercial equipment currently available.

**RECEIVING AERIAL SYSTEMS.** By I. A. Davidson. Published by Philosophical Library, Inc., 15 E. 40 St., New York 16, N.Y. 152 pages. Hard cover. \$4.75.

This British book covers both receiving and transmitting antennas. Design and operation are discussed, and one chapter is devoted to TV installations. This volume is of interest from a theoretical viewpoint, but it contains little data on TV antenna designs currently on the market.

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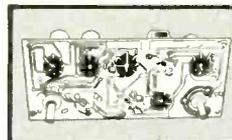


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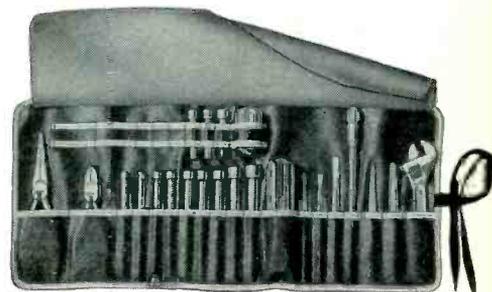
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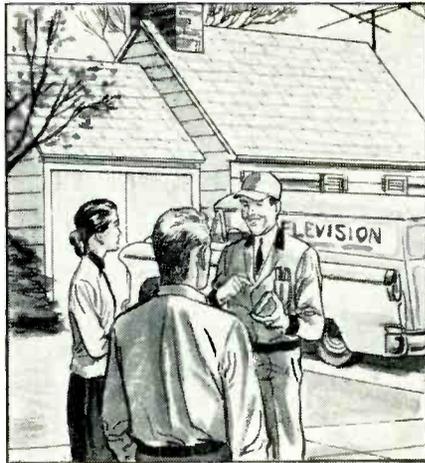
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# The Case of The Serviceman WHO SAVED A MARRIAGE!



Smith wanted to watch the fights; Mrs. Smith insisted on "This Is Your Wife". Fights they got, since a second set was within their means but there was only one antenna and no multi-set coupler they tried had worked satisfactorily.



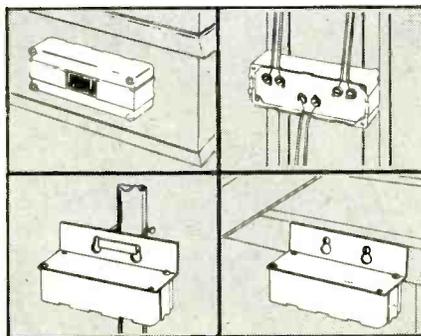
"You won't need another antenna with this 'NEW' Jerrold Multi-set COUPLER", said the TV Serviceman. "Its special design allows for equal distribution of the signal with *exceptionally low loss* and without smearing or ghosting"



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## ANTENNA Couplers

(Continued from page 33)

now down 3 db, the theoretical minimum.

Other systems may use "elevator coils," essentially coiled up transmission lines, as baluns to act as impedance changing sections. These devices are dependent for their mode of behavior upon the frequency at which they operate. They must be a quarter-wavelength long or three quarters of a wavelength long to operate according to theory and must also be designed to show a proper characteristic impedance. It is obvious that a quarter wavelength at channel 2 is not the same as at channel 6, although the situation is helped by the fact that a channel 4 quarter-wavelength is about equal to three quarter-wavelengths at channel 10. It is more than just a coincidence that approximately the center frequency of the upper channels is the third harmonic of the center frequency of the lower channels, and if the loss on either side of the center frequency is kept within reasonable limits, these units may be used to give satisfactory reception.

Still other systems make use of resonant circuits to act as coupling devices. It could be said that the circuit is resonant at one frequency and therefore other channels might have to go begging. Just as it is possible to design wide frequency response into a device that inherently has a narrow pass band, so it is possible to overcome what might look like a one or two channel device to accept all channels, and in addition offer certain advantages not found in other couplers.

So far, the problem appears fairly straightforward. Let's take a brief look at some of the components. Today's broadband antennas are good, they show VSWR's of from 1.5 to 2.0, all across the band. This is not bad, and they can be called 300-ohm sources and be not too far wrong; provided the antenna is carefully mounted, with no metal objects close to its active elements, especially metal objects that are parallel. Such metal will lower the impedance of the antenna.

How about the sets? Well, a good receiver may show from 200 to 400 ohms impedance at the antenna terminals—but only when turned on and only to the channel to which it is tuned. This is a problem. Consider, when two sets are hooked into a

system, how often are they both turned on at the same time, and then how often are they tuned to the same channel? If this simultaneity were expressed as a percentage of playing time, it would be a very small percentage indeed. Now our previous picture doesn't look so good—we no longer see a pair of paralleled loads whose effective impedance is the same as the antenna's. For instance, a set tuned to Channel 13 would appear as a very low impedance to a Channel 2 signal, while a set tuned to Channel 2 will look like a very high impedance to a Channel 13 signal.

This adversely affects the system, since all mismatches shown at the sets appear as a mismatch between antenna and coupling device, and between coupling device and sets. Between these components are the transmission lines. Transmission lines have peculiar habits. By redrawing the system and considering the real impedances with a typical condition, the circuit would look like that shown in Fig. 4.

Consider this system from the viewpoint of a Channel 2 signal. The signal currents delivered from the antenna proceed down the antenna lead to the coupler, are induced in the coupler secondary, and proceed along the branch lines to the sets. Since set A is tuned to Channel 2, it can be given credit for a fair match, so that most of the energy in this leg is dissipated in the load. At set B however, which is tuned to Channel 13, the Channel 2 signal sees a very low impedance, practically a short circuit. The energy arriving here is reflected, and starts back up the lead. Arriving at the coupler, part goes back up the antenna lead and is reradiated, and part goes along the lead to set A, where it shows up as a ghost or smear, due to the delay it suffered in making the roundabout trip. At the same time, this reflected signal produced standing waves on the lines. If the procedure is reversed and the situation is considered from the viewpoint of the Channel 13 signal, the situation is just as bad, but in reverse order.

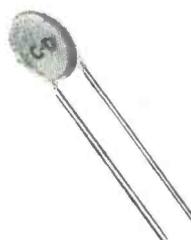
This condition stemming from the sets, presents a problem for all couplers. Thus it would seem that we are faced with a situation in which we cannot help but have mismatched conditions, as long as TV sets are used for loads. This makes the problem a little different. If it is accepted that the lines are not going to be loaded properly, and therefore must have reflections and standing waves, then the sets must be isolated from each other, specifically the ability to

reduce a signal travelling from set-to-set, as reflected signals do. Also, anything that can be done to make the loads represented by the sets appear to have less variation will improve the standing wave conditions along the lines, and reduce line losses.

At this time, it can be noted that the coupler introduces losses other than those caused by the dividing action of the coupler. Besides varying the line losses due to the standing waves, paralleling the input of

one tuner with the tuned circuits of the coupler (in the case of balun or transformer types) and the tuned circuits of the other set's tuner, interaction takes place and one set is affected by the tuning of the other. The resistive network helps considerably, since the loss it shows is effective isolation and also tends to make the tuners independent of each other. However, it does not improve the match, and has high loss.

Once again in an effort to obtain a unit with more efficiency, and in



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line with the foregoing discussion, a combination type consisting of transformer and resistive coupling was designed. Fig. 5 shows an autotransformer type of winding. It was used because it can be made somewhat less critical of frequency variations.

Consider a reflecting signal from Set B going back along the line to the coupler. It sees a circuit which looks like Fig. 6. The resistance imposed by  $R_1$  to  $R_4$  is twice as much as the resistance path for the desired signal going from the transformer RA to the set. The center resistor of the network is the effective impedance of the autotransformer and varies with the frequency of the signal. However, properly designed, such a coupler will show an average attenuation of less than 6 db, theoretically 4.5 db. This is a low figure; many couplers tested under real, not ideal, conditions showed losses exceeding 9 db on the low band and 14 db on the high band.

It would seem that the best results should be obtained when the coupler is mounted close to the antenna, since this lengthens the lines from the coupler to the sets, it increases the loss between sets, and improves isolation. Extra lead in might mean more pickup of undesired signal and more line loss. In the final analysis, it behooves the technician to survey the problem and temper his knowledge with good judgement.

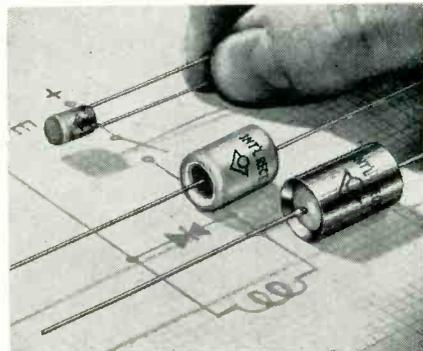
One of the situations that might present itself in the field, is unequal picture strength. It could be very embarrassing if the weaker picture happens to be on a new set. This is usually due to differences in receiver sensitivity. Fortunately the new sets can handle weaker signals. If the rest of the antenna system is satisfactory, and if the sets must be matched, then the signal going to the set showing the stronger picture will have to be attenuated. Fig. 7 shows several balanced attenuators for a 300-ohm system. After fighting a battle to get as much signal into the set, it does seem a bit incongruous to have to voluntarily cut the signal. Before resorting to the pads, it may be possible to improve matters by switching the position of the sets on the coupler. Some types of couplers provide for one set to be directly connected to the antenna, and the other set is connected through an isolation network. Properly designed pads also improve impedance match, and provide additional isolation.

Interference problems due to the proximity of two or more TV sets, antennas or transmission lines may be caused by radiation or direct

pickup. Common troubles may come from a harmonic of the horizontal frequency, or the local oscillator in some sets, particularly when the sets are tuned to stations which are four channels apart such as 7-11, 9-13, etc.

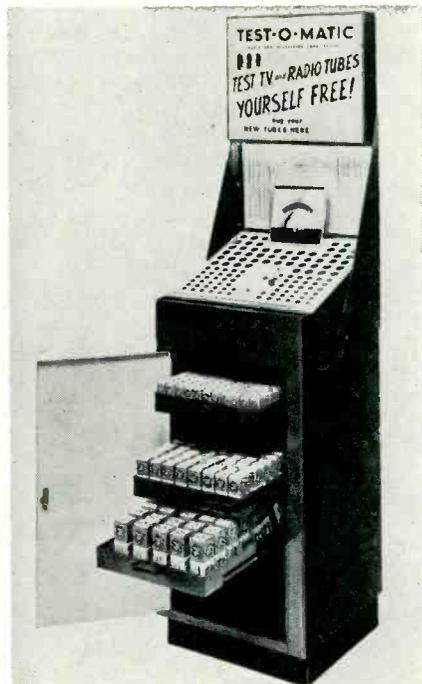
### Int'l Rectifier PROTECTORS

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vironmental conditions are encountered. Available for d-c voltages ranging from 15 to 154 volts, and at maximum coil currents ranging from 250 to 600 ma. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. (ELECTRONIC TECHNICIAN 12-44)

### Self-Service



Do-it-yourself TV set owners can check their own tubes on this machine made by Shell Electronic Mfg. Service operators install a route of them in high-traffic stores.

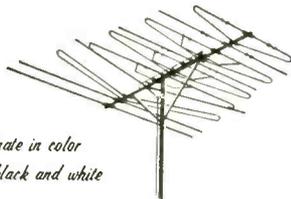


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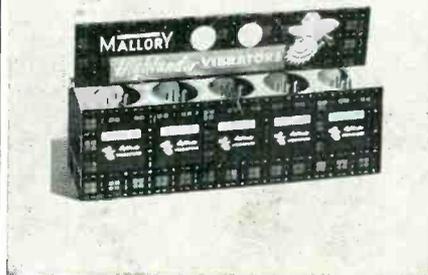
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**Walsco CABLES**

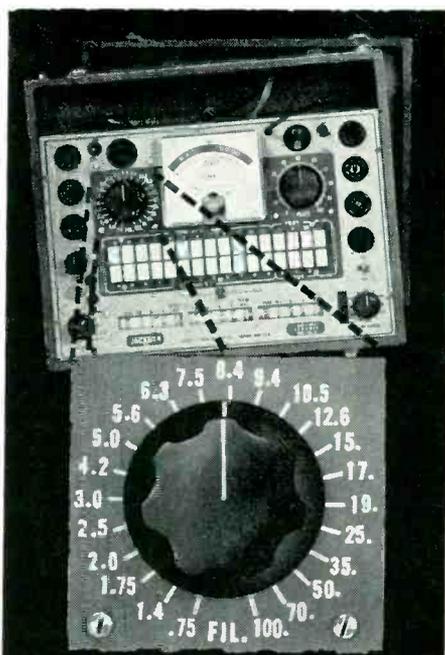
Shielded tenite cables, with molded-on connectors, for use with hi-fi systems and sound equipment. Supplied in lengths from 10" to 72", with various combinations of phono pin plugs and jacks, alligator clamps, spade lugs, and



photo jacks. Will withstand severe strains. Available in a rotating display rack. Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill. (ELECTRONIC TECHNICIAN 12-50)

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Write for free Catalog 57.

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Atlas Radio Ltd., Toronto, Canada

**You and the FCC**

(Continued from page 29)

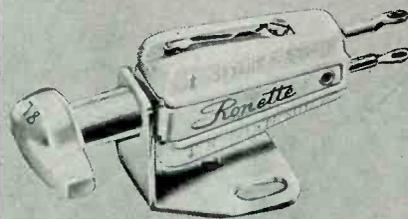
problems which are economical yet satisfactory.

Prior to August 31, 1955, it was mandatory that an FCC construction permit be obtained by the proposed radio user before the commencement of any construction or installation of a radio station. This included buildings to house the radio station, and the antenna with its supporting structure. A combination construction permit and license was normally issued, and by a simple notification on Form 456 to the Engineer-in-Charge of the local district of the FCC, that the installation was completed, regular use of the system could begin.

Today, the FCC permits the installation of radio equipment without prior authorization from the Commission, in all but a limited few kinds of stations in the land mobile services. Of course, this exemption from the usual construction permit does not apply to those radio stations wherein the antenna and supporting structure is a possible hazard to air navigation, and is subject to the FCC rules regulating antenna towers, (Part 17). The operating personnel of a communications service company should be thoroughly familiar with Section 1.333 of the Commission's Rules which sets forth the specific exceptions wherein it is necessary to obtain a construction permit before the construction of a radio station or the installation of equipment. It is the responsibility of the proposed radio user to know when a construction permit is necessary, and in those instances, the FCC cannot license any equipment wherein the construction was begun without a permit. There are cases on record where the Commission has required that towers be dismantled, when they were constructed prior to the receipt of a valid construction permit by the proposed radio user.

As far as specific kinds of equipment are concerned, the licensee in the regular land mobile services may use any equipment in the FCC's "List of Equipment Acceptable for Licensing in the Radio Services other than Broadcast," as long as the equipment meets the technical limitations on the license. In these Services, the FCC does not license a specific make and model of equip-

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37  
national  
brands**

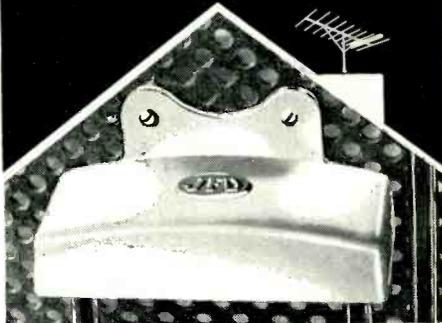


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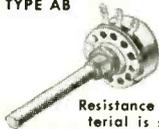
Industrial electronic servicing is profitable business for you. Especially when you stock and replace with dependable Ohmite components... the line your industrial customers know and prefer. With Ohmite you eliminate call backs, insure quality replacement, build customer satisfaction, and increase your industrial (and home) electronic servicing business. Service such industrial equipment as mobile radio, aircraft and marine radar and radio, electronic controls for factory processes and automation, industrial P.A. and intercom systems, and—medical and dental electronics. It's a big market!



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TYPE AB**



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ment, but allows the user to choose from the above list, which the Commission publicly announces as acceptable. This list is maintained at each local district office of the Commission. The two-way radio technician should be familiar with this list, in order to install only that equipment which is acceptable to the Commission.

For those communication service companies desiring to provide a little plus service to their customers over and above the routine servicing, there exists the opportunity to act as emissaries of the FCC by being conversant with the rules and regulations and the associated forms. The Federal regulation is exceedingly complex, and therefore, it is difficult for a land mobile radio user to become familiar with the rules and maintain a valid FCC license. In many cases, the service company is able to insure continuity in a customer's FCC authorization, by a brief reminder to file proper renewal forms 60 days prior to the license expiration.

A complete list of the Commission's Rules and their other publications may be obtained from the FCC's Washington, D. C. office, or any of its field offices. The following is a list of Government Printing Office publications containing the more essential provisions of law and regulation which pertain to the licensing and operation of the majority of radio stations used in the land mobile services. Any one or all of the following can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. They are not distributed by the Commission.

Study Guide and Reference Material for Commercial Radio Operator Examinations ..... \$35

Rules and Regulations of the Federal Communications Commission:

Part 10. Public Safety Radio Services .....	.15
Part 11. Industrial Radio Services .....	.15
Part 13. Commercial Radio Operators .....	.10
Part 16. Land Transportation Radio Services .....	.10
Part 17. Rules Concerning the Construction, Marking and Lighting of Antenna Structures .....	.05
Part 19. Citizens Radio Service .....	.05

The following is a list of FCC Forms most commonly used by customers of communication service companies.

Forms are available upon request from the regional or Washington, D. C. offices of the Commission.

(Continued on Page 54)

for

**LOWEST**

hum... noise...  
microphonics...

in a low- $\mu$   
dual triode ...



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**ECC82** A PLUG-IN  
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ECC81/12AT7	Low-noise medium- $\mu$ dual triode
ECC83/12AX7	Low-noise high- $\mu$ dual triode
GZ34	Cathode-type rectifier; 250 ma.
EZ80/6V4	9-pin rectifier; cathode; 90 ma.
EZ81/6CA4	9-pin rectifier; cathode; 150 ma.

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(Continued from page 53)

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CBS 12001051	2.88
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20U	25U	47U	74Q
20Q/R	27Q21MC	48U	74U
21R, 41MC	27 41MC	48R, 41 MC	73Q
23R	27Q	48 Q/R	77Q
23G1, 41MC	28U	48Q, 21MC	54GT
23U	28Q, 21MC	48Q.T, 41M	57R
24R	28G1, 41MC	49U	57R, 41MC
24G1	28Q/R	49R	58Q
24U	48R, 41MC	50R 41MC	58Q 21MC
30Q	29Q/R	51R 41MC	59Q 21MC
31Q, 21MC	29U	53K	59U
32R, 41MC	30Q, 21MC	53U	59R
32U	38R	53R, 41MC	60Q
33R, 41MC	38Q	53G1, 41MC	60Q/R
33Q, G1,41	39U	54Q/R	60G1
33U	38Q/R	62G1	62Q
33Q/R	39R	64Q	62Q
33Q	39Q/R	66Q	62Q
34Q	40U	67A	

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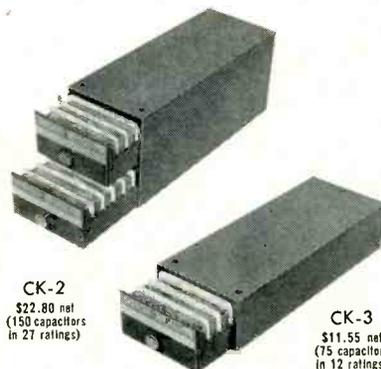
- Form 400 Application for Radio Station Authorization in the Safety and Special Radio Services.
- Form 400-A Request for Amendment of Radio Station Authorization.
- Form 401-A Description of Proposed Antenna Structure(s), (Services other than Broadcast).
- Form 405-A Application for Renewal of Radio License.
- Form 456 Notification of Completion of Radio Station Construction.
- Form 505 Application for Citizens Radio Station Construction Permit and License.
- Form 753-1 Application for Restricted Radiotelephone Operator Permit by Declaration.
- Form 756 Application for Commercial Radio Operator License or Permit.

An excellent understanding of the FCC can be obtained by reviewing the Commission's annual reports which are released the first of each year and are available from the Superintendent of Documents, Government Printing Office. In addition, a weekly paper, "Industrial Communications", which covers the current happenings of the Commission, of interest to the two-way radio user and his service technician, is issued by the Telecommunications Publishing Co., 1208-1216 National Press Building, Washington 4, D. C. It behooves the communication service companies to keep abreast of the regulations governing their customers' use of radio equipment.

To have a complete working knowledge of the FCC's Rules, every service organization should maintain a file of the various rules covering the particular Service in which his customers are licensed, and a copy of Part 13 of the Commission's Rules, which regulates commercial radio operators.



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\$22.80 net  
(150 capacitors  
in 27 ratings)

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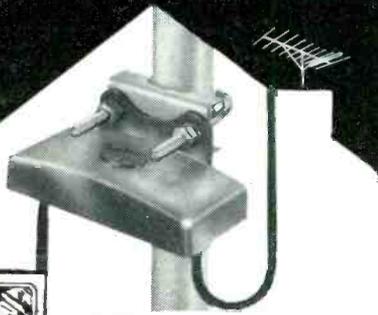
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1R5	1.00	6A28	1.60	8CMT	1.15
1S4	1.15	6B4G	1.85	12AB5	.80
1S5	.85	6B6A	.80	12AC6	.90
1T4	.95	6B7A	1.30	12AD6	.90
1U4	.95	6B85	.90	12AE6	.75
1U5	.85	6B87	1.35	12AH7	1.25
1X2B	1.20	6B85	1.45	12AL5	.75
2A3	2.10	6B86	.85	12AQ5	.85
2AF4A	1.60	6B86	.85	12AT6	.75
2B4A	1.00	6B87	.95	12AT7	1.15
3AL5	.80	6B86	.75	12AU7	.95
3AU6	.90	6B6GG	2.50	12AU6	.80
3AV6	.75	6B86	1.05	12AV6	.70
3BE6	1.00	6B88	1.35	12AV7	1.25
3BC5	1.00	6B86	1.00	12AW6	1.15
3BN6	1.25	6B87	1.00	12AX4GT	1.05
3BU8	1.10	6BK5	1.25	12AX7	.95
3BY6	1.00	6BK7A	1.30	12AY7	1.85
3C26	1.00	6BL7GT	1.65	12AZ7	1.10
3C6	1.00	6BN6	1.15	12B4A	1.00
3C6F	1.10	6B6GTA	1.65	12B4G	.75
3C6G	1.00	6B07A	1.50	12BA7	1.30
3TD6	.95	6B87GT	1.60	12BD6	.85
3LF4	1.35	6BY5G	1.40	12BE6	.80
3Q4	1.00	6BY6	.90	12BF6	.80
3Q5GT	1.15	6B26	.90	12BH7A	1.15
3S4	.95	6B27	1.55	12BK5	1.30
3V4	.95	6C4	.65	12BN6	1.10
4B28	1.65	6C5	.90	12B06GT	1.75
4B7A	1.65	6C85	2.90	12BR7	1.05
4B88	1.60	6C86	1.60	12BT7	1.25
5AM8	1.25	6CD6G	2.25	12BY7A	1.15
5AN8	1.35	6CF6	.95	12BZ7	1.20
5A05	.90	6CG7	.95	12C5	.80
5AS8	1.30	6CG8	1.35	12CA5	.95
5AT8	1.25	6CH8	1.25	12CU6	1.75
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5A24	.95	6CM7	1.10	12S67	1.15
5BK7	1.45	6CS6	.80	12S7	1.15
5BR8	1.40	6CS7	1.10	12S17	1.05
5B07	1.65	6CU5	.90	12SK7GT	1.00
5CG8	1.35	6CU6	1.65	12SL7GT	1.20
5J6	1.10	6DC6	1.05	12SN7GTA	1.00
5R4GY	1.60	6DE6	.95	12S07GT	.90
5T8	1.40	6DT6	.90	12V6GT	.85
5U4G	.85	6D06	1.65	12W6GT	1.10
5U4B	.85	6E5	1.00	12X4	.65
5U8	1.30	6F6M	1.35	14B6	1.00
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6A15	1.85	6SF5	.95	35L6GT	.90
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6AK5	.90	6SH7	1.00	35Y4	.85
6AK6	.95	6S17M	1.05	35Z5	.70
6AL5	.75	6SK7GT	1.00	50A5	1.20
6AL7GT	1.90	6SL7GT	1.25	50B5	1.00
6AM4	2.10	6SN7GTAB	1.05	50C5	.85
6AM8	1.25	6S07GT	.85	50L6GT	.90
6AN4	1.85	6SR7	1.00	50Y7GT	1.10
6AN5	3.70	6T4	1.40	70L7GT	2.70
6AN8	1.35	6T8	1.25	80	2.00
6A05	.85	6U8	1.25	81	.85
6A06	.70	6V3A	1.70	83	1.35
6AS5	.90	6V6GT	.85	117N7GT	2.95
6AS6	1.00	6V6M	1.60	117P7GT	2.25
6AS7G	3.15	6W4GT	.90	117Z3	.90
6AS8	1.30	6W6GT	1.10	117Z4GT	1.20
6AT6	.75	6X4	.65	117Z6GT	1.50
6AT8	1.25	6X5GT	.75	5642	1.15
6AU4GT	1.40	6X8	1.25	5654	1.40
6AU5GT	1.60	6Y6G	1.05	7AU7	1.00

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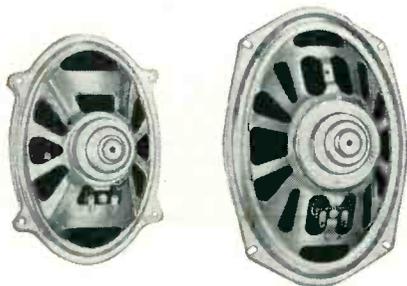
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## CONCERT SPECIAL OVAL GROUP

Jensen designed this extra ruggedized Special Oval Group at the request of one of the largest automobile manufacturers. Millions of units with years of service in truck and passenger vehicles have established the complete dependability of these speakers for use as replacements wherever 6 x 9 and 5 x 7 units are required. Not to be compared with conventional ovals, they are up to 3 times as resistant to housing distortion due to mounting strains and vehicle vibration, maintain alignment indefinitely in specially oversized gaps, withstand severe overloads, are immune to weather and temperature changes. Efficient magnetic structure design, using DP-Alnico 5 magnets, has made possible shallow construction, virtually universal in complying with crowded installation conditions.

New high fidelity models will give superior wide range performance and added power handling capacity for a noticeable improvement in auto radio sound quality.

## VIKING

For lowest cost, combined with rugged compactness, Jensen VIKING Series ovals fill the bill in automotive and other replacement services. Features include a completely enclosed magnetic structure, with precision locked-in alignment and new high efficiency DP-Alnico-5 magnet. Heavy gauge rigid housing. Solder lug terminals. One model in each 5" x 7" and 6" x 9" sizes handles 90% of your oval speaker requirements.

### CONCERT SERIES—SPECIAL OVAL GROUP

Nominal Size Inches	Model No.	Magnet Weight* Ounces	Voice Coil			Dimensions, Inches			List Price
			Imped. Ohms	Power Watts	Dia. Inches	H. & W.	Depth	Baffle Opening	
5 x 7	P57-U	1.73†	3.2	8.0	1	5 x 7¼	2½	4¼ x 6½	\$7.20
5 x 7	P57-TX§	2.5‡	3.2	9.0	1	5 x 7¼	2½	4¼ x 6½	8.35
6 x 9	P69-U	1.73†	3.2	9.0	1	6¾ x 9½	3½	5¼ x 8½	7.80
6 x 9	P69-T	2.5‡	3.2	10.0	1	6¾ x 9½	3½	5¼ x 8½	8.65
6 x 9	P69-TX§	2.5‡	3.2	10.0	1	6¾ x 9½	3½	5¼ x 8½	8.95
VIKING SERIES									
5 x 7	57-J9	1.47	3.2	6.0	¾	5 x 7¼	2½	4¼ x 6¼	5.85
6 x 9	69-J9	1.47	3.2	7.5	¾	6¾ x 9½	2½	5¼ x 8½	6.50

§High Fidelity Model. \*All Magnets DP Alnico 5.

†Performance Equivalent to RETMA 2.15 oz. ‡Performance Equivalent to RETMA 3.16 oz.



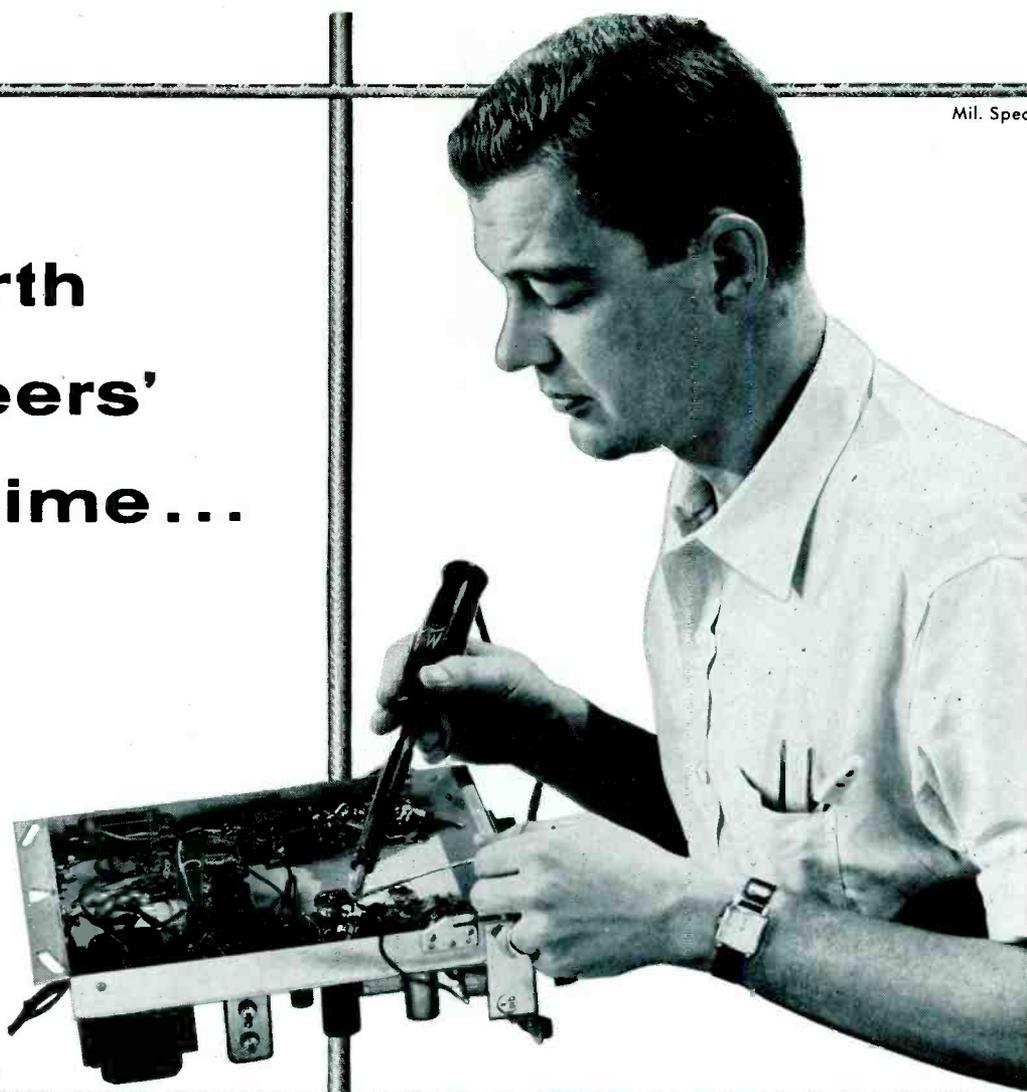
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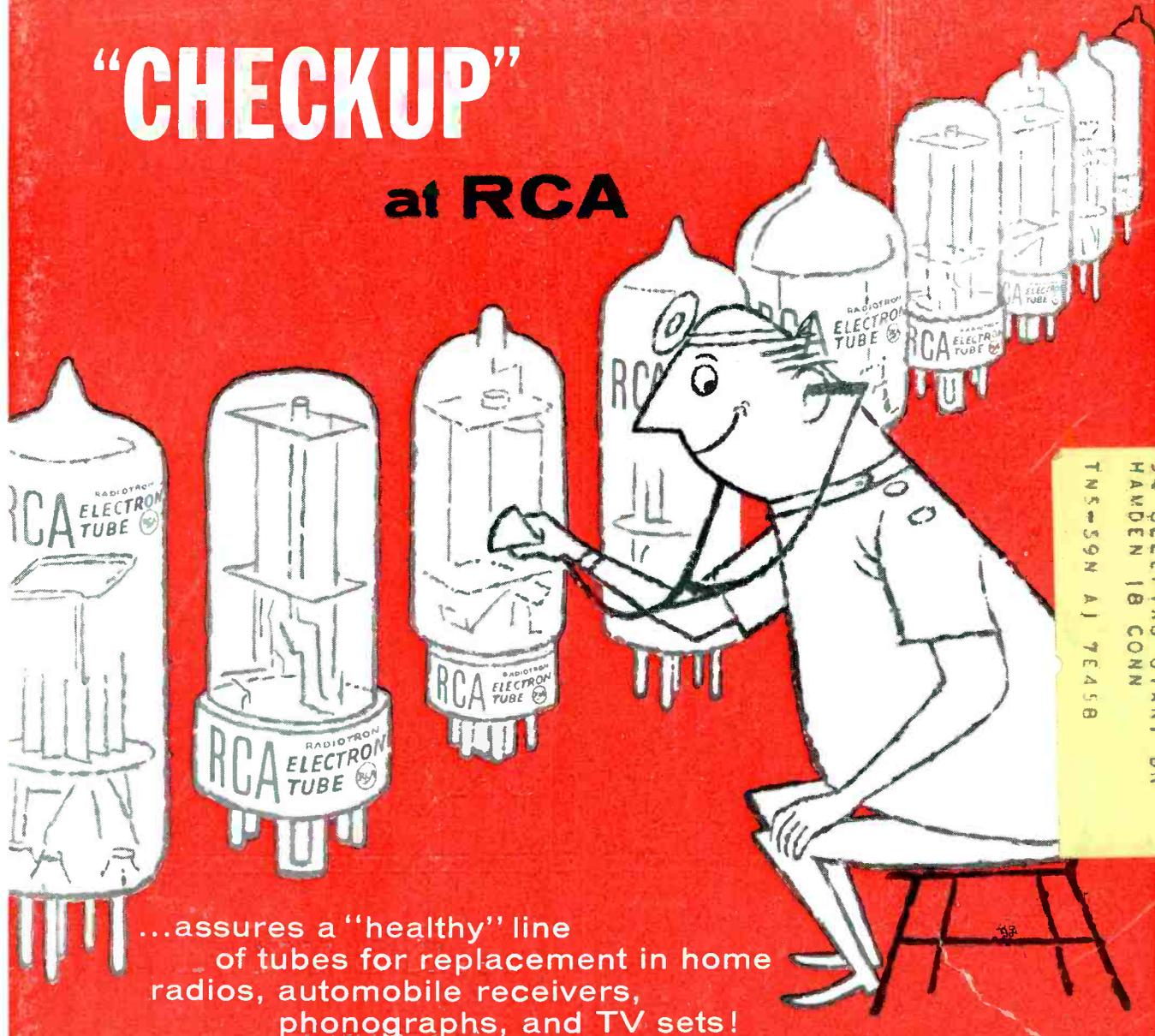
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## at RCA



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Tests for shorts, heater-cathode leakage, and transconductance help weed-out the weaklings—assure superior-quality tubes. And where low noise and low microphonics are essential to top performance, certain tubes undergo visual and acoustic tests. Before RCA tubes are put into the famous red-and-black RCA carton they are tested all over again at the warehouse for "solid" shorts "flicker" shorts, and continuity. Add to this RCA's quality monitor: microscopic inspection of welds, seals, stems, and electrodes of all popular-types and new-type receiving tubes used in black-and-white and color-TV sets, and automobile receivers...and you have powerful reasons why RCA tubes are preferred by manufacturers of electronic equipment and by you who service it. So, never ask your distributor for "tubes" alone. Always specify: RCA TUBES!

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